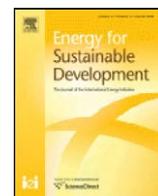


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Energy for Sustainable Development



Lessons for low-carbon energy transition: Experience from the Renewable Energy and Energy Efficiency Partnership (REEEP)

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ABSTRACT

The article is intended as a report on the performance of the Renewable Energy and Energy Efficiency Partnership (REEEP) in delivering a global low-carbon energy market facilitation programme. The article documents REEEP's 5 years of experience in energy efficiency and renewable energy programme delivery, as well as market development in developing countries; it describes the delivery mechanisms, process, and governance before proceeding to analyse the REEEP portfolio. The article then assesses REEEP's experience in delivering a capacity building initiative, identifying lessons in the areas of programme management, carbon finance, financing, business models, energy in buildings, rural energy, energy regulation, and energy policy. The article demonstrates that REEEP programmes offer a number of lessons for policy makers and managers involved in climate change and development issues in developing countries. It also shows that REEEP is positioned to scale-up its activities and respond to requests that are currently constrained by limited resources. The article concludes by recommending the scaling up of REEEP's operations.

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Introduction

In 2009, the Renewable Energy and Energy Efficiency Partnership (REEEP) completed 5 operational years as a public–private partnership supporting low-carbon energy market development in developing countries. The objective of the article is to inform the climate change and development communities about REEEP's activities in technical assistance and capacity building for low-carbon energy transition. The article also aims to synthesise some of the key lessons for programme management and low-carbon energy policy from REEEP's body of experience in policy, finance, regulation, and business themes and present an outlook.

Energy and climate

The projected 1.5% annual increase in global primary energy consumption (IEA, 2009) and the continued high share of fossil fuels in 2030 would result in an increased concentration of greenhouse gas (GHG) emissions and serious environmental consequences. According to the primary energy demand projections from the International Energy Agency (IEA), global energy-related CO₂ emissions would

increase from 28.8 Gigatonnes (Gton) of CO₂ in 2007 to 40.2 Gton of CO₂ equivalent in 2030. Such an increase would result in a long-term concentration of GHG emissions of over 1000 ppm CO₂ equivalent and a global average temperature rise of 6 °C. The prospect of global warming and associated climate change places an imperative to reduce the energy-related CO₂ emissions through transition to low-carbon energy sources while managing energy demand.

As shown in Fig. 1, the increase in energy demand and thereby in GHG emissions is projected to mostly occur in the developing parts of the world (IEA, 2009). Low-carbon energy technologies, such as those in renewable energy and energy efficiency, will need to be increasingly deployed in developing countries to mitigate climate change. However, a large number of barriers in the realms of policy, regulation, financing, and business frameworks prevent the accelerated development of markets for low-carbon energy technologies. Several initiatives are needed to address the barriers.

Public–private partnerships

Partnerships for sustainable development (also called the UN-Type II partnerships) are voluntary, multi-stakeholder initiatives aimed at implementing sustainable development and were an important complementary outcome of the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002. The partnerships launched by governments and international organisations were global

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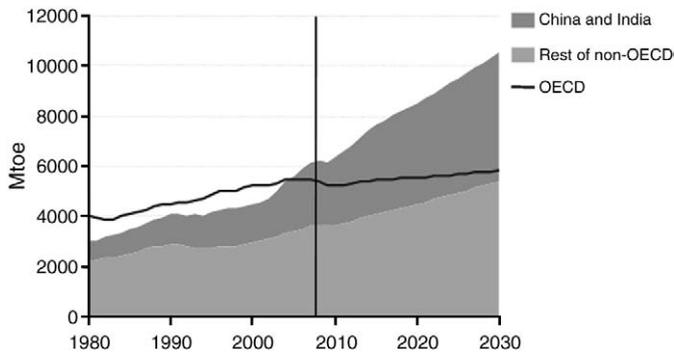


Fig. 1. Projected world primary demand by International Energy Agency. Source: International Energy Agency, 2009.

or regional in scope and reach and aimed at supporting the practical implementation of Agenda 21 and sustainable development activities. It was estimated that a total of over 200 partnerships were launched at WSSD, of which 23 focused on energy issues (Cañeque, 2003). Some of the key energy issues addressed by these partnerships were in the action areas of water, energy, health, agriculture, and biodiversity (WEHAB) and focused on initiatives such as energy access, efficiency, renewable energy, advanced fossil fuel technologies and energy and transport. Some of the key energy partnerships launched at WSSD include Clean Fuels and Vehicles Partnership, Collaborative Labelling and Appliance Standards Programme (CLASP), European Union Energy Initiative (EUEI), Global Village Energy Partnership (GVEP), Global Network on Energy for Sustainable Development (GNESD), Industrial Energy Efficiency Initiative (IEEI), Mediterranean Renewable Energy Partnership (MedREP), and REEEP.

Partnerships are considered to be an innovative approach to overcome existing deficits in global governance regulation, implementation, and participation (Szulecki et al., 2010). Energy partnerships carry out activities such as publications, training programmes, barrier removal activities, and implementation of energy infrastructure. Through their activities, energy partnerships contribute towards low-carbon and sustainable energy systems. Partnerships' activities are reported annually to the Commission on Sustainable Development (CSD) sessions through the United Nations Department of Economic and Social Affairs (UN-DESA). It may also be noted that 47% of the energy partnerships launched at WSSD have no traceable signs of activity (Szulecki et al., 2010).

REEEP

REEEP was established in 2002 by the United Kingdom (UK) government, together with other committed governments, businesses, and NGOs, in order to deliver WSSD commitments. One of the objectives was to take forward the key recommendations of the G8 Renewable Energy Task Force. REEEP was formally launched at a ceremony in London in 2003 and was subsequently established in June 2004 as an association in Austria, founded by the governments of UK and Austria (Florini and Sovacool, 2009).

The interest in REEEP and its activities has grown considerably since 2004. It currently consists of over 270 partners, of which 46 are national governments. REEEP supports three sub-networks: the Sustainable Energy Regulators Network (SERN), focusing on clean energy regulation; the Renewable Energy and International Law (REIL), focusing on international renewable energy laws; and the Energy Efficiency Coalition (EEC), focusing on building energy efficiency. REEEP also maintains a search engine and information gateway, called Reegle, which provides information about renewable energy and energy efficiency. REEEP also supports about 129 projects in 56 countries globally.

Programme

Programme delivery

REEEP started funding projects in 2004 and has consistently increased the level of its funding over the years. Table 1 provides an overview of the projects supported by REEEP since 2005, not including those projects from 2002 to 2004, which were supported under REEEP by the UK Government before REEEP's establishment as a legal entity.

As of January 2010, REEEP has supported 129 projects under its programmes, targeting low-carbon energy interventions in renewable energy and energy efficiency and covering 56 countries (REEEP, 2006, 2007, 2009). The support to these projects was facilitated by financial contributions to REEEP by the partner governments of United Kingdom, Norway, Ireland, Australia, Italy, and New Zealand. The €10.8 million of REEEP financial support to projects has also leveraged €26.7 million through co-financing from implementing partners, as well as other development and market transformation agencies. Although the maximum REEEP contribution until 2007 was €70,000, current average REEEP project financing is about €100,000.

The current level of funding was set in 2007 and was considered to be appropriate for the themes and types of initiatives being supported by REEEP at the time. However, increases in individual project funding and duration of implementation are being considered, as these are currently limited. Support may be given to projects in four thematic areas: finance, policy, regulation, and business.

Process and governance

REEEP employs a bottom-up and broad-based process to develop its programme framework. Every year, regional preparatory meetings are organised in regions where REEEP provides support to projects; currently, these include East Asia, Latin America, the Pacific and Southern Africa. Until 2007, these also included Eastern Europe, Russia, and the former Soviet Union. These meetings bring together REEEP partners in the region, including national and regional governments, finance and business organisations, NGOs, and other key experts. These experts identify the needs for REEEP interventions in the region, taking into account opportunities within REEEP's four thematic areas, past work done by REEEP, and the resources available for programming. The general public and the partners who are unable to attend the regional stakeholder meetings are also invited to provide inputs towards defining the programme priorities through a public invitation. The regional priorities are then discussed and refined by the REEEP Programme Board, which consists of the regional members, members from non-government organisations (NGOs), business and finance, and donor governments. The Programme Board develops REEEP's Global Programme Priorities based on regional and public inputs. Nonetheless, the Global Programme Priorities form just one of the two key building blocks in the REEEP programme framework. The second important aspect is the donor priorities, which are specified by the Programme donors and primarily define the countries where donor funds may be used. Donors such as the UK and Norway show considerable flexibility to support good projects outside of their priority countries. The Programme framework, shown in Fig. 2, forms the basis for the selection of the projects to receive REEEP support.

Table 1

Year	Projects Supported	Funds Deployed (€)	Countries Covered (One Project May Cover Multiple Countries)
2005–06	18	1.12 million	19
2006–07	28	1.94 million	31
2007–08	35	3.15 million	19
2009–10	48	4.6 million	23
	129	10.83 million	56

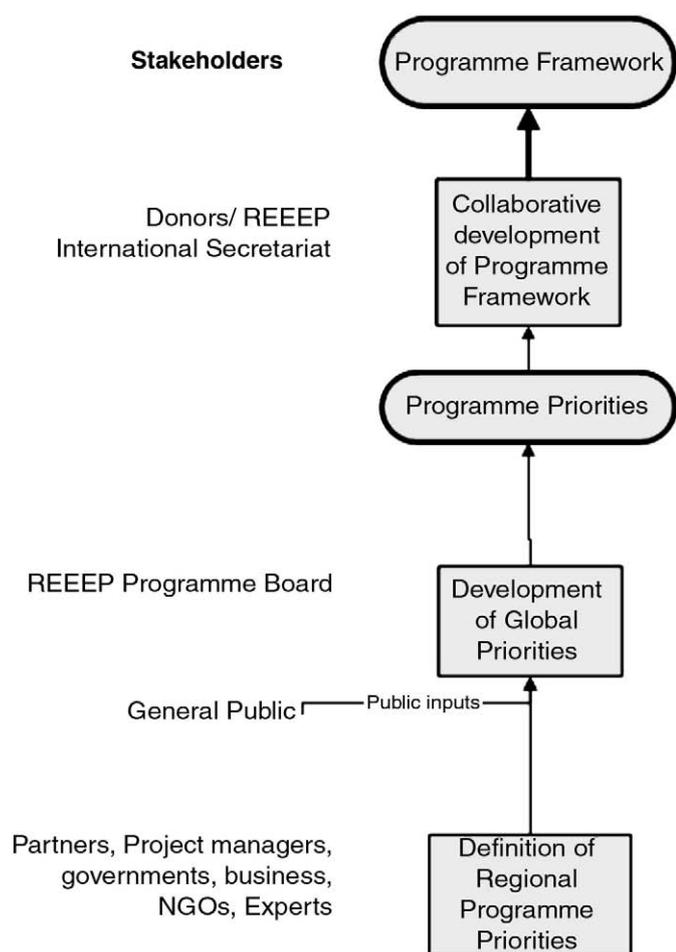


Fig. 2. Development of REEEP programme framework.

The projects that receive REEEP support are identified through an open and transparent process, as illustrated in Fig. 3.

Any organisation that has a concept for an intervention or a project addressing the REEEP programme priorities may submit it for consideration, regardless of whether the organisation is an existing REEEP partner. In fact 85% of all project applications to REEEP have been from organisations that are not existing REEEP partners, although a number of organisations who have secured project funding from REEEP subsequently became REEEP partners. The share of partners and other organisations applying for REEEP project funding for each of the programme cycles is illustrated in Fig. 4.

The concepts are submitted online through the REEEP Programme Management Information System (PMIS; pmis.reEEP.org). All of the criteria for assessing the proposals and their weights during the concept and full proposal stages are announced to the public during an open call for proposals. The concepts submitted are assessed online by committees consisting of REEEP staff, steering committee members, and independent experts using the pre-defined assessment criteria. In the short-listing stage, the assessment is strongly based on conformity to REEEP and donor priorities, described in previous paragraph. In any case, all proposals must address issues relating to the low-carbon energy technologies of renewable energy and energy efficiency. The results are based on the average ratings by the different judges. Then a pre-specified number of project concepts are short-listed and invited to submit fully developed proposals, on average within 1 month. The short-listed project concepts are also provided with suggestions and advice from the REEEP experts on how to improve their proposals and align them with REEEP priorities. The short-list is also shared with other entities, such as the World Bank

(WB) and the United Nations (UN), for comments, to ensure synergies and avoid duplication. Direct submissions of full proposals can also be made by Governments, Development Financial Institutions and also by completed projects that are seeking to replicate or scale-up past efforts. Banking and Financial institutions can also submit proposals to REEEP but need to follow the two-step process. The full proposals are appraised and ranked by REEEP experts on a second set of criteria with the emphasis being on the impacts the projects may achieve. The ranked full proposals are considered for final selection by a committee consisting of REEEP staff, programme donors, as well as representatives from the UN and the WB. The key criteria for selection are the ranking and inputs from other implementing agencies, especially relating to duplication of efforts.

The selected projects go through final approvals via the REEEP internal governance system and are contracted to implement the proposed activities. During the typical implementation period ranging from 12 to 24 months, the project progress is monitored on the ground by REEEP staff or regional secretariats. In addition, both strategic and operational guidance are given regarding activities, outcomes, and possible linkages. The REEEP monitoring period continues beyond the implementation period for an average of 6 months until the project impacts occur and can be independently assessed. Important project outputs, including a synthesis report of the impact assessment reports, are made publicly available through the REEEP digital library, available on the REEEP website at toolkits.reEEP.org. REEEP also promotes the activities through press releases highlighting key achievements and milestones of specific projects, and through publishing the profiles of each project on its website and as a printed publication. REEEP also produces think pieces and case studies based on the projects dealing with specific issues (micro-finance for renewable energy, rural electrification, etc.). These are promoted through specialised media focussing on low-carbon energy, climate change, or the environment. When all project activities are completed, an independent evaluation of the project is carried out by the implementing partner before final reporting and closure. REEEP encourages the use of independent experts and provides a panel of independent experts to the implementing partners on request. REEEP also carries out impact assessments by independent experts after the projects are completed and after providing enough time for the impacts to develop. The implementing partners are also given an opportunity to reflect and comment on the impact assessments before they are finalised, and lessons are synthesised for the improvement of programme processes and frameworks.

Portfolio

The REEEP project portfolio consists of 129 projects over the last 5 years. Fig. 5 shows that the largest share is occupied by renewable energy technologies, followed by energy efficiency technologies. The share of resources directed towards projects that combine both renewable energy and energy efficiency technologies is about 24%.

Fig. 6 shows a detailed breakdown of all projects according to specific technologies. Over 60% of the projects cover all renewable energy and/or energy efficiency technologies. Less than 40% of projects focus on a specific renewable energy or energy efficiency technology.

In terms of the thematic areas supported by REEEP, it is evident from Fig. 7 that the REEEP portfolio is dominated by policy projects, followed by projects focused on finance issues. Regulatory projects have a smaller share of 8%, while projects focusing on business have attracted 16% of resources.

Fig. 8 shows a detailed breakdown of all projects by specific sub-themes within policy, regulation, finance, and business.

Of the 58 completed projects, a small share of projects have not been able to achieve their objectives, as shown in Fig. 9. In this context, it may be noted that a project is deemed to have failed if it is

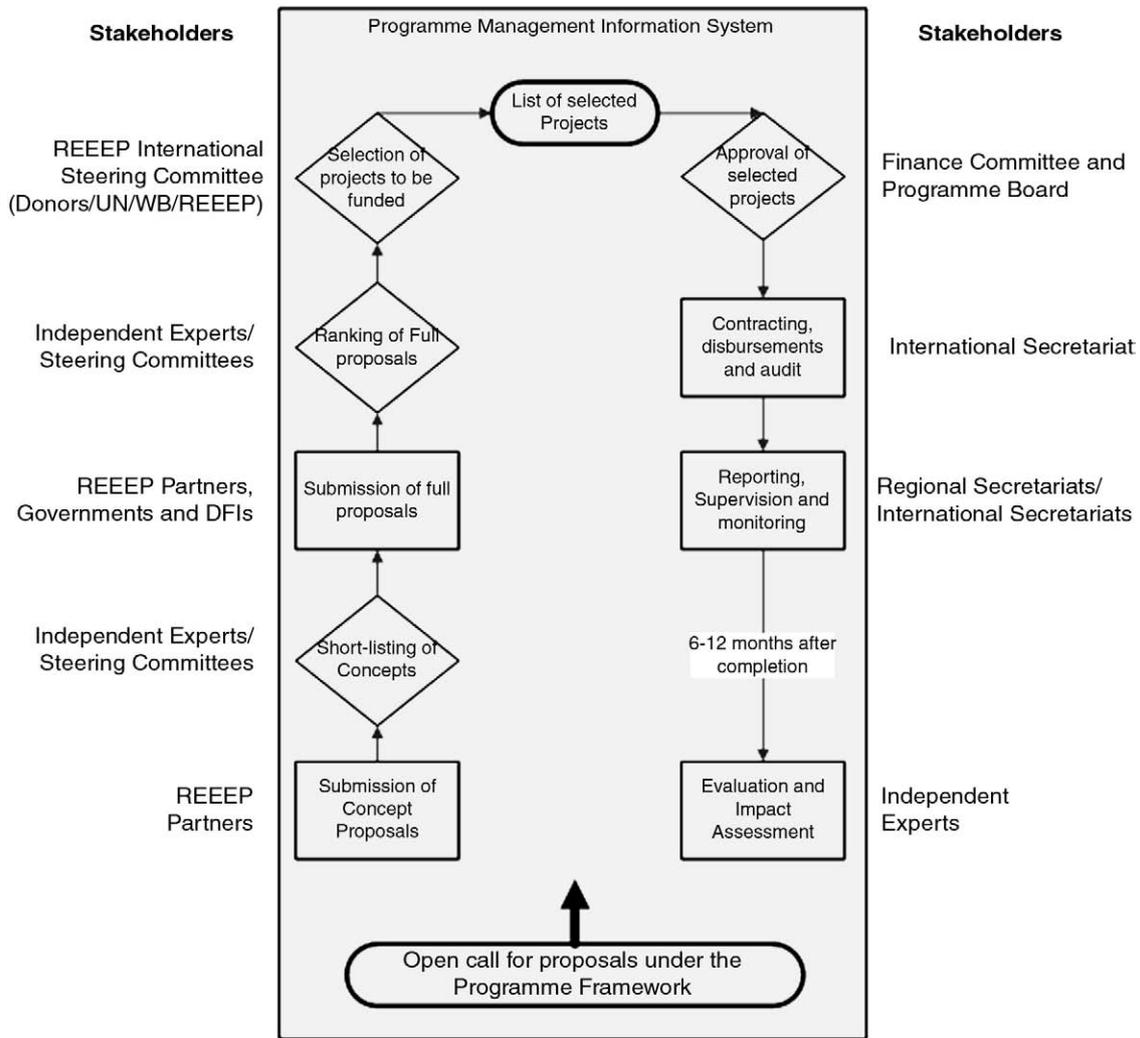


Fig. 3. REEEP project cycle.

not able to achieve the objectives it originally set out to achieve, i.e., when all the project activities have been completed and the project implementation contract concludes.

Although REEEP projects have so far covered 56 countries, most REEEP funding was awarded to projects situated in large and emerging developing countries, especially Brazil, South Africa, India, and China (BASIC). Fig. 10 shows the distribution of all REEEP-

supported projects across the world. The map shows that REEEP has had a global presence covering large and small developing countries, complemented through project implementation with global demonstration benefits in some industrialised countries.

Fig. 11 shows the top countries of REEEP's interventions. India has received the maximum share of REEEP resources, followed by China, Brazil, and South Africa.

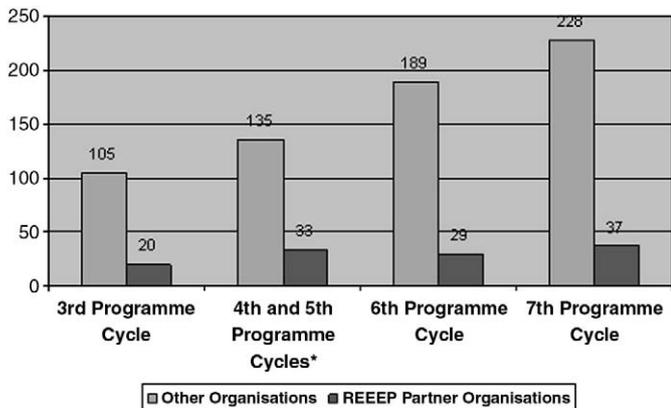


Fig. 4. Total project applicants for REEEP funding. *The 4th and 5th programme cycles were conducted parallel.

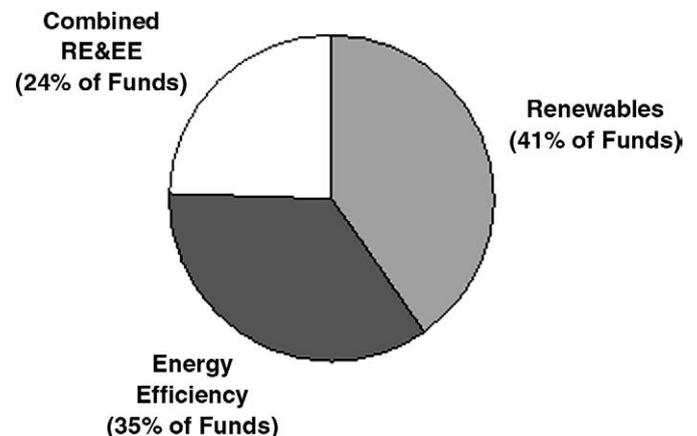


Fig. 5. Low-carbon energy technologies in the portfolio.

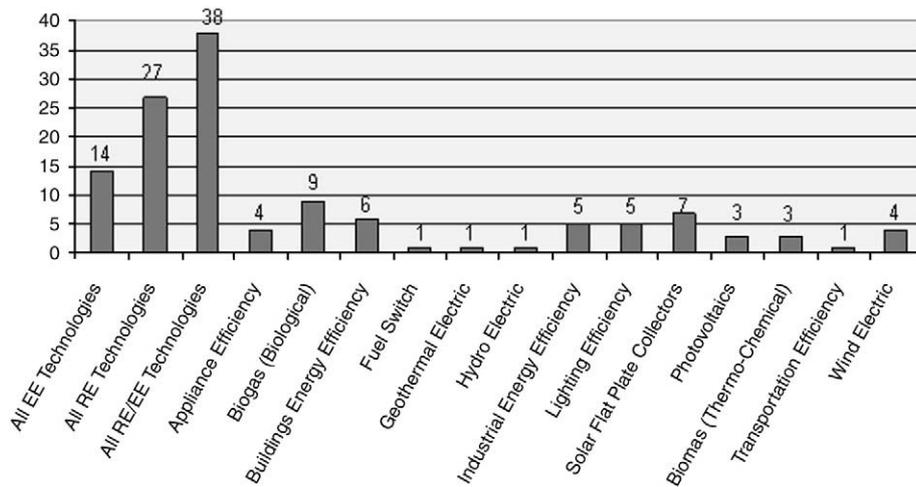


Fig. 6. REEEP programme project technologies.

Any government or organisation that has been established for at least 3 years is eligible to apply for REEEP funding. Fig. 12 shows that the major share of REEEP projects are implemented by non-government and academic organisations, followed by those from the private sector and lastly by governments and development financial institutions.

REEEP supports projects on the basis of the proposals and irrespective of the location of the implementing agency. Fig. 13 shows that there is a good balance within the REEEP portfolio where there is an equal balance of organisations from industrialised regions (primarily countries in North America and Europe within the Organisation for Economic Cooperation and Development (OECD)) and developing countries (non-OECD countries).

Programme management lessons

REEEP sees a number of lessons for itself and other organisations active in low-carbon energy transition in developing countries. Some of the key lessons from a process perspective from REEEP’s experience are as follows.

Importance of failures

While the projects that have failed to achieve their objectives represent a small share of the REEEP portfolio, failures provide very valuable lessons for market transformation. REEEP requires the independent experts to spend 50% more time carrying out the assessment of failed projects and to examine the reasons and the

lessons from the failures. From a process perspective, REEEP would encourage implementing agencies to acknowledge that failures do happen and to accept that some initiatives and projects will fail.

Analysis by REEEP shows that most failed projects conducted inadequate risk management. Several of the projects were subject to external risks, such as political risks, which were not adequately captured in the risk identification and assessments during the proposal development stage. When the risks precipitated, implementing partners were unable to manage the fallout. The level of funding was not seen as a reason for failure. This calls for better risk assessment in the proposals and for ensuring that the organisations proposing project concepts have the capacity to manage risky situations.

Engagement of key stakeholders

The key stakeholders in REEEP’s programme themes of policy, regulation, finance, and business are governments, regulators, financial institutions, and energy businesses. These stakeholders have a key role in low-carbon energy transformation in developing countries. REEEP’s direct engagement of these stakeholders is currently at 22% as shown in Fig. 12. REEEP needs to directly engage more government agencies dealing with low-carbon energy issues, as well as energy regulators, banking and financial institutions, and energy businesses. The share of key stakeholder segments needs to increase within REEEP’s portfolio. Where it is not possible to directly engage these stakeholder groups, other organisations such as consulting companies, NGOs, research and academic institutions may be engaged as intermediaries, provided that key stakeholders demonstrate full output ownership through formal commitment and financial and in-kind contributions.

Impact measurement, reporting, and verification (MRV)

The themes supported by the programme are policy, regulation, finance, and business. The types of activities that REEEP supports and their outcomes do not generally lead to direct low-carbon energy generation or to a reduction in GHG emissions. REEEP does not usually support hardware and the creation of physical infrastructure; a small 6% percent of REEEP projects do result in clean energy production and GHG mitigation. Such projects typically involve renewable energy devices such as cook stoves and PV systems, a small number of which are implemented as part of project activities. Therefore, the majority of project activities have impacts in the realms of capacity building and market development impacts (Ballard-Tremeer and Searcy, 2009). The current logical framework approach that REEEP adopts for impact assessment is not able to reliably attribute the project

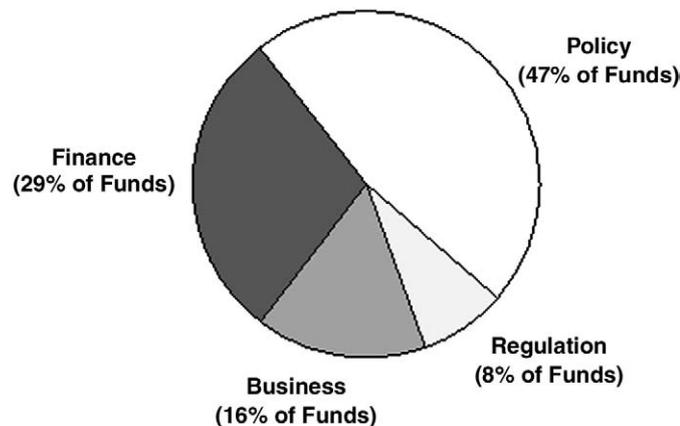


Fig. 7. Distribution of the portfolio across thematic areas.

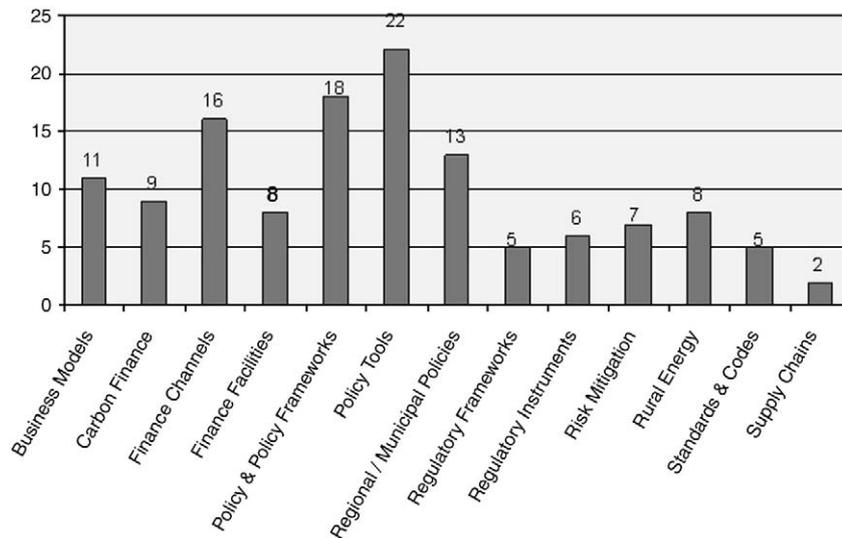


Fig. 8. REEEP programme project sub-themes.

impacts because projects are largely unable to influence outcomes beyond direct project outputs. This challenge of attribution arises because REEEP projects support policies, regulations, and measures in finance and business—activities that typically have a shorter time-frame. REEEP and its consultants have considered 16 different MRV approaches such as Clean Development Mechanism (CDM) methodologies, Global Environment Facility (GEF) methodologies, Most Significant Change (MSC), Results Based Monitoring (RBM), United Nations Development Programme (UNDP) Capacity Assessment Framework, Clean Technology Fund (CTF) Results Measurement System, World Business Council for Sustainable Development (WBCSD) Framework, Outcome Mapping, Logical Framework approach, etc. The current thinking is to develop a new synthesis model that combines the Logical Framework Approach with Outcome Mapping (LFA + OM). Under this proposed approach, OM will be added to the current LFA being followed by REEEP and this integration is expected to address the attribution challenge. The OM will identify key stakeholders, or “Boundary Partners,” and will track changes in approach and actions of these boundary partners using an objective and graduated set of indicators (Ballard-Tremeer and Searcy, 2009). This approach is currently under development and is expected to be tested for REEEP projects before large-scale implementation. This is expected to provide a better basis for measuring project success, as it will be based on the impacts rather than on outputs, which is the current approach.

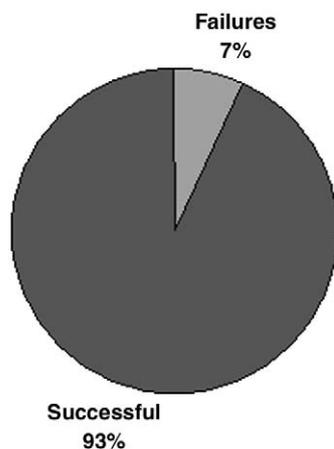


Fig. 9. Achievement of objectives by projects.

Ownership

Ownership of project outputs and outcomes by the key stakeholders are important to achieve the desired impacts. REEEP's partnership approach in working directly with key stakeholders is resulting in higher levels of ownership, especially in rapidly emerging developing countries such as Brazil, China, and India. By assuming a supervisory position and encouraging prospective implementing partners to play a role in Programme framework development, REEEP's bottom-up, broad-based approach to developing its programme framework strongly contributes to increasing key stakeholder interest in REEEP programmes.

This contrasts the approach taken by several development agencies, especially bilateral development agencies, where donor country-based organisations and experts define the framework and deliver the outputs. The procurement procedures of several bilateral development agencies either limit or give preferential treatment to services and goods from the donor country. While organisations and experts from recipient countries are involved in implementation, their roles remain peripheral in most cases.

Technology neutrality

REEEP's approach is similar to some of the other development agencies, in that it maintains technology neutrality and offers implementing partners the choice of low-carbon energy technology. Experience from energy initiatives in developing countries show that international, national, regional, or sectoral market development approaches that are focused on a specific technology have had limited success and tend to be restrictive in terms of resources and energy conversion. Therefore, REEEP advocates technology neutral approaches and refrains from picking technology winners before implementation. The technology neutrality is enshrined in the programme framework development process by ensuring that the regional and global priorities remain technology neutral. The criteria for project concept short-listing and proposal ranking are also technology neutral.

Advocates of renewable energy and energy efficiency technologies generally tend to prefer specific technologies and sometimes exaggerate the low-carbon and economic benefits of the technologies under consideration. Such practices result in renewable energy and energy efficiency technologies being applied in inappropriate situations. REEEP takes an unbiased and balanced approach in advising partners on the choice of the technologies and discourages the use of

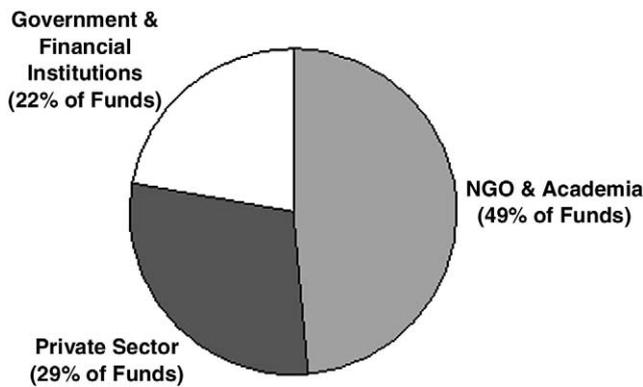


Fig. 12. Type of organisations implementing REEEP projects.

- o Several household energy projects and end-use energy efficiency projects are benefiting from the voluntary carbon markets and are using instruments such as the CDM Gold Standard to obtain higher prices for renewable energy and energy efficiency technology-based emission reductions.

Financing

REEEP has been quite active in supporting projects and initiatives that carry out finance-related activities such as supporting funds, finance facilities, and financial and risk mitigation instruments for low-carbon energy and has supported 31 projects in this space, committing about €2.6 million and leveraging about €13.5 million. The REEEP-supported projects in this area have covered 21 countries including Brazil, China, India, South Africa, Solomon Islands, Morocco, Uganda, and Zambia. Some of the key initiatives supported by REEEP include the following:

- o West Africa Modern Energy Fund of over 8 million USD to invest in energy enterprises, covering Ghana, Mali and Senegal by E + Co;
- o establishment of Private Financiers Network (PFAN) and scale-up of activities in Mozambique and Uganda with the objective of achieving financial closure on up to eight clean energy projects, raising a total of 10–60 million USD;
- o development of RETScreen version 4, multi-lingual energy models and M&V tool by CanmetENERGY;
- o use of international renewable energy finance and local financial support for renewable energy applications in small-scale, value-added agriculture by the LaGuardia Foundation in Brazil and Mozambique.

Key lessons from REEEP's experience in local finance include the following:

- o Supporting the establishment of funds and finance facilities is a high-risk, high-impact theme for REEEP and other low-carbon

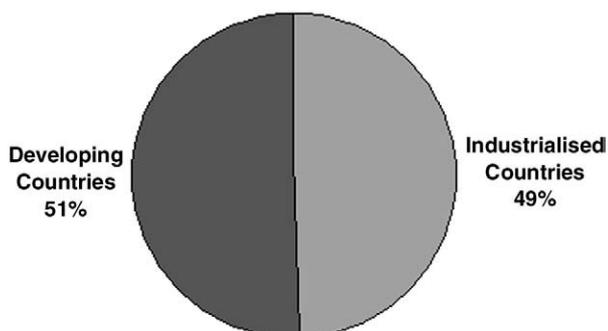


Fig. 13. Percent of funding granted to implementing partners by location.

energy market development agencies. Some of the ways to manage the risk with such initiatives are to ensure that the project pipeline is credible, that there is evidence of serious commitment from early stage investors in the fund, and that the promoter company has a strong past track-record.

- o In general, significant local financing is available on the wholesale level in most developing countries for energy investments, partially from institutions such as local development banks, commercial banks, and agricultural development banks, and in other cases from specialised low-carbon energy finance institutions, such as REEEP partner Indian Renewable Energy Development Agency (IREDA). Generally missing are finance and risk mitigation instruments and retail-level institutions for channelling the finance.
- o The absence of risk mitigation facilities is constraining the flow of private finance to low-carbon energy investments in large developing countries. Guarantee funds have been used effectively in early stages of market development but need to be designed in a way that the guarantee fund is replenished and sustained over the long run. There is a significant gap in terms of risk insurance products covering the performance and energy meteorological risk.
- o Micro-finance can play a major role in development of markets for small low-carbon energy systems and devices, but the achievements have so far been in market niches. The three critical factors to be addressed to scale-up the role of micro-finance in low-carbon energy are the management of transaction costs, credit risk management, and the availability of low-cost long-term financial resources.
- o The finance and banking sector in the commercial, development, and agricultural sectors needs significant capacity building in low-carbon energy finance and economics and feasibility analysis, reflecting the need for decision support tools. For example, RETScreen, which is supported by REEEP and is the world's most widely used clean energy analysis software with 300,000 users in over 140 countries, is significantly contributing to financial sector capacity building.

Low-carbon energy business models

REEEP has supported business and institutional models for low-carbon energy market development through committing over €1 million to 13 projects in this space. The REEEP-supported projects in the finance work stream have covered 14 countries including Brazil, China, India, Nepal, Ethiopia, etc. Some of the key initiatives supported by REEEP in business models include the following:

- o local energy and development centres in Mozambique by OVE—the Danish Association for Sustainable Energy,
- o low-carbon energy supply chain in the Indian state of Karnataka by the Small-Scale Sustainable Infrastructure Development Fund (S3IDF), and
- o business model development for biogas electric power generation in Chinese livestock farms by Tsinghua University.

Key lessons from REEEP's experience in business models include the following:

- o Due to renewable energy products and efficient end-use equipment not being readily available to general customers in developing countries, there is a need for supply chains and marketing networks to make low-carbon energy systems and devices in a consumer purchasing context.
- o Low-carbon energy businesses in developing countries active in marketing, sales, installation, and service remain relatively small and are often managed by first-generation entrepreneurs without business backgrounds. To increase the scale, there is a critical need

for developing and incubating energy enterprises that can market, sell, install, and service low-carbon energy systems and devices.

- o In contrast to an incorrect perception that both urban/peri-urban and rural poor people cannot pay for low-carbon energy, most poor people pay for energy in absolute terms that are quite significant, considering their total incomes. An additional inaccurate perception is that low-carbon energy delivery services are more suited to not-for-profit organisations, but we see that providing energy services to the poor is a profitable business with a bigger role for for-profit principles and enterprises.
- o Energy Service Companies (ESCOs) in developing countries are often being implemented in niches and generally on a relatively small scale, possibly dependant on public expenditure on energy efficiency. Most ESCO businesses are under-capitalised and small; many focus on selling equipment rather than services. There is a need to mainstream and increase the scale of operations of ESCOs to realise its potential in developing countries. Financing mechanisms such as securitisation or forfeiting are needed to provide funding to the ESCO businesses that are not supported by local banks and financial institutions.

Low-carbon energy in buildings

Low-carbon energy issues in the built environment have been a key focal area for REEEP since the G8 Gleneagles Plan of Action in 2005, which called for REEEP to do more work in the areas of energy efficiency in buildings. Since then, REEEP has been supporting both energy efficiency and the integration of renewable energy in buildings, having supported six projects and committed about €0.6 million in this space. The REEEP-supported projects in low-carbon energy have covered four countries: China, Fiji, South Africa, and India. Some of the key initiatives supported by REEEP include the following:

- o financing the promotion of energy efficiency in China by Energy Research Institute of the National Development and Reform Commission;
- o promotion of energy efficiency in the hospitality sector in Fiji by the Greenlight Technology Group;
- o policies and regulations for building energy efficiency in Bangalore, India, by the Energy and Resources Institute (ERI).

Key lessons from REEEP's experience in low-carbon energy in buildings include the following:

- o Solar flat plate collectors are a mature, appropriate, financially viable, and ready technology for a large-scale rollout in developing countries (Winkler, 2007).
- o Appliance standards and labels are a very effective policy and regulatory instrument. Their role will increase as people in developing countries increasingly acquire energy-consuming equipment such as refrigerators, air conditioners, washing machines, etc. There is also a need to expand the scope of standards and labels to include thermal energy appliances such as gas room heaters and gas cooking stoves.
- o The direct and indirect subsidies on electricity and heating fuels are a major barrier to achieving low-carbon energy transition in buildings in developing countries (Srivastava and Rehman, 2006). Reform of administered prices and rationalisation of subsidies in electricity and fuels are a pre-requisite to achieving significant gains in energy efficiency and renewable energy in the built environment (Johansson and Goldemberg, 2002).

Rural energy

REEEP has also been supporting the use of low-carbon energy technologies in rural energy, which remains an important challenge.

In 2008, there were 1.46 billion people who did not have access to modern forms of energy. Even in 2030, over 1.28 billion people in Sub-Saharan Africa and South Asia may still lack access to modern energy (IEA, 2009). REEEP has supported eight projects in these regions, committing over €0.6 million. The REEEP-supported projects in rural energy have covered 16 countries including Brazil, China, South Africa, Mongolia, Lesotho, etc. Some of the key initiatives supported by REEEP in rural energy include the following:

- o Amazonia Energy Initiative to link rural energy to income generation in Brazil by Winrock International;
- o Integrated Rural Energy Utility Roadmap in South Africa, Tanzania, and Uganda by Restio Energy; and
- o creating linkages between energy services and income generation in India by SELCO Solar.

Key lessons from REEEP's experience in rural energy include the following:

- o Rural energy programmes often focus only on electricity and ignore the thermal and mechanical energy needs of rural areas without modern energy.
- o Biomass remains a key resource for meeting the thermal energy needs of the rural population today. Future efforts in rural energy will need to put adequate emphasis on thermal and electrical energy conversion technologies based on biomass.
- o Many rural energy programmes have restricted their impacts by focusing on a single technology, such as energy conversion or end-use energy service technologies. A technology-neutral approach, which would include technologies such as gas stoves and the use of fossil fuels such as liquefied petroleum gas, is recommended for interventions in this sector.
- o Rural energy business is a long-term, low-return prospect; private businesses are unlikely to be significant players unless required by regulation. In the absence of strong regulation, governments and utility companies will need to play a more active role in low-carbon rural energy.
- o Rural energy business in the public and private sectors will need financial and fiscal incentives to service the rural population without access. These incentive frameworks should encourage energy service delivery, rather than buying down capital costs.

Low-carbon energy regulations

Since its inception, REEEP has supported sustainable energy regulation. SERN has worked on regulatory capacity building by developing databases and publications on energy and regulatory policies. Furthermore, REEEP has supported 11 projects in this sector, committing over €1 million. The REEEP-supported projects in low-carbon energy regulation have covered seven countries including Brazil, China, Mexico, Namibia, etc. Some of the key initiatives in energy regulation supported by REEEP include the following:

- o roadmap development for the implementation of renewable energy certificates in India with IREDA and the Forum of Regulators;
- o improving electricity governance in Brazil and South Africa with the World Resources Institute;
- o development of a technical quantity assurance framework for light emitting diode (LED) lighting, in order to support implementation of the Chinese Government's energy efficiency policy with National Light Testing Centre; and
- o development of regulation methodologies for renewable energy in Mexico by Comisión Reguladora de Energía Mexico.

Key lessons from REEEP's experience in low-carbon energy regulation include the following:

- o In developing countries, significant capacity constraints with energy regulators act as major barriers to transitioning to a low-carbon energy system. The regulators generally have little or no experience with renewable energy sources or low-carbon energy technologies. There is also a dearth of instruments for regulating low-carbon energy.
- o Governance is a key barrier in infrastructure regulation, affecting also the energy sector. Governance issues have affected energy access, services quality, and mainstreaming low-carbon energy. Energy governance needs to improve to ensure a low-carbon energy transition in developing countries.

Low-carbon energy policy

The majority of REEEP-supported projects and initiatives are in low-carbon energy policy. Energy policy is vital for the support of developing countries' transition to low-carbon energy systems. REEEP has been supporting policy frameworks, instruments, and legislation through a commitment of over €3.2 million to 40 projects in this space. The REEEP-supported projects in the finance work stream have covered 31 countries including Argentina, Brazil, China, Liberia, Guatemala, Tonga, Ghana, etc. Some of the key energy policy initiatives supported by REEEP include the following:

- o development of a roadmap to meet 30% of energy demand in China through renewable energy by 2030 by the Center of Renewable Energy Development (CRED) of the National Development and Reform Commission;
- o development of Renewable Energy Legislation for Kazakhstan by UNDP;
- o development of international energy management standards for integration into ISO standards by United Nations Industrial Development Organisation (UNIDO); and
- o development of a renewable energy policy in Ghana by the Energy Commission.

Key lessons from REEEP's experiences in low-carbon energy policy include the following:

- o The number of people living in urban centres in developing countries is increasing, and more urban centres are being developed. Cities and towns provide a good opportunity to transition to a low-carbon energy system through a focused, area-based approach. Low-carbon energy planning needs to be integrated into urban planning and should cover topics such as transportation, building, and water supply as well as electricity and heat.
- o Policy instruments such as feed-in-tariffs have helped in increasing the share of renewable energy in electricity systems. However, feed-in-tariffs should be carefully designed to ensure economic efficiency and long-term sustenance of the renewable energy market. Feed-in-tariffs are not relevant to off-grid energy systems, thermal energy, or energy efficiency market development. Mechanisms such as bidding systems and certificate systems (renewable energy certificates, white/EE certificates, etc.) provide an alternative market-based mechanism, but new institutional frameworks should still be established before they can be implemented.
- o Buildings energy performance standards and codes are key policy instruments for low-carbon energy transition in buildings.
- o Corporate policy and corporate social responsibility have not played a significant role in low-carbon energy market development in developing countries. As traditional and new businesses grow in developing countries, the role of corporate policy will increase, relative to government policies. Several reporting initiatives, such as the Carbon Disclose Project (CDP) supported

- by REEEP, are beginning to sensitise corporate policy to low-carbon energy opportunities.
- o Technology roadmaps, when owned by the government and with the right incentives, technical frameworks, and targets, can result in effective market transformation and technology leapfrogging (Williams, 2001).

Conclusions and outlook

This article has sought to inform the low-carbon energy policy and development community about REEEP programmes and the lessons from its 5 years of implementation. We see a number of lessons for policy makers and managers involved in climate change and development issues involving energy in developing countries to integrate into future initiatives and programmes on the national levels.

REEEP's experience presents possibilities in market development for two low-carbon energy technologies in developing countries: renewable energy and energy efficiency. REEEP provides on-the-ground, bottom-up examples of lessons and good practice that public policy makers can utilise. Over its 5 operational years, REEEP has emerged as a key player in achieving low-carbon energy impacts in developing countries through targeted market development impacts.

REEEP is in a position to significantly scale up its activities to achieve even greater impacts. For example, REEEP is planning to run longer term and larger scale projects in the countries that it operates. There is also a significant demand for REEEP support, which is generally available to only 10% of the received requests. We believe that a significant share of rejected proposals (about 10–15%) are of good quality and can be supported if additional resources were available. Apart from scaling up the level of activities in the major developing countries, Africa and the Pacific, there are demands for REEEP's interventions from Central America, the Caribbean, and Southeast Asia. Finally, opportunities are emerging in low-carbon energy technologies, such as energy storage and smart grids, which would supplement REEEP activities in renewable energy and energy efficiency.

With a wealth of lessons from 5 years of experience in about 130 projects in over 50 countries, REEEP is ready to move to the next stage of its development. There are significant opportunities and demand for an increase in the scale of REEEP's operations. REEEP is ready to leverage its capability to play an active role in the low-carbon energy transition in developing countries within the Climate Change Convention. REEEP is also ready to play an active role in the use of low-carbon energy for sustainable development.

REEEP invites low-carbon energy and development stakeholders to work with it and other institutions to help the transition to a low-carbon energy pathway in developing countries.

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