

# Financial Mechanisms and Investment Frameworks for Renewables in Developing Countries



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In accordance with its Statute, IRENA's objective is to "promote the widespread and increased adoption, and the sustainable use of all forms of renewable energy". This concerns all forms of energy produced from renewable sources in a sustainable manner and includes bioenergy, geothermal energy, hydropower, ocean, solar and wind energy.

As of December 2012, the membership of IRENA comprised 159 States and the European Union (EU), out of which 104 States and the EU have ratified the Statute.

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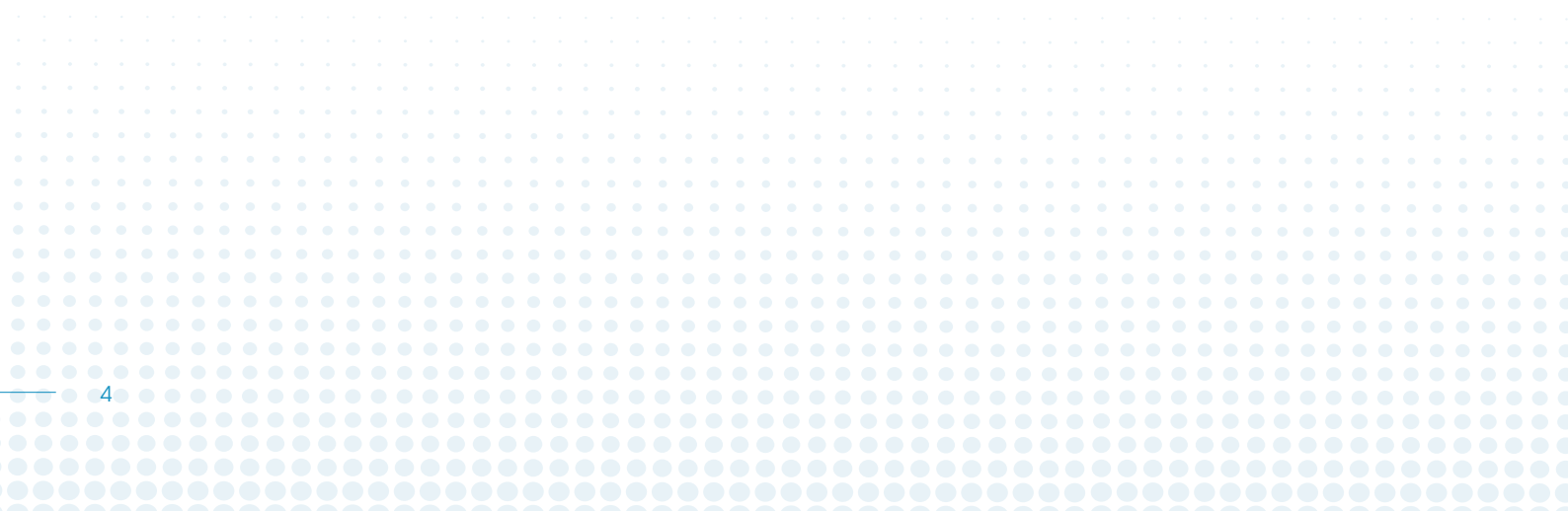
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# Financial Mechanisms and Investment Frameworks for Renewables in Developing Countries

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# Foreword

Renewable energy has made significant strides on the world stage in recent years and developing countries have been at the forefront of this progress. Global financing for renewable energy in the developing world grew to USD 89 billion by 2011, more than doubling the level of investment in only four years and accounting for a third of new total global investment.

Despite this encouraging picture, the sector has yet to reach its full potential. Renewable energy finance in developing countries faces a host of barriers. Heightened market risks due to macroeconomic instability, both perceived and real, give rise to stringent lending conditions.

High upfront costs for renewable energy technologies further compound the problem. Failure to account for externalities (such as health or the environment), coupled with fossil fuels subsidies, distort the market to the detriment of renewable energy. Knowledge and capacity among potential renewable energy financiers are often limited, resulting in increased risks and elevated costs.

Drawing on the latest research and experience in the field of renewable energy finance, and on data and analyses for six developing countries (*i.e.* Brazil, Egypt, India, Mexico, South Africa and Thailand), this report shows how good policy design can overcome these barriers.

It concludes that mobilising finance for renewable energy requires a holistic approach, keeping in mind that each renewable energy market is a unique and highly complex system. Policy must be tailored to the local context, combining a supportive and transparent regulatory framework with targeted government interventions.

Public finance programmes should seek to minimise investment risks and maximise leverage for additional financing through public-private partnerships. Finally, a comprehensive renewable energy financial strategy must include intensive capacity-building programmes targeting project developers, finance institutions and public officials.

I trust that the recommendations contained in this report will enable policy makers to design more effective renewable energy finance policies and programmes, unleashing the great benefits renewable energy has to offer to the developing world.

**Adnan Z. Amin**

Director-General

International Renewable Energy Agency (IRENA)

# Acronyms

Adder	Feed-in Premium (Thailand)
ADB	Asian Development Bank
AFD	Agence Française de Développement
AfDB	African Development Bank
AMDEE	Mexican Wind Energy Association
ANEEL	National Electrical Energy Agency (Brazil)
BASE	Basel Agency for Sustainable Energy
BBVA	Banco Bilbao Vizcaya Argentaria
BES	Banco Espirito Santo
BNDES	Brazilian Development Bank
BOO	Build, own and operate
BRL	Brazil real (reais)
CAF	Corporacion Andina de Fomento (Andean Corporación for Training) (Peru)
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CERC	Central Electricity Regulatory Commission (India)
CFE	Comisión Federal de Electricidad (Federal Electricity Commission) (Mexico)
CO <sub>2</sub>	Carbon dioxide
CORFO	Chilean Economic Development Agency
CRE	Comisión Reguladora de Energía (Regulatory Energy Commission) (Mexico)
CSP	Concentrating Solar Power
CTF	Clean Technology Fund
DFI	Development Finance Institution
DOE	Department of Energy
EE	Energy Efficiency
EERF	Energy Efficiency Revolving Fund (Thailand)
EETC	Egyptian Electricity Transmission Company
EGAT	Electricity Generating Authority of Thailand
EIA	Energy Information Administration
ESCOs	Energy Service Companies
ESG	Environmental, Social and Corporate Governance
ESMAP	Energy Sector Management Assistance Program (World Bank)
FDI	Foreign Direct Investment
FIRA	Fideicomisos Instituidos en Relación con la Agricultura (Mexican Rural Development Bank)
FIRCO	Fideicomiso de Riesgo Compartido (Shared Risk Trust) (Mexico)
GDP	Gross domestic product
GBI	Generation Based Incentive
GHG	Greenhouse gases
GW	Gigawatt

IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IDC	Industrial Development Corporation
IEA	International Energy Agency
IFC	International Finance Corporation of the World Bank Group
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Agency
KfW	Kreditanstalt für Wiederaufbau (German Development Bank)
kWh	Kilowatt-hour
LAERFTE	Law for the Use of Renewable Energy and Financing the Energy Transition (Mexico)
MEA	Metropolitan Electricity Authority (Thailand)
MME	Ministry of Mines and Energy (Brazil)
MNRE	Ministry of New and Renewable Energy (India)
MOEN	Ministry of Energy (Thailand)
Mtoe	Million tonne of oil equivalent
MW	Megawatt
MXN	Mexican peso
MSW	Municipal solid waste
NAFINSA	Mexican Development Bank
NAMAs	Nationally Appropriate Mitigation Actions
NREA	New and Renewable Energy Authority (Egypt)
OECD	Organisation for Economic Co-operation and Development
PEA	Provincial Electricity Authority (Thailand)
PPA	Power Purchase Agreement
PROINFA	Programme of Incentives for Alternative Electricity Sources (Brazil)
PV	Photovoltaic
RE	Renewable energy
Reegle	Clean Energy Info Portal
REFIT	Renewable Energy Feed-in Tariff (South Africa)
REFSO	Renewable Energy Finance and Subsidy Office (South Africa)
REPP	Renewable Energy Procurement Programme (South Africa)
SERC	State Electricity Regulatory Commission (India)
SPP	Small Power Producer (Thailand)
TWh/year	Terawatt-hour per year
UNEP	United Nations Environment Programme
USD	United States dollar
VSPP	Very Small Power Producer (Thailand)
ZAR	South African rand

# Preface

Addressing issues such as energy security, climate change, energy poverty, sustainable development and economic growth in developing countries brings policy makers face-to-face with two very complex fields: finance and renewable energy (RE). Designing policies to shift finance into RE can tackle all these overlapping challenges at once. In practice, however, the process is anything but straightforward.

The global financial system today is highly complex and, in the wake of the 2008 financial crisis and the on-going eurozone crisis, politically sensitive. Markets are in a risk-averse period. Meanwhile, RE markets overall are still relatively young and fluctuating. They comprise a variety of technologies and sub-sectors at different stages of maturity, and with distinct financing needs. The complexities of these two fields, added to the normal (and often unpredictable) pressures of politics in developing countries, pose an especially daunting challenge for policy makers.

This report aims to help relieve some of this pressure by providing up-to-date analysis, recommendations and, where possible, improve clarity for policy makers regarding RE finance. It presents qualitative and quantitative analyses of financing trends and mechanisms, investment frameworks, policies, and enabling conditions for RE in the developing world.

The report was elaborated by the International Renewable Energy Agency (IRENA) and the Basel Agency for Sustainable Energy (BASE). It draws on the best up-to-date research and experience in the field of RE finance, including extensive interviews as well as long-standing collaborations with leading international experts and practitioners.

There is a substantial body of knowledge and experience around developing frameworks and financing mechanisms that successfully mobilise investment into RE markets. The recommendations in this report are based on those strategies that have been able to stimulate and leverage financing, build commercially sustainable markets, and increase capacity to deliver RE technologies, projects and businesses. It is argued that an effective RE finance

strategy requires a holistic approach, tailored to the local context and combines a supportive regulatory framework with targeted interventions.

The report draws heavily on data and analysis of the local RE finance context in six developing countries: Brazil, Mexico, India, Thailand, Egypt and South Africa. Country analyses have been supported by in-depth research into the local energy market and RE finance contexts; by a review of existing local policies and finance programmes; and especially by in-depth interviews with local RE investors, policy makers, and finance experts. International expertise was also engaged. Lessons learned from the country analyses are found throughout the main section, and all six country case studies are included in the Annex.

#### **In summary, this report contains:**

1. A broad **global analysis** of RE finance flows, mechanisms, policy frameworks and enabling conditions in the developing world, with illustrative references and examples from specific developing country contexts;
2. Detailed **recommendations** for the design of national RE finance policy and RE finance programmes;
3. In-depth **country case studies** for each of a representative sample of developing countries – two each from Asia, Africa and Latin America (see the Annex).

#### **Note on RE data sources**

Unless otherwise specified, RE investment data are drawn from annual United Nations Environment Programme (UNEP), New Energy Finance (NEF)/Bloomberg New Energy Finance (BNEF) and Frankfurt School (FS) Global Trends' reports (2007-2012) and BNEF Desktop data (October 2011). Information related to RE targets is from national sources as well as data gathered and reported by REN21 in its Renewables Global Status reports and its interactive RE policy map.

<sup>1</sup> Bloomberg New Energy Finance tracks the following RE transactions: Asset Financing, Public Markets (publicly traded companies) and Venture Capital and Private Equity.

# Executive Summary

**R**enewable energy (RE) in developing countries moves steadily, year after year, deeper into the mainstream investment agenda (Chatham House, 2011)<sup>2</sup>. In many cases, this trend has been supported by substantial progress in the design and innovation of RE finance policy by developing country governments. Developing countries with growing economies have pressing needs for new power capacity and, in many cases, have large potential for RE resources – such as strong winds, extensive sun irradiation, substantial geothermal reserves, and abundant feedstock sources for biomass, or large landfills for waste-to-energy.

Private investors compete on the basis of financial returns, the highest of which are still found primarily in non-renewable energy production. RE can be economically viable even when it is not financially viable, given that markets are still learning how to adequately account for externalities (the social and environmental costs incurred by conventional energy production) and for the value of long-term success. To ensure a successful and sustainable future, therefore, governments are taking action to encourage and facilitate RE financing. In many developing countries, national policy has already played a decisive role in shaping RE markets so that financiers will find them attractive.

At the same time, over-regulation and other problematic policies in some cases inhibit the growth and financing of RE markets, particularly when they suppress the process of price discovery and impede the reduction of RE costs, thereby slowing the uptake. Whereas regulation is required to account for externalities, deregulation is in some cases required to improve the pricing of technologies and services. Moreover, in addition to regulatory frameworks, there are other targeted actions that can be taken according to the sequencing

of infrastructure, technical and capacity measures that enable deal-flow throughout RE markets.

This report discusses the current RE finance landscape in developing countries and provides recommendations for the design of national RE finance strategy, using country/project examples for context and illustration throughout.

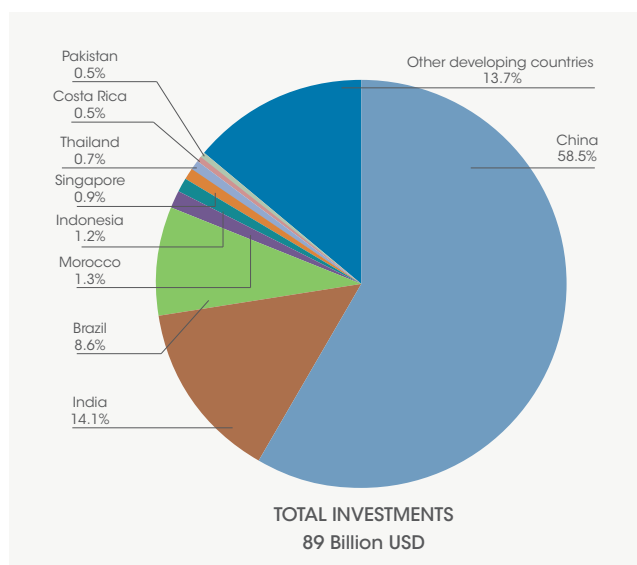
## RE Investment Trends in Developing Countries

Total new RE investments in developing countries rose 10%, as compared to the previous year, to USD 89 billion in 2011, representing 35% of total new global investment. Although the balance of overall RE investment had been shifting towards developing countries for several years, the share of total investment worldwide attributable to developing countries has in fact decreased from 37% in 2010 and 40% in 2009. At the same time, developing countries exhibit a range of financial conditions, and whereas most have domestic equity markets, only some have domestic debt markets. However, the data demonstrates that in 2005, developing country financing activity already rivalled the dominating developed countries, led by China, India and Brazil - the “big three” - with asset finance in particular driven largely by Chinese investments in wind energy. Developing countries other than these three have also experienced significant increases in investment. Figure 1 shows the breakdown of total RE investments among developing countries in 2011. China remains the top investor worldwide with USD 52.2 billion with a 17% growth rate over the previous year. However, the United States was a close competitor in 2011, with a 57% surge in its investment in the RE sector, so that it almost matched investments in China and allowed for a boom in developed countries’ performance.

<sup>2</sup> Although there is significant variation in where money is going.



FIGURE 1: FINANCIAL NEW INVESTMENT IN RENEWABLE ENERGY IN DEVELOPING COUNTRIES, 2011 (%)



Source: Based on the *Global Trends in RE Investment 2012 report* (UNEP, BNEF and FS, 2012).

Overall, RE investment in the developing world has been particularly active in wind energy projects, reflecting the maturity of wind technologies and the broader wind market. Investment in solar energy has also been on the rise, driven most recently by a substantial decrease in the cost of photovoltaic (PV) technology<sup>3</sup>. Biomass and waste-to-energy projects, as well as biofuels and small hydro, make up another important component of total RE investments in developing countries. Geothermal energy has caught the attention of some countries, such as Kenya, Nicaragua and Indonesia, and has seen an increase in investments as well. However, overall, the most dynamic areas of cost reduction are currently distributed and mini-grid solutions.

The global financial crisis and economic recession of 2008-2009, followed by the euro sovereign debt crisis of 2011 have constrained debt provision worldwide. Financing conditions have become more difficult in most countries, as European banks experienced sharp increases in their cost of funding and investors remain in a risk-averse position. Moreover, governments have become more reluctant to pass measures that would increase energy prices as a result of consumers' financial pressure. Nevertheless, the financial crunch had a less negative impact on overall RE finance trends globally in 2011 than in the previous year.

<sup>3</sup> In 2011, solar PV in fact attracted twice as much investment as wind energy worldwide.

<sup>4</sup> In India, for example, 94% of RE production in 2009 was from biomass and renewable waste.

The “big three” developing countries in RE finance all make heavy use of public banks (comprising 74% of the banks in India, at least 69% in China, and 45% in Brazil; World Bank (n.d.)), which proved more resilient than private banks to the financial crisis (Demetriades, Andrianova and Shortland, 2010). China's banking sector maintained particularly strong lending levels throughout this period.

While sovereign interest rates are at historic lows, risk and liquidity premiums are at or near historic highs, which means that – together with a number of reforms after the financial crisis (Basel III, Solvency II) – long-tenor bank lending for all forms of infrastructure has dried up. It may be replaced by bond markets, sovereign wealth funds and institutional investors (insurance companies and pension funds), but that is not certain and will take time.

The financial crisis also led to a strong increase in global commodity prices, including the price of raw materials for biofuels and biomass energy production. This trend particularly impacts the developing world, which is comprised of largely agrarian economies<sup>4</sup>. In Thailand, where biomass accounts for over 90% of RE production, the rising price of feedstock contributed to the current stagnation of investment in domestic biomass production.

## Types and Prominence of RE Investors

RE investors in developing countries include governments, banks, equity firms, insurance companies, pension funds, industry bodies, clean energy companies, and start-up project developers. In some developing countries, such as India and Brazil, there is a growing appetite for RE investment, in particular among local pension funds and insurance companies. In the aftermath of the financial crisis, public institutions played an especially critical role in providing capital that was otherwise unavailable from private sources.

The RE investment functions performed by banks include corporate lending, project finance, mezzanine finance, and refinancing. Debt finance is usually provided by banks, whereas equity finance is often provided by equity, infrastructure and pension funds, either into companies or directly into projects or portfolios of assets. Different types of investors will engage depending on the type of business, the stage of technology development, and the degree of associated risk.

For many developing countries, national development banks are the central actors in local RE finance. Multilateral development banks (MDBs) also lead and frequently partner with national banks on RE investments. Aside from providing concessional debt, MDBs help build the capacity of local financing institutions by passing on their experience through the preparation and analysis of technical and financial documents for RE projects, as illustrated by the case of wind financing in Mexico (Section 1.2). Moreover, South-South (as opposed to North-South) finance flows are expected to deliver international RE investment in developing countries in the future.

## Barriers to RE Investment in Developing Countries

Persistent barriers to RE investment in developing countries span the economic, political, legal, technical and non-financial spectrum. For any given RE technology, these barriers change as the market for that technology develops (IEA, 2011).

Broadly speaking, the developing world is characterised by greater real or perceived market risk due to its less stable macroeconomic conditions. The perception of higher risk leads to higher borrowing costs (*i.e.* interest rates), shorter loan tenor, and higher equity requirements in these countries. The general reluctance of commercial investors is exacerbated by limited understanding of RE investments, and the unique risks and high up-front liquidity needs of these technologies. This is further impaired in countries that have poor frameworks for foreign direct investment (FDI). Generally, RE investment has followed broader trends in FDI.

An overarching barrier that affects developed and developing countries alike is the failure of energy pricing to account for externalities, or for the environmental and social costs of production. This has suppressed RE technologies for decades by making them appear more expensive than they really are. When the true costs of production are considered (externalities included), RE investments become more financially attractive because they avoid the environmental and social costs generated by conventional energy sources. Unfortunately, most governments nevertheless provide

substantial subsidies to fossil fuels, giving them an even greater market advantage over RE technologies.

However, it would be erroneous to posit a pervasive unwillingness to provide capital for RE projects in the developing world. Conversely, in some contexts, there is actually a shortage of commercially attractive, easily executable deals in which to deploy capital. Often, there is too little focus on developing a national supply chain that supports local employment and manufacturing (*e.g.* through local R&D, business and project development assistance). The case of wind manufacturing in Egypt illustrates this point (Section 1.3).

Developing countries also face higher foreign exchange risks when sourcing international funds. Although financial instruments to hedge this risk are available for commonly traded currencies, the private sector appears unwilling to provide the same instrument for currencies traded less frequently (UNEP and Partners, 2009). Currency risk is therefore a greater problem for developing countries that do not use major currencies<sup>5</sup>. Even for those that do, however, hedging becomes prohibitively expensive as the tenor increases. Given that RE requires 12-15 years funding, hedging in any currency combination is difficult to do.

In some countries, uncertain policies create an ambiguous investment climate. Credible RE policy is required to generate private sector interest in this sector, and the lack of supportive, long-term, consistent or stable RE policy regimes constitute a formidable barrier to investment in many developing countries. Still, some developing countries have been able to create effective RE policies in spite of general political instability. Egypt, for example, is moving ahead with government support for wind development despite policy turmoil following the social and political revolution of 2011.

The lack of any clearly delineated authority over RE policy has also been a barrier to effective RE finance policy in some cases. In South Africa, finance institutions began preparations for preliminary investments after the government announced a feed-in tariff, which was subsequently cancelled. In this case, the number of ministries and government departments involved in RE policy in South Africa had made transparency and the establishment of clear lines of policy action

<sup>5</sup> This is a gap in the market that the public sector can fill (UNEP FI 2008). The Asian Development Bank (ADB) has addressed the barrier by offering guarantees for bond issues to finance RE projects (Section 1.3).

challenging. However, this was followed by the successful implementation of the RE auctions that resulted in the auctioning of 1416 MW in 2011 and 1044 MW in 2012.

The lack of clearly defined financial responsibility for relevant contracts can make or break RE projects. Unclear agreements for self-supply were problematic in the earlier stages of RE investment in Mexico. Similarly, costs and payment obligations for feed-in tariffs require up-front clarity, and a lack of such clarity or security around the backing of Power Purchasing Agreements (PPAs) can cause problems. In some cases (e.g. India), utilities have been unable to pay for purchasing power at agreed tariffs and have had to take on debt to stay afloat. Egypt avoids this problem by providing PPA backing directly from the central bank, rather than through a utility, department or special purpose vehicle.

Infrastructure challenges are particularly acute for RE deployment in developing countries, often increasing the risk associated with RE investments and, in extreme cases, preventing a prospective project from being realized. Key examples of infrastructure challenges include system constraints, lack of grid access, high grid connection costs, limited grid capacity and coverage, lack of technical standards and certification, and lack of operation and maintenance facilities (World Economic Forum, 2011). Construction and financing of new transmission networks will continue to be a barrier as capacity increases. In many developing countries, the best RE resources are located in areas that are far from the national transmission grid and/or are not well serviced with other forms of basic infrastructure, such as roads.

Finally, relevant knowledge and capacity among various actors involved in the RE finance arena in developing countries are often limited. There is less experience with RE project finance structures, limited equipment operations and maintenance expertise, and a greater need for technology transfer support. Banks that do not understand RE technologies are unable to assess the project risks in order to make the necessary financing decisions. Project developers often lack experience with business and financial planning, technical expertise, or adequate awareness of funding opportunities. Public administrators often lack the capacity to streamline approval processes or implement RE laws. It is therefore especially important in developing countries to pair RE finance

with capacity building efforts, as in the approach taken by the Government of Thailand (Section 2.3.6).

## Recommendations for National RE Finance Strategy

Effective national policy is critical to create the kind of markets that financiers will find attractive. The importance of the overall policy package was underlined by the International Energy Agency's (IEA) recent conclusion that differences in impact and cost-effectiveness among the various economic support systems for RE tend to be smaller than the differences among countries that have the same system (IEA, 2011). In developing countries, strong RE policies have proved easiest to justify in markets that are highly dependent on energy imports, such as Morocco and Chile.

Figure 2 outlines a RE finance strategy framework that takes a holistic approach, tailored to the local context, by combining a supportive regulatory framework with targeted interventions.

To shift finance into RE, there are central roles that must be performed by governments. At the same time, there are some roles that should not be performed by governments. In particular, attention should be paid to whether a regulation supports the process of price discovery to drive down RE costs. Where regulation inhibits this process, deregulation or regulatory reform may be appropriate to enable entry and exit of new RE providers into (and out of) the local markets. Furthermore, given that RE investment has followed broader FDI trends, countries which have poor frameworks for FDI in general cannot expect to attract overseas RE infrastructure finance. The macroeconomic reforms necessary to attract FDI more broadly will also enable increased foreign investment in RE.

In general, governments should seek to mobilise RE finance in two comprehensive ways: first, by setting overarching regulatory and incentive frameworks that shift investment into RE on a macro level; and second, by using targeted public funding to fill or overcome specific financing gaps and barriers. Regulatory frameworks can employ both energy policy mechanisms (e.g. feed-in tariffs, quotas, tax incentives) and finance policy mechanisms (e.g. banking regulations, interest

rates and other monetary policy approaches, 'Green Bonds' schemes, creation of new financing institutions). At the same time, deregulation within local energy markets is important to allow free entry and exit of new RE players and to create and facilitate competition among providers. Targeted intervention implies RE public finance mechanisms combined or coordinated with accompanying non-financial interventions, such as RE capacity building and knowledge management.

Both the regulatory and public finance approaches are important. At the same time, public finance should not be used as a substitute for underlying policy change when the latter is the more appropriate way to overcome a particular investment barrier or risk, so long as there is the option of making the necessary systemic improvement. Furthermore, it is important to embed RE support and other specific policies into the broader energy policy. Feed-in tariffs and other supports, while very important, are not enough for RE market policy. Issues like planning, grid connection and capacity, and PPAs are part of the deal cycle that the overall policy frameworks must address.

Because markets are unable to incorporate externalities into the price of energy, government action is required to 'level the playing field' until prices reflect the true costs of production. This can be achieved in part by shifting existing subsidies away from fossil fuels and towards RE. The short-term impact of these changes on energy consumers must be carefully managed to avoid political backlash. Thailand has set an example in helping to reconcile energy prices by taxing non-renewable energy to support RE development (Section 2.1.2).

National governments can help empower the financial sector to deliver a RE future by incorporating sustainability considerations directly into financial and monetary policy – such as in Costa Rica, where the Ministry of Finance is designing environmentally responsible bonds modelled after the World Bank's successful Green Bonds scheme; or in Japan, where the central bank in 2010 established preferential interest rates for environmentally friendly sectors. Governments can set-up specialised RE financing vehicles along the lines of the Indian Renewable Energy Development Agency (IREDA); or they can introduce guidelines and

FIGURE 2: NATIONAL RE FINANCE STRATEGY

Objectives			
<ul style="list-style-type: none"> <li>» Incorporate externalities into the price of energy (align market price with true cost)</li> <li>» Remove perverse incentives</li> <li>» Incorporate sustainability considerations into the financial sector</li> <li>» Overcome niche barriers to RE investment</li> <li>» Fill financing gaps that the private sector cannot</li> <li>» Bring RE technologies down the cost curve</li> </ul>			
Tools			
Regulation		Targeted Intervention	
Energy Policy	Finance Policy	Public finance programmes	Non-financial interventions
Examples: <ul style="list-style-type: none"> <li>» Feed-in tariffs</li> <li>» Tax incentives</li> <li>» Quotas and targets</li> <li>» Self-supply regulation</li> </ul>	Examples: <ul style="list-style-type: none"> <li>» ESG* lending criteria</li> <li>» Green Bonds</li> <li>» Differentiated interest rates</li> <li>» Public banking</li> </ul>	<ul style="list-style-type: none"> <li>» Tailored package of financing instruments (with flexible design)</li> <li>» Independent governance structure, public-private partnership</li> </ul>	<ul style="list-style-type: none"> <li>» Capacity building</li> <li>» Knowledge management/expertise</li> <li>» Multi-stakeholder coordination</li> </ul>

\* Environmental, Social and Corporate Governance

regulations based on the Equator Principles, the UN Principles of Responsible Investment (PRI), or other existing initiatives that integrate sustainability considerations directly into the financial decision making process. They can also engage global finance policy groups to include sustainability considerations within the analyses and recommendations of authorities such as the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision, whose policies have a record of successful adoption across the financial sector worldwide.

At this time, however, RE finance policy is most commonly designed not by central banks and finance ministries, but by energy and environment ministries. These entities employ policy mechanisms such as feed-in tariffs and tax incentives to help shape the RE investment landscape. While it is important to change the market baseline to include externalities and long-term sustainability in financial accounting, attention must also be paid to the sequencing of technical and infrastructure development for RE markets, which is where these agencies are particularly active. Even basic self-supply regulation has served as an initial catalyst for RE markets in some developing countries, such as in Mexico. In South Africa, government energy auctions have promoted investment in biomass, wind, hydropower, and solar PV. Between 2008 and 2011, a total RE based electricity capacity of over 6,900 MW was reached from auctions on small scale hydro, wind and bioelectricity.

## Characteristics of a Holistic RE Finance Approach

Every national RE market is unique. They are highly complex, living systems that involve a variety of technologies and sub-sectors at different stages of development, as well as distinct financing needs. There is thus no 'one-size-fits-all' policy formula. Rather, an effective RE finance strategy requires a holistic and nuanced approach that is tailored to the local context. This is exemplified by India, where a large range of policy measures and financial mechanisms have been differentiated according to local needs across different regions. The overall policy and financing mix, combining national and local strategies, has helped India to position itself as one of the most important markets for RE technologies.

Whenever possible, RE finance strategies should align themselves with local policy priorities in order to secure government support and engagement. Programmes may therefore seek to emphasise the employment, regional development, national security, poverty alleviation and energy access potential of the RE sector. The Brazilian RE finance framework, for example, places particular emphasis on maximising the employment and regional development impacts of the RE sector (Section 2.3.2).

When designing targeted interventions, the most meaningful public finance programmes employ a flexible package of financing mechanisms, rather than relying on any single mechanism or fixed set of mechanisms. These packages may include lines of credit to local finance institutions; project debt financing; loan softening programmes; guarantees to mitigate lending risk; grants and contingent grants for project development costs; equity, quasi-equity and venture capital; or carbon finance facilities. A common priority of public finance programmes is to maximise leverage of additional investment into RE sectors, which can be achieved so long as the financing instruments address one or more existing investment barriers. In principle, guarantees can leverage additional investment per unit spent better than either grants or direct loans. They are only appropriate, however, where borrowing costs are reasonably low and a number of commercial financial institutions are interested in the targeted market segment (UNEP SEF Alliance, 2010a).

It is not always the case that public finance must be spent where it can be directly recovered. Some non-recoverable expenses in the short term may constitute very important investments for the long term. These can include: RE academic and laboratory research; small business development; public RE infrastructure investments; RE stakeholder coordination and knowledge management; and RE finance training and capacity building programmes.

While it may be possible to identify specific technologies that are most appropriate for a local context at a given time, it is unrealistic to assume that the best choice of technologies will not change in the future along with the science, policy structures and the economy. For this reason, it is better to take a more diverse 'portfolio

approach' that can change over time, rather than choosing to support only a limited set of technologies. The process of developing and deploying new technologies generally follows an innovation pathway consisting of: (1) R&D, (2) demonstration, (3) deployment, (4) diffusion, and (5) commercial maturity (UNEP SEFI, 2008). As technologies progress, the cost per unit of production comes down. Another important priority of public finance programmes is thus to accelerate the progress of RE technologies along this path. At this time, distributed and mini-grid solutions merit particular attention, given that these areas are seeing more dynamic cost reductions.

RE finance programmes should seek to engage a range of stakeholders spanning the public, private, academic and non-profit sectors, both nationally and internationally. One approach is to combine finance with a centre of expertise, as undertaken by the Chilean Economic Development Agency (CORFO) (Section 2.3.3), in order to create more value than stand-alone approaches can.

An emphasis on capacity building in addition to financing is especially important, and should target three separate groups: (1) project developers, to prepare business plans for assessment; (2) local finance institutions, to promote the assessment of RE projects; and (3) public officials and administrators, to improve the design and implementation of RE policy. One way to promote such learning is by channeling funds through local finance institutions, as was done in Thailand (Section 2.3.6).

It can be advantageous to manage RE finance programmes through independent, mission-driven organisations. In general, operational success depends on three main factors: (1) appropriate governance that provides effective engagement and oversight while protecting the independence of the programmes; (2) funding at a scale and durability that enables the programmes to invest for the long term; and (3) tailoring the implementation strategy effectively to local needs (Carbon Trust, 2008). It is by no means a given, however, that new institutions need to be created. This can be challenging, and the decision depends on the specific context. With the emergence of national climate finance institutions,<sup>6</sup> an integral approach may be more valuable than setting up separate entities for different climate-related sectors.

RE finance programmes must be transparent in their budgets and evaluation processes, and adequately structured for long-term security. Particular emphasis should be placed on impact assessment, and especially for a rigorous comparison of goals to outcomes. Finance strategies must be flexible, capable of being adjusted based on these evaluations, and also capable of adapting to changes in local market conditions over time.

Policy makers should begin with an assessment of the country's energy profile and the local market, so that RE finance policies and mechanisms can then be matched with the best local market opportunities.

### Key Policy Messages

- » Mobilisation of RE finance requires a holistic policy strategy, that is **tailored to the local context** and that combines a supportive regulatory framework with targeted interventions.
- » Regulatory frameworks should include both **energy policy** and **finance policy** mechanisms.
- » **Public finance programmes** should offer a flexible package of financing mechanisms, seek to maximise leverage of additional financing, and adopt a portfolio approach that avoids creating path dependency on any specific set of technologies.
- » Overarching regulation is required to incorporate externalities into the price of energy. However, **deregulation** within energy markets can support the process of price discovery by facilitating the entry and exit of new RE providers.
- » **Macroeconomic reforms** that are necessary to attract overall FDI will also enable increased foreign investment in RE.
- » Interventions should include **capacity building** strategies that target project developers, local finance institutions, and public officials and administrators.

<sup>6</sup> See for more information the project National Climate Finance Institutions Support Programme (<http://ncfisp.fs-unesp-centre.org/>)

# 1. Renewable Energy Finance in Developing Countries

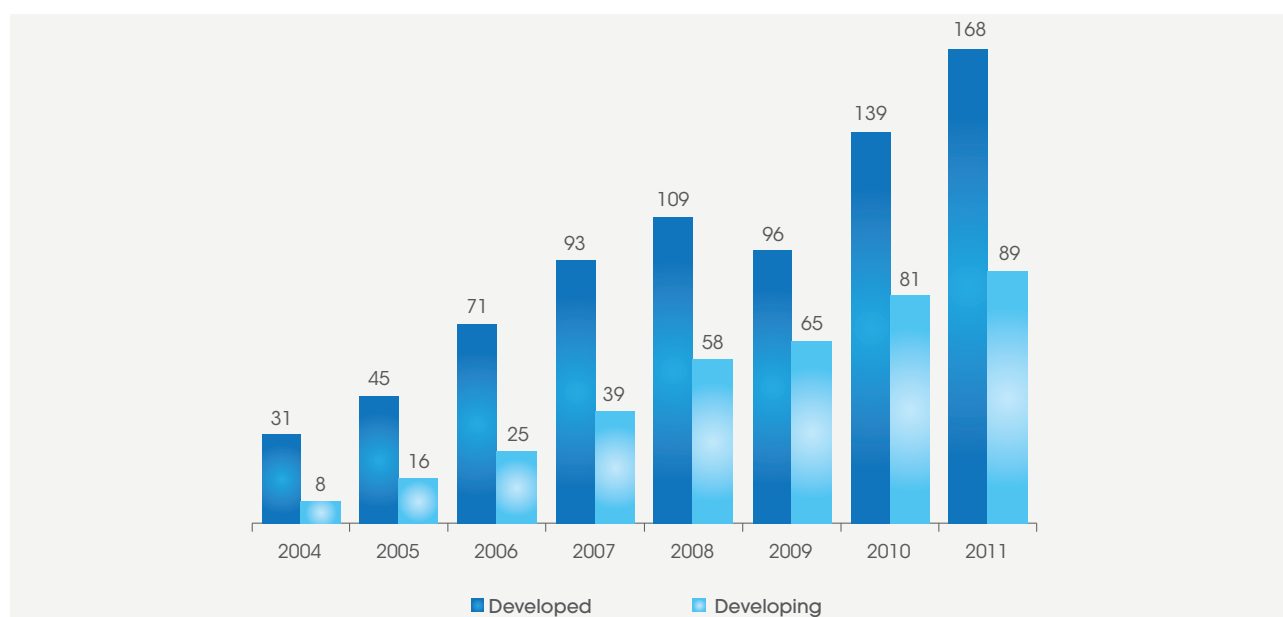
The renewable energy (RE) sector in developing countries is already on the radar screen for mainstream financiers and investors (Hamilton, 2010)<sup>7</sup>. Significant commercial potential is seen in RE as a growth sector, notwithstanding the impact of the financial crisis. Supportive policy frameworks, public finance interventions, basic energy supply and demand, developed and transferred capacity, security concerns arising from excessive dependence on energy imports, climate change concerns, and domestic factors are all key drivers of this activity. At the same time, developing countries exhibit a range of financial conditions, and whereas most have domestic equity markets, only some have domestic debt markets.

This section describes overall trends in RE investment in developing countries over the last few years as well as the different types of RE investors active in these regions. It also discusses the most common and persistent barriers to RE investment in the developing world, with an emphasis on the six case study countries, as well as the impacts of the global financial crisis.

## 1.1 CURRENT RE INVESTMENT FLOWS IN DEVELOPING COUNTRIES

In 2011, total RE investments in developing countries reached USD 89 billion; which represented an 10% increase in their value compared to 2010. The total percentage of RE investment in developing countries decreased slightly from 37% in 2010 to 35% in 2011. However, there is still a significant RE investment trend that is shifting towards developing countries (see Figure 3). In 2005, RE investment statistics illustrated that developing countries were already leading in RE financing activities, with China, India and Brazil as the forerunners. In 2011, the United States experienced a remarkable increase in RE investment reaching USD 51 billion, nearly matching the amount invested in the Chinese RE market. China still remains at the top of the list, with USD 52 billion in RE investments and a 17% growth rate for 2012 (United Nations Environment Programme (UNEP); Bloomberg New Energy Finance (BNEF); and Frankfurt School (FS), 2007-2012).

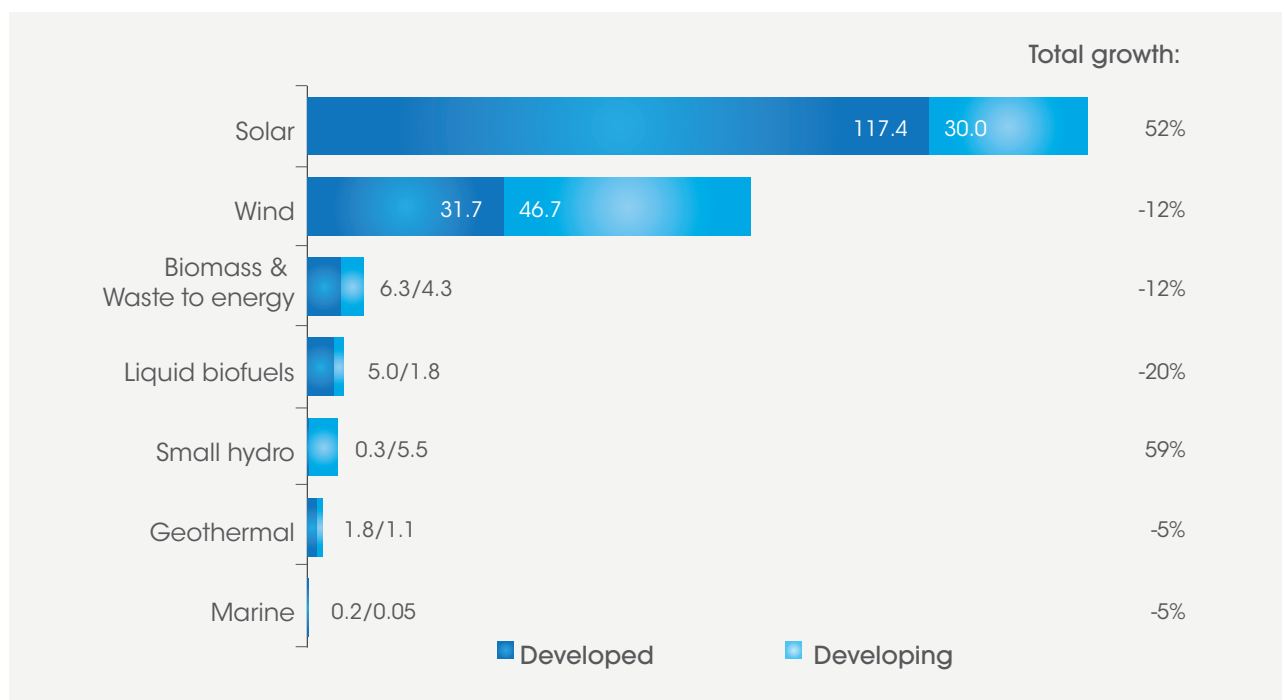
FIGURE 3: GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY: DEVELOPED VS DEVELOPING COUNTRIES, 2004-2011 (USD BILLION)



Source: *Global Trends in RE Investment 2012* (UNEP, BNEF and FS, 2012).

<sup>7</sup> See Hamilton 2010, which summarises the views of commercial investors.

FIGURE 4: GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY: DEVELOPED VS DEVELOPING COUNTRIES, 2011, (USD BILLION), AND TOTAL GROWTH



Source: *Global Trends in RE Investment 2012* (UNEP, BNEF and FS, 2012).

Although, developing countries outperformed developed countries in 2010 in terms of asset finance investment for utility-scale projects by USD 1 billion, this trend did not continue in 2011. Developed economies invested USD 86 billion while developing countries invested USD 79 billion. Developed countries also maintained their lead over developing countries in small-scale distributed capacity. This revival of developed countries' interest in RE could be a temporary phenomenon, given that the main driver was the imminent expiry of subsidy schemes in the United States, Germany and Italy.

PV solar and onshore wind equipment prices have been falling rapidly in both developed and developing countries. Rooftop solar is already competitive with retail electricity in various locations. It is estimated that average onshore wind energy will be competitive with gas-fired generation by 2016 (UNEP, BNEF and FS, 2012).

A comparison of the types of RE technology investments in developing vs. developed countries shows that developing countries have been particularly active in wind energy projects, reflecting the maturity of wind technologies and the broader wind market, combined

with the scope of new investment opportunities in developing countries (in Figure 4). Small hydro has seen a significant increase in the developing world with total new investment reaching USD 5.5 billion in 2011. Solar energy has also been on the rise in recent years, with substantial investment in the sector. This trend should continue, driven by national policies and the on-going decrease of the cost of PV technology. The average retail price of a solar module in 2001 was USD 5.4 per Watt-peak (Wp)<sup>8</sup>. By November 2011, the price had fallen to USD 2.49 per Wp, amounting to a decrease of 53.8%;<sup>9</sup> and in 2011, solar PV attracted twice as much investment as wind energy worldwide. Biomass and waste-to-energy projects, as well as biofuels, have also comprised an important part of total RE investments in developing countries. Geothermal energy has caught the attention of some developing countries (e.g., Kenya, Nicaragua and Indonesia) and has recorded an increase in investments as well.

In 2010, investment in China ranked first for the second consecutive year, with an increase of 28% over the previous year. However, in 2011, the growth of RE investment in China slowed sharply. This was particularly evident

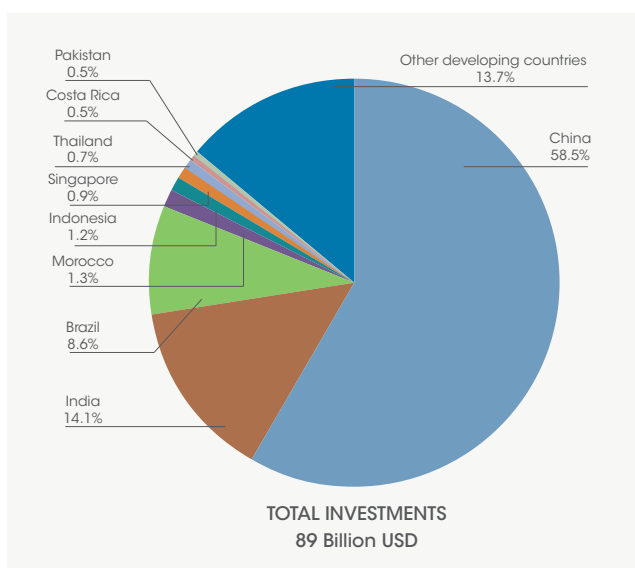
<sup>8</sup> Watt-peak is a measure of the nominal power of a PV solar energy device under laboratory illumination conditions.

<sup>9</sup> *Solar Market Research and Analysis* (<http://solarbuzz.com>; accessed September 2011).



in wind project development, after years of frenzied growth. China led the developing countries in RE finance, with 58.5% of their total investment in RE (Figure 5). China also led worldwide in the installation of wind turbines, as well as being the top producer of hydro-power and the leading manufacturer of PV modules. Investments (excluding R&D) amounted to USD 31.4 billion for wind, USD 13.3 billion for solar, and a total of USD 5.2 billion for small hydro, biomass and biofuels. Meanwhile, India had the highest rate of expansion in investment of any large renewables market in the world, with growth of 62% and total investment of USD 12.1 billion (excluding R&D). This was mainly due to the success of India's National Solar Mission, which aims to develop 20 GW of solar power by 2022, as well as an increase in wind capacity and private equity investment in RE businesses. In total, USD 12 billion was invested in India, of which 49% went into wind energy projects (see the India Country Case Study in the Appendix). USD 7.3 billion was invested in Brazil excluding R&D, which amounts to a moderate growth of 8% from the previous year, mainly due to shrinkage of the bioethanol sector (see Brazil country case study in the Appendix) coupled with a strong increase in domestic wind energy investments. The latter accounted for 68% of the total investments in RE in Brazil, while investments in bioethanol projects only totalled about 12%.

**FIGURE 5: FINANCIAL NEW INVESTMENT IN RENEWABLE ENERGY IN DEVELOPING COUNTRIES, 2011 (%)**



Source: Based on the *Global Trends in Renewable Energy Investment 2012 report* (UNEP, BNEF and FS, 2012).

Developing countries other than the “big three” have also experienced significant increases in RE investment in recent years, although in 2011 the increase was somewhat subdued. In 2011, USD 1.5 billion was invested in Latin America excluding Brazil, compared to the USD 6.2 billion of the previous year. Around USD 3.2 billion was invested in non-OECD Asia excluding China and India and USD 1.48 billion was invested in Africa. Morocco, Indonesia, Singapore, Thailand, Costa Rica and Pakistan are the next developing countries following the “big three” in terms of attracting the most financing into RE.

## 1.2 TYPES OF RE INVESTORS IN DEVELOPING COUNTRIES

RE investments in developing countries are undertaken by professional foreign and national investors, and national start-up project developers. Professional investors, both foreign and national, include private equity firms, insurance companies, pension funds, industry bodies, and clean energy companies. Many local businesses in developing countries, not only from the energy sector, are actively looking for potential projects in the RE market. In some developing countries, such as India and Brazil, there is also a growing appetite to invest in RE among local pension funds and insurance companies. Some commercial financial institutions are already active in the RE market and many others may enter soon.

Among foreign investors, Development Finance Institutions (DFIs) play an important role in channeling international funds to local actors, generally through national government agencies or national development banks. Whereas private investors primarily look for maximum financial returns, DFIs and other public investors (whether foreign or national) can include market development, as well as economic and social impact in their goals. This allows them to find value in RE investment beyond financial returns. The roles of the different types of investors are explored further in the following sub-sections.

## 1.2.1 RE Financing by Banks

The RE financing functions performed by banks include corporate lending, project finance, mezzanine finance, and refinancing<sup>10</sup>. These functions are explained by the United Nations Environment Programme's Sustainable Energy Finance Initiative (UNEP SEFI, 2009) as follows:

**Corporate lending** refers to the provision of finance to companies to support everyday operations, and these bank facilities place few restrictions on how the company can use the funds, provided certain general conditions are met. An assessment is made of the company's financial strength and stability, and debt is priced accordingly.

When banks provide **project finance** (or "limited recourse" finance), debt is borrowed for a specific project, and the amount of debt made available is linked to the revenue that the project will generate over a period of time, as this is the means to pay back the debt. This amount is then adjusted to reflect inherent risks (e.g. the production and sale of power). In the case of a problem with loan repayment, similar to a typical mortgage, the banks will establish first 'charge' or claim over the assets of a business. The first tranche of debt to be repaid from the project is usually called 'senior debt'.

**Mezzanine finance** is a type of lending that sits between the top level of senior bank debt and the equity ownership of a project or company. Mezzanine loans take more risk than senior debt because regular repayments of the mezzanine loan are made after those for senior debt. However, the risk is less than equity ownership in the company. An RE project may seek mezzanine finance if the amount of bank debt it can access is insufficient. The mezzanine loan may be a cheaper way of replacing some of the additional equity that would be needed in that situation, and therefore can improve the cost of overall finance.

A project or a business can be refinanced when it has already borrowed money but decides, or needs, to replace existing debt arrangements with new ones.

**Refinancing** is sometimes sought when more attractive terms become available in the market, perhaps as lenders become more familiar with the RE technology (meaning more money can be borrowed against the asset). The decision to refinance may also be motivated

by the duration of the loan facility, as loans are often structured to become more expensive over time due to the increasing risk of changes to regulation or market conditions.

## National And multilateral development banks

For many developing countries, national development banks are the central actors in local RE finance. The Brazilian Development Bank (BNDES) is the largest provider of credit to the Brazilian RE sector. Similarly, a prominent role is played by the Mexican Development Bank (NAFINSA) in Mexico; the Industrial Development Corporation (IDC) and the Development Bank of Southern Africa (DBSA) in South Africa; by Chilean Economic Development Agency (CORFO) in Chile; and so on with national development banks in other countries. These institutions provide both financial and non-financial support to engage local commercial banks and coordinate efforts for market development.

Multilateral development banks (MDBs) also have significant influence and presence in these arenas, frequently partnering with national banks on RE finance. Finance for RE projects by development banks increased from USD 4.5 billion in 2007 to USD 17 billion in 2011 (BNEF, 2012). Almost all of this money took the form of loans, with the exception of a few equity finance agreements. Aside from providing concessional debt, the MDBs also help build the capacity of national development banks and other local financing institutions by passing on their own experience with the preparation and analysis of technical and financial documents for RE projects. The case of wind financing in Mexico illustrates this catalytic function (Box 1).

The central challenge for RE investors is delivering an attractive return for the risks taken. However, there are different risk/return thresholds for different investors. The public sector is able to accept a lower return on RE investments when it takes on a longer term time horizon with public policy goals. It can tolerate more risk in the short term if it has the long view that these risks are inherent in the development process<sup>11</sup>. This helps to explain why development banks and other public finance agencies are often first movers of RE investment in developing countries. Countries with public

<sup>10</sup> These types of financing (especially mezzanine finance) are sometimes also provided by other, non-bank financial institutions, such as DFIs.

<sup>11</sup> The inherent yet necessary financial risk of the development process is addressed in Kurowski, 2009.

## Box 1

### MDBs CATALYSE WIND FINANCING IN MEXICO

Wind park financing in Mexico began when the International Finance Corporation (IFC) and the Inter-American Development Bank (IDB) agreed to provide an anchor investment of key senior and subordinated debt for a first Mexican wind park. National development banks NAFINSA and BancoMex were then able to model their own RE project evaluation processes on those used by the IFC and the IDB in this case, motivating them to join the investment as well. Other lenders also came on board, including foreign

private banks from Spain and Portugal, and further Mexican wind projects followed.

The MDBs thus effectively catalysed debt financing for wind projects in Mexico. A key part of this process was their capacity building function: once the MDBs demonstrated how to evaluate RE projects for debt financing, the local investment community was able to follow their example. More information can be found in the Mexico Country Case Study included in the Annex.

banks have an advantage in that these banks lend to support policy goals, and can draw in the private sector by taking on the riskier components of debt packages, enabling commercial investors to provide the rest of the financing.

A relatively new form of legal entity that can play a similar role within the private sector is the not-for-dividend or “common good” company. The UK Carbon Trust, for example, is legally private but with a not-for-dividend structure, meaning that it is mission-driven. All profits are therefore reinvested in the mission of the company, in this case, “to accelerate the move to a low-carbon economy”. The Carbon Trust has emerged as a leader in RE finance in the UK, helping to move the private sector. It has set an example for all countries in that it aligns the goals of public and private sectors, bringing together a multi-stakeholder set of key players from across legal boundaries. Many developing countries are seeking to replicate this model, and the Carbon Trust has written guidelines on how this could be achieved (Carbon Trust 2008).

#### 1.2.2 Venture Capital, Private Equity and Funds

In addition to debt financing by banks and other finance institutions, RE projects and companies also require equity financing. Equity investments take an ownership stake in a project or company. They involve

investments by a range of financial investors including private equity funds, infrastructure funds and pension funds, into companies or directly into projects or asset portfolios.

Depending on the type of business, the stage of technology development, and the degree of associated risk, different types of equity investors will engage. For example, venture capital will be focused on ‘early stage’ or ‘growth stage’ technology companies. Private equity firms, which focus on later stage and more mature technologies or projects, generally expect to ‘exit’ their investment and make their returns in a 3 to 5 year timeframe. Infrastructure funds, traditionally interested in lower risk infrastructure (e.g. roads, rail, grid and waste facilities), have a longer term investment horizon and therefore expect lower returns over this period. Institutional investors (e.g. pension funds) have an even longer time horizon and larger amounts of money to invest, with lower risk appetite (UNEP SEFI *et al.* 2009).

### 1.3 BARRIERS TO RE INVESTMENT IN DEVELOPING COUNTRIES

The following sub-sections discuss some of the most common barriers to RE investment in developing countries, with specific examples from the country case studies<sup>12</sup>. It is important to note, however, that the most

<sup>12</sup> These constraints affect different types of investors differently. Key challenges for foreign investors are regulatory-backed financial inflows, foreign currency finance for investments with operating revenue paid in local currency, and country-specific risks. Professional national investors often face problems in securing domestic funding in local currency with sufficiently long tenor, but they generally do not have problems securing equity. In contrast, most start-up project developers face problems, both in meeting lender expectations for equity participation and in securing debt finance. They do not enjoy a track record with banking institutions and hence are viewed as bad credit risks. Therefore, banks are generally unwilling to provide them with non-recourse finance or loans on terms longer than 5-7 years. This problem persists even in countries that help small and medium sized project developers by making technology-specific feed-in-tariffs (available for projects with less than 10-20 MW capacity) (GIZ 2011).

critical barriers to investment in a given RE technology change as the market for that technology develops (IEA, 2011). At the end of the section, Box 5 summarises a case study of a developing country RE project (*i.e.* Lake Turkana Wind Power in Kenya) that faced and navigated multiple investment barriers over the course of its development.

### 1.3.1 Economic Barriers

#### Faulty economics, market failure and perverse incentives

The traditional cost-benefit analysis of energy investments has not accounted for externalities, nor for the environmental and social costs of non-renewable energy production. This practice has been called “faulty” economics because externalities are part of the true cost of production and should therefore be factored into the price of energy (Henderson, 2007). The failure of markets to account for these costs has suppressed RE technologies for decades by making them look more expensive than they really are. When true costs of production are considered, RE investments become more economically attractive from a long-term policy standpoint as they avoid the substantial environmental and social costs created by conventional energy sources, which will be borne by the public and future generations.

Unfortunately, this market source code lies deep inside the programming of global economic institutions and in the minds of citizens. It has taken a long time to change ideas about what is truly “cheap” and what is “expensive” energy. Conventional energy continues to appear cheaper than it really is because it is allowed to hide environmental and social costs on balance sheets. Since these costs are then borne by taxpayers, this is considered by many to be a form of public subsidy for conventional energy. In addition, many governments provide additional subsidies for fossil fuels, giving them an even further market advantage over RE technologies.

Subsidies could be shifted from conventional to renewable energy until their respective prices reflect the true cost of production, including social and environmental impacts over a long-term time horizon. Unfortunately, there is reluctance in most countries (developed and

developing alike) to remove subsidies for fossil fuels or to increase the cost of non-RE to charge for externalities, in part because doing so could cause short term repercussions for energy consumers that would disproportionately impact the poor. Nevertheless, shifting these subsidies is critical to increasing the rate of commercialisation of RE technologies and moving towards truly sustainable development. Addressing the short term impacts on consumers (especially the poor) with targeted interventions to shift energy subsidies can help ease this process.

#### Local deal flow and value chain

Another preclusion to private sector engagement is the lack of sufficient deal flow. There is not always an unwillingness to provide capital for RE projects in the developing world. Instead, there is often a shortage of sufficiently commercially attractive, easily executable deals in which to deploy capital. Moreover, there is often too little focus on developing a national supply chain that supports local employment and manufacturing (*e.g.* through local R&D, business and project development assistance). The case of wind manufacturing in Egypt illustrates this point (Box 2).

Governments sometimes make a concerted effort to encourage the development of local manufacturing of RE technology components (*e.g.* Brazil in Box 12). However, there is often a great demand from foreign manufacturers to penetrate the markets of developing countries. The level of interest among foreign manufacturers has been illustrated by the experience of the ATN 30 MW Solar PV Project in the Philippines. So far some 50 foreign PV panel manufacturers have engaged with the project developers, five of whom indicated interest even to provide project financing tied to the PV panel supply. The schematic diagram shown in Figure 6 portrays the current liaison of ATN Solar with foreign suppliers and contractors.

#### Reticence of the commercial banking sector

Developing countries are characterised by greater real or perceived market risk due to less stable macroeconomic conditions. The perception of higher risk by financial institutions leads to higher borrowing costs in these countries. This has been a major obstacle in Brazil, for example, which has been characterised by

## LOCAL WIND MANUFACTURING IN EGYPT

The Egyptian electronic producer Elsewedy, with its wind energy branch SWEG, is a major regional player in a growing wind market. The company has developed into a full-service business and manufacturer of wind power. SWEG manufactures major wind farm components (e.g. wind towers, rotor blades, and the electrical components required to connect to the grid).

### Not yet a player in Egypt

Despite what would appear to be a success story for local Egyptian wind manufacturing, Elsewedy's growth in the wind sector was largely due to the market share gained elsewhere in Africa and in the Middle East. The company faced barriers to full entry into the market of its own country. Removal of taxes and duties imposed on wind power equipment in Egypt did not include components, which had negatively impacted Elsewedy's

ability to compete at home. The majority of both government/multilaterally-financed and commercially-financed Independent Power Producer (IPP) projects remain structured for large, international bidders with many years of experience. These requirements are prohibitive for smaller-scale, locally based players.

In the future, the feed-in tariff component of Egypt's commercial wind programme will be key to supporting local, small- and medium-sized developers. At this time, the programme is planned to include projects with capacities of 50 MW or less, with a long-term Power Purchase Agreement (PPA) (i.e. 15 years). It also aims to clarify who will have access to Egyptian land with the highest wind speeds, which is currently owned and controlled by the government, thus prohibiting private development.

prohibitively high interest rates resulting from problems with inflation in the past – although the government has recently made significant progress in this area.

The general reluctance of investors in developing countries is compounded by a lack of understanding of RE investments and public finance mechanisms to assume risk and permit commercial banks to invest in RE projects that have unique risks and high up-front liquidity needs compared to traditional investments. This is further exacerbated in countries that have poor FDI frameworks. Generally, RE investment has followed the broader trends in FDI.

### Lack of equity

Lending to project developers in developing and emerging markets typically requires a higher proportion of equity relative to debt than would be the case for similar projects in mature markets. Requirements for equity co-finance in developing countries are typically around 40%. At the same time, developing countries

are also characterised by less availability of angel and venture capital (business finance) for start-up of small and medium enterprises.

The inability of project developers to secure sufficient equity financing is thus a persistent constraint on debt financing for RE projects. The reasons lie in both a lack of equity availability, and a lack of capacity to design financially sound projects (see section 1.3.3).

### Currency risk

Developing countries face higher foreign exchange risks when sourcing international funds. Currency risk results from exchange rate fluctuations, which restrict private sector engagement because assets with stable and predictable returns in their local currency are much more volatile when converted to the currency of the investor, and this significantly increases the investment risk. Although financial instruments to hedge this risk are already available for commonly traded currencies, the private sector appears unwilling to provide the same instruments for currencies

FIGURE 6: PRESENCE OF FOREIGN SUPPLIERS WITHIN PHILIPPINES ATN SOLAR PROJECT PLAN

PROPONENT/ OWNER VALUE CONTRIBUTION						
LAND EQUITY OF PALLADIAN INC. 324 HA READY FOR USE WITH DOE SOLAR BLOCKING PLAN DENR TREE RE-PLANTING PLAN	DEPARTMENT OF ENERGY (DOE) 25 YR SERVICE CONTRACT & RE DEVELOPER CERTIFICATE OF REGISTRATION NO. SESC 2011-05-002 MAY 12, 2011	BOARD OF INVESTMENTS (BOI) APPROVAL (RA 9513) & REGISTRATION NO. 2011-183, FOR INCOME TAX INCENTIVES (AUGUST 12, 2011) DEPARTMENT OF TRADE (DTI)	DENR - INITIAL ENVIRONMENTAL EXAMINATION (IEE) OCT 4, 2011 OR # 1381349  LOCAL GOVERNMENT APPROVAL & TRANSMISSION RIGHT OF WAY	ENERGY REGULATORY COMMISSION (ERC) APPROVAL OF SOLAR FEED-IN TARIFF 2012	DOE ISSUED CLEARANCE TO UNDER TAKE GRID IMPACT STUDY WITH NGCP, OCT 17, 2011 QUANTA (USA), SENERGY (UK)  FIRST PRIORITY DISPATCH LAW SOLAR	CARBON CREDITS CDM (ASEAN + 3) CARBONERGY CONSULTANCY  KOREAN ENERGY MGMTCORP. ECOSIAN ASEAN CENTRE FOR ENERGY (ACE)

REQUEST FOR PROPOSAL (RFP) FROM SUPPLIERS & EPC CONTRACTORS			★ FINANCIAL CLOSING  GLOBAL BANKS & WORLD BANK-IFC UNDER SUSTAINABLE ENERGY FINANCE PROGRAM (SEEP)  US EX-IM BANK GUARANTEES	(A) 30 MW SOLAR POWER WITH FEED-IN-TARIFF  CLEAN ENERGY METRO MANILA 12 MILLION CONSUMERS	COMMERCIALITY PERMIT ISSUED BY PHILIPPINE DEPARTMENT OF ENERGY  60,000,000 kWh PER YEAR ++  GLOBAL CLIMATE CHANGE MITIGATION
SOLAR PANEL SUPPLIERS, GROUND MOUNT SYSTEM READY FOR SUPPLY CONTRACTS  ALEX SOLAR SUNTECH CHINA GA SOLAR SOLARING (SPAIN) FIRST SOLAR (USA) POWERWAY SCHLETTER (AG)	INVERTER & TRANSFORMER SUPPLIERS BALANCE OF SYSTEM (BOS) SUPPLY CONTRACT UNDER MOU  SHANGAI ELECTRIC CORPORATION HITACHI TECHNOLOGY ELTEK VALERE	ENGINEERING PROCUREMENT & CONSTRUCTION (EPC) CONTRACT READY TO SIGN  CHINA JIANGSU INTERNATIONAL HITACHI TECH. QUANTA SERVICES ENERGY INTL			

Source: ATN Solar

traded less frequently. Currency risk is therefore a greater problem for developing countries that do not use the major currencies. Even for those that do, however, hedging becomes prohibitively expensive as the tenor increases. Given that RE requires 12-15 year funding, hedging in any currency combination is difficult to do.

The hedging of less commonly traded currencies is a gap in the market that the public sector can fill. Public funding, channeled through either multilateral or bilateral DFIs, can create currency funds that would be supplemented with private sector capital. An example is the Currency Exchange Fund, which offers those investing in developing markets the opportunity to hedge their local currency risk with swap products. A first-loss tranche of capital is provided by the Dutch Ministry of Foreign Affairs, and other investors include DFIs such as the African Development Bank (AfDB), the European Bank for Reconstruction and Development (EBRD) and the German Development Bank (KfW), as well as private sector investors (UNEP and Partners, 2009).

The Asian Development Bank (ADB) has addressed this barrier by offering guarantees for bond issues to finance RE projects. For example, an ADB project supports the bond issue by a private corporate company to finance the construction of an 88 MW biomass project in Thailand by guaranteeing the timely payment of principal. The objective is to establish a link between local currency long-term fixed rate investors (*i.e.* pension funds and insurance companies) and infrastructure projects, in order to overcome the difficulties in finding suitable long-term fixed-rate financing in local currency. Local currency bonds cannot yet provide the long-term tenor required for infrastructure projects; most corporate bonds have a tenor of up to five years. The partial credit guarantee provides issuers with an enhanced credit rating, which will attract local institutional investors who limit their investments to only credit ratings of A+ or above (UNEP SEF Alliance 2010).

### Lack of access to loans with tenor longer than 5-6 years

Long-term loans are required to finance RE infrastructure projects that often have a payback period of longer than seven years, but debt financing in emerging and developing countries is in many cases not available

for more than 5-6 years. This is because debt providers are hesitant or unable to provide long-term loans when country conditions are unstable or financial conditions are constrained. Raising longer-term debt to cover the duration of RE projects in these countries can therefore be extremely difficult.

## 1.3.2 Policy and Legal Barriers

### Unfavourable or inconsistent policy

RE investment in developing countries is often hindered by unfavourable regulatory and political climates<sup>13</sup>. The lack of supportive policy regimes is a major barrier to investment because credible RE policy is required to generate private sector interest in these sectors. Unstable policy creates an uncertain investment climate.

Where supportive policies do exist, the regulations are sometimes inconsistent or uncertain. In South Africa, for example, investors began preparations for preliminary investments after a feed-in tariff was announced by the government, which was subsequently cancelled and replaced by an auction scheme (Box 3). According to local finance experts interviewed for this study, this led to confusion and an undermining of confidence among RE investors. Nevertheless, the auction led to a total contracted RE based electricity capacity of over 6,900 MW between 2008 and 2011. In general, investors need to see long-term, consistent and credible energy policy.

Unfavourable or inconsistent policy can result from, or be connected to, competing priorities, vested interests, market distortions, subsidies in favour of fossil fuels or a lack of clear RE authority. For example, many developing country populations lack an affordable and consistent basic energy supply, which can complicate the ability of the national government to justify a focus on RE. This is the case in South Africa where the urgency of poverty reduction makes it challenging for policy makers to avoid supporting energy production from coal, currently the country's cheapest energy source and thus the most affordable for the poor. Similar dilemmas are faced by policy makers across the developing world.

General political instability can compound these problems, such as in Egypt, which is currently characterised by uncertainty about the future direction of government

<sup>13</sup> This is supported by recent analysis from the World Economic Forum (WEF, 2011).

## WHAT HAPPENED TO SOUTH AFRICA'S FEED-IN TARIFF?

The national Renewable Energy Feed-in Tariff (REFIT) programme in South Africa was announced in 2009 but came to a halt before it could be implemented. It was replaced by a competitive bidding process, leading some to refer to the latter policy as "REbid."

The REFIT was effectively replaced with the Renewable Energy Procurement Programme (REPP) in August 2011, with the original tariff prices serving as a price ceiling for competitive bids. Procurement targets for numerous RE sectors have now been established by the national government as part of the programme, with an overall target of 3,750 MW for RE.

Reasons for the policy change are linked to the fact that the regulator did not originally have the legal authority to create these tariffs. Some speculate that the tariffs were also set too high at the outset. Regardless of the reasons, the policy changes have had a clear negative impact on investor

confidence and provides an example of the importance of clarity, consistency and the streamlining of government departments in implementing sound energy policy.

The REPP competitive bidding system that replaced REFIT is the model with which South Africa now seeks to ensure the production of RE electricity at the lowest possible cost. The process ensures the seriousness of bidders through their own investment in the bidding process. It also avoids legal uncertainties raised with the earlier feed-in tariff regarding tariff guarantees for long-term PPAs.

The RE tariff and policy can be revisited in the event that RE uptake does not proceed as planned. Serious bidders have been involved in the first procurement window and between 2008 and 2011, competitive bidding led to the contracting of a total RES-E (small-scale hydro, wind and bioelectricity) electricity capacity of over 6,900 MW.

policy after the popular uprising in February 2011. Impressively, Egypt is moving ahead with government support for wind development despite the social and political revolution (Box 4).

### Definition of RE authority

Legislation related to energy, environment, conservation, gas and electricity can all have an impact on the development of the RE sector. This is why there are often several ministries that play a role in crafting RE legislation. Having too many authorities involved in the formulation of RE policy, however, can lead to confusion and the absence of a well-defined policy.

The large number of ministries and government departments involved in RE policy in South Africa has made transparency and the establishment of clear lines of policy action challenging. Investors mention

this as one of the problems that has prevented South Africa from creating the kind of sound energy policy that is key to investor confidence. A favourable investment climate requires clear definition of authority over RE matters.

### Unclear agreements

A lack of clearly-defined financial responsibility for PPAs, feed-in tariff obligations or other relevant contracts can make or break any attempt to secure financing and the overall viability of a power project. Unclear agreements for self supply, for example, were a problem in the earlier stages of RE investment in Mexico. Similarly, for feed-in tariffs to be effective, costs and payment obligations must be planned at the outset. For PPAs, a long-term agreement is key to securing long-term debt financing. Investors need to see clear and secure PPA backing.



## WIND DEVELOPMENT UNDERWAY DESPITE REVOLUTION IN EGYPT

With the first government phase of wind development underway, Egypt is now focussing on its first phase of commercial IPP business models to continue building RE capacity. Despite the social and political revolution in early 2011, and the lack of finalised legislation or a Parliament, Egypt has moved forward in launching its first 250 MW “build, own and operate” (BOO) IPP project and part of the first tranche of a 2,500 MW procurement competitive bidding scheme. This is Egypt’s first private sector RE power producer experience and the first where project developers benefit from Ministry approved government incentives, including the following:

- » All permits for land allocation already obtained by the New and Renewable Energy Authority (NREA).
- » Signing a land use agreement with the investor against payment equivalent to 2% of the annual energy generated from the project. This percentage was determined by the Cabinet.
- » An environmental Impact Assessment, including a bird migration study, to be prepared by NREA in cooperation with international consultants and financed by the German Development Bank, KfW.
- » Exempting all RE equipment and spare parts from customs duties and sales taxes.
- » Signing long-term PPAs of 20-25 years.
- » The Central Bank of Egypt will guarantee all financial obligations of Egyptian Electricity Transmission Company (EETC) under the PPA.
- » The project will benefit from carbon credit.
- » The project company will receive licenses for power generation from the Egyptian Electricity Regulatory Agency.
- » Investors will be allowed to build and operate RE power plants to satisfy their electricity needs or to sell electricity to other consumers through the national grid.

The components of the BOO IPP are three-fold. The first two elements set the stage:

- » The World Bank Energy Sector Management Assistance Programme’s (ESMAP) technical assistance, coupled with financial support (*i.e.* USD 1.5 million) from the Clean Technology Fund (CTF) and the Public-Private Infrastructure Advisory Facility (PPIAF) for project preparation. The financing of transmission lines (*i.e.* USD 200 million) lines was provided by CTF and the International Bank for Reconstruction and Development (IBRD).
- » The third element will be an IPP bid for the 250 MW BOO wind park with a joint wind measurement campaign.

Indeed, the commercial risk of PPAs is often a significant barrier to RE investment. PPAs establish a complex relationship between the seller (generally the developer of the RE source) and the buyer (often a utility), including key provisions addressing allocation of future risks that

are inherent in long-term RE contracts. PPAs have a wide range of risk exposure and some tend to be very complex. Through various PPA terms, utilities seek to place the risks on the renewable project developer, which can result in PPA terms that are very problematic for project financing.

More often than not, a lack of clarity exists concerning who will guarantee a PPA in developing countries. This has been a concern in South Africa, for example. Investors prefer to see PPAs backed by a central bank or national treasury (e.g. Egypt where PPAs are to be guaranteed by the Egyptian Central Bank). Although exchange rate risks can still undermine a PPA (e.g. Egypt in the 1990s), this is nevertheless preferable to, for example, a utility, department or special purpose entity created to support the IPP or a feed-in tariff scheme. In some cases (e.g. India), this problem has led to some of the utilities being unable to pay for purchasing power at agreed tariffs and having to take on debt to stay afloat.

### 1.3.3 Technical and Non-financial Barriers

#### Infrastructure challenges

Infrastructure challenges present a major concern for energy project development. They are particularly acute for RE deployment, often increasing the risk associated with renewable investments and, in extreme cases, preventing a prospective project from being taken forward. Key examples of infrastructure challenges include system constraints, lack of grid access, high grid connection costs, limited grid capacity and coverage, lack of technical standards and certification, and lack of operation and maintenance facilities (WEF, 2011).

Construction and financing of new transmission networks will continue to be a barrier as capacity increases. New large-scale projects must have sufficient transmission components with well-planned financing of grid extension. In many countries, the highest wind velocities are measured in areas that are far from the national transmission grid and/or are not well serviced with other forms of basic infrastructure (e.g. roads). The Governments of Thailand and Mexico are among those that are actively seeking solutions to finance transmission grid extensions. The first IPP in Egypt provides an example of a project that included agreements for financing the transmission network (Box 4).

#### Limitations in knowledge and capacity

In developing countries, limitations in knowledge and capacity among relevant actors are a significant constraint on RE investment. This applies to project developers, financing authorities, and public administrators.

There is less experience with project finance structures, limited equipment operations and maintenance expertise, and a greater need for technology transfer support.

Bankers often do not understand RE technologies and are unwilling to approve financing due to an inability to assess the risk of the project. Project developers require support in business and financial planning, technical expertise, or basic information to be able to apply for project funding. Public administrators often lack the capacity to streamline approval processes effectively. Where supportive RE sector laws have been passed, public administrators often lack the capacity to implement them, rendering them ineffective at facilitating investment.

Similarly, lack of understanding of “carbon finance” has resulted in the inability to recognise potential Clean Development Mechanism (CDM) investments. However, this is one of several factors contributing to the under-utilisation of carbon finance in the RE market as part of project finance. Other factors include CDM procedures and timelines, low carbon prices and uncertainty about the post-2012 carbon market. Investors interviewed for this study generally predicted that carbon finance would not have a significant impact on the RE finance landscape in the near future.

## 1.4 IMPACTS OF THE GLOBAL FINANCIAL CRISIS

As a result of the recent financial crisis, which had particularly acute impacts in the banking sector in late 2008 and early 2009, the provision of debt was heavily constrained worldwide. Added to normal investment risks and barriers, the unrelenting credit crunch has made RE financing conditions more difficult in most developing countries. The financial crisis also affected loan tenor as banks became extremely reluctant to lend for more than six or seven years. That meant that RE projects requiring longer-term loans would be forced to refinance in the future and risk the terms that would be available at that time (UNEP SEFI *et al.*, 2009).

However, this financial crisis had less negative impacts on overall RE finance trends in developing countries than in developed ones. The “big three” developing

## KENYAN WIND POWER PROJECT OVERCOMES MULTIPLE BARRIERS

The development of the Lake Turkana Wind Power (LTWP) project in Kenya provides an excellent example of the complexity and difficulties faced by RE project developers, governments and financiers in developing countries. LTWP comprises a consortium of foreign and local entrepreneurs, and the project aims to provide 300 MW (1,250 GWh/year) of clean power to Kenya's national electricity grid, adding approximately 20% to the existing grid capacity. The wind farm requires a total investment of EUR 617 million (USD 835 million) and is Kenya's biggest single private investment, with a debt/equity ratio of 70% debt and 30% equity.

Fundraising by LTWP was hampered by a number of country-related risks, the small-scale nature of the company and the lack of confidence or willingness to take on project risk by many DFIs. Although the Kenyan off-taker, Kenya Power and Lighting Company (KPLC), has over 14 years of experience with IPPs and has never defaulted on any payments, it is treated in the same manner as it was 14 years ago due to the fact that it does not have an internationally recognised risk rating.

Moreover, a significant disadvantage of the project is its remote location, 400 km from the most suitable connection point to the national grid, with extremely poor services. There are no paved roads in the project area, some 200 km of road are in need of upgrade and several bridges require strengthening to transport the wind turbines from the port in Mombasa to the site. In addition, permanent housing for 150 staff members has yet to be constructed. Transmission and distribution infrastructure is completely absent in the project area and a 428 km 400 kV double circuit transmission line will have to be constructed to connect the wind farm to the national grid.

Nevertheless, in January 2010, a PPA was signed between LTWP and the KPLC based

on the following conditions: in return for a guaranteed tariff of EUR 0.0722/kWh (approximately USD 0.0976), KPLC will get USD 0.01/kWh from the carbon credit revenue generated by the project. The project's crediting period will begin in 2013 along with commission of the first batch of 60 wind turbines (50MW). The project is expected to generate an average of 736,615 tons of Certified Emission Reductions (CERs) annually during the crediting period. It was estimated that through the project, the government will earn about 10 billion Kenyan shillings (USD 100 million) in carbon credit earnings.

The African Development Bank will serve as the Lead Arranger to syndicate the Euro 340 million (USD 470 million) debt portion that will come from DFIs. Two commercial banks, Standard Bank of the UK and NEDBANK of South Africa are the co-arrangers for the commercial debt portion being offered through the Danish Export Credit Agency (ECA) EKF.

Since sovereign government guarantees to a private enterprise would have constituted a breach of the credit agreement with the International Monetary Fund (IMF), the Government of Kenya and LTWP signed a "Letter of Support" to demonstrate the commitment of the Government to the project, which was bankable and accepted by lenders. Development partners have applied for further support through the World Bank's International Development Association (IDA) Partial Risk Guarantees, but the due diligence, which usually takes between 18 and 34 months, puts the project under serious time constraints. In case this takes too long, the Kenyan Government is considering an increase of the electricity tariff for 33 months by USD 0.018/kWh by the Energy Regulatory Commission (ERC), which would act as a levy that would then be used by the off-taker (KPLC) to issue the relevant guarantees to the lenders.

countries (*i.e.* China, India and Brazil) in RE finance all make heavy use of public banks, which comprise 75% of the banks in India, 69% or more in China, and 45% in Brazil (World Bank, n.d.), which proved more resilient than private banks to the financial crisis (Demetriades, Andrianova and Shortland, 2010). China's banking sector maintained particularly strong lending levels throughout this period.

Global financial policy makers responded to the credit crisis by further constraining the ability of banks to take risks. The Basel III package of international banking regulations dramatically increased capital requirements for banks, which was considered necessary to ensure financial stability. Unfortunately, this also puts developing countries at a disadvantage in that riskier investments are an inherent and necessary part of the development process (Kurowski, 2009). The same is true of the RE sector more specifically, which is characterised by higher risk than the conventional energy sector.

During the economic downturn of 2008-2009, public institutions played a critical role in providing capital otherwise unavailable from private sources. Collectively, governments around the world approved more than USD 190 billion in stimulus funding for clean energy. Multilateral state-sponsored institutions made more than USD 21 billion in credit available in 2009

alone. However, a new era of fiscal austerity could have significant negative consequences for RE.

The financial crisis drove global investors into commodities because these were perceived as safe investments. This led to a substantial increase in global commodity prices. The soaring prices pose an obstacle to investment in RE production from biofuels and biomass in that they drive up the price of raw materials for these production systems. These RE sources tend to be important within the RE profile of developing countries, which are largely agricultural economies with abundant sources of agricultural waste to use as feedstock for biomass and biofuels. In Thailand, biomass also accounts for over 90% of RE production, and the rising price of feedstocks after the financial crisis contributed significantly to the current stagnation of investment in biomass production in that country (Box 6).

Investors remain in a risk-averse stance today. While sovereign interest rates are at historic lows, risk and liquidity premiums are at or near historic highs, which means that – together with a number of reforms after the financial crisis (Basel III, Solvency II) – long-tenor bank lending for all forms of infrastructure has dried up. This may be replaced by bond markets, sovereign wealth funds and institutional investors (*e.g.* insurance companies and pension funds), but that is not certain and will take time.

## RE FINANCE IN THAILAND STIFLED BY SOARING COMMODITY PRICES

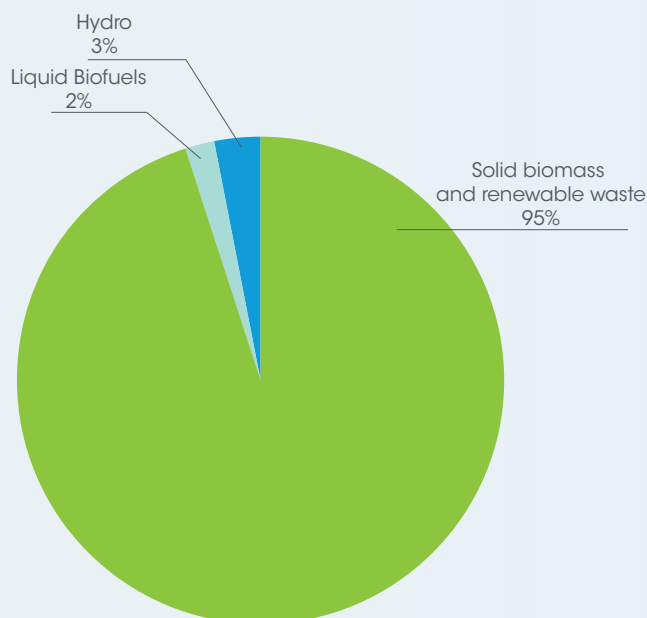
Thailand is an agricultural country and has abundant sources of agricultural waste in the form of corn husks, coconuts, etc. This helps explain why biomass constitutes the bulk (*i.e.* over 90% in recent years) of RE production in Thailand.

This also means that global commodities prices have a strong influence on RE markets in Thailand, because they affect the price of raw materials (feedstocks) for biomass production. In the aftermath of the global financial crisis, the soaring price of commodities (and therefore of feedstocks), spurred by investors fleeing to “safe” investments, posed the biggest obstacle to investment in biomass. As a result, biomass investment in Thailand has stagnated.

With the high price of raw material, the Thai biomass market is thus saturated for the time being. Lower feedstock prices and/or a breakthrough in the improvement of biomass technologies (*e.g.* mixed-fuel systems that can accept several different types of feedstocks in the combustion tanks or higher efficiency boilers) would be needed before private investment in biomass could resume growth.

Investments in solar, meanwhile, had started to boom in the recent years. Spurred by a global fall in the price of PV panels, in 2010 there was a sharp increase in new investments in solar in Thailand. In 2011 however, the investments in solar decreased in comparison to 2010.

FIGURE 7: TOTAL PRIMARY ENERGY SUPPLY FROM RENEWABLES IN THAILAND IN 2010



Source: IEA Statistics, World Energy Balances

# 2. Recommendations for National RE Finance Strategy

This section provides recommendations for the design of RE finance policies and programmes in developing countries. The recommendations are for a holistic approach, tailored to local context that combines a supportive regulatory framework with targeted interventions. An illustration of the overarching framework for RE finance strategy is shown in Figure 8.

In particular, when designing policies, attention should be paid to whether a given regulation supports the process of price discovery to drive down RE costs. Where regulation blocks this process, then deregulation or regulatory reform can be appropriate for enabling entry and exit of new RE providers into (and out of) the local market.

## 2.1 OBJECTIVES OF RE FINANCE POLICY

Effective national policy is absolutely crucial to shape the markets and geographies that financiers find attractive. This section provides an overview of critical roles that must be performed by governments to shift finance into RE. It should be noted, however, that there are some roles that governments should not perform.

### 2.1.1 Incorporating Externalities into the Price of Energy

In the absence of government policy, free markets alone are unable to incorporate the cost of social and environmental externalities into the price of energy. As discussed in section 1.3.1, externalities are a true cost of production and, in a perfect market, would be reflected in prices. If and when externalities are included in energy prices, RE

FIGURE 8: NATIONAL RE FINANCE STRATEGY

Objectives			
<ul style="list-style-type: none"> <li>» Incorporate externalities into the price of energy (i.e. align market price with true cost);</li> <li>» Remove perverse incentives;</li> <li>» Incorporate sustainability considerations into the financial sector;</li> <li>» Reduce the cost of RE technologies;</li> <li>» Overcome niche barriers to RE investment; and</li> <li>» Fill financing gaps that the private sector cannot address.</li> </ul>			
Tools			
Regulation		Targeted Intervention	
Energy Policy	Finance Policy	Public finance programmes	Non-financial interventions
Examples: <ul style="list-style-type: none"> <li>» Feed-in tariffs</li> <li>» Tax incentives</li> <li>» Quotas and targets</li> <li>» Self-supply regulation</li> </ul>	Examples: <ul style="list-style-type: none"> <li>» ESG* lending criteria</li> <li>» Green Bonds</li> <li>» Differentiated interest rates</li> <li>» Public banking</li> </ul>	<ul style="list-style-type: none"> <li>» Tailored package of financing instruments (with flexible design)</li> <li>» Independent governance structure, public-private partnership</li> </ul>	<ul style="list-style-type: none"> <li>» Capacity building</li> <li>» Knowledge management/expertise</li> <li>» Multi-stakeholder coordination</li> </ul>

\* Environmental, Social and Corporate Governance

will become more financially viable because it will not incur environmental and social costs to the same extent as non-renewable energy will. The market is then better able to shift more resources into these sectors based on standard cost-benefit analyses, without requiring government subsidies. Incorporating externalities into prices thus improves the functionality of the market by overcoming a core market failure, and it alleviates the need for subsidies that would otherwise be required to compensate for this failure, thereby saving the taxpayer money.

When externalities are not factored into price, the environmental and social costs of production are borne by taxpayers and future generations instead of being borne by the companies that are responsible for incurring the costs. When this is the case, which it is in most countries, this offloading of costs onto the public allows conventional energy to offer lower prices, and RE is then rarely able to compete directly with it in the marketplace. RE therefore requires government subsidies to level the playing field.

Other factors contributing to the relatively higher market price of RE technologies include: (1) higher up-front RE capital costs compared with conventional options, and (2) higher perceived risk of RE investments because they involve new technologies and sometimes also new project developers with little track record. Smaller-scale RE endeavours face further challenges given the level of due diligence required as a proportion of the overall deal size<sup>14</sup>.

Until RE technologies are competitive in the market, governments have little choice but to support their progress to ensure long-term success. A key role of policy, therefore, is to incorporate externalities into the price of energy, and – if necessary – to additionally (or alternatively) financially support RE until it is market competitive.

## 2.1.2 Removing Perverse Incentives

Aside from off-loading the cost of externalities, non-renewable energy often additionally benefits from an existing policy environment that favours and subsidises these energy sources (especially fossil fuels). Subsidies for non-renewable energy are perverse incentives in that they support an economic model that is not sustainable. Government action is required to reverse these incentives and level the playing field so that energy technologies can compete based only on the true costs of production, including social and environmental costs, that are measured over a long-term time horizon. The short-term impact on energy consumers of shifting subsidies must be carefully managed to avoid political backlash (International Institute of Sustainable Development, IISD and the Global Subsidies Initiative, GSI, 2010)<sup>15</sup>.

Thailand has set an excellent example of helping to reconcile energy prices by taxing non-renewable energy to support RE development (Box 7).

### Box 7

#### THAILAND FUNDS RE THROUGH TAXATION OF NON-RENEWABLE ENERGY

A particularly progressive aspect of Thailand's national RE strategy is that it funds RE development through taxation of non-renewable energy sources. Thailand's Power Development Fund, which provides financial support for RE generation, is capitalised through a levy on fossil fuel generation with rates that vary according to the amount of emitted pollution and fuels used. Thailand's national biofuels committees, moreover, are

supported by approximately USD 3 million in palm oil taxes. Finally, a levy on petroleum products raises about USD 50 million per year and is used to fund the Energy Conservation Promotion (ENCON) Fund. Together, these taxes help to correct the "faulty economics" that has so commonly resulted in the under-pricing of non-renewable energy worldwide by failing to account for social and environmental costs.

<sup>14</sup> Small enterprise-scale finance is a significant, but underdeveloped, market segment that has a critical role in delivering RE on the ground.

<sup>15</sup> The IISD and GSI have published practical recommendations for reforming fossil fuel subsidies based on experiences from Ghana, France and Senegal.

### 2.1.3 Integrating Sustainability into the Financial Sector

The nature of the financial system shapes the economy (Guttman, 1994), and financial markets are still learning how to value sustainability. Governments can support this process by incorporating social and environmental sustainability considerations into financial and monetary policy. Many institutions from across the public, private and non-profit sectors are now working on strategies to integrate sustainability into financial policy. For example:

- » The Equator Principles were developed by banks working in project finance that had been seeking ways to assess and manage the environmental and social risks associated with such investment activities (Equator Principles, n.d.). The Principles are a credit risk management framework for determining, assessing and managing environmental and social risk in project finance transactions. They are based on the IFC Performance Standards on social and environmental sustainability and on the World Bank Group's Environmental, Health and Safety Guidelines (EHS Guidelines).
- » The United Nations-backed Principles for Responsible Investment Initiative (PRI) is a network of international investors working together to put the six principles for responsible investment into practice (PRI, n.d.). The Principles were devised by the investment community and reflect the view that environmental, social and corporate governance (ESG) issues can affect the performance of investment portfolios and therefore must be given appropriate consideration by investors if they are to fulfill their fiduciary (or equivalent) duty. The Principles provide a voluntary framework by which all investors can incorporate ESG issues into their decision-making and ownership practices and so better align their objectives with those of society at large.
- » The UNEP is a partnership between UNEP and the global financial sector on sustainability (UNEPFI, n.d.). UNEP works with over 170 banks, insurers and investment firms, as well as a range of partner organisations, to develop and promote linkages between sustainability and financial performance. Its work programme encompasses research,

training, events and regional activities to help identify, promote and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

- » The Unified Rating System, Universal Lifecycle Assessment (URSULA) project is a worldwide, online open community that develops unified scores and ratings that act as value measurements to eventually inform a true price for everything (URSULA, n.d.). This will enable policy to recognise true value rather than market price, and to work towards an economy where the two are aligned.

Governments can help to incorporate sustainability considerations into the financial sector at the national level. For example, in June 2010 the Bank of Japan began applying lower interest rates to environmentally preferable sectors across the board, thereby shifting commercial finance into these sectors throughout the economy without spending public funds (The Economist, 2010). Other examples include: the issue or adoption by central banks and national treasuries of environmentally responsible bonds along the lines of the World Bank's successful "Green Bonds" scheme, which is currently being replicated by the Costa Rican Government (Gomez-Echeverri, 2010); establishing public RE development banks (e.g. IREDA); or providing guidelines, potentially based on the Equator Principles, UN PRI and other existing initiatives to integrate sustainability considerations into financial policy (UNEPFI, n.d.)<sup>16</sup>.

National governments can also encourage global policy groups to include sustainability considerations within the recommendations of authorities, such as the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision, which have a record of successful adoption across the financial sector worldwide<sup>17</sup>.

### 2.1.4 Bringing RE Technologies Down the Cost Curve

In addition to regulatory frameworks, there are other targeted actions that can be taken according to the sequencing of infrastructure, technical and capacity measures that enable deal-flow throughout RE markets. For

<sup>16</sup> For more on the financial policy approach, refer to the UNEP Finance Initiative website.

<sup>17</sup> In legal and regulatory terms, finance is the most globalised of any sector. For example, bank lending around the world is limited by Capital Requirements, which are set by a single regulatory body at the Bank for International Settlements (BIS) in Basel, Switzerland. In response to the financial crisis, national governments took steps to further expand the reach of BIS-based authorities. The former Financial Stability Forum, also hosted at the BIS, became the Financial Stability Board (FSB), intended to serve as "a roof over all the global standard setters" (Reuters, 2010).



example, many RE technologies are still completely or relatively new. The process of developing and deploying new technologies generally follows an innovation pathway consisting of: (1) R&D, (2) demonstration, (3) deployment, (4) diffusion, and (5) commercial maturity (UNEP SEFI, 2008). As technologies progress along this pathway, the cost per unit of production gradually decreases (Figure 9). Government action aimed at bringing RE technologies down the development cost curve, for example, is a priority to improve the economics of RE investing in developed and developing countries alike<sup>18</sup>.

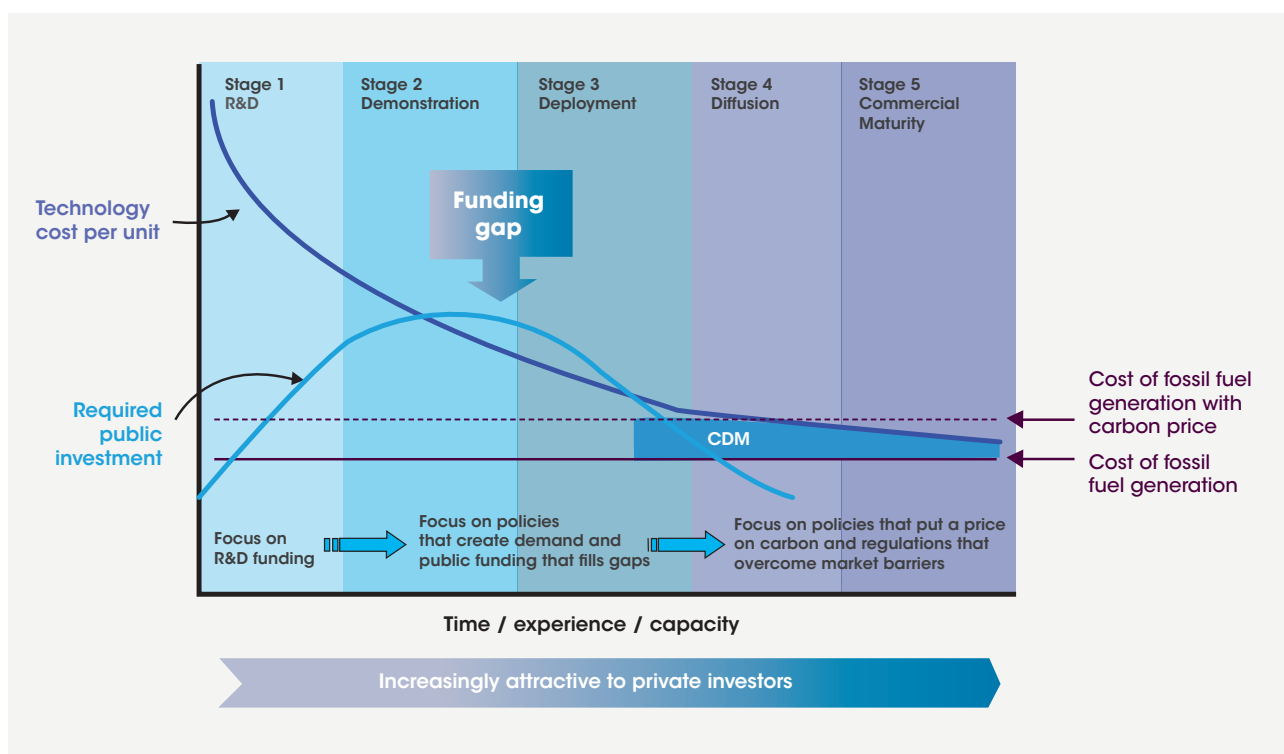
This process can be supported with targeted interventions and, in some cases, appropriate deregulation of local RE markets. While overarching market regulation is required to incorporate externalities into energy prices, the process of price discovery within the RE sector requires free entry and exit of new and competitive RE providers into local markets. Competition among providers helps drive down the cost of RE technologies as they develop, thereby accelerating market uptake of these

technologies. This sometimes means removing regulations that block competition.

## 2.1.5 Overcoming Niche Barriers and Financing Gaps

In addition to shaping the overarching framework of market incentives, national governments can address important niche barriers to RE investment (Section 1.3) through more targeted interventions. For example, the problem of the so-called financing “Valley of Death” confronting many new RE technologies is largely intractable. This occurs at the point when a technology concept has already been proven, but the first few full-scale projects or manufacturing plants have not yet been built. Energy technologies appear to suffer particularly high attrition at this point in the development cycle (UNEP SEF Alliance, 2010b). The fundamental problem is a dearth of capital with the right risk/reward profile combined with adequate capital resources (Figure 9). This “valley” cannot be traversed without public support in many cases.

FIGURE 9: BRINGING RE TECHNOLOGIES DOWN THE COST CURVE



Source: UNEP SEFI, 2008

18 A substantial body of literature has grown up around the question of how to design financing programmes for this purpose, for example: by UNEP (SEFI, <http://sefi.unep.org>); UK Carbon Trust; Sustainable Development Technology Canada (SDTC); BASE; OECD; and the LSE Grantham Institute. Programme managers should be familiar with this literature and these strategies, especially for filling niche barriers and financing gaps along the technology finance continuum (UNEP SEFI, 2008).

## 2.2 COMBINING REGULATION WITH TARGETED INTERVENTION

There is no “one size fits all” RE finance policy formula. However, governments generally seek to perform the functions described in Section 2.1 in two comprehensive ways: (1) by setting overarching regulatory and incentive frameworks that help shift finance into RE; and (2) by using targeted public funding to fill or overcome specific financing gaps and barriers to RE investment.

Regulatory frameworks that mobilise finance for RE can employ both energy policy mechanisms (e.g. feed-in tariffs, quotas and tax incentives) as well as finance policy mechanisms (e.g. banking regulation, interest rates and other monetary policy mechanisms, “Green Bonds” schemes, or establishment of special-purpose RE financing vehicles). At this time, however, RE finance policy is most commonly designed by energy and environment ministries and only rarely by national treasuries and central banks. Energy and

### Box 8

#### ENERGY AUCTIONS DRIVE RE INVESTMENT IN BRAZIL

The Brazilian Government carries out energy auctions annually to support the viability of national manufacturing of RE technology by ensuring stable demand. Under the regulatory structure introduced in 2004, most new power projects participate in auctions for long-term PPAs with energy distributors who are required to enter into long-term contracts for all of their electricity demand via a reverse auction system. The energy auctions are carried out by the energy regulator (*i.e.* National Electrical Energy Agency, ANEEL). There are specific auctions for existing energy sources and for new energy sources, respectively. Auctions for RE plants target specific energy sources and, for larger hydropower projects, also specific sites.

In the auction process, the regulator informs participants (energy companies) that there will be a tender for a specific technology (e.g. wind or hydro). No information is given on how much the government will contract. The companies advise how much energy they can create for what price, and a competitive bidding process ensues. The government offers the winner a 20 year PPA, providing substantial incentive for competition among the private bidders and pushing prices down. The tenders fix maximum price caps and have penalties built in for developers who sign contracts that they cannot uphold.

ANEEL held the first biomass-only reverse energy auction in 2007 and the first wind energy auction in December 2009. In August 2010, 89 projects representing 2.9 GW of installed capacity and involving BRL 26.9 billion (USD 15.2 bn) in investments were contracted from small hydro, biomass and wind farm developers.

In 2011, an auction for mixed technologies revealed wind as a cheaper option than natural gas plants at USD 61/MWh for 2 GW wind installation across 78 projects. In addition, 13 biomass projects were awarded that year.

ANEEL’s energy auctions changed the way the surplus cost of RE is financed. Acquired power is fed into the power pool at the contracted price, raising the average pool price. The increase is subject to a politically fixed maximum: the average price of energy for end consumers can increase up to a maximum of 0.5% (annually) and 5% during the 20-year PPA period. The auctions, together with subsidised interest rates, have been especially important for the wind sector, which has experienced tremendous growth since the first wind auction in 2009.

Final outcomes of the Brazilian auctions are still unclear and time will show whether all projects will start operation as planned.

environment ministries employ policy mechanisms such as feed-in tariffs and tax incentives to help shape the RE investment landscape. In Brazil, government energy auctions have promoted investment in wind and hydropower, and are now being considered for solar PV as well (Box 8). In general, auctions are a promising tool as long as they are well designed and their objectives are defined appropriately.

Given that RE investment has followed broader trends in FDI, countries that have poor FDI frameworks in general cannot expect to attract overseas RE infrastructure finance. The macroeconomic reforms required to attract FDI more broadly will also enable increased foreign RE investment.

Targeted intervention implies public RE finance mechanisms combined or coordinated with accompanying non-financial interventions (e.g. RE capacity building and knowledge management). The most meaningful public finance programmes will employ a flexible package of financing mechanisms, which may take the form of credit lines to local finance institutions; project debt financing; loan softening programmes; guarantees to mitigate lending risk, grants and contingent grants for project development costs, equity, quasi-equity and venture; or carbon finance facilities<sup>19</sup>. They will also seek to engage a range of stakeholders from across the public, private, academic and non-profit sectors, both nationally and internationally. It can be advantageous for these programmes to be managed by independent, mission-driven organisations.

Both the regulatory and public finance approaches are important. At the same time, public finance should not be used as a substitute for underlying policy change when the latter is the more appropriate means to overcome a particular investment barrier or risk, so long as there is the option of making the necessary systemic improvement. Furthermore, it is important to embed RE energy support and other specific policy in broader energy policy. Feed-in tariffs and other supports, while important, are not robust enough RE market policy. Issues like planning, grid connection and capacity, and PPAs are part of the deal cycle on which overall policy frameworks must be aligned.

## 2.3 CHARACTERISTICS OF A HOLISTIC RE FINANCE APPROACH

The most successful experiences in RE finance are broadly correlated with a holistic and nuanced approach (GIZ, 2011). This is because RE markets are so complex, involving a variety of technologies that are either young or still being developed. These require the engagement of actors across many sectors (e.g. policy makers, utilities, financial institutions, technology and project developers, academics) that face distinct barriers to effective participation. Financing needs vary according to the type of technology and its degree of advancement, the market segment targeted, and the conditions specific to a given country. Rather than relying on a single financing mechanism, it is therefore more appropriate to develop a package of instruments accompanied by and coordinated with non-financial measures.

### Box 9

#### WHAT MAKES RE POLICY EFFECTIVE?

The characteristics of policy that can build an attractive environment for investment opportunities include: clear objectives, coverage of issues from planning and permitting to delivery and grid regulations, enforcement, time horizons consistent with underlying finance needs and stability (sometimes described as “investment grade”

policy). Embedding RE policy in wider utility and energy sector policy, and tackling risk factors in the broader energy sector are central issues at the on-grid end of the market. In developing countries, a robust social policy and clear economic policy can contribute to a sense of market stability (Hamilton, 2010).

<sup>19</sup> UNEP SEFI (2008) provides a useful introduction to the different forms of public finance mechanisms. Further resources to support public finance approaches are developed by the UNEP SEF Alliance see [www.sefalliance.org](http://www.sefalliance.org).

Moreover, every economic system is unique, and RE development is inescapably a question of local conditions. No two economies are alike; thus no single finance package will be equally suitable for all. Instead, a distinct package will be needed for each country that is tailored to the local context. The starting point for finance strategy is therefore a differential diagnosis for each country<sup>20</sup>.

The experience of India provides an example of such an approach to RE finance policy that has helped the country position itself as one of the most important markets for RE technologies (Box 10). However, while holistic financing strategies are ideal, it is important to ensure that these idealised strategies do not remain “on paper” only without any progress in market uptake and generation of RE power or fuels. It is therefore important to identify and focus on the specific steps that are achievable within the local context (Section 2.4). Also, where funds have been created, they will not find their way into a project pipeline if there is no simultaneous support for market development as part of the approach.

### 2.3.1 Ensuring Local Commitment

Developing countries have compelling priorities, such as addressing high levels of poverty and inequality, that compete with RE for the attention of policy

makers. This is especially true in the least developed countries but is also the case in middle-income countries. In South Africa, for example, issues including poverty, high unemployment levels and health-related problems compete with RE for priority. With the exception of a one-time load-shedding in 2008, South Africa has sufficient, reliable fossil-fueled energy; thus, making RE a priority in the context of other key socio-economic policy priorities becomes a particular challenge.

It is especially important in these countries, therefore, to align RE finance programmes where possible with local policy priorities in order to secure government support and engagement. For this purpose, it can be advantageous to emphasise the potential of the RE sector in terms of employment, regional development, national security, poverty alleviation and energy access. For example, a focus on maximising the socio-economic co-benefits of RE investments is illustrated, by the Eurus wind park project in Mexico (Box 11).

In some situations, RE is already the most cost-effective option to achieve certain policy goals. For example, developing countries often have a substantial number of people without access to national electricity grids, making expanded energy access an important policy priority. Small-scale RE installations for remote off-grid

#### Box 10

#### A HOLISTIC COMBINATION OF RE FINANCE STRATEGIES IN INDIA

India employs an extensive and well-balanced combination of policy measures and financial mechanisms to support its growing RE market. This reflects: (1) India’s high level of national RE ambitions (e.g. implementation of the Solar Plan calls for investments of about USD 100 billion, requiring an estimated USD 17 billion in subsidies over the next 30 years); and (2) the federal status of India under which its individual states implement their own energy policies, an approach that has helped to achieve more locally tailored solutions. It is also a

result of the gradual shift of clean energy policy from the margin to the mainstream of energy policy. In this process, some older instruments were retained, although newer and more powerful instruments were adopted. The resulting policy and financing mix, combining national and local strategies, has helped India to position itself as one of the most important markets for RE technologies. The country is well on its way to achieving its RE targets. Please see India Country Case Study in the Annex for more detail.

<sup>20</sup> For a more detailed discussion of how to choose the financing strategy based on these characteristics, see UNEP SEFI 2008

communities can be the cheapest way to achieve this goal in some regions. The Brazilian government's commitment to providing energy for 100% of the population ("Energy for All") has a strong RE component for this reason<sup>21</sup>.

Poverty alleviation is another important policy priority in developing countries. The governments often subsidise fossil fuels in part to alleviate a significant expenditure for low-income populations. This approach can be very expensive for the public sector. The Brazilian

## Box 11

### EURUS WIND PARK MAXIMISES SOCIO-ECONOMIC CO-BENEFITS

With 250.5 MW in service since November 2009, the Eurus wind park in Mexico has the highest capacity in Latin America. It is a self-sufficient project developed by ACCIONA Energía and the cement company Cemex, representing an investment of USD 550 million with 167 wind turbines of 1.5 MW capacity each, plus USD 60 million of investment in electricity transmission, transformation and distribution infrastructure to the Federal Electricity Commission (CFE).

The Eurus project has had a significant effect on the socio-economic situation of the region where it is located. Around 1,000 jobs were created during the construction of the wind park and around 60 in operations and maintenance. The area – in which an indigenous population with limited resources predominates – was given a stable source of income, road access was improved, and purchases from local suppliers were made for around USD 11 million.

In addition to the direct social repercussions of the project, an ambitious Corporate Social Responsibility (CSR) programme was set up to encourage the participation of the indigenous community, promote its development and improve its living conditions. This reflects Acciona's philosophy of promoting social welfare and economic progress through sustainable development. It also ties in with criteria imposed by the IDB and other participating financial entities that demanded evaluation

and mitigation of potentially adverse impacts on the environment and the directly affected population.

This CSR programme was organised on the basis of an integral plan ("Plan de Manejo Social Integrado") aimed at promoting relations with the affected community; studying the demographic and socio-economic conditions of the inhabitants of the area around the wind park; evaluating the impacts of the facility on the community; and driving a community investment plan to improve local services and infrastructure. Local inhabitants participated in prioritising the activities under the community investment plan, leading to projects under four main themes: basic rights, basic services, promotion of sustainability and Corporate Volunteers. As a general criterion, Acciona contributes to the initial development of initiatives with a view to their becoming financially self-sufficient in the future.

Acciona's theme of basic rights includes projects related to healthcare, education and culture. The basic services theme covers infrastructure, energy and access to water projects. Under the theme "promotion of sustainability", Acciona has focused on protecting the basin of the Río de los Perros, and on reforestation of protected natural spaces. Through the Corporate Volunteers theme, Acciona has carried out a number of activities involving improvements to infrastructure and reforestation.

Source: Acciona

21 It assumes that (i) the use of approximately 130,000 PV systems is the most economically efficient electrification option for about 17,500 localities with small populations in the Amazon territory; (ii) a further 2,300 villages with about 110,000 buildings could be equipped with a mini-grid based on PV or biomass sources, 680 additional medium-sized communities could be supplied on the basis of hybrid systems, and 10 larger communities could be provided with power generation based on conventional diesel generators or hybrid systems. (UNEP SEF Alliance, 2010a)

Government, for example, provides a large subsidy for diesel to off-grid areas of the Amazon. The government is reducing its own expenditures by investing in small-scale solar applications for these areas, which are cheaper than continuing the diesel subsidy. This is an example of a clear “business case” for public sector support of RE.

Historically, perhaps one of the most important factors in motivating policy support for RE in developing countries has been dependence on energy imports. There is a positive correlation between import dependence and national RE policy support. In North Africa, for example, the country with the most substantial RE policy is Morocco, which is also the only country in the region without oil production. Import dependence makes countries vulnerable to fluctuations of energy prices in the global market, and local RE production enhances energy security by relieving this dependence. It also reduces the need to hold reserves of foreign currency with which to purchase oil.

Some countries with no energy import dependence are nevertheless planning for times when oil reserves are depleted and fossil fuel prices increase. Egypt and Mexico are two examples of oil producing countries that are pushing forward with RE market development.

At the national level, coordinating RE finance strategy with Nationally Appropriate Mitigation Actions (NAMAs) can also enhance the effectiveness of projects, policies and programmes by reducing barriers to RE deployment (IRENA, 2012).

In countries with relatively low electrification rates, RE strategies should emphasise expansion of energy access. This applies in India, for example, where 34% (in 2009) of the total population and 45% (in 2007) of the rural population still lives without access to electricity.

National content requirements attached to RE financing, such as in Brazil (Box 12), can also help gain local policy support although they may sometimes run the risk of becoming the subject of international trade disputes.

## 2.3.2 Engaging Multiple Stakeholders and Expertise

Barriers to RE investment are frequently compounded by the lack of a central organisation acting as the focal point to bring together the academic, business and government communities to address the RE innovation and diffusion challenge in a coordinated manner. Where focal points do exist, they sometimes lack the scale and experience needed to have a significant impact (Carbon Trust, 2008). It is important, therefore, for financing programmes to bring together partners from the private, academic and public sectors. RE finance programmes should thus seek to grow a network of stakeholders and partners.

Exchange between policy makers and financiers is important for developing comprehensive frameworks, helping to circulate feedback on market activity and anticipating factors that may impact them. Regular engagement among local technology innovators, academics, entrepreneurs, investors and public administrators helps to form strategic relationships and build a critical mass of RE development capability (GIZ, 2011). One approach is to combine financing programmes with a Centre of Expertise that would develop these relationships (Box 13).

## 2.3.3 Choosing Technologies

Most RE technologies are young or still being developed, and many new and important innovations in this field are likely to emerge. While it may be possible to identify the technologies that are most appropriate for a given context based on the status of the industry and local conditions at a particular time, it is unrealistic to assume that the best choice of technologies will not change in the future along with science, policy and evolving economies. For this reason, it is better for RE finance programmes to take a “portfolio approach” that can change over time, rather than choosing to support only a limited set of technologies to support.

Some developing countries find it most feasible to begin with an exclusive focus on mature technologies. In principle, however, it is better – if possible – to support all stages of technology development and

## Box 12

### SUPPORTING EMPLOYMENT AND REGIONAL DEVELOPMENT WITH RE FINANCE IN BRAZIL

The Brazilian RE development strategy emphasises the employment and regional development potential of the RE sector. RE funding is primarily channelled through the BNDES, which then passes funds to regional banks, thereby helping build the RE financing capacity of local finance institutions. The rural electrification programme “Light for All” has a strong RE component based on an assumption that the use of PV systems is the most economically efficient electrification option for localities with small populations in the Amazon territory.

The government also uses a number of instruments to ensure that RE investments support the creation and growth of national businesses. To benefit from

subsidies and from BNDES financing, projects must fulfill national content requirements. Law 10762 mandates a minimum nationalisation of 60% in total construction costs, as well as regionalisation criteria, under which each state has maximum limits of 20% of total capacity for wind and biomass and 15% for small hydro. Foreign manufacturers of RE and Energy Efficiency (EE) technology, moreover, face a 14% tax surcharge on imports. The 60% national content requirement has led to significant installed production in Brazil. Major industry companies, such as Siemens, GE, Vestas, Suzlon and Fuhrländer, have now gone to Brazil for production or are actively seeking local presence there.

deployment, instead of limiting finance to either the early or late stages. In other words, focusing only on mature technologies has the drawback of ignoring new technologies that may have even better future potential.

#### 2.3.4 Leveraging Additional Finance

RE finance programmes should seek to maximise leverage of additional investment. When designed for this purpose, relevant programmes have been shown to

## Box 13

### CHILE PAIRS RE FINANCE WITH EXPERTISE AND NETWORKING

As part of Chile’s Economic Development Agency (CORFO), the Renewable Energy Center was launched in 2009 with a budget of USD 1.6 million to promote and facilitate RE development in the country. Before the creation of the Renewable Energy Center, CORFO employed a series of financing instruments for RE projects through its divisions InvestChile and InnovaChile. As of 2011, the Renewable Energy Center fully operates those promotion instruments and designs new ones as needed.

Beyond financing, the Centre also studies the evolution and development of RE technology and its implementation around the world; promotes and develops a network of other centers, stakeholders and constituents nationally and internationally; serves as an information centre to orient investors and project developers; and supports RE related capacity building and technology assistance programmes.

deliver ratios of between 3:1 and 15:1 (UNEP SEFI, 2008). In theory, addressing any of the existing investment barriers will achieve leverage. For private RE investors in particular, the central challenge is delivering an attractive commercial return for the risks taken, which come in various forms (Section 1.3)<sup>22</sup>.

In principle, guarantees can leverage additional investment per unit spent better than either grants or direct loans (SEF Alliance, 2010b). This is because fees for guarantees, even when set at levels that cover the full cost of the expected future claims for loss minus expected recuperation of assets, are a fraction of the committed loan or equity capital (SEF Alliance, 2010a)<sup>23 24</sup>. However, guarantees are only appropriate in financial markets where borrowing costs are reasonably low and where a good number of commercial financial institutions are interested in the targeted market segment. Among the countries studied for this report, the only one in which these criteria were not yet fulfilled was Brazil, which has relatively high borrowing costs. However, this should change in the future as its borrowing costs started to decrease in response to recent achievements in combating inflation.

Leveraging private investment through public finance mechanisms will be more difficult in countries with small domestic markets and/or those lacking clear

policy frameworks to incentivise RE development. In these contexts, the first focus should be on mobilising finance through regulation. Indeed, a well-designed policy environment can be one of the most effective ways of reducing risk for investors. Appropriate engagement of energy and finance policy makers on possible regulatory measures is also important as a component of financing programmes.

### 2.3.5 Accompanying Non-financial Interventions

Aside from designing tailored national financing packages, various non-financial interventions are also key to remove RE investment barriers and should be part of the holistic package of financing instruments and non-financing measures. Supportive policy frameworks, as already discussed, are absolutely critical to create attractive investment conditions.

Capacity building is especially important and should target three separate groups: (1) project developers, to prepare business plans for assessment; (2) local finance institutions, to understand how to assess RE projects; and (3) public officials and administrators, to understand how to design and implement RE policy. This is particularly critical in uncertain and evolving regulatory environments where timing costs and development risks are significant (*i.e.* Thailand, Box 15).

## Box 14

### ALL FINANCE IS LEVERAGED

In today's fractional reserve banking system, banks create the money supply by leveraging capital into loans. The vast majority of modern money is created in this way. At an 8% capital requirement, capital can be leveraged by a factor of 12 so long as the banks can attract sufficient deposits to clear outgoing checks. Using public

finance to establish or increase the capital of a special-purpose RE bank, along the lines of the IREDA, can provide an excellent option for leveraging finance into RE sectors while also establishing a lasting, independent, self-sustaining finance institution that will require no additional future support from the government (GIZ, 2011).

<sup>22</sup> For the RE sector in particular, risks to private investment have been examined in-depth in a number of recent studies. For example: UNEP SEFI, 2004; UNEP DTIE, 2007; UNEP and Marsh Ltd., 2007.

<sup>23</sup> The degree of achievable leverage is directly connected with the guarantee percentage offered. A guarantee percentage of 50% results, mathematically, in a higher leveraging ratio than an 80% guarantee. However, if a 50% cover is insufficiently attractive for potentially interested commercial finance institutions, it will not be taken up. On the other hand, if an 80% guarantee is too risky for the guarantor, then it cannot be offered. The ratio must be placed within the comfort range of both sides.

<sup>24</sup> For more on RE guarantee programmes, see: SEF Alliance, 2010.



Programmes should therefore emphasise technical assistance and capacity building, and should channel funds where possible through local FIs in order to increase learning, knowledge transfer and absorptive capacity among local actors. Institution building (related to government ministries, universities, research institutes, businesses, and civil society) also has a cost that must be anticipated to ensure a long-term impact.

### 2.3.6 Flexibility, Transparency and Impact Assessment

RE markets are young and dynamic, changing over time as the sectors mature, relevant policy frameworks evolve and the economy as a whole develops. Finance strategy must be adapted to the growth and relationship dynamics that characterise these living systems. Changes in country conditions must be carefully monitored over time, and should lead to corresponding

modification of the financing strategy as appropriate. It is therefore important to build flexibility into financing strategies.

Financing strategies need to be transparent in the budget and evaluation process. It is important that the financing strategy is adequately structured for long-term security, and consistent with national targets and priorities. To ensure that this is the case, the most successful RE finance programmes place particular emphasis on monitoring and evaluation, and especially on a rigorous comparison of goals and outcomes. RE finance practitioners should always be prepared to revise the approach according to the best emerging information and research. Therefore, impact assessment is a critical component of public finance strategy.

The UNEP SEF Alliance recently published a set of guidelines for the evaluation of public finance

#### Box 15

### THAILAND'S CLEAN ENERGY FINANCING EMPHASISES TECHNICAL ASSISTANCE AND CAPACITY BUILDING

Local banks in Thailand have found the establishment of two foundations helpful for facilitating RE finance: the Energy for Environmental Foundation (EfE) and the Energy Conservation Foundation (ECFT). Both foundations provide equity investment for Very Small Power Producer (VSPP) projects; but most important, according to investors interviewed for this study, is the technical information and support they provide to projects.

Moreover, Thailand's Energy Efficiency Revolving Fund (EERF) provides an excellent example of how governments can promote learning within the local finance sector and leverage additional financing by channeling funds through local FIs. Although EERF is primarily focused on efficiency measures, its mandate is to fund sustainable energy more broadly; and its strategy could be applied equally to more RE-focused strategies.

EERF aims to stimulate the banking community's interest in lending to industry for sustainable energy projects. It does this by providing funds to collaborating financial institutions at an interest rate of 0.5%, with a maximum loan tenor of seven years.

The financial institutions are allowed to "on-lend" these funds for sustainable energy projects at an interest rate of no more than 4%. Technical support from the Department of Alternative Energy Development and Efficiency (DAEDE) helps give banks the confidence needed to consider sustainable energy projects, even without technical or engineering staff of their own. The effort has led to loans worth over THB 10 billion (USD 286 million). Almost half of this was provided by the banks themselves by blending government funds with their own funding sources into single loans.

mechanisms (i.e. Irbaris and Climate Bonds Initiative, 2011). In 2008, this same group performed a review of impact assessment methodologies used by member RE finance agencies, and the most advanced frameworks among this group were found to be those of the UK Carbon Trust (see [www.carbontrust.com](http://www.carbontrust.com)) and Sustainable Development Technology Canada (SDTC; see [www.sdtec.ca](http://www.sdtec.ca)). Examples such as these of existing impact assessment frameworks could be used to inform the evaluation process.

### 2.3.7 Programme Governance and Operating Structure

In general, operational success for financing programmes depends on three main factors: (1) appropriate governance that provides effective engagement and oversight while protecting the independence of the programmes; (2) funding at a scale and durability to enable the programmes to invest for the long term; and (3) tailoring the implementation strategy effectively to local needs (Carbon Trust, 2008).

#### Independent, mission-driven organisations

Many experts recommend that RE financing programmes should be managed by organisations that are “independent”, meaning that their decisions should not have to be ratified by anyone in the executive or

legislative branches of government. The aim of this strategy is to protect the mission of the programmes from political interference.

An independent organisation can exist in any legal sector: public, private or non-profit. If in the private sector, however, it should have a not-for-dividend structure so that all profits are reinvested in the mission. Such companies are sometimes referred to as “common good” corporations. This protects the mission from being compromised by the need to maximise profits for shareholders.

To illustrate the different ways that RE finance programmes can be structured, a variety of successful examples – spanning the entire legal range from public to non-profit to private – are counted among the member organisations of the UNEP SEF Alliance. This is the international convening body for national public finance agencies in the clean energy sector. The range of legal structures among SEF Alliance members is illustrated in Table 1<sup>25</sup>.

It is important to note, however, that setting up new institutions can be challenging, and the decision to do so depends on the context. With the emergence of national climate finance institutions<sup>26</sup>, an integral approach can be more advantageous than setting up separate entities for different climate-related sectors.

TABLE 1: RANGE OF LEGAL STRUCTURES AMONG UNEP SEF ALLIANCE MEMBERS

Type of legal entity	Country	Programme
Public agency	Ireland Chile	Sustainable Energy Authority of Ireland (SEAI) Chilean Energy Efficiency Programme
Public-independent	Finland	Sitra, the Finnish Innovation Fund
Development bank	Mexico Chile	FIRA, the Mexican Agricultural Trust Funds Development Bank CORFO, the Chilean Economic Development Agency
Non-profit	Canada	Sustainable Development Technology Canada (SDTC)
Private not-for-dividend (“common good”) company	UK	The Carbon Trust

Source: includes data from UNEP and FS (n.d.).

<sup>25</sup> It is instructive that the two Latin American member organisations are both development banks, consistent with the observation made earlier that national development banks play a key role in RE finance in developing countries.

<sup>26</sup> South Africa has reliable coal-fuelled power generation and some of the most inexpensive power in the world, making renewable electricity generation financially unattractive. Furthermore, it has been difficult for the government to justify the prioritisation of RE in South Africa given the other socio-economic-problems demanding attention.

## Local ownership of financing strategy

Local ownership of RE financing strategy is key to embedding an approach within the structural development of a country and thereby ensuring absorptive capacity – which is critical in terms of developing both the project pipelines and the enabling conditions needed to make them commercially viable. Where international donors are involved, decades of development policy experience have taught that programmes are best designed in the context of an equal partnership between donor and recipient countries. The goal is to create lasting change that will be learned and embraced by local stakeholders, which requires active participation by local actors in the actual design of programmes.

## Illustrative structure of a National RE Finance Centre

For illustrative purposes, this section describes the “ideal” structure of a National RE Finance Centre. This could be operationally similar to the Innovation Centres that have been proposed for establishment in developing countries by the UK Carbon Trust. Its recommendations (Carbon Trust, 2008) have therefore been adapted here (based on GIZ, 2011).

A National RE Finance Centre could be a publicly funded organisation set up as public-private partnership at the national level. The Centre would be an independent, mission-driven organisation – as exemplified by the IREDA (Box 16). There would be appropriate local ownership, with establishment of local governance and control of project prioritisation. A partnership element between the developing countries and international donors could include agreed goals and success criteria.

The Executive Board could consist of equal representation from the central institution, national government and independent members (e.g. local business, academic communities). It would be responsible for defining the strategy, plans and budgets for the delivery of activities, developing an organisation capable of delivering the plans, managing the delivery of the plans and monitoring and reporting on progress.

The structure of the Centre would suit local conditions. As an example, it could comprise an administrative group, a national strategy group and a series of

in-house teams and/or third party delivery partners. The administrative group would facilitate the delivery of the various programmes and would act as a local centre of excellence for RE finance, engaging with public and private stakeholders. The national strategy group would be responsible for analysing and explaining the issues and opportunities around RE finance locally and for providing input into the development of the Centre strategy and delivery plans. In-house local delivery managers would be responsible for the delivery of the activities, supported where necessary by external delivery agents.

The Centres would draw up proposals on an annual basis for approval. Objectives and targets could include a leverage target (i.e. raising additional private and/or public sector funds), project delivery targets (i.e. the number of projects started/completed across the various areas of activities) and outcome targets, which could include Intellectual Property generation, the numbers of companies attracting further funding, and installed RE capacity.

Funding must be on a scale and commitment time horizon sufficient to allow planning and implementation of complex projects, including sufficient public funding to undertake pre-commercial activities. An effective collaborative relationship with government and the private sector would be needed to leverage additional funding, without compromising the ability of the Centre to provide an independent viewpoint on the policies needed to contribute to agreed goals.

One single financing Centre could require funding of approximately USD 40-100 million per year. Given the long lead times involved in RE development and deployment projects, a five-year funding budget would be the minimum necessary to establish local networks and achieve measurable progress. Future funding for subsequent time periods should be considered in light of the success of the first phase. The Centres would seek additional funding from other sources and could reasonably be expected to leverage 5-10 times as much in private sector investment overall. Funding from additional sources and leveraging of private sector funding would be expected to increase over time.

The size of the Centres needs to be sufficient to support a range of RE projects and early-stage companies.

## THE INDIAN RENEWABLE ENERGY DEVELOPMENT AGENCY

IREDA is an example of a national RE financing vehicle established as an independent, mission-driven and self-sustaining financial institution. It was incorporated in 1987 as a public limited company and non-banking financial institution under the administrative control of the Ministry of New and Renewable Energy (MNRE) to promote, develop and extend financial assistance for sustainable energy projects. Its mission is “to be a pioneering, participant friendly and competitive institution for financing and promoting self-sustaining investment in energy generation from RE, energy efficiency and environmental technologies for sustainable development.”

IREDA has for many years been the main provider of credit to RE and EE projects in India and has played a catalytic role in market development, leading to commercialisation of RE technologies. IREDA provides direct loans to developers of RE and EE projects; creates and manages innovative instruments for structured financing, securitisation and refinancing; and administers a number of government programmes on behalf of MNRE. These include the Indian Government’s Generation Based Incentives (GBI) for wind and solar, rooftop solar, and solar off-grid refinance schemes.

IREDA’s direct lending covers up to 70% of project costs at an interest rate of 11.50% to 13.75% with repayment periods up to 15 years. Current financing schemes include project financing, equipment financing, and financing through intermediaries. Sectors being financed are wind, hydro, biomass power and cogeneration, solar, waste-to-energy, EE and conservation, and

bio/alternative fuels. Nearly half of IREDA’s sanctions are for the wind energy sector, with the rest for mini-hydro, biomass and solar projects.

IREDA has been the main cooperating partner and channel in India for lines of credit for RE projects from multinational and bilateral development banks and international funds. In fact, more than two thirds of the IREDA’s funds are sourced from other development banks, including KfW (Germany), and the World Bank. Recent international partnerships include KfW (EUR 200 million), AFD France (EUR 70 million), JICA (JPY 30 billion) and Nordic Investment Bank (USD 50 million). Other than the funds from international sources, IREDA also raises funds from the domestic markets through bonds and loans from commercial banks.

In summary, IREDA has developed RE through innovative financing; encouraged entry of the private sector into RE; helped create manufacturing, design and engineering, O&M capabilities; and assisted the government in designing supportive RE policies. However, its limited capital base and resources make it unable to participate in lending activities on a scale similar to other emerging market development banks (e.g. BNDES or the China Development Bank).

In the fiscal year 2011-2012 IREDA provided project finance amounting to about US 370 million, which is not particularly significant as compared to the total green energy finance in the country. For fiscal year 2012-2013, IREDA expects disbursements to grow by 40% with significant increase in lending for solar projects.

Sources: Majumdar, 2010; Rao, 2010; Bloomberg NEF; Seetharaman, 2011; Popli, 2011

However, these must be set in the context of the ability for the local market to supply the required number of projects (e.g. larger, more industrialised countries are likely to have many projects to fund). However, countries where access to energy is of primary concern may wish to concentrate their efforts on funding deployment of one or two key clean energy technologies.

The Centres would allocate funds based on prioritisation of the range of projects available to them. The Centres could enable up to 50 projects per year to be supported in each Centre, many of which could lead to self-sustaining low-carbon technologies and businesses, given appropriate policy environments, with considerable carbon and economic benefits.

National RE Finance Centres from various countries could form an international network supported by a global secretariat, which would maintain a global perspective, agree on overall plans, monitor progress and ensure knowledge transfer between Centres.

## 2.4 WHERE TO BEGIN?

### 2.4.1 Understanding the Country's Energy Profile

The design of a financing programme should begin with an understanding of the local context, including the country's overarching profile of energy production and consumption. Programme developers should focus on local resources that can replace energy imports, and that can be readily implemented with the available technology. This approach led Brazil to become one of the most successful domestically-driven biofuel markets in the world.

In South Africa, biomass and biofuel sources (including landfills) are also abundant and, according to local investors interviewed for this study, harnessing these could be possible with relatively simple financing models and available technology. With the proper support and financing mechanisms, such initiatives enable replacing costly and unstable crude-oil and gas imports and provide co-generation power (Byrne Ó Cléirigh (BÓC) Consulting, n.d.).

### 2.4.2 Understanding the Market

Governments seeking to promote RE technologies should start with a market assessment that identifies:

- » RE business opportunities (*i.e.* technology and market sector) that have the potential to compete with other non-RE energy investments;
- » RE business opportunities that have a return on investment below the market expectation but above financial losses; and
- » RE projects that are not financially viable at all.

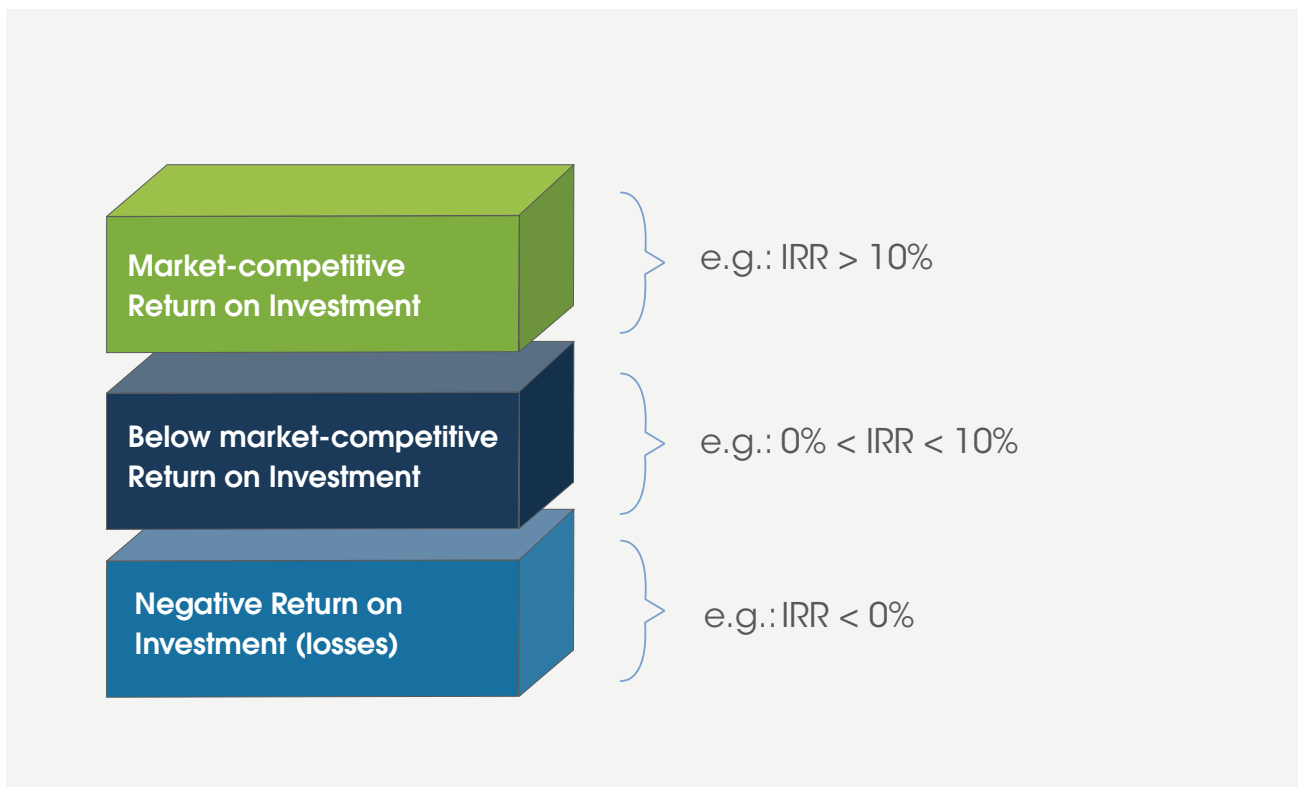
The Internal Rate of Return (IRR, or “rate of return”) is useful for assessing business opportunities and the financial viability of specific RE technologies, because investors use the IRR of each potential project as a key tool to reach their investment decisions. The IRR is used to measure and compare the profitability of investments. Funds will generally have an expectation of what IRR they need to achieve, known as a “hurdle rate”. The IRR can be said to be the earnings from an investment in the form of an annual rate of interest. Figure 10 illustrates the framework of a market assessment according to normal investor expectations for IRR – assuming a hurdle rate of 10%.

Once these market opportunities are identified, the technologies and sectors that can provide the best return on investment should be a primary focus (IRR > 10%) because they will not require subsidies from the government.

Examples of market assessments and cost-benefit analyses carried out to determine the support that is required from government to make specific RE technologies viable in a given country or region include Ireland's assessments of offshore wind projects (BÓC Consulting, n.d.) and assessments by BASE for the IDB to identify market opportunities, gaps, failures and risks that were used to design financial instruments in Colombia<sup>27</sup>.

<sup>27</sup> Contact BASE for more information: [www.energy-base.org](http://www.energy-base.org), BP (2010) and IMF World Energy Outlook (Sept 2011).

FIGURE 10: RE MARKET ASSESSMENT



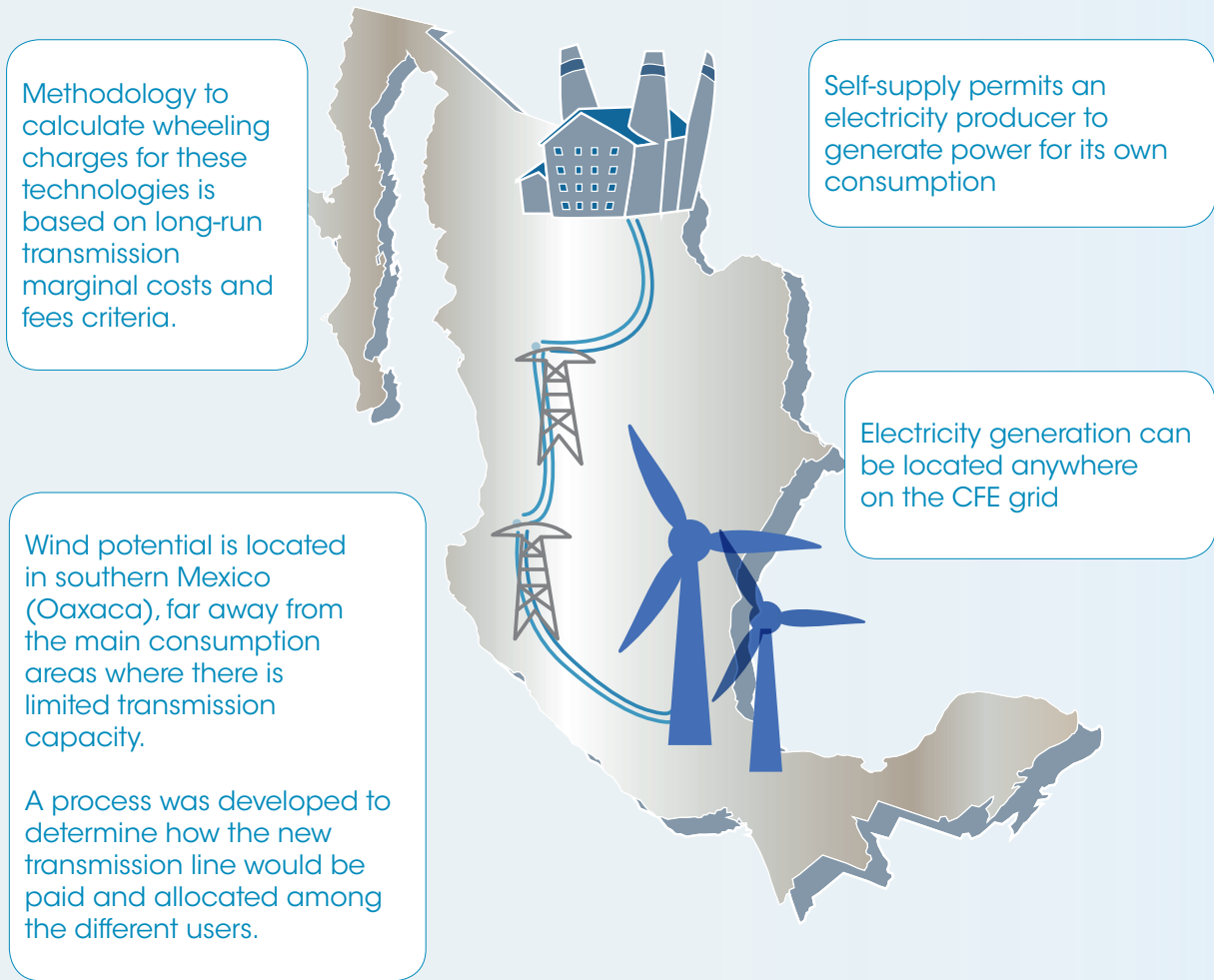
### 2.4.3 Aligning Market Opportunities with Targets and Policies

The next step is to align these market opportunities with national RE or climate change targets and identify initiatives, policies and efforts that could be integrated to develop the targeted technologies. As already discussed, a holistic strategy is required that

would likely include a variety of activities, such as: policy and regulatory initiatives, financial instruments, capacity building, partnership building, and demand stimulation. The private sector and investors can be engaged by implementing measures and policies (as opposed to subsidies) that catalyse the market, as in the case of the Mexican wind energy sector (Box 17), or the Brazilian wind sector (Box 8).

SELF-SUPPLY REGULATION TO CAPITALISE ON LOCAL LEGISLATION

FIGURE 11: SELF-SUPPLY IN MEXICO



An increasing number of companies are implementing self-supply power systems. Regulations that allow a producer to generate power for its own consumption have therefore proven to be an important enabling condition for self-supply RE investments in developing countries, which can

in turn catalyse the RE market more broadly. This is the case in Mexico, where most private power generation – including most RE projects – are done under the country’s self-supply scheme (please refer to Mexico Country Case Study in the Annex for more detail).

# Summary and Conclusions

The balance of overall RE investment has been shifting towards developing countries for several years. RE investment in the developing world has been most active in wind and recently also in solar energy, due to a substantial decrease in the cost of PV. Biomass and waste-to-energy, as well as biofuels and small hydro, also make up important components of total RE investments. The economic downturn of 2008-2009 constrained debt provision globally, but this had less negative impact on overall RE finance trends in developing countries compared to developed countries. The “big three” developing countries in the RE finance sphere (*i.e.* China, India and Brazil) make substantial use of public banks, which have proved more resilient to the recession. For developing countries in general, national and multilateral development banks are often central actors in RE finance; and in the aftermath of the crisis, public institutions played an especially critical role in providing capital that was otherwise unavailable from private sources.

A fundamental overarching barrier to RE investment is the failure of energy pricing to account for externalities, or the environmental and social costs of production, which has suppressed RE technologies for decades by making them look more expensive than they really are. Unfortunately, most governments continue to provide substantial subsidies to fossil fuels, imposing further disadvantages on RE. Shifting existing subsidies away from fossil fuels and towards RE is important, although the short-term impact of these changes on energy consumers must be carefully managed to avoid political backlash.

A lack of supportive, long-term, consistent and/or stable RE policy regimes often hinders RE investment

above and beyond the general uncertainty that characterises the investment climates of many developing countries. In some cases, a lack of clearly delineated authority over RE policy has also been a barrier to effective regulation; and a lack of clearly defined financial responsibility for relevant contracts (*e.g.* self-supply agreements, PPAs and feed-in tariff obligations) often complicates RE finance.

Lack of certainty translates into greater market risk for financiers, which means higher borrowing costs, shorter loan tenor, and higher equity requirements for RE finance. Developing countries also face higher foreign exchange risks when sourcing international funds. Infrastructure challenges are particularly acute for RE deployment in developing countries, often increasing the risk associated with RE investments or preventing a project from being taken forward. The reluctance of commercial investors is exacerbated by a lack of understanding of RE investments, and by the unique risks and high up-front liquidity needs of these technologies. Relevant knowledge and capacity is often also limited among project developers and relevant public administrators.

There is no “one size fits all” RE finance policy formula. Every national RE market is unique, and effective RE finance strategy requires a holistic approach that is tailored to the local context. That said, governments should generally seek to perform two broad functions: first, create overarching regulatory frameworks that shift incentives onto a macro level; and second, use targeted public financing to fill or overcome niche gaps and barriers. Regulatory frameworks can employ both energy policy (*e.g.* feed-in tariffs, energy auctions, and



self-supply regulation) and finance policy (e.g. banking regulation and other measures that incorporate sustainability into financial decision-making). While overarching regulation is required to improve the incentive structures for RE finance, deregulation within local RE markets can facilitate price discovery among competitive RE providers by allowing free entry and exit of new players into the RE sector, thereby driving down costs and accelerating uptake.

Targeted intervention implies public finance mechanisms combined or coordinated with accompanying non-financial interventions. The most effective public finance programmes will employ a flexible package of financing mechanisms rather than relying on any single mechanism or fixed set of mechanisms. These packages may employ credit lines to local finance institutions; project debt financing; loan softening programmes; guarantees to mitigate lending risk; grants and contingent grants for project development costs; equity, quasi-equity and venture capital; or carbon finance facilities. Public finance should not be used, however, as a substitute for underlying systemic and regulatory changes, so long as it is possible to make these changes.

A common priority of public finance programmes is to maximise leverage of additional investment into RE sectors, which can be achieved so long as the financing instruments address one or more existing investment barriers. Another important focus is to accelerate the progress of RE technologies along the innovation pathway, and in the process help to bring down the cost per unit of energy production. When choosing technologies to support, RE finance programmes should adopt a portfolio approach that

avoids creating dependency on any particular set of technologies.

RE finance strategy should align where possible with local policy priorities and may therefore seek to emphasise RE sector potential in terms of employment, regional development, national security, poverty alleviation and energy access. It is also especially important in developing countries to pair RE finance with capacity building efforts targeting project developers, local finance institutions, and public officials and administrators. To promote learning, funding should be channeled wherever possible through local finance institutions. RE finance programmes should also seek to engage a range of stakeholders from across the public, private, academic and non-profit sectors. One approach is to combine finance with a Centre of Expertise in order to create more value.

Operational success of RE finance programmes depends on appropriate governance that provides effective engagement and oversight while protecting the independence of the programmes; funding at a scale and durability to enable the programmes to invest for the long term; and tailoring the implementation strategy effectively to local needs. RE finance programmes must be transparent in their budget and evaluation process and should be adequately structured for long-term security. Particular emphasis should be placed on impact assessment, especially, on rigorous comparisons of goals and outcomes. Finance strategy must be flexible, capable of being adjusted based on these evaluations, and also of adapting to changes in local market conditions over time.





Annex:  
Country Case Studies

# BRAZIL

## A.1 INTRODUCTION

The Brazilian government emphasises the employment and rural energy access potential of renewable energy (RE) in its policies. The Brazilian National Development Bank (BNDES) is the dominant actor in RE finance. Brazil provides a valuable story of effective government auctions for RE projects, with its first wind-only energy auction held in 2009 in a move to diversify its energy portfolio. The auction process has boosted the wind energy sector, and has developed the market to the point of making it competitive with some other sources of power in Brazil, such as natural-gas thermal electricity plants. The wind energy sector has seen a considerable investment increase of more than USD 8 billion over the last 5 years. Possible new auctions are currently being considered (and are high on the investor wish list) for solar Photovoltaic (PV) as well, which is set to take off now that the price of PV has fallen dramatically worldwide. High tariffs in North America and Europe on biofuels imports and high feedstock prices are a major disadvantage for the Brazilian biofuels sector, which dominates the export market worldwide. Mixed-fuel cars will overtake standard cars in Brazil within a few years. Brazil is a global leader in mandatory blending. Biomass auctions have supported the development of cogeneration and biogas projects in Brazil, underpinning a boost to biomass investments since their implementation. The auctions, which have included long-term Power Purchase Agreements (PPAs) and connection to the grid, made several projects feasible.

TABLE 2: BRAZIL COUNTRY INFORMATION

Renewable Energy Targets by 2020		
Total RE (Electricity Generation without hydro)		16%
Wind (Capacity Elec.)		11.5 GW
Biomass (Capacity Elec.)		9.2 GW
Small Hydro (Capacity Elec.)		6.4 GW
Renewable Energy Shares in 2010		
In total primary energy supply		44%
In electricity generation (including hydro)		85%
In electricity generation (excluding hydro)		7%
Investment in 2011 (USD million)		
	2010	2011 (to 3 <sup>rd</sup> quarter)
Total Investments	5843.8	3788.9
Total Wind	2210.6	2963.1
Total Solar	6.4	6.5
Total Biofuels	2062.7	539.1
General Country Data		Year
Population	196.7 million	2011
GDP (USD)	2,477 billion	2011
GDP per capita (USD)	12,594	2011
GDP % of annual growth	2.7%	2011
Foreign Direct Investment (USD)	66.7 billion	2010
Investment in energy with private participation (USD)	20.2 billion	2011
Inflation	6.6%	2011
Unemployment rate	8.3%	2009
Balance of Payments - Current (USD)	52.6 billion	2010

Sources: Reegle, n.d.; REN21, n.d.; World Bank, n.d.; IEA, 2011a; UNEP, BNEF and FS, 2012

## A.2 THE ENERGY SECTOR

In 2009, the total primary energy consumption of Brazil was 240 million tonnes of oil equivalent (Mtoe) with strong contributions from oil (40%) and biomass (26%). Industrial, transportation and residential sectors demand 35%, 29% and 12%, respectively, of total energy consumption.

Brazil has the second-largest proven oil reserves in South America (12.9 trillion cubic feet of proven natural reserves) but remains a net energy importer. State-owned Petrobras is the dominant player in Brazil's oil sector.

Since the 1990s, the Brazilian electricity market has undergone two significant reforms enabling its energy market to move from being open and free, to one dominated by two main recently privatised national companies: Petrobras, controlling most of the oil and gas drilling, and Eletrobras, holding the majority of hydropower, nuclear and wind power companies. Almost 74.7% of Brazil's electricity capacity comes from hydroelectric plants, with fossil fuels representing 17.1% and biomass equaling 5.7%.

## A.3 RENEWABLE ENERGY

Brazil's RE power capacity, including large-scale hydropower, is the fourth largest in the world. Its biomass power capacity is the second largest. The 4.8 GW of biomass cogeneration plants at sugar mills generated more than 14 TWh of electricity in 2009, nearly 6 TWh of which was excess fed into the grid. 606 MW of wind farm capacity was installed, with another 450 MW under construction. Furthermore, it has been the world leader in mandatory blending of biofuels for 30 years under its "ProAlcool" programme.

Wind became one of the cheapest sources of power in Brazil as a strong currency and slowing global demand for turbines drove down costs. Developers agreed to deliver electricity generated by new wind farms at an average price of BRL 99.54 (USD 55.99) per MWh in a government-organised auction in August, 2011, the lowest nationwide rate for wind energy, according to Bloomberg New Energy Finance. It was cheaper than

two natural-gas thermal electric plants and a hydroelectric plant expansion that participated in an energy auction a day earlier, and 33% cheaper than contracts awarded in the country's first auction for wind power, in December 2009. The strong Brazilian currency (Real) was one reason developers could afford to sell power at those low rates. Brazil's currency climbed 9% between the 2009 auction and that of August 2011.

Investors hope that the government will soon begin offering tenders for solar as well, which is ready to take a similar path now that the price of PV panels has dramatically decreased.

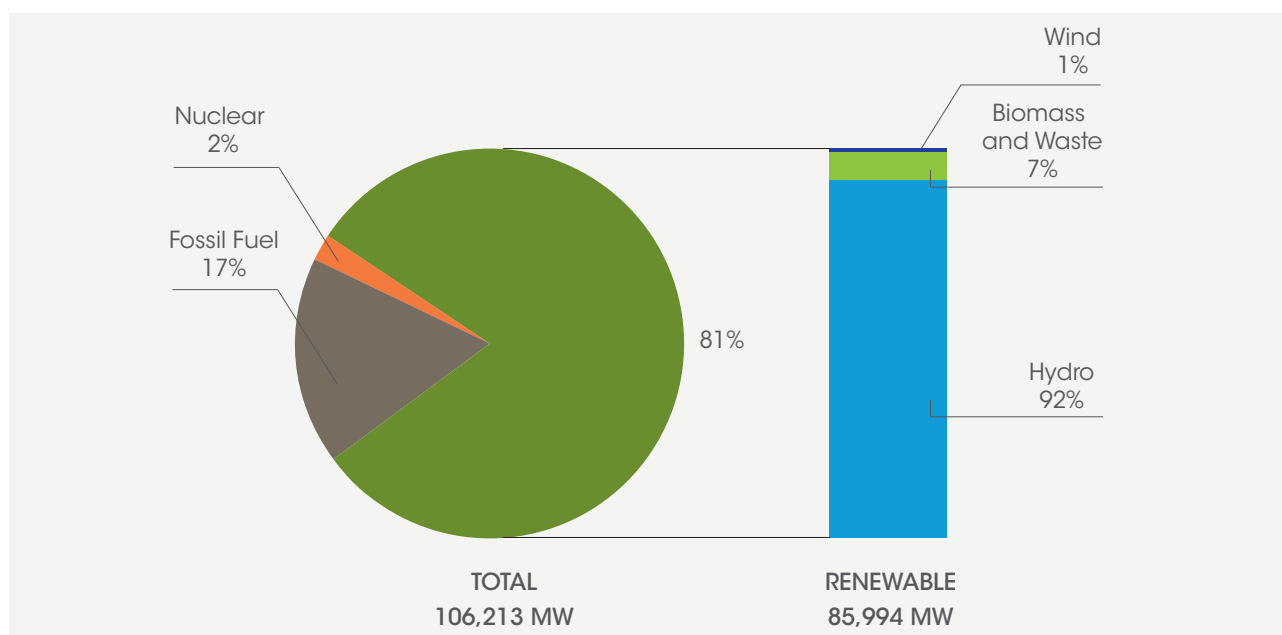
As of 2010, 44% of all of Brazil's Total Primary Energy Supply (TPES) was already met by RE with a rise to 46.3% forecast for 2020. Although the increase may seem small in percentage terms, a look into Brazil's energy needs for the next decade sheds a different light, with the demand for energy expected to rise by an estimated 60% due to increases in household demand, economic growth and heavy spending to improve infrastructure ahead for the 2014 FIFA World Cup and the 2016 Olympic Games. At 81% of the generation capacity, RE technologies dominate the electricity sector of Brazil, although 99% of this capacity is provided by hydroelectricity, biomass and waste. However, with a targeted capacity of 11.5 GW from wind by 2020, this situation should change (Figure 12).

### Hydropower

The hydropower sector is highly developed in Brazil. This is the RE sector that requires the least amount of financing, including small-scale hydro. The 10-year Energy Research Corporation (EPE) Plan predicts that the installed capacity from hydroelectric plants will rise from just less than 85 GW at present to more than 115 GW. The principal contributor to the increase in hydropower will come from the extra capacity generated by the proposed Belo Monte dam to be built on the River Xingu through a public-private partnership, and due to commence power generation in January 2015. Belo Monte will be the world's third biggest hydropower plant.

Brazil has an estimated 140 GW of total hydropower potential, with an estimated 40% remaining untapped, maintaining it as a valuable resource for future electricity generation.

FIGURE 12: ELECTRICITY CAPACITY MIX IN BRAZIL FOR 2009



Source: (EIA, n.d.)

### Wind

The Brazilian wind industry has transformed since its emergence in 2001, recording 931 MW in 2010, compared to installed capacity of 606 MW in 2009, and is predicted to continue growing rapidly until 2020. Recent measurements carried out in 2008 and 2009 from the Brazilian wind atlas indicate that the real potential for wind power in Brazil is 350 GW. This is more than double the initial predictions from 2001 of 143 GW – positioning Brazil as one of the future global wind energy giants.

The Brazilian wind market has expanded tremendously since its commencement and now boasts several key market players. Latin America, led by Brazil, is expected to develop 46 GW of total installed wind capacity by 2025; the Brazilian market is expected to represent 69% of the total installed capacity in Latin America by then.

Brazilian law requires manufacturers to produce 60% of wind equipment locally if it is to be used in Brazil. As a result Vestas (DAN), Enercon (GER) and Impsa (ARG) manufacture locally in Brazil.

### Biomass

Brazil is the third largest producer of biomass electricity behind the US and Germany thanks to its large amounts of sugar cane waste, covering most needs for its solid biomass electricity production.

28 Brazil has a large number of oilseeds that can be used to produce biodiesel such as the oil palm tree, castor oil plant, morichi palm and babassu palm.

### Ethanol

Brazil is also the second largest producer of ethanol in the world and the largest exporter of the fuel holding over 90% of the global export market. In 2010, Brazil was the world's top ethanol producing nation with a production of 26.2 million m<sup>3</sup> (Renewable Fuels Association, n.d.), and 1.6 million m<sup>3</sup> of biodiesel in 2009, making it the fourth largest biodiesel producer in the world<sup>28</sup>. Mixed-fuel “flex motor” cars in Brazil are projected to overtake traditional cars within the next two or three years – with over half of the cars in the country already being of the flex-fuel variety. The latter is expected to spur ethanol production to double in the next ten years (GENI, 2010).

### Solar

Due to its location, solar radiation is one of the highest recorded in the world, particularly in northern Brazil. The Amazon is the sunniest region in Brazil, with an average record of 6,000 Wh/m<sup>2</sup>. Solar energy potential is estimated at 114 GW (GENI, 2010).

According to the Global Energy Network Institute, total installed capacity of solar PV energy is estimated 12 MW to 15 MW and is primarily used to supply telecommunications and rural installations. In 2009, Brazil had approximately 5 million m<sup>2</sup> of solar panels installed – government plans, however, are to triple the area by 2015.

Solar hot water technologies are becoming widespread and contribute significantly to hot water production. Brazil led the market for newly installed capacity worldwide during 2009, when Brazil's capacity increased 14%, bringing total existing capacity to nearly 3.7 GW thermal (5.2 million m<sup>2</sup>).

## Geothermal

Geothermal remains the least tapped energy sector in Brazil, with only 1.84 GWh produced in 2005. Despite there being a potential for exploiting geothermal energy, particularly in southern Brazil, investment is currently not being pursued (GENI, 2010).

## Renewable Energy Targets

Brazil's national 10-year energy strategy lays out the following RE targets for the next ten years (CleanTechnica, n.d.):

- » Wind energy: Brazil hit the 1 GW milestone in May 2011, but plans to have to 11.5 GW by 2020.
- » Small hydro: An increase from 3.8 GW (2010) to 6.4 GW in 2020.
- » Biomass: An increase from 4.5 GW (2010) to 9.2 GW (2020)

In total, wind, small hydro and biomass are expected to reach 27 GW by 2020, compared to 9 GW in 2010.

### Investment plans to reach targets are as follows:

- » BRL 70 billion (USD 44.5 billion) for RE sources excluding large hydro
- » BRL 96 billion (USD 60.7 billion) for large-hydro plants
- » BRL 25 billion (USD 15.8 billion) for fossil projects.

In late 2010, Brazil enacted a decree targeting its CO<sub>2</sub> emissions. The decree requires a 1.3 billion tonne reduction in emissions by 2020 (UNEP, BNEF and FS, 2011).

Brazil aims to maintain or increase the existing share of RE in total energy (44% in 2010) and in electricity

generation (85% in 2010) through 2030, and this policy goal is broken down into a number of technology-specific goals. For wind, the government has set a goal of achieving 11.5 GW of production capacity by 2020<sup>29</sup>. In biofuels, Brazil intends to double national production of ethanol by 2017, to 63 billion litres annually. This includes moving into second-generation biofuel production that at present exists at pilot scale only<sup>30</sup>. Ethanol accounts for more than 50% of current light vehicle fuel demand, and Petrobras expects this to increase to over 80% by 2020.

## Regulatory Framework

The National Council for Energy Policy (CNPE), which is part of the Ministry of Mines and Energy (MME), advises the government on national energy policy issues. The National Agency of Petroleum, Natural Gas and Biofuels is responsible for biofuel policy; and the Agência Nacional de Energia Elétrica (ANEEL) for the implementation of RE policy goals in the power sector. The CNPE provides market agents with indicative projections for their investment plans. The Energy Research Company (EPE) calculates the National Energy Balance.

The Brazilian government uses mandates, state enterprise investments and technology-specific auctions for power supply as tools to promote clean energy. In 2002, the government launched the Programme of Incentives for Alternative Electricity Sources (PROINFA) to encourage the use of RE sources such as wind power, biomass, and small hydropower stations. In August 2012, ANEEL announced two new pieces of regulation to support the solar industry: first, a net metering for micro generation up to 1MW; and second, a tax break of 80% for installations up to 30 MW. ANEEL also announced that they will launch an auction for solar projects between 1 MW-3 MW, but no details are available yet (IRENA, 2013).

PROINFA was intended to be implemented in two stages. By 2008, PROINFA 1 was to add 3,300 MW of electricity capacity stemming from RE sources, divided equally among wind, biomass and small hydropower, to the interconnected system. The chosen subsidy instruments were technology-specific feed-in-tariffs with a cap on the number of supported MW. The programme is operated by Electrobrás, which buys energy

<sup>29</sup> Since the inception of PROINFA, Brazil's wind energy escalated from 22 MW in 2003 to 602 MW in 2009, as part of 36 private projects, another 10 projects are under construction, with a capacity of 256.4 MW, while 45 additional projects have been approved by ANEEL with an estimated potential of 2,139.7 MW.

<sup>30</sup> Novozymes has established a second-generation pilot plant in Brazil. Novozymes reached benchmark enzyme costs of USD 1/gallon in March 2009 and is targeting 50 cents/gallon in 2010.

at preset preferential prices (different for each of the three sources) and markets the electricity. The cost of subsidies and incentives is covered by the Energy Development Account, funded by end-use consumers through an increase in energy bills. Low income sectors are exempt from this increase. PROINFA was expected to generate 150,000 jobs and to leverage private investments of around USD 2.6 billion. PROINFA 1 was completed in 2008 with 3.3 GW installed. Wind farm capacity increased from 22 MW in 2003 to 606 MW in 2009, as part of 36 private projects; another 10 projects with a capacity of 256 MW were under construction, while 45 additional projects with a capacity of 2,140 MW had been approved by ANEEL. The MW of supported biomass projects was far below the original target: the feed-in-tariff for biomass projects was too low, making it more favourable for new biomass plants to sell directly to the wholesale market.

All gasoline in Brazil contains ethanol, with blending levels varying from 20 to 25%. Since 2008, a 3% blending requirement was enforced for domestic diesel sales, which was increased to 5% in early 2010. The blending mandate is accompanied by a host of supporting policies, including retail distribution requirements - all fuelling stations are required to sell both gasohol (E25) and pure ethanol (E100). Furthermore, there are tax incentives for “flex-fuel” vehicles (meaning that they can run on 100%

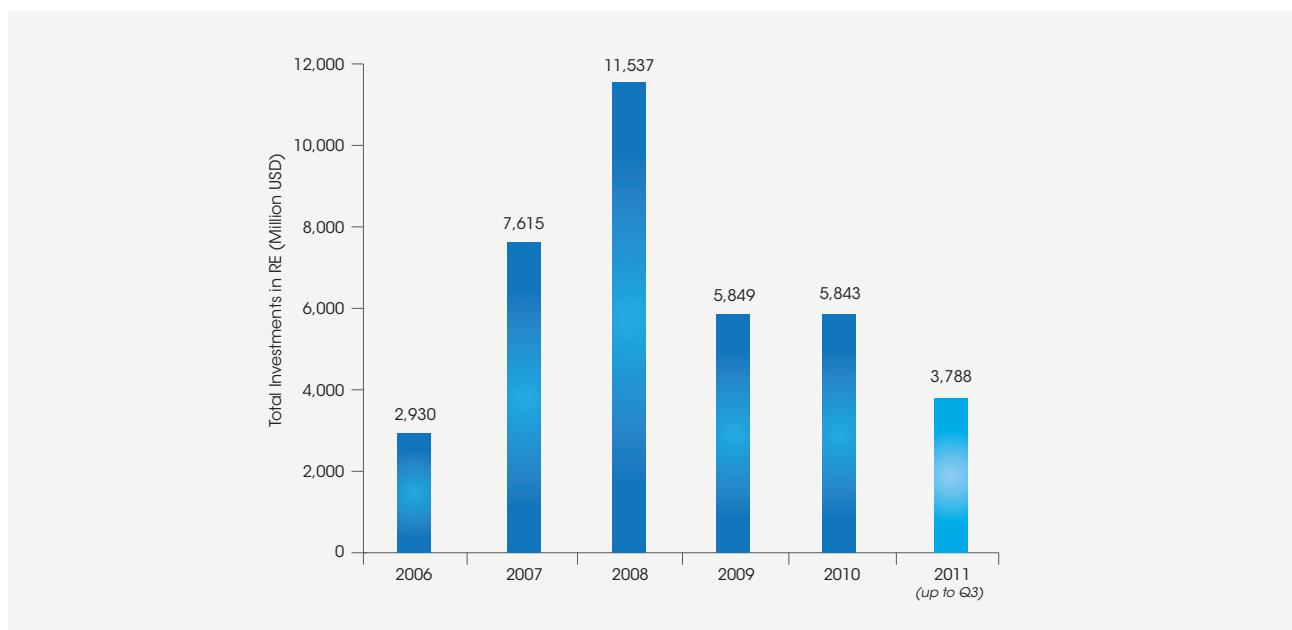
ethanol or an ethanol-gasoline mixture) as well as for family agriculture that produces feedstock for biodiesel.

Under the regulatory structure introduced in Brazil in 2004, most new power projects participate in auctions for long-term PPAs with energy distributors who are required to enter into long-term contracts for all of their electricity demand via a reverse auction system. The energy auctions are carried out by ANEEL through a delegation from the MME. There are specific auctions for both existing energy sources and for new energy sources. Auctions for RE plants target specific energy sources and large hydropower project specific sites. The tenders fix maximum price caps<sup>31</sup> and have penalties built in for developers who sign contracts they cannot uphold.

### Financial Flows in Renewable Energy

The Brazilian RE market saw similar investment for 2010 (USD 5,844 million) and 2009 (USD 5,850 million). The renewable reverse auctions have boosted the interest of investors in the wind energy sector, where investment has seen tremendous growth since 2009. Specifically, growth in absolute terms went from USD 115 million in 2006 to USD 1,598 million in 2009 and to USD 2,963 million in just the first three quarters of 2011. Put differently, there was 38% growth between

FIGURE 13: BRAZIL INVESTMENT IN RE (USD MILLION)



Source: BNEF (n.d.)

<sup>31</sup> The biddings for two plants of the Madeira River Hydroelectricity Complex, for example, were subject to a cap of BRL 91/MWh and BRL 122/MWh, which were marked down by up to 35% in the 2008 and 2007 auctions.



2009 and 2010 which continued as a positive growing trend from 2010 to 2011 (up until Q3 2011), showing a growth of 34% from the previous year's baseline. The cumulative investment in the wind energy sector from 2005 to the third quarter of 2011 was USD 8.4 billion.

The Brazilian RE market has not recovered the investment level that it had in 2008 (USD 11,538 million), which was mainly boosted by the biofuel sector that accounted for 75% (USD 8,656 million) of the total investment in that year. From 2008, biofuel investments decreased to USD 2,063 million in 2010 and then to USD 539 million by the third quarter of 2011. High feedstock prices and over-capacity gave way to apparent balance sheet difficulties over the last few years.

Small hydro investments have decreased in the last few years, but still have a relevant share in the total RE investment. In 2010 the small-scale hydro power sector represented 14.1% of the total 2010 RE investment, an annual figure of USD 826 million, which was almost 50% less than the highest yearly investment figure of USD 1,574 million in 2007.

The Brazilian biomass sector has seen a growing interest from investors since the launch of biomass-specific auctions by the government in 2008. The auctions, which included long-term PPAs and connection to the grid, made several projects feasible. Besides organising the auctions, the federal government has taken a series of technical and administrative measures that aim to facilitate and speed up the participation of a large number of sugarcane factories and integrating their produced bio-electricity into the grid. The biomass project mainly consists of cogeneration technologies

that use sugar cane bagasse as a feedstock on the back of Brazil's sugar/ethanol industry, and biodigester technologies that produce biogas from waste. The total investment in biomass projects in 2010 was USD 730 million, a figure that was 24% higher than the investment figure of 2009.

## A.4 FINANCING MECHANISMS

Another strength of Brazil's RE development strategy is that it emphasises the employment and regional development potential of the RE sector. As in many developing countries, the national development bank (BNDES) plays a central role in RE finance country-wide. Its funds are often passed to regional banks, which help build the capacity of the more local financing institutions. BNDES is the favoured channel for funding from international donors or finance partners, such as the German Development Bank, KfW, which provides a credit line to BNDES for small hydro, supports pilot projects in biogas and is working on grid-connected PV pilot projects<sup>32</sup>. BNDES' overall RE lending amounted to USD 6.4 billion in 2009.

Moreover, the government uses a number of instruments to ensure that RE investments support the creation and growth of national businesses. To benefit from subsidies and from BNDES financing, projects must fulfil national content requirements. Law 10762 mandates a minimum nationalisation of 60% in total construction costs, as well as regionalisation criteria, where each state has maximum limits of 20% of total capacity for wind and biomass and 15% for small hydro. Foreign manufacturers of RE and EE technology, moreover, face a 14% tax surcharge on imports.

TABLE 3: BRAZIL RENEWABLE ENERGY INVESTMENT (USD MILLION)

	2010	2011 (to 3 <sup>rd</sup> quarter)
Total Investment	5843.8	3788.9
Total Wind	2210.6	2963.1
Total Solar	6.4	6.5
Total Biofuels	2062.7	539.1
Total Biomass/ Waste	729.9	106
Total Marine	8.1	-
Total Small Hydro	826.1	174.2

Source: (UNEP, BNEF and FS, 2012)

The 60% national content requirement has led to significant installed production in Brazil. Major industry companies such as Siemens, GE, Vestas, Suzlon and Föhrländer have now gone to Brazil for production or are actively seeking local presence there.

The Brazilian government has also provided significant support for solar energy in rural applications. The rural electrification programme "Light for All" has a strong RE component and assumes that the use of PV systems is the most economically efficient electrification option for small localities in the Amazon territory.

<sup>32</sup> The PV sector in Brazil is currently very small, and KfW expects a growth by a factor of 10 or 20 in the next few years now that PV prices have significantly fallen.

Regional banks, such as Banco de Nord Este, are also active in RE finance. However, these banks generally work with BNDES funds that are passed on to the regional level.

For new projects, the PROINFA system has been replaced by ANEEL's energy auctions, which also changed the way the surplus cost of RE is financed. Acquired power is fed into the power pool at the contracted price, raising the averaging pool price. The increase is subject to a politically fixed maximum: the average price of energy for end consumers can increase up to a cap of 0.5% (annual) and 5% during the 20-year period.

ANEEL held the first biomass-only reverse energy auction in 2008, contracting 2,379 MW produced by 31 thermoelectric plants using sugarcane and napier grass with the supply beginning in 2009 and 2010, and contracts extending for a 15-year period. The final average price was USD 32/MWh. In 2010, ANEEL contracted 191 MW in addition to 554 MW and 60 MW in 2011.

The first wind energy auction was carried out in December 2009, resulting in 1.8 GW being contracted from 71 wind power plants scheduled to operate by July 2012.

In August 2010, 89 projects representing 2.9 GW of installed capacity and involving BRL 26.9 billion (USD 15.2 billion) in investments were contracted from biomass and wind farm developers<sup>33</sup>. Biomass

projects with a capacity of 713 MW were contracted at an average price of BRL 144, or USD 83.50 per MWh, whilst the 2.1 GW generated from the wind power were contracted at an average price of USD 74.4 per MWh.

The rural electrification programme, "Light for All", has a strong RE component. It assumes that (i) the use of approximately 130,000 PV systems is the most economically efficient electrification option for about 17,500 localities with small populations in the Amazon territory; (ii) a further 2,300 villages with about 110,000 buildings could be equipped with a mini-grid based on PV or biomass sources, 680 additional medium-sized communities could be supplied on the basis of hybrid systems, and 10 larger communities could be provided with power based on conventional diesel generators or hybrid systems (UNEP SEF Alliance, 2010a).

Brazil is a successful promoter of Clean Development Mechanism (CDM) projects. Brazil's CDM projects account for 40% of all CDM projects in South America and for 44% of contracted Certified Emission Reduction (CER) credits up to 2012.

Brazil's National Fund on Climate Change is an example of a holistic fund concept with a strong RE component. It aims to mitigate the environmental impact of oil production by allocating a portion of the State's revenue from oil to support projects, studies and enterprises relating to climate change mitigation and adaptation. The law establishing the Fund was adopted in December 2009. At that time, the

## Box 18

### ENERGY AUCTIONS

The Brazilian government has been carrying out auctions to meet electricity demand and to increase the share of RE in the electricity mix while giving incentive to domestic RE industry through local content requirement.

Auctions involving RE projects are organized for both firm electric energy generation and reserve electricity capacity. A typical auction consists of two stages. In the stage

1, a 'descending price clock' auction mechanism is used for price discovery. The successful bidders of Stage 1 participate in stage 2, where a 'pay-as-bid' auction is used for further reduction in the price of RE (see Dutra and Menezes, 2005 and Maurer *et al.*, 2011 for more details).

These auctions have been successful in deploying RE while creating competition and bringing down RE costs.

<sup>33</sup> Observers are concerned that the wind farm prices offered by several developers are not realistic; some projects projecting capacity factors of 55%.

Government pledged USD 113 million, part of which will come from oil industry revenues. The Fund has already started supporting mitigation and adaptation programmes and projects involving a wide range of activities. Such activities include capacity building, climate science, adaptation and mitigation projects, projects aimed at reducing carbon emissions from deforestation and forest degradation, particularly in vulnerable areas, development and dissemination of technologies, R&D, development of products and services that contribute to mitigation and adaptation, payment for environmental services, establishment of agro-forestry systems that contribute to reducing deforestation and carbon sinks and finally the rehabilitation of degraded areas.

## Future Development of the Investment Framework

One of the obstacles to investment that remains to be overcome relates to high interest rates, which should decline in coming years as Brazil makes significant strides in controlling inflation. The Brazilian economy is experiencing high growth overall, and investment opportunities in other sectors are so good that investors have trouble justifying RE investments by comparison.

There is also a perception among many investors that Brazil does not require further investment in RE because it already has such a high percentage of energy supplied by hydro. RE investment was also hampered by high and complicated taxes<sup>34</sup>.

A barrier to the growth of the Brazilian biofuels sector in particular relates to the high tariffs imposed on imports of these fuels by the US and Europe. Reductions of these tariffs over time, along with steadily increasing global demand, will support further growth of these Brazilian exports.

The Brazilian government is working on tax incentives to reduce the cost of production in the RE and EE value chain. There is interest in transforming the Northeast into a platform for the supply of equipment both for local demand as well as for export. Moreover, two new pieces of regulation to support the solar industry were introduced: a net metering for micro generation up to 1 MW and a tax break of 80% for installations up to 30 MW. An auction for solar projects between 1 MW to 3 MW was also announced, but no details are available as of yet. The solar industry is now seen to be where the wind sector was 2 or 3 years ago in Brazil, ready for take-off after substantial global price reductions.

## A.5 CONCLUSIONS

There are still many RE opportunities in Brazil to be exploited, yet it is already one of the most important markets for RE technologies in the world. The country is well on its way to developing the RE sector through a solid and mature biofuels market, growing wind power generation, and the consolidation of small hydro projects. The technology-targeted energy auctions have catalysed the RE market and provided:

- » A reliable policy framework for investors;
- » Understanding and involvement from public and private investors; and
- » Development of a local RE industry.

Brazil has provided an excellent example of the implementation of creative policy measures, which, in combination with financial and risk mitigation support, have been able to increase the national RE capacity.

<sup>34</sup> For comparison purposes, Brazilian tax rates are only slightly lower than those of Germany.

# EGYPT

## B.1. INTRODUCTION

Looking to meet growth-based energy needs and to diversify its power sector, Egypt is preparing for the future as it moves from being a net oil exporter to a net oil importer by setting aggressive targets and focussing primarily on wind, with some pilot solar installations. Egypt has led the African continent in both RE investment and installed RE capacity during 2010. New incentives are also being introduced for the country's first Independent Power Producer (IPP) project. These incentives are expected to drive Egyptian commercial wind programme, of which key examples include permits, land-use agreements, duty and sales-tax exemptions, and long-term power purchase agreements (PPA) of over 20 years, guaranteed by the Central Bank of Egypt. Environmental and avian impact assessments performed by the New and Renewable Energy Authority (NREA) are also part of these incentives. An innovative joint measurement campaign is a key component of this process, seeking to maximise success of the bids and project financing structure. Under ideal circumstances, Egypt will be installing 7,200 MW wind energy as part of its 20% renewable electricity target by 2020.

TABLE 4: EGYPT COUNTRY INFORMATION

Renewable Energy Targets		
Electricity generation from renewables		20% by 2020
Wind		12% by 2020
Hydro		6% by 2020
All other renewables		2% by 2020
Solar Capacity		2800 MW CSP and 700 MW PV by 2027
Renewable Energy Shares		
In total primary energy supply		4%
In electricity generation (including hydro)		11%
In electricity generation (excluding hydro)		1%
Investment in 2010 (USD million)		
Wind		869.5
Solar		714
General Country Data		Year
Population	83.7 million	2011
GDP (USD)	218.9 billion	2010
GDP per capita (USD)	2,781	2011
GDP % of annual growth	1.8%	2011
Foreign Direct Investment, net inflow (USD)	6.4 billion	2010
Investment in energy with private participation (USD)	314 million	2010
Inflation Rate	13.3%	2011
Unemployment Rate	12.2%	2011
Balance of Payments - Current (USD)	4.5 billion	2010

Sources: Reegle, n.d.; IEA, 2011b; World Bank Statistics, n.d.; UNEP BNEF and FS, 2012.

## B.2 THE ENERGY SECTOR

With 4.4 billion barrels (January 2011) of proven oil reserves and a daily output of over 662,000 barrels, Egypt is the world's 26th top oil producer.

Although actual oil production has remained stable, Egypt's domestic growth and energy needs led to a decrease in net oil exports, resulting in the country becoming a net oil importer in 2010 (BP, 2010; IEA, 2011b). With natural gas production on the rise, gas exports are now expected to grow significantly through to 2030, thus securing Egypt's role as a strategic source of natural gas for both the region and Europe.

More than 90% of Egypt's energy consumption today is met by oil and natural gas. The share of oil in the energy mix is mostly used in the transportation sector. However, with the development of compressed natural gas infrastructure and vehicles, the share of domestic use of natural gas in the transportation sector is expected to grow. In terms of electricity generation, natural gas represents well over 80% of the total mix, the remainder being met mostly by hydroelectricity. In 2008, Egypt became a net electricity exporter, with electricity exports reaching 1 TWh while imports stood at 896 GWh.

Egypt will need to address future energy challenges such as growing urban and rural development, high subsidies for energy prices, population growth and growing industrial needs.

In order to address future energy needs, Egypt's development strategy aims to (AfDB, 2010; Georgy and Soliman, 2007; CIF, 2009):

- » Increase the use of efficient fossil-fuel generation technologies.
- » Maximise the use of natural gas in thermal power plants.
- » Maximise the use of hydropower through electrification of suitable dams on the Nile River and its branches.
- » Further develop Egypt's renewable resources in the power generation mix.

- » Interconnect the Egyptian electricity grid with neighbouring countries.
- » Improve the efficiency of energy use, generation, transmission and distribution as well as increase the overall efficiency of energy consumption.
- » Adopt measures to enhance environmental protection.

The Egyptian government controls 91% of all electricity production and maintains a monopoly on transmission and distribution.

## B.3 RENEWABLE ENERGY

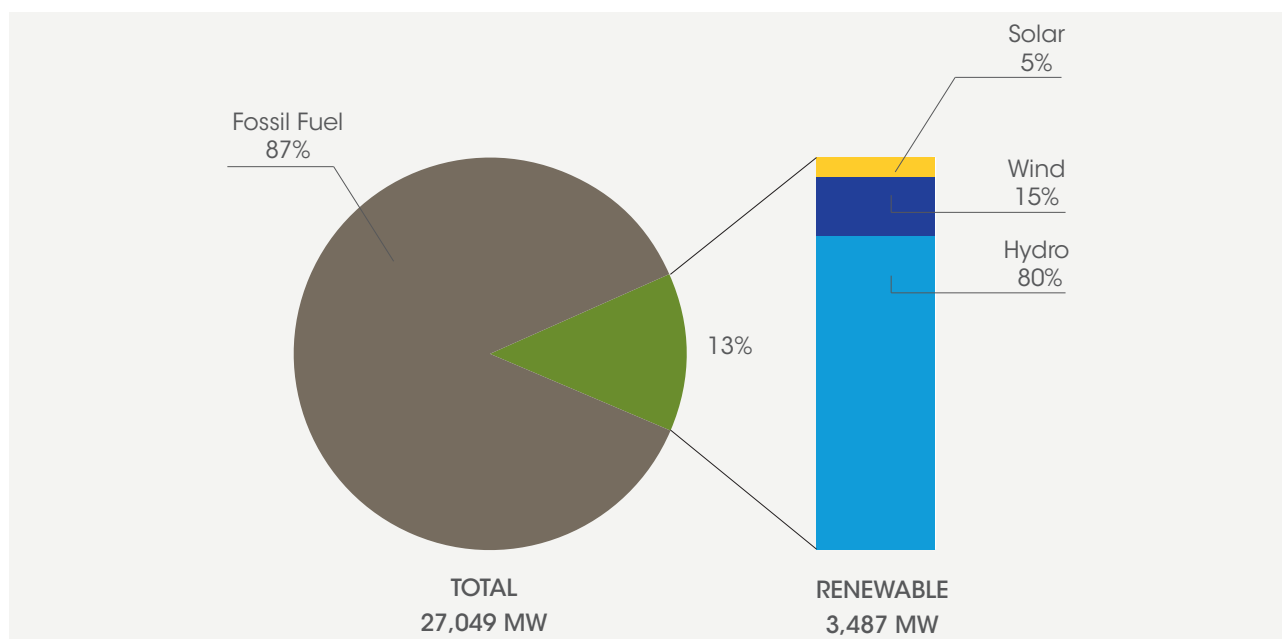
### Current Status

Egypt has the largest percentage of RE in the southern and eastern Mediterranean region. It accounts for 68% of the total installed wind capacity and 43% of the total hydro capacity in the region. Nevertheless, RE currently make up only 13% of Egypt's total generation capacity, including 80% of hydro, 15% of wind and 5% of solar (see Figure 14). These figures are expected to change drastically in the years to come, as a result of the new wind capacity currently in development.

Taking the increasing pressures on fossil fuel resources and the resulting increase in local and global environmental impact into consideration, one of the key pillars of Egypt's energy strategy is greater reliance on RE sources. This strategic reassessment of energy first occurred during the oil crisis in 1970s when the sharp increase in the price of fuel fostered growing interest in exploring RE opportunities, as well as their potential to be used on a large scale.

The creation of a wind atlas, specifically for Egypt, paved the way for its first government wind pilot projects in the early 1990s. Since sources of hydroelectricity are at near capacity with regards to new installations, wind and solar power are the main sources of RE that are expected to grow. Although there is potential in many RE sectors, wind is seen as being the most mature and commercially viable

FIGURE 14: ELECTRICITY CAPACITY MIX IN EGYPT FOR 2010/2011



Source: Ministry of Electricity and Energy of Egypt

technology, particularly given the low energy costs in Egypt (USD cents 3.5/kWh). As such, wind is the RE source being most aggressively pursued (AfDB, 2010). Although concentrated solar power (CSP) has matured, it is still in the demonstration phase and is not yet as commercially viable as wind energy. Large scale RE generation projects are given the utmost priority in Egypt's RE strategy, serving both regional and national objectives of achieving fossil fuel savings, environmental protection, job creation and the transfer of technology (World Bank, 2010).

## RE Potential

Egypt is focussing on wind power production given that the mean wind speeds of wind energy sources, particularly in the Gulf of Suez, are in the range of 8 m/s – 10.5 m/s at 25m. The West of the Suez Gulf Zone is particularly promising due not only to wind speeds, but also to its proximity to load centres, transmission infrastructure and the large uninhabited desert area (AfDB, 2010; Reegle, n.d.).

Solar potential in Egypt has been estimated at several thousand MW of installed capacity per year. There are a number of trial solar installations, including a 140 MW hybrid thermal/solar generation power plant (120 MW thermal and 20 MW CSP in

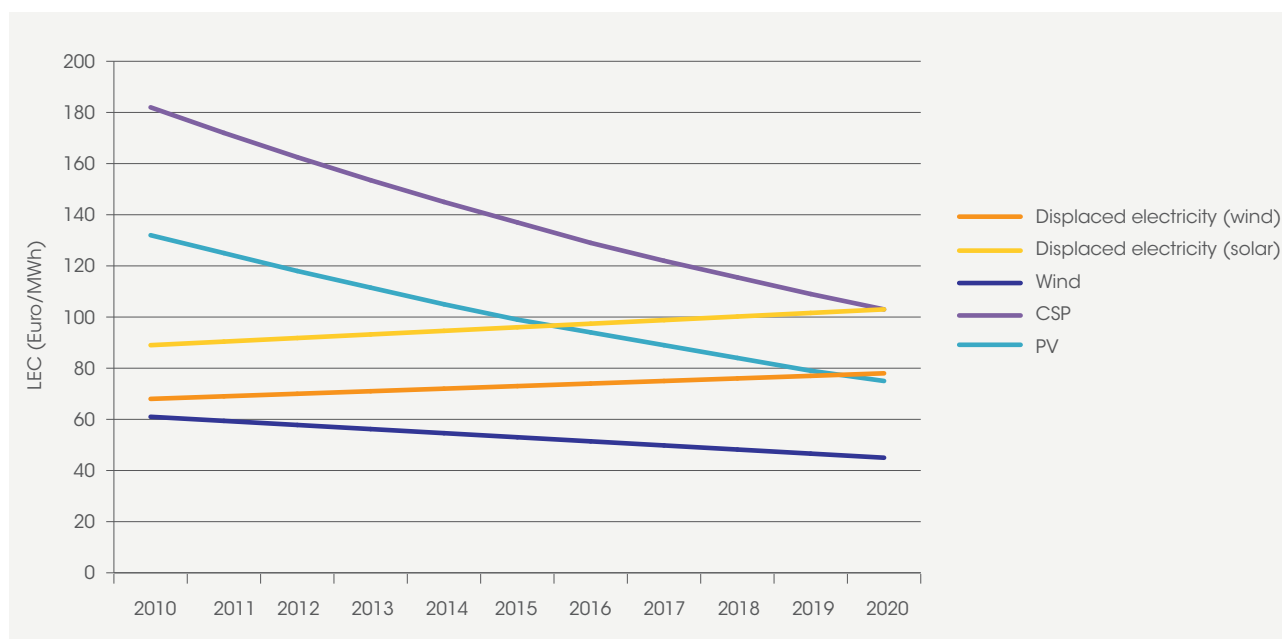
Koraymat). A multi-lateral, government financed, 100 MW CSP model project in Kom Ombo, Aswan, is also in the planning stage.

Hydropower is currently the major RE source accounting for 10% of electricity generation. However, 85% of the Nile's hydropower potential (there are five hydropower stations along the Nile) has already been exploited, approximately generating 13,000 GWh per year (AfDB, 2010; Reegle, n.d.).

The biomass resource in Egypt has been estimated at 40 million tonnes per year, or 3,600 kilo tonnes of oil equivalent per year. In spite of its high energy and economic value, agricultural residues in most cases are disposed of by direct open burning, causing serious pollution problems (e.g. the case of rice straw burning). Bagasse and livestock waste have also been identified as potential biogas feedstocks. Potentially, 1,000 MW could be generated from agricultural waste.

Currently, geothermal resources do not play an important role in Egypt's electricity generation; although, thermal use does amount to approximately 1 MW. Several geothermal spas are located across the country, endowed with temperatures ranging between 28 °C and 70 °C.

FIGURE 15: LEVELIZED ELECTRICITY COST (LEC) FOR EACH TECHNOLOGY



Source: EIB, 2010

## Renewable Energy Targets

On April 10, 2007, the Supreme Energy Council established the 20% renewable electricity generation target for 2020. Wind is expected to make up the largest share representing 12% (7.2 GW) of this target. Hydropower currently represents 10% of the entire electricity production and in the 2020/20% scenario, this rate would fall to around 6%. Solar will play a limited role until it reaches maturity, but the Egyptian electricity generation expansion plan includes achieving a total solar capacity of 150 MW by 2017 and 3.5 GW by 2027.

Aggressive targets are based on dwindling oil supplies combined with increasing energy demand. The priority is first wind power, followed by solar, with clear indications that both are becoming increasingly competitive.

Figure 15 shows the trends of power production costs from different technologies for Egypt in the period 2010-2020. Due to the low energy prices prevalent in Egypt, there is a wide economic gap between fossil fuel power production cost and solar power production cost. Wind has been the main focus in achieving RE targets as it has proved to be the most cost-effective. By 2020, typical Photovoltaic (PV) and wind plants could respectively save 30% and 40% of production costs for each MWh produced. Also by 2020, CSP technologies

could produce power at approximately the same cost as that of fossil fuel power.

## Financial Flows in Renewable Energy

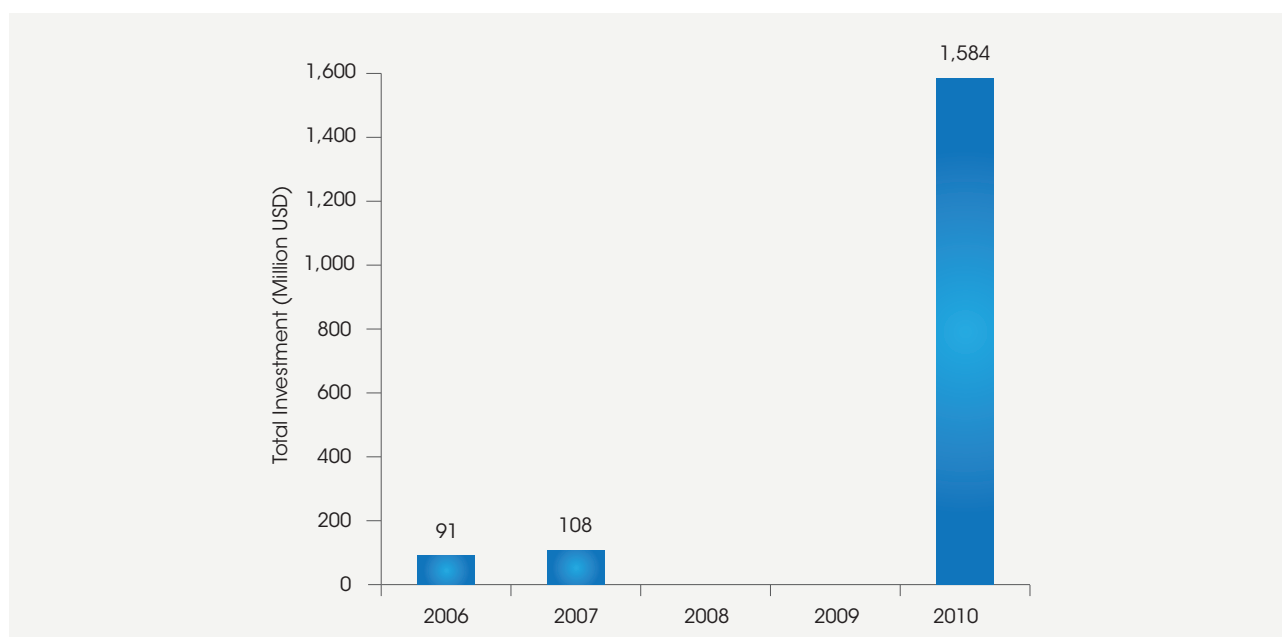
RE investments, run by the NREA and financed by development banks, were limited to asset finance in early stages of wind and solar development during the last 5 years. According to Bloomberg New Energy Finance (BNEF) Global Trends in Renewable Energy Investment report (2011), RE investment in 2010 reached an all-time high of USD 1.58 billion, attributed to large scale government owned onshore wind projects and large scale state-utility demonstration of CSP projects. Large-scale plans for commercial wind development are expected to maintain the increasing trend to reach the goal of 7.2 GW of installed wind capacity by 2020.

## B.4 FINANCING MECHANISMS

### Regulatory Framework and Financial Incentives for Promoting Wind Energy

The regulatory framework for RE is expected to further develop in the near future. Currently implemented financial incentives and RE targets are included in the draft Electricity Law. Pending the adoption of the the law by the Parliament, implementation is taking

FIGURE 16: EGYPT INVESTMENT IN RE (USD MILLION)



Source: BNEF (n.d.)

place through regulations issued by the Supreme Energy Council with ministerial approval. Some of these incentives require parliamentary approval of the Electricity Law, whilst others are being used with Ministerial approval to support moving ahead with the RE strategy.

In order to build the necessary capacity toward achieving its 2020 targets for wind energy, Egypt has committed to both government - and commercially - led strategies for wind energy. They are to be achieved through:

- » Capacity generation from government projects (NREA) with a target of 2,375 MW<sup>35</sup>, and
- » A commercial wind programme with a target of 4,825 MW.

The governmental NREA wind projects are developed, owned and operated by NREA. These projects are financed by multilateral and bilateral financing agencies, as well as national government concessional financing and grants, and are open to public bidding.

The commercial wind programme consists of two components: a competitive bidding large-scale IPP

commercial wind programme and a commercial wind programme for small-scale IPPs benefitting from a feed-in tariff.

*The competitive bidding commercial wind programme for large-scale IPPs*, which is currently approved and in the planning phase, plans to select experienced IPPs through competitive bidding to build, own and operate (BOO) wind power plants for a term of 20-25 years, on pre-determined sites on the shores of the Gulf of Suez, and the East and West of the Nile River. The Egyptian Electricity Transmission Company (EETC) will purchase the energy generated from the wind power plant throughout the duration of the agreement according to the terms and conditions of the PPA. These particular IPP projects benefit from newly approved government incentives (see below).

*The commercial wind programme for small-scale IPPs*, benefitting from a feed-in tariff, is currently planned, but not yet in effect, pending the passing of legislation. It will be applied to wind farms of up to 50 MW to be executed either on pre-determined sites allocated by the Egyptian government or on private sites owned by the developers. The EETC will purchase the energy generated from the wind farms using a price set and approved by the relevant Egyptian authorities.

<sup>35</sup> At present, capacity installed and planned by the state-owned utility are not part of these strategies and from the perspective of the Egyptian Electricity Holding Company and Transmission Company (that oversees generation, transmission and distribution), are separated from government and commercial procurement explained above.



*In addition, a third party scheme* is currently planned (pending the passing of legislation). It is similar to the self-supply approach that served as a catalyst for wind financing and uptake in Mexico. The scheme includes bilateral agreement between the IPP wind power project and its direct customers, while the EETC provide third party access to transfer the power from the power plant to the customers. Additionally, the EETC will purchase any excess wind power and provide supplemental energy to customers during low wind production time (NREA, 2010). Although the launch and legal details such as modelling agreements are still pending, the first of these projects is to be undertaken by Italgem, the energy generation arm of Italian cement giant Italcementi. Italgem plans to invest EUR 140 million for a 120 MW facility to be constructed along the shores of the Red Sea in the Gulf El Zeit area and supply energy for the group's Suez Cement plant (Middle East Energy, 2011; NREA, 2010). The success of future self-supply in Egypt will depend upon pending legislation as well as the ability to have access to government-controlled land where high wind-speeds make wind power development feasible.

## Government incentives for IPPs

Wind capacity installed to date has been provided by NREA-led government projects. With the first government phase of wind development underway, Egypt is now focussing on its first phase of commercial IPP business models for continuing to build RE capacity. These power projects benefit from the government incentives approved by the Supreme Council of Energy, including (NREA, n.d)<sup>36</sup>:

- » All permits for land allocation already obtained by NREA.
- » Land use agreements signed with the investor against payment equivalent to 2% of the annual energy generated from the project.
- » Environmental impact assessment including bird migration study will be prepared by NREA in cooperation with international consultants and financed by the German Development Bank (KfW).
- » Exempting all RE equipment and spare parts from customs duties and sales taxes.

- » Signing long-term PPAs of 20-25 years.
- » The Central Bank of Egypt will guarantee all financial obligations of EETC under the PPA.
- » The project will benefit from carbon credits.
- » The project company shall receive licenses for power generation from the Egyptian Electricity Regulatory Agency.

Despite the social and political revolution in early 2011, and the lack of a finalised legislation, Egypt has moved forward in launching its first 250 MW BOO IPP project and part of first tranche of a 2,500 MW procurement competitive bidding scheme. This is the first private sector power producer experience in RE in Egypt, and the first where project developers benefit from ministry-approved government incentives.

A recent announcement by the Ministry of Electricity and Energy confirmed the plan to hold an auction on the right to use land in the Gulf of Suez to build wind power plants with a total capacity of 600 MW. The investors will be entitled to at least 2 per cent of the power generated, according to the auction rules.

## Financing of IPPs

IPP projects are commercially financed (El-Salmawy, 2009), and international lenders who can provide more flexible terms will play a key role in leveraging further project financing. In turn, this will benefit the overall feasibility of projects.

At this stage, given the less than ideal financial climate as well as the lack of long-term government stability, investors are evaluating Egypt with additional risk. It is hoped that further financial stability will be achieved once the political climate calms down.

In addition, the EETC, responsible for the IPP bidding, in cooperation with the World Bank was to submit the projects to be registered under the Kyoto Protocol before the end of 2012. A unit that will be established within the EETC will be the responsible government unit for the sale of the Certified Emission Reduction

<sup>36</sup> See the National Strategy in detail at: <http://www.nrea.gov.eg/>

(CER) credits of the IPP projects. Given that environmental attributes of IPP projects remain the property of the government of Egypt, the proceeds of the CER sale remain within the government treasury and do not contribute to the overall IPP financing package.

There are three components of the first BOO IPP. The first two set the stage:

» The World Bank Energy Sector Management Assistance Programme's (ESMAP's) technical

assistance, coupled with Clean Technology Fund (CTF)/Public-Private Infrastructure Advisory Facility (PPIAF) financial support for project preparation (USD 1.5 million) and for the financing of the transmission lines amounting to USD 200 million, financed by the CTF and the International Bank for Reconstruction and Development (IBRD).

» The third element is an IPP bid for the 250 MW BOO wind park, with a joint wind measurement campaign (see box 19).

## Box 19

### JOINT WIND MEASUREMENT CAMPAIGN – 250 MW BOO

Bidders are obliged to participate in a joint measurement campaign (JMC) for the preparation of their bids. Bidders for the JMC co-finance the wind measurement.

The advantage for the EETC, the electricity transmission company that purchases the energy and that manages private sector IPPs in Egypt, is the inclusion of a common baseline of wind data for the subsequent evaluation of bids. Project developers benefit from the highest quality of measurement equipment at lower, shared costs.

As all bidders are owners and co-managers of the measurement campaign, they are ensured of reliable, transparent and shared data that is not always provided by the energy buyer (as can be the case in some developing countries). Bidders use the same baseline for preparing bids and are supported by national and international consultant teams for final measurement data. The measurement campaign began in November 2010. The IPPs package their financing and the winning bid will ultimately offer the lowest price for purchase by the EETC.

## B.5 CONCLUSION

Egypt will face many challenges in the next few years as it sets out to achieve its target of 20% RE by 2020. The first 250 MW IPP and testing of the effectiveness of incentives will set the stage for future projects leading up to the remaining 2,500 MW of procurement. Most local and international actors recognise the strength of the incentives in making projects bankable, in particular the highly-sensitive environmental impact assessments and PPAs being guaranteed by the Egyptian Central Bank. Ensuring on-going transmission capacity will remain a challenge as capacity is built. All eyes will be on the 100 MW CSP pilot project for future commercial solar energy applications, as solar power becomes more price competitive. It is important that key legislation is finalised once democratic elections have been held. This will be crucial in paving the road to economic and political stability, and establishing investor confidence, perhaps on a level never reached before the Arab Spring.

# INDIA

## C.1 INTRODUCTION

India's fast growing economy requires action to substantially increase energy capacity. It is primarily dependent on fossil fuels; however, the government has set very ambitious targets and plans to increase Renewable Energy (RE) capacity. India is rapidly expanding markets for RE, thanks to the government's commitment to promote the sector. In 2010, almost USD 2 billion were invested in India in the wind energy sector alone, and the solar sector saw more than USD 1.1 billion invested during the first three quarters of 2011. The solar PV sector has been a particular success story in India and is growing very fast as the result of:

- » Clear government targets (20 GW of grid connected solar PV by 2022);
- » The implementation of policies that incentivise the market; and
- » The decreasing price of solar PV technology worldwide.

However, big challenges still need to be overcome by the government in order to shift investment into RE. Primary among those is the need to address the deteriorating financial situation of state utilities that are a source of increasing uncertainty and financing risk among investors and financing institutions. This is particularly the case of the project developers who are seeking finance for projects that tap into the state subsidies and incentives.

TABLE 5: INDIA COUNTRY INFORMATION

Renewable Energy Targets by 2017		
In Electricity (installed capacity)	53 GW <sup>37</sup>	
Renewable Energy Share by 2009		
In total primary energy supply	26%	
In electricity generation (including hydro)	14%	
In electricity generation (excluding hydro)	2%	
Investment (USD million)		
	2010	2011 (Q1 to Q3)
Wind	1,933.5	994.1
Solar	263	1,127.4
General Country Information		Year
Population	1.241 billion	2011
GDP (USD)	1.85 trillion	2011
GDP per capita (USD)	1,488	2011
GDP % of annual growth	6.9%	2011
Foreign Direct Investment (USD)	34.8 billion	2010 <sup>38</sup>
Investment in energy with private participation (USD)	22.9 billion	2009
Inflation	8.86%	2010
Unemployment rate	4.4%	2005
Balance of Payments - Current (USD)	-51.8 billion	2010

Sources: World Bank Statistics, n.d.; IEA, n.d.

<sup>37</sup> Capacity addition of 29.8 GW (excluding large hydro) by 2017 was proposed in the 12<sup>th</sup> Five Year Plan

<sup>38</sup> Financial year Apr'10-Mar'11

## C.2 THE ENERGY SECTOR

In 2009, 26% of primary energy for India was supplied from RE and 94% of this was biomass. The country is heavily dependent on fossil fuels, with 42% of primary energy supplied from coal. Indian policy makers look favourably towards coal because of its high domestic availability and the security of coal supplies globally. Oil and natural gas contributed to 24% and 7% of the primary energy supplied, respectively.

The per capita consumption of primary energy was 0.47 toe and the carbon dioxide (CO<sub>2</sub>) emissions per capita were estimated at 1.6 tCO<sub>2</sub> equivalent in 2009. Electricity is the largest consumer of primary energy (EIA n.d.).

The electrification rate in India is 65% and only 47% of rural population lives without access to electricity. India is planning to nearly triple its electricity capacity to almost 450 GW by 2020 from around 162 GW in June 2010, which means a yearly addition of nearly 28.8 GW in the next decade.

Installed power generation capacity in 2012 stood at 201 GW. About 69% of electricity capacity in 2012 was generated by thermal power, 20% was hydroelectricity and 2% was nuclear (Figure 17). At present, the installed thermal power capacity is 137 GW and the nuclear capacity is 4.8 GW.

## C.3 RENEWABLE ENERGY

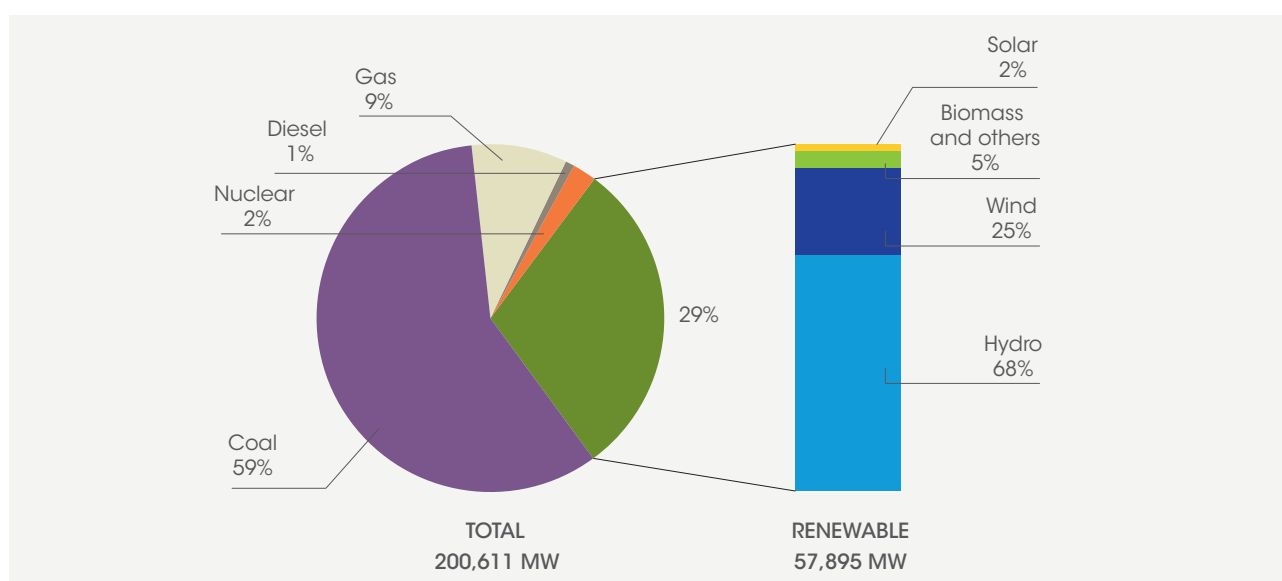
India ranks fifth, worldwide, in installed RE capacity (excluding large hydro), with 94% of RE production consisting of solid biomass and renewable waste. Renewables have a significant share (29% of total capacity) in the Indian electricity mix; hydro has the lion's share of renewables (68% or RE capacity) with 39 GW of installed capacity and wind, growing rapidly, is around 15 GW (25% of RE capacity) (Figure 17).

India is home to around 4 million biogas systems, with 16.25 MW of rural biomass gasifiers in operation. Solar hot water installed capacity reached 1.8 GWh in 2008, and an estimated 20,000 solar hot water systems (0.3 GW thermal) are installed each year. As of 2009, close to 500,000 solar home PV systems and 700,000 solar lanterns had been purchased nationwide. Biofuel production comprised 0.2 million cubic meters of ethanol and 0.1 million cubic meters of biodiesel in 2009.

India has implemented a well-balanced combination of policy measures and financial mechanisms to support the growing Indian RE market. This "holistic" approach has allowed India to position itself as one of the most important markets for RE technologies, and India is well on its way to achieving its RE energy targets.

India's overarching policy on clean energy stems from its National Action Plan on Climate Change,

FIGURE 17: ELECTRICITY CAPACITY MIX IN INDIA FOR 2012



Source: Central Electricity Authority of India

TABLE 6: INDIA'S RENEWABLE ENERGY TARGETS

Total Renewables (excluding large scale hydropower).	53 GW by 2017, addition of 29.8 GW between 2012-2017
Grid-connected solar PV and CSP:	20 GW by 2022
Off-grid Solar:	2 GW by 2022
Wind power:	15 GW added between 2012-2017
Small hydro:	2 GW added between 2012-2017
Biomass:	2 GW added between 2012-2017
Waste-to-energy:	0.7 GW added between 2012-2017
Solar hot water:	7 million m <sup>2</sup> by 2013, 15 million m <sup>2</sup> by 2017; 20 million m <sup>2</sup> by 2022
Rural lighting systems:	20 million by 2022. Off-grid solar lanterns 200 MW added between 2010-2013, 1 GW between 2013-2017 and 2 GW between 2017-2022.

Source: MNRE (Ministry of New and Renewable Energy), 2010.

which comprises of 8 national “missions” including the National Solar Mission which was officially launched in 2010. The 11<sup>th</sup> Five-Year Plan (2007-2012) aimed to add 12.23 GW of renewables (including wind, small hydro, and biomass power), renewables contributed to nearly 14,660 MW power during the 11<sup>th</sup> Plan. The 12<sup>th</sup> Plan (2012-2017) aims to add 29.8 GW of renewable energy capacity.

In addition to national-level targets, sub-national targets exist at the state level. At the time of writing, eight Indian states have targets based on a renewable portfolio standard or as policy goals.

## Regulatory Framework

The Ministry of New and Renewable Energy (MNRE) is responsible for RE policy in India. The Central Electricity Regulatory Commission (CERC) enforces power sector regulations at the national level, and the State Electricity Regulatory Commissions (SERCs) at the state level. The SERCs in each state sets tariffs for electricity sales and has the mandate to promote RE within the state.

The vertically integrated electricity supply utilities in each Indian state were unbundled by the 2003 Electricity Act (Electricity Act, 2003) into a transmission utility and a number of generation and distribution utilities. The Act enabled open access to the transmission system, allowing any consumer with a load greater than 1MW to buy electricity from any generator. The Act also introduced the Renewable Purchase Obligation,

requiring each SERC to specify the minimum percentage of electricity that each distribution utility, as well as direct consumers in the bulk power market, must source from RE<sup>39</sup>.

The National Electricity Policy (2005) stipulates a progressive increase in the share of electricity from non-conventional sources. Distribution companies purchase electricity through a competitive bidding process among suppliers offering energy from the same types of non-conventional sources. In cases where procurement is not through competitive bidding, the Central Commission sets guidelines for pricing non-firm power from non-conventional sources. Policies for wheeling/banking/third party sale vary from state to state. Prior to 2009, India had not enacted any national renewable portfolio standard; Renewable Purchase Obligations (RPOs) were set at the state level only, which restricted RE development to states that had a favourable RE resource endowment.

In May 2010, the Government announced intentions to introduce a Renewable Energy Certificate (REC) system to address the mismatch between availability of RE sources and the requirement for obligated entities to meet their RPOs. Hence, The Renewable Energy Certificate Registry of India was launched with the first non-solar REC being issued in March 2011 and solar REC in May 2012. Since its introduction, 12.6% of the total installed capacity of renewable energy sources- 3,337 MW out of the total 26,266 MW- has been registered with the REC scheme. RE generators will be allowed to sell electricity at an above-market tariff set by local power

<sup>39</sup> Entities required to purchase RE are referred to as 'Obligated Entities'.

regulators, or to sell the electricity and associated REC separately. Separate REC categories have been introduced for solar energy and for other RE technologies. Certificates will be exchanged within a floor and ceiling price established on a regular basis by CERC.

In October 2007, 5% blending of ethanol with petrol became mandatory, with individual states given the option to increase this to 10%. From October 2008, 10% blending became mandatory. For 2017, the target blending fuels are E20 and D20<sup>40</sup>.

## Financial Flows in Renewable Energy

India has dominated RE investment in developing countries together with China and Brazil. In 2006, investment activities included a large wind acquisition and overall wind sector investment of USD 1.1 billion. Biomass and waste together received well over USD 200 million in investment that year, as did small hydro. In 2007, while India continued to invest heavily in research and development, asset financing also increased significantly, demonstrating the shift to focus on power generation. In particular, investment in the wind sector skyrocketed in 2007, comprising USD 2.5 billion of the USD 3 billion total shown in Figure 18 for this year.

The financial crisis impacted investment in 2008 and 2009, which shrank due to banks adopting a more

cautious attitude towards RE lending in the wake of the global economic recession. However, investment nevertheless remained stable in biofuels and biomass, and a first series of investments occurred in the solar sector during these years.

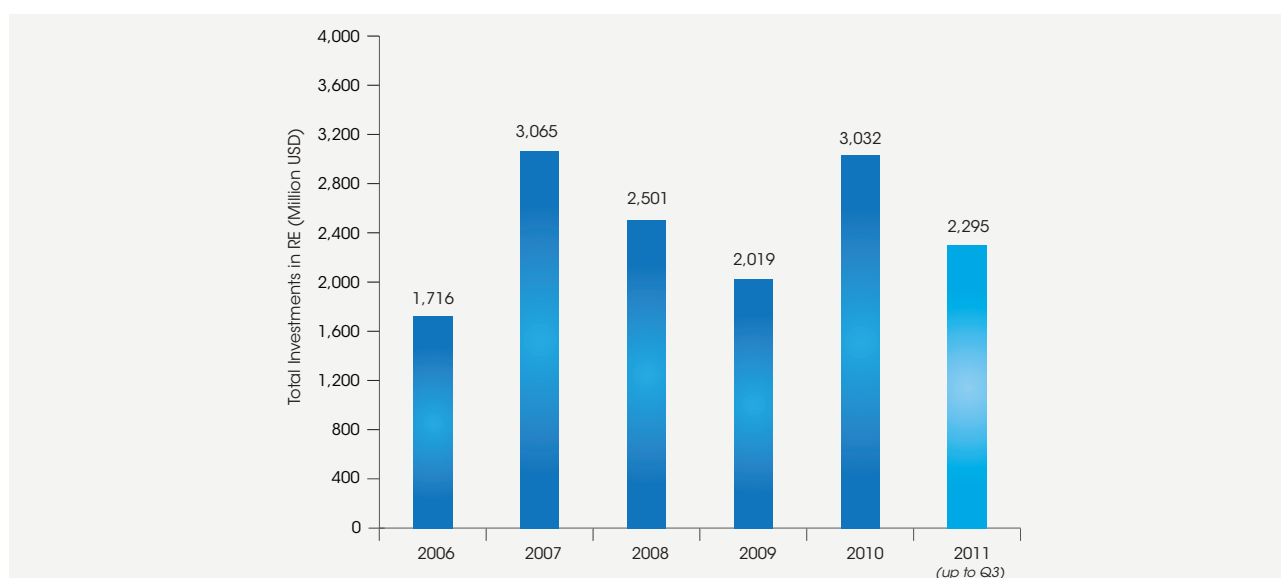
Today, India is a major player in the global wind energy market, ranking 5th worldwide. Most of the investment in this sector occurred in the last 5 years, with an average of nearly USD 1.3 billion investment per year. Compared to the 2010 investment levels, the wind energy sector suffered a slight slowdown in growth in 2011 (USD 994 million through Q3, 2011).

The PV sector has seen a tremendous increase in investments, from USD 263 million in 2010 to USD 1.13 billion in the first three quarters of 2011, thanks to recent policies and programmes to boost solar. Biomass and waste represented a large share of investment at USD 732 million in 2010, and small hydro and other renewables held a consistent, but smaller share of investments.

## C.4 FINANCING MECHANISMS

India employs a large range of public finance instruments to make investments in clean energy economically viable and facilitate financial closure. This reflects the high level of national clean energy ambitions and

FIGURE 18: INDIA INVESTMENT IN RE (USD MILLION)



Source: BNEF (n.d.)

40 E20, sometimes called gasohol, is a fuel mixture of 20% anhydrous ethanol and 80% gasoline. D20 fuel is a blend of 20% biodiesel and 80% dyed petroleum diesel. For more information see [www.ethanolindia.net/](http://www.ethanolindia.net/)

TABLE 7: INDIA RENEWABLE ENERGY INVESTMENT

Investment (USD million)		
	2010	2011 (to 3 <sup>rd</sup> quarter)
Total Investment	3,031.91	2,294.55
Total Wind	1,933.54	994.07
Total Solar	263.12	1,127.38
Total Biofuels	0	0
Total Biomass/Waste	731.78	105.92
Total Geothermal	0	0
Total Marine	0	12.60
Total Small Hydro	93.97	54.58
Total Energy Smart Technology	5.50	0
Total Other low carbon tech.	4	0

TABLE 8: PUBLIC FINANCE INSTRUMENTS FOR GRID-CONNECTED RE PROJECTS IN INDIA

<b>Feed-in tariffs offered by the states</b>	These range from 3.14 INR/kWh to 4.08 INR/kWh (USD 0.0646/kWh to USD 0.0839/kWh <sup>41</sup> ) for wind, from 2.25 INR/kWh to 2.75 INR/kWh (USD 0.046/kWh to 0.0565/kWh <sup>41</sup> ) for small hydro, and from 2.63 INR/kWh to 4.00 INR/kWh (USD 0.0541/kWh to USD 0.0822/kWh <sup>41</sup> ) for biomass. The feed-in tariff period for most technologies is 13 years, for small hydro (below 5MW) 35 years and for solar PV and solar thermal 25 years. Feed-in tariffs were fixed up until 2009 by SECRCs. From then on, in order to support the Solar Roadmap, CERC introduced feed-in tariffs for solar electricity that are revised annually for new investments. For the year 2009-2010, the preferential tariff was fixed at 18.44 INR/kWh for solar PV and 13.45 INR/kWh for solar thermal ( <i>i.e.</i> CSP).
<b>Topping-up premium: Generation Based Incentives</b>	In 2008, MNRE introduced Generation Based Incentive (GBI), which is paid over and above the tariff approved by the SERC. The payment is funded by the MNRE and disbursed through IREDA on a half-yearly basis. The incentive is for a minimum of 4 years and a maximum of 10 years. The GBI for wind farms is INR 0.50 (USD 0.01) per kWh; with a total cap of INR 6.2 million (USD 121,000) per MW, and a cap on annual payments of INR 1.55 million (USD 30,000) per MW <sup>42</sup> . For grid-connected solar PV plants the GBI is 12 INR (USD 0.23)/kWh and for solar thermal power 10 INR (USD 0.20)/kWh <sup>43</sup> .
<b>Tenders for solar capacity with tariff levels established by reverse auction procedure</b>	In September 2010, the first auction for the solar programme was concluded for the 620 MW of solar capacity to be set up by 2013, namely 470 MW of large solar thermal capacity and 150 MW of PV capacity through 30 projects of 5 MW each. The applicants that offer the largest discounts to the established feed-in tariffs are selected. The second batch of bidding for 350 MW total installed was concluded in 2011.
<b>Subsidised loans for investment</b>	Provided by IREDA
<b>Income tax holiday</b>	Applicable to grid connected RE power as in the case of power projects
<b>Concessional import duty and excise duty reliefs</b>	5% concessional import duty on specified wind turbine and solar power parts
<b>MNRE subsidies</b>	Under the Central Financial Assistance (CFA) scheme, MNRE provides per plant investment subsidies in support of the construction and maintenance of biogas plants. MNRE also subsidises training and awareness creation, technical centres, and service charges or salary support to implementing agencies.

See next page for the footnotes

the federal status of India, under which its states implement individual energy policies. It is also the result of the gradual shift of clean energy policy from the margins to the mainstream of India's energy policy. In this process, some older instruments were kept, although newer and more powerful instruments were adopted.

Table 8 describes the incentives offered to grid-connected RE projects in order to make them commercially viable.

Public finance instruments in support of the manufacturing of RE technology (and thus the development of local industry) include:

- » Capital subsidy for semiconductor based units.
- » Soft loans available through IREDA for RE equipment manufacturing.
- » Financial support to RE industries for R&D projects in association with technical institutions.
- » Domestic solar and wind energy equipment is exempt from the excise levy.
- » The Solar Mission stimulates national research, development and demonstration, and academic research by providing innovation subsidies and scholarships to young scientists.
- » The National Mission for Enhanced Energy Efficiency includes a fund to support investment in the manufacturing of energy efficient products and provision of EE services.

The tender for solar capacity in September 2010 mandated a 30% local content for solar thermal projects; for PV projects it mandated the use of domestically made

PV modules in this phase (only for projects based on crystalline silicon technology) and domestically made cells and modules in the next phase.

## Dedicated Renewable Energy Finance Institutions

IREDA, incorporated as a public limited government company under the control of MNRE, has for many years been the main provider of credit to RE and EE projects in India. IREDA has demonstrated a catalytic role in market development leading to commercialisation of climate-related technologies (Majumdar, 2010).

IREDA's direct lending covers up to 70% project costs at an interest rate of 11.50% to 13.75%<sup>44</sup> and repayment period up to 15 years. The size of its loans does not exceed INR 2 billion (Seetharaman, 2011). Current financing schemes include project financing, equipment financing and financing through intermediaries. Sectors being financed include wind, small and medium hydro, biomass power and cogeneration, solar, waste to energy, EE and conservation, and bio/alternative fuels (Rao, 2010).

Nearly half of IREDA's funds are sourced from other development banks, including KfW, ADB and the World Bank Group. Recent international partnerships include KfW Germany (EUR 200 million), AFD France (EUR 70 million), JICA (JPY 30 billion) and Nordic Investment Bank (USD 50 million) (Majumdar, 2010). Other than the funds from international sources, IREDA also raises funds from domestic markets through bonds and loans from commercial banks.

However, IREDA is constrained by its limited capital base and resources, making it unable to participate in lending activities on a scale similar to other emerging market development banks (such as BNDES and China Development Bank). In 2010, it provided 4% of the total

41 Currency exchange on 29 October 2011. USD 1 = 48.635 INR

42 To be eligible, new wind power projects must have at least 5 MW of grid-connected capacity, and must be installed at sites validated by the Centre for Wind Energy Technology. The tariff does not apply to investors setting up capacities for captive consumption, third party sale, merchant plants, and to those benefiting from depreciation under the Income Tax Act. The projects must be registered with IREDA. The GBI is introduced to reach the 10.5 GW target of installed capacity and is limited to the first 4000 MW commissioned after 17.12.2009 and before 31.03.2012.

43 A maximum capacity of 10 megawatts from each Indian state will be eligible under the scheme and 5 megawatts per developer. Capital investors will not be eligible to apply.

44 IREDA cannot be viewed as a source of "subsidised" lending given that its interest rates are more or less the same as commercial lenders (10%-12%).



clean energy project finance in India, which is not very significant in the Indian RE financing context (UNEP, BNEF and FS, 2011).

The National Clean Energy Fund was announced in early 2010 with the intention for it to serve as the main mechanism for channelling public finance for funding research and innovative projects in clean energy technologies. Finance for the fund is to come from an energy fee on coal produced in India and imported coal at a nominal rate of INR 50 per ton, which would generate an annual revenue of around USD 600 million. National Clean Energy Fund's areas of intervention and range of instruments are broad:

- » For resources assessment: upfront grant-subsidy
- » For project implementation: risk guarantee fund (foreign exchange risk management, weather risk management, guarantees/risk sharing), gap finance, upfront grant-subsidy, soft loan-interest subsidy
- » For technology incubation: equity, venture capital, soft loan-interest subsidy, upfront grant-subsidy
- » For technology demonstration: upfront grant-subsidy, soft loan-interest subsidy,
- » For technology development: upfront grant-subsidy.

The Climate Innovation Center financed by the World Bank and the Department for International Development will support innovative start-up companies in climate technology (water, EE, agriculture, solar, transportation, bio-based energy) with incubation and advisory services; provide risk capital through a flexible fund that offers financing at various levels including proof of concept (up to USD 50,000), pre-seed (up to USD 250,000) and seed (up to USD 750,000); and facilitate other sources of financing through syndicating investors, cataloguing existing sources of funding and building partnerships with banks to facilitate working capital finance.

Finance institutions with important clean energy portfolios, that are not specifically dedicated to clean energy, include:

- » The government agencies, such as Power Finance Corporation and Rural Electrification Corporation, that actively fund EE projects
- » The Infrastructure Development Finance Company Limited, set up by the Indian Government initially, is India's leading infrastructure financing institution and a complete life cycle financier: from growth capital to project finance. Their exposure to clean energy by 2009 is in excess of INR 30 billion, of which INR 10 billion are equity investments.
- » Prominent domestic banks that fund renewable projects are IDBI Bank, ICICI Bank, Industrial Financial Corporation of India (IFCI) Ltd., State Bank of India and the Punjab National Bank.
- » The Reserve Bank of India and the National Bank for Agriculture and Rural Development have supported the national biogas programme, for example through automatic refinancing facilities to commercial banks for loan amounts disbursed for biogas plants.

## The Solar Sector: A Success Story

The solar energy sector in India in particular has benefited from an array of RE policies and financing initiatives in India. This sector received more than USD 1,000 million in investment in the first three quarters of 2011. Although this was supported by a considerable drop in the technology price of solar PV over the last year, this growth was also substantially underpinned by the "National Solar Mission", which is the Indian government's plan to install 20,000 MW of solar power by 2022. It aims to position India as a global leader in solar energy by creating favourable policy conditions for its diffusion across the country as quickly as possible (MNRE, 2010). The NSM targets are:

- » To create an enabling policy framework for the deployment of 20,000 MW of grid connected solar power by 2022.
- » To increase the capacity of grid-connected solar power generation to 1,100 MW from 2010-2013 and add an additional 3000 MW by 2017 through the mandatory use of the Renewable Purchase Obligation by utilities backed with a preferential tariff. This capacity can be more than doubled, reaching 10,000MW installed power by 2017 or more, based on the enhanced and enabled international finance and technology transfer.
- » To create favourable conditions for solar manufacturing capability, particularly solar thermal for indigenous production and market leadership.
- » State electricity regulatory boards such as Rajasthan, Gujarat, have announced state level schemes to support additional capacities.
- » The NTPC Vidyut Vyapar Nigam (NVVN) was established as the nodal agency for the purchase and sale of power from developers allocated capacities under the National Solar Mission auctioning. NVVN bundles the electricity from NTPC thermal power stations with those from solar PV plants to normalize the cost of electricity that is sold to the utilities.
- » The GBI scheme was created for Small Solar PV Power Plants (IREDA, n.d.) in order to support small solar power plants with a capacity of 100 KW to 2 MW connected to a distribution network. The scheme is limited to a total capacity of 100 MW and 20 MW per state.
- » Additional incentives include lower import duties on raw materials and excise duty exemption on certain devices.

The ambitious target of 20,000 MW or more by 2022 will be dependent on the ‘learning’ of the first two phases. If successful, this could lead to conditions of grid-competitive solar power. The transition could be appropriately scaled up, based on availability of international finance and technology.

The proposed roadmap for the National Solar Mission is shown in India’s solar strategy and employs attractive policy incentives. For example:

The implementation of the solar plan amounts to investments of about USD 100 billion. This implementation requires an estimated USD 17 billion in subsidies over the next 30 years.

TABLE 9: INDIA’S NATIONAL SOLAR MISSION

S.No.	RE Technology	Phase I target (2010-2013)	Phase II target (2013-2017)	Phase III target (2017-2022)
1	Solar Collectors	7 million m <sup>2</sup>	15 million m <sup>2</sup>	20 million m <sup>2</sup>
2	Off grid solar applications	200 MW	1000 MW	2000 MW
3	Utility grid power including roof top	1000-2000 MW	4000-10,000 MW	20000 MW

Source: *protekan.com*

## C.5 CONCLUSIONS

India ranks amongst the most important producers of RE worldwide and its experience has demonstrated that policy can play a major role in developing national RE markets. India began producing RE relatively early on, creating markets that contain many components of the RE value chain. India also employs a large range of public finance instruments to make RE investments economically viable and facilitate financial closure. This reflects the high level of national clean energy ambitions and the federal status of India, under which its states implement individual energy policies. It is also the result of the gradual shift of clean energy policy from the margins to the mainstream of India's energy policy.

Although India has achieved exemplary success in increasing its share of RE, there is still much work to be done by the Indian government to consolidate the growth and development of the market; and its experience illustrates the importance of matching policy with an accompanying financial plan that can ensure economic backing of the policies. The RE policies and incentives introduced by the states face specific challenges in terms of creating an environment of investor confidence especially in the backdrop of deteriorating financial condition of most state utilities<sup>45</sup>.

Despite the challenges, India continues to be among the fastest growing clean energy markets in the world. The three largest clean energy projects funded through the first half of 2012 were located in India, Kenya, and Mexico. The trend is expected to continue as the solar mission gains momentum and the key challenges facing the domestic market are addressed.

<sup>45</sup> Each state is in a different financial situation; some states have more money and are better organised than others. The support and stimulus to RE projects depend of each state, so there are states where the RE projects have developed more than others. For example, the state of Tamil Nadu has been the leader in RE production in India accounting for around 50% (5,500 MW) of the wind capacity installed.

# MEXICO

## D.1 INTRODUCTION

Mexico has an abundance of renewable energy (RE) sources such as geothermal, wind, hydro, solar, biomass and biogas. Newest efforts for reaching Mexico's RE targets focus almost exclusively on wind power. Key legislation has allowed for the generation of wind power through a model called "self-supply". Despite few existing financing mechanisms and incentives, and a state-owned utility that controls the market and presently offers an energy purchasing price that makes RE power non-viable, self-supply wind parks have served as a key catalyst to build capacity and provide financing models for Mexico's first Independent Power Producer (IPP) project and future RE power projects.

TABLE 10: MEXICO COUNTRY INFORMATION

Renewable Energy Targets by 2012		
Total Renewables (Capacity, without hydro)	7.6%	
Wind	4.34%	
Small Hydro	0.77%	
Geothermal	1.65%	
Biogas/biomass	0.85%	
Total Renewables (with hydro)	25%	
Renewable Energy Shares by 2010		
In total primary energy	10%	
In electricity generation by Capacity (including hydro)	22.4%	
In electricity generation by Capacity (excluding hydro)	3.9%	
Investment in 2010 (USD million)		
Wind	1,779.5	
Biomass/Waste	48	
General Country Data		Year
Population	112.34 million	2010
GDP (USD)	1,040 billion	2010
GDP per capita (USD)	9,255	2010
GDP % of annual growth	5.5%	2010
Foreign Direct Investment (USD)	19.626 billion	2010
Investment in energy with private participation (USD)	1.21 billion	2011
Inflation	4.2%	2010
Unemployment rate	5.2%	2010
Balance of Payments - Current (USD)	5.626 billion	2010

Source: CIA (Central Intelligence Agency), 2012.

## D.2 THE ENERGY SECTOR

Mexico is the world's seventh largest oil producer and state-owned Petroleos Mexicanos (Pemex) is one of the largest oil companies globally. Proven oil reserves are at 10.2 billion barrels (Jan 2011) but oil production is on the decline. In 2010, oil was being produced at 2.98 million barrels per day, maintaining the same figures in 2011 and a production forecast of 2.6 million in 2012. Oil remains a crucial sector in the Mexican economy, generating 14% of export earnings (2010); this makes up 32% of government revenues and has a significant impact on the fiscal balance (CIA, 2012; EIA, n.d.).

The state-owned utility, Comisión Federal de Electricidad (CFE) is the main player in the power generation sector, and controls approximately two-thirds of installed generating capacity. CFE also holds a monopoly on electricity transmission and distribution. The Comisión Reguladora de Energía (CRE) has principle regulatory oversight of the electricity sector. The Mexican Constitution states that the government is responsible for the control and development of the national electricity industry and the CFE is mandated to carry out these tasks. Mexico has an extensive electricity transmission and distribution infrastructure that serves approximately 27 million customers. The private sector does not participate in transmission or distribution of electricity. Mexico's total installed electric capacity is 60,936 MW (2010).

In Mexico's case, 75.4% of installed capacity belongs to technologies using fossil fuels such as natural gas, fuel oil, coal and diesel, while 24.6% corresponds to alternative sources, of which 22.4% of the total installed is from hydro and other RE and 2% from nuclear energy (Garrison, 2010) (see Figure 19).

Key changes to the Public Service Electricity Law (SENER, 2010) in 1992 established key activities that were no longer defined as an exclusive public service and permitted private sector participation in electricity generation in the following areas:

- » Self-supply (see below)
- » Co-generation
- » IPP
- » Small Energy Producers and
- » Import/Export

IPPs are contracted to sell power to the CFE with a long-term Power Purchase Agreements (PPAs). In 2010, there were over 24 IPPs operating in Mexico, accounting for approximately 19.5% of total installed capacity and 29% of generated electricity. While the IPPs account for significant generation, they have traditionally been low-cost fossil fuel projects due to the state utility's mandate to provide electricity at the lowest possible cost, making larger scale RE power generation under these conditions, neither viable nor financially attractive (CIA, 2012; EIA, n.d.; Garrison, 2010).

## D.3 RENEWABLE ENERGY

The 1992 electricity law was a key piece of energy legislation that helped pave the way for RE uptake in the last 10 years. Most RE private power generation has taken place under the self-supply model. Self-supply permits an electricity producer to generate power for its own consumption. The electricity generators are not permitted to sell any excess electricity to third party buyers. They can, however, sell the electricity to CFE, the state utility, at a very low price and with a potential supplementary network fee. The self-supply model has been crucial in paving the way for a new launch of RE IPPs in the wind sector (USAID, n.d.; Reegle, n.d.).

### RE Potential

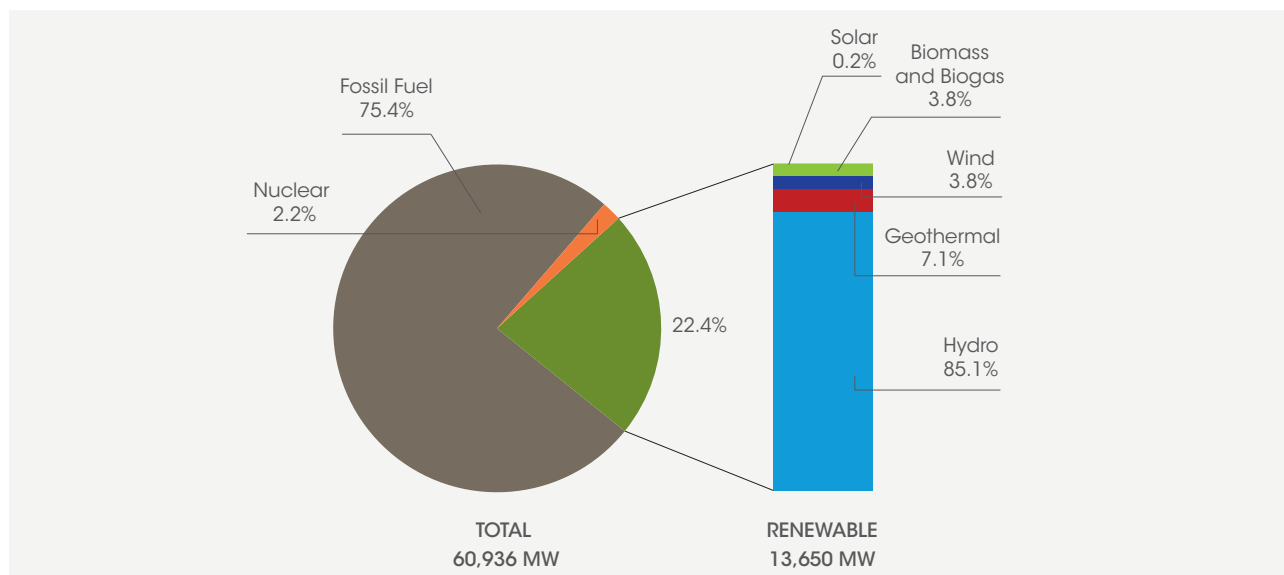
Mexico has significant RE resources including geothermal, wind, hydro (large and small), solar and biogas.

Large-scale hydro dominates RE power capacity in the country, followed by geothermal (Figure 19), although most of the capacity was installed in the 1980s (after the 1970s energy crisis).

Wind potential is estimated at more than 20 GW. The region of the Isthmus of Tehuantepec in the state of Oaxaca is one of the best regions for the generation of wind power, with average wind speeds measuring over 12 metres per second.

Solar resources in Mexico are excellent averaging 5 kWh/m<sup>2</sup> per day and with values of 7 kWh per day in the northern and western areas of the country. Due

FIGURE 19: ELECTRICITY CAPACITY MIX IN MEXICO FOR 2010



Source: CFE and Guzman (2011) CRE Mexico

to the price of the technology, the market remains underdeveloped despite the high theoretical potential of Concentrated Solar Power (CSP). Without significant drop in the technology cost, legislative support and further incentives and mechanisms, most activity is limited to small scale or grant-supported pilot projects.

Mexico has a successful solar water heater (SWH) programme and is creating models to increase up-scaling and bankability of SWH business models by making it mandatory for all social housing<sup>46</sup>. By 2010, 1,665,502 m<sup>2</sup> of solar water heaters had been installed (ANES (National Solar Energy Association), n.d.), with a projected expansion in 2012 to bring the accumulated area up to a total of 1,735,325 m<sup>2</sup> (Conae (The National Commission for the Saving of Energy), ANES and GTZ, 2007).

Large-scale hydro is the most exploited RE source in Mexico. There are currently almost 4,000 dams that generate 19 TWh/year. Small hydro capacity potential (<10 MW) is calculated at 3.25 GW<sup>47</sup>.

Mexico has a large potential to produce energy from biomass. It is estimated that, taking into account agricultural and forest waste with energy potential and solid urban waste from the ten main cities, the country has an unexploited potential capacity of 9,000 MW. In 2009,

Mexico's second landfill biogas electric generation facility was launched, and close to 30 existing landfills have power-generating potential. Agricultural applications for biogas also provide considerable opportunities.

Installed geothermal is the largest RE producing source next to large-hydro at 970 GW, making it the third largest producer of geothermal energy worldwide. Further development of geothermal capacity is planned by CFE, which has the exclusive right to develop hot water and steam resources underground. It plans to add another 388 MW of capacity by expanding existing facilities.

### Renewable Energy Targets and Regulatory Framework

The government of Mexico has established a target of 7.6% of the installed capacity to be based on RE sources by 2012 (not including hydroelectric projects over 30 MW). Sub-sector goals are: 4.34% wind, 0.77% small hydro, 1.65% geothermal and 0.85% biomass and biogas). With large-scale hydro, the target is raised to 25% (Reegle, n.d.; SENER, n.d.; Garrison, 2010).

Other than the 1992 Electricity Law, a series of laws and regulations have both recognised the importance of RE, and have also assisted with its uptake (Reegle, n.d.; SENER, n.d.; Garrison, 2010). These include:

<sup>46</sup> Mexico has a history and culture of providing extensive social housing giving SHW uptake for this sector great potential.

<sup>47</sup> Other RE developers have identified up to 4.8 GW. Source: SENER, 2006.

- » 2005: A federal tax law amendment allowed for 100% depreciation of capital expenses for RE investments in their first year.
- » 2007: Model interconnection agreement for RE projects to facilitate connecting them to the grid (although this had a low impact at the time, due to low purchase prices from CFE, the state-utility).
- » 2008: Passing of the Law for the Use of RE and Financing the Energy Transition (LAERFTE), including shifting renewable energy and cogeneration power projects to the CRE (regulator versus the utility) and calling for the creation of an Energy Transition Fund. Although the MXN 143 million (USD 10.8 million) fund was originally conceived for renewables, it will provide funds almost exclusively for energy efficiency (EE) projects, and support carbon financing and Nationally Appropriate Mitigation Actions (NAMAs)<sup>48</sup>. This law gave SENER the mandate to set goals for the use of RE. Specifically, it allowed them to set the percentages of RE, levels of capacity and the diversity of RE sources updated on an annual basis (such as is now in the Programa Especial para el Aprovechamiento de Energías Renovables). Mexico also passed a law for the efficient use of energy in parallel to LAERFTE.

## Financial Flows in Renewable Energy

Mexican RE investment trends in the last five years show sizeable leaps driven almost exclusively by the wind sector.

Investment in 2007 was largely in wind (USD 160 million). In 2008, wind investment leapt to USD 550 million as state-utility and self-supply wind park development got underway. Other investments in 2007 and 2008 were accounted for by smaller-scale hydro, biomass and waste projects.

In 2009, wind continued to be at the forefront of Mexican RE investment, with USD 685 million invested in self-supply wind projects. A further USD 127 million was invested to expand existing state-utility-owned geothermal plants installed in the 1970s and 80s.

Global Trends in Renewable Energy Investment reports that Mexico had the largest increase in investments in clean energy technologies within Latin America in 2010<sup>49</sup>. This trend will persist as Mexico continues to install large wind projects beyond self-supply, now focussing on IPP wind park projects. Wind accounts for 4.3% of the overall RE target for 2012.

## D.4 FINANCING MECHANISMS

### The Self-Supply Power Generation Model

The Self-Supply Power Generation Model provided key capacity and set the stage for Mexico's largest wind project. The catalyst for this was a 250.5 MW and USD 600 million deal for the EURUS wind park in the midst of the financial crisis.

Thanks to high wind speeds demonstrating a capacity for wind power generation, coupled with a government strategy and RE targets, Mexico was well-poised to develop its wind power capacity. This led to EURUS, a self-supply project that set the stage for the present wind sector boom in Mexico.

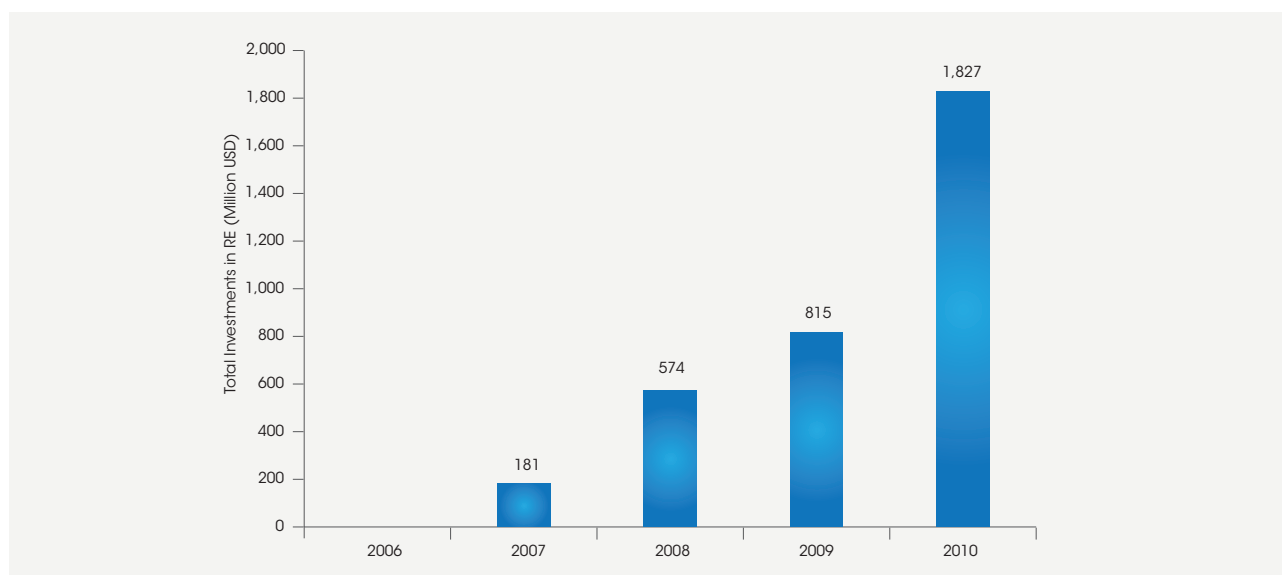
The Mexican cement company Cemex initiated the development of the farm in order to reduce its greenhouse gas (GHG) emission impact and to produce power to meet 25% of its energy needs. The arrangement permitted Cemex to forecast electricity prices via a 20-year PPA, versus depending on the state electricity utility - which has a monopoly of the market and often sells at fluctuating prices. Cemex joined the Mexican subsidiary of Spanish wind power developer Acciona to build what was then the largest wind park in Mexico (2010). Financing the park was a challenge, not only due to the volume of investment required but also due to the lack of public and private technical and financial experience available domestically. These problems were compounded by the financial crisis.

Commitment within the Mexican Development Bank (NAFINSA) to wind energy and the project led to partnerships with development banks at the multi-lateral level, namely International Finance Corporation (IFC), Inter-American Development Bank (IDB) and Corporacion

<sup>48</sup> USAID and SENER fund status data (US AID, n.d.; SENER 2011a). Funds size data from Oct 2011.

<sup>49</sup> The same document reports an increase in investment in one geothermal project, but this investment was for expansion of more than one state-utility owned existing geothermal plant, and not for new geothermal capacity in the near future.

FIGURE 20: MEXICO INVESTMENT IN RE (USD MILLION)



Source: BNEF (n.d.)

Andina de Fomento (CAF). The experience and capacity of these players to prepare and analyse technical and financial documents, coupled with their approval of an anchor investment of key senior and subordinated debt for the project, paved the way for the rest of the financing package. This provided key security for other investors whose risk analysis was heightened due to the financial crisis. Other development banks and lenders followed suit and came on board. Of particular interest is the participation of two private banks, Banco Espirito Santo (BES) (USD 35 million) and Banco Bilbao Vizcaya Argentaria (BBVA) (USD 27 million). Their participation encouraged other private commercial banks to participate in debt packaging for wind projects in Mexico.

### Key Enabling Policies

- » Law for the Use of RE and Financing the Energy Transition
- » Law on the Sustainable Use of Energy
- » Modifications to the Public Service Electricity Law, permitting changes such as self-supply for energy and IPPs
- » Methodology to establish service charges for transmission of renewable electricity
- » Signatory of the UNFCCC and the Kyoto Protocol

Carbon financing was negotiated separately from the project. EURUS is permitted to generate 876 GWh annually and as a Clean Development Mechanism (CDM) project, EURUS benefits from the sale of Certified Emission Reduction (CER) credits for offsetting a total of 599,571 tonnes of CO<sub>2</sub> annually. (UNFCCC, 2010).

The power-producing model that accounts for most of Mexico's wind power generation falls under the "self-supply" rule, which allows a producer to generate power for its own consumption. Power producers must identify users for all power output and may not sell electricity to a third party. They may sell the power to the state-utility, CFE, but at a very low price. Co-generation is allowed under the same conditions as self-supply projects. The contract indicates that the payment for transmission services will be in line with actual energy and capacity transferred. The electricity network plays the "energy-bank" role to compensate surpluses and shortages of energy supply. Surplus energy during one period can offset against the other, according to current electricity prices. To calculate the charge according to the demand at the consumer point (that is, Cemex), the monthly average energy delivered during peak demand hours during working days of each month is taken into account as energy contributed to the system.

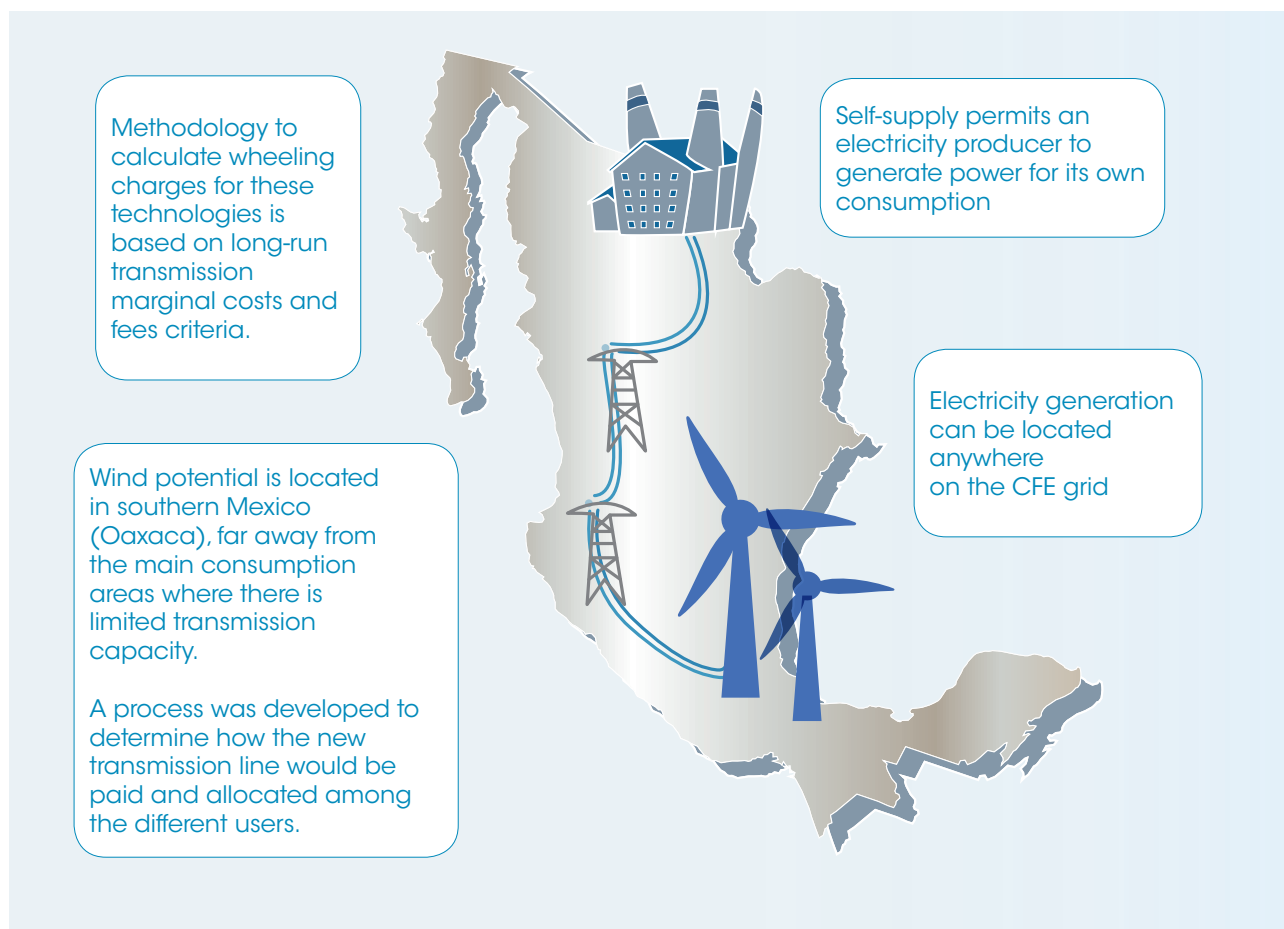


TABLE 11: FINANCING PACKAGE EURUS – CEMEX SELF-SUPPLY WIND POWER PROJECT

<b>Total Debt</b>	USD 375 million
<b>Senior Debt</b>	USD 310 million
	IDB – USD 45 million
	IFC – USD 36 million
	BES – USD 35 million
	BBVA – USD 27 million
	Bancomext – USD 22.5 million
	CAF – USD 20 million
	German Investment and Development Company USD 32 million
	Instituto de Credito Oficial (ICO) – USD 35 million
	Nacional Financiera (NAFINSA) – USD 22.5 million
	Proparco – USD 35 million
<b>Subordinated Debt</b>	USD 65 million
	ICF – USD 35 million
	CIF – USD 30 million
<b>Equity</b>	USD 225 million

Source: Inspiratia

FIGURE 21: SELF-SUPPLY IN MEXICO



These self-supply projects have led to wind park construction and pipeline projects totalling close to 9,500 MW (2011), (Mexican Wind Energy Association, AC (AMDEE), n.d.) some of which include large-scale projects by companies such as Bimbo, which, with the acquisition of Sara Lee, has become the world's largest bread and pastry maker. Due to key capacity gained by earlier wind energy projects, NAFINSA has taken on a leadership role along with Bancomext as well as other banks and the wind park developer Renovalia, for the first USD 200 million/90 MW phase<sup>50</sup> of projects.

These early projects, led by multinational corporations, gave way to the government utility opening the bidding process for the first IPP projects for domestic use - in addition to the self supply provision already available for large corporate or industrial needs. The IPP projects (La Venta III and Oaxaca I, II, III and IV), in operation and in the final stages of construction, represent over 500 MW of capacity (AMDEE, n.d.).

### Small Scale Rural Biogas Applications in Agribusiness - FIRA

Another Mexican financing model that has been made possible by the latest RE law and self-supply law has been provided by Mexico's rural development bank (FIRA) (FIRA, 2011; FIRA, 2012; FIRA, n.d.). It operates on a smaller scale and employs a holistic approach within its biodigestors programme.

FIRA has developed an innovative financing "modular" approach to addressing methane emissions, which are the third largest contributor to GHG in Mexico. The first phase of this programme targets pig-farms - the largest contributors to methane emissions from agricultural activities. It also attempts to support the Mexican government's long term goal to reduce subsidies and replace them with credits for cost and energy-saving RE and EE technologies<sup>51</sup>.

In order for FIRA to support the programme, it launched the FONAGA Verde, a MXN 20 million (USD 15 million) loan guarantee instrument to support farmers' purchase of biodigestors and for overall sustainability improvements to their farms (FIRA, n.d.).

TABLE 12: BIOGAS – BIODIGESTOR DATA

Hog population of 15 million
Farms with 500 hogs or more can operate biodigestors on a break-even basis
Minimum of 3000 tonnes per year per biodigestor
Minimum of 120 kW of energy production representing a saving of 6%

FIRA's technical team supports the farms with the business plan development, technical plans and applications for carbon financing via CDM. A typical FIRA supported biodigestor financing package includes:

#### Loan/Guarantee

Project loans are obtained primarily from commercial banks<sup>52</sup>. Risk is mitigated in part by two FIRA guarantee products using combined FONAGA Verde and "FEAGA" guarantees<sup>53</sup>. Whereas FONAGA is focused on guaranteeing a portfolio of projects, FEAGA is focused on providing guarantees on a project by project basis - covering 50%-80% of the loan amount, leaving a minimum of 20% risk to be covered by the lending institution.

#### Subsidy

A grant is provided by Fideicomiso de Riesgo Compartido (FIRCO), a state entity that provides financial support to assist with "risk-sharing" for sustainable agro-business investments.

#### Technical Support

Provided by FIRA and its partners, the technical support is key in developing the technical and financial aspects of the projects, including assessment of energy savings from the biodigestors and sustainability components of the projects, beyond the purchase, installation and operation of the technology.

#### CDM phase for less "bankable" projects

A supplementary module containing a CDM component was planned for the end of 2010. It is designed to help smaller agricultural producers, where a financial analysis does not result in a positive or break-even

50 At the time of publication of the study financing details could not be disclosed.

51 For example, electricity prices for farmers are subsidised at a rate approximately 60% lower than urban areas. Energy producing biogas (biodigestors) will help local producers create their own energy, reducing dependence on electricity subsidies.

52 In some cases non-commercial banking entities such as trusts provide credit.

53 Taking the form of a typical guarantee product where the fee is from 0.75% to 2% per year of the guaranteed amount, depending on the bank's risk assessment of the project.

analysis, which is often the case for smaller farms. Producers then use carbon revenues (after the first phase of financing) to pay off the loan and reduce their payments accordingly.

As of 2011, 14 out of 35 biodigester pipeline projects had been financed and constructed. The initial market analysis indicated a target of 50 farms. However, FIRA estimates that this could be increased five-fold.

On average, costs amount to approximately USD 235,000 – USD 275,000 per project. The first 14 constructions and the remaining projects in the pipeline represent a total value of USD 6.3 million. This results in an average of approximately USD 173,000 per project grant, accompanied by an average of USD 79,000 of a FIRCO subsidy.

Average minimum GHG savings amount to approximately 3,000 tonnes of CO<sub>2</sub> equivalents annually. The

#### Key FIRA Financing Instruments

Loan
Guarantee
Technical Assistance
CDM carbon financing

120 kW per year of biogas for electricity production is relatively small and when compared with Mexican wind investments, the potential for scale-up is significant. Furthermore, the overall benefit from sustainability, air quality, and work conditions on the farms and in the surrounding area is considerable.

#### Small-scale farming

FIRA assists small farmers (less than 200 hogs) by bundling their waste and biogas capacity, creating economies of scale for the purchase of smaller biodigestors. This provides similar results albeit on a smaller scale.

## D.5 CONCLUSIONS

There are many untapped opportunities to further diversify the RE sector in Mexico, such as through a greater application of solar power, or by generating new geothermal power. However, the country is well on its way to creating a new RE landscape through wind power generation. Self-supply has catalysed and provided for:

- » Crucial technical capacity for financial evaluation of wind power projects
- » First involvement of commercial bank investment in large scale renewables
- » Understanding and mitigation of risk
- » An avenue for future self-supply and the first Mexican wind IPP

This example has proven that despite existing technical and financial barriers, creative ways to increase RE capacity within existing conditions are possible.

# South Africa

## E.1 INTRODUCTION

South Africa has been one of the African countries on the “watch list” for several years. Policy promises had not led to the large investments originally anticipated and the cancellation of feed-in tariffs had rendered the investment climate shaky at best. However, the introduction of the competitive bidding has led to the contracting of 6900 MW (small scale hydro, wind and bioelectricity) between 2008 and 2011. Currently, the majority of on-going developments and new funds have been targeted towards the energy efficiency (EE) sector. New policy developments, however, should create a promising future for RE in South Africa. Large amounts of investment for large scale state utility projects have been announced and a pilot competitive bidding approach for Independent Power Producers (IPPs) (in lieu of feed-in) has been introduced. Redefining policy has attracted the required investments for the first round of renewable energy procurement.

South Africa is the largest contributor to greenhouse gas (GHG) emissions in Africa. According to the Long-Term Mitigation Scenarios (LTMS) project for South Africa, emissions reached 415 million tonnes of carbon dioxide equivalents (MtCO<sub>2</sub>e) in 2000, placing South Africa as the 11th largest emitter globally. The country's emissions per capita are about 10 tonnes of carbon dioxide (CO<sub>2</sub>) per person, the eighth highest in the world.

TABLE 13: SOUTH AFRICA COUNTRY INFORMATION

Renewable Energy Targets		
Electricity from Renewables	10,000 GWh by 2013	
RE Installed Capacity	3,100 MW (4% of generation) by 2013	
Wind	500 MW by 2013	
CSP	50 MW by 2013	
Total RE (Generation)	13% by 2020	
Renewable Energy Shares in 2010		
In total primary energy supply	11%	
In electricity generation (including hydro)	1%	
In electricity generation (excluding hydro)	0%	
Investment (USD million)		
Wind 2010	20.5	
Wind 2011 (upto Q3)	142.5	
General Country Data		Year
Population	50.6 million	2011
GDP (USD)	408 billion	2011
GDP per capita (USD)	8,070	2011
GDP % of annual growth	3.1%	2011
Foreign Direct Investment (USD)	5.7billion	2011
Investment in energy with private participation (USD)	6 million	2010
Inflation	5.0%	2011
Unemployment rate	23.8%	2009
Balance of Payments - Current (USD)	13.7 billion	2011

Sources include Reegle, n.d.; Crossflow Consulting, 2011; World Bank Statistics, n.d.; UNEP BNEF and FS, 2012; IEA, 2011b.

## E.2 THE ENERGY SECTOR

The South African energy sector (Department of Energy, Republic South Africa (DoE RSA), n.d.) and its dependency on fossil fuels stems primarily from the Apartheid period when independence from external energy supplies was a political necessity. Coal is the most abundant source of energy in South Africa, therefore the energy sector is largely based on coal<sup>54</sup>, making it the largest emitter of GHG on the continent.

In October 2010, the Inter-Ministerial Committee on Energy presented the draft Integrated Resource Plan, which was subsequently approved by the national government in March 2011. The plan outlines that with a 4.5% average yearly growth in gross domestic product (GDP) over the next 20 years, 41,346 MW of newly installed capacity will be required to meet energy demands (excluding new capacity to replace decommissioned plants).

In addition to projected growth, South Africa is facing increased pressure to limit energy exports by the state owned utility, Eskom. Approximately 95% of South Africa's electricity is generated by Eskom, equivalent to approximately two thirds of all electricity produced in Africa. Energy accounts for approximately 15% of South Africa's GDP.

## E.3 RENEWABLE ENERGY

In 2009, renewable energy (RE) amounted to approximately 2% of the total electricity capacity in South Africa, with hydro accounting for 76% and biomass and waste representing 23% of the capacity (see Figure 22). Although the Integrated Resource Plan calls for 40% of new electricity generation to be provided by renewables by 2030, coal will continue to be the dominant source of electricity for the country.

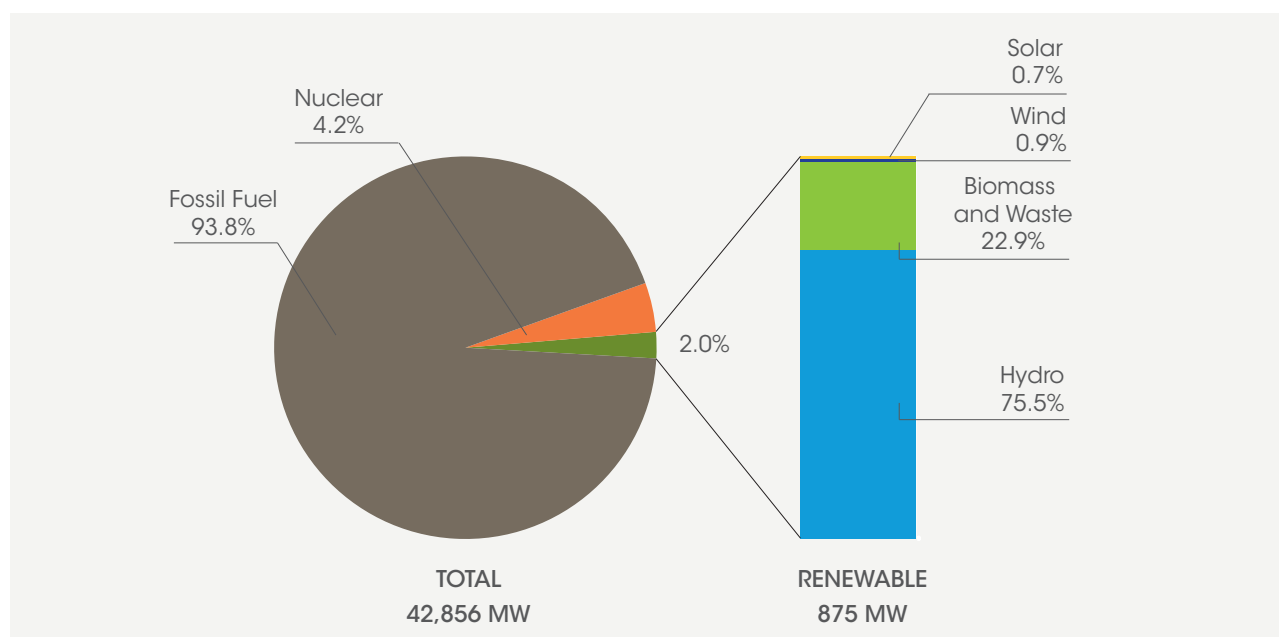
Despite a broad range of RE programmes, including solar water heating (SWH), demonstration solar and wind power projects based on competitive bidding with some feed-in support; large scale RE projects for electricity generation have yet to be deployed.

### RE Potential

The Western Cape and parts of the Northern Cape and the Eastern Cape offer the best potential for **wind energy** projects in South Africa. Ambitious goals for expanding the production of wind energy have resulted in 1196 MW wind power procurement through IPPs.

Despite little interest in recent years, the renewable resource with the greatest potential in South Africa is

FIGURE 22: ELECTRICITY CAPACITY MIX IN SOUTH AFRICA FOR 2009



Source: Energy Information Administration (EIA, n.d.); [www.eia.gov/countries](http://www.eia.gov/countries).

54 About 77% of the country's primary energy needs are provided by coal.

solar energy. The annual 24-hour global solar radiation average is about 220 W/m<sup>2</sup> for South Africa which is very high when compared with about 150 W/m<sup>2</sup> for parts of the United States and about 100 W/m<sup>2</sup> for Europe and the United Kingdom. The solar water heater (SWH) market in South Africa has taken off due to energy efficiency (EE) policies and targets that are part of an overall demand management strategy. The government has a target of installing at least 1 million SWHs by 2014 to reduce the water heating load on the national grid. Eskom hydropower has planned a 100 MW capacity concentrated solar power (CSP) plant in Upington - the first ever large scale CSP in Sub-Saharan Africa. The first 3,725 MW of RE procurement auctions through the Renewable Energy Procurement Programs (REPP) include 200 MW of CSP.

Existing Photovoltaic (PV) systems in South Africa are all small-scale (less than 1 MW) and are mainly for off-grid (rural) applications where the cost of extending the grid is high. Typical applications include schools, health centres and rural households, with a total estimated installed capacity of 21 MW.

Studies carried out by the South African government indicate that specific areas in the country show significant potential for the development of all categories of hydropower, in both the short and medium term. There is an enormous potential beyond South African borders for development of hydro power capacity. The Southern African Power Pool allows the free trade of electricity between Southern African Development Community member countries, and could provide South Africa with access to the vast hydropower potential from the countries to the north<sup>55</sup>.

Biomass has enormous potential in South Africa. In fact, most households in Africa use biomass and not electricity as their main energy source for cooking. There is a significant potential for larger-scale biomass-based power production using wood, agriculture and grass residues as feedstock. Similarly, there is high potential for biogas production, with many large landfills in South Africa being project ready. Other opportunities may lie in agricultural applications including biogas, biomass and landfill gas.

<sup>55</sup> In particular there is significant potential in the Congo River (Inga Falls).

## Renewable Energy Targets

The Department of Energy (DoE) has established a target for RE production at 10,000 GWh by December 2013. The 10,000 GWh represents approximately 4% of overall national electricity requirements.

There are many actors in South Africa involved in matters influencing the development of the RE sector. As a result, there are several long-term RE targets in place. A breakdown of the targets is shown in Table 14.

TABLE 14: SOUTH AFRICAN RE TARGETS BY SECTOR

RE sector	Targets
Solar Thermal Electric	43 TWh by 2030
Hydropower	4,700 MW
Biomass	In the longer term, around 9% to 16% of the energy demand
Landfill gas	7.2 TWh to 10.8 TWh of electricity generation by 2040
Wave and other categories	33 TWh per year by 2050

Source: Reegle, n.d.

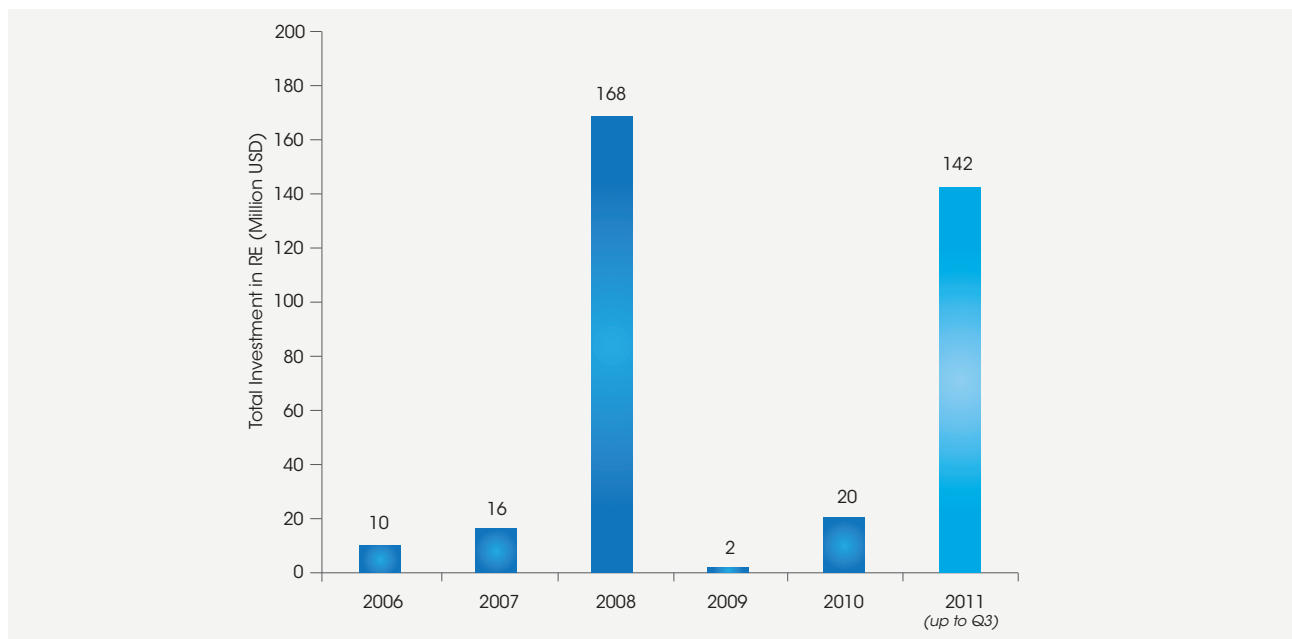
## Financing Flows in Renewable Energy

In 2006, the majority of investment in renewables was directed towards the first wind farm in the country (5 MW in Darling), as well as bioethanol and waste-to-energy pilots. These have been slow to move forward because of the abundance of coal and cheap electricity tariffs.

Although investments remained low in 2007, there was movement by Eskom, with plans to create funds for SWH and the initiation of planning for large scale wind and CSP projects. There was also a small increase in the number of Clean Development Mechanism (CDM) projects coming from South Africa.

With the announcement of a feed-in tariff in 2008, the South African Government promised to provide a stable rate of return to IPPs. This generated enthusiasm, both nationally and internationally, surrounding the potential of the South African renewables market. Despite this hype, few projects were introduced. Of the total USD 169 million investment in renewables in 2008, USD 150 million was a venture capital investment in the biomass and waste sector (see Figure 23).

FIGURE 23: SOUTH AFRICA INVESTMENT IN RE (USD MILLION)



Source: BNEF (n.d.)

Little movement in the market in 2009 reflected slow implementation of policies in South Africa. Investment in 2010 was limited to around USD 20 million for the first stage of a USD 290 million wind park (Kouga Wind Farm) as part of the third quarter of new wind procurement plan. Investment as of 2011 included another USD 142.5 million in wind power.

The Renewable Energy Feed-in Tariff programmes (REFIT) policy (See Box 20) has been replaced by the Renewable Energy Procurement Programme (REPP). Between August 2011 and July 2012, South Africa opened three RE auction rounds, of which two are now closed. The third is anticipated to close in May 2013. The DoE plans to have a total of 5 auction rounds with a targeted capacity of 3,725 MW. Within each auction, specific targets are set for each technology as to avoid competition between different technologies.

As of August 2012, the DoE had rewarded projects with a total volume of 2,456 MW, of which it allocated 1,416 MW in the first round, and 1040 MW in the second. In the first renewable energy auction in 2011, 53 bids were submitted in November and 28 preferred bidders announced in December 2011. Wind and solar PV were the main tendered technologies, each with a capacity of roughly 630 MW being tendered. With an additional

150 MW of solar CSP allocated, the total volume allocated was 1,416 MW. The average prices of the bids were: wind USD 0.17/KWh; solar PV USD 0.41/KWh; and CSP USD 0.40/KWh.

In the second auction in 2012, 79 bids were received in March 2012. 51 bids met the criteria but only 19 bidders were selected in May 2012 due to the cap of 1,044 MW. The average prices of the bids were: wind USD 0.13/KWh; solar PV USD 0.25/KWh; and CSP USD 0.38/KWh. No successful bids have been received for biomass, biogas, and landfill gas technologies as of yet. One possible reason for this is that the ceiling price for these technologies may have been too low initially (IRENA, 2013).

In general, investors felt that the policy and tariff shift was unfortunate. As such, the long-term policy stability will now be crucial in order to regain investor confidence. Securing finance for projects awarded will be the first test in understanding the impact of unstable RE policy on investors.

### A bumpy road to finalising policy

Finalising RE policy in South Africa has been a challenging process, but the state-owned utility is building capacity, and bidding has been completed for wind,

solar and small-hydro. South Africa faced several barriers during this process, including lack of a legislation targeting RE specifically, as well as the involvement of a large number of ministries and government departments, making transparency and the establishment of clear lines of policy action challenging.

The regulatory framework for RE in South Africa is guided by a series of policies, strategies and plans. The White Paper on Renewable Energy<sup>56</sup> (2004) laid the foundation for the widespread implementation of RE in South Africa and set a target – although not mandatory – of 10,000 GWh of RE contribution to final energy demand by 2013. The policy is currently being reviewed to assess progress following the first five years of policy implementation and to propose medium to long-term RE targets. Other legislation related to energy, environment, conservation, gas and electricity have an impact on the development of the RE sector as well.

## E.4 FINANCING MECHANISMS

RE legislation and policy objectives have resulted in a series of policy and financial instruments. Many of the initiatives remain on paper and have yet to demonstrate

how they will impact on RE uptake towards the goals set.

- » The REFIT and REPP (see Box 20).
- » The Renewable Energy Market Transformation project supports the DOE in developing regulatory and policy framework for RE, and develops institutional and financial support within the economy to promote the uptake of RE.
- » The Renewable Energy Finance and Subsidy Office (REFSO) has a mandate that includes: management of RE subsidies; and offering advice to developers and other stakeholders on RE finance and subsidies. Since the establishment of REFSO, six projects with a total installed capacity of 23.9 MW received REFSO support<sup>57</sup>.
- » The Demand Side Management Subsidy Solar Water Heater Programme was implemented largely by Eskom as part of demand management within a mass roll out of SWHs. To eliminate cost-related barriers, Eskom provides incentives to offset SWHs (geysers). Potential savings of the programme could amount to 650 MW. The amount of the incentive given to any SWH participant is

### Box 20

#### WHAT HAPPENED TO THE REFIT?

The national REFIT programme was announced in 2009, and came to a halt before it was implemented. It was replaced by a competitive bidding process. Some South African investors now refer to the former policy as RE “bid” – however, the REFIT was effectively replaced with the new REPP in August, 2011, with the tariff prices serving as a price ceiling for competitive bids.

Procurement targets for numerous RE sectors have now been established by the national government as part of the

programme, with an overall target of 3,750 MW for RE.

Reasons for the policy change are linked to the fact that the regulator did not have the authority to create the tariffs and that it was “unlawful”. Others speculate that it was because the tariffs were too high at the outset. Regardless of the reasons for the policy changes, there is no doubt that this negatively impacted investor confidence and provides another example of the importance of stability in the implementation of energy policy.

<sup>56</sup> The White Paper is complemented by the Energy Efficiency Strategy of the Republic of South Africa (from 2005, reviewed in 2008), which sets out a national target (currently not mandatory, only a policy objective) for energy efficiency improvements reaching 12% by 2015, and provides for a number of “enabling instruments”.

<sup>57</sup> There is no dedicated REFSO fund, financing comes from other sources.



based on the capability of the SWH system to replace the use of electrical energy and is paid directly to the consumer.

## First IPP

The First steps towards building RE electric capacity in South Africa are fuelled by both government and government utility sponsored projects for wind energy and CSP, and a first IPP for on-shore wind.

## Eskom Renewable Support Project – Combined 200 MW of Wind and CSP

Eskom will be installing 100 MW of on-shore wind power on the western cape at Seri/Sere, and will couple this with another 100 MW of CSP in Upington (located on the northern cape). A multilateral package has financing of over USD 1.2 billion and has been largely secured for both projects (see Table 15). This includes a recent addition of USD 135 million (EUR 100 million) debt participation by the AFD (Agence Française de Développement) for the wind park<sup>58</sup>.

TABLE 15: FINANCING FOR THE 100 MW WIND AND 100 MW CSP IN SOUTH AFRICA (CREAMER, 2011)

Investor	USD million
IBRD	260
IBRD CTF	100
AfDB	260
AfDB CTF	100
Other lenders including AFD	270
Eskom	89
Total	1,229

## First 3,725 MW IPP – A test of investor confidence and policy

Along with the multilateral financing, Eskom and the DoE have initiated IPP projects including the successful bids of the 1,025 MW window for RE-based electricity procurement.

TABLE 16: THE FIRST 3,725 MW OF PROCUREMENT

Technology	Capacity
Oshore wind	1,850 MW
Concentrated solar thermal	200 MW
Solar photovoltaic	1,450 MW
Biomass	12.5 MW
Biogas	12.5 MW
Landfill gas	25 MW
Small hydro	75 MW
Small projects	100 MW

## Policy challenges

The Introduction of the modified feed-in tariff, which benefited from high levels of subsidies for the purchase of RE, and its replacement with a competitive bidding scheme in July 2011 brought about considerable market uncertainty. The newly introduced competitive bidding system sees lower tariffs which function as a price ceiling for bidders. Now known as the Renewable Energy Procurement Programme (REPP), this is the model with which South Africa seeks to ensure the production of RE electricity at the lowest possible cost. The process further ensures the seriousness of bidders, due to their own investment in the bidding process. It also avoids legal uncertainties raised with the earlier feed-in tariff regarding tariff guarantees for long-term PPAs.

The RE tariff and policy can be revisited in the event that RE uptake does not proceed as planned. However, IPPs have come through, despite a number of “false starts” and uncertainty from policy changes.

The DOE’s strategy to assist with project bankability and to attract the most serious bidders in order to ensure feasibility of IPP projects is to supply a 20-year guaranteed Power Purchase Agreement (PPA), accompanied by the price ceilings that are defined in REFIT<sup>59</sup> (see Table 17). Projects selected require a strong local

58 Climate Investment Funds Project Document – Oct 2010 and BNEF announcement of AFD portion of 100 million Euros for Seri wind park. Only AFD portions of this, included in BNEF country investment data (2011), are presented in this section.

59 Although REFIT is still officially in place, the tariffs for the IPPs act only as price ceilings, to provide flexibility for unforeseen risks and costs, but still expecting the bidder to come in under those ceilings.

TABLE 17: SOUTH AFRICA REFIT 2009 vs. 2011

Year	REFIT 2009	REFIT 2011 *	Percentage change 2011/2009
Technology	ZAR/kWh	ZAR/kWh	
Wind >1MW	1.25	0.938	-24.9%
Landfill Gas > 1 MW	0.90	0.539	-40.1%
Small Hydro > 1MW	0.94	0.671	-28.6%
CSP trough > 1MW with 6 hours storage	2.10	1.836	-12.6%
CSP trough > 1MW without storage	3.14	1.938	-38.3%
CSP central receiver (tower) > 1 MW with TES 6 hours	2.31	1.399	-39.4%
PV > 1 MW ground mounted	3.94	2.311	-41.3%
Biomass solid > 1 MW (direct combustion)	1.18	1.060	-10.1%
Biogas > 1 MW	0.96	0.837	-12.9%

\* REFIT prices act as price ceiling for REPP

Source: (NERSA, 2011)

and community economic development component, demonstrating local and social value. Interest has already been shown from the side of investors, including multi-lateral investors as well as South African and international commercial banks who have given the RE procurement policy a high ranking (8/10). Many questions, however, remain unanswered, such as the level of government support, the identity of the power buyer, risk allocation in the PPA, and in how to guarantee access to the grid. These and a number of other open

questions have impacts on the risk assessment and bankability of these IPP projects, and therefore require addressing before commercial investors commit to the South African renewables market.

### Small-scale Projects

Small-scale projects (under 5 MW) will have two year guaranteed PPAs and will benefit from higher tariffs within the REFIT.

## E.5 CONCLUSIONS

South Africa is moving ahead with RE-based electricity production. The country's ability to materialise substantial RE production will depend on a number of factors. These include transforming plans and initiatives into actions as has been demonstrated by the recent auctions. Most important will be the government's ability to ensure long-term consistent policies so that the right messages are sent to investors. In terms of strategic decisions impacting the next steps in its RE strategy, South Africa might consider looking at another portion of its energy consumption pattern beyond electricity; focusing for instance on fuels, which could be sourced from local feedstock and would provide a local resource strategy to address the dependency on oil imports.

# THAILAND

## F.1 INTRODUCTION

Thailand offers a well-developed infrastructure, free-enterprise economy, pro-investment policies and strong export industries. It ranks 20th in the world by population, 25th in gross domestic product (GDP), and 23rd in electricity-generating capacity.

The renewable energy (RE) sector in Thailand has been largely dominated by biomass, and investment in this sector has been negatively affected by rising feedstock prices. At the same time, installation of solar energy began to skyrocket in 2010 due to the low price of PV panels. The Thai Very Small Power Producer (VSPP) programme, which benefits from the bonus model of feed-in tariff design, supported growth during this period. Thailand is focused on mitigating the on-going impact of rising feedstock prices, and on solar, where investment reached USD 476 million in 2010. This was largely due to new capacity created through nine deals, all but one of which were large-scale Photovoltaic (PV) projects.

Thailand sets an example of using taxation and fuel pricing to level the playing field between non-renewable and renewable energy sources. There are several excellent public finance models in Thailand, including two new foundations – the Energy for Environmental Foundation and the Energy Conservation Foundation – that were recently created to provide equity and technical support for VSPP projects. Aside from managing the influx of solar projects, other specific government focus areas currently include (i) extending the electricity grid to remote areas that have the best potential for wind, and (ii) overcoming bureaucratic barriers to waste-to-biofuels related to municipal ownership of landfills.

The recent unexpected influx (1,600 MW) of solar projects in Thailand, necessitated action to maintain investor confidence. This included a stop on requests for projects as well as an adjusted feed-in tariff for projects in the current pipeline. It remains to be seen what the full impact of these measures will be.

TABLE 18: THAILAND COUNTRY INFORMATION

Renewable Energy Targets by 2021		
Total renewable and alternative energy (primary energy)		25%
Renewable Energy Share by 2010		
In electricity generation (including hydro)		6%
In electricity generation (excluding hydro)		2%
Investment in 2010 (USD million)		
Solar		476.1
Biomass and Waste		31.5
General Country Data		Year
Population	69.5 million	2011
GDP (USD)	346 billion	2011
GDP per capita (USD)	4,972	2011
GDP % of annual growth	0.1%	2011
Foreign Direct Investment (USD)	9.7 billion	2010
Investment in energy with private participation (USD)	2.9 billion	2011
Inflation	3.8%	2011
Unemployment rate	1.2%	2009
Balance of Payments - Current (USD)	13.1 billion	2010

Sources: World Bank Statistics, n.d.; REN21, 2011; IEA, n.d.; also includes ObservER, 2009 data and Thai Ministry of Energy website.

## F.2 THE ENERGY SECTOR

Thailand's per capita energy use was 1.5 toe in 2009, and per capita emission of greenhouse gas (GHG) were at 4.2 tonnes of CO<sub>2</sub> in 2008. The installed electricity capacity was 47,375 MW in 2009, and the demand for electricity is forecasted to grow by 5%-7% per year over the next 10 years. Thailand is highly dependent on energy imports, particularly oil, and plans to reduce its consumption of petroleum and imports of gasoline additive methyl tertiary butyl ether (MTBE) by promoting the domestic production and consumption of ethanol (Reegle, n.d.).

The Thai power sector is dominated by three state-owned companies: the Electricity Generating Authority of Thailand (EGAT), the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA). EGAT owns about half of national power generation capacity, and it is the national transmission system owner-operator and single buyer. EGAT sells bulk power to the two distribution utilities (MEA and PEA). MEA is responsible for the sale of electricity to consumers in Bangkok and surrounding areas, and PEA is responsible for the sale of electricity in the remaining parts of the country. There is no third-party access as of yet.

Private sector investments in conventional (large scale) power generation projects take place through the Independent Power Producer (IPP) programme that was initiated in 1994. Private investments in cogeneration and RE power are implemented under the Small Power Producer (SPP) Programme for generators selling 10 MW to 90 MW capacity (introduced in 1992 and suspended during 1997 to 2006) or under the VSPP programme for projects selling up to 10 MW<sup>60</sup>. IPP and SPP power projects enter into PPAs with EGAT with terms of up to 25 years<sup>61</sup>; VSPP projects can sell power to EGAT, MEA or PEA.

## F.3 RENEWABLE ENERGY

Thailand is an agricultural country, with biomass constituting the bulk (approximately 90%) of the total

primary energy supply from RE in the country. Thailand has abundant sources of agricultural waste, such as corn husk and coconut shells, which can be used in biomass systems. Global commodities' prices therefore have a strong influence on RE markets in Thailand in that they affect the price of raw materials (feedstock) for biomass production. The rise in commodity prices in the aftermath of the global financial crisis resulted in the stagnation of biomass investment in Thailand. The Thai biomass market is therefore currently saturated. Lower feedstock prices and/or a breakthrough in the improvement of biomass technologies (for example, mixed-fuel systems that can accept several different types of feedstock in the combustion tanks, or higher efficiency boilers) would be needed before private investment in biomass could resume growth.

In the electricity sector, renewables represent 9.1% of the installed capacity, 81.2% of this capacity comes from hydro; 18.6% from biomass and waste; and solar claims a very modest share at 0.2% (Figure 24). However, investment in solar has just begun to take off. In the year 2010 there was a rapid increase in the investment in solar, reaching USD 476 million, spurred by a sharp fall in the price of PV panels globally.

The current and potential developments in the various Thai RE sectors are summarised as follows:

### Biomass/biogas/ethanol

As of 2009, there were 31 SPP biomass projects with an installed capacity of 721 MW, 4 combination fuel projects utilising biomass and conventional fuel with a capacity of 476 MW; and 42 VSPP biomass projects with a capacity of 509 MW supplying 197 MW of power to the system. There are 900 MW in new biomass capacity expected by 2011, given the established subsidies (Reegle, n.d.: Thailand Country Profile).

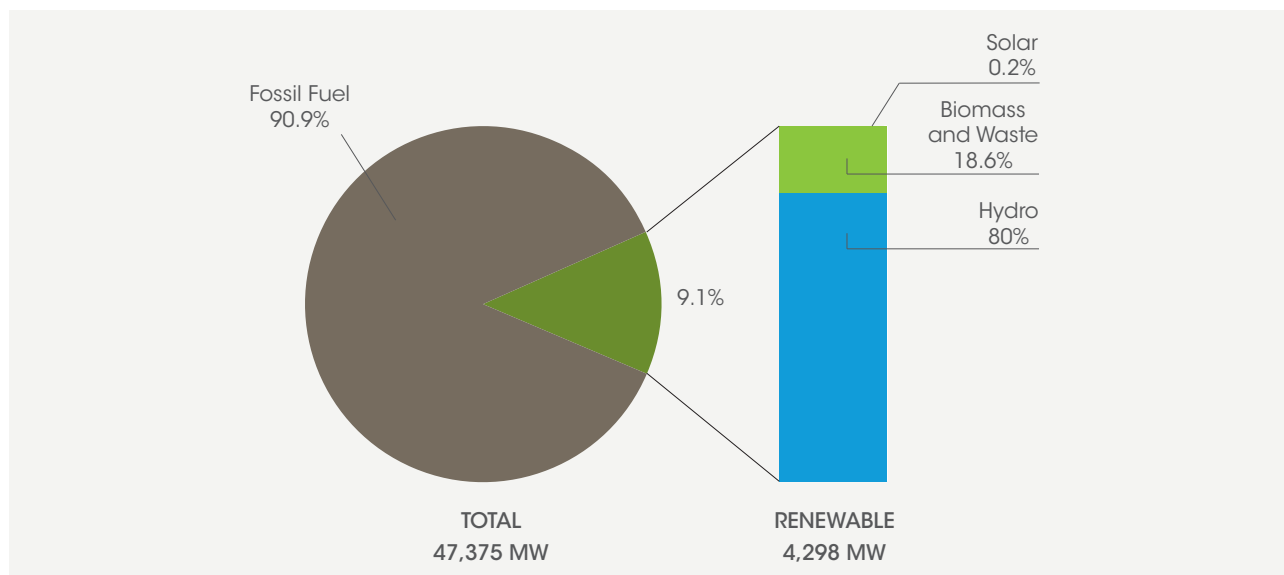
In 2009, Thailand doubled its capacity of biogas-based electricity to 51 MW.

The Department of Alternative Energy Development and Efficiency (DEDE) within the MOEN estimates the feasible potential at more than 5 GW for biomass (mainly bagasse, paddy husk and woodchips), municipal wastes and biogas.

<sup>60</sup> The SPP scheme promotes the use of RE and efficiency of primary energy by defining an SPP as a private or state enterprise that generates electricity either (i) from RE sources such as wind, solar, mini-hydro, waste, or biomass, or (ii) from conventional sources (natural gas, coal, or oil) using cogeneration (combined cycle units capable of producing power and steam).

<sup>61</sup> The power purchase price is based on EGAT's avoided cost calculated from the cost of avoiding a gas fired combined cycle plant. However, non-gas fired SPPs can choose an alternative tariff based on the costs of a coal fired power plant. It reflects the cost structure of biomass power plants more closely than gas fired power plants both in the capacity component and the energy component since the prices of various types of biomass, being used as substitute fuel for coal in industry, tend to move in line with the price of imported coal.

FIGURE 24: ELECTRICITY CAPACITY MIX IN THAILAND FOR 2009



Source: EIA (n.d.)

### Solar

Thailand is endowed with abundant solar resources with average irradiation rates estimated at 5 kWh/m<sup>2</sup>/day, making it an ideal location for deployment of PV energy.

In 2009, there were 32 grid connected solar rooftop projects with a generating capacity of 0.14 MW, and many small off-grid solar VSPP projects producing a total of 32 MW. A few small solar farms, sponsored by EGAT and the private sector, have a generating capacity of less than 2.2 MW. An Asian Development Bank (ADB) financed 55 MW PV-plant is in the stage of preparation. The MOEN estimates that only 0.064% of the total solar potential has been developed – just 32 MW, of which less than 10 MW is grid connected. The DEDE estimates the feasible potential of solar energy in Thailand at 50 GW.

### Wind

Thailand does not have a very sophisticated wind map; but the best wind resources seem to be located in rain-forests and mountain areas that are not yet reached by transmission infrastructure. Thailand’s southern coastline is therefore considered to have the best potential for wind power generation. This sector is one of the least tapped RE sectors with just 0.985 MW of a possible 1,600 MW exploited so far (Reegle, n.d.: Thailand Country Profile). This is due in part to a lack of grid access in the locations with the best wind potential.

### Hydropower

As of 2007, approximately 50 MW of hydropower generation was installed, most of which is limited to small-scale, hilly areas. Due to the perceived risk of negative environmental impacts, it has not been pursued in other regions of the country (Reegle, n.d.: Thailand Country Profile). DEDE estimates Thai hydropower potential at 15 TWh.

### Financing Flows in Renewable Energy

Early investments in 2006 focussed on biofuels (USD 125 million), with smaller investments made in biomass and solar. This trend continued into 2007 with another USD 144 million being invested in biofuels and USD 35 million in the biomass sector. Biofuel investment was cut by over half in 2008 to USD 58 million. This was largely the effect of falling fuel prices, supply storage and the first of a string of negative investment impacts to come in the future years due to an increase in feed-stock prices. This investment was nearly matched by small hydro, where investments totalled USD 57 million. Biomass led 2009 investment with USD 86 million, with small hydro following in second place. An investment of USD 21 million in 2009 initiated an upward trend in solar power, followed by USD 476 million in 2010.

Most recently, solar energy has attracted the attention of the private sector, and the number of applications

to the Thai government's subsidy programme on solar electricity has been considerably increased. As of October 2010, 397 applications for PV projects (totalling 1,600 MW) were submitted to the VSPP programme, and 302 applications for Concentrated Solar Power (CSP) projects totalling 477 MW were submitted to the SPP programme. Of these projects, as of October 2011, only 55 solar PV projects totalling 16 MW, which represent 1% of the applications, were selling electricity to the Thai utility. No CSP projects have yet been connected. All the remaining projects are at different stages of development.

## Renewable Energy Targets

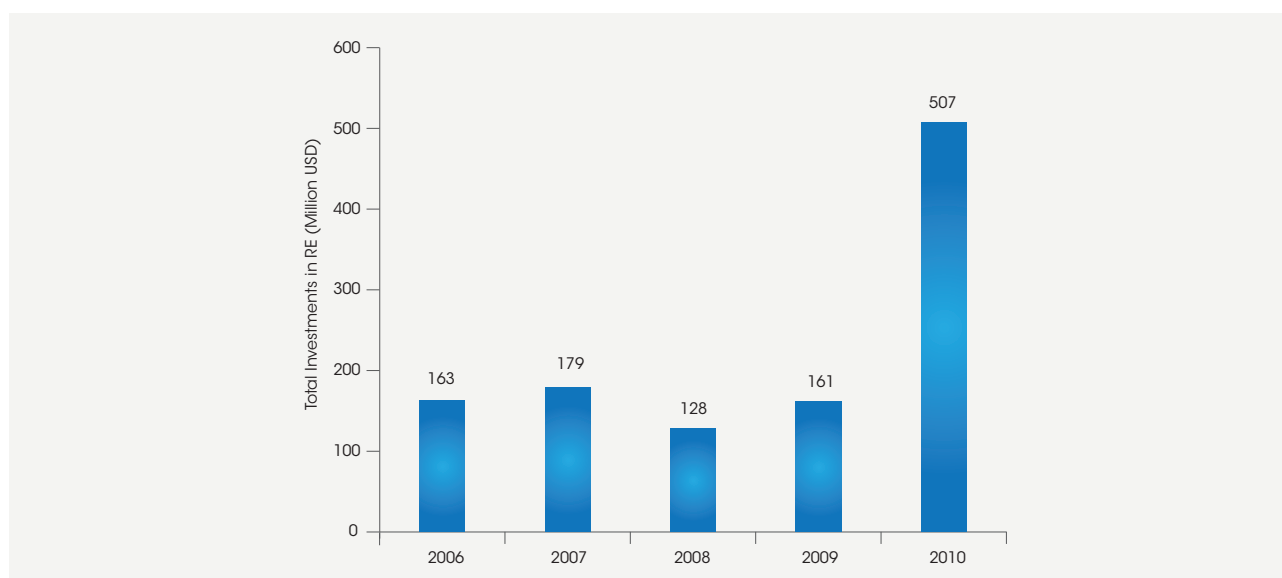
The national energy strategy for 2006-2015 is composed of four strategic plans that identify specific targets, measures, and responsible agencies:

- » Strategic plan for energy efficiency (EE)
- » Strategic plan for RE development
- » Strategic plan for energy security enhancement
- » Strategic plan for Thailand to be the "regional energy centre".

The strategic plan for RE development initially took the form of a 15-Year Renewable Energy Development Plan (REDP) 2008-2022, that was published in 2008. The goal of the plan was to increase the share of alternative energy to 20% of Thailand's final energy demand in 2022; to utilise alternative energy as a major energy source, replacing oil imports; to increase energy security; to promote integrated green energy utilisation in communities; to enhance the development of the domestic alternative energy technology industry; and to research, develop and encourage high-efficiency alternative energy technologies.

After the formulation of the government of the new Prime Minister H.E. Yingluck Shinawatra, a new target on renewable and alternative energy was announced to signal Thailand's stronger political will of developing a low carbon society through an even more ambitious Alternative Energy Development Plan for 2012-2021 (AEDP 2012-2021). In this Plan, the key target for renewable and alternative energy development is to reach 25% of total energy consumption in 10 years, i.e. by 2021, or equivalently to approximately 24.3 Mtoe in 2021, on the assumption that the total energy demand in 2021 will be 97.2 Mtoe. According to DEDE, the current energy consumption for Thailand is 71.7 Mtoe while renewables account for only 10%, or 7.4 Mtoe in absolute terms.

FIGURE 25: THAILAND INVESTMENT IN RE (USD MILLION)



Source: BNEF (n.d.)

The new target is more challenging when compared to the one set in 2008. The total energy demand is estimated to increase by 25.4 Mtoe during the next decade. In order to achieve the 2021 target, the renewable and alternative energy sources will have to provide 16.7 Mtoe of this added demand. This clearly requires stronger budgetary support from the government in particular to R&D, more favorable supportive schemes for private investors and for all communities to encouraging them to actively engage. If that can be accomplished, the security of energy supply will be enhanced and Thailand will be one step closer to the goal of developing a low-carbon society.

Table 19 shows the target capacity for different RE resources by 2021. It is estimated that in order to achieve the 25% target by 2021, Thailand will need 24.3 Mtoe of alternative energy; of which 2.7 Mtoe will be used for electricity, 9.4 Mtoe for heat and 12.2 Mtoe as biofuels for transportation.

## Regulatory Framework

The MOEN is the ministry responsible for the energy sector. It is tasked with supervising the state-owned companies and overseeing overall energy policy formulation and implementation. Its Energy Policy and Planning Office is responsible for the implementation of voluntary EE programmes and awareness raising. Its Department of Alternative Energy Development and

Efficiency (DEDE) is responsible for mandatory policies and promotion. DEDE manages an Energy Efficiency Revolving Fund (EERF) and an ESCO Venture Capital Fund. The Energy Regulatory Commission (ERC) was set up by the Energy Industry Act of 2005, which in 2007 set up the Power Development Fund.

## F.4 FINANCING MECHANISMS

A particularly progressive aspect of the Thai strategy is that it funds RE development partly through taxation of non-renewable energy. The Power Development Fund provides financial support to the promotion of RE generation and is funded by a levy on fossil fuels based generation. The Energy Conservation Promotion (ENCON) Fund is capitalised through a levy on petroleum products. Palm oil taxes are used to support the national biofuel committees.

Another mechanism that is very helpful for the banks is the establishment of two foundations, the Energy for Environmental Foundation (EfE) and the Energy Conservation Foundation (ECFT). Both foundations can provide equity investment for VSPP projects. But most importantly, they provide technical information and support to the projects.

Although the EERF is primarily focused on efficiency, its mandate is to fund sustainable energy more broadly; and it provides an excellent example of how governments can promote learning among local financial institutions. The Fund aims to stimulate the banking community's interest in lending to industry for sustainable energy projects, providing funds to collaborating financial institutions at an interest rate of 0.5% with a maximum loan tenor of 7 years. The financial institutions are allowed to "on-lend" these funds for sustainable energy projects at an interest rate of no more than 4%. Technical support from DEDE helps give banks the confidence needed to consider clean energy projects, even without technical or engineering staff of their own. The effort led to loans worth a total of THB 10 billion (USD 286 million). Almost half of this was provided by the banks themselves by blending DEDE funds with

TABLE 19: THAILAND RE TARGETS FOR POWER GENERATION

RE Source	Capacity by 2021 (MW)	Current Capacity (MW)
Solar PV	2,000	150 - 200
Wind Energy	1,200	7 - 8
Hydropower	1,608	86 - 96
Biomass	3,630	1,790
Biogas	600	140 - 170
MSW* to Energy	160	27
Geothermal	1	0.35
Wave and Tidal	2	0

\* Municipal solid waste (MSW)

Source: Reegle, n.d.; Sarochawikasisit, 2009.

their own funding sources into single loans. The resulting energy savings amount to 750 GWh per year.

The VSPP<sup>62</sup> programme constituted a breakthrough in RE finance in Thailand as it allowed for the sale of power back to the grid at levels lower than 10 MW. This led to a boom in projects, especially biomass-related. Investors normally require around 15% IRR on equity investments. For biomass, two policy mechanisms in particular have made it easier for investors to achieve this:

- » **Tax privileges:** Imports of RE equipment are tax free. Income from RE production is not taxed for the first 8 years. After that, it is taxed at half the normal rate (the latter being 30%). Investors estimate that this normally adds around 2%-3% to the expected IRR on equity for biomass projects.
- » **Feed-in premium (called "Adder") on top of the regular "EGAT avoided cost" tariff<sup>63</sup>** The Adder depends on the type of renewable energy being used and is given only the amount of RE capacity that is solicited from the various types of RE. Solar energy projects receive a fixed Adder subsidy of THB 6.5/kWh for 10 years (it was at THB 8/kWh but was adjusted in 2010) from the start of commercial operations. Wind farms have an Adder of THB 3.50/kWh. There is also a special Adder for SPPs/VSPPs in the three Southern-most provinces at a rate of THB 1.50/kWh for wind and solar energy, and THB 1.00/kWh for other types of RE to compensate for the political risk from the unrest (Energy Policy and Planning Office (EPPO), n.d.). In the case of biomass projects, the premium is not fixed, but awarded on a competitive basis through reverse auctions. The maximum Adder available for biomass-fuelled energy producers is THB 0.30 per kWh over 7 years. Investors estimate that the Adder provides an additional 2%-3% to the expected IRR for biomass projects.

Other instruments that support RE finance in Thailand are described in Table 20.

## Future Development of the Investment Framework

Positive developments are expected from the government's evaluation of over 200 CSP project applications, given Thailand's challenging alternative energy target of 25% by 2021. Some concerns had been raised by the Thai government with regards to solar investment. One such concern was that the capacity of the solar projects under evaluation was considerably higher than what was targeted. Policy makers were thus concerned about the impacts the Thai feed-in tariff (Adder) on consumers and on tax payers, who are ultimately paying for the subsidy<sup>64</sup>. Another concern was that considerable increases in the purchase of electricity from VSPP RE can cause a problem with the stability of EGAT's transmission system, thus affecting the overall stability of the country's electrical system, and establishing the need to improve the Thai transmission system.

In addition to addressing these issues, the Thai government is currently looking at how to provide the needed transmission lines that would make wind investment possible. Investors hope that wind policy could provide a further step forward in the RE investment framework in Thailand. With regards to biomass, current investments are mostly for production of 6 to 10 MW (under the VSPP framework described earlier). The government is hoping to promote investment for production of less than 1 MW, which would bring these systems to local villages and rural people. Organising the waste from agriculture at this small-scale is a matter of logistics.

Waste-to-energy from landfills is another area where the Thai government is focused on removing barriers to additional investment. The main obstacles in this area are bureaucratic complications resulting from the fact that landfills generally belong to local governments, which makes obtaining permits complicated for potential investors. Smoothing out the permit process will be a further breakthrough for investment in this sector.

62 See also, *future of the investment framework for developments on VSPP solar*

63 The level of the normal tariff is THB 2-2.5 per kWh = USD 0.065-USD 0.082 (currency Exchange October 29).

64 In July 2008, the National Energy Policy Council passed a resolution that lowered the 10-year Adder subsidy for all solar projects that were in the application process, pending approval. The Adder for solar PV projects currently stands at THB 6.5/kWh (around USD 0.26/KWh). The National Energy Policy Council resolution also stated that applications received after 28 June, 2010 would no longer be accepted.



TABLE 20: ADDITIONAL RE SUPPORT MECHANISMS IN THAILAND

<b>Net metering</b> for small-scale RE systems installed for self-consumption	Net metering is an electricity policy which allows utility customers to offset some or all of their energy use with self-produced RE. Net metering works by utilising a meter that is able to spin and record energy flow in both directions. The meter spins forward when a customer is drawing power from the utility grid ( <i>i.e.</i> , using more energy than they are producing) and spins backward when energy is being sent back to the grid. Under this arrangement, generators that produce less than they consume in a monthly period receive the retail tariff rate for electricity fed onto the grid. For net excess production, producers are compensated at the "bulk supply tariff" - which is the average cost of generation and transmission in Thailand and is about 80% of the retail rate. Either way, it is a very good arrangement for small RE producers in Thailand.
<b>Investment grants</b> of 10%-30% for biogas, MSW and SWH projects	Some of these are not SPPs or VSPPs <sup>65</sup> , but produce energy for their own use or off-grid village-based projects in remote areas. The subsidies are paid by the Energy Conservation Promotion Fund.
<b>Soft loans</b> for RE investments	These include municipal waste projects.
<b>Tax incentives</b> awarded by the Board of Investment (BOI)	Investors in RE generation selling to the grid enjoy an 8 year tax holiday and a 50% tax reduction for the following five years. Sales tax exemption is given to clean energy equipment.
<b>Supportive fuel pricing</b>	The consumption of high-RE-Fuels (E10, E20, E85 and B5) is promoted by the pricing of conventional transport fuels.
<b>Direct public investment</b>	The government also invests directly in RE projects. Government agencies receive funds from the central budget to implement mini and micro hydro projects as in most cases obtaining various permits is extremely difficult for the private sector. EGAT plans to spend THB 22 billion (USD 710 million) over the 2008-2022 period to construct RE power plants with a combined capacity of 258 MW, specifically mini-hydropower (170 MW), waste power plants (15 MW), wind power plants (65 MW) and solar power plants (8 MW).
<b>Publicly backed guarantees (PGB)</b> for bond issued to finance RE projects	An ADB project supports the bond issue by a private corporate company to finance the construction of an 88 MW biomass project; it guarantees the timely payment of the principal. The objective of the PBG is to establish a link between local currency long-term fixed rate investors (pension funds and insurance companies) and infrastructure projects. This is to overcome the difficulties finding suitable long-term fixed-rate financing in the local currency. Local currency bonds cannot yet provide the long-term tenor required for infrastructure projects; most corporate bonds have a tenor of up to 5 years. The partial credit guarantee provides issuers with an enhanced credit rating, which will attract local institutional investors who limit their investments to only credit ratings of A+ or above.
<b>Partial credit guarantees</b> to bank loans for RE projects.	An ADB project to support a major private solar power plant project expects to give a partial credit guarantee to eligible lenders up to the lower of USD 70 million equivalent in baht and 25% of project costs.
<b>Levy on petroleum products</b>	This levy raises about USD 50 million per year and is used to fund the Energy Conservation Promotion (ENCON) Fund. ENCON, in turn, finances the two funds managed by DEDE: the Energy Efficiency Revolving Fund (EERF) and the ESCO (energy service company) Venture Capital Fund. The latter was provided with a capital of approximately USD 16.2 million.
<b>Levy on generation using fossil fuels</b>	This levy is used to fund the Power Development Fund. The rates vary, depending on the amount of emitted pollution and fuels used. The Fund gives financial support to the promotion of RE generation.
<b>Palm oil taxes</b>	USD 3 million in palm oil taxes are used to support the national biofuel committees.
<b>CDM carbon credit trading</b>	Approval of policy allowing the trading of carbon credit through CDM was made in early 2007 after five years of indecision by the earlier government. This has given an enormous boost to a number of marginal projects, particularly biogas and municipal wastes projects.

<sup>65</sup> These regulations allow small community-owned or small entrepreneur-owned RE generation to connect to the grid and sell excess electricity to utilities.

## F.5 CONCLUSIONS

The eyes of RE investors are on Thailand following the results of the latest democratic elections held in mid-2011 – both to seek reassurance of a stable political climate, and in anticipation of the impacts that the new government will have on establishing coherence in the short- and longer-term development of Thailand’s RE action programmes, policies and financing strategies, and particularly regarding local manufacturing. Therefore, the recent announcement of a more ambitious alternative energy target by the new government should have a positive impact. Thailand’s Very Small Power Producer programme, using the “bonus model” of feed-in tariff design (where the final tariff paid is composed of several “Adders” on top of the avoided wholesale cost of generation), has been very successful in generating contracts to develop RE generation; but with the unexpected influx of solar projects, attention is still largely focused on how this will be managed going forwards. Thailand sets an example for other countries by taxing non-renewable sources to help finance RE, and of having developed a number of excellent public finance programmes including an emphasis on channelling support through local finance institutions.

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# List of Interviews

## Interviews completed by end of 2011

Company/Organisation	Contact person	Position
CIMB THAI Public Company Limited	Mr. Chirawut Chaiyawat	Special Corporate Banking Projects, FVP, Corporate Banking Division
KfW	Mr. Karim Ould Chih	Senior Project Leader, Brazil
FIRA	Mr. Luis Roberto Llanos Miranda	Director General Adjunto de Promoción de Negocios
FIRA	Mr. Erick Rodriguez Maldonado	
UNEP	Ms. Dolores Barrientos Aleman	Country Director
NAFINSA	Mr. Enrique Nieto	Director Internacional
KfW	Mr. Thomas Eisenbach	Country Manager
DEG	Mr. Martin Romberg	Country Manager
KfW	Mr. Kurt Hildebrand	Division Chief Climate and Environment, North Africa and Middle East
World Bank	Mr. Chandrasekar Govindarajalu	Team Leader
SWEG MD – Wind Division of Elsewedy Electric	Mr. Faisal Eissa	Managing Director
EETC (Egyptian Electricity Transmission Company)	Ms. Soufie Basta	Specialist
KfW	Mr. Klaus Gihir	Team Leader - South Saharan Africa
KfW	Mr. Harald Gerding	Director Office Pretoria
IDC	Mr. Raoul Goosen	Senior specialist – Green Industries Unit
Tri-Invest	Mr. André Stürmer	Managing Director
Government of South Africa Department of Energy	Ms. Nelisiwe Magubane	Director General
CRESTAR Capital India	H V Kumar	Director
KfW	Dr. Claudia Loy	Division Chief, Energy Asia
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