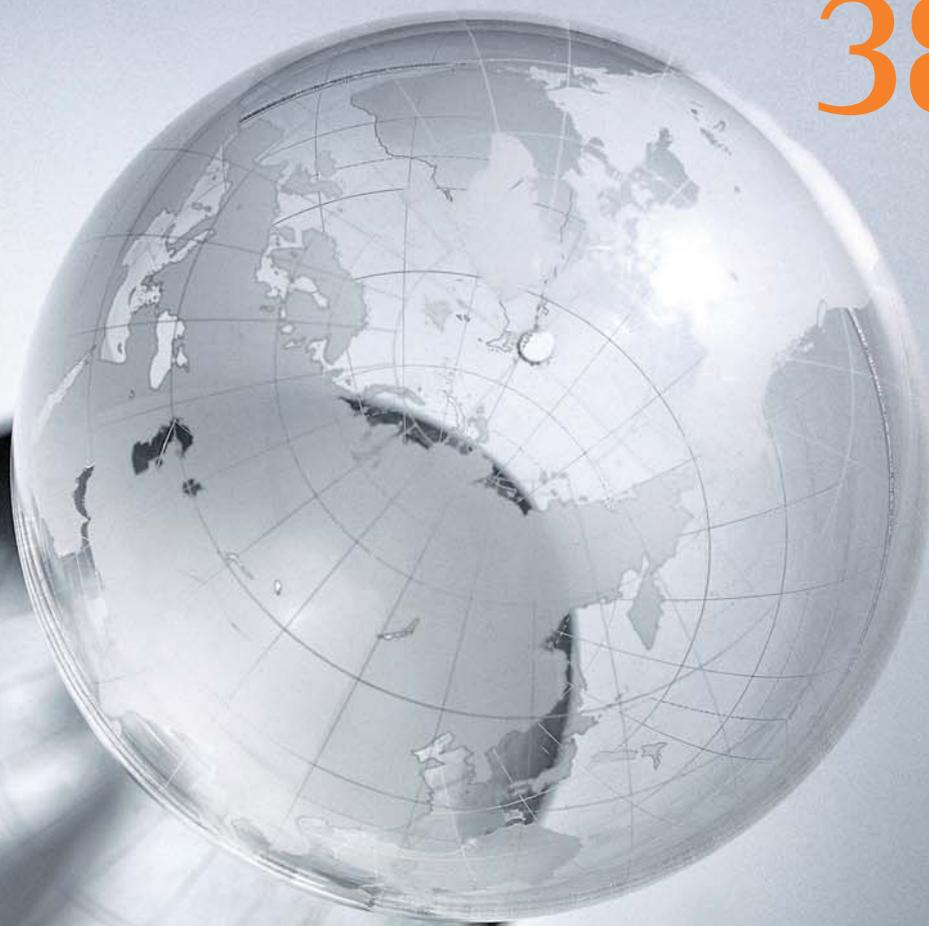


Discussion Paper.

38



Financing Renewable Energy.

Instruments, Strategies, Practice Approaches.
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Editorial staff:

KfW Entwicklungsbank (KfW Development Bank)
Energy and Policy Division, Competence Centre Energy

Peter Lindlein, iCee, Frankfurt a. M., Germany
Wolfgang Mostert Associates, Gentofte, Denmark

Frankfurt am Main, December 2005

Introduction & Acknowledgement

There is broad consensus that our global energy system has to undergo significant changes in order to urgently meet the demands for modern energy services for the over 2 billion people without access in developing countries while preserving our global climate, ecosystems and human health. Renewable energies can contribute considerably to meeting these needs. Nevertheless renewable energies still confront serious obstacles that make their promotion a strenuous and risky task, more so in developing and transitional countries.

A critical challenge is to enhance affordability by mobilizing financing for renewable energy investments given higher up-front capital costs and perceived commercial risks still associated with some renewable energy options. Another challenge for developed countries is to ensure that costs for renewable energies will continue to come down through R&D and widespread application (economies of scale).

The study draws on good practice examples of World Bank Group, KfW Development Bank and DEG and discusses how these can be applied to enable broader access to reliable energy services to poor people in developing countries and economies in transition.

The report was sponsored by the German Federal Ministry for Economic Cooperation and Development (BMZ) and prepared by Dr. Peter Lindlein and Wolfgang Mostert under the guidance of KfW Development Bank, Energy Sector and Policy Division. It furthermore benefited immensely from discussions in Bonn, Germany at the event, "Financing Renewable Energies in International Financial Cooperation - Innovative Concepts for Ensuring Sustainability and Broadening Access". This event was held in conjunction with the International Conference on Renewable Energies held in June 2004.

The World Bank, Energy and Water Department was a partner in the preparation of the report in formulating its concept and offering peer review comments. We are especially grateful to Jamal Saghir, Director Energy and Water for his support, Anil Cabraal, Lead Energy Specialist in Energy and Water for his guidance and to Jeffrey Delmon, Senior Infrastructure Specialist in Infrastructure Energy Finance, at the World Bank for a very comprehensive review of the draft report.

Financing Renewable Energy

Instruments, Strategies, Practice Approaches

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Executive Summary

The need for a **special financial mix** for **renewable energy** is the consequence of particular conditions on the supply side, constraints on the demand side and - most numerous - of limitations in the framework conditions.

The profile of difficulties for RE varies with the type and size of RE projects as well as with the regional economic context. Consequently, there is no golden rule or a standard set for financing of RE projects, but each individual RE project requires its own specific **adequate mix of funds and conditions** to be financially viable.

Financing in this study refers to the perspective and activities of the **project sponsor** at the micro level as well as the possibilities and prospects of donors and **promotional financial institutions** to bridge gaps in the financial sphere for RE. The study does not present the impressive development of sophisticated instruments in the financial sector to refinance or structure risks of portfolios of projects and/or financial activities, as it is difficult to introduce sophisticated credit derivatives when there are almost no credits like in the context of so many LDCs!

Depending on the type of **RE** they **demand** substantial amounts of funds. As RE projects are very capital intensive they are extremely sensitive to the structure and the conditions of capital cost financing. Due to their time horizon, RE have a very long exposure period to risk. To avoid further handicap of competitiveness in comparison to conventional power they need cash-flow adequate terms, i.e. **long to extra-long maturities** and **interest rates** in the lower range of the market. RE finance has to take into consideration that many of the RE developers and sponsors are classified as higher risk clients with limited own possibilities to reduce or to offer own proper means as coverage for this risk.

RE finance is not only very different for the distinct types of RE technologies,

but is much more **segmented** by the size of projects and the type of debtor:

- Consumer- and microfinance for off-grid RE projects,
- Corporate Finance for small on-grid RE projects,
- Project Finance for large RE projects.

The demand for RE finance in many LDCs faces severe constraints on the supply side of the **financial system** in LDCs. Depending on the maturity of the financial markets, there is a 3-dimensional gap of financing:

- Amount of funds
- Terms and Conditions of Funds
- Available Financial Instruments

Thus the practical relevance of the many **financial instruments** is rather limited in the commercial financial markets of the developing countries for RET financing. We can identify some kind of development sequence of financial instruments:

- **Credits** are used already at the earliest stages, and as an instrument are available for RE finance, although there may be (severe) limitations to the conditions and amounts depending on the stage of development of the local financial market.
- **Leasing** as an instrument can seldom be found in LDCs, but is already in use in emerging financial markets, offering some chances for RE finance.
- **Equity and Mezzanine Finance** becomes more common only in the more advanced emerging financial markets. In poorer countries the market will rarely offer these instruments and the corresponding funds.
- Although **Bonds** are in use in many emerging financial markets, there seems little chance to use this instrument on pure market base for RE finance due to the risk aversion

of the public as well and the high transaction cost.

The **local commercial financial and capital markets** are at least offering some interesting **basic elements for a partial solution** to the financing problems for RET, which however need the completion by smart promotional instruments to make them a viable path for RET finance. And as ODA and **promotional finance** of DFIs with lower expectations for return and their higher risk disposition can potentially use each and every of the described financial instruments, the described instruments can serve – together with the instruments in the next chapter – as something like a toolbox for adequate RE financing within promotional schemes.

As RE-projects are more complex and risky, also because most of these technologies rely on the supply of fuel from nature without a chance of substitution by another source, risk management and **risk allocation** are extremely important. The proper planning of a RE project with carefulness, attention and accuracy exercising the due diligence of a businessman is the most important risk management factor. The capital and insurance markets have developed a series of financial instruments to support the structuring of the risk of projects and to make financial deals viable at all. The most important and **relevant risk instruments** at the present stage of development are:

- Political Risk Insurance,
- Wind Insurance,
- Swaps, and
- Contingent Finance.

Due to the limited experience, the early stage development of the relevant markets and the risk-aversion of the players such instrument will only seldom be available for RE in LDCs per se. Given these constraints, there is a task for the public sector and the donor community to take on to catalyze the utilization of innovative risk management schemes to facilitate commercial investment flow to RE sector. Thus, some of these **instruments** presented offer an interest-

ing **starting point** for **policy makers and donors** to support the structuring of risk in RE by assisting the players in the financial and insurance markets to develop their skills and instruments. Furthermore some of them could be used directly by donors to assist RE projects and programs.

Taking into consideration the limited resources, the study presents on the base of the rationale of economic and financial viability some conclusions for an approach of **RE promotional finance** and policy makers:

- Pick the low-hanging fruits in RE-investments, i.e. financially viable under current conditions. They could be financed by commercial finance, provided they get adequate. In cases of financial market failure this needs compensation by agents who have the willingness and the funds to create or give the access. This is a case for **market-based development finance**.
- Other RETs are economically viable, but not (yet) financially viable, because external costs and benefits are not reflected in the financial market prices. They need some compensating financial support to become financially viable. This is the field for RET financial support through subsidies and ODA with grant elements.

Promotional schemes could play an important role to improve the financial viability of RE projects by an approach to increase funding availability, aiming at leverage of private finance, with a risk-sharing approach, and the facilitation of the bundling of (small) projects to help absorb their higher proportional level of transaction costs. A financing framework for renewable energy based on the economic principle and the principle of subsidiarity is composed of three inter-linked pillars:

- Support access to commercial finance by making equity and long-term debt finance available.
- Create a market expanding regulatory framework, which reduces

risks, keeps down the costs of projects transactions.

- Offer financial subsidy-instruments to bridge the gap between economic and financial viability, thereby making otherwise financially unviable energy investments “bankable”.

Opportunities for donors (in combination with the existing financial instruments and players) in the local capital markets include:

- Support private firms by providing financing and/or equipment subsidies. Enterprise development support, seed capital, debt finance etc.
- Support of Specialized Financial Institutions (RE, Microfinance).
- Creation of new financing vehicles like revolving funds, credit lines, and contingent business loans that are forgivable under specified conditions.
- Reduction of (commercial) risks by financial guarantees like for example maturity guarantees, rolling guarantees and pool guarantees.

Subsidies are needed to bridge the gap between economic and financial viability of RE, which should be done by **smart subsidies** reaching intended markets only and encouraging least cost option to achieve social goals at least cost while providing incentives for business to serve target markets. They encourage commercial participation by the private sector and should have a built-in element of phasing out. As a general international tendency in the developed countries the following can be observed, which are not always in line with the principles of smart subsidies:

- a shift in the subsidy burden from tax-payers to electricity consumer pays instruments;
- replacement of direct investment subsidies to RE to subsidies linked to the output;
- focus on elimination of “windfall” subsidy payments.

The possibilities of the **interaction of financing instruments, regulations and institutional innovations** as an approach to overcome the hurdles of RE finance and to “mainstream” RE in bulk power markets and rural electrification is presented in a chapter of **case studies**, making the step from the single RE-project implementation perspective to a program-approach to RE. After presenting basic elements of a program approach to promote RE, examples are presented illustrating, how

- the creation of specialized institutions for RE finance,
- the introduction of new financial products into the capital market and
- the re-allocation of risks RE-Investments can be enabled and
- how problems of collateral could be solved.

Trying to summarize the quintessence of this study an outline of the **rationale** of a **RE financing strategy** calling for a well-targeted support by promoters of RE and development is presented:

1. The **limited financial viability** and the **elevated risk profile** of RE require **special efforts** in financing and structuring.
2. The financial **approach** has to determine the distance of the RE project to commercial financial viability, and define a set of cost reducing and income increasing measures on three levels (project, framework, outside support) to **create conditions of financial viability** ex ante as a key factor for investment decision.
3. **Risk Allocation** between project sponsor, contract partners, the (financial) market and promoting institutions is the other key determinant for successful project financing of RE.
4. This risk structuring and financial engineering of RE projects is a **complex and time-consuming process**, demanding staying power and corresponding resources itself.

5. For projects with a perspective of viability, the **financial** world has ready a well-equipped **toolbox** with adequate instruments to finance the specific needs of RE projects and to structure its risks, at least in theory.
6. A proper **risk allocation** with view on the markets perception of RE can make a generally viable RE project creditworthy at all or credit-worthier, thus helping to attract more funds and reduce the cost of financing in the **market**.
7. However in **practice, local capital markets** are not the magic solution due to their limitations on the different levels of financial deepening in the various markets, although even in LDCs they can offer some **contribution** to financial closure.
8. The **3-dimensional RE financing gap** (funds/terms/instruments) can be bridged with the assistance of institutions with **higher risk- absorptive capacity**, and which by themselves can potentially offer each professional financial instrument to complete the market. However, as the resources of promoting institutions are not unlimited, their approach has to be selective and targeted.
9. To maximize results donors should offer assistance to **pick the low hanging fruits of RE**, i.e. projects, which are close to market competitiveness. Smart subsidies can be a valuable instrument in such a context, especially if their use needs to be only transitory.
10. **Donors** could help **create credit-worthiness** (Training for RE project sponsors and RE interested financial institutions, Risk structuring and coverage) and **look for leverage**, offering assistance (Financial Guarantee, subordinated debt) to bring down the risk of RE to a market-attractive level.

Foreword

'Renewable energy' and the 'Financial Sector' have one thing in common: due to their crucial role and their fast technical progress they are attracting more and more attention, especially in the world of development assistance, which is looking for an approach to alleviate the energy problems of the developing countries by adequate technology.

Applying a market-oriented approach, the starting point of this study are the barriers to the further development of the **renewable energy (RE)** sector on the supply side, the demand side and the framework conditions within the energy sector. Identifying the financial constraints as one the most important the study tries to systematize the hurdles in the financial sphere of RE projects on the demand side, the supply side and the framework conditions of the financial sector.

In this context, it is important to clarify the perspective and focus of this study. **Financing** in this study refers to

- the perspective and activities of the **project sponsor** at the micro level as well as
- the activities and instruments of the regulatory **authorities** and Government in the **energy** sector and at macro level,
- as well as the possibilities and prospects of donors and **promotional financial institutions** to bridge gaps in the financial sphere for RE.

It does not refer in detail to the impressive development of sophisticated instruments in the financial sector to refinance or structure risks of portfolios of projects and/or financial activities. Although the use of such techniques by financial institutions in the end may also benefit the supply of finance for single RE projects, their orientation on portfolio aspects and refinancing of the financial institution itself would overstretch the coverage of this study.¹

Accordingly the analysis of the task of **financing** of a RE project making use of the supply of the commercial financial sector in this study centers on the possibilities on the utilization of classical financial instruments and of their availability in the financial market at the different stages of development.

This is also the perspective and approach in this report to address the specific **risks** RE projects have to manage. Within the scope of this study, this chapter can give only an overview about the wide range of risk factors within RE projects and present an outline of the generally available risk instruments. Within this context it would be too ambitious to present every financial instrument in detail and to develop a replicable blueprint for its utilization for RE projects.² Thus the chapter will focus on the most essential instruments at the project level and present an approach for a risk strategy for RE. A typical scheme for risk allocation at the RE project level is derived from a screening of risk instruments used in the financial market.

Although the commercial financial sector offers a wide variety of instruments for financing and risk coverage which potentially could be used for RET finance, there is a gap

¹ Some of these aspects will be covered in the study "Assessment of Financial Risk Management Instruments for Renewable Energy" to be implemented by UNEP in co-operation with the World Bank and UNDP from 2005-2007.

² As mentioned earlier some of these aspects will be covered in the study "Assessment of Financial Risk Management Instruments for Renewable Energy" to be implemented by UNEP in co-operation with the World Bank and UNDP from 2005-2007.

due to their actual availability in LCDs. Thus the following chapter gives an overview of **financial supporting approaches and instruments** to bridge such gaps.

The possibilities of the **interaction of financing instruments, regulations and institutional innovations** as an approach to overcome the hurdles of RE finance and to “mainstream” RE in bulk power markets and rural electrification is presented in a chapter of **case studies**, making the step from the single RE-project implementation perspective to a program-approach to RE. After presenting basic elements of a **program approach** to promote RE, examples are presented illustrating, how

- the creation of specialized **institutions** for RE finance,
- the introduction of **new financial products** into the capital market and
- the **re-allocation of risks** RE-Investments can be enabled and
- how problems of **collateral** could be solved.

This study is concluded with some general conclusions for the financing of RE from the point of view of a promotional institution.

Peter Lindlein

Wolfgang Mostert

Frankfurt, 2005

1 The Need for a Special Financial Mix for RE

1.1 Constraints for the further development of Renewable Energy

Renewable energy (RE) is on the agenda for decades and it has gained a strong momentum, but despite this, renewable energy projects still face serious constraints hampering their further development and commercialization. Of course, the variety of RE types is affected in a different degree of the various problems due to their specifics and maturity. A large number of reasons are named as barriers in this context: internal and external, political, technical, financial and institutional. If we try to sort them, it may be appropriate to group the problems by the market categories supply, demand and framework conditions.

On the **supply side** RE development has difficulties due to its own technical and economic characteristics, because of the type of project sponsor and shortcomings in the commercialisation³:

Supply	RE characteristics	<ul style="list-style-type: none"> - Newer technologies -Higher operating risks - Smaller project sizes -Higher transaction costs - Longer lead times -Higher development costs - Higher ratio of capital costs to operating costs - Need for longer-term financing at reasonable rates - present technologies not yet fully competitive
	RE Project Sponsor	<ul style="list-style-type: none"> - Less experienced sponsors - Higher completion and operating risks - Low level of own funds for investment cost contribution
	Commercialization and Marketing	<ul style="list-style-type: none"> - Commercialization barriers faced by new technologies competing with mature technologies - Lack of commercial business models - lack of established infrastructure of some re technologies

As a new technology with a high up-front cost, RE has to face some constraints on the **demand** side, as well on the level of individual consumers as on the level of network operator:

Demand	Awareness and Willingness	<ul style="list-style-type: none"> - Society lacks of awareness or familiarity with renewable energy practices - Limited cultural acceptance of renewable energy technologies - Power grids operators are reluctant to deal with decentralized suppliers of energy
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³ Adapted from, among others: Beck, Fred and Martinot, Eric - Renewable Energy Policies and Barriers , in Encyclopedia of Energy, Cutler J. Cleveland, ed. (Academic Press/Elsevier Science, 2004)

	Adequacy and Cost	<ul style="list-style-type: none"> - Electricity consumption too low for financial sustainability (not enough productive use) - Low demand at relatively high initial cost for individual investor-clients - Low demand from power grids on base of actual LRMC level
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However, most numerous are the constraints in the **framework conditions**. Policy and the legal regulations affect the RE sector itself and the energy sector in its entirety. Furthermore, on the base of the prevailing price formation, which is not taking into consideration external cost and benefit in the energy sector, the market mechanism acts not in favour of RE. As one of the most important barriers in the framework conditions, the deficiencies of the financial sector to deal with RE and to offer adequate funds at appropriate conditions are mentioned:

Frame- work Condi- tions	Policy and Legal Framework	<ul style="list-style-type: none"> - Independent power producers may be unable to sell into common power grids - Transmission access and pricing rules may penalize smaller and/or intermittent renewable energy sources, Utilities may set burdensome interconnection requirements - Permitting requirements and siting restrictions may be excessive. - Requirements for liability insurance may be excessive.
	Energy Sector Competition and Bias	<ul style="list-style-type: none"> - low cost of energy from conventional sources - price distortions from existing subsidies and unequal tax burdens between renewables and other energy sources
	Market Performance	<ul style="list-style-type: none"> - failure of the market to value the public benefits of renewables - lack of environmental externality cost in the current price of fossil fuels - market barriers such as inadequate information
	Financing	<ul style="list-style-type: none"> - RE unfamiliar to financiers due to lack of information - RE often considered not attractive, because high risk without adequate risk compensation in form of risk coverage instruments or higher returns - Financing hardly available for projects and customers due to lack of funds and/or lack of instruments

Obviously, not each of these constraints is relevant for every RE technology, and conditions and hurdles differ much from country to country. However, many of otherwise viable RE projects is blocked from being realized by one of these barriers. As no project can be realized without proper funds, financing is still one of the core problems of RE development.

1.2 Outline of barriers for RE financing

On the long way to closure of the financing of a RE project many hurdles have to be cleared. With each of the necessary steps we move closer from the energy market to the financial market, thus not only changing the focus and perspectives of the actors of the general scheme presented above but also applying strictly financial and economic criteria. From this point of view, the most important barriers to finance renewable energy are:

- On the **demand side** for RE finance we find inherent barriers due to the characteristics of **renewable energy projects**, and internal problems of RE **project sponsors**.
- The **framework conditions** for the project within the **energy sector** may include substantial burden and barriers for RE finance.
- On the **supply side** of RE finance there are a series of shortcomings in the **financial sector**, in some of the LDCs to an extent, that there is no supply at all.

If we look into further detail we can identify a series of barriers, some of them interrelated, in each of the steps of a RE project on the way from demand to supply on the financial market:

Hurdles for Renewable Energy Projects in the steps to Financial Closure			
<p>Inherent barriers of <u>renewable energy</u></p> <p>Cost: Capital cost intensive structure;</p> <p>Analysis: insufficient data for prudent project analysis.</p> <p>Risk: High or unclear risk, incl. difficulties in guaranteeing cash flow and no enforceable securities</p>	<p>Inherent hurdles of RE <u>project sponsors</u></p> <p>Weak project developers and lack of project experience,</p> <p>Limited financial/ managerial capacity,</p> <p>Limited credit-worthiness, particularly due to lack of complementary own funds</p>	<p>External hurdles in the <u>energy sector</u></p> <p>Politics: Regulatory and policy issues which favor conventional energy types or hamper RE; insecure legislation in the energy sector</p> <p>Energy market: deficiencies in the financial, legal and institutional framework conditions as well as imperfections of the market mechanism.</p> <p>Lack of reliable partners for take off contracts/ feed-in laws</p>	<p>Barriers in the <u>financial sector</u> especially in <u>LDCs</u></p> <p>Lack of funds and/or improper financial conditions,</p> <p>Lack of instruments and shortcomings of local financial institutions,</p> <p>Lack of sector know-how and willingness to invest in RE, low level of awareness and understanding of the RE as well as insufficient information for prudent investment analysis.</p> <p>High collateral requirements.</p>

The following sub-chapters will analyze these barriers in more detail to make a proper first diagnosis of the problem of RE financing in developing countries.

Financing in the context of this study includes

- the perspective and activities of the **project sponsor** at the micro level as well as
- the activities and instruments of the regulatory authorities and **Government** at the sector and macro level,
- as well as the possibilities and prospects of donors and **promotional financial institutions** to bridge gaps in the financial sphere.

1.3 The demand side: RE characteristics and the consequences for financing

RE projects are different from conventional investment projects also in the energy sector due to some **characteristics**:

- RE can have a high amount of **cost**, especially for project development and investment cost, and have a very different cost structure with an extreme up-front share and usually very low operational cost.
- As RE projects are very capital intensive they are extremely **sensitive** to the structure and the conditions of capital cost **financing**.
- They often have insufficient **data** for prudent project analysis, due to lack of accurate reports on the supply of “fuel” at specific sites.
- This **uncertainty** and the limited possibilities of control of essential factors like “fuel” create a difficult **risk profile** with an elevated ratio of high risk factors or unclear risk, incl. the difficulties in guaranteeing cash flow.
- Due to their time horizon, RE have a very **long exposure** period to risk.
- To avoid further handicap of competitiveness in comparison to conventional power they **need cash-flow adequate terms**, i.e.
 - long to extra-long maturities and
 - interest rates in the lower range of the market

Such characteristics of renewable energy⁴ specify the task financing has to solve: Potential returns and possible risks as well as the necessary amount for investment determine which part of the capital market would be the most appropriate to deal with this task.

1.3.1 Amounts and levels be financed

As most of the RE technologies fall in the range of unit investment costs between Mio US\$ 0.5-1.5 per MW, the capacity determines the capital cost. An RET can easily exceed a cost of US\$ 20 Mio making it a big project in most LDCs and a serious challenge for their financial sector.

RET technologies and Capital Cost (\$m) to be financed					
RETechnology	Size	Micro <100kW	Small 100kW-1MW	Medium 1-20MW	Large >20MW
Biomass			0.1-0.8	0.8-16	>16
Geothermal				2-40	>40
Hydropower		<0.1	0.1-1	1-20	>20
Wind power		<0.1	0.1-0.9	1-18	
Solar Thermal		<0.3	0.3-3	3-60	>60
Solar PV		<0.6	0.6-6		

Based on: USAID - Best Practices Guide: Economic and Financial Evaluation of RET, 2002 and V. Bakthavatsalam, Financing Renewable energy projects - Raising Local Capital

⁴ This sub-chapter refers to finance and risk at the level of a single project – not a program, not a whole sector strategy! Thus many important issues for RE sector finance and sector risk strategies now under discussion are not presented here. This excludes also some of the very important aspects of perception/inclusion of cost and risk to give RE a full and fair comparison to conventional energy.

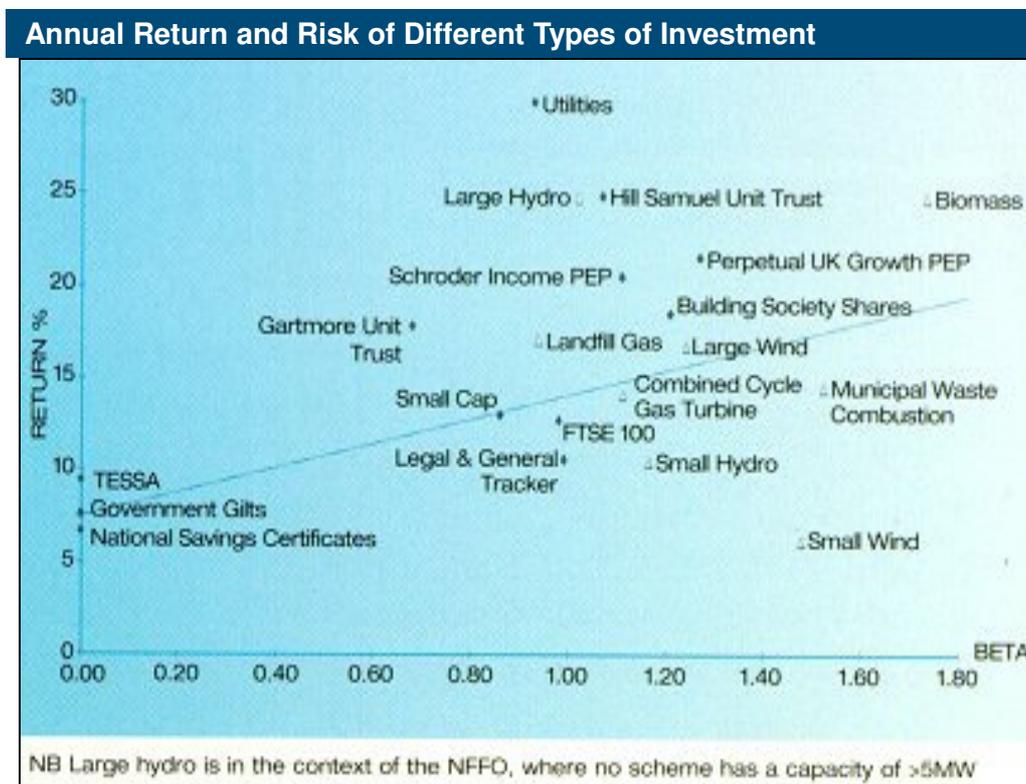
On the other side of the range are microsystems for end-user, which cost only a few hundred dollars, but this is already exceeding by far the usual accumulated savings of the customers, making it necessary to find an adequate financing scheme.

But large segments of RE-Technologies still have difficulties to find commercial financing sources. Characteristics that act as **barriers to finance** comprise the following:

- Size: many RE projects are too small to attract commercial lenders;
- High transaction cost: new technology and less experienced developers make RE-projects more complicated and time-consuming from the lenders point of view.
- Low returns with positive cash-flows coming first in the long run. In principle, the profile of long-time exposure calls for compensation in the form of higher interest rates and returns on equity. The possibility for that is limited by the low project returns, which make such kind of projects rather unattractive.

1.3.2 Viability and access: Return, risk and competitiveness

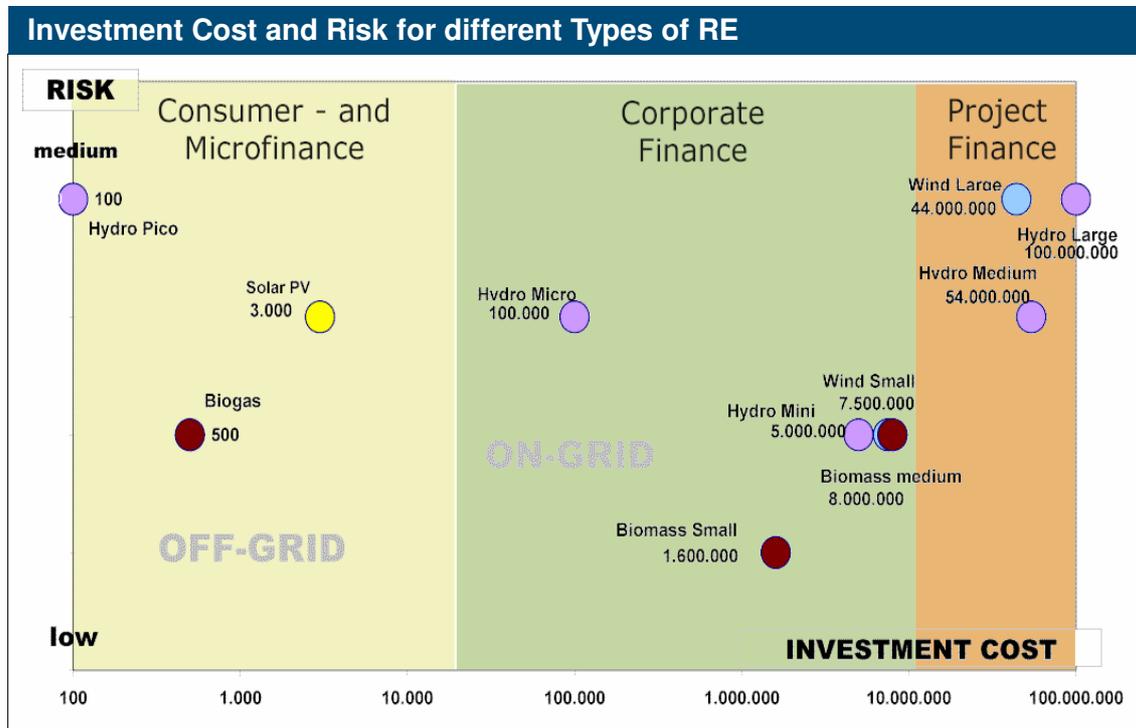
A simple and basic truth: Commercial bankers and investors may be considered one-dimensional, as all that matters to them is return. Return is sexy - risk is not. And most RET offer a low return with an extra portion of risk. This makes it complicated – not for investors as there are enough other opportunities - but for the RE promoting community. A comparison with conventional private investments is shown below with the axes of risk (BETA) and return:⁵



⁵ Source: Jonathan Johns – Renewable as investments, The Quarterly Newsletter for the UK New and Renewable Energy Industry, Issue 38, November 1998

This example from the UK in 1998 makes the criteria to attract private capital quite clear – and indicates at the same time that the situation can change as the private investment in wind energy demonstrates.

The **risk** of the different RE is varying widely, giving a wide range of risk/cost combinations as the playing field for RE finance:



Depending on the size, RET sector and region, the relevance of the different sources and instruments for RET finance varies extremely, reaching from private finance from savings or relatives to finance very small RET (pico hydro) to two-digit million credits from advanced domestic banks participating in the project financing.

- ➔ Thus, **RE finance** is not only very different for the distinct types of RE technologies, but is much more **segmented** by the size of projects and the type of debtor:
 - Consumer- and microfinance** for off-grid RE projects,
 - Corporate Finance** for small on-grid RE projects,
 - Project Finance** for large RE projects

1.3.3 Project Sponsors

RE has extended the energy sector not only technically, but also with its wide range of project size and its possibilities for off-grid and decentralized energy supply, it has also enabled the insertion of **new players** in the field.

Therefore, in comparison to conventional energy RE has also widened the range of financial tasks to be solved. Thus, financial needs for RE exist at three **levels**:

- **households** and community groups need **micro-credit**;
- **entrepreneurs** need long-term “**patient capital**” that allows them time to develop products and services based on renewable energy; and

- **investors** need **reduced or shared credit risks** until confidence in renewables grows and track records of success emerge.

On the other side, despite all the good intention, quite often the developers of these projects and the project sponsors from these very diverse groups **lack project experience** in the sector, or even project and investment experience at all, as for many the RE project is a very new experience stressing their **managerial and financial capacity**.

Furthermore, most of these players are new clients for the financial business. And as many of them did not have accumulated own funds to invest, they have difficulties to meet the requirement for **complementary financing by own funds** and/or **collateral**.

- ➔ RE finance has to take into consideration that many of the RE developers and sponsors are classified as higher risk clients with limited own possibilities to reduce or to offer own proper means as coverage for this risk.

1.3.4 RE in rural electrification: what is the financing challenge?

A special case is RE in rural electrification, which refers to the off-main-grid use of RE in small isolated rural grids and in off-grid, stand-alone demand for electricity. Some developing countries are at the end of their electrification drive – providing electricity services to the large majority of the population; other countries are at the start of national electrification with national electrification rates being as low as 5-7%. In both types of countries, the rural electrification program is not commercially viable; which is why its scope and implementation depend on Government and/or donor subsidies.

Promoting the use of RE in rural electrification projects is different from promoting RE on the bulk power market:

- The **size of the RE-technologies** in rural electrification is in the Wp and kW-range instead of MW. This hugely increases the costs of project preparation and implementation per MW of promoted RE-generating capacity.
- The bulk market for power is a commercial viability business; if the sector is financially weak there is a problem of regulatory failure; subsidies are used to correct for market imperfections. Large sections of rural electrification are **inherently non-commercial**, and subsidies are used to improve social equity.
- The strategy for promoting and financing RE is a sub-ordinated part of the overall strategy for organizing and financing rural electrification. The key question for RE-subsidy policy in rural electrification is not whether the RE-promotion element within the rural electrification strategy is effective (that's a second order issue), but whether the overall approach to rural electrification is effective (first order issue). The optimization issue is how to get maximum electrification access for the subsidy amount that is available for rural electrification.
- The **key financing challenge** in RE for the main-grid is to minimize the upfront cost of project finance. In RE for rural electrification it is equally important to secure the financial sustainability of RE-generators during operation.⁶ Revenues must as

⁶ For RE-generators on the bulk market for power, generating survival during operation depends on their short-term costs of O&M being lower than the SRMC per kWh of conventional power generation. That is usually the case: RE-generators are upfront in the merit order for daily scheduling. Since the cost of O&M in RE-projects generating power for the grid is lower than the market price for bulk power –, creditors to a money-losing RE-project have in interest in keeping RE-generator going when the original investor goes bankrupt. For RE in rural electrification, being least-cost in the short run compared with alternative generators is not enough for survival.

a minimum cover the cost of O&M; otherwise the generator is not maintained and kept in operating conditions.

1.4 Framework Conditions: Energy market and policy imperfections that discriminate against RE

RE is inserted in a **framework** of competition and regulations in the energy sector. Here it faces general and specific problems, which indirectly affect the possibilities of financing of RE:

- **Politics: Regulatory and policy issues** which favor conventional energy types or hamper RE; insecure legislation in the energy sector
- **Energy market: deficiencies** in the financial, legal and institutional framework conditions as well as imperfections of the market mechanism.
- Lack of reliable **partners** for take off contracts/ feed-in laws.

These conditions strongly affect the possibilities and competitiveness of RE, sometimes in a way that economically viable RE projects are financially not viable. **Factors**, which introduce a **bias against investments in RE**, are:

- **Price distortions** on the bulk power market caused by subsidized prices for fossil fuel consumption of thermal power plants and by import duties & VAT on RE-components: A widespread energy price distortion is that components and fuels for thermal power production are exonerated from import duty and VAT, whilst investments in RE (in particular PV-systems, which are treated like consumer goods) are not offered the same privilege. In fossil fuel-exporting developing countries fuels consumed at power plants are typically priced below their net-back value⁷ as export product.⁸
- The cost of negative **environmental externalities**, which is not included in the power prices from thermal power plants: The environmental costs of thermal power plants comprise the impacts of local/regional pollution (health and productive impacts from air, ground and water pollution) and the global warming impacts. The CDM and JI-mechanisms assign a market value to the latter through the revenue from sales of CERs and ERUs⁹, which by reducing the required “full cost of production” power tariff of RE improves its competitiveness on the bulk power market. The local environmental costs need to be quantified. Environmental cost estimates are not exact science. They are highly dependent on derived assumptions concerning the effects and the value assigned to lost mandays and lost life. Yet, once a per kWh benefit of replaced thermal power figure has been agreed to politically, it reflects the environmental premium value of RE to use in power planning models.
- Non-recognition of the **portfolio value of RE** – the value of its price stability. The portfolio value of RE refers to the value of protection against fuel price fluctuations. Fluctuating fuel prices impose adjustment costs on agents in the power system and

⁷ Net-back value of fossil fuel consumption at thermal power plants is equal to the price (fob) of the fuel if exported, minus the domestic cost of converting the domestic fuel into an export product (of e.g. domestically produced natural gas into LNG).

⁸ During the “*pilot project years*” of collaboration programs for RETs, donors accepted such price distortions. But since donor policy has shifted to fund now only “*RE-mainstreaming*” collaboration programs, donors increasingly refuse to finance RE-collaboration programs unless steps are taken to eliminate the pricing bias. It has become common practice for donors to make assistance to a RE-program conditional on a Government commitment to the phasing out of *import duties and VAT on RE*.⁸ When faced with *fossil fuel subsidies* in the host country for a proposed RE-project activity, a recommended option for donors is to include a consultant study for the Ministry of Finance on the distortion costs of energy subsidies in their RE-collaboration program⁸ and their social equity impact.

⁹ Certified Emission Reductions (CDM-projects) and Emission Reduction Units (JI-projects).

on society; long-term shifts in fossil fuel prices change the ranking of generators in the merit order for scheduling permanently. Given today's dynamic and uncertain environment however it is impossible to correctly identify the 30-year "least cost" option. Traditional methods for least-cost power planning, however, do not quantify the price of fuel price uncertainty, including it as a cost component in the levelized cost of production per kWh of generators. Conventional project analysis for least-cost planning compares alternatives on a plant to plant comparison using a fixed forecast fuel price; with the sensitivity of results to the fuel price assumption being shown in a separate risk analysis. By omitting a cost component of conventional power altogether, this approach has an inherent bias against RET.¹⁰

- Consumer willingness-to-pay for the **consumption value of "clean energy"**, which is not fully expressed on the market:¹¹

These imperfections in the power market keep investments in RE below the economically optimal level.

1.5 The supply side: Capital Market Imperfections in Developing Countries

The demand for RE finance in many LDCs faces severe constraints on the supply side of the financial system in LDCs:

- Lack of **funds** and/or
- improper financial **conditions**, especially the maturity of credits and the requirement for collateral;
- Lack of **instruments** and shortcomings of local financial **institutions**,
- Lack of **sector know-how** and willingness to invest in RE, low level of awareness and understanding of the RE as well as insufficient information for prudent investment analysis.

1.5.1 Domestic Financial Markets – Potential for RET ?

With some simplifications, the current state of the capital markets in the world¹² can be summarized as follows:

- **LDC-countries** have a very low level of financial activities as they do not have much (idle) capital and do not attract much capital from abroad. RETs compete with all other sectors for very scarce local finance. Even for smaller off-grid investments

¹⁰ A more objective approach is to use the market price of hedged fuel prices as fuel price in the financial-economic modeling of levelized power plant prices. Bolinger/Wiser/Golove found that this approach increases the calculated cost of natural gas fired power plants by UScents 0.5/kWh. Another is to apply the Capital Asset Pricing Model (CAPM) from portfolio asset theory to derive different discount factors for different levels of uncertainty. Using lower discount factors for uncertain fuel costs increases the NPV of these and thus, the cost of production per kWh of plants using these fuels.

¹¹ The "consumption value" of "clean energy" refers to the premium on top of the retail price for electricity, which some consumers and politicians are willing to pay for the "sustainable energy" attributes of RE-based power supply. Part of the premium reflects willingness-to-pay for the environmental and portfolio values of RET. But a minority of consumers has a willingness to pay, which is higher than that, because they attach additional value to the intrinsic quality of getting energy supply from "renewable" sources. This willingness to pay offers a niche market for marketing power supply from RETs as "green energy". In some developing countries, there exists a small commercial demand for green power from firms exporting "clean products" and from a tiny fraction of domestic consumers. Yet, being positively correlated with GDP per capita, the consumption value of green electricity can be ignored in RE-strategies for developing countries.

¹² See Annex for more details

it is difficult to reach financial closure without securing additional funds outside local bank and equity finance as part of the of technological package.

- **Emerging markets** with their access to international finance have much higher investment levels, both absolutely and as a percentage of GDP, but face problems of volatility of their and the international financial markets. This limits the availability of funds for long-term finance and during crisis periods. Furthermore, domestic credit to the private sector per capita is still only \$ 1149 in emerging markets, and only meager \$ 113 in LDCs. The figures for gross private capital flows and FDI are well below these amounts. Even with substantial progress in the deepening and development of these financial markets this indicates a general limited availability of funds for RET.

The figures are an indication of the **very limited volume of available funds**, and of the limited scope for developing and introducing new **financial instruments** on these markets: It is difficult to introduce sophisticated credit derivatives when there are almost no credits!

1.5.2 Availability of financial instruments: Classification of standard types of financial/capital markets

Thus for RET the barrier of financing depends much on the level and type of (domestic) financial market. The ability to reduce the financial barriers to the market penetration of RET depends on the availability of (i) funds and (ii) of adequate financial and risk mitigation instruments.

New financing instruments are typically developed in mature financial markets and find later application in other regions as their financial systems become more advanced.

Some emerging economies (e.g., Chile, Malaysia, and Mexico) have domestic markets that can provide long-term, fixed-rate local currency financing for infrastructure. Others (e.g., possibly India, Peru, and Brazil) have emerging long-term debt markets, where interventions can be made to extend the tenors available or to enable infrastructure projects to access long-term debt (or currency swap) markets from which they may otherwise have been excluded.¹³

A very simplified **typology of financial markets** may help to illustrate the relevance of certain instruments for RET financing:

Typology of Financial Markets			
Classification of Financial markets	Availability of Financing Instruments	Availability of Risk-Mitigation Instruments	Examples for RET Cases
Mature financial markets	Advanced	Regular – Full set	US, EU, Japan
Advanced Emerging Financial Markets	Advanced	limited	India, Thailand, Philippines, Mexico, South Africa
Emerging Financial Markets	Regular	None -minimal	Former CIS, Argentina
Basic Financial Systems	Very Basic	None	Mongolia, Nepal

¹³ Tomoko Matsukawa, Robert Sheppard and Joseph Wright - Foreign Exchange Risk Mitigation for Power and Water Projects in Developing Countries, December 2003

Only the financial sectors of the advanced emerging markets offer an almost full set of financial instruments, which in principle could be used to solve the financing task for RE.

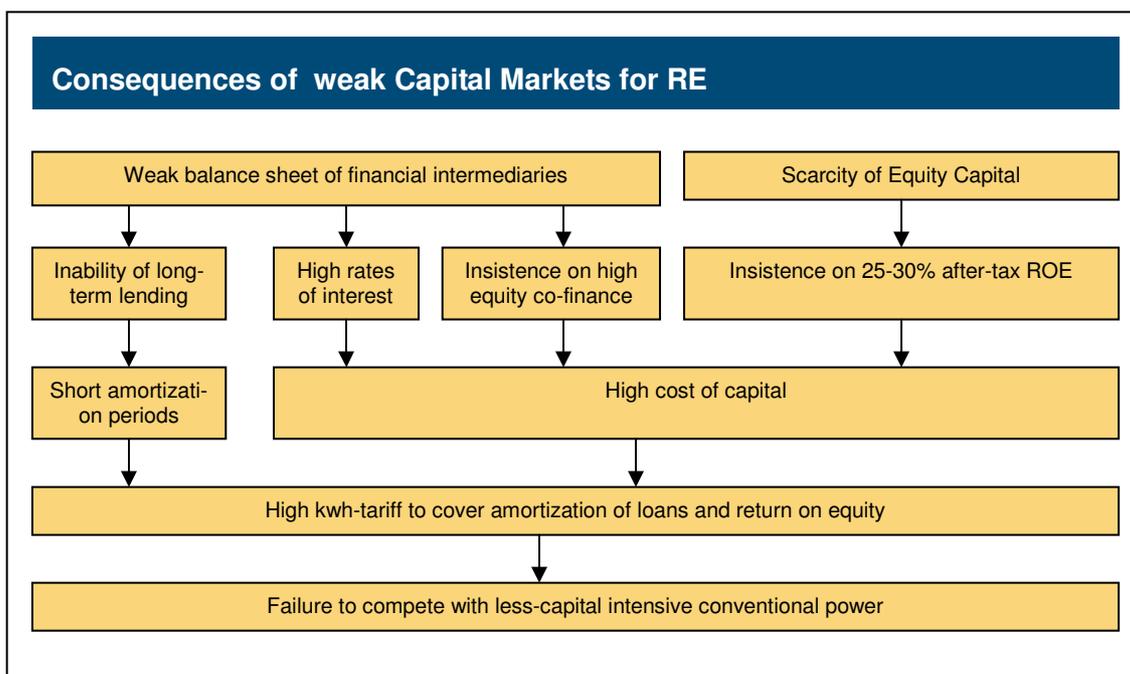
- ☞ In the markets of many LDCs there are only basic financial systems with only a minimal set of financing instruments and generally without any risk-mitigation instruments. Depending on the maturity of the financial markets, there is a **3-dimensional gap** of financing:
 - Amount of funds,
 - terms and conditions of funds and
 - available financial Instruments.

1.5.3 A core problem: Absence of long-term finance

In many LDCs the private sector faces problem to get access to the credit market at all, which due to limited long-term funds and the instability of the market very seldom offers medium- and long-term funds. Absolute dearth of loan or equity capital may prevent potential RE-projects from even trying to reach financial closure.

Weak capital markets are not only a problem of access for finance for RE itself, as they introduce a bias on the free market in favor of investments in fossil fuel based technologies. Because RETs are more capital intensive than conventional power technologies, high interest rates, short maturities and low gearing ratios¹⁴ shift the financial price per kWh of RE upwards relative to conventional power.

The chart below summarizes the consequences of weak capital markets for RE investments.



¹⁴ In many developing countries, banks ask for a 50% equity co-finance

Donor assisted RE-projects in developing countries circumvent the capital market problem by providing project finance in the form of donor grants and concessional loans for RE. Local banks are used as on-lending vehicles in this financing modality.¹⁵ The approach solves the financing problem of RE on an individual project-by-project basis, but does little to assist the **development of a local capital market**, which is indispensable if a sustainable scaling-up of private investment in RETs is to take place. This requires an autochthonous financing framework where local equity investors and financial intermediaries play a pro-active role in financing RET-projects. In recognition of this structural weakness, donor finance is shifting from conventional project finance to **underwriting risk management instruments** that **enable local finance institutions to engage in active project lending**.

However, taking into consideration the subsidiarity principle we should start our analysis looking to which extent private finance is available for RET to determine on the base of the results to which degree they may need financial support by other instruments. In the next chapter we will have a closer look on the commercial finance instruments and their potential for RET, however with a focus on the larger projects of RET close to market competitiveness and their problems to find adequate commercial finance.

¹⁵ India was an exception with regard to use of national capital market institutions. Soft loans from bilateral donors and multilateral banks are made available as credit lines for national development banks that proactively encourage RE-investments. The key institution is IREDA (India Renewable Energy Development Agency, which is the main national provider of finance for RE-projects. Local commercial banks, in turn, are drawn into RE-financing by the example of IREDA.

2 Commercial Financial Instruments for RE

The commercial private sector offers a wide variety of instruments for financing and risk coverage which potentially could be used for RET finance. This chapter gives an overview of the instruments, their characteristics and requirements, their suitability and the general availability for RET, particularly in LDCs. The focus of this study is on the presentation of instruments for medium and large sized RE projects, not on instruments for financing of micro-sized projects, although they are not excluded totally.

As most of the LDCs do not have a very developed local financial sector and are currently lacking many of the instruments presented below, it is important to note, that in a process of globalization this does not mean, that such mechanisms and instruments and funds could not be made available for RE at all. Their contribution to overcome the hurdles of financing of RE projects depends on the willingness to deal with risk and invest funds as well as on the capability to use them for the realization of RE projects. If this would still mean overstrain for the actors in some countries, this may be an ideal case for external assistance to share this burden in order to promote RE.¹⁶

2.1 Demand profile for RE financing

Finance is essential for RET projects in two ways: Without funds projects would not materialize, with inadequate financing structure and conditions the disadvantage in competitiveness of RET would even increase, as the costs of electric power utilizing renewable energy technologies are highly sensitive to financing terms.¹⁷

As described above the typical demand for RE financing has the following characteristics:

- Client: Investors, entrepreneurs or households with limited experience and track-record
- Type of funds: "patient capital", either credit or equity or equivalent
- Amounts: Depending on project and RE type, from micro-finance till major project finance
- External Financing Share: High, due to limited own capital
- Maturity: Very Long term
- Interest Rate: Lower Range of the market, due to limited return of investment.
- Security and Collateral: Limited capacity for collateral, preferably on base of cash-flow

This profile sets the benchmark for checking to which extent the local financial system with its funds and instruments can match the needs of RE financing.

¹⁶ See the Chapter 3 and Chapter 4 of this study.

¹⁷ Ryan Wisser and Steven Pickle created a financial cash-flow model that closely replicates those used in the private power industry to evaluate the impact of financing variables on overall project costs, in the context of mature financial markets in 1997. The model tracks revenues, expenses, debt payments, and taxes over a 20-year period and estimates an after-tax, net equity cash flow. The model then calculates the 20-year levelized cost of electricity from the project being evaluated. See Wisser, Ryan and Pickle, Steve - Financing Investments in Renewable Energy: The Role of Policy Design and Restructuring, Berkeley 1997.

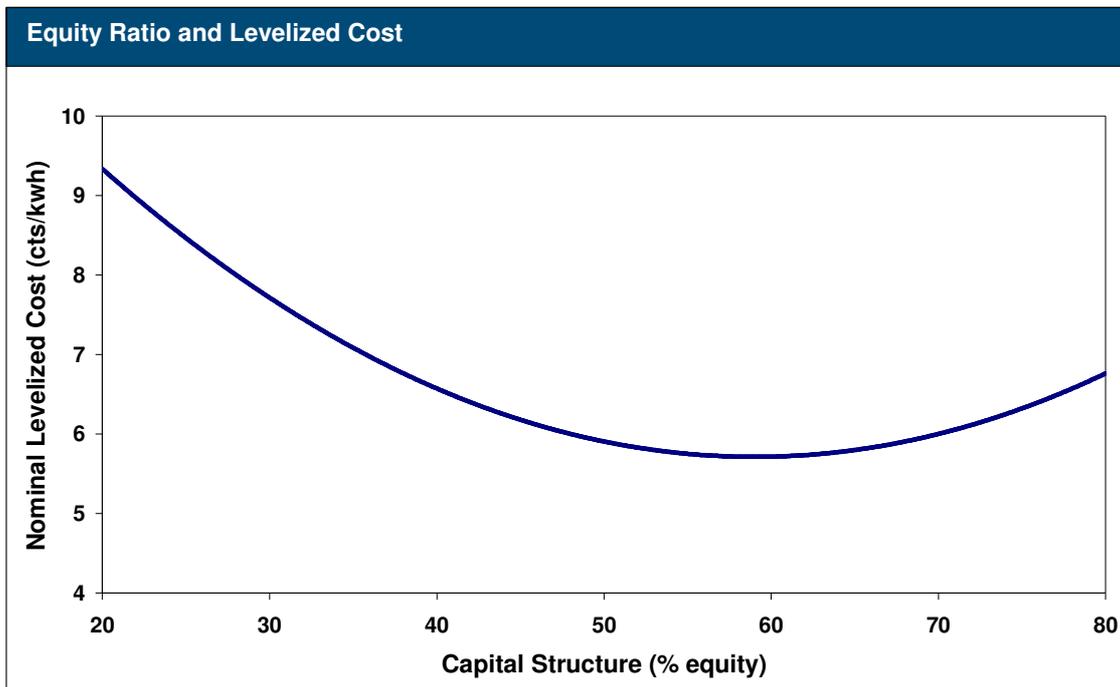
2.2 Types of Financial Instruments

Project developers generally can obtain capital for the up-front cost of building a RE project through a **debt** and/or **equity financing**. There are a large number of ways to structure loan agreements, and debt can be obtained through public markets (bonds) or private placements (bank loans and institutional debt).

Equity investors and lenders view and analyze projects (and firms) very differently.

2.2.1 Equity Finance and Risk Capital

In a model Wisser and Pickle demonstrated the relevance of an adequate equity ratio on the cost of RET like the following example for wind power illustrates¹⁸:



Equity can take the **form** of direct investment of

- **own resources** and capital, or
- as **third party capital inputs**, e.g. in the form of risk capital by venture capital funds or simply by funds from family members.

There is an expectation on the part of debt providers that all projects will be at least part-financed through equity. Lenders demand that borrowers take an equity stake in their own right (to build their commitment to their stakeholding). In practice lenders normally look for a minimum of around 20% of the project cost to come in the form of borrower equity. RET with higher risks are expected to have a corresponding higher equity ratio.

¹⁸ See Wisser/Pickle p.17. The results in this graphic are based on a whole set of assumptions and are presented here only for illustrative purposes.

On the other hand, the typical **project developer** has only **limited own funds** to make this essential contribution to the whole financial package. This creates the need for the participation of additional investors in equity.

Equity investors have the potential for unbounded returns from project (or firm) success and will therefore take high-risk investments if the potential rewards are large. Investments are analyzed from a risk-return tradeoff with a strong inclination on the expected investment return, what is reflected in the top position of venture capital (VC) in ranking of return targets of the alternative financing sources.¹⁹

Return Targets of Financial Investments	
Asset Class	Target annual return (%)
Early stage VC	40 - 50
Balanced VC	30 - 50
Buyout	23 - 30
Infrastructure	15 - 25
Real Estate	10 – 20
Mezzanine	14 – 20
Listed Equities	6 - 8
Corporate Bonds	5 – 7
Governments Securities	4 - 5

To maintain a high degree of control over their investments, **venture capital firms** typically demand a large equity stake. Returns on the order of 50-60% are not uncommon targets in venture capital projects. Typically venture capital investments are made in high-growth enterprises that have large market capitalization and are involved with new technologies. However, smaller deals on the order of 1 million are also considered.

Private equity is not generally interested in **renewables**, as it does not meet the return targets, has long hold periods and only limited public exit routes. However, alternative fund managers are attracted by sector growth. Thus, venture capital funds have funded renewable energy businesses, but only on a very limited basis since more profitable shorter-term opportunities abound elsewhere.²⁰ They tend to be very selective: a deal-closure-ratio on proposals of only 5% is not unusual. Core required characteristics of RE to attract alternative investors are:

- Returns consistent with alternative assets classes with similar risk profiles: 14 – 20% IRR.
- Larger scale transactions - 5-10 million minimum investment.
- Ability to exit – within 10-15 years.

So although there is an instrument to cope with the shortage of own capital in the financial sphere, this instrument is especially scarce in **LDCs** as a consequence of the limited accumulation. In **emerging markets** experience has shown that there is a sub-

¹⁹ Source: Murley, Thomas S. - Renewable Energy Infrastructure Finance and Private Equity BASE International Investment Forum, Bonn, 2004.

²⁰ APEC, Guidebook, p. 3-12

stantial potential for the use of equity. However, RET has yet shown only limited success in attracting these funds.

However, **specialized equity funds** have been created to invest in environmentally and commercially sound energy companies providing equity investment capital. Some are in the private sector (e.g. Triodos bank in the Netherlands) and others are sponsored by the multilateral organizations (IFC, GEF).

The dutch **Triodos Bank** is a social bank lending only to organisations and businesses with social and environmental objectives. Triodos Renewable Energy for Development Fund provides finance to promote and support the accessibility and use of renewable energy services in developing countries.

The fund offers finance for importers, wholesalers, energy services companies and retail chains for expansion of working capital or for investments. Amounts may vary from Euro 100,000 – Euro 250,000.

For project developers the fund can provide seed capital. Funding will typically be limited to amounts of maximum Euro 50,000. However, the fund will not finance new technology development, but only proven technology.

www.triodos.com

2.2.2 Debt Financing

Classical debt financing is done with (fixed) interest rates and repayment schedules, but in different ways by the source of finance:

- Conventional **commercial bank loan**, and **credits** are provided by other private persons or institutional investors. Loans and Credits as instruments are known and practiced all over the world. With the microfinance revolution credits have reached even the poorest in the most remote areas also in small-scale renewable energy project like Solar PV. However the higher the amount needed and the risk, the more difficult for RE projects to find adequate credits for their project. Here, RE projects have to face the same barrier which is common to many private enterprises, especially in LDCs.
- **Bonds** are interest-bearing instruments issued by companies and sold to investors in order to raise capital. They are usually issued and sold in the public bond markets, although increasingly some are sold directly to institutional investors in which case the financing is known as a "private placement". Although known for centuries, bonds still are a rather advanced instrument, as they require either such institutional investors or a functioning capital market, both not self-evident in developing countries. Thus their relevance for most RET is rather limited.

Most **lenders** tend to be far more risk averse than equity investors. The debt contract is a fixed obligation and the lender does not profit beyond a certain level from project success.

- Unlike equity investors, lenders typically analyze a project (or firm) from a worst-case perspective. Thus RE project developers have to be very careful to shape and structure their project in a way, that even its worst case will still meet the requirements of the lenders. This requires a proper handling of risk instruments (see next sub-chapter).
- Up to the limit of unacceptable risk, lenders adjust (i.e. increase) debt interest rates and terms with increasing default risk.

In the US and Europe **commercial banks** have financed **renewable** projects, however mainly in the wind sector, although they are looking for opportunities in other areas, such as landfill gas and biomass. One example is Fortis Bank, with a portfolio of € 1.4 billion in renewables, of which 95% are for wind projects. This is a considerable amount, however it should be noted, it includes merely 18 projects,²¹ making clear that the minimum size is rather elevated: €20 million is the minimum size of project that a bank like Fortis is likely to consider, because of transaction costs.²²

In many LDCs banks are reluctant to extend **long-term loans**, however sometimes offering instead a **mid-term loan** with a potential follow-up finance at the end of the term. This creates the problem of higher amortizations or the risk of follow-up financing. A third party liquidity guarantee for the follow-up financing allows the **extension of maturities** to RE compatible length by the up-front signing of a two step loan, of which the first will be a bullet loan with an adequately adjusted repayment schedule paid back mainly with a bullet at the end of its term. The bullet payment is refinanced by the second loan, which then has to be repaid with annual payments till the end of the total maturity. Such an approach is used in the Uganda West Nile Project with the assistance of World Bank²³.

2.2.3 "Mezzanine finance" and subordinated debt

Mezzanine Finance is a general term used to describe various financing arrangements that rank below the senior debt. Subordinated debt is debt that ranks below the main (senior) debt in terms of its priority of payment or in liquidation. Its debt principal and interest is paid only after the senior debt principal and interest is paid. Private creditors using this instrument are usually compensated for their higher loan risk by some participation in the profits or capital of the company. As most of the financiers in developing countries perceive RET projects as higher risk, such a mixed form financing would imply higher risk acceptance. As they already are hesitant to extend credits to RET it is not very likely that they would provide "mezzanine finance".

However, this approach used by promotional institutions could ease some of the concerns private creditors may have going the risk to extend a credit to a RET project as they would be privileged in debt service in case of financial stress.

2.2.4 Sales-Lease-Back Arrangements for RE-Finance

Leasing is a potentially interesting instrument for financing private RE-projects in developing countries:

- Since the financing institution maintains ownership of the financed assets, the need for other collateral is largely eliminated.
- Local banks, which for various reasons may be able to provide short-term finance only, can be drawn into RE-financing in the initial project development stage.

²¹ Gardiner, Nick - Bank Financing for the Renewables Sector, SEFI Bonn 2004.

²² Finance and Investment: a challenge of scale, in: Renewable Energy World, September–October 2004.

²³ See Case Presentation in Chapter 5 of this study

A strong virtue of the lease-buy-back instrument is its flexibility. Depending on the situation in the country and the RE-project it can be applied in different ways. The up-front project development cost up to the point of commissioning can be financed by the bank which subsequently acts as lessor, by a different bank, by suppliers credits, or by a combination of all three. The lessor can be a bank or the off-taker of the power supply if the power utility signing off the long-term PPA with the RE-project has access to long-term finance at favorable conditions.

2.3 Financing Object: Corporate Finance and Project Finance

Financing a RE project generally can be done in two different structures: **financing for a project** and **financing to a project**.

Personal and Corporate Finance are providing funds to an **economic subject**, which can use it for the agreed purpose, for example a certain project. The person or the company is the debtor, liable with their whole property, especially the collateralized items of 'on-balance sheet' assets or personal property. Balance sheet finance has the following characteristics:

- Simplicity - it is relatively easy and quick to arrange
- Cost - it is usually cheaper in terms of arrangement and legal fees and the annual cost of borrowing may be lower
- Structure - it will normally reflect a looser, more flexible financing structure.

This includes consumer finance, often required for rural clients as a means of making modern energy services affordable. Various types of micro-credit schemes are now being deployed in the solar home system market, for example, which often involve risk-sharing at the local and institutional levels. However, the possibilities to use such instruments are limited for RET-finance, as balance sheet financing for bigger RET projects may be considered as not viable/adequate by project sponsors and potential financiers, both looking for a more tailored financial structure, such as project finance.

Applying the central approach of structured finance of making use of a **special purpose entity** (SPE), with **project finance** it is possible not just giving funds for a project, **but to a project itself**, involving usually the participation of several financing entities. This is also known as off-balance sheet or non-recourse finance, since the financiers rely mostly on the certainty of project cash flows to pay back the loan, not the creditworthiness of the project sponsors. This seems to be a proper approach for RE, especially as RE projects in many cases imply the creation of a new entity anyway.

In this case banks provide funds to distinct, single-purpose companies. From the developers point of view project financing has several **advantages** to corporate financing. If there is a parent company loans are generally non-recourse (sometimes limited-recourse) to it and therefore do not have a substantial impact on the company's balance sheet or creditworthiness. There is another important advantage in the context of many developing countries, as project finance would form not only the adequate financial structure but together with the Special Project Vehicle (SPV) also the necessary management structure to implement the project. Structured Finance are non-standard lending arrangements customized to the needs of specific clients. However, although custom-tailored suits are fitting perfect, they have their price. Thus, **negative aspects** of project financing compared to corporate financing, include the large **transactions costs** of arranging the various contracts, high legal fees, higher debt costs, and a greater array of restrictive loan covenants and of course the time needed to form such

a complex structure. Non-recourse lending has been used for large fossil-based and geothermal power plants in Asia. In the case of **large renewable energy** projects, resource risk is addressed by incorporating additional mechanisms such as reserve accounts or contingent repayment schemes.

The following table presents a **typical financial structure** for a conventional power project²⁴ and illustrates the complexity of financial engineering for bigger projects even for well-known technology indicating the high demands of the task for financing of bigger RET projects.

Typical Project Financing Structure for Conventional Power Project		
Sources	% of Project Costs	Tenors
Foreign Export Credits	40% total project costs, and/or 85 % equipment costs	12 years, 3 years grace, slightly concessionary rates
Multilateral Agencies	10-15% credits & loan guarantees	12-15 years
Commercial Bank Debt	10% loans, 5-15 member bank syndicate	5-12 years
Multilateral Co-Financing Facilities	10% loans, umbrella for commercial banks reduces risk; participation limits may require co-financing	12-15 years
Local Bank Debt	10% loans in local currency for working capital	5-8 years, 2 years grace, usually higher interest rates
Private Placements	10% loans, beyond what may be available for commercial banks	5-12 years

2.4 Financial Problems and potential solutions

Summarizing our analysis hitherto we could relate RE financing demand profile and problems with the instruments offered by the different institutions in the ideal financial sector in a simplified scheme:

²⁴ Source: Dr. J. Michael Cobb - Global Infrastructure Financing. Sources & Structures, IDC International Development Consultants, LLC, available at: <http://www.idcworld.com/sources.htm>

RE Financing Problems and the Relevant Instruments and Potential Partners to address them

Problem Factor	Kind of Problem	Possible Instrument to address the problem	Partner Institution in the financial sector to address the problem				
			Commercial Banks	Venture Capitalists	Institutional Investors	Supplier of Equipment	Promotional and/or Specialised Institutions
Type of funds	“patient capital”, either credit or equity or equivalent	adequate outside equity		■	■	■	Specialized equity funds, Promotional Institution
Amounts	Low amount	Household credit					Microfinance institution
	Mid range	Company credit				■	Promotional Institution
	High amount	Project Finance	■	■	■	■	Promotional Institution
External Financing Share	High, due to limited own capital	Outside equity by third party		■	■	■	Specialized equity funds
Maturity	Very Long term	Long-term credit or equity	■		■		Promotional Institution
Interests	Interest rates in the lower range of the market, due to limited return of investment	Proper risk management to keep risk compensation in debt finance low					Insurance with RE experience, Promotional Institution
		Sub-ordinated debt to ease risk compensation element of senior debt					Promotional Institution
		Make use of the market to get adequate conditions	■				
	Limit for interest bearing funds for financing	High outside equity		■	■		Specialized equity funds
Security and Collateral	Limited capacity for collateral, preferably on base of cash-flow	High outside equity		■	■		Specialized equity funds
		Use of leasing, or sell and lease back scheme	■			■	Specialized institution

■ indicates potential partner to solve the corresponding problem

At first sight, it seems that there is a cure for most of the problems of RE financing. However, this refers only to the ideal conditions in mature financial markets, and even there some critical factors like high minimum size for transactions, limited risk of projects and return expectations are still barriers for many RE projects commercial financing. For RE financing in LDCs the conditions are even more difficult, as the following sub-chapter shows.

2.5 Market Access: Types of finance and their availability

The different instruments and sources of finance presented are well known in theory all over the world, but their accessibility depends on the degree of development of the financial systems and the availability of the corresponding capital. Summarizing and simplifying the following overview with its traffic lights colors indicates the degree of availability of financial instruments for RE finance in the different stages of market development:

Comments on the general availability of financial instruments (for RET) in the commercial financial markets					
Markets	Equity	Credits	Bonds	Mezzanine	Leasing
Mature Financial Markets	Yes	Yes, however with difficulties within the segment of extra-long maturities	Difficult, due to high level of transaction cost	Yes	Some financial institutions provide leasing schemes (however mainly with limited amounts available)
Advanced Emerging Financial Markets	Capital is not scarce in general, however, the venture capital markets lacks formalization and accessibility	Yes, however only with mid- to long-term maturity (max. 8 years); only very limited schemes with RET adequate extra-long maturities	Hardly available due to high level of transaction cost and risk aversion of investors	Some schemes may be available by semi-commercial institutions	
Emerging Financial Markets	Limited, some venture capital schemes, however mainly orientated to mid-term investment with an corresponding exit approach	Yes, but limitations of amounts and only with mid- term maturity (max. about 5 years); no schemes with RET adequate (extra-)long maturities	Practically not available due to high transaction cost, risk aversion and volatility of markets	Some schemes may be available by semi-commercial institutions	
Basic Financial Systems	Very Limited, due to lack of accumulated own funds and underdeveloped venture capital market	Only limited amounts with mid-term maturity;	Not available, if any mainly dominated by state bonds	As basic instruments are missing also no mix available commercially	

Thus the practical relevance of the many financial instruments is rather limited in the commercial financial markets of the developing countries for RET financing. We can identify some kind of development sequence of financial instruments:

- **Credits** are used already at the earliest stages, and as an instrument are available for RE finance, although there may be (severe) limitations to the conditions and amounts depending on the stage of development of the local financial market.
 - **Leasing** as an instrument can seldom be found in LDCs, but is already in use in emerging financial markets, offering some chances for RE finance.
 - **Equity and Mezzanine Finance** becomes more common only in the more advanced emerging financial markets. In poorer countries the market will rarely offer these instruments and the corresponding funds.
 - Although **Bonds** are in use in many emerging financial markets, there seems little chance to use this instrument on pure market base for RE finance due to the risk aversion of the public as well and the high transaction cost. However, in a combination with a RE promotional tax scheme this instrument could be made more attractive for the investors offering some potential for RE finance.
- As indicated also by the latter case, the local commercial financial and capital markets are at least offering some interesting basic elements for a partial solution to the financing problems for RET, which however need the completion by smart promotional instruments to make them a viable path for RET finance.
- And as ODA and promotional finance of DFIs with lower expectations for return and their higher risk disposition can potentially use each and every of the described financial instruments, the described instruments can serve – together with the instruments in the next chapter – as something like a toolbox for adequate RE financing within promotional schemes.

3 Risk of RE and Instruments of the Financial Sector

Risk management is one of the keys to deployment of RE, as it influences the availability of commercial financing to the projects: As RE depend on funds from lenders to implement the project, and the RE cost and competitiveness depend on the terms and conditions of these funds, which on the other hand are determined by lenders with their risk aware perception, **risk** is one of the **crucial factors** for almost any RE project financing.²⁵ Thus, financial risk management instruments are an essential part of any financial structuring in infrastructure projects, yet their application to RE hitherto has been limited especially in LDCs. Within the scope of this study, this chapter can give only an overview about the wide range of risk factors within RE projects and present an outline of the generally available risk instruments. Within this context it would be too ambitious to present every financial instrument in detail and to develop a replicable blueprint for its utilization within for RE projects.²⁶ Thus the chapter will focus on the most essential instruments at the project level and present an approach for a risk strategy for RE.

3.1 Risks for RE projects

A RE-project essentially is just like every other project, with the exception that it is in many cases not competitive per se, it has a much more complex structure and is more risky.²⁷ Some simple truths about risk:

- As each and **every factor** of a project has a degree of **uncertainty**, all these factors represent a potential threat for the success of the project.²⁸
 - For each of these **risks** some party has **to take** it, willingly or unwillingly, getting a premium or none.
 - Although the theory of **probabilities** seems to reduce the problem to a simple calculation of an expectation value to be taken into consideration for the computation of the expected return, it should be noted that such an approach is based on the law of large numbers and may include the fatality for the single project under decision.
 - Furthermore the financial market will require a **risk premium**, not only as compensation for any loss, but as payment for uncertainty itself. Additionally they will charge for their administration cost and their expected profit. Without taking into consideration the utility functions the risk compensation premium to be paid is higher than the simple statistical expected value of loss.
 - Greater uncertainty means that less debt capital, if any at all, will be available.
- ➔ So full range **risk management** is needed to get the financial structure viable at all. Otherwise more equity would be needed, increasing capital costs, or making the project unviable.

²⁵ Important aspects of this factor in RE Finance have been presented in detail in two recent studies: Olivier, E. - Survey of Contingent Financing & Risk Mitigation Instruments for Clean Infrastructure Projects, November 2003; UNEP - Financial Risk Management Instruments for Renewable Energy Projects, Summary Document, 2004.

²⁶ As mentioned earlier some of these aspects will be covered in the study "Assessment of Financial Risk Management Instruments for Renewable Energy" to be implemented by UNEP in co-operation with the World Bank and UNDP from 2005-2007.

²⁷ Walid Musallam - International Private Hydro Power Development and Risk Management, 2000

²⁸ See: Ole Langniß (ed.), and others (1999). Financing renewable energy systems, Stuttgart 1999.

3.1.1 Standard Project Risks

Like other energy projects RE face numerous risks, which would have to be addressed for most (large) infrastructure projects.²⁹

Standard Project Risks			
Commercial Risks			Non Commercial Risks
Financial Risks	Operational Risks	Business Framework Risks	Country & Event Risks
Balance Sheet Income Statement Capital Adequacy Credit Liquidity Interest Rate Currency	Business Strategy & Market Management Systems & Operations Technology Fraud & Corruption Business Disruption	Legal Policy Change Financial System Business Support Infrastructure Environmental Factors Competition	Political Factors Creditworthiness War & Conflict Natural Event Policy Failure Event Global Event Impact Civil Society Processes

In the context of RE the most relevant risk types seem to be³⁰:

Risk Types for RE	
Fuel Supply Risk	The risk that the fuel supply will be unreliable, resulting in the inability to generate energy in a predictable and dependable manner
Performance Risk	The risk that the plant will not operate according to the contractually prescribed requirements in terms of time and quantity.
Demand Risk	The risk that the energy that has been contracted for will not be needed as anticipated
Macroecon. Risks	as local currency devaluation, inflation or interest rates increase.
Environmental Risk	financial risk stemming from both existing environmental regulations and the uncertainty over possible future regulations
Regulatory Risk	The risk that future laws or regulations, or regulatory review or renegotiation of a contract, will alter the benefits or burdens to either party
Political risks	political violence, expropriation or convertibility
Nature	Force Majeure events
Other Risks	The parties to an energy contract face numerous other sources of uncertainty, including the risk that the transmission system will be unreliable, and the risk that a party to the contract will default on the contract, for example by entering into bankruptcy

²⁹ Excerpted from: Mistry, Percy & Olesen, Niels – Mitigating Risks in Foreign Investments in least developed countries, Stockholm 2003

³⁰ These issues are not addressed explicitly in this paper, but are addressed peripherally in discussion of other risk elements. Table adapted from Devra Bachrach, Ryan Wiser, Mark Bolinger, and William Golove -Comparing the Risk Profiles of Renewable and Natural Gas Electricity Contracts: A Summary of the California Department of Water Resources Contracts, April 2003, Download from: http://eetd.lbl.gov/ea/EMS/EMS_pubs.html#RE

3.1.2 Profile and nature of risk of RE-projects

However, besides all the similarities, RE project risk and its management is different from that of other infrastructure projects, as it relies to a large extent on nature and its random character, especially in the case of “fuel”, and has its **proper RE risks**.

The problem of “**fuel**” **supply** is of special importance of RE projects, as most of these technologies rely on the supply of nature without a chance of substitution by another source or provider.

Fuel Risk for RE Technologies			
RE Project Type	Known	Predictable	Uncertain
Biomass	Known	Predictable	
Geothermal	Known*		
Hydropower		Predictable	Uncertain
Windpower		Predictable	Uncertain
Solar Thermal Power		Predictable	Uncertain
SPV		Predictable	Uncertain
Wave-power		Predictable	Uncertain
Tidal Power		Predictable	
<i>Adapted from: FAO, Options for Dendro Power in Asia, April 2000</i>			
<i>*after exploration</i>			

Furthermore, some of ordinary **standards risks** are much **more marked**, like it is illustrated in the risk profile comparison example for hydro and thermal power below³¹

Hydro Risk Profile Compared to Thermal Power	
Technology / performance risk	Lower
Construction / completion risk	Higher
Environmental risk	Higher / lower
Operating risk	Lower
Payment or Off-take risk	Same
Market risk	Same
Revenue / hydrological risk	Higher
Non political force majeure risk	Higher
Foreign exchange risk and availability risk	Same
Political risk	Lower

³¹ Walid Musallam (Infrastructure Finance Group LLC) - International Private Hydro Power Development and Risk Management, Washington 2000
http://www.worldenergy.org/wec-geis/global/downloads/accelerating/b1a_s_p.pdf

Other **standard risks** may **not be covered** by an insurance company because of a general reluctance to deal with RE under the concrete circumstances.

Moreover, as a playground of **promotion and politics** RE is extremely exposed to changes in these which may take place between the time the investment is made and the time at which invested capital is fully repaid from project cash flows.

Furthermore many of **RE technologies** face **additionally their specific typical risks**:

Typical RE risks of the different RE technologies	
RE type	Key Risk Issues
Geothermal	<ul style="list-style-type: none"> • Drilling expense and associated risk (e.g. blow out) • Exploration risk (e.g. unexpected temperature and flow rate) • Critical components failures such as pumps breakdowns • Long lead times (e.g. planning consents)
Large PV	<ul style="list-style-type: none"> • Component breakdowns • Weather damage • Theft / vandalism
Solarthermal	<ul style="list-style-type: none"> • Prototypical / technology risks as project sizes increase and combine with other RET e.g. solar towers
Small hydro-power	<ul style="list-style-type: none"> • Flooding • Seasonal / annual resource variability • Prolonged breakdowns due to offsite monitoring (long response time)
Windpower	<ul style="list-style-type: none"> • High upfront costs • Critical component failures • Wind resource variability • Offshore cable laying
Biomass power	<ul style="list-style-type: none"> • Fuel supply availability / variability • Resource price variability • Environmental liabilities associated with fuel handling and storage
Biogas power	<ul style="list-style-type: none"> • Resource risk • Planning opposition associated with odor problems
Tidal/wave power	<ul style="list-style-type: none"> • Survivability in harsh marine environments • Prototypical / technology risks, Various designs and concepts but with no clear winner at present • Small scale and long lead times
<p><i>Source: UNEP - Financial Risk Management Instruments for Renewable Energy Projects, Summary Document, 2004</i></p>	

3.2 Instruments for Risk Management: Insurance

3.2.1 Available insurance for RET

Insurance typically requires a certain amount of accumulated experience, and becomes available only as the technologies reach a certain degree of maturity. For some of the RE technologies there is considerable experience, other show only a very limited record. The following chart presents an overview of traditional insurance products available for RET projects:

Traditional Insurance Products available for RET Projects			
Risk Transfer Product	Scope of Insurance / Risks addressed	Coverage Issues / Underwriting Concerns	Availability and Coverage
Construction All Risks / Erection All Risks	All risks of physical loss or damage and third party liabilities including all contractors work	Losses associated with cable laying, especially for off-shore wind projects Quality control provisions for contractors.	Partial – Broad
Physical Damage	“All risks” package including Business Interruption	Explosion / fire concerns for biogas, geothermal Increase in fire losses for wind Quality control provisions for contractors.	Partial – Broad, but only limited for biogas and biomass
Machinery Breakdown	Defects in material, design construction erection or assembly Fortuitous working accidents	Concern over errors in design, defective materials or workmanship for all RET Lead times for replacement Manufacturing guarantees (especially for turbines) Wear and tear can be an issue for biogas (typically excluded from MB)	Very limited - Partial
Business Interruption / Delay in Start Up (DSU) / Advance Loss of Profit (ALOP)	For Business Interruption perils insured under the Property Damage policy DSU / ALOP	Cable losses represent largest potential BI scenarios Reinstatement periods can be long (e.g. biomass resource supply, lead-times for repairing / replacement of items off-shore (e.g. wind)	Partial cover for interruption; very limited for DSU and ALOP

Operators Extra Expense	All expenses associated with controlling the well, redrilling / seepage and pollution	Some geothermal projects require relatively large loss limits Exploration risk excluded Well depths, competencies of drilling Contractors	Limited
General / Third Party Liability	Includes coverage for hull and machinery, charters liability, cargo etc.	Concern over third party liabilities issues associated with toxic and fire / explosive perils	Partial - Broad
Source: <i>Scoping Study on Financial Risk Management Instruments for Renewable Energy Projects, 2004</i>			

Marsh³² presents a risk transfer heat map of existing insurance products depending on their availability of cover and the corresponding terms, indicating good chances to find some coverage especially for wind energy and geothermal energy.

➔ A trivial but important remark: Insurance is a financial compensation, not a protection against the (physical) damage itself, whose real reparation will require much additional efforts and time of the project sponsor / operator.

3.2.2 Private credit insurance

Credit risk insurance is a form of casualty insurance which protects manufacturers, merchants and other suppliers of goods and services against losses that may result from non payment by their customers after granting credit terms to domestic or foreign buyers. It does not cover physical damage to the product. Although this instrument is addressed first to the supplier, it could be very useful in the allocation of risks from the point of view of a RE developer, as it allows to transfer some of the existing projects risks to a professional risk taker lowering the financial risk profile of the project and **increasing its chances to be financed and implemented at all**. The insurable risks include:

- **Commercial:** Bankruptcy, Insolvency, Protracted Default/Refusal to Pay, or Breach of Contract.
- **Political:** Exchange Transfer/Inconvertibility, Expropriation, Nationalization, Confiscation, Embargoes (Export or Import), Cancellation of Required, Licenses/Permits, War, Strikes, Riot/Civil Commotion, Governmental Intervention, Contract Frustration, Unfair Calling of Guarantees/Standby Letters of Credit and other similar risks.

The advantage attributed to private credit insurance in comparison to Government credit insurances are

- Flexible;
- countries not politically but economically motivated;
- no domestic content product requirements;
- high discretionary credit limits;

³² Scoping Study on Financial Risk Management Instruments for Renewable Energy Projects, 2004

- low percentage buyer underwriting.

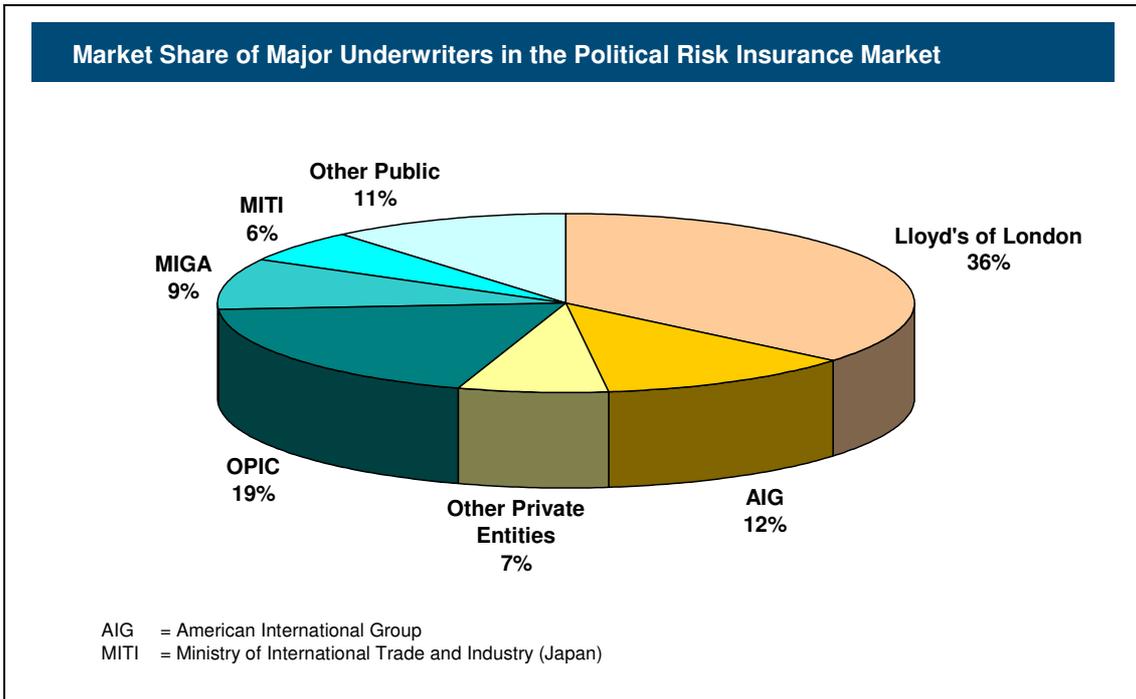
Currently, private credit insurance is only available to some extent for private infrastructure projects, especially in developing countries. Thus, its practical relevance for RE financing may be rather limited.

3.2.3 Political Risk Insurance

The three classic types of **coverage** are protection against restrictions on the transfer and convertibility of currency, expropriation of project assets, and damage to project assets as a result of political violence. Coverage against breach of contract or certain changes in the regulatory regime which amount to “creeping expropriation” can be negotiated on a case-by-case basis. Political risk insurance (“PRI”) is **provided** by

- the Multilateral Investment Guarantee Agency (“MIGA”), an institution of the World Bank Group;
- the Overseas Private Investment Corporation (“OPIC”), an agency of the U.S. Government,
- by export credit agencies, and
- by various private insurers , especially Lloyd’s of London.

The market of political risk insurance is dominated by a few private and public underwriters³³:



Availability of coverage depends upon the project’s host country, as well as upon the project’s ability to comply with criteria regarding the environment, treatment of labor, etc. As with all forms of insurance, coverage is limited with respect to its tenor and maximum amount. Commercial bank lenders typically require coverage in an amount

³³ Source: ADB – Review of the Partial Risk Guarantee of the ADB, November 2000

equal to the full principal amount of the loan, and occasionally, for some portion of scheduled interest.

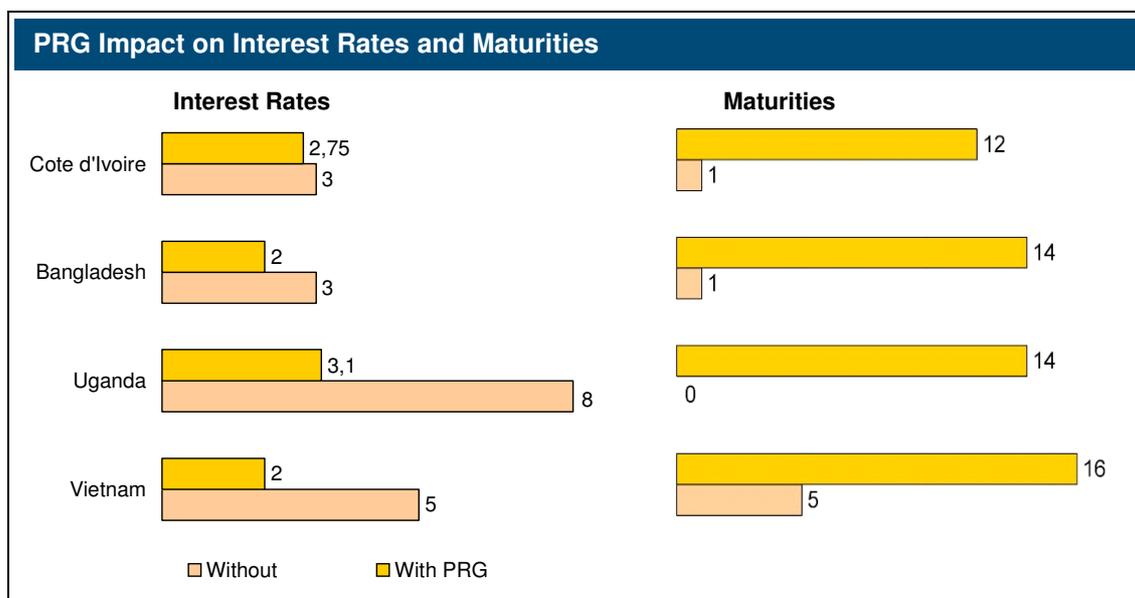
There is agreement that these structures succeed in protecting against the risks which they are specifically designed to cover. A **partial risk guarantee (PRG)** can be effective when **key risks** include

- Tariffs
- Regulatory framework
- Rights of way
- Licenses
- Expropriation
- Termination amounts
- Interference in arbitration process
- Rule of law.

Partial risk guarantees are typically provided by multilateral agencies and, as the name implies, cover a portion of the financing for which they provide support. With the exception of hydropower there have not been a large number of these transactions for RE.

A **PRG** is not only a instrument for mitigation of project risk, but also an **instrument** to enhance **creditworthiness**, improve lending terms, encouraging risk sharing and providing additional leverage with the government. The following charts illustrates the catalytic impact on the access to private finance:

- PRG attracts funds in considerable amounts, as each dollar of guarantee catalyzes close to 5 dollars of private finance³⁴:
- Equally important: the funds have more sustainable terms, i.e. longer maturities and lower interest rates, which are crucial for RE³⁵:



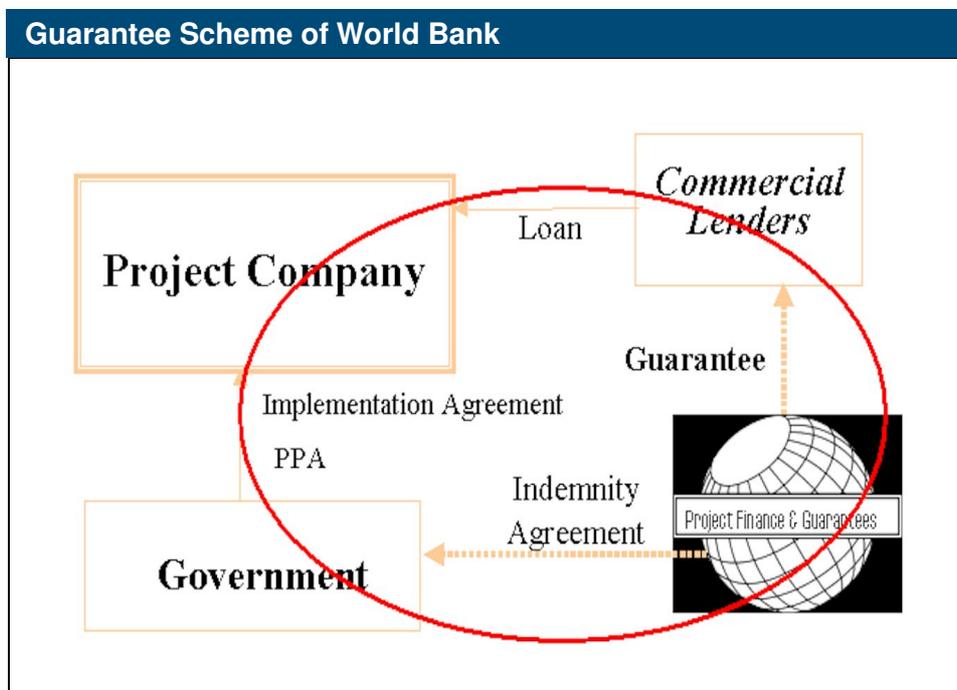
³⁴ Adapted from: Babbar, Suman – Infrastructure Financing. Growing risk aversion in emerging markets and the need for risk mitigation Workshop on Tools for Risk Mitigation in Small-scale Clean Infrastructure Projects, November 19, 2003

³⁵ See above.

The **World Bank** offers a partial risk guarantee to cover debt service defaults on a loan to a private sector project caused by a government's failure to meet its contractual obligations related to a private project. The principal categories of risks covered by the guarantee are:

- Breach of Contract
- Availability and Convertibility of Foreign Exchange
- Changes in Law
- Expropriation and nationalization

With respect to RET it is important to note, that PRGs can be used for a series of smaller projects with an intermediary for the retail of partial risk guarantees and help access private finance at improved terms. The World Bank charges a standby **fee**, a guarantee fee, and a front-end fee to provide a guarantee.³⁶



³⁶ Source: IBRD - Catalyzing private finance: The relevance of World Bank Guarantees at time of risk aversion. The contractual guarantee fee is equal to the contractual lending spread on IBRD loans prevailing at the time guarantee is approved by the Board (currently 75 bp per annum), and remains same for the term of the guarantee. At the date of each fee payment, private sector borrowers pay the contractual guarantee fee, plus a premium of up to 25 bp per annum. The premium depends on the scope of risk coverage provided under the guarantee. The initiation and processing fees will only be charged in the case of private sector borrowers, and applies to loans and guarantees. The Bank charges the borrower a one-time initiation fee of 0.15% or US\$100,000 (whichever is higher) of the guaranteed debt; payable as a condition of guarantee effectiveness. The Bank also charges a processing fee of up to 0.50% of the guaranteed debt to generally cover the cost of external consultants and out of pocket expenses that the Bank incurs for the transaction, if any. A front-end fee of 1%, if applicable to IBRD loans, applies to all IBRD guarantees. The fee is charged in full as a condition of guarantee effectiveness. The fee is charged on Bank's maximum exposure under the guarantee.

MIGA provides investment guarantees against certain non-commercial risks (i.e., political risk insurance) to eligible foreign investors for qualified investments in developing member countries.

- MIGA insures new cross-border investments originating in any MIGA member country, destined for any other developing member country.
- Types of foreign investments that can be covered include equity, shareholder loans, and shareholder loan guaranties, provided the loans have a minimum maturity of three years.
- Equity investments can be covered up to 90 percent, and debt up to 95 percent, with coverages typically available for up to 15 years, and in some cases, for up to 20. MIGA may insure up to \$200 million.
- Pricing is determined on the basis of both country and project risk, with the effective price varying depending on the type of investment and industry sector. The investor has the option to cancel a policy after three years, however MIGA may not cancel the coverage.

One of the main differences between a MIGA guarantee and a World Bank partial risk guarantee is that the World Bank requires a counter-guarantee of the host government; also, the World Bank only insures debt instruments, while MIGA covers equity as well.³⁷

OrPower 4 Inc. involves the design, construction and operation of a 48 MW geothermal power plant, located in the Olkaria geothermal fields, in Kenya's Rift Valley.

In 2002 MIGA has provided Ormat Holding Corp. of the Cayman Islands with a \$70 million guarantee to cover its equity investment and shareholder loan totaling \$171 million, in OrPower 4 Inc. in Kenya, as well as future loans to the project.

The coverage is against the risks of transfer restriction, expropriation, war and civil disturbance and breach of contract, and is for a period of 14 years.

http://www.ormat.com/news_023.htm

Although MIGA does not require a counter-guarantee, it does request host country approval before issuing a guarantee. MIGA can insure investments in projects with or without the involvement of another member of the World Bank Group.

To date, **ECA's** have little experience with RE support for various reasons. The G8 Renewable Energy Task Force mentioned in its report³⁸, that less than 5% of the ECA covers for energy projects were related to RET. However, ECA staff pointed out that this result is demand driven.

➡ However, potentially there is a larger role in RET financing for these bilateral insurers to play in future when adequate projects are presented. ECAs can potentially act as bridges to help mobilize the commercial and concessional financing the RETF identified as necessary.

³⁷ <http://www.worldbank.org/html/fpd/guarantees/>

³⁸ G8 Renewable Energy Task Force, Final Report, 2001. p.37 and Crescencia Maurer with Ruchi Bhandari – The Climate for Export Credit Agencies, May 2000 and Crescencia Maurer - The Transition from Fossil to Renewable Energy Systems: What Role for Export Credit Agencies?, Berlin 2003

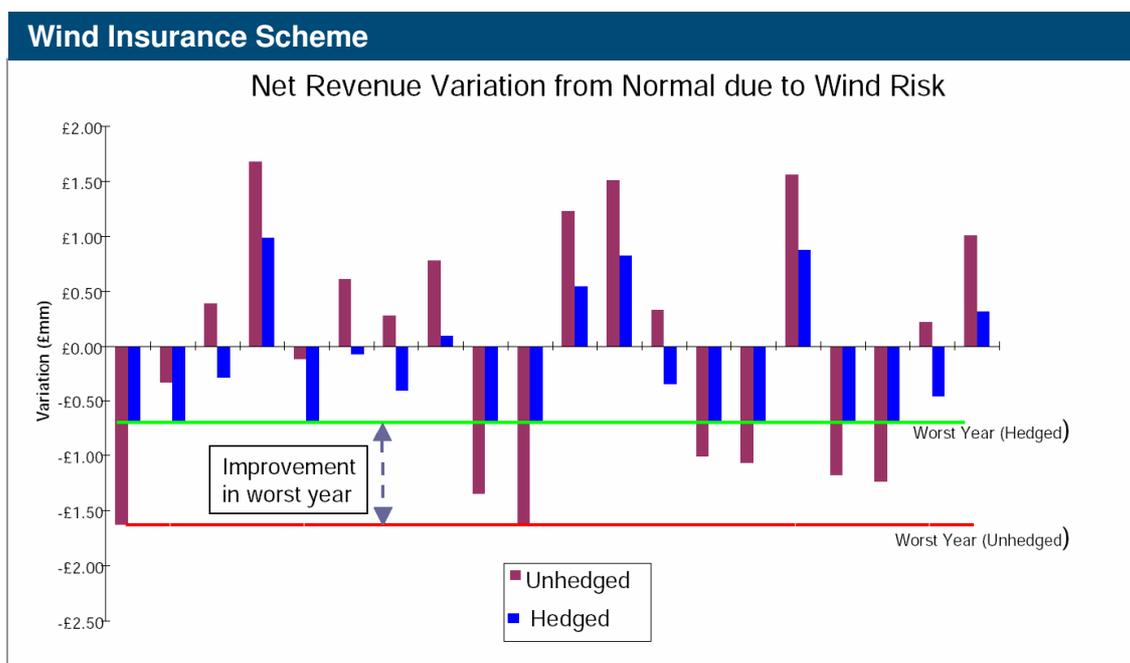
For ECAs to play this bridging role, however, will require governments to renegotiate an adaptation of Guidelines for ECAs, for example to include renewable energy in the list for more favorable repayment terms for particular sectors,³⁹ such as aviation, nuclear power and dams, as they also have particular financing requirements.

3.2.4 Weather insurance/ Weather derivatives

Weather hedges, or derivatives, protect a range of industries against weather-related damages, most notably in the agriculture and energy sectors.

Wind-, precipitation- and stream flow-linked derivatives are most suitable for Renewable Energy projects and a growing market is offering this service. Wind risk is defined as the risk of lower than expected wind speeds and hence generation, resulting in lower revenues.

As an example of a wind insurance, a wind farm operator may choose to purchase an annual put option, struck at 95 Wind Power Index units. This would give him in return a compensation if the wind fall below that level, thus reducing his risk considerably⁴⁰:



With such an instrument RE project developers/financiers/investors can remove volume risks that cannot be managed in any other way. After completion of a weather hedge, developers are able to realise projects with higher gearing, reduced cost of capital and raised return on equity.

³⁹ These sector arrangements essentially allow extended repayment periods of 12 to 15 years for nuclear power projects and dams.

⁴⁰ Source: Böning, Jens - Weather Derivatives as Risk Management Instruments for Renewable Energy Project, SEFI Bonn 2004

Such instruments are offered in Europe and the US for worldwide use. However, outside Europe and the US the access the market for weather insurance is underdeveloped, even in emerging markets.⁴¹

3.2.5 Example: Wind energy

Wind energy already has a substantial record making it possible to calculate risks. However, due to bad losses the insurance market backed off, and wind energy became a no-go area for many insurance underwriters. The most common claims have been⁴²: lightning (52%) and fire (27%) and , mechanical breakdown (16%). Those underwriters who are prepared to insure wind power have substantially increased the premiums and deductibles levels. But now insurance brokers are coming up with some creative solutions and doing a lot of awareness raising. Risk sharing is also helping. Brokers say that many underwriters will typically syndicate a risk.⁴³ One of the most complete insurance solutions is offered by Windpro (see box). WindPro is a facility underwritten by certain underwriters at Lloyd's and other insurers.

Private Insurance for Wind energy

Established in 1999 the **WindPro** facility can include a “**cradle to grave**” **insurance policy** that is available to both new and repowered wind farms. This policy is activated as a Builder’s All Risk policy upon commencement of construction, remains in full force as each turbine is erected and commissioned, and simply transitions to an Operational All Risk policy when commercial operations begin. This includes non-warranty mechanical breakdown and may eliminate the need for a separate boiler and machinery policy. Among the solutions offered are global cover for transit, delay in start up, construction, liability (primary and excess), operating risks and business interruption. The facility can provide limits up to \$184 million (£130 million) on any one project and is underwritten primarily in the Lloyd's market. WindPro is accessible via an insurance broker or directly for all businesses involved with the wind energy industry. It can provide tailored insurance solutions to transfer risks endured by wind farm contractors, owners, developers, financiers and manufacturers. WindPro has provided cover for over 4,500 megawatts (MW) out of the 28,000 MW capacity from wind power worldwide.

<http://www.windpro-insurance.com>

3.3 Financial instruments for project risk management

The financial world has developed a series of more complex and sophisticated structures to manage the structural challenges. Some of these instruments have already been used for RE-financing addressing the problems of big debtor risk and foreign exchange risk. However, due their transaction cost and structure such approaches only would make sense for RE projects with larger project financing structures.

⁴¹ Sensing a need to fill that gap, IFC has joined with Aquila Inc., to create the \$80 million Global Weather Risk Facility (GWRP). Aquila will syndicate \$70 million of GWRP to its network of reinsurance partners. In addition to the capital support, Aquila will leverage relationships with international banks and insurance companies to source weather risk in developing countries.

⁴² Source Windpro

⁴³ JESSICA McCALLIN and FRASER McLACHLAN. - Wind power, risk and finance. Can the wind industry get a better deal from insurers? Renewable energy world, Nov. 2002; http://www.jxj.com/magsandj/rew/2002_06/wind_power.html

3.3.1 Contingent Capital

Contingent capital structures ensure the availability of committed finance to the risk seller in circumstances where a loss event occurs. As it is already difficult to find a private investor to take the risk of the first financing there is hardly any supply in the commercial market of the developing countries to step in with contingent finance.

➔ However this instrument would be a very appropriate tool for promotional agencies to cover the risk a private investor would otherwise deter from financing RET projects. It is clear, that this requires are very precise and solid definition of risk trigger and the coverage.

3.3.2 Pledge of Shares

As a special collateral serves a **pledge of shares** for **start-up capital**. Private investors sometimes need a pledge over other shares in a company so they can take control if the company defaults on its obligations. The pledge of shares, like other pledge instruments, is an accessory agreement which may only be used to secure an underlying debt obligation. Pledge of shares may be a useful collateral instrument especially in cases, where the company structure and company laws are quite clear, but land property rights and mortgage laws are complex and risky.

3.3.3 Exchange risk instruments

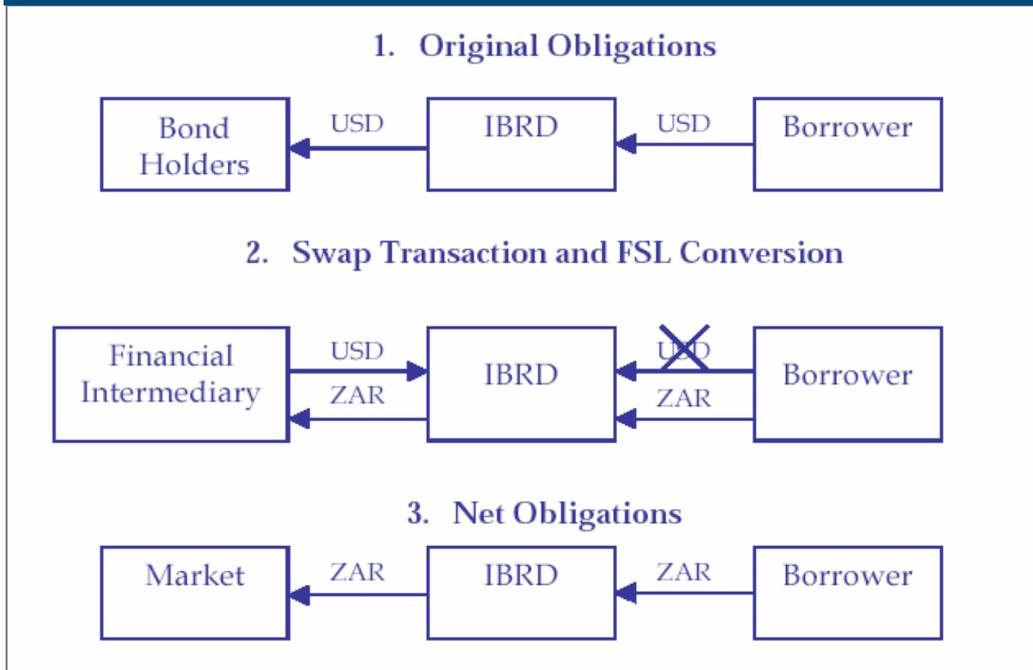
A **SWAP** is an agreement between two counterparties to exchange something (one "leg" of the swap) for something else (the other "leg"). These things can be anything that has a financial value. Most important for our topics and the financial problems of RET funding are cross currency swaps which allow the **management of exchange risk**, as foreign exchange is a special concern for many RET projects. Power projects typically generate revenues in local currency, while their financing costs and investment cost are denominated in U.S. dollars or other hard currencies, creating the risk of a mismatch in the development of the exchange rate between the two currencies.⁴⁴

A **Cross Currency Swap** is an agreement between two parties to exchange principal amounts in two different currencies, to pay interest based on those amounts during some period of time, and to re-exchange the principal amounts at maturity. Graphics and an example make the process more illustrative⁴⁵:

⁴⁴ The IFC is lending in local currency to projects in developing countries where it can fully hedge its **foreign exchange** exposure back to dollars in the currency swap market. In 2002 IFC offered local currency loans and hedges for the following 11 emerging markets outside Europe: Korea, India, Indonesia, Philippines, Thailand, Mexico, South Africa. However, the availability of these currencies, and the terms and conditions that the IBRD and IFC could obtain, will depend on swap market conditions at the time of execution of the proposed transactions. Because conditions in emerging financial markets can change rapidly, the IBRD will determine, upon a borrower's request, whether it is able to offer financing in a specific currency.

⁴⁵ IBRD Local currency financial products: An introduction.

Cross Currency SWAP Scheme of the World Bank



“In this illustration, the IBRD has made a USD loan to a borrower. The original USD loan is financed by borrowing in the international bond markets. After the loan is disbursed, the borrower requests that the IBRD convert its USD obligation into local currency, in this case south African Rand (ZAR). In response to the borrower conversion request, the IBRD arranges a ZAR-USD swap with an institution in the financial markets. The swap is structured such that the currency payments under the swap match exactly the currency obligation under the original loan and the borrower’s desired ZAR cash-flows.”⁴⁶

The principal amounts in each currency remain constant throughout the transaction, and interest payments are a function of indigenous fixed or floating rates. The customer is able to lock-in a specific exchange rate for the life of an asset or liability. The pricing of IBRD hedging products consists of the market cost of the hedge (IBRD will pass through to the borrower the exchange rate and interest rate terms achieved) and a transaction fee. The transaction fee payable in respect of local currency conversions and swaps is $\frac{1}{4}$ of 1 per cent of the principal amount swapped.

➡ So SWAPs can solve the problem of foreign exchange risk at a reasonable price. However, this instrument is only available for the rather advanced financial markets of the developing countries.

⁴⁶ IBRD Local currency financial products: An introduction.p.4.

RET projects in other countries have to look for the less elegant solutions, as presented in the following table:

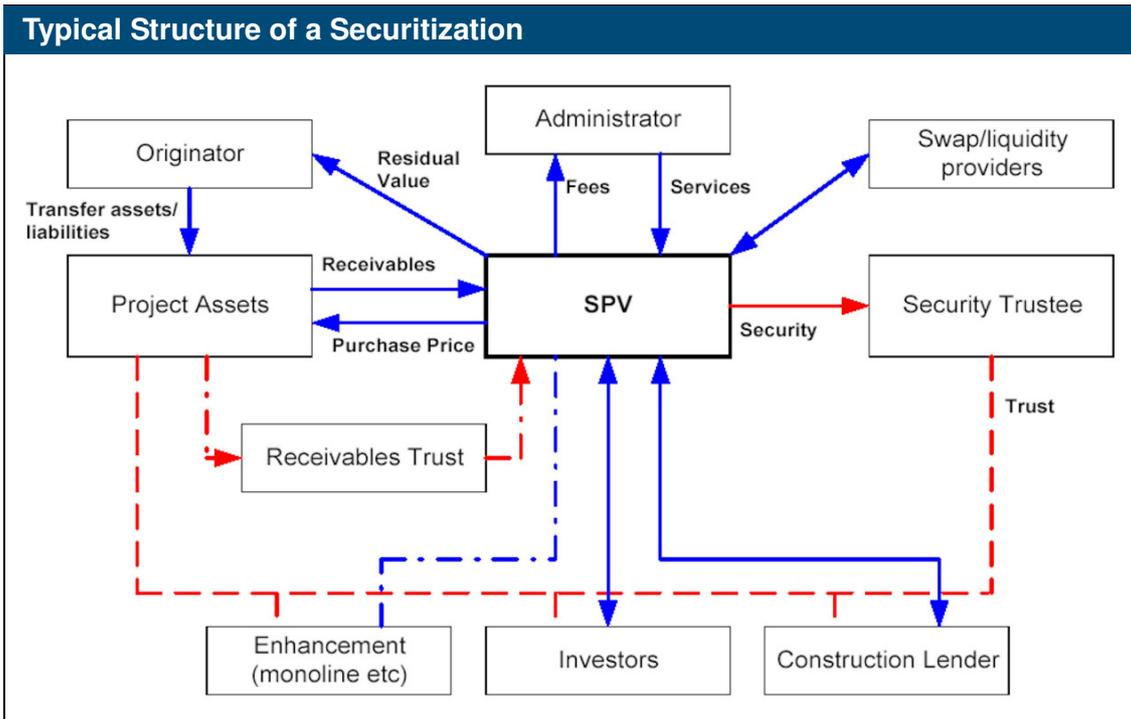
Mechanisms that allocate the Exchange risk to	
Government	Fixed Exchange Rates Public Sector Lending in Local Currency Exchange Rate Guarantees
Tariff Index	Foreign Exchange Index Inflation Index Regulatory Risk Mitigation
Liquidity Facilities	Escrow Accounts Liquidity Facilities dedicated to Exchange risk mitigation (stand by credit facility for devaluation)
<p><i>Source: Matsukawa, Tomoko et al. - Foreign Exchange Risk Mitigation for Power and Water Projects in Developing Countries, World Bank, December 2003</i></p>	

3.3.4 Securitization of credits

Making use of the **structured finance** approach of the creation of a special purpose entity like project finance, but on the level of **refinance**, securitization is a financing technique transferring the **risk** of loans to bond investors and distribute it among them. The term credit securitization refers to the transformation of non-marketed assets into marketable assets, i.e. securities.

- In the first step of the credit securitization process the originator **pools** a number of roughly homogeneous **assets**.
- In the next step, the originator sells the assets to a **special purpose vehicle (SPV)**, which is a trust or a corporation with the sole function of holding these assets.
- The SPV issues **securities**, which are sold with the help of a banking consortium in private placements or public offerings.

The payment of interest and principal on the securities is directly dependent on the cash-flows deriving from the underlying pool of assets. The underlying pool of assets is usually provided with some form of credit enhancement, because investors are normally not willing to bear all the credit risk associated with the pool. Common forms of credit enhancement are e.g. overcollateralization, third-party insurance and insurance by the originator.



Source: Haggard, M.E. - Exploring the capital Market and securitization for renewable projects, 2000

As the chart demonstrates securitization is a complex procedure, which may be time-consuming and costly. Furthermore the capital markets will consider RE only if they exceed a certain size. The quality requirements are the same as for any other project, i.e. proven technology, strong EPC, bankable fuel supply, PPA and O&M agreements. Institutional investors try to avoid complex projects, which could discourage using this instrument for certain types of **RE** investments, especially as the RE includes risks conventional projects do not face.

In general, bigger and calculable investments like windpark financiers with their placement of bonds in Europe and America have proven already that RE potentially can make some use of this instrument (See box). Furthermore Chapter 5 presents a case of securitization in microfinance (ICICI, SHARE - India), which could serve as a blueprint for RE microfinance.

3.4 Risk Strategy: Prevention and allocation

The utilization of **financial instruments for risk mitigation** can only be the **closing element** of a wider strategy to deal with the risks of the RE project. First, RE developers have to do their homework in risk management, before they can qualify as a partner for risk allocation with third parties.

3.4.1 Own Risk Management

Proper risk management is a prerequisite for any investment and includes a series of steps, which would have to be carried out for each and every RE project:

- All risks are correctly **identified** and as much as possible **quantified**, and **assessed** in their consequences for the project,

- followed by a definition of **risk tolerance limits**;
- efforts are made to **mitigate** the risks, residual risks are properly **allocated** and **managed**.

The decision also depends also on the following **crucial criteria**, whether

- the **consequences** of particular risks are **catastrophic** or not,
- the risks are **controllable** at the micro level or not,
- the consequences are **reversible** or not, and
- the risks are **insurable** or not,
- how much is to **pay** for somebody else covering the financial damage resulting from a certain risk
- and how much resources we are willing to **spend** to deal with all this.

Only after the execution of this steps and procedures it can be determined which risks shall be transferred and what kind of financial risk mitigation instruments are needed. All this may sound trivial, but in reality can be an **extremely complex and time consuming procedure** involving substantial **transaction cost**, especially for such difficult structures as RE:

- It may sound very trivial, but the proper planning of a project with carefulness, attention and accuracy exercising the **due diligence** of a businessman is the most important risk management factor.
- The selection of solid, reliable and experienced contract **partners** is an central approach to compensate for the risk balance of RE.
- Collection of relevant **data**, investigation and research for the RE project and its location does not come without a cost, but may reduce substantially the uncertainty and reduce the cognitive barriers, which relate to the low level of awareness, understanding and attention afforded to the RE financing and risk management instruments.

3.4.2 Partners and standard approach for risk allocation

However, even the best efforts to avoid or mitigate risks cannot eradicate them. And most of the above-mentioned risks can hardly be assumed by a private investor or a commercial lender alone.

☞ Therefore, those **risks** must be **allocated** and be taken on by other key stakeholders.

In this context of risk allocation it is important to note that a single asset or liability contributes different amounts of risk, depending on the portfolio it is a part of. Thus the proper allocation can contribute to the reduction of risk.

Like for any other major project the **partner of the commercial contracts** form the basis of the security structure for a RE project. For renewable energy projects, the typical principal contracts are:

- Engineering, Procurement and Construction Agreement (may be separated into more than one agreement)
- Fuel or waste supply contract (if required)
- Operating agreement
- Power purchase agreement

- Shareholders (or joint-venture) agreement
- Loan agreement.

Other important institutions to structure the risk allocation are:

- The host government, which is chiefly responsible for creating the proper legal and institutional environment in which developers will feel reasonably protected,
- The (multilateral) development banks, which can help in different ways: by lending to the project while taking political risk, by providing partial risk guarantee (PRG) products or political risk insurance cover (from MIGA for instance).
- Export Credit Agencies (ECAs), which can cover part of the commercial risk.
- Professional risk takers, like Insurance Companies.

The skill in structuring a successful project financing for a renewables project is to transfer or allocate specific risks to external parties best able to manage, absorb or mitigate the risk in the most efficient manner, thereby leaving only a residual risk with the developer.

These **external parties**, and the principal risks which typically could be allocated to them, can be summarized as follows⁴⁷:

Pre-completion risk		
Risk	Third Party	Comments
Technology	Contractor/Equipment Supplier	Risk transferred through monetary damages for performance shortfall.
Delay	Contractor	Risk transferred through monetary damages for delay in completion.
	Insurance	Certain delay risks can be covered by insurance.
Capital Cost Overrun	Contractor	Contractors are often prepared to offer fixed-price turnkey contracts, thereby accepting much of the capital cost overrun risk. Equity may be required to provide completion cost guarantees, particularly for new technologies or small, less well known construction contractors.

⁴⁷ DTI – Financing Renewable Energy Projects – A Guide for Developers, February 2000

Post-completion risk		
Risk	Third Party	Comments
Operating	Operator	Project operators can be prepared to guarantee minimum performance levels of a project
	Insurance	The insurance markets may cover the risk of certain events affecting a project
Market	Off-taker	An off-taker of a project's output may be prepared to offer a long term contract at a minimum or "floor" price. In a power purchase agreement the terms and price should be clearly defined and there should be no 'market out' clauses allowing for contract cancellation due to market conditions.
	Commodity Markets	The commodity markets (eg the futures market) can be used to absorb commodity price risk.
Interest and Exchange Rate Risk	Financial Markets	The financial markets can be used to hedge interest rate or currency risk.

The adequate allocation of risk between other parties and the project company itself requires a proper judgments of the risk tolerances and the effective cost of transferring the risks: Each party **charges** - in one form or other - the project company for taking over that risk from it. The charge or cost may be a direct one in form of a fee, but also could be an indirect one for the project developer/sponsor hidden as less favorable conditions and terms in the project related contracts.

From the point of view of the project developer a proper balance must be kept between the risks retained within a project and the costs of transferring risks out of a project to third parties.⁴⁸ This in certain contrast to the perspective of potential lenders, as their risk tolerance is usually rather low.

➔ A **risk allocation profile** according to the principle of control and willingness to accept would look like this:

⁴⁸ If the risks of the project are high, the costs levied by third parties to bear this risk may exceed the expected returns that will be earned by the project.

Risk Allocation Profile for RE Projects

Risk Category	Risk Sub-Category	Project Developer	Potential Risk Partner								Potential Risk Mitigation Instrument
			Contractor / Supplier	Grid / Power Distributor	Private Investor	Commercial Lender	ODA Institution	ECA, MIGA, PRG	Commercial Insurance	Others	
Country Risk	Expropriation							■		ECA Cover, PRG, MIGA Guarantee	
	Breach of Contract							■		ECA Cover, PRG, MIGA Guarantee	
	Convertibility of Foreign Exchange							■		ECA Cover, PRG MIGA Guarantee	
	Change in RE Policy							■		ECA Cover, PRG, MIGA Guarantee	
Exploration		■									
Development		■									
Technology		■									
Construction	Delay		■							Construction Contract	
	Cost Overrun		■							Construction Contract, Contingent Finance	
Operating	Fuel Input	■							■	Wind Insurance, Weather Insurance	
	Damage, Theft								■	Standard Insurance	
	Technical Performance		■						■	Supplier Performance Guarantee	
	Management	■									
Commercial	Operating Cost	■									
	Price / Tariff			■					■	Long-term PPA; Guarantee by Government; PRG	
	Demand			■					■	Long-term PPA	
	Payment			■						Escrow-Account	
Financial	Total Debt Amount		■			■	■			Project Finance, Syndication	
	Loan	■				■				On Balance Sheet Instruments like mortgage etc., or Limited Recourse Project Financing like an assignment of earnings from the PPA	
	Interest rate					■			■	Interest rate SWAP	
	Exchange Rate					■	■		■	Exchange rate SWAP	
	Maturity					■	■			Financial Instrument, Conditional Loan	
	Force Majeure								■		

3.4.3 Preliminary Conclusion on risk instruments for RE

The capital and insurance markets have developed a series of financial instruments to support the structuring of the risk of projects and to make financial deals viable at all. The most important and **relevant risk instruments** at the present stage of development are:

- Political Risk Insurance,
- Wind Insurance,
- Swaps, and
- Contingent Finance.

It has been explained, that due to the limited experience, the early stage development of the relevant markets and the risk-aversion of the players in developing countries such instrument will only seldom be available for RE in LDCs per se. The availability of such instruments in LDCs is summarized by the proposal for the abovementioned research study: "In developing countries, standard insurance products for RE projects may be partly available through local insurance and re-insurance brokers, who then place insured risks directly on international market. However, these have even higher underwriting restrictions because of difficult re-insurance procedures and low capacity on international markets. The market conditions are more or less similar for other non-insurance risk management instruments, and there are very few commercially available financial instruments for RET projects, such as guarantees, guarantee funds, or finance risk hedge mechanisms."

Given these constraints on the capital markets in LDCs to respond, there is a task for the public sector and the donor community to take on to catalyze the utilization of innovative risk management schemes to facilitate commercial investment flow to RE sector. Thus, some of these **instruments** presented offer an interesting **starting point** for **policy makers and donors** to support the structuring of risk in RE by assisting the players in the financial and insurance markets to develop their skills and instruments. Furthermore some of them could be used directly by donors to assist RE projects and programs.

- When **governments** with assistance from donors introduce **risk management products** for RE-projects on the market, the market price of private project finance for RE decreases while the availability of domestic debt and equity capital for RE-projects increases. The objectives of the approach are (i) to leverage donor finance (generating an increase in domestic project finance, which is larger than the donor-financed cost of developing and marketing the hedging product) and (ii) to assist a long-term strengthening of the capital market.
- In **emerging economies**, one can expect a significant impact on RE-investments from new risk instruments. Investors in East-Asia in particular react very quickly to new commercial opportunities and are capable of rising significant capital.
- In **poorer developing countries**, the leveraging effect on the availability of capital for RE is likely to be small in the short-term and requires a subsidization of the risk product. The donor would finance a reserve fund to cover the expected financial losses on the under-priced product. In these countries, it is not the short-term impact, but the longer term impact on the capital market which provides the justification for adopting the approach.

⇒ It is recommended, therefore, to *use modalities for providing financial assistance to RE-investments, which strengthen the local capital markets*, even if they offer few short-term advantages for RE-investments compared with conventional donor-assisted project finance.

4 RE Financing Strategy and Financial Supporting Instruments

As the commercial markets do not provide a satisfying set of financial instruments in most regions, policy makers and donors have to look for additional financial supporting instruments to make economic viable RE projects and programs financially possible.

To find a proper approach for such a support we have to precise a strategy RE financing and its promotion. After that this chapter will have a closer look on such financial supporting instruments:

- **ODA-instruments** as grants, soft loans, promotional credits and other financial supporting instruments as guarantees as well as financial instruments provided by private sector promoting DFIs.
- International promotional schemes like **CDM and GEF**.
- **Subsidies**, which could be used by policy makers, electricity providers and third parties as donors.

Such instruments could play an important **role** to improve the financial viability of RE projects

- by an approach to increase **funding** availability for renewable energy investments, aiming at leverage of private finance,
- with a **risk-sharing** approach,
- and the facilitation of the **bundling** of (small) projects to help absorb their higher proportional level of transaction costs.

4.1 Basic Approach for a RE financing strategy

Obviously, as described above, the characteristics of RE and its project sponsors on the demand side of finance do not match the requirements of a very incompletely developed supply side. The framework conditions in the energy market tend to increase the gap between RE investors and financial institutions in LDCs. Obviously in many countries and situations there seems to be a need for assistance to overcome this severe barrier for making full advantage of RE for development of these countries.

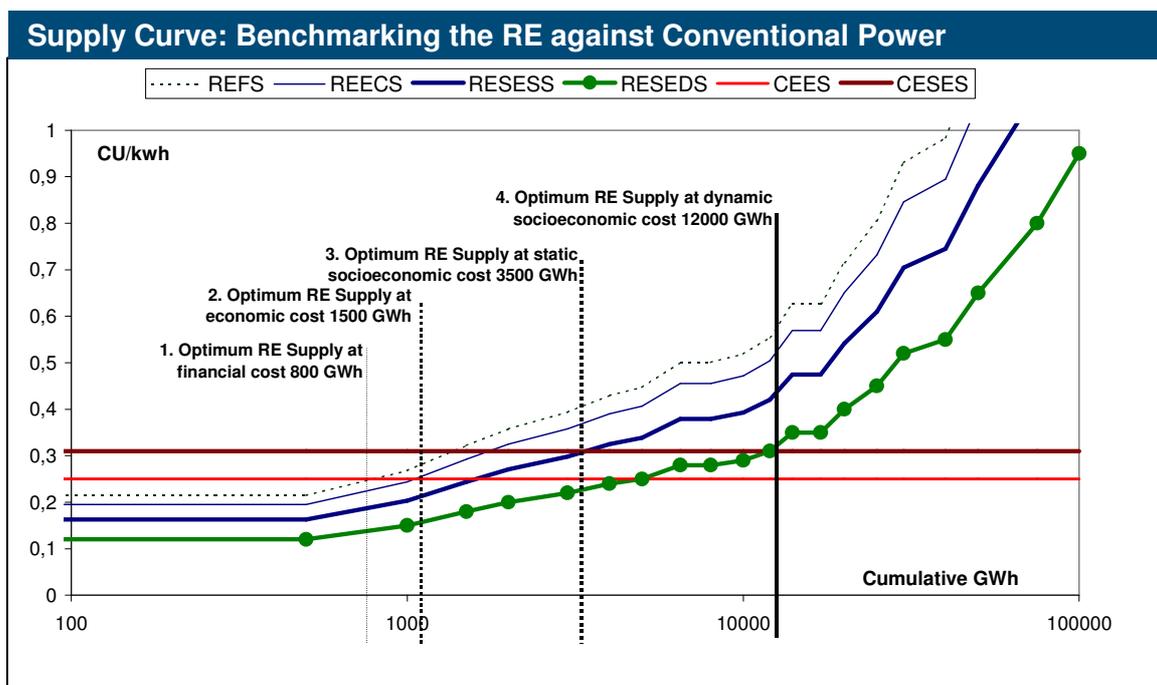
However, before we can start to think about a promotional package of financial instruments for an RE activity, we have to make a diagnostic of the state of viability of a certain RE activity and whether and to which extent it makes sense, to use scarce resources to solve financial problems of such a RE project. This problem has to be addressed on the base of the concept economic viability. This means, that a proper strategy for RE finance does not aim at the promotion of RE per se, but on the creation of proper financial conditions for economic viable RE projects. In detail:

4.1.1 RE Supply Curve, and Viability

The **RE-supply curve** shows the marginal cost of production per GWh of RE as a function of the scale of national RE-production. It benchmarks Government RE-priorities and targets against the scope for financially viable, economically viable and non-economic RE-supply. Benchmarking the RE-supply curve against the supply curve for conventional power supply permits identifying the scope for economically viable RE-

investments. An example with styled facts is shown below.⁴⁹ The supply curve for RE is presented based on three basic concepts:

- the **financial supply** curve (REFS) includes all costs (capital, and operating and maintenance costs) priced at current market prices. Capital costs are annualised, using a formula that incorporates the lifespan of the capital equipment, and a discount rate.
- the **economic supply** curve for RE (REECS) is based on the data used in deriving financial curves, making adjustments for two categories of inputs: (i) the input data for labour, fuels and the exchange rate are shadow priced to reflect the opportunity cost to the economy rather than the market price; (ii) CO2 emission offset data is included, valued with Certified Emission Credits (CER) of the Clean Development Mechanism (CDM).
- the **socio-economic supply curve** is equal to the economic supply curve minus the value of the indirect and induced labour created by the introduction of RE technologies. Since technological progress and the growth in the RE-market bring down the cost of production per kWh of new RE-projects, the dynamic supply curves in the long run (RESEDS) are lower than the static supply curves in the short run (RESESS). The dynamic socio-economic cost curve shows the lowest cost scenario for RET, the financial supply curve the highest.



The chart benchmarks the cost of RE-supply against these two LRMCs. The point of intersection of the RE supply curves with the conventional supply curves indicates the optimum RE-quantity based on the different concepts.

Even the socio-economic curve shows that a large **market share for RE** carries a high **price tag**: the socio-economic cost per kWh of RE-production increases sharply as soon as contribution of RE is expanded beyond a few thousand GWh, and quickly

⁴⁹ Based on Conningarth Economists: "Economic and Financial Calculations and Modelling for the Renewable Energy Strategy Formulation - technologies for fulfilling the 10 000 (4 000) GWh target a least cost for the South African society". February 4, 2004. Off-grid RETs are not included in the supply curve for South Africa. Solar water heaters are included because they reduce demand for power from the grid.

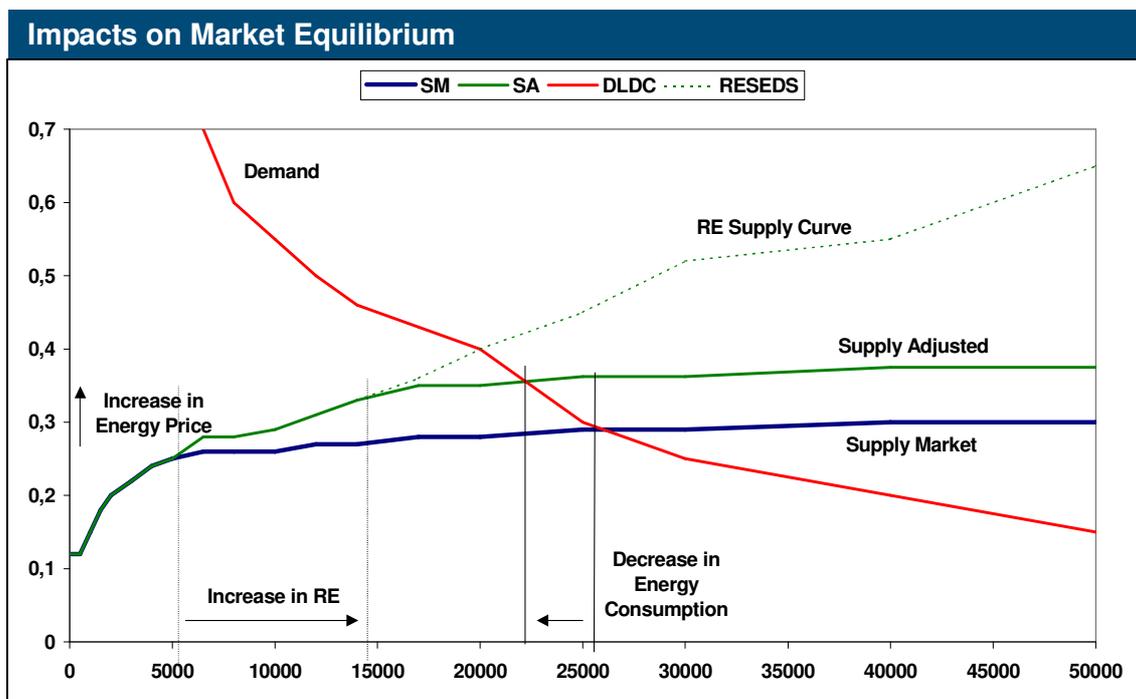
oversteps the two benchmark figures for the Long Run Marginal Cost (LRMC) of conventional power (the cost with (CESES) and without (CEES) the environmental cost of thermal power).

The **central observations** from the RE-curve benchmarking against conventional power supply in this example are:

- there are few **low-hanging fruits** in RE-investments, i.e. **financially viable** under **current conditions** (Optimum 1);
- the **cost of expanding** investments beyond the “commercial” **RE-potential** rises steeply, calling for increasing amounts of compensation to be introduced;
- however, under a **long-term socio-economic perspective** a much **higher RE-Supply** is **desirable** (Optimum 4), setting the rational limits for interventions and corrections in the current (renewable) energy framework.
- On the other side, a considerable **share of technically feasible RE-supply is non-economic** even under long-term socio-economic perspective.

In countries that are blessed with hydropower resources and/or geothermal resources RE can make up close to 100 percent of national power generation. Here there are enough low-hanging fruits to cover total demand for power with few or no RE-specific incentives.

In other countries, the task is to find niche markets for the lowest-cost RETs. Many of these are only marginally competitive with conventional power supply on the free market due to (i) price distortions on the energy market, which prevent RE from being offered tariffs that reflect their full economic value and (ii) weaknesses on the capital market which reduce the price competitiveness of RE-generated power. They, therefore, need compensating innovative finance and market regulations to secure a market share reflecting their objective value for society.



If the energy policy is taking into consideration the long-term and socioeconomic aspects by inserting them into the cost of the energy suppliers to promote the viability of RE, this will not only increase the competitiveness of RE projects, but it may also lift the energy supply curve (from SM to SA). This would lead to a **new market equilibrium** with an increase of the energy price and a reduction in the total energy consumption along the demand curve, both being detrimental to the consumers of energy, which may create a substantial problem in a very sensitive field.

The final consequences for the economy of the LDC, its production and consumption levels, tax income etc., depend on the actual situation in the country. However, this illustrates, that even well-intended interventions in the market to the benefit of RE development in the short run may have **severe impacts on the welfare** of the LDC in general.

The fact that some RETs have a large medium to long-term potential for cost reductions (due to scope for technological innovations and economies of scale) poses a policy dilemma for poorer countries. Should it invest in a “developing RET” now, or is it economically more rational to wait a few years until annual cost reductions seem to flatten out?

➔ The **policy conclusions** from this for policy makers in developing countries are:

- pick the low-hanging fruits,
- wait with large-scale investments in marginally economic RETs until they reach technological “maturity” (=normal annual productivity developments), and
- in the meantime, let donors fund the subsidies for capacity building investments.

4.1.2 Viability and competitiveness of the different RE Types

RE projects vary not only considerably in scale, energy source characteristics, points of sale for output and other factors, but they are also in a different state of economic and financial viability:

- Some renewable energy technologies (RETs) are **economically viable** and, being cost-competitive with conventional power, are also **financially viable**.

They could be financed by **commercial finance**, provided they get adequate access to the financial market. The potential commercial financial options for RET are presented in Chapter 2, as well as the limitations for RET finance in developing Countries. In such case this market failure needs compensation by agents who have the willingness and the funds to create or give the access. This is a case for **market-based development finance**.

- Other RETs are **economically viable**, but not (yet) financially viable, because external costs and benefits of energy technologies and other factors are not reflected in the financial market prices.

They need some compensating financial support to become financially viable. This is the field for RET financial support through **subsidies** and **ODA with grant elements**. (Chapter 3)

- Other RETs are **not economically viable**, according to classical cost-benefit analysis.

In the long run sustainable market penetration depends on improved commercial viability. But for some RETs this is still a long way ahead:

Differentiating Financing Strategies for Renewable Energies		
	Market competitiveness (Financially viability)	
Grid	Close to	Far from
Grid-connected	1 Windpower Biomass + Biogas Hydropower Geothermal energy	3 Solar thermal electricity generation Photovoltaic energy Fuel cells
Off-grid	2 Photovoltaic energy household biogas-plant	4 Solar dishes PV-diesel-hybrid-systems

Source: Seifried, Rolf (KfW) - Investing in Renewable Energy / Status, Challenges and Perspectives; 2nd European Congress on Private Sector Participation in Infrastructure

4.1.3 Promoting RE viability, the Market and the Development Continuum

The problems analyzed hitherto make quite clear, that there are no simple solutions. The financing of the diverse range of RE-projects cannot be accomplished with one basic project financing strategy in the way that many large scale conventional energy projects are financed.

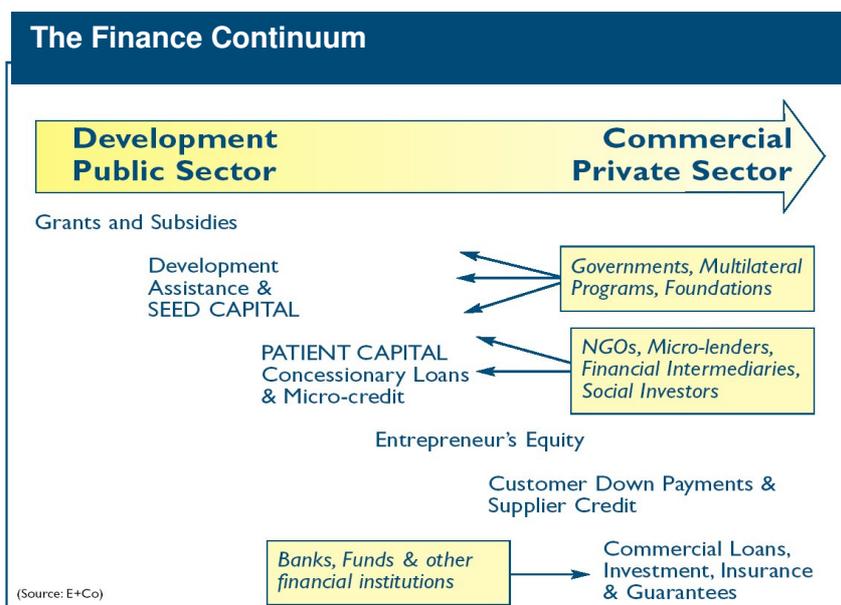
A **financing framework for renewable energy** based on the economic principle and the principle of subsidiarity is composed of three inter-linked pillars:

- **Support access to commercial finance** by making risk mitigation instruments available to raise equity and long-term debt finance available in sufficient quantities and at competitive terms for investments in RE-projects.
- **Create a market expanding regulatory framework**, which reduces risks, keeps down the costs of projects transactions, and gives supply from RE priority access to the power market.
- **Offer financial subsidy-instruments** to bridge the gap between economic and financial viability, thereby making otherwise financially unviable energy investments “bankable”.

The chart “The Finance Continuum” presents an model scheme for use of financial instruments by different financial sources to guide RET through the different stages (phase of project, size of project, market maturity) of the process from initial development to commercialization as well as of the amounts to be financed.⁵⁰

From the point of RE development it is assumed that they need public sector support for financing at their initial stage, which can be phased out with the ripening of the RET and its competitiveness.

⁵⁰ Source E+Co, taken from: Open for Business, Entrepreneurs, Clean Energy and Sustainable Development.



4.2 Use of Development Finance Instruments for RE

In line with the subsidiarity principle ODA and DFI can offer instruments and funds to **bridge the gap** between the capability of the local financial markets and the needs of RE projects either by cooperating with the supply or demand side of funds.

As mentioned before, the **promotional financial institutions** can **potentially use each and every professional financial instrument described** in this study, as their expectations concerning the return and their ability to support risk are well different from pure commercial financial institutions. As the financial objectives are secondary to economic and social goals, their **lower expectation on the return on capital** and the **higher risk tolerance** widens the range of feasible RE projects. This chapter gives only a brief overview about the activities and instruments in use. Chapter 5 will present some examples for the combination of these instruments for specified projects.

4.2.1 Activities of Development Banks

During the last decade the World Bank and other multilateral and bilateral **development banks** have been among the largest and **most active investors** in renewable energy throughout the developing world.

Donor grants and (concessional) loans for RE come from three sources:

- Donor grants allocated to RE-capacity building and investment within the framework of pluri-annual bilateral aid-programs;
- (Soft) loans from international development banks, such as IDA and ADB, for rural electrification and RE programs;
- Donor soft loans to specific RE-investment projects.

Furthermore **Development Finance Institutions** and Promotional Banks provided funds for RE at conditions at the lower end of markets in form of equity or loans assuming a risk commercial institution is not willing to accept presently.

Besides the **sector** strategic approach by support for electric power policy frameworks and regulations, development banks channeled funds directly or indirectly through private Participating Credit Institutions (PCIs), to provide medium and long-term financing

to private sector firms, NGOs, and cooperatives for solar home systems, village hydro projects, grid-connected mini-hydro schemes and other renewable energy projects. Some of these activities are presented in chapter 5 in the context of best practice approaches.

4.2.2 Approach and Lessons learned

In recipient countries, the funds provided fulfill two equally important **functions**:

- they channel foreign grants to investments in RE,
- they provide long-term project finance, which is not available in most countries.

The strength of donor credits is the ability to raise **important sums** of project finance for individual projects. Loans at favorable conditions from different donors can, as demonstrated by IREDA⁵¹, be combined into a long term financing facility for RE-investments. This is the approach to adopt when a country wants to mainstream RE. A weakness is that soft credits often are restricted to finance supplies from the donor country. This is changing; KfW, for example, accepts that the host country organizes international tenders for supplies to projects financed by KfW.

The strength of the development banks in their assistance to RE is their ability to combine breadth in terms of scope of intervention with depth in terms of the scale of financial volume they can provide. Development banks can and do finance the “whole chain of support activities from institution-building TA to project finance and risk guarantee facilities. Their weakness is slowness in procedures from the time of initial contact till the flow of investment funds.

A frequent **weakness** of donor aid programs was a “**single technology**” **focus**, the tendency of individual donors to re-invent the wheel once more, or pursuing an RE-promotion strategy in the country, which contradicts policies being implemented in the country with help from other donors.⁵²

RE-policies in developing countries have moved beyond the pilot and demonstration project phases towards the mainstreaming of RE within national energy policy. This requires **improved coordination** of donor activities, eliminating the simultaneous pursuance of mutually contradictory approaches.

4.2.3 Available Financial Instruments

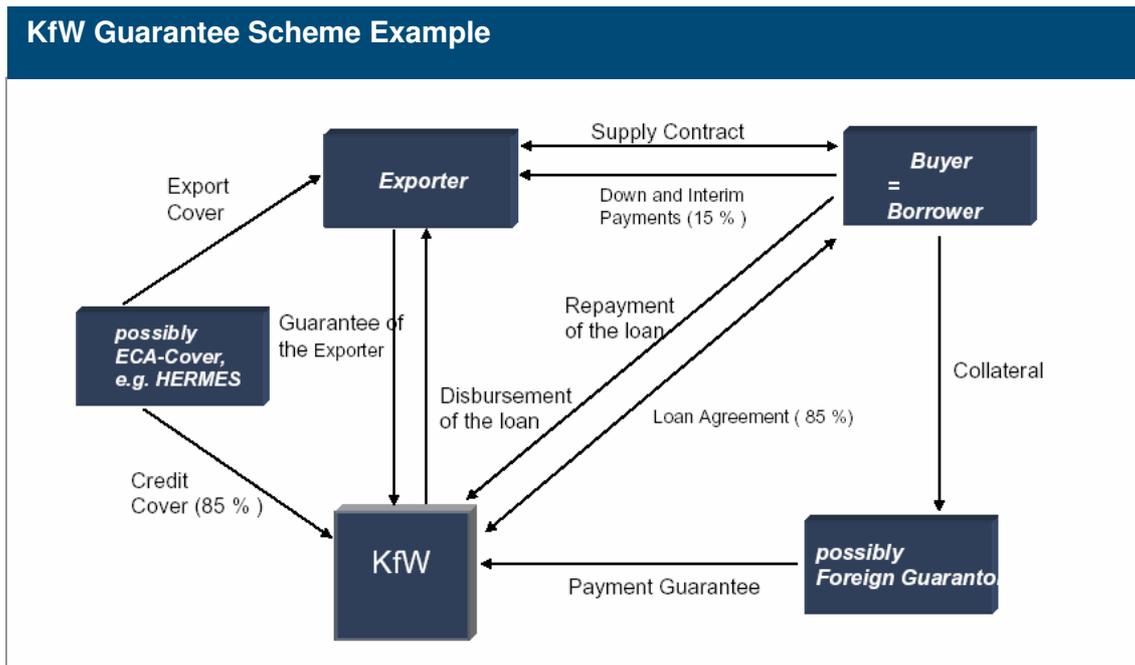
Multilateral and National Development Banks can play an active and supportive role in structuring tailor made financings as arranger, underwriter and participating lender with their ability to fully underwrite large amounts making long term loans in USD, EUR and other major currencies with fixed and floating interest rates. Depending on their individual approach and instrumental limitations this may be done in the form of:

- Project Finance and other Structured Finance (Cash-Flow based);

⁵¹ See Chapter 5

⁵² For example, while one donor would try to promote sales of PV-systems by assisting existing dealers in extending their marketing and after-sales network, another would bypass the local dealer chains in the country, installing institutional PV-systems in a “big-bang” approach through a single foreign supplier’s contract.

- Concessionary financing
 - Financial cooperation (soft loans or grants from Government budget)
 - Combination of soft loans with commercial funding
 - Equity participation and mezzanine loans (IFC, DEG etc);
- Leasing Finance;
- Innovative financing instruments like Carbon credits (implementation of carbon fund under consideration);
- Preparatory investigations and analyses financing facilities;
- Commercial financing like Export Credits with cover from Export Credit Agencies, like in the following example of KfW's export and project finance:



The affiliated private sector promoting **Development Finance Institutions** like IFC and DEG have further financial instruments available for RE Finance:

- Equity participation
- Subordinated loans without conversion option (Mezzanine)
- Long-terms loans
- Guarantees
- Mobilization of additional finance (e.g. syndications, coordinations).

A typical **equity participation** of DEG used for capital expenditures in green-field-projects or as a capital increase in existing RE projects would have the following characteristics⁵³:

- Amount: 2.5 – 15 million €
- Participation: between 10 % and 49 %

⁵³ Source: Investing in Renewable Energy - The Experiences and Possibilities of Financing of DEG in Emerging Markets and Developing Countries, Cologne 2002

- Exit option: IPO (after 3-6 years), Private Placement (after 3-6 years), Put option against other shareholders (if other options less realistic, after 7-10 years)

A DFI's input as **subordinated lender** would render a quasi-equity function with lower costs and without additional dilution. The debt service would be subordinated to senior loans with an individual amortisation structure (e.g. longer grace period). Also securities would be subordinated to senior loans with second ranking mortgage. DEG could offer subordinated loans up to 20 million € in €, USD (depending on country risk), but local currency only in special cases. The maturity would be up to 15 years (including grace period). Interest rate would be variable or fixed calculated on a base rate plus a margin for country, project and subordination risk and a possible variable part of interest rate depending on EBITDA or profit.

4.2.4 Risk Instruments

Given the gaps on the capital markets in LDCs to respond, there is a task for the public sector and the donor community to take on to catalyze the utilization of risk management schemes to facilitate commercial investment flow to RE sector.

At present, the multilateral development banks are using various guarantee schemes help to structure the more general risks of RE projects⁵⁴:

Some Guarantee Instruments available by Multilaterals					
Entity	Instrument	Degree of participation	Tenor	Private Participation	Main Requirement
MIGA	Political Risk Insurance	Up to US\$ 150 millions	Up to 20 years	Direct or Indirect	Requires letter of approval from the host country
World Bank	Partial Credit, and Partial Risk Guarantees	Up to US\$ 150 millions	Up to 20 years	Direct or Indirect	Requires a formal counter-guarantee from the host Government
IFC	Funding and Financial Guarantees	Up to US\$ 150 millions	Up to 20 years	Direct	Requires that the private sponsor have the majority stake in the project
IADB	Funding, Political Risk Insurance and Partial Credit Guarantees	Up to US\$ 75 million or 25% of total debt finance	Up to 20 years	Direct	Requires that the private sponsor have the majority stake in the project

⁵⁴ Source: da Fonseca, V. - Risk Management, Insurance and Guarantees: Overcoming the Challenges of Infrastructure Financing in Latin America and Caribbean, 2004

Furthermore **financial guarantees** like Partial Credit Guarantees (PCG) may improve the RE projects credit risk profile to capture private capital on adequate terms & conditions.

As **innovative approaches** the Interamerican Development Bank started offering the following types of PCG in support of infrastructure projects in Latin America recently⁵⁵:

- **Maturity Guarantee:** Guarantee of a portion/all principal due giving an option to a potential investor to redeem a portion/all of the principal outstanding by putting the issue to the Guarantor on the Maturity Guarantee date, increasing the chance that the investor may be willing to accept issues with **longer-dated final maturities**.
- **Rolling Guarantee:** providing a guarantee of a specified number of interest and/or principal payments, on a rolling forward basis – i.e. the guarantee rolls forward to the next installment date upon payment by the issuer of the current installment, to smooth out the repayment profile and **allay investor concerns about potential timing/cash flow issues**.
- **Pool Guarantee:** A bank with a RE credit program may pledge debt service receivables as collateral to repay a bond issue, but the collateral may not be sufficient to **attract local investors** to purchase the bond. The Donor could further enhance the bond with a partial credit guarantee providing a **guarantee for a portion of principal and interest** sufficient to offset potential losses resulting from non-performing assets within the underlying collateral pool.

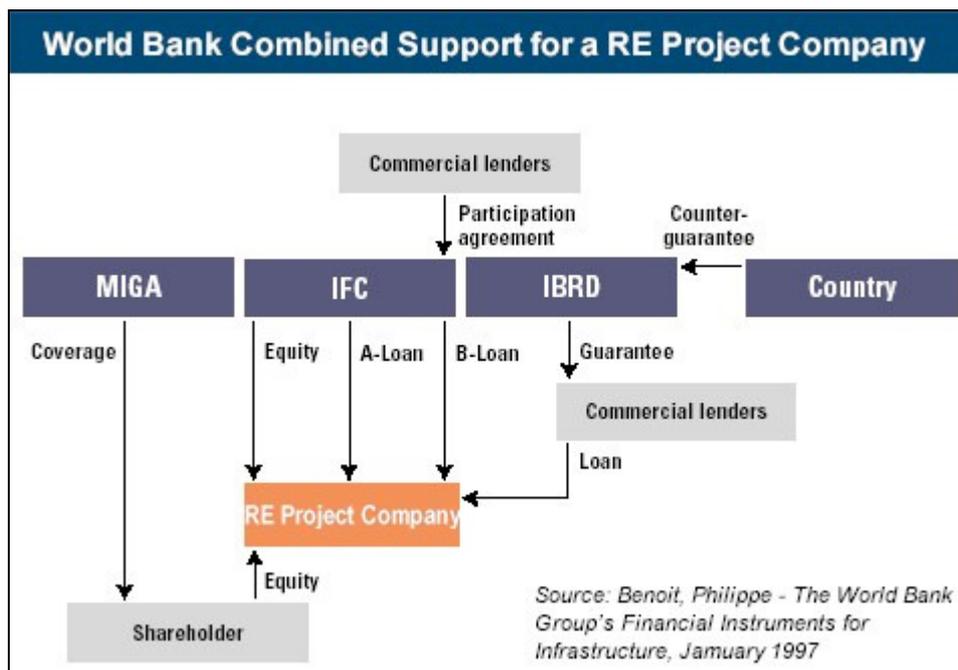
4.2.5 Combined Support

The full set of potential support by a proper cooperation of the different specialized institutions of a development bank group and their **combined instruments** is demonstrated in the following chart, showing the **coordinated interaction** of IFC, IBRD and MIGA:

- MIGA **covers** the shareholder/investors, which are participating in the **equity** of the Renewable Energy Project Company.
- IFC is a partner in **equity** and additionally gives an **A loan** and channels a **B Loan** from commercial lenders.
- World Bank is giving a **guarantee** to the commercial lenders, which are giving credit to the Renewable Energy Project Company.

This illustrates how the support of DFIs could promote the participation of the private sector in RE.

⁵⁵ Inter-American Development Bank /Private Sector Department/Capital Markets Unit - Capital Markets Development : Financial Guarantee Program; Credit Risk Mitigation, local currency instruments; IDB Capital Market for Development, June 03, 2003.



4.2.6 Opportunities in RE for Development Banks and DFIs

Essential elements of a strategy for development capital in supporting the further RE development are⁵⁶:

- Build up innovative approaches to tap commercial markets with enhanced risk sharing models;
- Utilization of flexible mechanisms of the Kyoto Protocol, primarily project-based “Joint Implementation”, “Clean Development Mechanism”;
- Strengthen strategic partnership with the Global Environment Facility (GEF), UNEP and other donors;
- Expand development partnerships with the private sector. This includes risk sharing with regard to preparatory measures via PPP facilities to mobilize private capital and entrepreneurial competence for the partner countries.

Opportunities for donors support for RE in combination with the existing **financial instruments** and players in the local capital markets could be.⁵⁷

- Support private firms by **providing financing and/or equipment subsidies**. This support helps firms expand their business, innovate and test new business models (i.e., demonstrate profitability), and lower costs and Development Capital can be used in many ways, including:
 - Enterprise development support: supporting energy enterprises to start-up, by subsidising advice and offering capacity building;
 - Seed capital: provide high risk capital that entrepreneurs cannot obtain elsewhere, usually in relatively small amounts;

⁵⁶ Seifried, Rolf - Financing Energy Services for Rural and Urban Poor within German Financial German Financial Co-operation, Brussels, July 23, 2002.

⁵⁷ Excerpt of: Martinot, Eric - Renewable energy investment by the World Bank, Published in Energy Policy 29(9): 689-699 (2001).

- Debt financing for either the company (working capital) or for customers (micro credit for purchase of equipment).
- Development Capital can be invested via intermediaries to **support specialized financial institutions** like Renewable Energy Finance Institutions and Microfinance Institutions with classical refinancing mechanisms;
- Creation of **new financing vehicles** like revolving funds, credit lines, and contingent business loans that are forgivable under specified conditions.
- **Reduce commercial risks and provide financing guarantees.** For example it was suggested to the World Bank that it could provide a “secondary mortgage market” to provide guarantees against project risks. Another proposal said the World Bank could induce governments to guarantee power purchase agreements with utilities, so that project developers could more easily obtain commercial financing based upon the power purchase agreements.
- **Finance pre-feasibility studies for small companies.** Firms need funding for pre-feasibility studies to support their project development work, often lacking the resources themselves to invest in studies with uncertain outcomes.

In general there seems to be a big room to explore the full potential of professional financial instruments within the field of promotional financial institutions for the benefit of RE support. The mix of financial instruments used by these institution depends on the kind of RE technology and its competitiveness, as is illustrated by the following table with examples of KfW support for RE:

Examples for different Financing Strategies for RE KfW Projects				
Market competitiveness (Financially viability)				
Grid	Close to		Far from	
Grid-connected	1	<p>Commercial financing is viable, grant financing for incremental costs may be necessary for a transitory period.</p> <p>Commercial financing: <i>Hydro-power projects</i></p> <p>Concessionary Financing (ODA): <i>Windparks in People’s Republic of China, Egypt and Morocco</i></p> <p><i>Geothermal plant Olkaria, Kenya</i></p> <p><i>Biogas generation plant, Turkey</i></p>	3	<p>Special funds for kick-off financing to achieve cost reduction through economies of scale and technological leap-frogging, temporary subsidies justifiable through technological development and competitiveness:</p> <p><i>Photovoltaic energy generation and hydropower in combined power production (project in design phase)</i></p> <p><i>Solarthermic power generation plant Mathania, India</i></p>
Off-grid	2	<p>High investment costs and low purchasing capacity of target group make high subsidies necessary. Finance Channeling through special funds/ODA financing and output-based aid, prefinancing schemes:</p> <p><i>Biogas home digesters in Nepal</i></p> <p><i>Solar home systems in Morocco, South Africa</i></p> <p><i>Use of photovoltaics for water pumps</i></p>	4	<p>High subsidies necessary with small impact on market or technology development.</p> <p>Financing only opportune under very special framework-conditions</p> <p><i>Solar dishes, photovoltaic networks with diesel back-ups</i></p>

Source: Hellstern, Elke (KfW) - *The Financing of Renewable Energies, The Financing for Development Conference in Monterrey and its Prospects for Renewable Energies*

It is quite obvious that the more commercially viable a project is the lower the component of grants and subsidies should be. In the field of on-grid RE close to competitiveness the development banks are mainly offering to complete financial packages of project sponsors by catalytic or complementary financial packages reducing risk and/or cost to make the project financially viable. Off-grid and far from competitiveness a much higher subsidy component is necessary requiring a financial package with a much higher grant element.

4.3 GEF and CDM Finance

Generally there are high expectations on global environment programs like the Global Environment Facility (GEF) and the Clean Development Mechanism (CDM) to contribute to alleviate the problems of financing of RE projects.

4.3.1 GEF Finance

The Global Environment Facility (GEF) is an intergovernmental fund for environmental protection. The GEF is managed jointly by the World Bank, UN Environment Programme (UNEP) and UN Development Programme (UNDP) and provides non-reimbursable funding for the incremental costs of enhancing international environmental public goods in projects. Countries can obtain GEF funds if they are eligible to borrow from the World Bank (IBRD and/or IDA) or receive technical assistance grants from UNDP through a country program.

One of its operational programs seeks to reduce GHG emissions associated with energy consumption and production through increased use of already commercially viable REs. Any eligible individual or group may propose a project. GEF finance is “**incremental cost**” financing of marginally economically viable **RE projects** – to permit an early entry of these on national power markets. GEF funds the additional costs associated with transforming a project with national benefits into one with global environmental benefits; for example, choosing solar energy technology over coal or diesel fuel meets the same national development goal (power generation), but is more costly. GEF grants cover the difference or “increment” between a less costly, more polluting option and a costlier, more environmentally friendly option. The value of incremental cost finance for larger scale RE-projects was partly undermined by an ideologically driven refusal by GEF to co-finance CDM-projects.⁵⁸

From 1991 till 2003 GEF has provided about US-\$ 840 Mio for renewable energy activities. Three **trends** can be witnessed:

- Support to hardware investments is becoming increasingly less important for GEF.
- There is a move away from direct investment subsidies and towards **risk sharing contingent finance**.
- The direct subsidy payment has shifted from the “per MW-subsidy” form to a “per MWh subsidy” during the initial five years of operation.

⁵⁸ Part of the incremental cost financed by GEF, therefore, was the artificial cost increase from not allowing CER-revenues to be used to reduce the cost of the energy output.

The “per MWh subsidy” involves less risk sharing than the “per MW-subsidy” and, unlike the latter, does not reduce the size of commercial project finance. However, it facilitates project finance by allowing a five year loan to be included in the package equal to the NPV of expected per MWh-subsidy payments. One can expect, though, that the “per kW-subsidy” will continue to be used for micro- and mini-hydro power projects and biomass-based generators in rural electrification. One reason for this is reduced costs of transactions; the other the high value of reducing the upfront size of project finance in the rural context of weak financial intermediation. In PV-finance GEF has dropped the initial “per Wp-subsidy”, which was a total misunderstanding on both market-expansion and social equity grounds. GEF now gives “per system subsidies” to systems in the 18-50 Wp range.

The **Renewable Energy and Energy Efficiency Fund (REEF)** is a specialized fund of the **International Finance Corporation (IFC)**, focused on investment in private sector projects in the renewable energy and energy efficiency sectors in emerging markets. The fund is targeted to be capitalized by the **Global Environment Facility** (US\$30 million), IFC, and a group of large investors (US\$210 million), which stand to be able to leverage projects with total costs of US\$300-800 million.

REEF consists of an equity fund with capitalization of US\$110 million and a debt facility with a loan portfolio of US\$100 million. The GEF funds are intended to be used for grants to finance incremental costs and/or mitigate risks of investing in projects that may not be acceptable to commercial investment funds, because of their inadequate risk-adjusted rate of return. However, REEF will never serve as the principal investor on a project. The underlying goal of the REEF is that it is to catalyze further investment. This is to be done by making investments in:

- grid-connected renewable energy power projects;
- small-scale off-grid power systems that use renewable energy technologies (e.g., small distributed mini-grids);
- local manufacturing companies and financial intermediaries involved in the renewable energy and energy efficiency sector.

The debt and equity components of the REEF are able to invest primarily in projects with total costs less than US\$50 million. However, the equity fund seeks to allocate at least 20% of its resources to smaller projects (less than US\$5 million). In terms of geographic focus, the guidelines also specify that not more than 60% of the funds can go to one particular region. The regions are defined as Asia, Latin America and the Caribbean, Africa and the Middle East, Central and Eastern Europe, and the Newly Independent States.

Source: UNDP - Sustainable Energy Strategies – Materials for Decision Makers

4.3.2 Clean Development Mechanism Finance

The basic principle of the CDM is simple: It allows developed countries to invest in low-cost abatement opportunities in developing countries and receive credit for the resulting emissions reductions (CER). Developed countries can then apply this credit against their 2008-2012 targets, reducing the cutbacks that would have to be made within their borders.

As a result, projects in these countries will get a new source of financing for sustainable development in the introduction of clean and renewable technologies by selling their emission reduction on the market, for e.g. to the Prototype Carbon Fund (see box). Thus carbon finance like CDM potentially could provide bankable, hard-currency revenue streams for clean technology projects.⁵⁹

The **Prototype Carbon Fund (PCF)** has pioneered the market for greenhouse gas emission reductions (ERs) as a CDM project facility. The IBRD is the Trustee of the PCF, and purchases Certified Emission reductions on behalf of the Participants in the Fund, Six governments and 17 companies—including power and oil companies from Japan and Europe, and leading global banks, which have contributed US\$180 million in funds to the PCF, committed to purchase ERs from approximately 30-40 projects.

PCF prefers to pay for ERs after verification and upon delivery of a certificate confirming that the ERs have been achieved in compliance with relevant criteria. As a rule, PCF payments to the project entity on delivery of ERs should be considered as a revenue stream against which the project entity can invest equity or borrow. (-> Monetization Chart) As a pilot activity, the PCF does not endeavor to compete in the Emission Reductions market and is scheduled to terminate in 2012.

These revenue streams can increase projects' financial IRRs by several percentage points, depending on the technology and on the "carbon intensity" of the fuels displaced. Through financial engineering of carbon transactions, banks can mitigate currency convertibility and transfer risk and, in some cases, country risk and lending ceilings.

The **effectiveness** of Clean Development Mechanism (CDM) for facilitating investments in RE is limited:

- The CDM-approval process imposes high costs of transaction.
- At CER-prices of around US\$4 per ton, the NPV of future CER-revenue amounts to no more than about 2% of the initial cost of investment in windfarms or small hydropower.⁶⁰

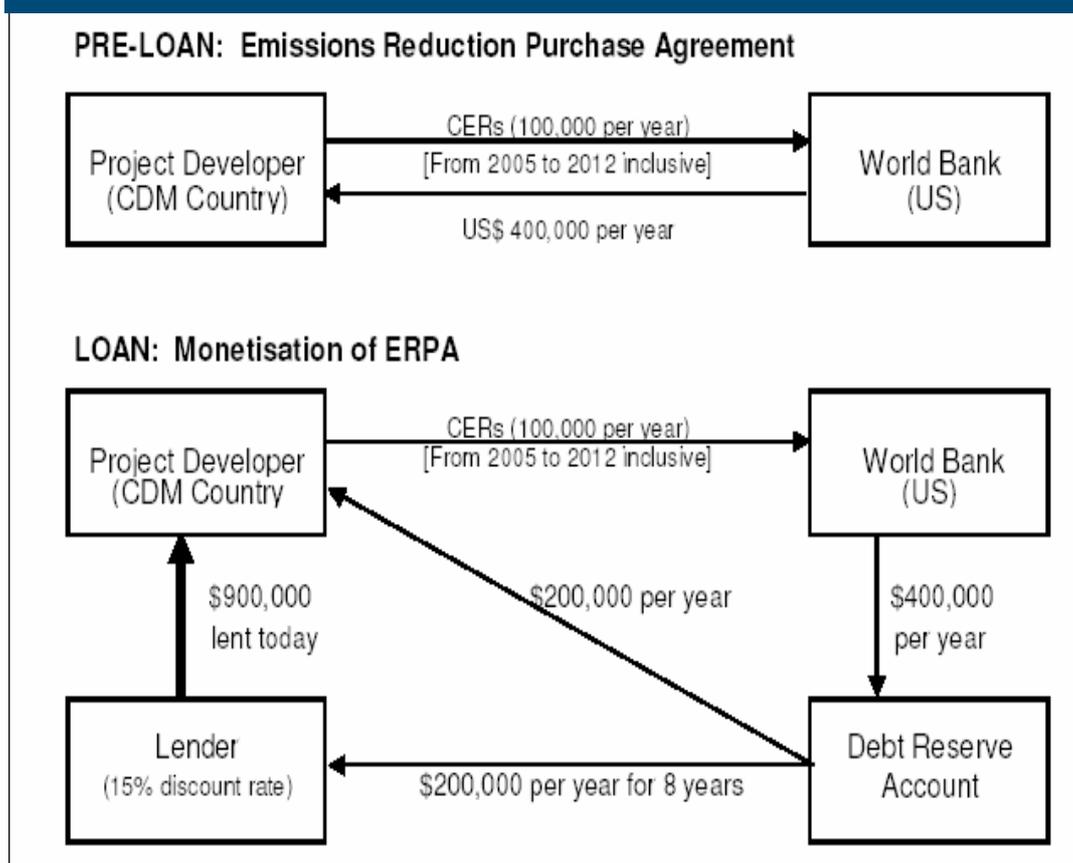
Thus Project Developers are experiencing a financing gap because they are unable to monetize their Emissions Reductions Purchase Agreements (ERPA). **Monetization** potentially could fill this financing gap, by bringing additional capital to clean energy project developers:⁶¹

⁵⁹ Summary of Workshop on Tools for Risk Mitigation in Clean Infrastructure, Paris, November 19-20, 2003

⁶⁰ The small percentage belittles the psychological impact of the CDM-mechanism on expanding the market for renewable energy. Renewable energy lobbyists in host countries use the "ability to attract CER-payments to the national economy" as an argument to increase political support for RE.

⁶¹ Source for the chart: Usher, Bruce – ERPA Monetization, UNEP/SEFI 2004

Monetization of Emissions Reductions Purchase Agreements (ERPA).



However, “financing through the CDM will remain a fringe activity until complexity is reduced and policy risk is eliminated.”⁶²

With reference to the share of CER-income in total project revenue, it is useful to distinguish between three **categories of projects**:

- CER-revenue intensive projects are projects, where the net present value of future CER-revenue is higher than the initial cost of investment. RE-projects are not found in this category, which is made up of projects, where methane use, recovery and generation forms part of the activities.
- In CDM projects with a modest, but commercially essential CER-revenue content, CER-revenue does not make up the bulk of operating income. But the ability to access CER-revenue, turns a marginal investment opportunity into a commercially interesting opportunity. RE-projects with relatively low costs of production per kWh can be found in this category. Examples are co-generation projects in the sugar and paper industries (biomass-based fuels), and wood processing factories (use of wood wastes/residues).
- CDM-projects, where CER-revenue secures commercial viability if a third party in addition gives subsidies to the project. The bulk of RE-projects are in this category.

⁶² Usher, Bruce – ERPA Monetization, UNEP/SEFI 2004

There are exceptional cases – such as a marginal hydropower plant – where CER-revenue turns a non-commercial renewable project into a commercially viable investment opportunity.

☞ In general, CER-revenue represents either “icing on the cake” for project developers and/or a means for the state to reduce the cost of national subsidies to renewable energy projects. CDM promotes investments in RE only when it is part of a larger financial support package.

4.4 Subsidies

4.4.1 Justification of financial support to RETs

One can identify seven justifications of **RE-subsidies**, each driven by a specific motivation:

- 1) Subsidies given to RETs to **compensate for price distortions in the energy market**, which prevent economically viable RETs from competing on equal footing with conventional power supply. (e.g. subsidized natural gas prices in thermal power);
- 2) Subsidies to RETs to **compensate for the non-inclusion of external costs** in the financial cost of production of conventional power (environmental costs or macro-economic costs of fuel price risks);
- 3) Subsidies to RETs to **compensate for weaknesses in the financial markets**, which prevent RETs from getting access to debt finance on competitive terms with conventional power plants;
- 4) **“Market jump-starting” subsidies to RETs** with a mass market potential (household PV-systems), which create the minimum demand needed to motivate entrepreneurs to invest in an effective marketing and after-sales-service infrastructure for the RET;
- 5) **“Learning curve” subsidies to RETs** with a strong potential for technological progress (wind energy, PV-systems). They create the mass market demand which motivates manufacturers of RET to invest considerable amounts in R&D bringing down each year the cost of production of new generations of the RET. Subsidies, which increase consumer demand for new RETs, thus, expand the market directly in the short term and, by accelerating the rate of cost reductions in the subsidized RET also in the long term;
- 6) **“Sustainable development” subsidies to RE**. These subsidies allow RETs with an economic cost of production higher than conventional power production (according to conventional economic cost analysis) to gain market shares. Because conventional power production uses finite resources and contributes to global warming it is not considered to be sustainable;
- 7) **“Picking the winner” subsidies to R&D&D** in potentially promising RETs that are at the pilot stage of development.

4.4.2 Portfolio of Financial Supporting Instruments

The portfolio of financial support instruments used to increase the market share of RE-generated electricity is summarized in the matrix below.

- The rows identifies four **potential financing sources** for subsidies to RE:
 - (i) subsidies financed by the public budget,
 - (ii) subsidies raised through electricity invoices,
 - (iii) subsidized export credits for RETs and soft loans from development banks,
 - (iv) payments for greenhouse gas reductions from use of RE
- The columns point out three **potential subsidy targets**:
 - (i) subsidies to investments,
 - (ii) subsidies to output
 - (iii) subsidies to the cost of operation.

Portfolio of Subsidy Instruments for RE			
Financing Mechanisms	Subsidy Targets		
	Cost of investment	Price of output	Operating Costs
Public Budget Finance Instruments	<ul style="list-style-type: none"> • direct capital subsidies • soft loans • VAT exemption • Import duty exemption • Accelerated depreciation • Tax holidays on income • Subsidies to exporters of RET- equipment • Subsidies to R&D&D 	<ul style="list-style-type: none"> • topping-up premiums to producers • production tax credit • topping-up premiums to consumers • VAT/excise duty exemptions • Public green electricity purchases 	<ul style="list-style-type: none"> • Subsidies to the marketing of green electricity
Electricity invoice financed instruments	<ul style="list-style-type: none"> • Grid reinforcement (deep connection costs) paid by utilities • Part of (shallow) connection costs paid by utilities • R&D&D of power utilities on interfaces between windfarms and regional/national power system 	<ul style="list-style-type: none"> • Premium feed-in-tariffs for RET-electricity • Renewable portfolio standards with or without RECs • Eco-taxes on alternative fuels • Voluntary green consumer premium tariffs 	<ul style="list-style-type: none"> • Wheeling tariff below the true opportunity cost of utility • Balancing costs charged to consumers not to generators • Use-of-system charges fixed below cost • Subsidized administration of green invoicing
Subsidized export credits to RETs	<ul style="list-style-type: none"> • Soft loans for RE-investments • Grants for project preparation 		
Greenhouse gas payments		<ul style="list-style-type: none"> • CO₂-certificate • CER-/JI revenue/kWh 	

All strategies for increasing the share of RE in national energy supply involve use of subsidies to some degree, and all use a portfolio of subsidy instruments to promote the defined goal. Most subsidy instruments in the table are complementary to each other, and the few that are direct alternatives can be modified to co-exist. There is, thus an **infinite” range of subsidy combinations.**

The “ideal” subsidy package depends on its political expediency, the scope and scale of potential RE-supply in the country, and the power market philosophy of the Government. This chapter looks at the pros and cons of individual instruments and the determinants for their use. The issue of combinations of instruments, which together represent best practice, is taken up in chapter 5.

The rows in the table are arranged according to the worst case scenario from the point of view of the Ministry of Finance in the host country, starting with instruments paid by the public budget and ending with foreign payments for national CO₂-credits.

The first two rows (below the heading) show national sources of subsidy finance; the use of which involves real trade-offs. Grants from pluri-annual bilateral aid programs, used to cofinance RE-projects, are included under “tax payer financed instruments”, as finance from bilateral donor aid programs is transferred to the national ministry of finance (in principle, being a line on the national budget) and could have been allocated to other sectors.

Getting approval from the Ministry of Finance for raising subsidies to RE from the national budget, is very difficult in all developing countries except in rapidly developing and larger countries such as China, India and Brazil. To get “electricity consumer pays” financing instruments accepted is equally difficult as also the financial situation of the power companies normally is tight, giving power companies strong motivation and arguments to fight against being imposed new financial burdens.

4.4.3 Taxpayer financed Subsidy Instruments

4.4.3.1 Type of instruments

Strategies that rely on the **tax payer** to subsidise renewable energy systems use the following instruments:

- **Direct capital subsidies.** State grants to purchases of renewable energy equipment are used in industrialized countries for jump starting demand for a RET. In the Netherlands, until 1995, investors in wind farms were given a 30% subsidy; in Denmark until the mid-1980s. In Spain, during the second half of the 1990s, investment subsidies of up to 40% were given to investment in RE; wind farms could be no larger than 20 MW each; and the subsidy limit per project was ESP 400 million (US\$ 2.8 million). Some German “Länder” give a capital subsidy of up to 8% to wind energy projects. In developing countries, market jump-starting subsidies are given to household PV-systems, while investment subsidies to grid-connected RE-generators are an instrument to facilitate financial closure.
- **Soft loans** are a different way of giving capital subsidies. In Germany, investors in wind farms can get 10 year loans at a rate of interest of 4.75%.
- **Tax exemptions / tax rebates** are used to either reduce the cost of the investment (the first three below) or to increase the RE-investors net revenue after taxes from the sales of the output (the last item below):

- exemption from payment of VAT on renewable energy equipment
 - exemption from import duties for renewable energy technologies
 - accelerated tax deductions for investments in renewable energy,
 - tax breaks on returns from investments in environmentally sound initiatives,.
- In India, the VAT on renewable energy equipment is lower than the normal rate. In China, the imports of renewable energy technologies used to be exempt from payment of import duty; in India this is the case for renewable energy technologies not produced in India. In the Netherlands, such investments can be written off against tax at any time – a scheme, which is particularly attractive to firms with fluctuating incomes. In Navarra, Spain, wind power investors can deduct up to 15% of their earnings from wind power before handing in their tax returns. In Denmark, a wind turbine owner does not have to pay taxes on the level of production, which equals his annual power consumption. Similar tax breaks exist in the Netherlands.
 - **Top-up premium payments per kWh** are paid by the state budget to producers making use of renewable energy. In Denmark until 2001, IPPs and utility companies were paid a so-called CO₂ premium of 0.1 DKK/kWh (=1.5 US-cents) for power produced on the basis of renewable energy. IPPs, were paid an additional premium of 0.17 DKK/kWh (=2.5 US-cents). On top of that, the power utilities were obliged to pay IPPs a tariff equal to the avoided cost of production (around 4.3 US-cents). An indirect form of the topping-up subsidy is the production tax credit of 1.5 UScents per kWh in the USA.
 - A kWh premium is **paid to electricity consumers** that purchase “green energy” from their power companies.
 - **Public sector purchases** of “green power”. In this case the public sector through its green electricity purchases provides both direct demand for green power and assists in developing a voluntary green market in general.
 - **Lower VAT** on power produced by renewable energy. In the Netherlands, the government set the rate of VAT on green energy to 6% compared to the normal rate of 17.5% for conventional energy. This permits renewable energy producers to raise their prices net of VAT, and still be competitive in the eyes of the final private consumers, who cannot deduct VAT payments.
 - **Eco-taxes** / green taxes on non-renewable forms of energy reduce the gap in the market prices of RE and non-RE forms of energy. In theory the approach is ideal, since it intends to “internalise” the “external” costs of non-renewable energy (cost of environmental damages) into the market price of non-RE. In practice, it runs into problems in countries with free cross-border trade. Energy intensive industries must be exempted to avoid bankruptcy due to competing imports from countries that do not impose green taxation on their manufacturers. Domestic electricity generators selling into open regional (cross-country) markets get hurt if their foreign competitors do not pay eco-taxes on their fuel consumption.
 - **Export subsidies** to exporters of renewable energy technology. The Netherlands had a generous program in place to subsidize exports of renewable energy technologies to non-OECD countries. The belief was that a larger market for national producers would reduce the cost of production also domestically due to economies of scale. Between 1993 and 1996, the German program Eldorado paid 70% of the list price of wind farms in a number of developing countries.

4.4.3.2 Time frame for tax payer financed instruments

Tax payer pays instruments play an essential role in the **initial market start-up phases**. Once the RE-market achieves a significant penetration on the power market,

say a 5% penetration, the cost of the subsidy burden to the public budget becomes increasingly heavy, and the need to “mainstream” RE into the general procedures and rules of the power market increasingly urgent. Inevitably, then tax payer pays instruments begin to be phased out – one after the other - and replaced by mandated “electricity consumer pays” instruments.

The public subsidy instruments most likely to remain are tax write-offs and public green electricity purchases.

In developing countries with small power markets and low per capita income, foreign donor may fund the tax payer pays instruments.

4.4.4 Subsidies to RE financed by Electricity Consumers

4.4.4.1 Mandated Market: definition

All “electricity invoice-financed subsidy instruments” are “forced subsidies to RE” created by regulations. The exception is the voluntary green electricity scheme. A Mandated Market is defined to include any scheme for RETs where there is:

- an obligation on transmission and distribution companies to connect RETs,
- a right for commercial power suppliers to recover legally-imposed surplus RET-costs from consumers and
- a national (or state) policy target for the penetration of RE on the market

4.4.4.2 Subsidy cost effectiveness of Mandated Market Schemes

A key discussion is whether to use a variant of the “**mandated quantity**” approach (a quantified off-take is defined by law, while the economic conditions for windfarms are project specific and defined in individual commercial contracts), or, of the “**mandated tariff**” approach (economic terms for off-take and connections are defined by law and confirmed in standard contracts between the commercial actors).

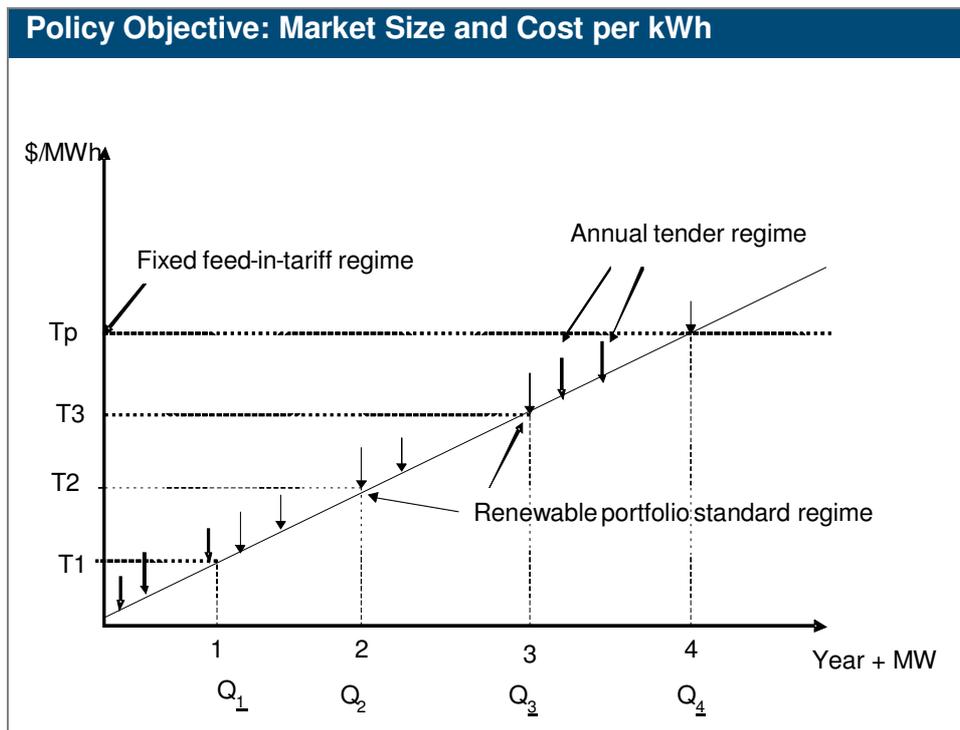
Much discussion in international literature has centered on the supposedly superior subsidy-cost-effectiveness of mandated quantity regimes over mandated tariff regimes. Studies financed by the EU Commission have, in addition, underlined the higher allocative efficiency of an EU-wide “RE-certificate”-scheme, as it allows member countries with high RE-ambitions to invest in “RE-certificates” from RE-projects in other EU countries where costs are lower.⁶³ The theoretical basis of the higher subsidy-cost effectiveness of mandated quantity regimes is illustrated in the chart below.

The small arrows indicate the location of individual RET-projects along the RET-supply curve. We look at the impact to achieve a RE-policy target of Q_4 within four years:

- In a **fixed feed-in-tariff regime**, a tariff of T_p is offered to all projects, allowing a quantity of Q_4 to be reached – either at the end of the four years or before.

⁶³ Once political economy is taken into account, the picture is less rosy. The Netherlands has shown political willingness to import “green electricity”. Yet, in Spain, Germany, Denmark, the strong political support to green electricity would evaporate if it meant investing in RE-plants outside the national territory.

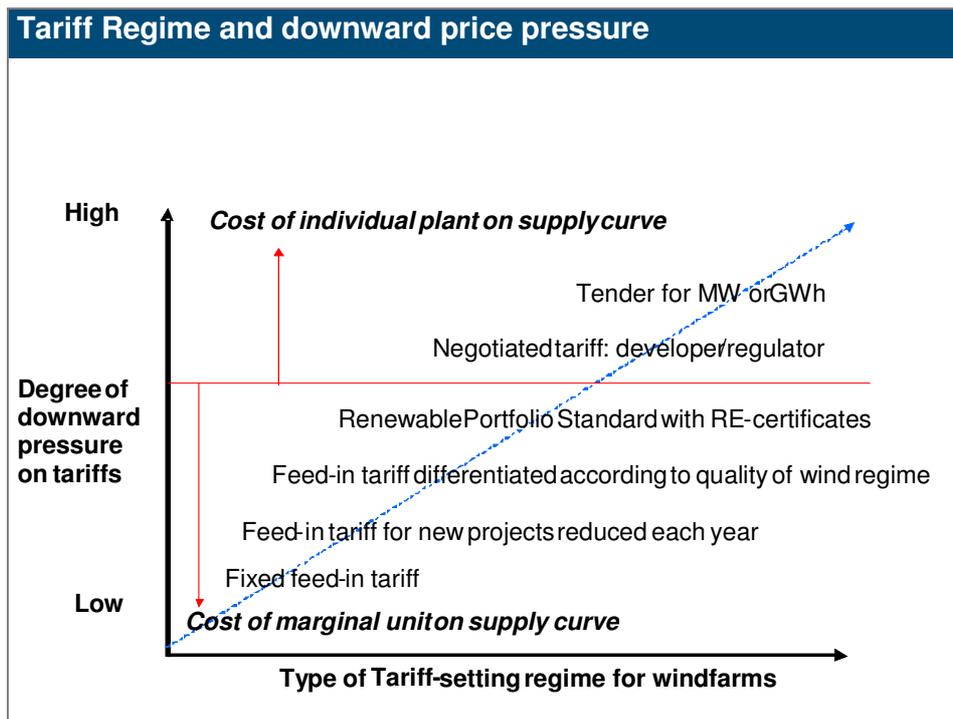
- In a **renewable portfolio scheme**, a quantity of Q_1 would be required in national power supply in year 1 (all projects paid the market clearing price of T_1), Q_2 in year 2 (all year 2 projects paid the market clearing price of T_2), Q_3 in year 3 (all year 3 projects paid the market clearing price of T_3) and Q_4 in year 4 (all year 4 projects paid the market clearing price of T_4).
- In an **annual tender regime**, a quantity of Q_1 would be tendered in year 1, of Q_2-Q_1 in year 2, of Q_3-Q_2 in year 3 and of Q_4-Q_3 in year 4. All projects would be paid the specific price they bid in the tender (an alternative is to offer the marginal bid price to all). Hence, the conclusion that the tender regime results in the lowest RE-tariffs/subsidies and the feed-in-tariff regime in the highest.



The real life differences in the **subsidy-cost-effectiveness** of the three schemes are smaller than indicated by the analysis because policy makers adjust the details of each approach to its specific weaknesses. Year 2004 versions of the feed-in-tariff have largely eliminated subsidy-financed producer surpluses, by using more complex pricing formulas to calculate “individualized” tariff levels.

4.4.4.3 Type of tariff regime and downward pressure on tariff level

The chart below ranks the “subsidy-cost-effectiveness” of different schemes, not taking potential differential dynamic impacts on technological progress into account.



The red line in the chart marks the dividing line between tariff regimes that seek to hit the specific cost of production of individual windfarms (eliminating subsidy-financed producer surplus altogether) and those that tend towards pricing according to the cost of the marginal windfarm.

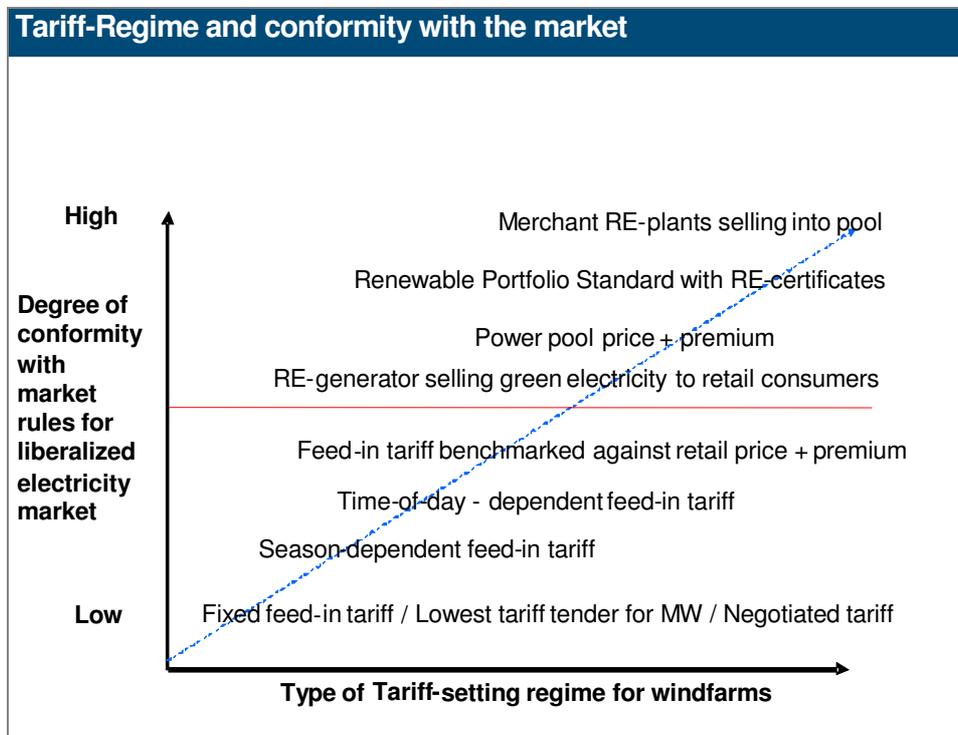
4.4.4.4 Degree of conformity with the general market rules on the power market

PPA-contracts and grid-connection contracts play a much smaller and less commercial role in feed-in-tariff-schemes than in mandated quantity-schemes:

- The economic terms and conditions of contracts in mandated tariff schemes are **law-based**, turning contracts between windfarms and other market operators (transmission company for connections, distribution company for power purchase, etc.) into a formal confirmation of the economic conditions defined by law. Contracts are standard-documents, stating that “power off-take is paid according to terms defined by law”. It may even be that contracts are not used at all (case of Denmark during the 1990s for the power off-take from distribution companies).
- Mandated quantity schemes are **contract based**: the economic terms and conditions for power off-take, use of grid, etc. are not defined by law; they are the outcome of negotiated deals between two commercial parties. The economic terms for a windfarm, therefore, are defined in details in the commercial contracts that link the windfarm to the power market.

Ceteris paribus, mandated quantity schemes allow wind energy to be more seamlessly integrated within the normal rules of the power market. Thus, although the newest FIT-schemes are subsidy-cost effective, the application of specific tariff rules for windfarms works against the survival of the feed-in-tariff in the longer run. Exceptions from rules irritate established market players and reduce the operational effectiveness of power pools.

The international trend, therefore, is to **make frameworks more compatible with the general operation of the power market**. Originally, the market access rules were tailor made to the needs and technical characteristics of wind energy. Now, the pendulum is swinging the other way: the regulatory framework for RET-generators is adjusted to better match the needs and rules of the liberalized power market.



The chart ranks different market schemes according to the **market compatibility dimension**. The red line charts the dividing line between fixed and market-determined tariffs. It shows ways in which the fixed tariff regime is adjusted to “mimic” the outcome of free market forces. In Costa Rica, for example, the rate of the feed-in-tariff, depends on the time of day (higher during peak demand hours) and on the season (higher during the dry season, when hydro-reservoirs are low).

The use-of-system charges – the terms for using the transmission/distribution grid and for operating on the power market - are also increasingly priced to reflect the higher costs of satisfying the needs of intermittent power supply.

4.4.4.5 Burden sharing

An issue in the “electricity consumer pays” strategy is how to distribute the extra cost associated with renewable energy use among the regional and local utilities on an equitable basis. Since wind and hydro-resources are unevenly distributed, some regional companies have a “high” rate of wind energy penetration, others a low rate.

The **renewable portfolio standard** (RPS) approach solves this directly and equitably. In feed-in-tariff and tender systems, a possibility is to let the system operator (either the operator of the power pool or of the transmission system) charge a levy on all traded / transported electricity. The revenue from this levy is then used to subsidise new investments in renewable energy via a tender system (the British NFFO approach), or to

compensate the different distribution companies for the extra-cost of their renewable energy purchase obligations (the Danish “public service obligation”, PSO, approach).

A different approach used in the German Electricity Feed Law during the 1990s was the **hardship clause**. The law obliged regional distribution companies to purchase any amount of power, produced by wind farms in their concession area. The law, therefore, contained a so-called “hardship clause”, which allowed utilities to pass on costs of their premium payments to wind power to the neighboring utility once wind energy reached a 5% penetration.

4.4.5 Smart Subsidies

Subsidy will be necessary, but should be considered as a transitional policy tool only. Subsidies are needed to expand service, but many subsidy programs impact long-term sustainability and distort market signals. The answer are “**smart subsidies**” reaching intended markets only and encouraging least cost option to achieve social goals at least cost while providing incentives for business to serve target markets. Thus, smart subsidies must have the following qualities⁶⁴:

- “They are well **targeted**. A rigorous method is applied to determine who should receive the subsidies; and the same discipline is used to prevent “free riders”.
- They support **least cost options** for service. Smart subsidies are not married to particular technologies or to state implementation of such technologies.
- They **encourage commercial participation** by the private sector. Ultimately, government's role is to formulate an effective business environment for private initiatives to prosper.
- Similar to the government's construction of roads and bridges, smart subsidies are applied to the **front-end cost**. It is when subsidies are given to consumption that sustainability problems arise.”

These are the criteria for the selection of subsidies, which obviously for **different stages** of the technology introduction cycle, are needed in a **different package of subsidy instruments**:

- A “**tax payer pays**” based strategy is useful in the **short term** to get a development process started.
- The “**electricity consumer pays**” strategy is the solution in the **mid term**, as tax based financing would become too expensive.
- However, each of these instruments need some **built-in element of phasing out**, to give an incentive that only **long-run** viable RE is supported.

As an **example of smart subsidies**, the **reduction of the up-front investment** may trigger entrepreneurs to develop RE products and may be applicable to buy down the costs of purchase of available products for consumers. For low-income customers, additional measures are required such as subsidies for **end-user price reductions**. One-off costs of connection, installation or purchase of many energy solutions may be useful within such an approach: biogas generators, efficient stoves, hydropower connections, solar electricity, solar heating.

⁶⁴ Excerpt of: Del Rosario, Tony - Alleviating Poverty by Sustaining Energy Development Accessibility Issues and Innovative Financing, World Energy Council, G8 Energy Ministers Meeting, Detroit, USA, May 1-3, 2002

As a **general international tendency** in the developed countries – with deep pockets and relative high RE ambitions – the following can be observed, which are not always in line with the principles of smart subsidies:

- a shift in the subsidy burden from tax-payers to electricity consumer pays instruments;
- replacement of direct investment subsidies to RE (“per MW capacity” subsidies paid by the state budget) to subsidies linked to the output (per kWh-subsidy);
- focus on elimination of “windfall” subsidy payments (standard subsidies or tariffs creating artificial producer surpluses for best-site RE-operators);
- RE-generators are increasingly charged the full-cost for market access services provided by grid operators and system operators.

A special case under electricity invoice paid instruments is the **voluntary premium market for “green electricity”**, which can be developed by electricity retailers through appropriate branding. Development of the green electricity market requires a sophisticated industrial-commercial base and a large number of relatively wealthy households.

In the tight financial context in most **developing countries**, the most relevant financing sources for RE-subsidies are promotional credits and CER-revenues. Normally, it is not difficult to get political approval for using **soft credits from donors** to co-finance RE-projects. Using soft credits to finance RE-projects may reduce their availability for other sectors in the country, but more often than not, the effect is that more soft credits are attracted to the host country, and less to others. **CER-revenues** and the rare **foreign-purchases of green electricity credits** are technically speaking not subsidies, but market payments for positive attributes of renewable energy. Yet, they are totally “free gifts” to the host country, and are, therefore fully exploited whenever possible.

5 Practice approaches to finance RE projects in LDCs

This chapter shows how some of the essential RE problems are addressed by the interaction instruments presented hitherto in an integrated manner. After presenting basic elements of a **program approach** to promote RE, examples are shown for

- Raising experience and awareness in the financial sector,
- Offering **funds at adequate terms** for RE, incl. the **new financial products** on the capital market and
- how problems of **collateral**
- and **market risks**, the latter by the **re-allocation of risks**, could be solved.

The following table gives an overview on the cases and the instruments addressing the different problems of RE projects:

No.	Problem addressed	Approach	Instrument	Type of RE Energy	Country	Involved Institutions	See Chapter
1	RE Awareness and knowledge in the Financial Sector	Create Experience	Contracting banks to channel loans	RE General	Burkina Faso	ODA	5.2.1
2		Widening the Financial Sector	Creation of a specialized financial institution for RE	RE General	India	IREDA	5.2.2
3	Adequate funds and terms	Commercial Long-term loan	DFI supported commercial financing	Windpower	China	DEG	5.3.1
		Currency Swap	Cross Currency Swap HK\$ to US\$				
4		Two Step Financing	Short-term ODA loans for implementation, which on commissioning are repaid by long-term finance raised on the national capital market	Windfarms	Egypt	ODA	5.3.2
5		Two Step Financing	Bullet loan and liquidity stand by guarantee for follow-up loan	RE Rural electrification mini hydro-plants	Uganda	World Bank, Barclay	5.3.3
6		Securitization	Securitization of Microcredits by commercial bank	RE	India	ICICI	5.3.4
7		Subsidy	Initial investment cost subsidy to private operator	Rural Electrification and RE	Senegal	ODA, GEF	5.3.5
8		Subsidy	Investment cost and operation cost subsidy to private operator	Solar energy	South Africa	ODA	5.3.6
9		Collateral	Guarantee Scheme	Small Firms Loan Guarantee	Solar energy	UK	
10	Risk (Exploring and Operation)	Risk Sharing	Contingent Finance	Geothermal energy		GEF	5.5
11	Market access/ Off-take Risk	Market development	Market pump priming Subsidy	Solar PV		ODA	5.7.1
12		Leasing	Lease-financing with power company	RE rural transmission	Cambodia	ODA, Power Co.	5.7.2
13		Sharing the market off-take risk	Priority access to the power-pool on base of a fixed PPA-tariff	RE	Nicaragua	Government	5.7.3
14		Reducing the off-take risk	Municipality involved as buyer of last resort	RE	South Africa	Municipality	5.7.4
15		Energy pricing	Higher turnover for RE	Premium on tariff for green consumers		RE	

5.1 Basic Elements of a Program Approach to promote RE

As soon as the policy ambition is to “mainstream” RE in bulk power markets and rural electrification programs, one shifts from the RE-project implementation mode to a program-approach to RE.

The optimization process for RE-finance in a program approach concerns the inter-linked processes of structuring project finance and the composition of project revenues in a way which maximizes the benefits to society of investments in RE.

The optimizations of project finance and of project revenue are equally essential elements in the RE-promotion strategy; focusing on one without getting the other right, prevents mainstreaming.

Because of contextual differences between countries and the wide range of instrument combinations, which can deliver similar results, generally applicable recipes for RE mainstreaming cannot be developed.

Instead, this chapter attempts (i) to offer guidance to policy makers on how mainstreaming of RE is to be approached, and (ii) show examples of innovative solutions to concrete problems in finance, but also demonstrates shortcomings of some innovative approaches in practice. This chapter first lists the necessary elements of mainstreaming approaches. Then it uses case studies of optimization concepts to show how new financing instruments, new regulations and institutional innovations can interact to generate the mixture of energy and economic development results, which politicians are looking for.

Large segments of RE-Technologies still not able to attract commercial financing and subsidies are needed for kick-start over a limited period until market distortions and barriers will be eliminated to a large extent, but wide-spread use and dissemination of RE can not be financed through subsidy schemes or concessionary financing, as this would overstress the possibilities of ODA.⁶⁵

At a very general level, best practice mainstreaming of RE calls for the following:

- The quantified policy targets for RE-supply are based on an analysis of the national RE-supply curve and its identification of the country’s commercially viable, economically viable, and economically non-viable RE-potential. Otherwise, quantitative long-term targets are hollow statements with no relevance in practice, which do not strengthen investor certainty about the RE-market, and reduce the risks premiums charged by equity investors and banks.
- A holistic **financing strategy** makes cost-effective use of a mix of new financial risk management instruments, more effective regulations and a carefully chosen portfolio of subsidy instruments to reach the Government’s policy targets for RE.
- **Risks** in upfront financing and in revenue generation are allocated to the agents best capable of handling them.
- The cost-reducing potential of regulatory reforms and commercial finance innovations is exploited fully before subsidies are used to cover commercial viability gaps.

⁶⁵ Seifried, Rolf - Financing Energy Services for Rural and Urban Poor within German Financial German Financial Co- Co-operation operation, Brussels, July 23, 2002.

- The **pricing and subsidy instruments encourage** the lowest-cost RE-supply to be developed; while pilot investments in a “marginally economic RET” are undertaken only if the RET offers a large and realistic supply potential in the long-term.
- “**Electricity consumer pays**” subsidy instruments for RE are normally more effective than “tax payer pays” subsidy instruments with regard to allocative efficiency (right price signals), income distributional impacts and RE-expansion per unit of subsidy.
- **Donor activities** are coordinated and comply with the specific modalities of the program approach. Since donors and Governments in developing countries have routine procedures and forms of providing assistance, which may not be effective within the framework of a program approach, both sides need adjusting.
- **Grant finance** - whether by donors or by Governments – does not substitute for private capital, but is used in ways that leverages the amount of private finance for RE, even when the short-term gains are not evident.
- **Concessional loans** from donors are channeled to RE-projects through the local capital markets, not by bypassing it.
- The **power market rules** provide for an equitable burden sharing of extra costs associated with a penetration of RE between the distribution companies, retailers and large consumers purchasing power on the bulk market.
- **Access rules** in favor of RE-generators are compatible with the general market rules established for the power market, and do not distort the smooth operation of the bulk market for power.

5.2 RE Awareness in the Financial Sector

5.2.1 Contracting banks to channel loans to rural electrification projects - Burkina Faso

Burkina Faso is attempting to separate the grant-financing function of the Rural Electrification Fund (REF) from the debt financing functions of the commercial banks. Mixing grants and commercial loan functions in one single institution may create confusion about the mandate and behavior of the institution.

In Burkina Faso, the government leaves rural expansion to be done by a single national distribution company. Isolated grid projects will be done by local communities, who will set-up a electrification cooperative for the purpose. The REF gives 75-80% grants to the rural investment projects, and the remaining 20-25% in the form of 10 year loans on concessional terms, which are administered by a rural bank on behalf of the REF. The rural bank runs no risk. The idea of the approach is that the local banks will find rural electrification too risky to enter. Administering the loans creates trust between the electricity cooperative (demonstrating its ability to repay loans on schedule) and the rural bank. Thus, when need arises for a major re-investment calling for a bank loan, the bank will be willing to give it.

While the idea of making banks comfortable with rural electrification in the long run is laudable, the approach is high risk. It is against the logic of the long-term institutional objective that the loan terms do not reflect normal commercial terms. The track record of electricity cooperatives created “externally” for concrete projects in rural electrification is not strong. The REF may be too soft in its insistence on loan repayments.

5.2.2 Creation of a specialized financial institution for RE – India (IREDA)

As the capital market was not willing to finance renewable energy projects adequately the Indian Government opted for the creation of a specialized financial institution for that purpose, which seems a rather logic approach and – taking into consideration the results for renewable energy promotion as well as the institution financial side – a fairly successful one.

Indian Renewable Energy Development Agency Limited (“IREDA”) is a Government owned specialized financial institution under Ministry of Non-conventional Energy Sources (MNES) for promoting and financing renewable energy and energy efficiency projects in India. IREDA was incorporated as a Public Limited Government Company in March 1987. Seat of the financial institution is New Delhi, where almost its entire staff of some 100 is working, as IREDA has non branches in the country.

IREDA has evolved into a good, active, financially sound and innovative Financial Development Agency for the Indian renewable energy sector. During sixteen years of operations, IREDA has sanctioned loans to over 1600 projects with cumulative sanctions and disbursements of € 1.1 billion and € 0.5 billion till 31 March, 2003. IREDA has supported about 30% of about 3700 MW of power generating capacity based on renewable energy sources installed in the country so far.

➔ In the case of IREDA we can observe the combination of the use of the local capital market, ODA, tax-subsidies and the utilization of various financial instrument on the lending and on the refinancing side.

IREDA extends **long-term credits** directly to project sponsors (7-12 years repayment period) with a grace period (up to 3 years) at competitive interest rates (9-12% p.a.) to refinance up to 70% of the project cost of renewable energy projects.

IREDA's resources are mobilized from the following main sources:

- Equity contribution from the Government of India
- International Development assistance
- Market borrowings
- Bank and other borrowings

IREDA is availing assistance from various international organizations like International Development Association (IDA), IBRD, KfW, Asian Development Bank and IBRD. As more than 80% of the IREDA's funds are borrowing, their terms and conditions play a crucial role. **Domestic borrowing** are made by tax free secured redeemable energy bonds with a maturity of 7-10 years with a favourable interest rate of 6%. In the case of **foreign borrowings** IREDA needs to hedge against risks of interest rate variations and foreign exchange rate variations with the foreign-exchange swaps and interest swaps.

Although IREDA's non-performing asset portfolio is not neglectable, IREDA's performance compares well with other Indian term lending institutions.

IREDA has satisfactorily performed the operational and institutional responsibilities in accordance with the diverse objectives for which it was created. Despite its fairly young age, IREDA is an able and competent financial institution and has retained its financial strengths through years of very rapid growth and in sectors with considerable technological and financial risks. Furthermore it demonstrated the financial viability for several types of RE projects, which are nowadays – due to this successful example - are financed by the commercial banking sector.

However, in the mid-term view it seems worthwhile to review the **strategic approach** and market positioning of a special purpose financial institution like IREDA:

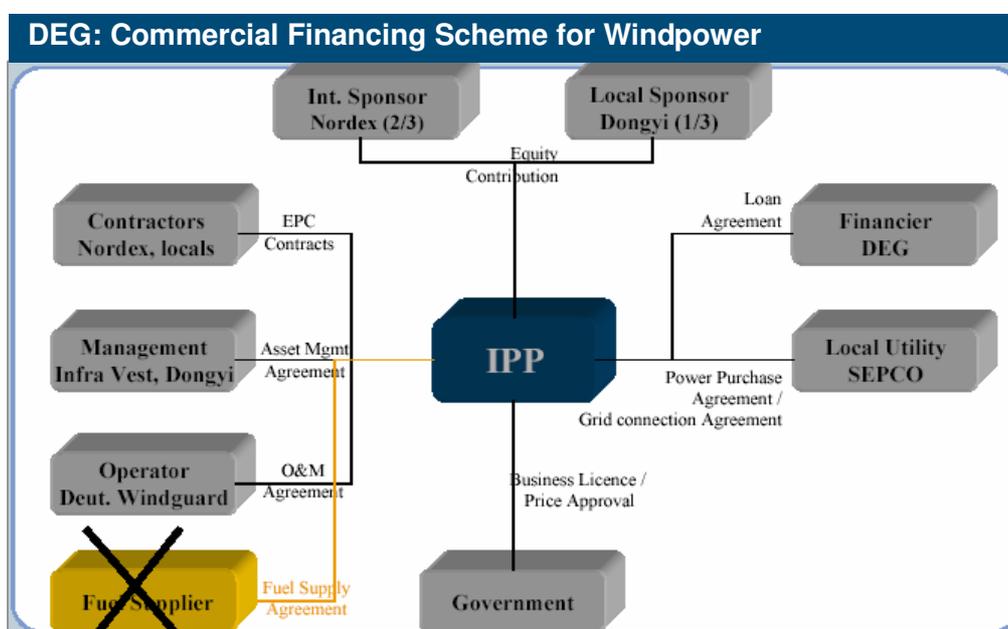
- Due to the limited size of the market it will be rather difficult for a centralized and small institution like IREDA to reach the productivity of universally active banks in its financial and credit operations.
- Thus, it seems rather reasonable to think about a proper division of labour between IREDA and the commercial banks.
- As an apex level institution offering refinancing services or (partial) guarantees, IREDA could make use of its specific knowledge of the market and energy projects, while commercial banks would handle the financial and credit operations more efficiently. Although this may be only a mid-term approach, it would be worthwhile for potential donors to take this strategic option into consideration for the project and program design in the sector.

5.3 Adequate Funds and Terms

5.3.1 DFI structuring commercial financing of renewable energies

Qingdao Huawei Windpower in the P.R. of China, a Joint venture between Nordex Energy GmbH (2/3) and Qingdao Dongyi (1/3), is the case of the first project financed wind park in China.⁶⁶ Its 15 Wind turbines located in Qingdao (eastern coast) have an output capacity of 16.35 MW (about 34.200 MWh p.a.) and a total cost of US-\$ 17.5 million.

DEG financed 58% of the cost with long term loan (maturity of 9 years including 1 year grace period) with a mortgage style repayment schedule. To cover the foreign exchange risk a cross currency swap HK\$ to US-\$ was used.



⁶⁶ Biley, Amichia - How to structure commercial financing of renewable energies – the case of the first project financed wind park in China, International Renewable Energy Conference, Bonn, June 1, 2004

However this financial package would have been too risky if the other major risks would not have been addressed and structured properly:

- The wind yield was assessed by wind studies.
- The EPC risk is borne by the main supplier Nordex with a semi-turnkey contract, and technical completion guarantee.
- There is a tariff subsidy of approximately 79% compared to grid average (financial completion guarantee)
- There is a chance for additional income by carbon reduction (25.000 t p.a.) with possible of 1 million USD if certification is successful.

5.3.2 Introducing new financial products: Two step finance for Windfarms in Egypt

Egypt has at the Gulf of Suez some of the best wind resources in the world. The windfarm effort so far has been undertaken by the New and Renewable Energy Authority, NREA, a former off-spring of the national power company. The build-up of windfarm capacity is impressive, but rests on an artificial foundation. The windfarm investments were financed 100% by soft loans, on-lend to NREA through the national development bank. NREA's PPA-tariff with the national power company of 10 piaster/kWh does not fully cover the costs of operation and debt service.

The exploitation of the economic potential for windfarms requires the removal of energy pricing and capital market barriers. First, *subsidized gas prices* reduce the financial value of saved thermal power production. Second, the *import duty and sales tax on windfarm components* artificially increase the cost of windfarm output. Third; the *national capital market* does not offer project financing on internationally competitive terms. The situation on the capital market can be summarized as follows.

- Investors have to rely on bank loans for their debt finance. Under the best of conditions, a private investor would be offered (i) interest rate of 13%; (ii) loan maturity of 8 years; (iii) 30% equity-self-finance. Non-recourse lending is unlikely.
- The bond market is almost non-existent in Egypt. The equity market is small. There are few listed companies and turn-over of equity is low.

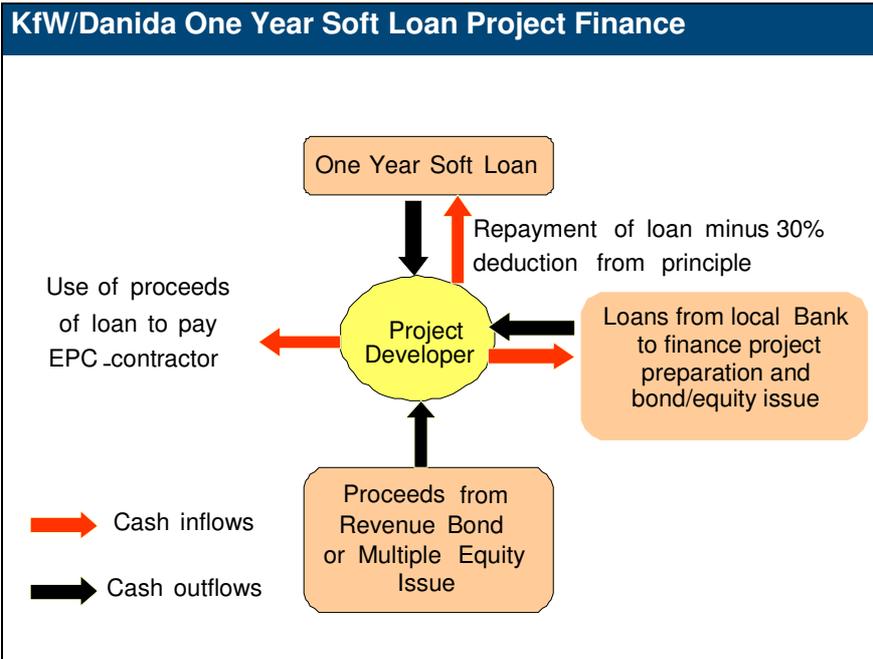
The result is a huge “**financial cost-benefit gap**”, as the minimum PPA-tariff requirement of 27.6 piaster/kWh is 19.4 piaster/kWh higher than the financial value of the cost savings for the “single buyer” in the national power system and 17.7 piaster/kWh above the economic value of the avoided cost savings.⁶⁷

The economic cost-benefit gap is to be closed by a threefold combination of external finance, provided in a manner that interacts with the national capital market:

- All new windprojects are to be developed as CDM-projects to tap CER-revenue, which could bring 1.1 piaster/kWh in revenue (=UScents 0.2).⁶⁸
- Soft loans (mixed credits) from donors continue to be the main source of subsidy support for windfarms. But to eliminate the foreign exchange risk of the long-term investment, donors are asked whether it is possible to provide soft credits as short-term loans, which upon commissioning of the windfarm are repaid by long-term finance raised on the national capital market.

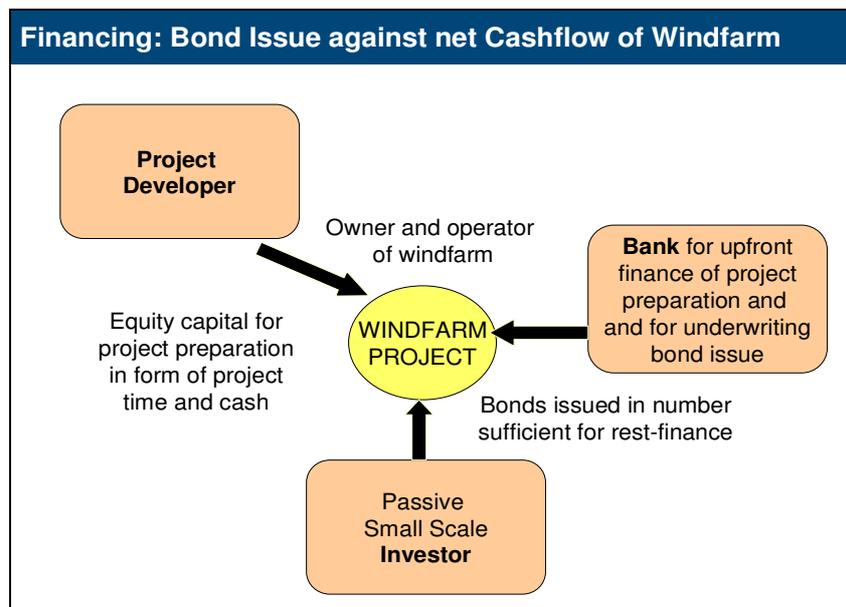
⁶⁷ Due to subsidised gas prices in thermal power production, the financial value of cost savings are lower than their economic value to the national economy.

⁶⁸ The payment falls each year, due to improved thermal power plant efficiency. In 2024, the average emission in steam turbine plants of 0.43 kg/CO₂ triggers a payment of 1.0 Piaster/kWh.



A potential means to reduce the cost of capital and increase the maturity of debt, is to take windfarms, developed by private project developers, “public” (shares or bonds sold by a public offering) upon commissioning, instead of being kept “private” (equity is owned by the project investor and not listed as shares on the stock exchange). Two financial innovations could be tested:

- Long-term revenue bond issues backed by the revenue stream of a windfarm and sold on the open market to small-scale and institutional investors.



- The Danish-German “windfarm ownership certificate” – or “partnership” model, where non-listed ownership shares in a specific windfarm are sold to a multitude of

individual investors. Shares are not publicly listed, but purchased and sold through the developer company managing the windfarm.

The new financing proposals may be based on rather optimistic assumptions. The potential rewards, on the other hand, would be especially high: the introduction of the new financing instruments, if successful, will have a cross-cutting importance for the economy, which goes beyond the windfarm sector.

5.3.3 Bullet loan and liquidity stand by guarantee for follow-up loan - Uganda

Uganda is a developing country with no capital market, but a banking sector with good basic potential, which is slowly re-emerging after having been in ruins after the civil war in the 1980s. Credit-worthy investors with strong collateral can get loans with up to eight years maturity, provided they co-finance 50% of the investment with their own equity. Yet, except for loans to major agro-business like tea plantations and sugar processing plants, banks have little presence in rural Uganda.

Uganda carried out a **power sector reform**, which broke up the previously state owned monopoly utility UEB into generation (to be privatized), transmission (kept in state hands), the interconnected distribution system (privatized as one concession) and dispersed isolated grids (held by successor-UEB in one portfolio for later privatization). The **Rural Electrification Fund**, REF, was created by the Government as an integrated element in its overall reform of the power sector.

National **banking regulations** prevent banks from providing loans with maturities longer than 8 years. Yet, if the commercial banking sector is to be an effective instrument for the co-financing of rural electrification and RE-investments, loans must have longer maturities.

The obstacle can be circumvented by offering a **bullet loan** to an investor in a rural electrification and renewable energy project.⁶⁹ An investor in need of a 15 year loan is provided with an eight year loan, but the amortization profile is similar to that of a 15 year loan, except that there is a “bullet payment” due at the end of year 8, when the remaining principal has to be repaid. At that time, the bank gives a new 7-year loan to the investor to pay the bullet payment; the annual amortization payment remains the same.

The procedure poses a **liquidity risk for the bank**: the bank may at the end of the seventh year period be in a liquidity crunch, preventing it from giving the seven year loan to the bullet-payment. This risk can be mitigated by **liquidity stand-by guarantees** by a third party. It steps in, when the bank, due to shortage of liquidity, is unable to give the investor a new 7-year loan when the bullet payment is due.

The bullet-loan approach is pilot-tested in the financing of the **West Nile rural electrification project**, a regional grid project, which is supplied by power from two minihydro plants under construction. The World Bank gives a loan to the Bank of Uganda, which onlends the loan to the commercial bank Barclay at the average cost of capital to Barclay.

⁶⁹ A bullet loan is a term loan with periodic instalments of interest, where the entire – or a sizeable part – of principal is due at the end of the term as a final payment. The final payment on a bullet loan is sometimes referred to as a bullet.

Barclay offers the investor, who is a blue-chip client, a loan for seven years, but the client knows that in the end he will de facto get a loan for 15 years. The repayment rate is based on 15 years. To reduce the risk for Barclay a **separate credit support facility** is established, which places funds into an account to accumulate enough funds to pay the required bullet payment at the end of year 7 and take over the rest-loan. Barclay pays a fee for that facility, which is passed on to the borrower via an increase in the interest rate.

That the bank loan, which is enabled through this mechanism, provides only about 10% of total project finance, shows how difficult and long-term task it is to develop commercial project finance for rural electrification.

5.3.4 Securitizing micro-credits via partial payment risk guarantee

It is well-known that the development of a mass market for solar home systems in a dealer-sales approach depends on the availability of micro-credits to assist households with the co-financing of the investment in the systems.

Finance for these can be provided through dedicated solar home system credit lines provided by donors to micro-finance institutions or by raising funds from the local finance markets. An innovative example of the latter is the securitisation of microcredits in India. In 2004, ICICI, an Indian bank, paid \$4.3m for a portfolio of 42,500 loans from SHARE, a microfinancier.⁷⁰ It differs from the more familiar process of securitisation car-loans or home mortgages in a number of ways:

- SHARE shall be responsible for collecting the loans.
- The securitisation will not be “asset-backed”; ICIC will have as collateral a “first loss” guarantee of an 8% deposit of the total from the Grameen Foundation, a charity devoted to propagating microcredit.
- There is as yet, no secondary market for the securities, though ICICI is talking to Crisil, a credit rating agency, about the prospects for its rating the paper.

All three parties benefit:

- SHARE secures a new source of funds, off SHARE’s balance sheet, at a cost that is three to four percentage points cheaper than it pays for a bank loan.
- Grameen sees its cash deposit multiply twelve fold in terms of loans to poverty stricken borrowers.
- ICICI manages to reach borrowers it could never otherwise approach, and leaves most of the administration to SHARE. This helps it meet a Government-set target of directing 40% of its total lending to “priority sectors”, including 18% to farmers.

5.3.5 Initial investment cost subsidy and GER Grant – Senegal/Rural Electrification

The IDA/GEF financed Senegalese rural electrification project aims at supporting the development of access to electricity services in rural areas in Senegal through a **fee-for-service model**, by offering an **initial investment cost subsidy to private operator** selected under an international competitive bidding process. The unserved rural

⁷⁰ Source: *Economist*, February 7, 2004

areas in Senegal are divided into 17 “non-commercial” concessions, meaning electricity concession in require of subsidies. The concessions are assigned to bidders through tenders. The concession is technology neutral, meaning that both grid and off-grid electrification is authorized. An additional GEF subsidy mechanism encourages the use of SHS.

The selection criteria of the bidding process to select future rural electrification concession operators are the following:

- A **volume of subsidy financed by the IDA loan** is targeted for each concession and announced in the Request of Proposals. Eligibility of proposals will include minima of connections to be achieved (detailed by sub-regions of the concession).
- The winner is the bidder who commits to serve the highest total number of individual users.

The **GEF grant** is used to ensure a level playing field for RE:

- a certain amount of GEF grant is allocated to each concession, and announced in the Request of Proposals;
- the bidder who offers to use renewable energy may claim for an additional subsidy which comes from the allocated GEF grant;
- there will be a ceiling defining a limited maximum unitary amount of GEF subsidy for each renewable technology (for instance max \$ of GEF subsidy per Wp installed in case of photovoltaics). This ceiling will be defined according to the lesser of the values of subsidies observed in other WB projects for the same technologies, and the incremental cost calculated in the Project Brief;
- the selection criteria to identify the winning bid remains the maximum number of consumers served using both the non-targeted “IDA source” of subsidy and the targeted “GEF subsidy”.

This way the bidders will receive a double incentive:

- to increase the proportion of renewable in their proposal, because of the additional “GEF” subsidy they can get to help overcome the adoption barriers,
- to claim for the lowest “GEF” subsidy per renewable energy based system, since they need to maximize the number of consumers served to win, using the global amount of subsidy (IDA+GEF) allocated for the considered concession.

The approach has interesting merits. The weaknesses are (i) that the SHS-system sizes to be used are pre-defined and (ii) that some of the 17 concessions may not attract any bidders.

5.3.6 Fee-for-Service PV-Concessions - South Africa

The fate of the fee-for-service concessions in South Africa shows the **perils** of public-private-partnerships for social projects that depend on heavy **subsidization** during the **investment phase** as well as during the **operating phase**:

As early as 1997, the Department of Mining and Energy (DME) in South Africa had identified a number of under-serviced geographic areas, suitable for the off-grid electrification of some 300000 rural dwellings over ten years using stand-alone home solar systems. To make the projects viable and sustainable, a capital subsidy of R3500 per installed home solar system would be funded from the fiscus through the DME.

- Interim concession contracts of 18 months were intended as a pilot phase from which lessons could be learned for the final 20-year concessions. In 2001, these in-

terim tri-partite contracts were eventually signed for each of five concession areas, between the concessionaire, the National Electricity Regulator (who acts as an agent of the DME), and Eskom, as the licensed distributor in the areas.

- However, free electricity promises in election campaigns, broken commitments to concessionaires concerning operating subsidies, made its doubtful, whether the schemes would be sustainable in the longer term. The **concessionaires** suffered serious damages to their reputation and credibility with suppliers and customers, as their promised installation and connection dates were delayed, and the fee-for-service first dropped substantially and then increased by 200%.
- The Eskom/Shell concessionaire's technical partner for the manufacture of the home solar systems, Conlog, experienced some early technical problems in the pilot phase and has since ceased manufacture of the systems due to an "unsustainable business case" including a limited and erratic local demand that is inadequate to support further developments required.

This case illustrates that – despite all good intentions at the beginning – these rather complex schemes with many partners are especially prone to politically or commercially motivated stretches that question the rules of the game in an environment which is still developing in legal terms. To ease such risk, these approaches for the RE promotion could benefit substantially if they would include some forms of Partial Risk Guarantees.

5.4 Collateral Problems

The UK's **Small Firms Loan Guarantee (SFLG)** scheme can serve as a model for how commercial lending can be directed from banks and towards PV-system dealers and developers of rural electrification projects who want to expand their activities.

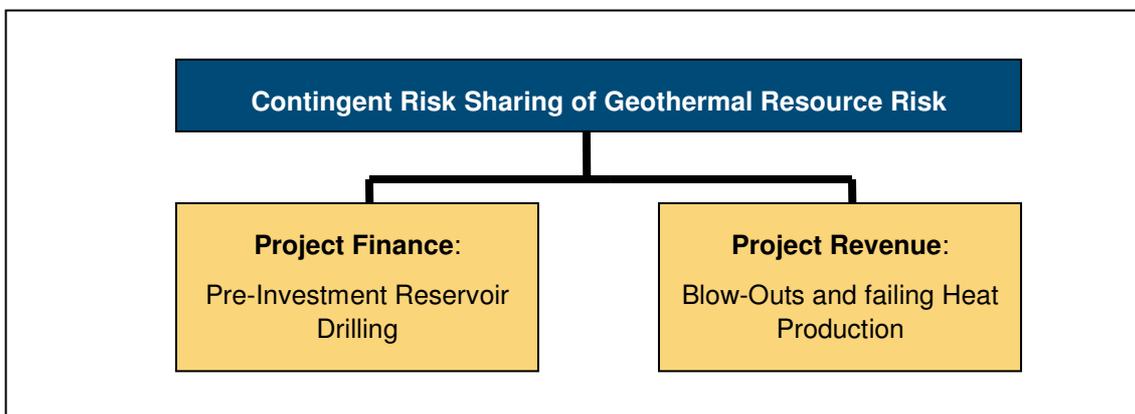
The Small Firms Loan Guarantee (SFLG) makes it possible for small businesses with a workable business proposal, but lacking security, to borrow money from approved lenders. The scheme is structured as follows:

- The SFLG is a joint venture between the UK Department of Trade and Industry (DTI) and approved lenders.
- It is administered by the Small Business Service (SBS), an agency of the DTI. In the REF-approach to rural electrification (section 4.5), a Business Development Organisation is normally contracted to provide TA on a cost-shared basis to rural entrepreneurs. It would be the logical "SBS"-candidate.
- Borrowers must present a viable business plan for the investment.
- The loans are provided by the approved lenders who make all the commercial decisions about borrowing.
- The Government, through the SFLG, helps by providing a guarantee to the lender, guaranteeing 75 per cent of the loan (maximum loan of £30,000).
- The business pays the Government a premium of 2 per cent per year on the outstanding loan amount.

5.5 Exploring Risk and Operation Risk: Contingent finance for geothermal resources for energy production

Geothermal energy poses two risks for investors. During the pre-investment phase, rather large investments are needed to establish the geological resource potential at the investigated site, and checking whether it can be exploited commercially. During operation, the resource may turn out to be less attractive than estimated, with the result that peak production capacity declines after a few years.

The **tolling arrangement** represents the extreme case of upfront risk sharing. In this, a Government entity invests in the exploration and development of a geothermal resource. Once the commercial feasibility of exploiting the resource is established, the national energy regulator issues a tender for the electrification part of the project. The tender can be for a **steam purchase contract**, in which case the electricity generator sells the electricity on the power market, or a **steam-to electricity conversion contract**. In the latter case, the government entity – a state owned power company - provides steam to the plant without cost and accepts power generated from the plant against a conversion fee.



The scheme has two drawbacks: no private capital is attracted to finance geothermal exploration and the geothermal plant; and the assumed efficiency advantage of private investors in the construction and operation of the plant is not exploited.

The “**Geothermal Energy Development Fund**” created by the World Bank’s “ECA Geothermal Energy Development Project” is a more efficient and market-based energy risk-sharing facility for mitigate exploration and development risks⁷¹. The fund uses the “contingent finance” to risk sharing.

The fund has three financing windows.

- A “**technical assistance window**” assists in developing a data base on geothermal resources and strengthening local capacities.
- A **partial risk guarantee window** partially ensures investors against the short-term upfront geological risk of exploration and/or the long-term geological risk of facing a deposit with lower than expected temperature, higher than expected levels of mineralization or difficult re-injectivity.
- An **investment financing window** provides contingent grants and low cost loans.

⁷¹ The World Bank - GEF Geothermal Energy Development Project focuses on Russia, Poland, Bulgaria, Romania, the Czech Republic, Slovakia and Hungary. The facility covers the geological risks of geothermal investments.

The soft investment finance is a traditional investment subsidy. The preparation of better a priori resource data and the partial risk guarantee for the exploration phase, on the other hand, make efficient use of public money to attract private risk capital to the sector. Large, risky outlays during the pre-investment phase have a particularly large impact on the NPV of the expected cost of investment (and levelised cost of production) in pre-feasibility studies. One can therefore, expect the leveraging effect to be considerable.

5.6 Market- and Off-take Risk

5.6.1 Market pump-priming Subsidies and Market deepening subsidies - Promoting PV-systems in the off-grid electrification market

The market for PV-systems in rural electrification consists of two segments:⁷² (i) PV-power supply for *productive uses in social institutions*, such as schools, rural clinics, community telecom centers and water pumping; (ii) *solar home systems* (SHS) from rural households and small rural businesses. The **institutional PV-market** segment depends on finance from donor programs, which normally finance the cost of investment 100% upfront. The key success factors for sustainability are well-known.

- **Financial engineering** in this market means making the social institutions receiving the PV-systems and the ministry responsible for the beneficiary institutions aware of the O&M costs of the PV-systems and of the need to inscribe a budget line for PV-O&M in the annual budget of the institutions.
- The most sustainable **delivery mode** is to supply the institutional systems through established dealers. This improves the likelihood that effective after sales service is available.

Despite their mass-market potential, solar PV-systems have not achieved the market penetration, which was expected. This has been blamed on the accessibility problem posed by the “large” upfront payment for the SHS-systems

SHS “is not a substitute for grid based electrification; it plays a supplementary role to grid-based electrification, offering individual consumers a power supply option when grid based electricity is not available. SHS is an individual consumer good and is best promoted as an individual **consumer product**, as in this way its advantages in terms of flexibility. **Financial engineering in SHS-promotion** means getting (i) commercial banks involved on the supply side, financing working capital and investments finance to dealers and (ii) micro-finance institutions to provide consumer loans for SHS purchases. The difficulty in getting finance to both the supply and the demand side explains, why despite the market penetration of SHS in developing countries has been lower than expected by energy experts in the early 1990s. This is not for want of donor projects trying out different delivery and financing models: leasing, fee-for-service, sales-to-end users, consumer finance via banks, consumer finance dealers, diffusion via regional power utilities; the list goes on. The multitude of approaches, however, illustrates the fundamental problem: there was widespread confusion about how to proceed.

Developers lacked the confidence in the market and the financial means – because sales volumes were low - to undertake effective promotion campaigns. This “deadlock”

⁷² *Commercial demand from telecommunications* for productive use in relay stations and other applications is important in terms of installed MW but is outside rural electrification.

situation justifies the introduction of "**market pump priming subsidies**". A market pump priming subsidy is a temporary, time limited subsidy to lift market demand to a size that is sufficiently large to permit commercial delivery structures to be developed. The **objective** is to get the development of this "natural commercial market" jump started to a level that makes investments by the private sector in a nation-wide SHS marketing and service infrastructure commercially viable. A market pump-priming subsidy for solar home systems should:

- Have a maximum lifetime of two to five years
- Be launched with either pre-announced time-limits for its duration or with pre-announced sales targets, after which the subsidy scheme will stop.
- Have pre-announced declining subsidy rates during the subsidy period.

The "natural, without subsidies" market for solar home systems amounts to 10-20 percent of households in the off-grid areas. The objective of a "**market deepening subsidy**" is to expand sales to reach the poorer households also.

5.6.2 Energy Market Access: Lease-buy-back scheme to channel long-term donor loans to RE-generators - Cambodia

The scheme described below has been conceived to accelerate investments in **rural electrification** in **Cambodia**, where the financial markets for individual project developers are largely dysfunctional – project loans have a maximum of four years maturity and require 50% equity co-financing - but where the public power utility, EdC, although being very small and financially weak, is relatively well-functioning, and, therefore, credit-worthy in the eyes of the donor community.⁷³

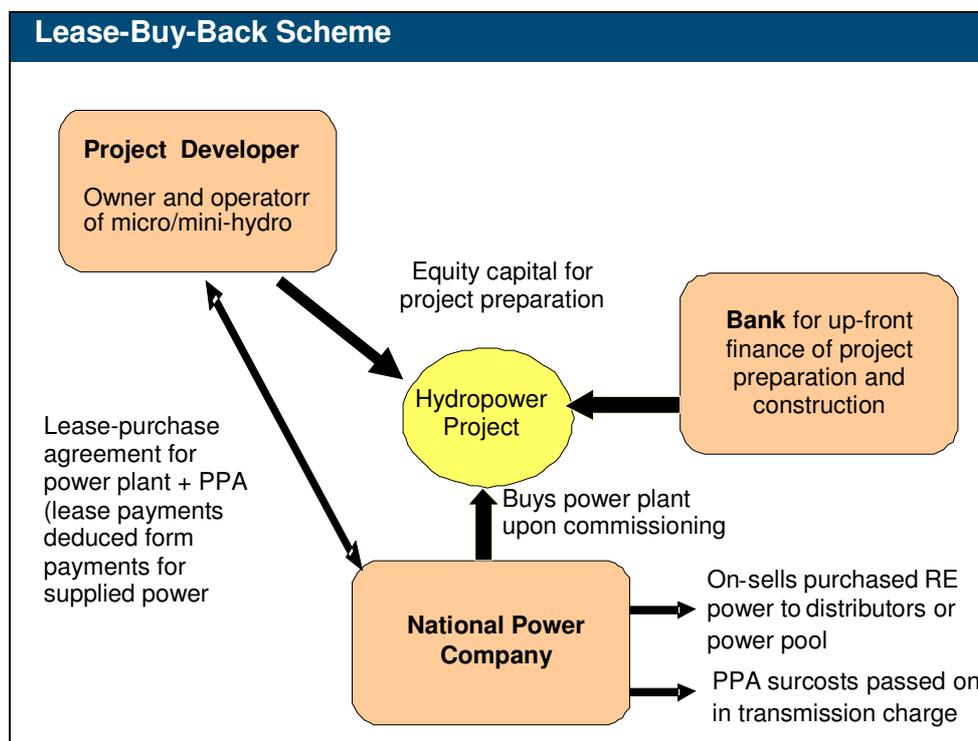
EdC assists rural electrification by investing in rural transmission using soft loans from international donors, but is not interested in managing small rural distribution systems. Cambodia has very active entrepreneurs operating in rural areas, who largely using informal financial channels to raise capital for investments. Since finance is scarce, they make recourse to second-rate equipment to keep down the costs of investment. This leads to high costs and low quality of rural power supply.

A scheme was therefore conceived to combine the economies of scale in investment and in finance of EdC with the managing and operating advantages of rural entrepreneurs. In this, EdC finances and constructs the rural transmission lines, including simple back-bone distribution grids, which are leased to the local entrepreneurs having the local distribution concession. The entrepreneurs own and operate the local "distribution utility", and finance the line drops from the backbone grid to the individual houses through a mixture of bank loans and connection charges.

Grid-connected mini-hydro plants can be financed in the same way through a lease-buy-back scheme, where local project developers undertake all project preparation. Once the PPA and lease-finance agreement is signed, the project developer uses a mixture of own-equity, supplier credits and a local bank loan to finance the cost of investment up to commissioning. At commissioning of the installed plant, the national power company purchases the plant from the developer, at a price equal to the debt finance used for development and construction. The sales revenue goes to repay the debt for project development. The plant is leased back to the developer on a long-term

⁷³ The scheme has not been approved yet by the Government of Cambodia.

lease-buy-back contract. At the end of the lease-period, the plant returns to the developer as his property against a nominal US\$1 payment.



The leasing fee equals the amortization payments and other financing costs, which the power company incurs on its loans from the development banks, plus a risk-and administration fee for the power company.

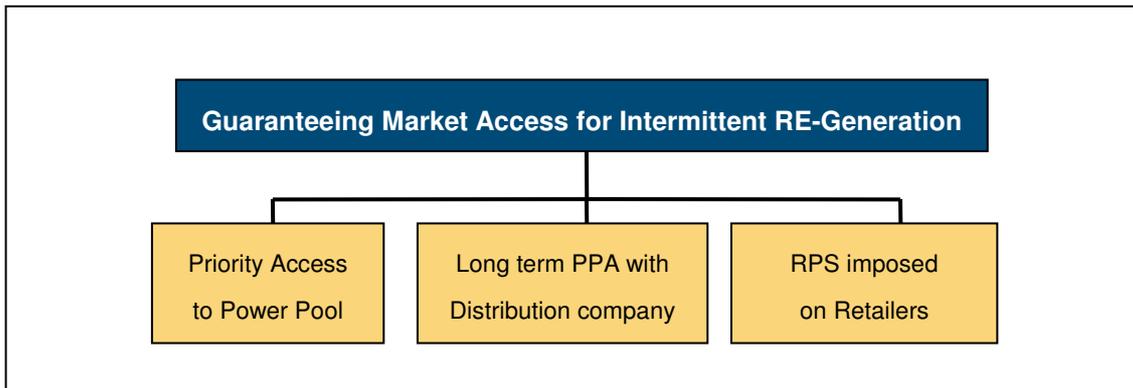
The lease-buy-back scheme:

- eliminates the need for collateral,
- reduces the project lending risks,
- provides long maturities,
- and lower costs of capital than any alternative scheme,

making the financing conditions of small biomass based and hydro-based RE-projects competitive with supply from conventional power plants. This eliminates the need for subsidies.

5.6.3 Reducing the market risk for intermittent power supply – sharing the market off-take risk: Nicaragua

RE-projects for the bulk power market need long-term PPAs with a financially sound off-taker to be bankable. In many developing countries, however, the financial situation of the distribution companies is weak. The experience of Nicaragua illustrates what options are available.



Nicaragua has first class RE-resources, especially in hydropower, geothermal energy and MW wind energy.

Nicaragua implemented in the late 1990s a power sector reform, which broke up the state-owned national power company, vertically separated ownership of generation, transmission and distribution and privatized the company's generation and distribution assets.⁷⁴ Union Fernosa operates as the only large distributor. Three to four local project developers were in 2003 ready to invest in windfarms and tried to negotiate a PPA with the regulator and the distribution company, Union Fernosa. However, for the financial community, Union Fernosa is not a creditworthy off-taker.

Faced with this situation, the Government in 2004 introduced a special **legislation** giving the intermittent **RE-power sources**, windfarms and run-of-the-river hydropower plants **priority** access to the **power pool**, at a **fixed PPA-tariff during ten years**. Since the Government did not want to destroy the working of the competitive power pool by allowing large supply to be priced outside its mechanism, the priority access is limited to hydropower plants that are installed within five years of the issue of the decree, and to an initial 20 MW windfarm capacity allocated by competitive tender. Losing windfarm developers can later access the scheme, provided they finance a study for the system operator, demonstrating that their additional power can be absorbed by the power system.⁷⁵ The system operator will pay the RE-generators; any financial losses – the difference between the fixed PPA-tariff and the power pool prices – will be charged to all off-takers from the power pool on a pro-rated basis.

The scheme provides two benefits for RE-generators:

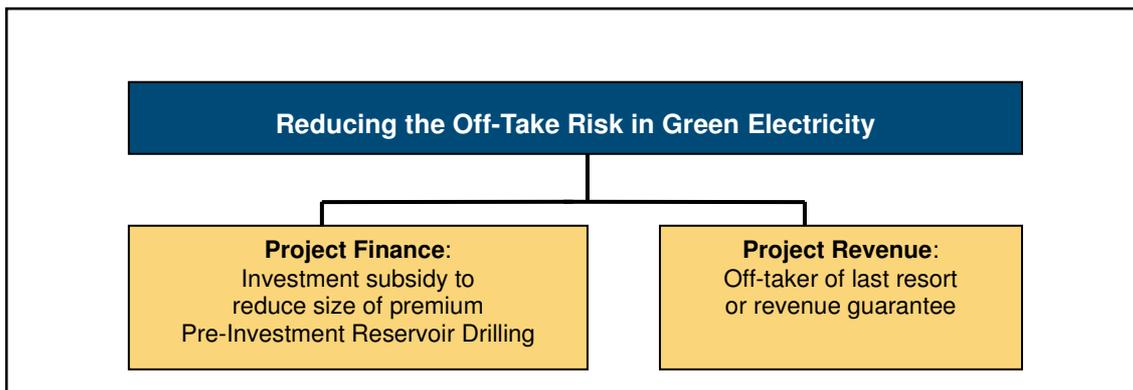
- it eliminates the market risk (indirectly the risk is transferred to all other generators, as the size of the free power market, for which they compete is reduced) and
- largely reduces the payment risk for supply.

5.6.4 Reducing the off-take risk in green electricity schemes: South Africa

RE-promotion strategies making use of a green electricity scheme can reduce the off-take risk of green electricity by interventions on the project finance side and the off-take side.

⁷⁴ The privatisation of some generation assets failed, and are in 2004 still owned by the state owned holding company, which replaced the previous power company.

⁷⁵ A study commissioned by the Government concluded that the national power system could economically absorb 50-60 MW of intermittent wind power.



Policy makers in South Africa use an interesting **mix of instruments** and institutional solutions in their green electricity scheme for wind energy.

South Africa is a tough market for RE, as the cost of coal-fired power production is the cheapest in the world. Thus, although South Africa has reasonably good wind resources the green electricity premium of windfarms is much higher than elsewhere. The political willingness to pay for such a high green premium is low.

A private developer had for years tried to get the **first commercial windfarm** in South Africa established: the 5 MW Darling windfarm located some 80 kms West of Cape Town. But, due to the high cost of production it was not possible to get the project finance together. In the end the **green electricity scheme** was seen as an option to make the project commercially viable. The main innovative feature of the green electricity scheme was to get a **municipality** involved as **buyer of last resort**, thereby taking over the off-take risk:

- The nearest large distribution company, owned by Cape Town Municipality, is to sign a 25 year purchasing power agreement (PPA) to purchase the output of the windfarm, paying a substantial green premium.
- The distribution company resells the electricity to “**green consumers**”. These are a broad spectrum of different private firms in different sectors (including those who want to export “environmentally clean” products to the US and EU niche market for these higher priced products) as well as state and provincial Government institutions.
- National power sector regulation does not allow distribution companies to make losses by paying non-commercial prices for any inputs. This means that the distribution company can not recover losses on non-sold green electricity via its average tariff. To solve that problem, the **municipality takes over the market risk** by purchasing non-sold “green” quantities for its municipal institutions.

Although this was an innovative solution to the financing problems of the Darling project, the concept has little to offer as a means to sustain national investments in wind energy. Its potential **replicability** is too **limited**, are not so many potential buyers of last resort and the unsubsidized green electricity premium of windfarms in South Africa is so large.

Since the Government is interested in getting an additional 45 MW of windfarms installed by 2010, equal to nine times the size of the Darling windfarm, another solution

had to be found. The preliminary strategy of the Government, to be implemented with the help of a GEF project⁷⁶, is the following.

- The size of the green premium is reduced by using **soft loans** from donors (35% grant element) to co-finance a substantial part of the investments in the windfarms and by the state providing a roughly 15% investment subsidy to the windfarms.
- A green power **guarantee scheme** will be set up, initially funded by GEF (US\$3.2 million contribution) to a dedicated account, to cover shortfalls which distribution companies face in the uptake of the green power purchased from windfarms. The shortfall will be assessed and averaged on a six-month basis.
- Additional light investment subsidies are given through **GEF-support** to wind measurements and **pre-feasibility studies** of sites.

However, to provide sufficient demand for 45 MW it would require a mandated central Government demand for green electricity. Thus, a “**state sector renewable energy portfolio standard**” could outline green electricity purchase targets for state institutions with increases year for year.

This example makes clear, that – besides certain financial instruments - it requires a lot of combined efforts and financially strong good will, to make RE investment viable, as long as its price is not competitive in commercial terms.

6 Some general conclusions

This study tried to give an overview on the needs and approaches for RE financing in LDCs. Taking into consideration the great range and variety of problem situations of the different RE technologies in the various context frameworks, it is quite clear that such a study cannot produce a standard set of reproducible recipes for RE finance. Each situation requires a specific diagnostic and a tailor-made approach for financial closure.

However, trying to summarize the quintessence of this study, we like to finish this study with some general conclusions giving an outline of the **rationale** of a **RE financing strategy** calling for a well-targeted support by promoters of RE and development:

1. The **limited financial viability** and the **elevated risk profile** of RE require **special** efforts in financing and structuring.
2. The financial **approach** has to determine the distance of the RE project to commercial financial viability, and define a set of cost reducing and income increasing measures on three levels (project, framework, outside support) to **create conditions of financial viability** ex ante as a key factor for investment decision.
3. **Risk Allocation** between project sponsor, contract partners, the (financial) market and promoting institutions is the other key determinant for successful project financing of RE.
4. This risk structuring and financial engineering of RE projects is a **complex and time-consuming process**, demanding staying power and corresponding resources itself.

⁷⁶ South Africa Wind Energy Programme (SAWEP), GEF OP-6.

5. For projects with a perspective of viability, the **financial** world has ready a well-equipped **toolbox** with adequate instruments to finance the specific needs of RE projects and to structure its risks, at least in theory.
6. A proper **risk allocation** with view on the markets perception of RE can make a generally viable RE project creditworthy at all, thus helping to attract more funds and reduce the cost of financing in the **market**.
7. However in **practice**, **local capital markets** are not the magic solution due to their limitations on the different levels of financial deepening in the various markets, although even in LDCs they can offer some **contribution** to financial closure.
8. The **3-dimensional RE financing gap** (funds/terms/instruments) can be bridged with the assistance of institutions with **higher risk-absorptive capacity**, and which by themselves can potentially offer each professional financial instrument to complete the market. However, as the resources of promoting institutions are not unlimited, their approach has to be selective and targeted.
9. To maximize results donors should offer assistance to **pick the low hanging fruits of RE**, i.e. projects, which are close to market competitiveness. Smart subsidies can be a valuable instrument in such a context, especially if their use needs to be only transitory.
10. **Donors** could help **create creditworthiness** (Training for RE project sponsors and RE interested financial institutions, Risk structuring and coverage) and **look for leverage**, offering assistance (Financial Guarantee, subordinated debt) to bring down the risk of RE to a market-attractive level.

ANNEX

Annex 1: Capital Market Conditions in Developing Countries

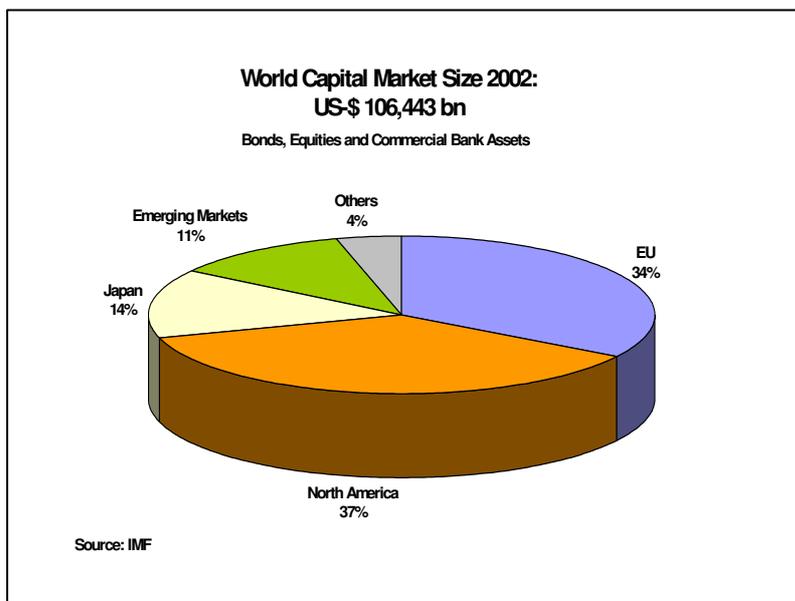
Annex 2: Leveraging Capital with Risk Management Instruments

Annex 3: References

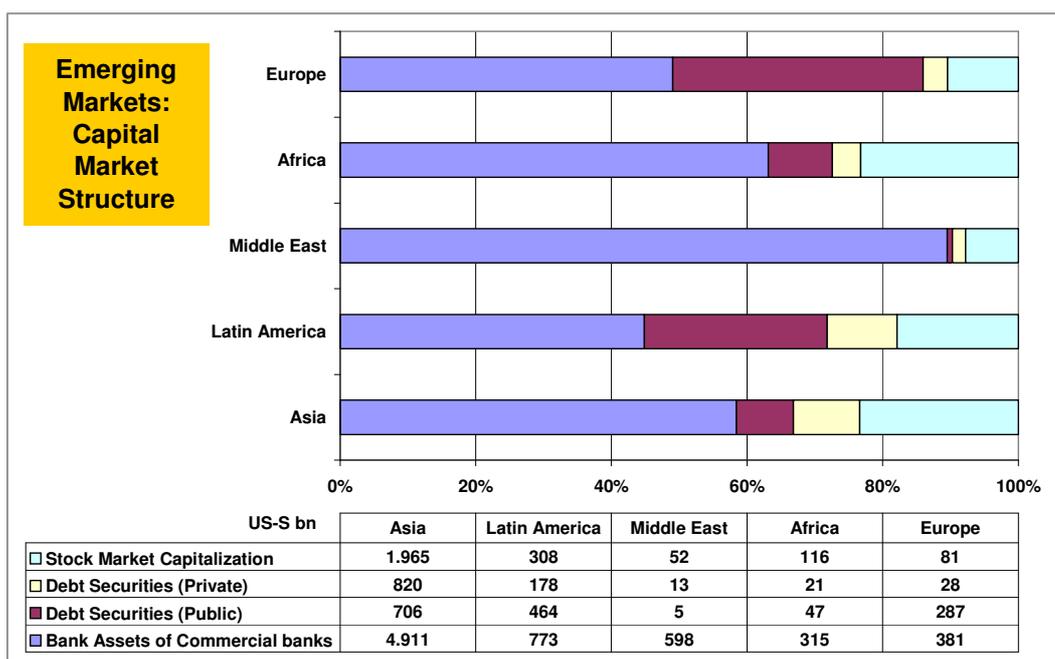
Annex 1 : Capital Market Conditions in Developing Countries

Domestic Financial Markets – Potential for RET ?

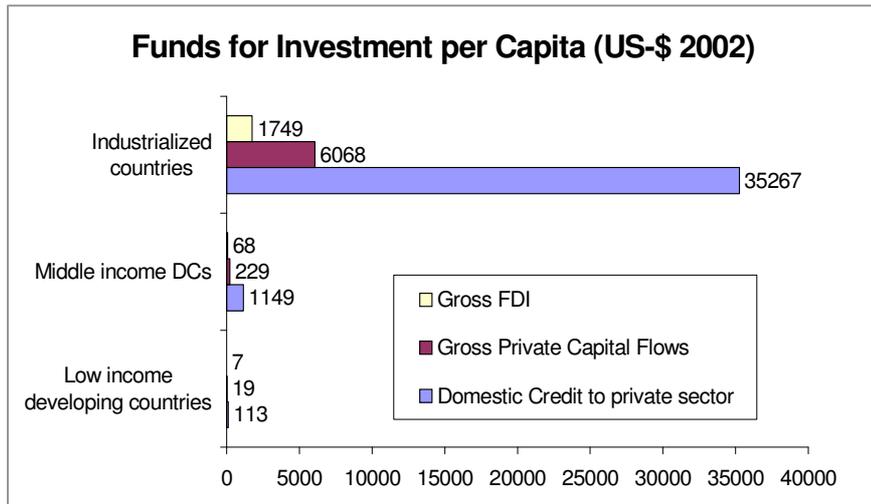
Although the facts and deficiencies about financial and capital markets in DCs are well known, the dimension of disparities to the mature financial markets are less present in our minds. However, at the moment they are simple facts to be taken into consideration for thinking about the potential sources and instruments of commercial financing of RET in DCs: More than 85% of the world's capital funds are concentrated in the mature financial markets, which also absorb the vast majority of them. The share of the emerging markets and the developing countries markets in the total capitalization is about 15%. About two thirds of the latter are concentrated on the Asian emerging market economies, leaving only minor shares for Latin America and Africa.



The classic instruments of bank assets and public debt securities dominate even the capital markets of the emerging markets. The more advanced instruments of private debt securities and stock markets play a minor but recently growing role.



Furthermore, domestic credit to the private sector per capita is still only \$ 1149 in emerging markets, and only meager \$ 113 in LDCs. The figures for gross private capital flows and FDI are even well below these amounts. Even with substantial progress in the deepening and development of these financial markets this is a clear indication of the general limitations of the availability of funds for RET.



Even with substantial progress in the deepening and development of these financial markets this is a clear indication of the general limitations of the availability of funds for RET.

Country Group	Low income developing countries	Middle income DCs + emerging markets	Industrialized countries + Mature financial markets
Population mio	2495	2738	966
GNI total in bn	1070	5056	25596
GNI per cap \$	430	1850	26490
Domestic Credit to private sector in % GDP	26,5	62,2	133,1
Domestic Credit to private sector	283	3145	34068
Domestic Credit to private sector US/\$ per cap.	113	1149	35267
Gross Private Capital Flows % GDP	4,4	12,4	22,9
Gross Private Capital Flows US/cap	19	229	6068
Gross FDI % GDP	1,7	3,7	6,6
Gross FDI Per cap	7	68	1749
Investment in Energy with private participation	29 bn	156 bn	

Source: World Development Indicators 2004

In summary:

- **LDC-countries** have a very low level of financial activities as they do not have much (idle) capital and they do not attract much from abroad. RET would have to compete with all the other sectors for very scarce resources. Even for smaller off-grid investments this will be difficult without additional funds as a package of technology and financing.
- **Emerging markets** with their access to international financing are playing on a higher level, but face the problems of volatility of their own and the international markets, thus limiting the availability of funds and instruments especially at the long end and during crisis periods.
- These figures are not only an indication of the very limited volume of available funds, but also for the development of these financial markets and the **practical availability of financial instruments**: You don't have to think about sophisticated credit derivatives when there are no credits at all!

Annex 2 : Leveraging Capital with Risk Management Instruments

Risk management in project finance involves the intelligent use of *regulatory* and *financial risk sharing instruments* to:

- attract private debt and equity capital to project finance,
- get debt capital with longer maturities into the market,
- reduce the cost of capital for a given maturity.

The buzz word is “*leveraging*”: investing an amount equal to “Y” in risk management instruments allows a multiple of “YxN” of private loan and equity finance to be channeled to RE-investments.

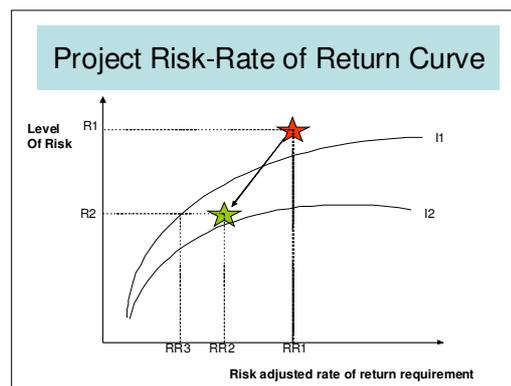
Some changes in the regulatory framework reduce the *absolute risk* of RE-projects; an example is the introduction of a feed-in tariff for RE. The reduction in risk reduces the cost of capital and hence the cost of production per kWh.

Other regulatory instruments and financial *risk sharing instruments* reallocate project risks from lenders and equity investors to entities better equipped to handle perceived specific risks. Sovereign guarantees for loans of development banks to RE projects transfer default risks to the state, which reduces the cost of private project finance. Project insurance and weather derivatives transfer risks from the project investor to private insurers and hedgers against a premium.

The impact of that on the cost of capital is explained with the help of the chart below.

A project developer or a lender reacts to project risks and uncertainty by either (i) staying away from undertaking the activity, or (ii) adjusting his risk-free rate of return upwards as compensation for accepting the risk and/or (iii) taking insurance against the risk. The “*project risk-rate of return*” indifference curve (*RR-line*) shows how a project developer’s asked for rates of return on equity (or a lender’s rate of interest) vary according to the perceived levels of project risks and uncertainties. Higher risks are accepted if compensated for by higher potential returns. Risk aversion leads the agent to ask for increasingly higher increments in the rate of return as projects move

into incrementally higher risk areas until the agent’s upper limit for accepted risk is reached. Projects located on or below the RR line (green project) are accepted by the agent with RR-line 1, projects above the line (red project) are rejected: corporate *risk-tolerance limits* cannot be exceeded.



Let us assume that a project developer asks a bank for a loan offering to pay the rate of interest RR1. Due to the project’s risk level of R1, the bank is not interested. Let us then assume that use of hedging instruments shifts the project risk for the bank from the red to the green position. The fee RR1-RR2, which the bank pays the seller of the risk instrument to take over a specific risk, reduces the net interest rate for the bank from RR1 to RR2; yet, because the risk is reduced to R2, the bank is now willing to lend to the project.

Commercial risk instruments owe their existence to three factors:

- *Agents have different levels of risk aversion*: I2 in the chart could represent a commercial bank, I1 a development bank: the latter would finance the green project, the former not.
- *Portfolio investors* invest in assets with different RR-profiles, some high risk/high RR, some low risk/low RR. Adding a high risk/high RR asset, is profit-maximising strategy as long as the total risk-RR profile of the portfolio is not pushed beyond the RR-line frontier.
- Risk specialists, such as insurance companies or hedgers, can *price risks*,

and thereby *changing what for a project developer is a project stopping uncertainty, into a quantified risk.*

Adding new risk management (hedging) instruments to the financial market *enables otherwise unwilling local project developers and financial intermediaries to engage in the development and financing of RE-projects* or to *provide funds with longer maturities* to RE-projects.⁷⁷

The transfer of risks to specialists comes with a price tag for the lending institutions and/or project developers, which is part of the cost of capital. But since specialists are more efficient at managing specific risks than the entity transferring it, and risk transfers take place at the margin, where a reduction in risk leads to a relatively large reduction in the asked for rate of return, the *cost of capital in a free and efficient capital market will go down or, as a minimum be unchanged.* Otherwise, risk management instruments would not be on the market. This outcome is shown in the chart, where the hedging transaction brings the RR-profile of the project below the lender's RR-curve; meaning that the cost of capital to the project is reduced by the transaction. At the risk R2, the bank's minimum net rate of interest requirement is RR3, enabling the project developer to get his loan at a rate of interest of RR1 minus the difference between RR2 and RR3.

Under free competition, hedging instruments reduce the cost of capital. When governments with financial and TA help from donors introduce risk management products for RE-projects on the market, the *market price of private project finance for RE decreases* while the *availability of domestic debt and equity capital for RE-projects increases.* The objectives of the approach are (i) to leverage donor finance (generating an increase in domestic project finance, which is larger than the donor-financed cost of developing and marketing the hedging product) and (ii) to assist a long-term strengthening of the capital market.

In *emerging economies*, one can expect a significant impact on RE-investments from new risk instruments. Investors in East-Asia in particular react very quickly to new commercial opportunities and are capable of rising significant capital in a short time. In *poorer developing countries*, the leveraging effect on the availability of capital for RE is likely to be small in the short-term and requires a subsidization of the risk product. The donor would finance a reserve fund to cover the expected financial losses on the under-priced product. In these countries, it is not the short term impact, but the longer term impact on the capital market which provides the justification for adopting the approach.

It is recommended, therefore, to *use modalities for providing financial assistance to RE-investments, which strengthen the local capital markets*, even if they offer few short term advantages for RE-investments compared with conventional donor-assisted project finance. An example is a project financing scheme composed of:

- investment support from CDM and/or a rural electrification grant;
- a donor funded credit facility for banks involved in RE-lending to provide up to 30-70% of the debt finance for individual projects;

a donor funded partial risk finance facility for rest-finance.

⁷⁷ In the chart the original stumbling block could have been that the bank was willing to provide a 6-year loan but not the 12-year loan, which the project developer needed

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