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The effectiveness of foreign aid for sustainable energy and climate mitigation

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Foreign aid and technology transfer are an essential means, especially for the least developed countries, towards meeting the Millennium Development Goals as well as facilitating adaptation to, and mitigation of, climate change. The deployment of technologies harvesting renewable energy flows and efficiency improvements is the key for improving access to modern energy services and mitigating climate change. However, support of sustainable energy, until recent, has been the step-child of foreign aid and its efficacy has been questioned. This paper reviews what the literature has to offer as to the effectiveness of foreign aid for sustainable energy and climate mitigation.

Keywords: official development assistance, foreign aid, climate change mitigation, renewables, good practices

JEL classification: F35, Q20, Q40, Q54

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Acronyms

Given at the end of the paper.

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1 Introduction

Foreign aid and technology transfer are essential means towards meeting the Millennium Development Goals (MDGs) as well as to facilitate adaptation to, and mitigation of, climate change. They also constitute fundamental components of sustainable development. Although access to affordable and clean energy services is a key prerequisite for the realization of all MDGs and climate change objectives, energy or access to energy itself is not one of the MDGs. Development aid, therefore, has been preferably allocated to the specific quantitative and time bound MDGs rather than to the enabling investments in energy access or to clean and sustainable energy services.

Still, development aid disbursements allocated to renewable energy technologies, infrastructures and efficiency programmes have not been negligible over the past decade. Quite a number of specialized funds have been established since the 1992 United Nations Conference on Environment and Development (UNCED), a.k.a. the 'Rio Summit 1992', in support of facilitating technology transfer and investment in sustainable energy.

The United Nations Secretary General's initiative Sustainable Energy for All (SE4ALL) launched in 2011 is one of the most ambitious campaigns undertaken to date aimed at transforming the world's energy systems. It is based on the premise that current energy systems are unsustainable and in danger of compromising the future in a variety of areas in which they themselves constitute some of the most serious challenges of our century: security, climate change and other environmental impacts, poverty eradication, and equality. To address all these challenges, SE4ALL has three goals to reach by 2030: universal energy access, doubling the rate of energy efficiency improvements and doubling the global share of renewable energy in the final energy mix.

Reaching the triple objectives of SE4All by 2030 will require substantial amounts of capital from the public sector, the private sector and the donor community. The private sector will have to provide the bulk of investments and finance for the implementation of SE4All. The international financial institutions will have a key role to play in mobilizing financing, in providing risk coverage and in acting as a catalyst for private sector involvement and energy sector reforms (AGECC 2010).

Energy related development aid during the first decade of the twenty-first century is estimated at close to US$60 billion of which renewable energy technologies received about US$8 billion (OECD 2012a). Multilateral development banks (MDBs) provided some US$70 billion of energy related funding of which energy efficiency projects received US$8.2 billion and renewable projects US$10.1 billion. However, the Secretary General's Advisory Group on Energy and Climate Change (AGECC) estimated the funding requirements for access and energy efficiency at US$205 to US$245 billion annually (AGECC 2010)—a huge funding gap compared with the funds available between 2000 and 2010.

Given this large funding gap, it is crucial that the limited resources for sustainable energy and environmental protection are used most effectively. This paper, therefore, explores the effectiveness of foreign aid on the advancement of sustainable energy, reviews enabling conditions and policy prerequisites. This paper aims to document 'what works', 'what could work', 'what is scalable', and 'what is transferable' in the context of sustainable energy investment. This is fundamental for private sector participation and the extent to which public and concessional finance is leveraged with venture capital, private equity and/or asset finance.

2 Foreign aid, energy and climate change

The terms ‘foreign aid’ and ‘financial assistance’ are not precisely defined in the development literature (Urban and Wolcott 2009). It is generally interpreted as a voluntary transfer of public resources, from a government to another independent government, to an NGO, or to an international organization, such as the World Bank (WB) or the United Nations Development Programme (UNDP), with at least a 25 per cent grant element. Foreign aid usually targets the socioeconomic factors underlying poverty with the objective to improve the human condition in the recipient country (Lancaster 2007). Foreign aid encompasses various types of financing mechanisms including official development assistance (ODA),[1] other official flows (OOF),[2] foreign direct investment (FDI), direct budgetary support (DBS), basket funding as well as conditional and unconditional funding. The multilateral development banks (MDBs) or international financial institutions (IFIs) such as the World Bank Group (WBG) and regional development banks as well as private-public partnerships (PPPs) via a combination of ODA, private sector funding and/or funding from foundations and NGOs are transaction channels for transferring foreign aid.

There also exists a variety of funds that support projects targeted at mitigating, or adapting to, climate change in the context of sustainable development, e.g., the Global Environment Facility (GEF); the Climate Investment Funds (CIFs) which include the Clean Technology Fund (CTF), the Scaling Up Renewable Energy Programme in Low Income Countries (SREP), the Forest Investment Programme (FIP) and the Pilot Programme for Climate Resilience (PPCR). The flexible mechanisms under Kyoto Protocol Clean Development Mechanism (CDM) and joint implementation (JI) are also vehicles for the transfer of sustainable energy technologies and associated financial assistance.

Energy has long been the stepchild of foreign development aid, especially ODA. Although recognized as a necessary but not sufficient ingredient for sustainable development, energy’s cost share in the generation of welfare was much lower than the production factors of labour and capital. The adverse consequence of the oil price hikes of the 1970s on the terms of trade of oil-importing developing countries were quickly forgotten after the collapse of global oil market prices in 1986. The small amounts of ODA and FDI were largely targeted at upstream fossil resource and electricity sector development (thermal generation and transmission and distribution).

This changed in 2004 when oil prices started to climb, and culminated in 2007 and 2008 when they reached their historical peak. High oil prices disproportionally affect the poor as developing countries spend a significant share of their income on crude or oil products

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[1] Grants or loans to countries and territories on the list of the OECD Development Assistance Committee of ODA recipients (developing countries) and to multilateral agencies which are: (i) undertaken by the official sector; (ii) with promotion of economic development and welfare as the main objective; (iii) at concessional financial terms (if a loan, having a grant element of at least 25 per cent). In addition to financial flows, technical cooperation is included in aid (OECD 2008a; OECD 2012b).

[2] Transactions by the official sector with countries on the DAC list of ODA recipients which do not meet the conditions for eligibility ODA, either because they are not primarily aimed at development, or because they have a grant element of less than 25 per cent (OECD 2008a; OECD 2012b).

imports. The increase in oil prices (or rather fossil fuel prices in general) has made investment in energy efficiency measures and renewable energy an economically attractive proposition.

Indeed both ODA and FDI in energy efficiency and renewables began to rise rapidly. But even more effective than high energy prices has been the growing recognition that the potential detrimental effects of climate changes could well undermine the gains of development assistance, especially with regard to the implementation of the MDGs. As the SE4All initiative demonstrates, sustainable energy access, and mitigation of climate change but also coping with safeguarding against the adverse impact of climate change are now seen as non-negotiable prerequisites for achieving the MDGs.

An increasing variety of financial instruments for combating climate change has been developed under the umbrella of the UNFCCC, creating a dynamic financial innovation trend that has gained momentum over the past 20 years. But including the financial flows associated with these instruments in the current ODA reporting system is not allowed due to the additionality condition, i.e., climate change related foreign aid should not occur at the expense of regular development aid (ODA) for economic development in poor nations. Hence climate related funding must be reported separately by the various institution administering these funds or instruments.

This does not mean that ODA cannot be used for the support of energy efficiency and renewable projects in developing countries motivated by climate mitigation objectives. While there was an extensive debate about 'additionality' before the ratification of the Kyoto Protocol, the OECD Development Assistance Committee (DAC) decided in 2004 to exclude only those CDM activities which governments directly use to purchase certified emission credits (CERs) (Michaelowa and Michaelowa 2007).

The developed countries that signed the Rio Conventions in 1992 and amended in 2010 committed themselves to assist developing countries in the implementation of the conventions. The DAC monitors aid targeting the objectives of the Rio Conventions through its 'creditor reporting system' (CRS) using the so-called 'Rio markers'.[3] In short, there is also a sizeable ODA contribution to funding climate change mitigation (one of the Rio markers) either directly through bilateral support or indirectly through contributions to the MDBs.

Table 1 summarizes the development of foreign aid (ODA and OOF) in support of energy and renewables for the period 2002 to 2010. The data in Table 1 show the actual gross disbursements to recipient countries which, for a variety of reasons, can be notably lower than the original commitments made. The energy-related funding in total ODA and OOF disbursements has increased considerably since 2005, i.e., from 4 per cent to 10 per cent, while the share of renewables in total energy fluctuated and grew only slightly over the period.

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[3] There are four Rio markers, covering: biodiversity, desertification, climate change mitigation, and climate change adaptation. Every aid activity reported to the CRS should be screened and marked as either (i) targeting the conventions as a 'principal objective' or a 'significant objective', or (ii) not targeting the objective.

Table 1: Total and energy related gross ODA and OOF disbursements, 2002–10, in millions US$

	2002	2003	2004	2005	2006	2007	2008	2009	2010
ODA–All donors	67,367	80,414	92,149	120,771	120,241	122,168	144,423	139,893	148,380
ODA–DAC countries	58,575	69,432	79,854	107,838	104,814	104,206	121,954	119,778	128,465
OOF–All donors	1,003	767	-2,773	3,975	-8,090	-816	2,831	9,482	4,940
OOF–DAC countries	119	-420	-5,418	1,986	-9,822	-5,491	-55	10,119	5,878
Total ODA and OOF	68,370	81,181	89,376	124,746	112,150	121,352	147,253	149,376	153,320
Energy–DAC	889.6	945.1	1,632.2	3,083.5	3,046.4	3,476.6	3,716.7	3,417.9	4,910.5
Energy–MDBs	499.0	444.1	647.7	579.3	598.0	899.5	1,697.6	1,768.5	2,385.2
Energy–all donors (DAC)	1,388.6	1,389.2	2,280.0	3,662.8	3,644.3	4,376.0	5,414.3	5,186.5	7,295.7
Energy–OOF	1,346.5	708.9	723.6	627.6	669.5	1,290.9	1,667.8	6,867.9	5,508.1
Total energy	2,735.2	2,098.1	3,003.6	4,290.4	4,313.8	5,667.0	7,082.1	12,054.4	12,803.8
of which									
Renewables, incl. hydro	153.7	239.9	358.3	619.4	653.1	1,077.0	1,044.0	1,566.1	2,082.2
– Hydro	109.1	176.5	296.0	544.6	488.3	818.4	666.6	792.5	1,186.9
– Geothermal	8.4	0.5	2.3	2.4	3.6	11.8	33.8	53.9	46.7
– Solar	8.9	35.6	25.4	27.3	37.0	44.3	130.6	389.5	440.7
– Wind	17.1	22.4	27.6	32.7	112.4	186.0	180.8	291.6	332.3
– Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
– Biomass	10.2	4.9	7.0	12.4	11.4	16.6	32.2	38.5	75.5
Share of energy in total ODA and OOF, %	4.7	3.0	3.8	4.0	4.1	5.4	5.8	10.1	10.0
Share of renewables in total energy, %	5.6	11.4	11.9	14.4	15.1	19.0	14.7	13.0	16.3
Share of renewables in total ODA and OOF, %	0.2	0.3	0.4	0.5	0.6	0.9	0.7	1.0	1.4

Note: A disbursement is the actual placement of resources at the disposal of a recipient country or agency. This is different from ‘commitment, which is a firm written obligation by a government or official agency, backed by the appropriation or availability of the necessary funds, to provide resources of a specified amount under specified financial terms and conditions and for specified purposes for the benefit of a recipient country or a multilateral agency. The conditionality often leads to delays or lower actual disbursements.

Source: OECD (2012a).

Table 2: Energy and climate rated funding by the World Bank Group*

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Energy efficiency	295	193	67	177	92	217	761	753	1,521	1,685	1,802	1,551
Renewable energy	765	26	350	229	221	784	594	840	1,471	1,678	1,905	2,977
Thermal generation				599	272	100	511	364	1,087	987	4,287	290
Other energy				816	370	278	248	717	1,015	1,702	2,019	1,783
Transmission & distribution				216	248	906	1,465	458	1.650	1,204	2,208	1,397
Upstream oil, gas, coal				333	496	578	1,074	729	972	1,076	725	182
Total energy financing	2,756	2,776	2,914	2,370	1,699	2,863	4,653	3,862	7,670	8,332	12,947	8,181
Total low carbon				406	350	1,237	1,660	1,761	3,338	3,363	5,584	5,937
Total access				794	537	986	1,018	905	1,784	2,201	1,020	1,031

Note: * WBG includes the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA), the International Finance Corporation (IFC), the Multilateral Investment Guarantee Agency (MIGA) and the International Centre for Settlement of Investment Disputes (ICSID). These institutions include the following energy and climate related funds: Global Environment Facility (GEF), Programme for Scaling Up Renewable Energy in Low Income Countries (SREP), Clean Technology Fund (CTF). The Strategic Climate Fund (SCF), Climate Investment Funds (CIF), the Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDCF).

Source: Computed by author based on Tirpak and Adams (2008) and WBG Energy Portfolio Data.

Table 3: Funding for energy efficiency and renewables by the Asian Development Bank, in millions US$

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Energy efficiency	0.0	0.0	0.0	0.0	120.0	0.0	0.0	112.9	400.1	500.0
Renewable energy	297.3	0.0	0.0	0.0	161.6	41.9	426.5	216.6	265.2	214.6
Thermal generation & upstream fossil	0.0	0.0	0.0	0.0	0.0	27.9	0.0	902.9	135.0	309.9
Other energy	0.0	0.0	0.0	0.0	0.0	726.8	0.0	0.0	150.0	42.9
Transmission & distribution	124.0	0.0	400.0	386.6	210.5	310.0	860.5	605.4	651.3	1.827.5

Source: ADB (2012).

Tables 2 and 3 summarize the energy and climate related funding of the WBG and the Asian Development Bank (ADB). Despite the economic and financial crises (or perhaps because of them), the annual outlays for low-carbon projects have increased significantly after 2007.

3 Funding mechanisms

Renewable technology and energy efficiency measures are more upfront investment heavy than conventional technologies and fuels. In most developing countries, government resources alone are inadequate to meet the large investment requirements of scaling up renewable energy technologies and energy efficiency—in the past they were rarely sufficient to support conventional supply infrastructures. The bulk of investment funding, therefore, will have to come from the private sector. Without some kind of incentive, private sector investors find investing in energy efficiency and renewables a risky proposition—long amortization periods, lack of market regulation, poor governance, subsidized tariffs and prices that often do not cover generating costs are some of risk factors. The adoption of energy-efficient technologies, processes and devices suffer from limited access to capital and lack of sufficiently attractive loan conditions that would offer competitive returns[4] as well as uncertain returns. Funding to overcome the investment barrier and to provide access to capital, therefore, is a make or break factor for sustainable energy development in these countries.

Any instrument that makes climate change benefits financially ‘visible’ to investors or consumers would reduce overall economic and financial risks. Absent such instruments, mobilizing multilateral and bilateral financing institutions is vital for ensuring a sustainable development of clean energy markets, especially efficiency and renewables (N’Guessan 2012).

The following list summarizes the principal funding sources available for investments in renewable energy, energy efficiency and climate change mitigation which, except for carbon financing, are standard financing routes for any investment in developing countries:

- Country government sources;
- Domestic private sector sources (equity and quasi-equity);
- Conventional lending instruments (commercial banks, insurance companies, pension funds, etc.);

[4] There are many more barriers to investments in efficiency and renewables which are extensively covered in the literature (e.g., Reddy 1990; Kostka, Moslener and Andreas 2011; Verbruggen et al. 2010; Beck and Martinot 2004).

– Equity and quasi-equity;
– ODA and OOF;
– Multilateral institutions such as the WBG, various regional development banks and special funds such as the Global Energy Fund (GEF) and United Nations organizations;
– FDI;
– Carbon financing; and
– New and upcoming innovative financing.

Financing development and climate change agendas is intimately linked (as are climate change mitigation and renewables/efficiency). Development and climate change mitigation (and adaptation, of course) are the two sides of the same coin. Projected climate change appears likely to exacerbate poverty and undermine development, especially in least-developed countries. Development can increase or reduce emissions and thus increase or reduce vulnerability to climate change (Rogner et al. 2007). Moreover, climate mitigation can also provide co-benefits, such as improved health outcomes, energy or food security. Mainstreaming climate change mitigation is thus an integral part of (sustainable) development or green growth.

3.1 Official development assistance

For effective climate mitigation, the allocation of ODA, therefore, must necessarily accommodate and anticipate the effects of climate change—from traditional development activities that promote economic development and welfare of developing countries to a more proactive and impact-focused structure that fosters green growth, i.e., development and climate protection.

Indeed, ODA gained a new focus when UNFCCC was established. After a slow start, ODA support for climate change mitigation picked up momentum after CoP-13 held in 2007 in Bali and has more than tripled between 2007 and 2010. OECD-DAC estimates that bilateral ODA for mitigation-related activities averaged US$9.7 billion (about 7.7 per cent of DAC's total bilateral ODA) per year in 2008-10. These figures include contributions to specific climate funds, such as the Climate Investment Funds. In addition, DAC members' core contributions to multilateral organizations contain a climate-related share which in 2010 was US$718 million (OECD 2011).

Three bilateral financial institutions—Agence Française de Développment (AFD), Japan's JICA, Germany's Kreditanstalt für Wiederaufbau (KfW)—and the European Investment Bank (EIB) together provided US$13 billion concessional and non-concessional assistance for climate action in developing countries in 2009, with over two-thirds towards mitigation. Some 85 per cent of the concessional assistance is disbursed through ODA channels (Atteridge et al. 2009; UNEP 2010).

3.2 Multilateral agencies

Multilateral and national development banks continued to be important contributors to renewable energy asset finance in 2011. Provisional data collected by Bloomberg New Energy Finance from projects on its database suggest that these institutions provided US$17 billion of finance for renewable energy last year (UNEP-FI 2012).

The central purpose of multilateral development banks and similar agencies is to promote economic and social progress in developing countries by helping to raise productivity so that their people may live a better and fuller life. This includes promoting energy efficient and renewable energy for both access to affordable energy services to enable socioeconomic development as well as environment and climate protection. MDBs provide a wide array of support and services to developing countries ranging from concessional and non-concessional loans to human resource development and capacity building.

MDBs help developing countries take maximum advantage of existing instruments as the Global Environment Facility (GEF), various carbon funds associated with the clean development mechanism and Joint Implementation, the Carbon Partnership Facility, the Climate Investment Funds (CIF) including the Clean Technology Fund (CTF) and the Scaling up Renewable Energy Programme for Low Income Countries (SREP).

These institutions assist in the finance of demonstration, deployment, and transfer of low-carbon technologies with a significant potential for long-term avoidance of GHG emissions consistent with the development objectives of the recipient countries. For example, the SREP supports new renewable energy technologies include solar, wind, bioenergy, and geothermal, as well as hydropower with capacities normally not exceeding 10 MW per facility.[5] Complementary technical assistance is considered essential for transformative and enduring change and country engagement and ownership. SREP, therefore, supports planning and pre-investment studies, policy development, legal and regulatory reform, business development and capacity building (including for knowledge management and monitoring and evaluation) (CIF 2012).

At the lower end of financial assistance is the Small Grants Programme (SGP) of UNDP/GEF. The SGP grants range from US$7,000 to US$20,000 and are provided directly to community based organizations and nongovernment organizations for the implementation of sustainable development programmes at the grass root level. Since its inception in 1992, the SGP's strategy has evolved to deliver support to low carbon and climate resilient technologies in more than 130 countries. Typically, SGP projects involve community participation and align with national sustainable development priorities.

A new institution established in 2011 is the International Development Finance Club (IDFC), a network of 19 international and national development banks from both developed and developing countries.[6] IDFC supports a wide range of development projects that contribute to poverty alleviation, sustainable development and green growth (Höhne et al. 2012). Climate finance and access to clean sustainable energy service is a central IDFC objective. In 2011 a

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[5] By March 2012 US$37 million (elicited from the WB and the CIF) for 21 projects in seven countries had been approved, 90 per cent of which are projects are in sub-Saharan Africa (CIF 2012). The target is to use the existing commitment of the WB and the GEF to leverage US$1.7 billion from other sources.

[6] Agence Française de Développement, AFD (France); Banco Estado, BE (Chile); Bancoldex S.A. (Colombia); Banco Nacional de Desenvolvimento Econômico e Social, BNDES (Brazil); Black Sea Trade and Development Bank, BSTDB (Greece); Caisse de Dépôt et de Gestion, CDG (Morocco); Central American Bank for Economic Integration, BCIE/CABEI (Honduras); China Development Bank, CDB (China); CAF-Development Bank of Latin America/ Croatian Bank for Reconstruction and Development, HBOR (Croatia); Development Bank of Southern Africa, DBSA (South Africa); Indonesia Exim Bank (Indonesia); Industrial Development Bank of Turkey, TSKB (Turkey); Japan International Cooperation Agency, JICA (Japan); KfW Bankengruppe (Germany); Korea Finance Corporation, KoFC (South Korea); Nacional Financiera, NAFIN (Mexico); Small Industries Development Bank of India, SIDBI (India); Vnesheconombank, VEB (Russia).

total of US$74 billion was disbursed in support of green energy development and GHG mitigation (Höhne et al. 2012).

Services provided by MDBs that are equally important as actual loans include packaging of several financial instruments and risk management (interest rate, exchange rate, price and market risks) as well as capacity building in these areas.

3.3 Climate finance and UNFCCC

Developed countries were called to provide new and additional financial resources to mitigate climate change. When the Kyoto Protocol was adopted in 1997, clean development mechanism (CDM) was introduced, allowing developed countries to invest in climate mitigation and take credits. The MDGs established by the UN in 2000 included mitigation of climate change as part of the development goals. Negotiations in subsequent annual Conference of Parties (COP) of UNFCCC further refined the means, mechanism and conditions for the transfer of funds for the purpose of mitigation and adaptation of climate change. COP-13 at Bali called on developed countries to provide 'financial resources to support action on mitigation' and developing countries to receive assistance in 'technology, financing and capacity building'. COP-15 at Copenhagen further agreed to 'scale up, new and additional, predictable and adequate funding as well as improved access' (UNFCCC 2009). Close to US$30 billion were committed by the developed countries for the period 2010-12. They also committed to a goal of providing US$100 billion per year by 2020 to address the needs of developing countries. To put this commitment into perspective: during 2006-10, ODA disbursed as aid for energy was, on average, US$3.7 billion per year.

3.4 Micro finance

Micro finance and micro credits are particularly successful mechanisms for deploying renewable energy technology to off-grid poor communities. Typically, these communities cannot afford to switch to modern renewable energy, and the cost of connecting them to the main-grid is too expensive. Most of the people have also no access to banking services (bank accounts) or are not 'bankable'.

Micro finance is the provision of financial services such as loans, savings or insurance to poor people and small business which are not of interest to standard financial institutions. For small business and micro entrepreneurs, micro finance is a means to access loans without the high transaction costs and red tape of interacting with traditional banks. Generally, micro finance does not require collaterals or equity. It is based on relationship building and partnerships using local social networks between civil society, local banks and intermediaries, often NGOs or community cooperatives. The former provide low interest loans or grants to the intermediaries, the latter then make and administer loans to poor families and small businesses. Most micro finance schemes are revolving funds, i.e., loans are repaid over relatively short timelines and then recycled as new loans, 'keeping the money working and in the hands of borrowers' (Grameen Foundation 2012).

Payback calculations including interests for home photovoltaic (PV) systems are often determined by 'replacement expenditure', i.e., the amount that a family would have spent on kerosene for lighting. Loan amortization collection is usually carried out by the intermediaries or community cooperatives.

Micro finance programmes are funded by loans, grants, guarantees and investments from individuals, philanthropists, social investors, local banks, foundations, governments, and international financial institutions.

3.5 Essential instruments

3.5.1 Market incentives

A power purchase agreement (PPA) or feed-in-tariff (FIT) can be a vitally important component of a renewable electricity project for recipient/utility and seller/sponsor alike. In essence PPAs reduce the revenue risk emanating from the uncertainty of future sales volumes and sales prices, especially in deregulated markets. For the utility selling electricity, PPAs/FITs provide the long-term revenue stream needed to secure financing for the project. In the case a project sponsor does not have the up-front capital required to invest in the plant, a PPA/FIT can serve as collateral for a bank loan. For the project sponsor providing project finance, PPAs reduce the risk of financial default of the utility or loan recipient. For the utility customer, PPAs/FITS ensure the customer the availability of renewable generation applicable towards meeting its renewable portfolio standard (RPS) or climate mitigation commitments. As policies continue advancing renewable energy development, knowing and understanding the intricacies of PPAs is becoming increasingly important.

PPAs/FITs create long-term relationships between parties. Key elements of PPAs/FITs are the terms and conditions regarding price of the electricity, penalty for non-compliance, duration of the agreement which can be up to twenty years and more, periodical PPA/FIT revisions in the light of possible market changes, termination clauses, reporting and verification requirements, etc. In short, PPAs govern the transaction for years into the future. These terms are usually heavily negotiated prior to the signing of PPAs and meant to fairly allocate risks between participating parties. As the renewable energy community continues to grow, these negotiations are becoming more and more sophisticated.

3.5.2 Regulation

However, in the presence of regulatory uncertainty, e.g., before or during a shift from regulated to deregulated market structures, large customers or distributors may be reluctant to commit themselves to long-term PPAs/FITs (WB/IMF 2006). Regulatory certainty and predictability are essential for PPAs and finance of energy projects.

MDB support programmes can serve as leverages to encourage private sector participation both for funding and capacity building. The involvement of MDBs in partner countries can lead to changes in the regulatory environment resulting in lower market risks and increased competition. Technical risks of projects can be shared and thus reduced via support for pilot projects (WB/IMF 2007).

The adoption of renewable technology and energy efficiency measures has often been linked to technology ‘appropriateness’ which is generally defined as ‘the degree to which a technology fits its specific context of use; to be relatively low cost, locally made and serviced, and well suited to their cultural, material, and ecological contexts’ (Nieusma and Riley 2010: 5).

It has been recognized that technology transfer and implementation on the ground alone are usually not sufficient to achieve their goals. For example, while funding access to electricity by itself is desirable, failing to attend to a broader set of factors could limit access to a shortlived affair. Key factors include careful attention to community capacity building: educating electricity consumers on what types of appliances would not be allowed, training plant operators on operations and maintenance, creating organizational procedures for troubleshooting and conflict resolution in advance of system breakdown but also the need for rate payment schemes for the electricity used by consumers. Regardless of social equity and other development goals, these factors are required simply to ensure the technology remained functional and economically viable over time.

Nieusma and Riley (2010) argue that a combination of renewably sourced electrification with productive income-generation activities based on the now available access to electricity improves the acceptance of, and care for, the technology. Here development assistance, e.g., by development oriented NGOs, that incorporates a range of social, organizational, and economic goals with electrification has proven successful, especially as such an integrated approach greatly facilitates payment for the electricity used and thus the payback of loans for the project. Still technical functionality trumped all other aspects. Without it the income generation and other benefits would be void—precisely what the production of electricity is designed to leverage. Successful renewable technology implementation requires a 'package approach' including support for training and maintenance, project finance, payment collection, development of market incentives as well as opportunities for income generation (Barton 2007).

Capacity building for effective utilization of development aid for clean energy finance and climate change mitigation must also focus on a technology's intangible knowhow and services (Brewer 2008).

Key findings of a case study on six African countries indicate that the effectiveness of foreign aid and carbon finance is hampered by a lack of domestic leadership, with the adverse effect that the national responses are driven by international and donors' priorities and are not necessarily linked to national priorities (Thornton et al. 2011). As regards access to finance, studies observed that recipients had to conform to donor or funders' requirements and schedules (e.g., budget cycles) rather than funders' conforming to recipients' needs and requirements. Policy capacity at the national and local levels of how to define climate change mitigation and climate finance is often lacking (especially the concept of additionality which is not even harmonized among different funders (Thornton et al. 2011).

While the Paris Declaration on Aid Effectiveness of 2005 requires donors and recipients to jointly manage the implementation of mitigation programmes, lack of coordination between funders and the recipient government appears to be another area for improvement of the effectiveness of green energy funding.

3.5.3 Business models

Merely supplying renewable energy systems to a few tens of homes in a given village is unlikely to gain climate change mitigation or sustainable development benefits. What is needed are business models that:

- Establish a mechanism that would pave the way for the commercialization of rural household electrification in the developing world. Numerous projects have demonstrated the willingness of rural households to pay for, say, solar home systems as long as they are given access to credit;

– In the case of village-wide energy systems, develop commercially viable distribution and service chains for these renewable energy services using local entrepreneurs and multi-sector collaboration;
– Further integrate technology transfer and access to credit with other poverty alleviating (income generating), health and education improving measures (see Nieusma and Riley 2010). Renewable energy programmes such as the 'Whole Village Development Model' (SELF 2013) or the 'Base of Pyramid (BoP) Model,[7] (Prahalad 2004) have been adopted by numerous communities in different countries and cultural settings, in large part, because of the real and measurable indirect (non-energy) benefits deriving from the implementation of the business model.

Successful implementation of a business model often depends on the products and services matching local needs and expectations (e.g., charging possibilities for mobile phones in addition to solar lights).

4 Evaluation of effectiveness

The literature on the effectiveness of foreign aid is vast. It focuses primarily on the impact that foreign aid has had in reducing poverty and inequality, advancing economic growth, building capacity and accelerating achievement of the MDGs. Indicators used by the World Bank cover aid received as well as progress in reducing poverty and improving education, health, and other measures of human welfare (WB 2012a). As regards effectiveness of foreign aid, especially ODA, there is hardly an aspect of it that has not yet been criticized (de Coninck et al. 2010). Symbols of failed ODA range from 'white elephants', developing country leaders' Swiss bank accounts to calls to abolish aid altogether based on the rationale that dependence on international aid undermines democracy and governmental accountability (Moyo 2009). Easterly (2005) argues that IMF's structural adjustment loans (SAL) of the 1980s did not generate the intended outcome of improved per capita growth as a function of increased SAL lending.[8]

Undeniably there are instances of aid failing to work. Still the accumulation of empirical evidence shows that aid has had broadly positive effects on socioeconomic growth and development (Addison, Arndt and Tarp 2011). Arndt, Jones and Arndt (2009) conclude that on balance foreign 'aid's impact is positive and conforms to priors from modern growth theory'. WB indicators show that human welfare improved through the positive aid impact on HIV, primary education and child mortality (WB 2012a).

The quantified and time bound MDGs agreed in 2000 made monitoring the effectiveness of aid somewhat more transparent. Annual progress reports on the MDGs assess to what extent goals are met. Although progress has been made since 2000, it is not evenly distributed across the developing world. It seems likely that many targets will be missed in most regions (UNDESA 2012).

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[7] The BoP project is market development: enhancement of the economic situation by simultaneously providing affordable energy services and income opportunities for the local population as well as profitable business for large corporations (Prahalad 2004).

[8] SAL provided finance over a period of several years in return for reforms in trade protection and price incentives for efficient resource use with the aim to assist countries in reducing their current account deficits, strengthening their balance of payments, while maintaining their growth and developmental momentum.

Failure of many development aid schemes result from a disregard for the complexity of institutions and incentive systems. MDBs often impose conditions and restrictive policies on recipient countries which disregard engagement with the way the recipients see their problems and stifle individual country actions (Sen 2006). Bilateral aid driven by geopolitical factors does not have an effect on growth as it primarily serves donors' global geopolitical interests (Headey 2007). Failure also results from policy advice given by donor country experts in the absence of a proven track record of economic development policies ('no one size fits all'). The Barcelona Development Agenda (2004) concluded that:

> there is no single set of policies that can be guaranteed to ignite sustained growth. Nations that have succeeded at this tremendously important task have faced different sets of obstacles and have adopted varying policies regarding regulation, export and industrial promotion, and technological innovation and knowledge acquisition.

Easterly (2012) therefore suggests freeing development aid from the delusion that it can accomplish development and focusing it on financing particular tasks and projects for infrastructure development and agriculture to education and health—in essence practical steps towards meeting the MDG and SE4All targets. Dedicated funding of energy efficiency programmes and the spread of renewable energy technologies would perfectly fit such a template.

4.1 Measuring effectiveness

The effectiveness of foreign aid for sustainable energy may be assessed along several dimensions: (i) increased *access* to clean energy services, (ii) improved *affordability* of energy services, (iii) *reduced environmental* impacts (local and climate mitigation) and (iv) rates of *efficiency* improvements throughout the energy system (including reducing energy intensities of the economic production process) and deployment and market penetration of renewable technologies. All four dimensions are interrelated with numerous trade-offs between them.

Access is about bringing modern forms of energy to households, community institutions (schools, health clinics, etc.) and productive applications including micro mini enterprises and agriculture (e.g. irrigation and food processing). It is also about connecting households in underprivileged parts of large metropolitan areas (the urban poor). It is usually considered synonymous with access to electricity—both grid and off-grid—and clean cooking fuels. Access also means adequate supply, reliability and quality, especially during periods of highest demand, and, in the case of off-grid intermittent sources, adequate back-up and/or storage capacity.[9] At the national level, energy security is yet another aspect of access.

Affordability of modern energy services, i.e., the upfront costs for the purchase of electric devices or modern cooking stoves, hook-up costs as well as electricity and fuel charges are often constraints to access even in the presence of a supply infrastructure. Energy charges and

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[9] Note: While industrialized countries are used to a grid availability of >99.9 per cent, developing countries often experience supply disruptions, voltage variation, etc. on a daily basis. This lack of reliability adversely affects economic productivity and socioeconomic development and, therefore, is an area for imminent improvement. However, for a household currently without access to electricity, availability of electricity even a few hours per day (or rather evening) represents enormous progress.

their collection, however, must fully cover supply costs in order to be consistent with the concept of sustainable energy.

Technology deployment of renewable energy technologies (as well as energy efficient infrastructures and end-use devices) is a key enabler of sustainable energy. The efficient generation and use of energy services is a central pillar of sustainable energy. Doing more with less generally reduces pollutant emissions and wastes, enhances energy security and can lower the costs of energy services, hence improving affordability.

Environmental impacts span a wide range of adverse consequences for human health, air and water quality and agricultural productivities to anthropogenic interference with the climate system. Pollution and wastes from energy resource extraction and energy conversion increasingly stress and overburden the carry capacities of ecosystems. Monetized environmental impacts progressively undermine the economic gains from the production and use of energy services.

On the supply side, the potential of renewable technologies that tap the abundant energy flows provided by nature to supply an increasing share of the world's energy demand while delivering substantial sustainability benefits has long been acknowledged (IPCC 2011). On the demand side, energy efficiency improvements have been confirmed as the low hanging fruit for any pathway to sustainable energy (GEA 2012). Jointly, accessibility and efficiency can curb greenhouse gas (GHG) emissions, cut emissions that cause poor air quality and regional acidification, enhance energy security, improve balance of payments through lower energy import bills and safeguard against the price volatility of international fossil markets.

Unlike in the OECD where renewably generated electricity over the last decade has grown more than twice the rate of total generation, in the developing countries the market penetration of renewables despite all these benefits has barely kept pace with total supply.[10] One reason is that renewables have long been the stepchild of foreign aid even though substantial development assistance for energy supplies has been provided by OECD donor countries and multilateral development banks (MDBs). Lack of financial support may have been one reason, indeed. Another reason could also be that the effectiveness of the foreign aid expended for renewable energy over the last two decades has been wanting (1.4 per cent of ODA for renewable energy in 2010).

This paper explores the effect of foreign aid for sustainable energy development with a view on 'what works', 'what could work', 'what is scalable', and 'what is transferable' on the effectiveness of foreign aid in boosting sustainable energy in developing countries.

The effectiveness of foreign aid has been a highly controversial topic, especially with regard to what works, what could work and what does not work. On balance, the empirical evidence on its effectiveness is discouraging (Djankov, Montalvo and Reynal-Querol 2006; Easterly 2006; Moyo 2009; Doucouliagos and Paldam 2009). Given the purpose of foreign aid of promoting development and alleviating poverty leaves ample room for a vast array of areas for aid application ranging from economic reform, building institutions and good governance to building roads, pipelines lines and power plants, measuring effectiveness of foreign aid is not a straightforward affair. It is certainly much easier to measure success related to 'hard'

[10] Note: In terms of TWh, renewably generated electricity in developing countries grew by almost 900 TWh over the period 2000 to 2010, more than twice the 405 TWh observed in the OECD (IEA 2012).

infrastructure projects than to, say, 'soft' institutional reforms. Still, having successfully implemented a solar PV system in a rural village so far without access to electricity is, by itself, insufficient as a measure of effectiveness of foreign aid on sustainable energy. Important aspects to consider are the project's effect on the betterment of the social, institutional, economic and/or environmental conditions within the village.

More specifically related to aid effectiveness on climate mitigation, based on an analysis of aggregated data from 80 low- and middle-income countries between 1973 to 2005, Kretschmer, Huebler and Nunnenkamp (2011: 86) conclude that 'Aid tends to be effective in reducing the energy intensity of GDP in recipient countries. …the carbon intensity of energy use is hardly affected. Scaling up aid efforts would thus be insufficient to fight climate change beyond improving energy efficiency'.

In 2002 the Monterrey consensus was forged when donors recognized that their fragmented efforts added undue cost and reduced their effectiveness. In 2003 OECD convened a high level forum on harmonization in Rome, during which donor countries agreed to better coordination with the recipient countries and to work towards a more acceptable working relationship. Subsequently, in 2005 the Paris Declaration on Aid Effectiveness was endorsed by 137 countries, all the major multilateral funding agencies and several large NGOs. The Paris Declaration established five principles for effective aid (OECD 2008b):

i) *Ownership*: Developing countries set their own strategies for poverty reduction, improve their institutions and tackle corruption;

ii) *Alignment*: Donor countries align behind these objectives and use local systems;

iii) *Harmonization*: Donor countries coordinate, simplify procedures and share information to avoid duplication;

iv) *Results*: Developing countries and donors shift focus to development results and results get measured; and

v) *Mutual accountability*: Donors and partners are accountable for development results.

Subsequent to the Paris Declaration, two high level fora have taken place at three year intervals (2008 in Accra, Ghana and 2011 in Busan, Republic of Korea) to review and assess the progress of implementation. While the Paris Declaration is slowly being considered in the actual process of planning, execution and evaluation of foreign aid projects, these five principles provide a benchmark for an assessment of the flow of funds to developing countries over the years.

4.2 Review of effectiveness

Numerous renewable projects funded by foreign aid starting twenty years ago were reviewed to see where they stand now in 2013. Most of the early renewable-energy projects served the purpose of providing desperately needed access to electricity and other modern energy services projects and were rarely motivated by sustainable energy or climate mitigation objectives. This changed fundamentally with the entry into force of the CDM in 2005 and climate change benefits are now an integral part of a project's rationale.

Successful implementation of renewable energy technologies in ODA recipient countries has been used in this paper as a proxy for action that fosters sustainable energy and generates immediate climate change benefits. Until entry into force of the Kyoto Protocol in 2005, ODA support for renewables has been marginal compared with ODA disbursement for fossil resource development and combustion technologies. As well, the modest investments in renewables were predominantly driven by the ultimate ODA paradigm of advancing economic development rather than environmental protection and mitigating climate change albeit these co-benefits are now duly recognized.

The literature on specific investment projects which received development assistance from DAC member countries, MDBs or any of the other climate finance channels is vast. The majority describes technical aspects of the projects. Unlike studies and review of policy relevance and effectiveness, only a small portion of the technical studies goes further and reviews project effectiveness and lessons learned from successful or less successful projects. A notable exception is the project evaluations carried out by MDBs, international and national funding institutions. These evaluations examine the outcome of projects guided by a uniform set of performance indicators.

The following sections summarize our literature review of the effectiveness of foreign aid (in essence ODA) for climate mitigation using the four categories (i) what worked, (ii) what could work, (iii) what is transferrable and (iv) what is scalable. A selection of projects reviewed is presented in the Appendix.

4.2.1 What worked

The following list of factors translates insights, prerequisites and lessons learned from specific local project evaluations into more generic terms of what worked in advancing the deployment of sustainable energy and efficiency measures supported by foreign aid:

- Consistent government policy and strong commitment at all levels—national, regional and local—play a key role for the adoption and use of renewable energy technologies. Implementation of renewable projects predominantly occurs at the local level. National legislation, e.g., renewable energy targets, and support policies provide the framework conditions for local government action. Local governments assume multiple roles from planning authorities, decisionmakers, managing of local infrastructures, service providers and prime interlocutors for their citizens and businesses. Local government or community championship of renewable energy development is an attribute of successful project implementation.

- Regulatory frameworks and policies that incentivize private investment and guide structuring the financial and ownership arrangements for large renewable projects are indispensable.

- Of equal importance is the presence of enabling laws and national policies such as renewable energy acts, energy market regulation with provisions and incentives for private sector involvement. This includes, but is not limited to, policies such as those that guide the purchase, grid connection and transmission of electricity generated from renewable energy sources and incentives ranging from feed-in-tariffs, power purchase agreements, direct and indirect capital subsidies to accelerated depreciation or exemption from various taxes and duties.

- Full alignment of the project with local, regional and national development plans is one of the principal components of successful renewable technology deployment.

- Government guaranties for ODA loans are one important sign of government support and concurrence with a renewable project.

- The presence of excellent renewable resource flows alone is not sufficient to attract funding for renewable energy projects. In the past, only countries with an adequate enabling environment and long-term stable comprehensive public policy and strong political commitment have succeeded in developing and maintaining renewable energy supplies. Therefore, grants or funding assistance should be first allocated to creating an enabling environment for renewable projects and to removing barriers. This includes appropriate legislation and regulation, raising awareness and disseminating information, capacity building, etc. as well as the development of renewable energy resource assessments (wind, solar or biomass maps), technology development, grid issues, economic and financial analysis, localization and industrial development opportunities, education and awareness-raising. Knowhow transfer from more advanced countries as integral part of development assistance is often at the roots of successful programme implementation. It reinforces both lender confidence and governments' resolve for further development of renewable energy programmes.

- A legitimate public authority that sets rules and obligations and enforces them in a transparent and equitable manner instils credibility and confidence to investors. Because of their intermittent availability, policies on preferential grid access are particularly important for wind or solar farms. Minimum requirement is a fair and open grid access.

- Policies giving grid access to renewable energy are the most critical. Feed-in laws—the main instrument used in Europe to promote wind energy—have the advantage of giving developers long-term stability and predictability. In many countries, other forms of public support such as tax credits, soft and concessional loans, an increase in electricity tariffs or portfolio standards (quotas) are used along with feed-in-tariffs.

- Extensive pre-feasibility studies and comprehensive energy planning taking into account local circumstances plus environmental impact assessments with involvement of stakeholders, especially the local communities directly affected by a project, add credibility to the project and raise funding-agency confidence in project viability. Comprehensive energy plans for larger beyond community level projects help communicate the rationale of the project and its relative merits against alternative options.

- Community ownership of micro energy projects through in-kind (labour) or financial contributions to the establishment of the project helps community identification with the project. Team building of the community with consultants, timely availability of funds and compensation to farmers and households affected by rezoning or land acquisition are other elements contributing to successful implementation and operation of a project.

- Micro finance-schemes with payback arrangements based on avoided costs of the recipient household or business, and arranged and administered by local NGOs or user organizations make access to modern energy services affordable. Micro finance and foreign aid in the form of SGPs pair up well.

- Capacity building to elevate cooperatives and intermediaries to competent financial and business agencies is essential for sustained success of micro finance.
- One of the success factors for micro financing is when women are incentivized to subscribe to the renewable energy (biogas cook stove, solar home systems, micro hydro or micro wind turbine) which in turn provides opportunities for income-generating activities for the women.
- Availability of rural electricity is a necessary but not sufficient condition for the poor to improve their economic status. They need access to income-generating activities, seed money for small and medium enterprises and markets for their products, which in turn sustain the operation of the renewable energy technology via revenues from energy sales.
- Providing electricity is not an end in itself. Therefore as important as income generation, is a package approach of renewable technology, storage dealing with intermittency and end-use equipment (lamps, radios, TV, water pumps, refrigeration, etc.)
- Privatized operation and maintenance with user tariffs that cover costs appear to be a critical element of success. Many failures can be attributed to the absence of user tariffs or insufficient collection of revenues. The business model of community ownership with in-kind contribution from the community is further enhanced when local capacity is developed to manage, operate and maintain the energy system. Such cash-generating activity has functioned best via private sector participation within the local community. Capacity building of community members in the operation and maintenance of the equipment or micro system is essential, as is basic business education for small enterprises providing maintenance services and revenue collection. Reliable maintenance service ensures acceptability.
- Good plant operation management and routine maintenance schemes need competent operators, skilled technicians, incidentals and spare parts. The lack of any of these elements can seriously jeopardize an otherwise successful project.
- Supplemental activities such as training for para-technicians, marketing and knowledge sharing in the productive use of energy are important for sustainability of micro finance and use of renewable technologies that maximize benefits.
- Integration of larger renewable energy projects, e.g., hydropower, with community infrastructure development such as local road improvement or improved health and education services enhances overall acceptance of project otherwise viewed as ‘disruptive’ by the local community.
- The simultaneous development of domestic manufacturing capability (supply push) and a domestic market (demand pull) has been extremely successful.
- Distribution and allocation of project risks between different entities or partners to parties best suited to manage such risks. For example, there are good track records of public-private partnerships (PPP), where governments retain significant responsibilities over certain portions of an asset and entrust private parties with the operation and management.

- Making the climate mitigation benefits financially visible to investors, e.g., earning income through the sales of emission credits reduces economic risks and makes attracting funding easier.

Effective use of foreign aid for sustainable energy and climate mitigation is not the result of any individual feature or factor alone but rather of a well-coordinated package of features tailored to the local conditions in the targeted area.

4.2.2 What could work

The phrase 'what could work' necessarily includes a fair degree of speculation and uncertainty. It intrinsically suggests that correcting all the things that caused failure in past projects could probably make them work in the future. In any case knowledge management and information exchange on 'what worked' and lessons learned are prerequisites for 'what could work'—at the minimum it prevents reinventing the wheel. Foreign aid is an essential ingredient to most, if not all, aspects of what 'could work'.

Mechanisms for the dissemination of 'what worked', lessons learned in specific cases and the application of design practices to inform effective policy designs and implementation strategies in other jurisdictions do not exist—but a comprehensive data and information system could work in accelerating the deployment of sustainable energy. Sustainable energy and energy efficiency are capital intensive—for local manufacturers of key components, such as PV modules, and for consumers who purchase PV systems. Access to finance, especially longer-term loans and financing vehicles that reach the target consumers, is at the root of 'what could work'.

Strengthening domestic capital markets, providing basic insurance services and risk management instruments would improve access to capital and lower financing costs. For example, an energy efficiency project in China fell by the wayside because of a lack of collaterals for the lending. In India the ADB covers up to 50 per cent of the payment default risk on commercial bank loans of up to 15 years to private sector developers of small solar power projects (WB/IMF 2011). From a policy perspective, MDBs can encourage developing country institutions in mainstreaming clean energy options into national development plans and investment decisions. Foreign aid for partial risk guarantees, currency hedging or commodity and interest rate risk management lowers borrowing costs and thus the barrier for the investment in renewable energy.

The expected rate of return (ERR) required by public or private investors often cannot be met. Financial and regulatory incentives, as well as concessional financing schemes, can significantly lower the investment and ERR barriers. Here simple tax reductions and exemptions tend to have the lowest impact (not considering economic opportunity cost). By contrast, concessional financing schemes tend to have the highest impact and are likely to be the most cost-effective incentives in terms of their overall impact on generating costs and competitiveness (Kulichenko and Wirth 2011). Cost reductions could also result from scaling up of the level of implementation. But more importantly, the countries involved would benefit from the project economically through a high localization factor of technology components and services. The latter could be accelerated by concessional loans and grants.

Acceptance beyond the demonstration period is enhanced when the households can make income-generating uses of the energy. Helping the local community to develop and implement business plans improves the likelihood of collecting revenues that pay for the energy services. Programmes and grants for community development could be instrumental to develop and maintain the consumer base for low-carbon energy. This could be accomplished if the financial institutions (and foreign donors) willing to finance solar home systems, micro hydro or mini-grid solutions, were also funding associated end-use investments. Support of businesses that utilize the electricity would help create a profitable demand load.

Introduction and development of micro finance programmes by local institutions without requiring conventional banking and consumer credit would increase the potential customer base. Repayment of loans, however, is intimately tied to new income-generating activities.

Typical financing packages offered by commercial banks as well as development financing institutions require feasibility studies, loan collaterals and equity from borrowers, all of which come at a cost. Measures to reduce these costs would encourage a wider participation of commercial banks, lower interest rates and, consequently, a final price that is affordable to poor consumers. An affordable price (calculated as upfront cost or instalment payment) would ideally be similar to the cost that the consumer would bear for kerosene or diesel. Creative ways to collect payment is also important for the sustainability of the scheme.

Employment opportunity (another form of income-generating activity) in the renewable energy business as technicians, plant operators, book-keepers, fee collectors and managers also help sustain the consumer community's interest in the utility. Therefore education and training in all aspects of renewable energy systems could make a renewable technology a sustainable community asset.

A broader 'programmatic' approach is more effective than a narrowly defined 'project' design for the deployment of sustainable energy. Foreign aid could consider a multi-disciplined approach, i.e., in addition to funding the design, building and operation of renewable energy systems, ODA could integrate community development and introduction of micro financing for business as part of the programme. These aspects of development would create the 'pull' effect for the success and effectiveness of low-carbon technologies.

Gender is usually not included in foreign aid projects for sustainable energy. However, in recent years there has been an increase of research on gender issues with foreign aid support. Gender is slowly being recognized as an issue in energy delivery. Women are actively involved in the livelihood of the family and, therefore, more open to embrace new concepts or new technologies that hold promise of improving their living standards. An accelerated involvement of women is likely to have a positive impact of the deployment of sustainable energy. Mainstreaming gender issues in project design and implementation could create additional impetus to sustainable energy.

Succession planning is essential for a seamless continuation of activities and services provided by aid supported individuals and institutions or directly by the sponsor organization once the funding period ends.

Maintenance service businesses are often reluctant to service large but low population density areas. Here additional economic incentives could improve the 'serviceability' of such areas and thus the deployment of sustainable energy technologies.

Clear and mutually agreed objectives (outcomes) of a low-carbon energy project increase the probability of success. Strengthening long-term self-reliance—via revenue generation and reinvestment—improves the probability of success but requires that revenue covers costs. It is easier to make a profitable energy system socially beneficial than to make a socially beneficial plant profitable. Low-carbon energy should be promoted for its role in securing livelihoods or enabling small enterprises, rather than as an 'energy programme' or environment protection programme (Khennas and Barnett 2000).

Many renewable energy projects will generally be able to comply with CDM eligibility rules. Capacity building in utilizing CDM for finance could enlarge the financial pool for renewable energy and efficiency programmes. CDM finance is not necessarily sufficient. If combined with other policies such as FITs, it would generate additional revenue and remove non-economic barriers. FITs and CDMs pair up quite well for reducing investment risks and providing stable revenue. The engagement of multiple suppliers for similar technologies or micro systems forfeits potential cost reductions of 40-50 per cent associated with bulk-purchases (Mahama 2012).

Demonstration projects should hold the potential for scaling up to commercially sized and economically viable sustainable energy projects.

Martinot, Ramankutty and Rittner (2000) made an assessment of GEF's loan portfolio for PV projects based on the project cycle of the WB solar programme. The WBG (2007) also published a report on the lessons learned from WBG's funding experience of PV projects, valued more than US$600 million, in 30 countries for a total of 62 MW capacity. These two publications offer the following recommendations on what 'could work' pending on further investigation with emphasis on:

- Affordability through fee-for-service and consumer credit;
- Use of GEF resources for non-recurring costs related to business and market development;
- Access to finance and incremental risk sharing;
- Explicit linkages to rural electrification policies and planning;
- Commercially feasible business models that are sustainable and can be replicated;
- Project finance design must be flexible per local situation;
- Support must be for the technology of choice as consumers choose among several options;
- Private equity is not always the best finance as the returns are less than what could be obtained in other ventures;
- Good government relations and support are necessary;
- Quality of product must not be comprised; and
- Other financing vehicles must be accessible (explore all options).

4.2.3 What is transferrable

Transferability of 'what worked' and 'what could work' depends on numerous factors ranging from geographical, weather, climate and environmental conditions to energy resource endowment, stage of economic infrastructure development, governmental structures, social and cultural realities (this an indicative not comprehensive list). Although 'one size does not fit all', many of the features listed under 'what worked' above are transferrable if adjusted to account for the different circumstances present in the target area or country.

For example, there is no inherent reason why the rationale for, and development of, appropriate macro-level framework conditions (legislation, government commitment, private sector participation, incentives, etc.) are not transferrable to other jurisdictions. Likewise 'participatory approaches' to create, nurture and capacitate communities to build, own and operate micro energy systems are essentially location independent. Examples of successful south-south cooperation are often replicable.

Government participation or co-ownership enables access to international development assistance and reduces dependence on local financial institutions. As well, activities such as pre-project planning, resource mapping, site and infrastructure evaluation are prerequisites for any successful project. Human resource development and capacity building are always transferable.

A liberalized electricity market and experience with independent power production help attract private sector participation. The need for tariff structures that cover costs, especially after the end of the funding period, are universally applicable. BOT schemes require long-term PPAs or FITs plus a supportive and transparent market regulation.

The distribution and allocation of project risks between different entities or partners to parties best suited to manage such risks, e.g., PPPs and PPAs, have been successfully applied in different jurisdictions. Clearly defined and delineated business models and financing schemes plus guaranteed market access, and not just on financing the demonstration plant, are generally location independent. Business models where small micro enterprises are playing a central role in delivering micro renewable energy system based services to rural areas have already been transferred to several countries. Incentives such as FITs and associated laws have also been transferred and implemented in several countries. Micro-credits arrangements for financing renewable energy service packages with local intermediaries and user organizations are rarely location dependent. Especially at the village level, the SGP support of user organizations or intermediaries is transferrable.

Depending on the size of the country, the simultaneous development of domestic manufacturing capability of system components or entire system (supply push) and of a domestic market (demand pull) is transferrable if the domestic market is sufficiently large or a coordinated regional (several smaller countries) market can be accessed. This may need intergovernmental agreements on cross-border taxation etc.

4.2.4 What is scalable

In the context of foreign aid and sustainable energy, scalability is about broadening the project planning, finance, implementation and management approach and its beneficiaries to a larger scale. It may involve changing the project design, approach or focus but it is grounded in the same fundamentals as the original project (UNDP 2006).

Scalability depends on many features and dimensions—political and regulatory, institutional, economic (market structure and size), financial and technological. In many instances, scaling-up affects several dimensions simultaneously and, therefore, is a collaborative effort across the dimensions concerned and coordination is paramount. Scalability also depends on a society's preference and weights on issues such as jobs, energy security and environment protection. Scalability involving capital-intensive technologies is generally easier in an environment with a strong public sector presence than in a setting where myopic private sector objectives dominate.

Capacity building and human resource development are probably most suitable for expansion, and generate fast returns. Dispersed individual renewable technologies can be scaled up to energy parks/farms yielding higher returns of lower generating costs through streamlined procurement, management and maintenance costs. Off-grid local micro energy systems can be expanded to larger island systems with eventual grid integration.

A more commercial version of user organizations are renewable energy service companies (RESCOs). RESCOs either own the mini-grid infrastructure or lease it from a governmental or non-governmental organization and rent out electricity-generating equipment, e.g., solar home systems, and electric devices at fixed monthly tariffs or sell electricity services by the hour (IEA 2011). Like user organizations, RESCOs carry out maintenance and repair services, again utilizing local labour, and manage financial transactions, billing and revenue user fee collection.

The sustainability of renewable projects supported by micro finance schemes often depends on the capability of the technology supplier and the micro finance intermediary to reach large numbers of clients and a speedy recycling of the funds (UNDP 2012a). Micro-credits for financing renewable energy service packages with local intermediaries and community-based user organizations can be, and have been, replicated in numbers (horizontal scalability) but with growth that will eventually overlap with commercially provided financial services. Fee-for-service systems are scalable to the point of traditional utility type generation, distribution, management and administration. The horizontal scalability of SGP funded projects has been demonstrated for more than two decade, has spawned numerous community-based organizations and by now has developed into overarching network committed to sustainable energy and environment protection (UNDP 2012b).

In fact, SGPs are also vertically scalable, i.e., income-generating activities and new local business opportunities eventually make them financially self-sustainable without the need of foreign aid support and subsequently integrate them in the standard economy.

MDBs and multilateral funds are increasingly called upon to contribute to the scalability of affordable renewable energy technologies by ‘supporting regional research, the testing of new technologies in selected countries, greater deployment of new technologies through technology transfers, and regional manufacturing of packaged renewable energy products and sub-assemblies’ (ADB 2009).

4.3 Further considerations

Bilateral versus multilateral aid: MDBs and other international financial institutions offer several advantages compared with bilateral assistance. They provide a platform for collective action; help to contain donor competition and minimize conflict among donors (Burall, Maxwell and Menocal 2006). As well, recipient governments generally have a greater say in the aid allocation process. In contrast, bilateral assistance often has a long history of engagement between donor and recipient country institutions; greater coherency with other national policies such as trade and security; and greater flexibility than multilaterals (Urban and Wolcott 2009).

Access and acceptance: Initiatives to increase energy supply in developing countries have not necessarily reached the poor, and initiatives designed specifically to increase energy access for the poor have not taken full advantage of clean energy technologies (OCI 2011). There are several reasons for this. Despite energy sector reforms in many developing countries encouraging private sector involvement, energy supply remains predominantly an affair of large state-owned utilities or energy companies. Even the private sector entities tend to become relatively large while pursuing 'conservative management philosophies' (Mahama 2012)—incremental rather than fundamental in technology choice or business development—not necessarily what customers and markets or policymakers expect and demand. Initially, the techno-economic performance of new renewable technologies is often inferior (upfront investment costs, functionality, familiarity, convenience, etc.) to their existing fossil alternatives and hence of little attraction for utilities and their affluent customer base (Christensen and Raynor 2003). In contrast, these technologies tend to appeal to those lacking access to modern energy services.

Development aid in whatever form is crucial to accelerate the market penetration of clean energy technologies. Mahama (2012) argues that policy and implementation advice for energy development, especially when linked with development aid, is provided by foreign technical experts who are often ignorant of local conditions and needs. As a consequence, development aid lacks the necessary effectiveness in providing access to clean energy services. Effective climate change mitigation requires concerted action over the long term by many partners in industry, finance, government, academia, and multilateral organizations. ODA and other forms of assistance remain essential tools for stimulating investment in climate friendly technologies. If the recent increase of ODA for climate-related projects is an indication, remarkable progress has been accomplished already.

But those achievements will not enter the mainstream unless new approaches—on the policy front, and in finance—come to complement existing initiatives. The problem is this: sustainable development through clean energy is still being addressed through short-term financing and regulatory frameworks that are not aligned to the immense scale of the challenge facing the globe (WB 2012b). Government resources alone are inadequate to meet the large investment requirements of scaling up renewable energy services and energy efficiency while private sector investors find it still too risky to invest in clean energy. Therefore, mobilizing multilateral and bilateral financing institutions is vital for ensuring sustainable energy development and climate protection.

Gender is usually not included in most energy or utility projects but it is increasingly being recognized as an issue in energy delivery. Renewable energy is being adopted for many rural off-grid communities, most of them among the poorest populations. Micro-finance has been proven effective in bringing micro hydro and solar PV to these communities. One of the success factors for micro finance is when women are incentivized to subscribe to the renewable energy projects that provide opportunities for income-generating activities for them (UNDP 2004; UNDP 2011). Projects with gender-related action achieved their overall objectives in relatively greater proportion than projects similar in sector and year of approval but without gender actions (Murphy 1997). Other studies also found that when gender issues were included in project design, greater end-user acceptance is achieved and more entrepreneurial activities were initiated (ENERGIA/DfID 2006). More recently, in assessing approaches to bring modern lighting to Africa, a study by the IFC found that women are both important beneficiaries and key facilitators of successful energy access programmes (IFC 2011).

Finally, the following list summarizes the key elements for a successful market penetration of sustainable energy technologies:

- High level of government engagement and responsibility;

- Institutional capacity for managing technical and policy components;
- Critical mass of human resources with technical and policy expertise;
- Investment and financial support driven by ‘need’ or ‘demand’;
- Technology solution contribute to the wellbeing (development, alleviation of poverty);
- Energy technology (hardware and software) are appropriate for the selected site;
- Financial and economic viability of projects;
- Governments are market enablers based on supportive policies and regulation;
- Private sector participation;
- ODA an enabling tether between governments and the private sector;
- Climate benefits ‘visible’ for investors and improve the ‘bottom line’;
- Investment in plant and equipment includes committing resources for training and capacity building (maintenance, management, business development);
- Overall integration in the local energy and economic infrastructure;
- Innovation in technology, business models, and financing; and
- Good intentions alone are not sufficient, money alone will not bring change.

5 Conclusions

ODA and other forms of development assistance have played and will continue to play an essential role in transferring climate-friendly technologies to developing countries. The effectiveness of the assistance depends on a variety of factors: political, economic, financial, geography/location, infrastructure, social and cultural. Because of the wide differences of these factors across countries, regions and continents, the literature review undertaken for this paper leads to a first conclusion: one size does not fit all and generalization, hence transferability and scalability, of the specific micro features associated with examples of effective use of foreign aid is limited. What is transferable are the macro-level framework conditions that formed the basis for the success of ‘what worked’. Solid government commitment at all levels, legislation in support of energy efficiency and renewable energy development (mainstreaming of climate change mitigation), incentives for private sector participation, participatory involvement of local communities (creation of local champions), communicating benefits and risks, linking energy access with income-generating opportunities and access to concessional loans and credits. In short, benefits exceed real and perceived risks or revenue cover costs.

A second conclusion concerns ‘what could work’. There are no inherent reasons why effective use of ODA would not work as long as the macro-level framework conditions are fully implemented and fundamental technical project prerequisites exist: sufficient resource base, technology adaptable to local conditions, sufficiently skilled labour and infrastructure availability. ODA might be more effectively spent on filling gaps in the macro-level framework than directly supporting on-site technology implementation.

The literature review revealed little on scalability. Again, scalability is a matter of the existence and further development of macro-level framework conditions, access to finance and the recognition that the ‘low hanging fruit’ is harvested first. Scaling-up of successful projects, therefore, necessitates due diligence of site conditions, infrastructure readiness and economic project feasibility under varying political and institutional framework conditions.

Finally, the literature review confirmed that effective use of foreign aid for sustainable energy and climate protection is possible and has taken place, yet there is lots of room for improvement. The review also confirmed that without ODA and other forms of development assistance many renewable and efficiency projects would have not been implemented in developing countries with resultant higher greenhouse gas emissions. Even with the rapid decline of renewable technology costs observed in recent years, effective and efficient climate change mitigation in developing countries will hinge on stepped-up development assistance and technology transfer, climate finance and, above all, a comprehensive and binding global environmental agreement for climate protection reflecting the UNFCCC principle of 'our common but differentiated responsibilities'. Future levels of ODA are the mirror image of the world community's resolve to avoid dangerous anthropogenic interference with the climate system.

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Appendix: selected studies

A1 Micro hydropower in Nepal

Nepal's technical hydro resource potential has been estimated at 40,000 MW large-scale hydropower and 50 MW micro hydrostations. Currently about 600 MW have been developed with another 135 MW under construction (WEC 2010). About 60 per cent of the population has no access to electricity. Micro hydropower (MHP) has been adopted as an effective way to provide electricity to isolated rural areas and, therefore, MHP development has been supported by foreign aid. Nepal is often cited as an example of both successful and failed development of micro hydropower. Lack of maintenance and local management capability were the main causes for numerous systems not lasting beyond one or two seasons (ADB 1998). In contrast, foreign aid that also included technical training and management capacity-building alongside the funding support for plant construction had sustained success.

The Butwal Power Company (BPC), a non-profit organization established by the United Mission of Nepal (UMN), began in the 1990s to develop micro hydropower systems using predominantly local expertise and capabilities in order to create rural employment, improve living standards, reduce costs of rural electricity and stem deforestation (Kozloff 1995a). Funding was provided by Norway and other foreign donors, a share of which was devoted to the development of self-competency in various facets of the hydropower industry like engineering, construction, operation, maintenance and manufacturing of hydroelectric equipment.

BPC also introduced user organizations (UOs)—local entities comprised of electricity users—which it contracted to manage rural electricity distribution, basic grid maintenance and simple repairs, hooking up new customers, billing and the collection of payments. Training on all these aspects, including safety and the productive use of electricity, is provided by BPC. During grid construction connecting the village to a hydroplant or substation, UOs contribute local labour (in-kind). UOs keep 10 per cent of the collected payments to cover their overhead costs; the remainder is remitted to BPC (IFC 2012).

Over the years, the BPC became the only power company other than the official Nepal Electricity Authority (NEA) to bring grid-connected electricity to rural areas—at much lower costs than the NEA due to the foreign aid it received which covered certain cost components such as engineering fees, contractors' overhead and profit or risk margins (USAID 2012; BPC 2012; UMN 2012). In 2003, the government of Nepal was able to sell its 85 per cent ownership of BPC to private investors under a public-private partnership—a success of BPC's inclusive business model.

The success of UMN and BPC should not mask the difficulties of many other attempts of foreign aid to development micro hydropower. In an independent review completed in 2010 of UNIDO's 24 small hydropower plants in 14 countries, only five were found operational. The problems identified in this review is a list of what 'not to do' for foreign aid involvement in MHP: inadequate site selection, insufficient planning, technology-driven but with minimal or no local input in planning, or capacity building, end-use production was lacking (UNIDO 2010). Similar problems in two micro hydropower plants in Nepal are also described in more detail by Upadhayay (2009). An analysis of 'best practice' for MHP is in a report prepared by Khennas and Barnett (2000).

A2 Renewable technologies in Sri Lanka

The Energy Service Delivery (ESD) project was launched in 1997, followed in 2002 by the Renewable Energy for Rural Economic Development (RERED) project (completed end of 2011).

Financial support was provided by the International Development Association (IDA) of the WB (credit line of total US$134.7 million) and the GEF (grant of US$11.8 million). The objective of these projects was to improve the quality of life and bring about economic development by promoting and supporting the development of renewably sources with off-grid and grid-connected energy services. Particular emphasis was put on the engagement of civil society and the private sector. The programme supported PV, hydro, wind and biomass systems. The support mechanism included grants for off-grid systems, credit finance through private credit institutions including micro finance intermediaries, as well as technical assistance for income generation and social services related to electricity. An integral part of the programme was the advancement of energy efficiency by mainstreaming efficiency within government policymaking.

At the outset of ESD in 1997, one mini-hydro developer, three PV dealers and two village hydro developers were serving the country's rural areas. By 2004 the programmes had established 40 mini-hydro companies backed by 20 active developers, ten registered solar companies, 22 registered village hydro developers and 12 village hydro equipment suppliers. More than 80 electricity consumer societies have been developed and operate under the schemes of ESD and RERED. The total investment over the programme period was about US$150 million.

Cumulatively the two back-to-back projects added 120 MW of renewable electricity-generating capacity to the national grid and assisted in the electrification of over 131,000 households with solar home systems (SHSs) and a further 7,900 households using village hydro projects (VHPs) and village biomass projects. They provided access to affordable electricity and helped implement Millennium Development objectives.

According to the WB, the programmes now serve as models for the development of multiple renewable energy markets with multiple stakeholder involvement (WB 2012). The success of the projects can be attributed to several factors: 'ESD and RERED are market-based projects, operating through commercially viable delivery and financing channels and streamlined project management structures. They demonstrate the potential of leveraging donor finance to expand the market for renewable energy' (UNDP 2012). The UNDP report notes further success factors: addressing existing policy barriers; capacity building and stakeholder involvement; focussing on commercially viable delivery and financing channels for technologies that meet the energy needs of rural populations; and responding to changing market conditions over the years such as higher transaction costs for micro finance than in the past and the expansion of the national grid reducing the demand for off-grid alternatives (UNDP 2012).

A3 PV in China

In 1989, the WB-IFC provided a funding of US$3 million (debt and equity) from its regular budget to a Chinese PV manufacturing company. Although the investment did not meet its original expectations, the investment signalled financial sector confidence in the viability of the technology and set a precedent for investing in PV businesses in a developing country (IFC 2007).

Twelve years later, the WB jointly with the GEF funded the Renewable Energy Development Project (REDP), a project in support of PV system deployment. The funding was provided in the form of a US$13 million concessional loan from the WB and a US$27 million GEF grant. This aid was further leveraged by state utility companies and private sector contributions to a total funding package of US$317 million. The main target group for the PV systems was the nomadic rural population in north western China. By the time the project closed in 2008, 400,000 solar photovoltaic home systems were sold, providing access to electricity for a population of about two million. These systems replaced kerosene or candles with substantial improvement in indoor air quality. As a follow-up, the WB is working with China to scale up the project's success to wind and biomass fuelled systems (WB 2011).

The implementation of REDP, however, also encountered hiccups. One lesson learned was the reluctance of trade and service businesses to operate in large areas with low population densities which can cause difficulties in establishing effective sales and service operations. The results in delays and poor maintenance hampered the reputation and market growth of PV systems (WB 2010). The project did not include financing mechanisms for rural consumers. Rather the PV systems were sold for cash which limited their deployment to the segment with access either to bank credits or herders who could sell yaks for cash. A consumer finance approach with 'partial credit guarantee' would have increased the sales of PV systems (WB 2010).

Parallel to the REDP, the WB (loan of US$86.33 million) and the GEF (grant of US$40.22 million) funded the China Renewable Energy Scale-up Project (CRESP) over the period 2000 to 2011. The objective of the CRESP was to demonstrate and commercialize the domestic manufacture of PV cells and wind converters. The CRESP spawned China's renewable energy programme and, subsequently, gave rise to its domestic manufacturing capability which in the course of a few years began, first, to challenge, then dominate the international PV and wind technology markets.

> The Bank and the GEF played a catalytic role in cementing the commitment through all the analytical work, knowledge activities, and consensus building during the first years of preparation. Scale-up of RE in China during the last five years has been unprecedented. The country has become the world's leader in renewable energy capacity, ranking number one in SHP and wind capacity, number three in biomass, and is on its way to achieving leadership in solar PV capacity (WB 2010).

The successes of the REDP and the CRESP are intimately interrelated and it is highly unlikely that one could have been as successful without the other. It was the combination or quasi dove-tailing of domestic demand pull and domestic supply push programmes which provided an immediate market for the domestically produced PV systems and wind converters. In addition, government support provided for planning certainty while a high localization factor and market volumes well suited for economies of scale generated high levels of value added in support of economic development.

One often overlooked aspect of China's success cannot be overemphasized: the proactive public policy support of rural electrification (with renewable energy) which has been an integral part of the Chinese government's rural development strategy.

When similar PV projects were implemented in countries where national polices have not been fully developed or politics of national and local government are in conflict, the results are quite different.

A4 The Ghana Energy Development and Access Project

One such example is the Ghana Energy Development and Access Project (GEDAP). Launched in 2005, GEDAP is a hybrid of the national government's electrification policy based on a traditional top-down approach, grid-based approach by the state-owned utilities and a bottom-up private sector approach with business models involving micro finance, decentralized off-grid and mini-grid renewables PV systems in remote areas (Mahama 2012). Particular emphasis was put on cost-effective access to modern energy services (WB 2007). Private sector entities were handed the responsibility for the entire procurement and execution process of PV packages including end-use equipment such as home lighting packages or inverters for TVs. A so-called 'dealer sales/consumer credit model' provided concessional loans (with a 25 to 50 per cent subsidy component) with 10 per cent down payments to households in target areas while rural and community banks managed the consumer credit arrangements. The arrangements also included generous periods for repayments of the non-grant portion of the loans.

The bottom-up private sector component of GEDAP was the continent-wide 'base-of-the pyramid' (BoP) project which in Ghana was called the Affordable Lighting for All (ALFA) project. The BoP approach is a cooperative initiative of the multi-national electronics company, Philips, with private sector entities and NGOs in Africa to provide affordable and sustainable renewable energy services (such as solar lights and efficient cook stoves) to the poor. The initiative is driven by a business model that includes the development of commercially viable distribution and service chains for these products using local entrepreneurs and multi-sector collaboration. The BoP project is market development: enhancement of the economic situation by simultaneously providing affordable energy services and income opportunities for the local population as well as profitable business for large corporations (Prahalad 2004) which provided the products match local needs and expectations (e.g., charging possibilities of mobile phones in addition to solar lights). The ALFA project had the objective to develop and field test commercially viable distribution and marketing, maintenance and after-sales service chains for electric lighting products and related services.

The ZEM Alliance (a Ghanaian and Norwegian partnership) develops grid quality electricity access for isolated communities based on stand-alone mini-grids using PV electricity and battery storage (Mahama 2012). The ZEM business model includes:

- Ownership of the PV equipment, battery storage and grid by the community;
- Initial investment from donor grants and in-kind contribution of labour from the community;
- Privatized operation and maintenance;
- Revenue covering operation, maintenance, and replacement costs through user tariffs; and
- Capacity building, i.e., local 'ZEM Entrepreneurs' capable of operating technical aspects of the micro grid system as well as the commercial aspects of selling electricity to the local customers and collecting revenue.

GEDAP attracted financial support from several MDBs including the WB, AfDB, GEF as well as bilateral assistance. While GEDAP was a first of its kind in Ghana to simultaneously develop grid and off-grid electrification alternatives that co-existed and complemented each other, Ghana's electricity system remains predominantly a grid based system. Of the total US$210 million available, only 12 per cent has been allocated to the development of off-grid decentralized systems (WB 2007). Despite the presence of almost ideal conditions, the effectiveness of GEPAP left much to be desired and there is much to be learned from the Ghanaian experience for other developing countries. As regards the implementation in off-grid rural areas, Mahama (2012) identifies the application of a top-down mentality to decisionmaking and service provision as one factor. The following list summarizes the lessons learned from the GEDAP, ALFA and ZEM initiatives:

- Absence of a policy and legal framework for investment and entry for new market participants limits competition and thus effectiveness;
- Despite mechanism for quality control, monitoring and regular maintenance of the home systems, customer satisfaction suffered from slow response times to system faults. Slow repairs and the resulting lack of operationality increase the risk of loan defaults;
- Market development was often hampered by poor infrastructures such as road access, etc.;

- The prerequisite of a bank account for credits severely limited the uptake of PV systems;
- Despite local micro financing, the PV systems were still too expensive for a large number of potential customers;
- A top-down mentality discouraged local entrepreneurs to manage and maintain the systems;
- The engagement of multiple suppliers for PV systems forfeited potential cost reductions of 40-50 per cent associated with bulk-purchases (i.e., tens of thousands of systems as planned); and
- Ghana has yet to development a feed-in tariff system to incentivize independent energy producers, be it solar home system or mini-grids.

A comprehensive study of Ghana's engagement in climate change mitigation projects found similar issues and implementation obstacles (Cameron 2011).

A5 Concentrating solar power in Morocco

Ouarzazate-I CSP is a large-scale concentrating solar power (CSP) plant currently under development in Morocco. The 160 MW Ouarzazate-I plant is the first phase of a larger 500 MW CSP facility with thermal storage. While CSP has proven technical feasibility and commercial viability in smaller scales elsewhere (e.g., the 50 MW Andasol-1 CSP in Spain which went on line in 2008), the size and cost of the Ouarzazate plant estimated at close to US$1.4 billion is unprecedented and its economics nowhere close to commercial viability. The government of Morocco worked at the stage of project concept development with international financial institutions (IFIs) for funding and financial packaging support. The project is based on a PPP ownership structure and PPAs. The PPP embraces the government of Morocco, via the Moroccan Agency for Solar Energy (MASEN), and private developers and investors which share ownership of the special purpose vehicle Solar Power Company (SPC) (Falconer and Frisari 2012). Foreign aid from IFIs and a consortium of seven European development banks are committed to fund the bulk of the investment costs. Construction start is scheduled for late 2012.

The PPA takes the form of the government covering the difference between the price at which MASEN buys electricity from SPC and the sales price it receives from the Office National de l'Eau et de l'Electricite (ONEE), the national water and electricity company. This subsidy—estimated at some US$880 million over the 25 year lifetime of the plant—is essential for the project's viability and is financed by the government and concessional IFI finance. The investment of Quarzazate-I is provided by national development agencies and IFIs (US$1.3 billion), private-sector investments (US$190 million for the 75 per cent equity share) and the government's equity contribution of 25 per cent (through MASEN) plus the operational subsidies throughout the lifetime of the plant.

The sponsors' motivation to engage in the project which, by normal standards, lacks economic rationale is the sponsors' expectation of the project (i) spawning a larger 'CSP market in the region that will bring longer-term and broader economic benefits', (ii) buying down the investment cost of future plants and (iii) reducing subsidy requirements via revenues from electricity exports (Falconer and Frisari 2012).

Important features of the project that worked in attracting sufficient financing for Phase I and which are largely transferable include:

- Lessons learned from earlier GEF-supported CSP project failures in Egypt and Mexico were taken into consideration (e.g., unsuitable business models, implementation delays, no provisions for scaling, a lack of opportunities to utilize economies of scale, etc.);

- The project benefited from information exchange with other large-scale CSP projects that are in development in India and South Africa;
- The project scale is sufficiently large so as to buy-down technology-costs;
- The PPP approach shares project costs and risks between the government of Morocco, MASEN, IFIs, private financiers and project developers;
- Government participation reduces policy risks;
- The subsidized PPAs supported by concessional IFI funding function as quasi market incentives and reduce revenue risks;
- IFI participation provides security for private investors in the event that the Moroccan government faces budget difficulties;
- Pre-project financing arrangements through concessional IFI funding reduces the completion risk due to capital shortages during construction; and
- The demonstrated success of Andasol-1 reduces technical risk and prejudices.

A6 Funding micro finance of PV home systems for rural electrification: Dominican Republic

Grid connection of many isolated communities is too costly, hence difficult to finance. Transition to modern electricity-based energy services, therefore, requires off-grid solutions ranging from stand-alone home solar systems to mini-grids connected to local hydropower stations of small solar and wind parks. Financing mechanisms for these settings are distinctly different from projects with grid-connection. The experience from the Asia Pacific region indicates that different financing schemes, alone or in combination, are needed. These schemes include targeted subsidies on capital costs for renewable technologies; community level financing mechanisms (micro credits) through special groups, community cooperatives and community-managed funds. Particularly effective have been women's self-help groups (UNDP 2011). Foreign aid has proven effective in the deployment of solar home systems and micro hydroplants via support of microfinance institutions; examples can be found in Sri Lanka, Nepal, Peru and Dominican Republic and elsewhere. Consumer credits through micro finance institutions stimulate private sector participation in various aspects of renewable energy services ranging from equipment sales and maintenance services to vendor credits.

In the Dominican Republic a community-based NGO, with funding support from GEF's SGP, supported ADESOL (Association for Solar Energy Development) to sell, install and maintain small PV systems in poor rural communities. Starting in 1994 with a grant of US$20,500, 'ADESOL paid the upfront costs for a small number of homes to obtain solar panels, and these people along with the rest of village formed a revolving fund to help others get the panels. After making a downpayment of approximately US$115, residents could pay off the remainder of a loan for purchasing PV home systems at about US$6 per month. This monthly payment is less than what households formerly paid for batteries and kerosene to light their homes. As of 2003, the revolving fund had financed the purchase of more than 600 solar home systems in marginal rural communities in 18 of the country's 30 provinces. ADESOL also supports community installations, including solar water pumps and lighting for schools, health centres, community centres and parks' (UNDP 2006).

A7 Pre-project finance: wind mapping in Morocco

Up-front pre-project costs are incurred with information collection, resource mapping, feasibility studies and impact assessments, site selection, comparison of technology options and may other preparatory and administrative tasks. Especially wind resource mapping and the assessment of geothermal resource potentials are time-consuming and expensive. Many developing countries lack the technical knowhow to conduct the necessary investigations. Reliable data on renewable resource flows determine the location and eventual success of an investment in a wind or geothermal project. Conventional financial institutions have been reluctant to fund such pre-project activities. Foreign aid and technical assistance supporting pre-project activities are mechanisms with an above average track record.

The German foreign aid agency GTZ Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH established TERANA (Technical Expertise for ReNewable Energy Application) in the 1990s, a programme in support of renewable energy in developing countries. In cooperation with the German Wind Energy Institute (DEWI), TERNA carried out resource measurements, resource assessments, data analyses, and site evaluations for wind parks in Morocco, Jordan, Namibia and China (Abramowski and Posorski 2000). The programme aims at minimizing the risks associated with the implementation of a new technology such as wind power plants.

TERNA also supports capacity-building through training courses (workshops) on problems of wind monitoring, analysis of wind potentials, technical and economic risk analyses of wind projects and grid connection; preparation of financing plans and project documentation for fund raising, as well as operator training (Abramowski and Posorski 2000). Although TERNA does not provide financial support for wind plant construction, the programme helps identifying and contacting funding sources.

Among the four countries assisted by TERNA, Morocco appears to have fully embraced the German recommendations. By 2012, all three sites that GTZ in the 1990s helped to assess have been implemented: 65 MW Essaouira (2007), 240 MW Laâyoune (2011) and 200 MW Tarafaya (2012). With these wind parks in full operation and more to be developed in the coming years, Morocco is moving along steadily to achieve its goal of meeting 15 per cent of the country's energy demand with renewable energy (Zafar 2012).

A8 Wind in Ethiopia

Capacity-building and knowhow transfer are other essential aspects for foreign aid. Between 2004-08, the GTZ funded a TERNA project in Ethiopia. The purpose of the project was to improve the technical and economic capabilities of experts and managers of the public electric utility company in order to promote, implement and manage grid connected wind energy utilization. The project's objective was transferring Germany's wind energy knowhow to Ethiopia with the aim to build the necessary human resources capacity in Ethiopia that would enable the country to realize its wind energy potential by building and operating wind parks (AGEG Consultants 2008).

The project was well aligned with the needs of Ethiopia Electric Power Company (EEPCo) and resulted in a healthy working relation between the GTZ and EEPCo project members. The valuation report praised the overall effectiveness of the project but noted several areas for improvement: lack of a comprehensive training-needs assessment and a capacity-building plan that reflects the existing human resource skill profile of EEPCo. Hands-on exercises in conducting pre-feasibility wind park studies rather than training in the use of highly specialized wind park design software used by engineering firms was clearly preferred by EEPCo staff. Other notable insights from the project included the reckoning that developing county utilities may need the capacity to manage foreign consultants much more than the ability to conduct a study by the utilities company itself. Innovative ownership models such as IPP/BOT should be included in the capacity-building at national government planning agencies to take full advantage of investment opportunities. For example, a US company proposed an unsolicited IPP, but the government of Ethiopia did not know how to respond and, in the absence of a policy framework, lost the opportunity to explore the possibility (AGEG Consultants 2008).

Wind park construction by EEPCo has been delayed due to the high altitude of Ethiopia's wind sites At sites above 2000 meters standard wind turbines are not suitable for operation and suppliers have shown little interest in offering modified turbines. In addition, towards the end of the project, the global wind market was extremely tight and EEPCo's tenders for a 120 MW wind farm met little interest from suppliers (AGEG Consultants 2008). By 2010, however, the market situation shifted towards a buyers' market and the first wind farm project in Ethiopia got underway and is scheduled to be completed in February 2013. The 120 MW park worth €210 million is financed by the French bank BNP Paribas through soft loan brokered by the Agence France de Development.

In 2011 Chinese wind turbine suppliers built a 51-megawatt wind park in central Ethiopia for which the China Exim Bank provided 85 per cent of the US$117 million project cost in the form of a loan, with the remainder coming from the Ethiopian government. Later that year, EEPCo announced construction start of six wind power projects and one geothermal power plant.

A9 Wind in Kazakhstan

Kazakhstan has numerous sites with excellent wind conditions. Wind development has been hampered by lack of (i) awareness, information and capacity barriers, (ii) financial barriers, and (iii) institutional barriers. Another critical barrier has been the traditionally low electricity tariffs based on short-run marginal costs (without annualized investment costs). The Kazakhstan Wind Power Market Development Initiative, a joint venture of the UNDP and the government of Kazakhstan, provided assistance to establish a national programme on wind energy development with supporting institutional, legal and regulatory frameworks. The initiative also included wind resource assessments (wind maps) for potential wind farms, site evaluations, feasibility studies and implementation of pilot wind farm. The initiative with a total budget of US$7274 million was led by the UNDP with funding co-financed by the GEF. Large part of the co-financing was earmarked for the investment in a 5 MW pilot wind farm at the Djungar Gate, located near the Chinese border.

By the mid-term review in 2007, the initiative had established the management structure and the national wind energy programme progressed according to schedule and work was almost completed on preparation of the wind atlas. Draft legislation on financial mechanisms and sharing of the higher cost of wind electricity, e.g., purchase power agreements (PPAs), feed-in-tariffs (FITs), a quota system, a bidding mechanism, fiscal measures or capital subsidy. The lack of a PPA was the main reason for the delay in the planned Djungar Gate wind farm pilot project as its cost per kWh was considerably higher than coal-generated electricity, deterring private investors' interests in the pilot wind park.

A10 Wind in China

In 2010, China became the largest wind energy producer worldwide, with an installed wind power capacity reaching 41.8 GW at the end of 2010 and 62 GW at the end of 2011 (Note: in 2010 about a quarter of the wind capacity was not connected to the grid, in large part due to delays in the expansion of the long distance transmission system and many local grids lack the capacity to absorb wind-generated electricity [Dermont 2011]).

China started its large-scale industrial sized wind power programme in the mid-1990s. One of the early wind park programmes was financed partially by Germany's KfW. KfW contributed €24 million in grants and loans, equivalent to 60 per cent of the total project investment. The project established four wind parks in the south-east coastal area of China, where most of China's industrial activities take place. These wind parks and the smaller projects in earlier years are perceived as highly promising, even with high specific costs at the time of the project's evaluation in 2005. The four wind parks avoid an average amount of 45,000 tons CO_2 emissions at a cost of US$26/ton avoided—much higher than the then-internationally established benchmark of US$10/ton CO_2. The overall performance of the parks was below expectation. One reason was an overestimation of the wind potential based on unreliable measurements in the run-up to the feasibility studies. Another reason was changes of the farm locations by the executing agency to sites with less wind potential but lower infrastructure costs (KfW 2005).

However the project is considered 'sustainable' because it has been able to essentially cover its generating costs through feed-in tariffs and provides long-term measurable climate benefits.

A11 Non-recurring costs related to business and market development

Private sector participants in renewable projects are often unwilling to bear non-project related transactions and intermediation costs. For example, the supervision and certification of loans or evaluation of collaterals for loans within the Sri Lankan ESD project were major cost factor. Initially and on a temporary basis these services were carried out 'for free' by Intermediate Technology[11] for both village people and financial institutions. With ESD continuing, these tasks either had to be supplied by local consultants at considerable cost or were not performed at all. Without funding for consultants readily available, the drawdown of loans was very low. A grant from the GEF for the remuneration of loan monitoring, certification of collaterals and similar services reversed the low drawdown trend (Khennas and Barnett 2000).

In Peru, the initial interest in support from an Inter-American Development Bank (IDB)-funded Revolving Credit Fund for micro hydro developments was modest. As it turned out, the 'marketing' programme required numerous costly visits to the project sites. Once it was possible to cover the travel costs with non-reimbursable funds provided by the IDB, claims for support started to increase. Khennas and Barnett (2000) observe 'that for every US$100 spent on a micro hydroplant in Peru (from grant or loan) an additional US$15 is currently spent on the system overhead costs'.

A12 Creating a level playing field: the Philippines

With a total installed capacity of 1,904 MW, the Philippines is the second largest producer of geothermal energy in the world, after the USA. The commercial utilization of geothermal energy dates back to the 1970s when Philippine National Oil Company–Energy Development Corporation (PNOC-EDC), a government owned corporation, started its geothermal activities with ODA loans from the WB and the Japan Bank for International Cooperation (JBIC). The WB helped finance exploration drilling, delineation of the country's geothermal resource potentials and site evaluation. After establishing technical and financial feasibility, subsequent WB project loans financed the development and commissioning of 777 MW of geothermal fields and power plants. The JBIC, also

[11] Intermediate Technology, known as the Intermediate Technology Development Group (ITDG), operates under contract to the UK Department for International Development.

through project loans, helped finance 305 MW (Dolor 2006). WB and JBIC appraisal of EDC's geothermal projects included due diligence by Bank consultants on the technical and financial feasibility, thorough consideration of environmental and social issues, and assessment of PNOC EDC's implementation capability.

ODA financing guaranteed by the government enhanced the economic viability of geothermal projects. This concessionary financing was made available pursuant to the government's energy sector goals and objectives, evaluations of proposed projects by the National Economic and Development Authority (NEDA) for financial viability as well as environmental impact assessments.

Private sector participation was made possible by an Executive Order (1987) and subsequently The Philippine BOT Law (1993), which allowed private sector's participation in geothermal power generation through build-operate-transfer (BOT) contracts. BOT arrangements are for a period of ten years after which the power plants are to be handed-over to EDC.

Philippines have one the highest electricity tariffs in Asia, second only to Japan. Given the geographic spread of the country and the often remote geothermal site locations, transmission is not only a significant part of the country's electricity tariffs but also a necessary prerequisite for the utilization of its geothermal energy resources. In 1992 funding from WB, GEF, JEIB and the Swedish AITEC helped built a transmission line connecting Leyte Island to Luzon levelling the playfield for geothermal with coal-fired power generation in Luzon. Initially the Leyte geothermal field planned, developed and managed by EDC was to produce geothermal heat for 440 MW of geothermal power. The WB and Export-Import Bank of Japan (JEXIM) co-financed the project with US$228 million and a grant of US$15 million was provided by the GEF. The above-ground thermal plants were built on BOT arrangements between EDC and the private sector.

At the time when funding for the Leyte's project was just approved, critics maintained 'while this project has succeeded on technical grounds its impact on carbon emissions would have been magnified if it were part of a strategic plan rather than the GEF's pilot-phase approach of providing incremental funds to affect plans for a project that is already under way or under consideration' (Kozloff 1995b). The plant was commissioned in 1997 but by 2010 the plant had greatly increased its capacity to over 700 MW.

This is a success story. In spite of critics of its limitation and 'pilot-phase' tentativeness, the Leyte Geothermal Plant set the stage for the expansion of Philippines geothermal strategy. The 2009-30 Energy Plan includes an expansion of geothermal generating capacity from to 3447 MW, an increase of almost 1500 MW.

In summary, the development and utilization of indigenous geothermal resources to displace imported fossil fuels is a corner stone of the Philippine government energy policy. Enabling laws/policies such as the Philippine BOT Law of 1993 or Renewable Energy Act of 2008 established the necessary infrastructure and mechanisms to promote the development, utilization and commercialization of geothermal energy (in fact all renewable sources), to enable the purchase, grid connection and transmission of electricity generated from renewable energy sources, and to provide markets incentives such as exemption from various taxes and duties to renewable energy developers.

Coordinated and integrated planning (and execution) of geothermal field development, thermal plant construction and transmission grid expansion was essential to bring clean geothermal electricity at competitive costs to consumers on different islands and reduce the use of coal and associated GHG emissions. EDC acquired the necessary expertise and technology in geothermal field delineation, field development and steam generation, as well as the expertise in environmental management, impact assessment and risk mitigation though knowhow transfer from more advanced countries like the United States, Italy, Japan, New Zealand and Iceland. Loans provided by WB for the exploration and delineation of prospective geothermal areas gave the necessary boost for the government's geothermal development programme.

ODA and other development assistance for geothermal energy development enabled a level playing field with coal. ODA loans from WB and JBIC guaranteed by the government ensured that the abundant geothermal electricity from Leyte can be transmitted to the load centres in Cebu and Luzon. Without this transmission line, a coal-burning power plant in Luzon would have been the least-cost supply option. The coal-fired power plant would have generated CO_2 emission of about 2.2 million tons per year (Dolor 2006). The environmental benefits of avoided greenhouse gas emissions translated into a US$31.2 million GEF grant which made the avoided GHG emissions 'economically visible' and the Leyte-Luzon project economically attractive.

The economic and financial risks of the project were distributed: EDC carried the (higher) risk of geothermal field development and steam supply obligation while the private sector carried the (lower) risk of thermal plant construction and operation but no resource risk. EDC also carried the market risk of selling the electricity. However, as a government-owned corporation, EDC has had access to concessionary finance and ODA which lower its financial risk.

A13 Hydro power: Gansu Province of China

The Gansu Clean Energy Development Project in China, the construction of the 98 MW Xiaogushan hydropower plant (XHP), was part of the national government's plan to introduce 'distributed' renewable energy in 100 second tiered cities. The project was modelled after the European Union's successful approach of involving municipal governments in similar programmes allowing individual municipalities to adapt energy development plans according to local needs and conditions. Prior to project approval, the 'ADB provided technical assistance to explore the need for policy and institutional reforms for clean energy development, and to examine the feasibility of power expansion programmes in the Zhangye City area. The resulting power system studies identified the 98 MW Xiagushan hydropower plant as the least-cost alternative for generation expansion (ADB 2010).

The XHP added desperately needed generating capacity to the 1.25 million population of Zhangye City, increasing electricity supply to the area by 17 per cent while closing down several small inefficient highly polluting coal-fired power plants totalling 85 MW. The total cost of the XHP project amounted to US$93.4 million and had the following finance structure: a loan/grant of US$34 million from the national government and co-finance of US$59.3 million in loans from the Bank of China (US$40.2 million) and ADB (US$19 million).

Shortly after construction started, the Chinese authorities decided to seek CDM eligibility, and in June 2005 the WB and XHC signed an agreement whereby the WB would purchase XHP certified emission reduction (CER) credits for a period of ten years (2006 to 2015). The cumulative CER volume will be three million tons and the total purchase value is estimated at about US$13.5 million. In 2006, XHP began to receive income from the carbon fund (ADB 2010).

The XHP project was fully aligned with the provincial and national development plan, go-ahead decision supported by a comprehensive electricity expansion analysis, project ownership by the local community, competent consultants, timely availability of funds, fodder or food subsidies to farmers or households affected by land acquisition. Community development was integrated with the hydropower plant development and ranged from local road improvement to enhanced health and education services. Finally, the project delivered the expected outcomes: access to low-cost, reliable and clean electricity. The average monthly electricity use of poor households increased from 53 kWh at project approval in 2003 to 194 kWh in 2007 (ADB 2010).

A14 Bagasse in Mauritius

Municipal solid waste (MSW), agricultural and other wastes are biomass resources, the utilization of which can lead to considerable economic and environmental benefits. One example is the use of bagasse, a residual from sugar production, for combined heat and power (CHP) generation in Mauritius. Between 1992 and 1996 Mauritius received a loan of US$15 million from the WB and a US$3.3 million grant from the Global Environment Trust Fund (GET) to develop bagasse-fuelled CHP systems for electricity and heat supply to meet the sugar industry's internal demand and to feed excess electricity to the national grid (Deepchand 2001).

The objectives of the project were to develop and adapt CHP technology to the sugar production process, and to establish and strengthen private-public collaboration in bagasse-fuelled CHP generation. The plants were designed to burn their own bagasse as well as that supplied from neighbouring sugar factories. Bagasse would be burnt during the crop season and for part of the intercrop season, depending on the amount of surplus bagasse stored. Coal would be burned in the off-crop period (Deepchand 2001). Training of technical staff from sugar and coal plants as well as capacity-building in management and coordination, including environmental monitoring, complemented the so-called Sugar Energy Development Project (SEDP).

The project was cancelled by the Mauritian government in 1997 due to slow progress in the planned bagasse efficiency programme (limiting supply) as well as delays in the completion of a dual-fuel CHP plant. Although it did not accomplish the objectives as planned, the project had positive impacts on the biomass prospect of Mauritius: an increase in bagasse generated electricity to near target levels, albeit not in the manner envisaged; enhanced sugar industry earnings; increased public/private sector capacity in evaluating technologies for efficient sugar/power production; environmental benefits and foreign exchange savings from reduced petroleum use; and improved environmental monitoring of the private sugar industry and independent power producers.

The main lesson learned from the Mauritius experience is that the development of bagasse-based electricity generation requires a stronger linkage between the sugar industry and the electricity sector, a greater emphasis on the multiple benefits of baseload bagasse/coal electricity generation, and new approaches on the part of both the funding and recipient institutions in evaluating and supervising cross-sector projects.

Finally, the experience and lessons learned from the SEDP encouraged the Mauritius government to construct a new bagasse power plant in the northern part of the island while building a modern sugar factory integrated with power generation (Deepchand 2001).

A15 Bagasse in India

While India competes with Brazil as the top sugar-producing country in the world, only 14 per cent of India's potential for bagasse-fuelled cogeneration of at least 5,000 MWe has be exploited (Brazil 43 per cent). Haya, Ranganathan and Kirpekar (2009) find the following explanation: 60 per cent of the sugar mills in India are owned and managed by farmers in cooperatives. Unit sizes are small and the equipment aged and inefficient. These smaller mills do not meet the minimum size requirement for financing from the climate change funds channelled through the WB or the GEF. Larger mills that installed modern CHP equipment made the observation that market price fluctuation of sugar and paper can generate more profits by selling bagasse instead of using it as a boiler fuel and replace it with coal. Absent environmental regulation or economic incentives, the bottom line trumped clean energy.

More than a decade ago the Ministry of Non-Conventional Energy Sources (MNES) began promoting bagasse-fuelled cogeneration by offering capital and interest subsidies, research and development support, accelerated depreciation, multi-year income tax holidays and excise and sales tax exemptions. A number of foreign aid agencies, international and bilateral finance institutions joined the national cogeneration development efforts.

A US$9 million grant from USAID was considered particularly successful. The grant paid for 10-20 per cent of the capital costs for nine high efficiency bagasse-fuelled CHP plants, the dissemination of relevant information on CHP technology as well as electricity sales opportunities to the grid, and training of operators and workshops. However, the grant did not reach the broader base of smaller cooperative sugar mills without English language skills or where staff could not afford the travel costs to attend information events or training workshops. In general, the bar of access to finance was not really lowered. The implementation of a FIT rate structure was hampered by a myriad of locally varying rates and concessions eroding the certainty that sugar mills and farmers need to commit fully to high-efficiency bagasse cogeneration with high upfront capital costs. Development and financial agencies have yet to develop a practical scheme for funding smaller cooperative sugar mills and farmers for a wider adoption of high-efficient bagasse cogeneration. In 2004 the GEF initiated a project to address financing barriers which by 2009 has not developed beyond the planning stage (Haya, Ranganathan and Kirpekar 2009).

Since the operalization of the CDM in 2005, India has eagerly pursued CDM project certification to exploit bagasse as a carbon-neutral energy resource. In late 2008, 88 projects totalling 1600 MW were in the CDM pipeline seeking approval for registration.

A16 Electrification in Bhutan

Another example is ADB’s twenty years effort to expand rural electrification in Bhutan. Between 1999 and 2006, ADB provided US$12 million in funds for expanding electricity access to more than 8000 new rural customers. Other development partners in this programme included foreign aid from Austria, India, Japan and the Netherlands. One hundred solar PV systems for off-grid monasteries and community institutions were installed. Lessons learned from this experience echo those in Nepal, Ghana and India: Availability of rural electricity may not be a sufficient condition for the poor to improve their economic status. They need access to income-generating skills, seed money for enterprises and market for their products, which in turn sustains the renewable energy programme (ADB 2010).

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Acronyms

ADB	Asian Development Bank
AFD	Agence Française de Dévelopment
AfDB	Africa Development Bank
AGECC	Advisory Group on Energy and Climate Change (UN Secretary General's)
ALFA	Affordable Lighting for All
BoP	base of the pyramid
BOT	build-operate-transfer
BPC	Butwal Power Company (Nepal)
CBA	community-based adaptation to climate change
CBO	community-based organization
CDM	clean development mechanism
CER	certified emission credits
CHP	combined heat and power
CIF	climate investment funds
COP	Conference of Parties
CRESP	China Renewable Energy Scale-up Project
CRS	Creditor Reporting System
CSO	civil society organization
CSP	concentrating solar power
CTF	Clean Technology Fund
DAC	Development Assistance Committee (OECD)
DBS	direct budgetary support
DFID	Department for International Development (UK)
ECA	Economic Commission for Africa
EEPCo	Ethiopia Electric Power Company
EIB	European Investment Bank
ERR	expected rate of return
ESD	Energy Service Delivery (Sri Lanka)
FDI	foreign direct investment
FIP	Forest Investment Programme
FIT	feed-in-tariff
GDP	gross domestic product
GEA	global energy assessment
GEDAP	Ghana Energy Development and Access Project
GEF	Global Environment Facility
GHG	greenhouse gas
GIZ	Deutsche Gesellschaft für International Zusammenarbeit GmbH
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IBRD	International Bank for Reconstruction and Development
ICF	International Finance Corporation

IDA	International Development Association
IDB	Inter-American Development Bank
IDFC	International Development Finance Club
IFC	International Finance Corporation (World Bank Group)
IFI	international financial institutions
IMF	International Monitory Fund
IPP	independent power producer
JBIC	Japan Bank for International Cooperation
JEIB	Japan Export Import Bank
JEXIM	Export-Import Bank of Japan
JI	joint implementation
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
LDC	least developed country
M&E	monitoring and evaluation
MASEN	Moroccan Agency for Solar Energy
MDB	Multilateral Development Bank
MDG	Millennium Development Goal
MHP	micro hydropower
MIGA	Multilateral Investment Guarantee Agency
MNSE	Ministry of Non-Conventional Energy Sources (India)
NEA	Nepal Electricity Authority
NEDA	National Economic and Development Authority (Philippines)
NGO	nongovernmental organization
ODA	official development assistance
OECD	Organization for Economic Co-operation and Development
ONEE	Office National de l'Eau et de l'Electricite
OOF	other official flows
PNOC-EDC	Philippine National Oil Company-Energy Development Corporation
PPA	power purchase agreement
PPCR	pilot programme for climate resilience
PPP	private public partnership
PV	photovoltaic
REDD	reduced emissions from deforestation and forest degradation
RERED	Renewable Energy for Rural Economic Development (China)
REDP	Renewable Energy Development Project (China)
SAL	structural adjustment loan
SE4ALL	Sustainable Energy for All
SEDP	Sugar Energy Development Project (Mauritius)
SGP	small grants programme
SHS	solar home system

SREP	scaling-up renewable energy programme
SRREN	Special Report on Renewable Energy Sources and Climate Change Mitigation (IPCC)
TERNA	Technical Expertise for Renewable Energy Application
UN	United Nations
UNCDP	United Nations Capital Development Fund
UNCDT	United Nations Conference on Trade and Development
UNCED	United Nations Conference on Environment and Development
UNCSD	United Nations Conference on Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNEP-FI	United Nations Environment Programme Finance Initiative
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UO	user organization
WB	World Bank
WBG	World Bank Group