International Support for Domestic Action

Mechanisms to Facilitate Mitigation in Developing Countries

Policy Summary

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1. Low-carbon development strategies

Domestic ownership is essential for the success of low-carbon development strategies – to ensure they capture the resources, capabilities and aspirations of a country. International cooperation can facilitate mutual learning and information sharing so as to ensure that low carbon development strategies:

Provide frameworks for the low-carbon transition in a country, avoiding the mere pursuit of marginal improvements of old technologies, but where possible allow to leapfrog towards low-carbon technologies and infrastructure that have long-term mitigation and market potential. A clear framework that is supported with credible policies allows firms and investors to anticipate future market opportunities and shift investments to low-carbon sectors and technologies.

Identify interactions across sectors to match energy supply, for example from biomass and renewable electricity production, with energy usage patterns in industry, transport and households. Also infrastructure needs can be met, e.g. by installing energy efficient agricultural pump sets together with electricity metering in order to facilitate efficient use of water and energy.

Align interests of domestic actors and international community in developing low-carbon development strategy that is consistent with domestic and global objectives. This requires that the plan is not taken as commitment, but merely as basis for the discussion of domestic commitments and international support for the implementation of NAMAs identified by the plan.

Comprehensive sets of actions and policies are required to create a framework for a shift to low-carbon development trajectories of individual sectors and ultimately the entire economy. We explore four components that underpin effective climate cooperation:

1. Low-carbon development strategies, initiated by South Africa and subsequently Mexico and South Korea, outline the intended economic, energy and emissions trajectory for their respective countries. The overall strategy helps to identify trigger points for policy intervention.

2. Nationally appropriate mitigation actions (NAMAs) comprises of a set of projects, programmes and policies that shifts a sector/technology in a country onto a low-carbon development trajectory.

3. International support mechanisms can provide tailored support for individual NAMAs, to enhance the scale, scope or speed of their implementation. To address the specific needs of a country and sector, easily accessible mechanisms for capacity building measures, technical assistance, technology cooperation and financial assistance are required.

4. Monitoring and Reporting is necessary for the implementation of an action or policy, international learning, and transparency to enhance private sector investment and innovation. This requires detailed quantitative and qualitative evidence.

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2. Nationally Appropriate Mitigation Actions

A set of actions has to be pursued in parallel to facilitate a shift to low-carbon development of a sector or technology, including: training, capacity, evolving institutional and regulatory structures, and initial access to finance. These require local knowledge and local stakeholders to initiate implementation and gain political support.

The interest of stakeholders from government, academia, and often from industry and finance was demonstrated in country workshops pursued as part of the ISDA project. The initial interest was typically triggered by the co-benefits of low-carbon transitions: opportunities to improve energy access and security, create jobs, and achieve broader development objectives.

Opposition to change is to be expected from other stakeholder groups that benefit from the status quo or have a lot to lose. Political support can be increased, for example when incumbent companies participate in the deployment of new technologies and the transition of the workforce is supported with training. The long struggle of policies to remove energy subsidies, points to the importance of schemes that create win-win situations from change, e.g. combining price changes with investment support for efficient appliances.

It is desirable to define one NAMA for any one transition in a sector or technology. The actions and associated politics for a low-carbon transition in any one sector or technology are complex; therefore further increasing the scope of a NAMA could delay delivery. The diversity of actions needed in such a transition requires involvement from many ministries and institutions in the design and implementation stages of a NAMA. Success hinges on high level political sign up, to coordinate and pursue such actions.

3. International support mechanisms

International support mechanisms need to be easily accessible by motivated domestic stakeholders to allow for domestic and international actors to structure support together. This ensures the support is demand driven, incorporates local insights, and tackles the specific needs of the country and sector or technology. Different support mechanisms can create synergies for the implementation of a NAMA: Capacity building enhances skills to manage, construct, maintain, and operate new technologies and practices that receive regulatory, financial and technical support.

International support can enhance the scale, scope and speed of implementation of NAMAs. If support is linked to individual NAMAs, then it creates an additional driver for the domestic implementation of the actions required for success. Linking the support to continued NAMA implementation enhances the stability of regulatory and policy frameworks. E.g. a feed-in tariff is more likely to be stable if international support contributes to the incremental cost over time. This attracts domestic and international manufacturing and investment.

Technology cooperation can support the development of an enabling environment for low-carbon technologies, encompassing technology innovation, human and institutional capacity, markets and regulatory frameworks, availability of finance, and focused national policies. The type of support has to be tailored to the state of development and diffusion of the technology, and the country needs. While the mechanisms often focus on cooperation between governments, their ultimate objective is usually the creation of an enabling environment for private sector innovation, deployment and use of the technologies.

The list of mechanisms proposed for technology cooperation is comprehensive. A subset of mechanisms needs to be developed and refined. Some mechanisms, like: R&D cooperation, technology-oriented agreements, intellectual property rights sharing agreements, and a global technology demonstration fund, focus on enabling new innovations. Other mechanisms, including a network of innovation centres and technical assistance, focus on the capacity to adopt, operate, and maintain technology.

Intellectual property rights (IPR) have to be handled effectively. While they are neither the sole solution nor dominant obstacle for technology cooperation, the current political focus on climate cooperation creates the opportunity to develop international institutional capacity to address IPR conflicts and facilitate cooperation on climate relevant technologies. Industry standard bodies provide examples of how licensing and IPR disputes can be quickly
resolved while balancing return expectations for innovative activities with the needs of technology development and adaption to local circumstances.

**Financial instruments matching the needs of actors and sectors facilitate the implementation of NAMAs.** Grants, loans, credit guarantees or equity funding can thus support public and private actors in dealing with the risks of new technologies and policy frameworks and create opportunities to acquire new skills and develop business models. International support for individual NAMAs can facilitate their implementation and enhance their long-term credibility. Public finance is therefore an essential catalyst to shift large volumes of private sector investment to low-carbon technologies.

**Choice of financial instruments needs to reflect institutional capacity and available resources.** Experience of bilateral and multilateral cooperation for specific financial instruments can inform the choice of institutions for their provision. The resource base of multilateral institutions can be strengthened with revenue from carbon pricing on international aviation and shipping. Commitment to hypothecation of domestic carbon revenue can create the public funds necessary for bilateral cooperation. If all support provided across all instruments is measured in grant equivalent terms, then developed countries’ contributions can be measured against their commitments.

### 4. Reporting

**Quantitative reporting has to expand beyond greenhouse gas emissions** to facilitate effective management of the implementation of NAMAs and to allow for international learning. It can create accountability for all parties involved in international support mechanisms, enhance the credibility of the transition strategy and attract private sector investment. Experience from industry and other sectors points to the need to link outcome measures to a combination of input, process and output indicators.

The subsidiarity principle emphasises the value of local development of indicators, to match local needs, enhance domestic ownership and create greater political support. International registration of monitoring strategies and reporting is essential for rapid international learning on how to best tackle the global problem.

**Internationally harmonised reporting of selected indicators and indicator categories** needs to be agreed on, to allow for international benchmarking, to identify best practice, to ensure reports on international support mechanisms, identify short-comings, and to allow for accounting of international support provided by developed countries against their commitments.

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The UNFCCC discussions concerning cooperation with developing countries on climate change mitigation increasingly focus on mechanisms that support mitigation activities through technology cooperation, capacity building and the direct provision of finance. This raises the question of whether the current monitoring and reporting structure under UNFCCC can effectively support successful implementation of actions and cooperation. Non-Annex I Parties are required to “provide a national inventory of anthropogenic emissions ... using comparable methodologies”. Thus the reporting requirement is constrained to the outcomes of policy action.

To inform this question, this paper surveys the vast literature surrounding the use of indicators. Debates on metrics are covered in international development, public administration and governance, energy and climate policy, and science and technology innovation sectors. This literature highlights both the usefulness of indicators as a monitoring tool, and explores questions on their design and implementation. To provide further evidence, we conducted a survey of indicator users, across a number of sectors. The results of the survey highlighted the usefulness of indicators in providing a wide range of information, and survey respondents have provided additional insights into indicator design questions.

Indicators can: facilitate implementation and management of individual programmes, create transparency to attract private sector investment and innovation, identify best practices and foster international learning, provide accountability to domestic constituencies, and provide mutual accountability in the case of international cooperation.

I. Indicators can measure different stages of programmes, from inputs to outcomes, yielding different information but with different costs, timeframes and opportunities for gaming. Programmes often deploy a range of indicators, although process indicators that measure the implementation of the programme and the barriers to a programme’s success are often overlooked. Incorporating intermediate indicators into frameworks containing input and final outcome measures can help to achieve the objectives and improve monitoring.

II. Indicators can be created based on, or incorporated into large data sets, or can be reported and used individually. Limiting the number of indicators reduces collection costs, making it easier for policymakers to analyse and manage the data, and can reduce the costs of any ex-post verification. Increasing the number of indicators allows more of the programme’s development to be demonstrated, and reduces the potential for indicators to be selected using criteria such as ‘ease of achievement’ rather than being chosen for the usefulness of information they provide. Increasing the amount of data that indicators are based on improves the accuracy of the measures but increases collection and verification costs. Building on existing capacity and data sets can reduce these costs and allow greater coverage of monitoring.

III. Indicators for reporting of international cooperation on climate change mitigation actions could be defined and reported at different levels. There may be an international agreement on which indicators are used and reporting may take place through a body such as the UNFCCC. This creates greater comparability and accountability of domestic action. It also reduces verification costs. Allowing countries to choose and report indicators that are suitable for each action at a national level creates greater ownership among policymakers and allows for better assessments of individually successful actions. A hybrid of these two options, where indicators are defined nationally by categories that have been defined internationally, can be useful for international cooperation.
learning and can help to identify country-specific measures and barriers.

In the field of development assistance, indicators have been used extensively at the programme level, country level (Poverty Reduction Strategy Papers (PRSPs) and internationally (Millennium Development Goals (MDGs). Experience here has highlighted the difficulties in only identifying outcome-based indicators and the lack of early information on programme performance, e.g. from measuring performance of ongoing activities with process indicators. Although such measures have been used sporadically in some PRSPs, their use is more widely seen in developed countries. In the energy sector, for instance, and particularly in the management of renewable energy deployment programmes, ‘process’-based indicators are becoming more widely used both to manage implementation of policies, and to support international comparison and learning. Lessons from the UK public sector suggest that a range of metrics, combining input, output, and process indicators outcome-based measures create a successful implementation framework. This framework also suggests that the use of both multiple short-term annual measures and longer-term performance plans increased the burden of data collection significantly. Tailored, locally designed indicator frameworks can provide policy stability for national government programmes and incentivise action to produce annual monitoring of specific change.

It might be necessary to require internationally harmonised reporting of a sub-set of such indicators:

- International learning about actions to facilitate a rapid shift towards low-carbon allows third parties to accelerate their decarbonisation. This will not necessarily be reflected in the discussions of indicator design by domestic actors. The UNFCCC framework might therefore require the monitoring and reporting of indicators necessary to facilitate international learning. International financial support for the necessary actions might be required for improving interest in cooperation and willingness to contribute.

- Experience from bilateral and multilateral development assistance points to slow reporting of failures of projects and programmes, as typically none of the actors involved have substantial interests in emphasising project difficulties to the public. However, in order to facilitate learning, and to ensure actions that contribute to effective de-carbonisation, early and transparent reporting will be valuable. The UNFCCC reporting framework, therefore, could require reporting of indicators that allow early identification of outcome delays and implementation problems to ensure mitigation is delivered and international learning is enhanced.

Such reporting has to go beyond the reporting of sector level CO\textsubscript{2} emissions, as emission levels often respond with long delays to policy actions. International reporting of the remaining (non-harmonised) indicators can facilitate learning about policy experiences and can serve as commitment for reliable reporting to domestic stakeholders.
Mechanisms for International Low-Carbon Technology Cooperation: Roles and Impacts

- Shifting to low-carbon technologies requires a favourable environment, encompassing technology innovation, human and institutional capacity, markets and regulatory frameworks, availability of finance, and focussed national policies.

- International support can enhance the scale, scope and speed of the development of such favourable national environments. The type of support has to be tailored to the state of development and diffusion of the technology, and the country needs. These different needs are addressed by the mechanisms discussed in this paper.

- Some mechanisms, such as R&D cooperation, technology-oriented agreements, intellectual property rights sharing agreements, and a global technology demonstration fund, focus on enabling new innovations. Other mechanisms, including a network of innovation centres and technical assistance, focus on the capacity to adopt, operate, and maintain technology. Any capacity building should be specific to the technology and the needs of the country.

- While the mechanisms are often focused on cooperation between governments, their ultimate objective is usually the creation of an enabling environment for private sector innovation, deployment and use of the technologies.

Adoption, diffusion and large scale use of low-carbon technologies depends on a complex interplay of technology innovation, human and institutional capacity, and other aspects of the enabling environment, such as availability of finance, international experience and expertise, markets and the regulatory framework.

International cooperation can support countries in moving technologies along the technology chain. The figure below shows a capabilities framework that connects country capacity needs, grouped with technological innovation stages as defined by Bell (2007). International cooperation offers benefits for all countries – but the emphasis is likely to differ across countries, characterised in the simplified representation by their income levels.

**Capacity to operate and maintain:** Large-scale use of a technology requires technical expertise to operate, repair and maintain the technology. International cooperation can provide technical assistance and basic capacity building.

**Capacity to adopt and manufacture:** A technology that needs to be adapted based on infrastructure, climate, resource-mix, and usage patterns requires an additional set of skills – the capability to adopt a technology to local circumstances, and where possible manufacture it for domestic use. International cooperation can ensure early exchange of information, so as to accelerate the learning process (e.g. IEA implementing agreements) and provide more tailored support to complement domestic capacities.

**Capacity to innovate:** Innovation has become a global activity of academic, public and private sector actors. International collaboration can help to maintain and enhance the close cooperation of these actors and also shift their focus to activities that might contribute to low-carbon economic growth. Furthermore, the design of incentive schemes (e.g.

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Countries with low levels of development might be served by mechanisms that address the technology-capability categories of “capacity to operate and maintain”, “capacity to adopt” and “capacity to regulate”. Such countries might thus participate more in a Network of Innovation Centres, in technology assistance and capacity building, in standards and regulatory cooperation and policy learning. Higher-income countries might participate in R&D cooperation and technology-oriented agreements, in agreements to address IPR issues and in a Global Technology Demonstration Fund. This would increase their capacity to innovate, which would “perfect” technology transfer by allowing them to be technology producers, manufacturers and developers. They could also participate in technology standards, policy learning and an International Technology Financing Scheme arrangement.

Industrialised countries would fortify national policies, spending on technology research, development and demonstration, and would need to provide bilateral and multilateral assistance for the development and implementation of mechanisms.

### Overview of international technology mechanism components

<table>
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<tr>
<th>International technology mechanism</th>
<th>Contributes to:</th>
<th>Technology-capacity type</th>
<th>Specific financial assistance for incremental costs of deployment and diffusion</th>
<th>Other domestic enabling environment activities, such as market formation and regulation</th>
</tr>
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<td>Capacity to innovate</td>
<td>Capacity to operate and maintain</td>
<td>Capacity to regulate</td>
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<tr>
<td>IPR sharing agreements, e.g., royalty fund</td>
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<td></td>
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<tr>
<td>Network of Innovation Centres</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Global Technology demonstration Fund</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Technical assistance / capacity building</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>Technology standards</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Regulatory cooperation and policy learning</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>TAPs / LCDSs</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>International technology financing scheme</td>
<td></td>
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Structuring International Financial Support to Support Domestic Action in Developing Countries

Objectives of Financial Support Mechanisms
The shift to low-carbon development trajectories requires that private and public sector investment choices are shifted from energy inefficient and carbon intensive infrastructure and technologies towards low-carbon choices. This requires domestic governments to provide a robust policy framework to attract and shift the corresponding investment volumes. International financial support mechanisms can:

- support countries in the implementation of policy frameworks by contributing to incremental costs
- enhance regulatory stability by creating incentives to maintain effective policy frameworks
- facilitate access to finance to support private investors in the transition to low carbon investment

This represents a shift in the objective of financial support mechanisms from the purchasing of cheap tonnes of carbon to creating a long-term vision for facilitating the implementation of low-carbon development strategies, with the following implications.

Structure Support to Match Requirements for a Low-carbon Transition
Climate change support is not about aid, with donors and recipients. It is about taking joint responsibility for a global problem, with each party contributing according to their means and their common but differentiated responsibilities.

Support mechanisms are most effective where they can target the sector and country-specific needs of different actors, including project developers, investors and developing country governments. Thus they can target bottlenecks and contribute to the development of technologies, industries and business models for the large scale roll-out of low-carbon technologies and practices.

The figure below structures the different mechanisms that are available to provide financial support in bilateral settings or through multilateral institutions. Sector and country-specific analysis is required to identify the most suitable set of instruments in each instance.

Linking financial support to the implementation of specific Nationally Appropriate Mitigation Actions (NAMAs) allows for the selection of the suitable mechanism(s) in parallel with implementation of the necessary regulatory framework. Current and future financial support creates incentives for the implementation and continuation of the policy framework defined in a NAMA, thus enhancing regulatory stability and improving the low-carbon investment framework.

Enhance the Capacity of the International Community to Provide Support
The choice of mechanism is intrinsically linked to the institution that can provide the mechanism. For example

- Bilateral cooperation offers the flexibility to tailor a grant to the specific needs of a sector or country, and might therefore be the preferred option to facilitate transition strategies. Only where incremental costs are clearly defined, e.g., with technology demonstration projects, are multilateral organisations more able to use standardised methodologies to offer grant support.

- Multilateral organisations offer a stronger track record in the provision and management of loans, e.g. for infrastructure development.

It will be essential to anchor the different support in an overarching framework, preferably a UNFCCC umbrella, to create synergies of the international cooperation rather than risk fragmentation of efforts.

To allow the mechanisms to provide support at sufficient scale, commitments for the gradual increase

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of the provision of public resources are necessary. Many options are discussed, including

- Reserving a share of auction revenue from national emission trading schemes
- Reserving revenues from carbon pricing on international aviation and shipping

Mechanisms can also be selected that provide effective support while being less demanding for balance sheets and current accounts. For example, if governments issue credit guarantees, this may not have direct implications for balance sheets and current accounts, but can still offer effective help. It allows pension funds and other private investors to offer low cost capital and learn about new technologies and regulatory frameworks so as to reduce the need for future public intervention.

**Match Demand Needs and Supply Capabilities**

The need for tailored financial support to implement individual NAMAs in developing countries has to be aligned with the constraints on scale and institutional capacity for the provision of such support. Further analysis and ongoing reviews will be necessary to ensure effective use of scarce resources so as to facilitate rapid implementation of low-carbon development strategies across developing countries.

If the value of financial instruments such as loans, equity and risk guarantees is reported in terms of grant equivalent contribution under the UNFCCC umbrella, then a fair comparison of contributions of different actors with their commitments will be possible. It also facilitates international learning about effective domestic policy and international support strategies.

The recent crisis in financial markets has demonstrated the risks associated with overly complex financial instruments. While international public support will have to use a set of instruments to unlock bottlenecks and target actors, it will be important to limit the number of mechanisms and ensure simple design.

The annual needs for public financial support for mitigation actions in developing countries will increase during the initial years of the low-carbon transition, as capacity and experience with the implementation of actions increases. If incremental costs are financed by newly issued dedicated bonds (at national or international level), then public finance needs will be increasingly stretched as this additional demand for public finance coincides with increasing costs of serving old bonds. Additional bonds or credit guarantees backed by governments in developed countries might however be a suitable approach to facilitate access to finance for low-carbon investments in developing countries. In this case the bonds will be served by revenues from low-carbon projects. This shows that a clear and consistent strategy will be important to enhance the credibility of low-carbon transition strategies.
Policy and Regulatory Framework for Renewable Energy and Energy Efficiency Development in Ghana
WILLIAM GBONEY

Abstract

Even though there are many opportunities to increase the scale and scope of adopting renewable energy (RE) and energy efficiency (EE) technologies in Ghana, their level of utilisation has been limited due to number of barriers. This case study explores actions to overcome the barriers, and the role of international support to leverage domestic policy to enhance the scale, scope and speed of implementing RE and EE technologies.

It emerged from the study that to promote RE energy, a combination of policy measures are required to accelerate the attainment of the 10% RE target in the energy mix. Policy options include, use of international support to enhance the regulatory framework, developing an all-inclusive energy policy, building domestic technical capacity, bridging the gap between policy makers and academics, and leveraging domestic financial environment.

It is estimated that Ghana has the potential to avoid at least 14,000,000 tons of CO2 emission over the lifetime of RE projects, if the barriers are removed and international support is utilized to leverage domestic policy. On EE, it is estimated that between 70,000 tons and 700,000 tons of CO2 emissions could be avoided during the implementation and roll-out phases.

Policy Description and Programmes.

The Ghana government policy on RE aims to remove the barriers which have hampered the exploitation of the country's renewable resources. This led to the development of a Strategic National Energy Plan which set a target of 10% of RE in the country's energy mix to be achieved by 2020. The Plan also sought to enhance EE through Demand Side Management (DSM) activities.

Other policy measures are leveraging the domestic financial environment with international support to provide financing at concessionary rates for both grid and off-grid RE and EE projects. The study also identified the need for the country to adopt appropriate market mandated policies, public benefit system and intensify efforts to take advantage of financing under the Clean Development Mechanism.

Needs: Barriers and drivers.

As part of this study, a stakeholder workshop was organized in Ghana, on April 8, 2009, to identify the barriers and discuss the options for overcoming them. It emerged that since the inception of energy sector reform in 1997; most of the regulatory institutions have already been established. Therefore the barriers which need to be addressed are those which have prevented effective functioning of the institutions and related to implementation, roll-out and ensuring continuity of RE and EE activities.

Table I: Barriers based on outcome of discussions from Accra workshops

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<th>Key Barriers</th>
<th>Implementation</th>
<th>Roll-out</th>
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<tr>
<td>Lack of Capacity to:</td>
<td>RE</td>
<td>EE</td>
</tr>
<tr>
<td>Innovate</td>
<td>Lack of critical mass of human capital.</td>
<td></td>
</tr>
<tr>
<td>Regulate</td>
<td>Inadequate policy, legal and regulatory framework; Lack of all-inclusive energy policy</td>
<td>Lack of clear policy and capacity to regulate</td>
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<td></td>
<td>Lack of regulatory capacity for project sustainability</td>
<td>Lack of technical standards and codes.</td>
</tr>
<tr>
<td>Adopt</td>
<td>Weak domestic capacity</td>
<td>Lack of appropriate technical standards</td>
</tr>
<tr>
<td>Operate &amp; Maintain</td>
<td>Lack of technical capacity</td>
<td>Lack of technical capacity for sustainability</td>
</tr>
<tr>
<td>Finance</td>
<td>Lack of access to long-term capital; High cost of capital</td>
<td>Lack of finance for ESCOs and private sector; Limited scope of operations of Energy Foundation.</td>
</tr>
<tr>
<td></td>
<td>Adoption of inappropriate business model</td>
<td>Lack of distribution outlets for EE equipment</td>
</tr>
</tbody>
</table>

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The key barriers are summarised in table I, on the previous page.

Despite the modest achievements of Energy Foundation on EE, the study revealed that most of the Foundation’s operations are limited to industries and households in Accra and few regional capital cities.

The key drivers identified for RE include inter alia, enhancement of regulatory framework, development of technical standards and innovative financing mechanisms. Other drivers include establishing information centres to provide potential users with information on equipment costs to enhance the level of interest from academics, private entrepreneurs, regulators and policy makers. For EE, stakeholders are becoming aware that adopting good energy conservation activities can yield significant energy savings; this can represent an alternative energy resource, which is less costly than constructing new energy infrastructure.

**Suitable Indicators.**

The author examined the tradeoffs between different choices of indicators namely *Input, Process/Activities, Output and Outcome* indicators. The tradeoffs considered include: qualitative or quantitative indicators, collection cost versus usefulness, input and outcome indicators and domestic versus international harmonised reporting. The author has focused on output instead of outcome indicators because of the former’s ability to measure short-term results. Outcome indicators on the other hand, tend to monitor the longer-term results, are future oriented and associated with extensive and costly data collection.

**Table II**: Major barriers and options to address

<table>
<thead>
<tr>
<th>Key Barriers</th>
<th>Policy Actions</th>
<th>Implementation</th>
<th>Roll-out</th>
<th>Regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Policy and Regulatory</td>
<td>1. Domestic</td>
<td>Development of all-inclusive policy framework for RE and EE.</td>
<td>Enhanced regulatory framework</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Domestic and International</td>
<td>Enhanced regulatory framework</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Weak Domestic Capacity</td>
<td>1. International</td>
<td>Development of critical mass of technical skills</td>
<td>Enhanced technical capacity for sustainability and replication.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. International</td>
<td>Enhanced capacity for financing institutions in RE and EE lending.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. International</td>
<td>Capacity building for regulatory agencies, Energy Foundation and policy makers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Financing</td>
<td>1. Domestic and International</td>
<td>Leveraging the domestic financial environment</td>
<td>Adoption of business model for sustainability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. International</td>
<td>Multilateral financial support</td>
<td>Adoption of business model for availability of EE technologies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Domestic and International</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Large-scale Roll-out of Concentrating Solar Power in South Africa
MAX EDKINS, HARALD WINKLER, AND ANDREW MARQUARD

Abstract
As part of Climate Strategies‘International Support for Domestic Climate Policies’ project this paper assesses the large-scale rollout of CSP in South Africa. Described as a Nationally Appropriate Mitigation Action (NAMA), the scale of CSP deployment is determined, and the amount of greenhouse gas emissions saved and incremental investment costs are estimated in line with the modelling outcomes of the Long-Term Mitigation Scenarios (LTMS) for South Africa (Chapter 2). Based on a stakeholder workshop held in May 2009 the drivers in support of the rollout of CSP are described, in particular the recently established Renewable Energy Feed-In Tariff (REFIT), and three major barriers relating to technology, regulation and infrastructure are highlighted (Chapter 3). The paper further assesses options of international support in light of the climate change negotiations to overcome the barriers identified (Chapter 4), and lastly, it assesses indicators that may be successful in monitoring the large-scale rollout of CSP (Chapter 5).

In this study we define the ‘large-scale’ rollout of CSP in line with the more optimistic ‘renewables extended with learning’ projection modelled in the LTMS of South Africa, as depicted in the figure below. The rollout is characterised by three phases: during the initial ‘Start’ phase, from 2010 to 2015, 2 GW of CSP capacity is constructed, from 2016 to 2020 the ‘Scale-up’ phase results in a 7 GW CSP capacity, and by the completion of the ‘Rollout’ phase (2021 to 2050) 100GW of CSP capacity should be established. In the long-term (post-2040) the large-scale rollout of CSP is expected to achieve cost savings in the South African electricity sector, though before then the cost to the electricity system is estimate at R2.5 billion for 2010-2015 and R8 billion for 2016-2020 above the baseline projection. The rollout could result in 3,850 Mt CO₂-eq saved over the period 2010-2050 and the build programme is estimated to require incremental investment costs of R3.9-10.3 billion per year if CSP technologies experience learning rates of 15 to 20% per year, and less (R3.6-3.9 billion per year) if the country manages to create a local CSP industry.

Needs: Drivers and Barriers
A number of technology, infrastructure, regulatory and industry barriers would have to be overcome for the country to achieve the rollout of CSP envisioned. The three main barriers identified include a lack of capacity to innovate, whereby in the ‘Start’ phase technology would have to be imported, and more storage technology would have to be developed. Towards the ‘Scale-up’ phase South African-specific technology would have to be imported, and more storage technology would have to be developed. Towards the ‘Scale-up’ phase South African-specific technology would have to be developed and by ‘Rollout’, technological innovations, such as water-saving technology would have to be implemented.

Barriers relating to South Africa’s low capacity to regulate are mainly linked to the recently established REFIT. There are still a number of issues that need to be resolved before private sector agents can fully engage in the CSP rollout in South Africa, in particular the question of whether REFIT will be capped and how the power purchase agreements will be administered. The Renewable Energy Purchase Office also seems to already be ‘oversubscribed’.

<table>
<thead>
<tr>
<th></th>
<th>Start 2010-2015</th>
<th>Scale-up 2016-2020</th>
<th>Roll-out 2021-2050</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂-eq emissions avoided</td>
<td>CO₂-eq emissions avoided</td>
<td>CO₂-eq emissions avoided</td>
<td>CO₂-eq emissions avoided</td>
</tr>
<tr>
<td>22 Mt (&lt;15 Mt/yr)</td>
<td>140 Mt (20-30 Mt/yr)</td>
<td>3670 Mt (30-230 Mt/yr)</td>
<td></td>
</tr>
<tr>
<td>Share of electricity sector (Installed generating capacity)</td>
<td>Share of electricity sector (Installed generating capacity)</td>
<td>Share of electricity sector (Installed generating capacity)</td>
<td>Share of electricity sector (Installed generating capacity)</td>
</tr>
<tr>
<td>4% (2 GW) cumulatively by 2015</td>
<td>27% (7 GW) cumulatively by 2020</td>
<td>55% (100 GW) cumulatively by 2050</td>
<td></td>
</tr>
<tr>
<td>2.5 (0.4/year)</td>
<td>8 (1.6/year)</td>
<td>21 (0.7/year)</td>
<td></td>
</tr>
<tr>
<td>23.5 (3.9/year)</td>
<td>24.6 (4.9/year)</td>
<td>310 (10.3/year)</td>
<td></td>
</tr>
<tr>
<td>With technology learning¹</td>
<td>With technology learning¹</td>
<td>With technology learning¹</td>
<td>With technology learning¹</td>
</tr>
<tr>
<td>22.9 (3.8/year)</td>
<td>19.4 (3.9/year)</td>
<td>106.7 (3.6/year)</td>
<td></td>
</tr>
<tr>
<td>With technology learning¹ and local production²</td>
<td>With technology learning¹ and local production²</td>
<td>With technology learning¹ and local production²</td>
<td>With technology learning¹ and local production²</td>
</tr>
<tr>
<td>Notes:</td>
<td>Notes:</td>
<td>Notes:</td>
<td>Notes:</td>
</tr>
<tr>
<td>¹ Learning ratio is 15% and 20% reduction per doubling of deployment for parabolic trough and power tower respectively.</td>
<td>² Local production of CSP components is assumed to reduce CSP investment costs at a rate of 5% per year.</td>
<td>¹ Learning ratio is 15% and 20% reduction per doubling of deployment for parabolic trough and power tower respectively.</td>
<td>² Local production of CSP components is assumed to reduce CSP investment costs at a rate of 5% per year.</td>
</tr>
</tbody>
</table>

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Operational barriers feature the need for large-scale grid expansion to link areas that are suitable for CSP development, such as in the north-western parts of the country, to the main electricity consumer centres. South Africa is fortunate to have the skills necessary to achieve this, though the financing of it may be a major barrier. Overall international financial support could alleviate most of the above mentioned barriers.

<table>
<thead>
<tr>
<th>Options for addressing barriers</th>
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</table>

**Operate**

Overcoming the innovation (technology) barriers would require support for the deployment of non-commercially available CSP technology, such as Eskom’s proposed 100MW plant. Initially the international financial support could be designed with 50% risk-sharing for the first 100 MW plant and 25% risk-sharing for four more 100MW plants, which would cost an estimated R10 billion. Later, agreements on bilateral R&D collaboration could be forged and technology discoveries could be shared under technology transfer agreements. International support at these stages could be in proportion to the incremental investment cost, which at 50% would be just over R2 billion annually for 2015-2020 and R2-5 billion annually for 2021-2050.

Barriers associated with the REFIT would largely be dealt with domestically in the short term, once the mechanism has been tested by an independent project developer and guidelines are finalised. International support to the REPA could be in the form of training 100 staff for 5 years at an annual cost of R50 million, and support could be directed at completing countrywide feasibility studies for CSP at a possible cost of R240 million annually. Furthermore the international community could contribute to the estimated cost of REFIT.

The grid-expansion necessary to facilitate the large-scale rollout is predicted to be substantial. The north-west of South Africa would have to be linked to the ‘backbone’ grid of South Africa, which may be achieved through the construction of a transmission line in 2010-2015, five more in 2016-2020 and 60 thereafter till 2050. The international community could support by financing the incremental costs incurred.

**Suitable indicators**

A number of suitable indicators to monitor the success of achieving the large-scale rollout of CSP can be identified. Of all the stakeholder responses, the outcome measure of electricity produced from CSP plants was ranked as the most successful. ‘CSP plant licences issued’, ‘CSP plants under construction’ and ‘committed finance to CSP developments’ indicators were also ranked highly.

In addition other important measures include a process indicator measuring the cost reduction in electricity supplied from CSP – this would highlight the effectiveness of the rollout programme in competing with nuclear and coal generated electricity. An input indicator assessing the reliability of the REFIT in South Africa would help overcome the barriers relating to regulation. Lastly, a process indicator of grid-readiness would help facilitate the rollout of CSP, in that grid planning bottlenecks would be identified and overcome.

<table>
<thead>
<tr>
<th>Technology innovation – domestic</th>
</tr>
</thead>
<tbody>
<tr>
<td>First plants by 2014 Eskom innovate ‘test plant’</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology innovation – international</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology innovation – domestic</td>
</tr>
<tr>
<td>Technology innovation – international</td>
</tr>
<tr>
<td>REFIT – domestic</td>
</tr>
<tr>
<td>REFIT – international</td>
</tr>
<tr>
<td>Grid-expansion – domestic</td>
</tr>
<tr>
<td>Grid-expansion – international</td>
</tr>
</tbody>
</table>
The National Plan of Logistics and Transport (PNLT) which was recently adopted by the Brazilian government, aims to induce a change to the modal shares of transportation types by increasing the share of low-carbon transportation technologies. Although the Plan does not explicitly address concerns over climate change, the effective implementation of the Plan will have the potential to lower GHG emissions. Despite this, many important barriers must yet be overcome throughout the process of implementing the PNLT. To address this, a workshop was conducted in order to identify the main barriers and opportunities that must yet be taken into consideration within the Plan.

A series of indicators is suggested that may facilitate the quantification of emissions reductions. This is an important step if international resources are to be mobilized to support domestic actions, as evident throughout the current negotiations on the future multilateral climate change regime.

**Short description of The National Plan of Logistics and Transport (PNLT)**

The PNLT, if implemented as planned, will allow the establishment of a low-carbon transportation system which will also lead to the decrease of road traffic and increase of energy efficiency in the transportation sector.

The energy consumption of the Brazilian transportation sector increased 75% from 1990 to 2007, representing an average annual growth of 3.3%. For road transport alone, the increase was higher, at 3.5%. In 2007, 57.6 Mtoe was consumed by the transport sector of which 91.8% was represented by road traffic alone. Within this subsector, 52.5% of energy consumption was represented by buses and freight, which occupied a further 62.5%. In all, freight transportation corresponded to 18.9 Mtoe in 2007.

The implementation of the PNLT would result in a minimum annual reduction of 5.4% of greenhouse gas emissions to the transportation sector after 2025. However, the ideal scenario of the PNLT would allow reductions of more than 40% of GHG emissions in the freight transportation sector, compared to the business as usual scenario.

**The main barriers**

The needs and barriers described below were identified at the workshop, "Implementation of Low Carbon Freight Transportation Policies in Brazil and Options of International Support", which focused on policies, actions and programs that have been implemented in and may lead to the reduction of greenhouse gas emissions in the transportation sector. The workshop also focused on the identification of barriers and drivers that could favour the consolidation of a low-carbon transportation system in the country. The methodology adopted in the research encompassed the consultation of several specialists in the sector (among them: Ministries and governmental agency representatives, and scholars who deal with logistics and transport).

Thus, relating to the needs and barriers:

- The only initial lack of capacity that we can highlight is the lack of political coordination between the the various levels of federal government, states and private companies
- Brazil has a strong and modern industrial sector, but not specifically in the area of manufacturing and adoption of equipment for the movement of containers in freight terminals (Portainers, Reach stackers, Straddle Carriers, Mobile Harbour Cranes, etc);
- The only area associated with innovation in the sector would be the integration of new information technologies with logistics of freight flows;
Elaborate and promote capacity building and training activities for the operation and maintenance of equipments and intermodal information systems.

Options for addressing barriers
There are other important barriers to overcome, such as:
1. The bi-taxation of intermodal transportation;
2. The dominance of road travel in freight transport;
3. The lack of reinforced regulatory frameworks by transportation agencies.

There are many significant internal barriers to the consolidation of intermodal transportation. Sufficient will is required by policymakers at all governmental levels to ensure that these barriers will be overcome. The evidence above shows us that it is important to integrate the actions of government, particularly with respect to political, taxation, and regulatory issues.

In the workshop held in Rio, participants came to agree on the measures and actions that must be taken to remove these barriers, focusing on the political context more so than regulatory issues. These were:
- The National Council of Policy Finances (Conselho Nacional de Política Fazendária - CONFAZ) shall harmonize state taxes, establishing a system by which service tax is charged only once in the case of multimodal transport. This requires actions from CONFAZ in order to create a mechanism to free the multimodal transport of double taxation.
- When the plan is institutionalized in the National Council for Integration of Transport Policies (CONIT), which is linked to the Presidency of the Republic, it will be a State plan, which reduces the possibility of its break with the end of the current administration.
- It will be necessary to review and reinforce the regulatory framework of transportation agencies.

Good indicators for Changing
To monitor the success of PNLT, it is recommended to use quantitative performance indicators (i.e., outcomes of actions taken). Besides such traditional indicators, another set of “Structural” indicators could be established. As the required level of data collection is relatively achievable, indicators could be used to monitor the evolution of modal integration, and evaluate the development of low-carbon freight transportation systems. This could be a powerful tool for evaluating the overall efficiency of the domestic cargo transport system, given the impact of increasing the use of less energy-intensive transport. The availability of intermodal terminals will depend basically on the geography of areas in question. Regarding the collection of data, depending on the economy and the size of the further national transportation system, a full census of data may or may not be necessary. In the case of large systems, it may be interesting to perform special data collection on each unit for subsequent statistical processing.
Energy Efficiency in Low Income Homes of South Africa
JUDITH SYKES

Abstract

Despite real and tangible benefits of energy efficient housing to low income families and emerging policy support, donor-funded pilot projects incorporating a range of passive thermal improvements and solar water heaters have failed to lead to wide scale implementation. In this paper, barriers and drivers to implementation of projects are evaluated through interviews and site visits to exemplar projects. Financing was found to be a significant obstacle, in addition to a series of systematic barriers. Proposals to strengthen domestic policy are discussed, including policies to build capacity, develop local technologies and implement performance standards. Two types of international support mechanisms for domestic policies, the CDM and Direct Support, are evaluated. Results indicated that support linked to carbon payments for emissions reductions do not provide a sustainable model for these types of projects; where carbon savings are small and dispersed. Mechanisms that provide upfront finance, support poverty alleviation, reduce growth of emissions and seek to remove systematic barriers are proposed as a preferable alternative.

Programme of Actions

The government of South Africa operates a subsidised housing scheme for low income families and has committed to the construction of 300,000 subsidy homes per annum. Studies show that relatively simple interventions can have significant impact on the thermal performance of a standard subsidy house. Passive measures of; orientation, correct window sizing, and insulation can eliminate the need for space heating (USAID 2000). Solar water heaters offer a further way of reducing use of dirty fuels for hot water in cooking and washing. There is also scope to retrofit existing housing, in particular with ceiling insulation and solar water heaters. The combination of these interventions on a new build project has estimated savings of 70% on fuel costs (Winkler 2008). The wider societal benefits of a healthy, more prosperous population and reduced emissions from burning of fossil fuels are also recognised.

Needs: Drivers and Barriers

Through an evaluation of case study projects and interviews with those involved in the delivery of housing and energy efficiency policy, barriers and drivers to mass deployment of energy efficient measures in low income homes have been identified.

The interviews reveal an absence of policy support for energy efficient low income housing and a huge disconnect between policy development and capacity to implement. Insufficient levels of funding and institutional capacity were significant issues found to have an impact on the project process at each phase of implementation. Interviewees described problems with a lack of knowledge amongst policy makers about the wider social benefits of energy efficiency in low income housing, a bureaucratic policy implementation process that protects business as usual approaches, and an inability to make decisions at both national and local levels of governance.

Principal drivers to project implementation were identified by interviewees as donor funding and the role of ‘champions’ either within the community, or project agents who would be able to successfully move projects forward, despite the severity and number of barriers that had to be overcome. Desirable character traits of such local champions included faith, perseverance, arrogance and ability to build relationships. Projects which harnessed community support were also perceived as being able to overcome any potential misunderstandings from homeowners.

Options for Addressing Barriers

In response to this assessment, recommendations have been made to strengthen national support for thermally improved subsidy housing. Options for this include: the introduction of an energy performance standard for low income housing, building the capacity of institutions and practitioners, and policies to stimulate the delivery of innovative solutions to energy efficient housing. Enabling policies should also strive to harness the potential that exists within those communities that stand to benefit from the interventions both in terms of driving and delivering improvements.

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International mechanisms for supporting domestic action are also evaluated. Financing through the Clean Development Mechanism was shown to be able to provide only part of the funding required. This is because of the low carbon price and small dispersed savings relative to the required initial capital investment. The narrow focus of the CDM on financial support also fails to address broader systematic barriers identified.

Direct support, either bilateral or multilateral, for energy efficient housing is proposed as an alternative to the CDM, providing accessible, upfront and comprehensive support to government institutions, developers and homeowners. Not only seeking to provide capital finance through grants, but also targeted support for domestic needs (e.g. in the form of capacity building). It is anticipated that such mechanisms could be one way of supporting Nationally Appropriate Mitigation Actions.

Options to use existing micro-financing and insurance markets are proposed, with the homeowner and local community at the heart of driving and implementing solutions. It is hoped that this option would contribute to innovative approaches of international policy solutions. The extent to which contribution to capital investment can be made by homeowners is also evaluated.

**Suitable Indicators**

A series of indicators have been recommended for monitoring of policy implementation. Indicators have been selected to assist with policy refinement, e.g. strengthening performance codes as the housing market responds to the provisions of the code.
A Policy for Improving Efficiency of Agriculture Pump sets in India:
Drivers, Barriers and Indicators
ANOOP SINGH

The Indian power sector provides significant opportunities for reducing energy consumption by addressing existing inefficiencies of technical, operational and economic nature. Replacement of inefficient agricultural pump sets has been identified as one of the key policy initiatives, which to date, has been limited to a few pilot projects. The policy objectives are to: replace inefficient pump sets, improve distribution grids and provide metering. Adequate readdressing of economic inefficiencies, in terms of electricity pricing, remains a long-term objective. The scalability of such a policy proposal across the country offers many challenges. The paper identifies drivers and barriers for implementation of the policy, role of international cooperation and indicators for policy implementation with international cooperation.

Policy for Adoption of Efficient Agricultural Pump sets

The policy recommendation is to implement a joint programme for replacement of inefficient agricultural pump sets (including motor/engine and pump assemblies, piping, foot valves etc.) along with mandatory electronic metering. Such a programme should be supplemented with feeder metering and system modernization of the low tension (LT) distribution network with a High Voltage Distribution System (HVDS). The distribution companies (discoms) should also undertake separation of rural feeders with partial support from Restructured Accelerated Power Development and Reforms Programme (R-APDRP).

While a number of pilot projects have been undertaken and are proposed to replace inefficient pumps, the task of replacing about 16 million pumps presents financial, implementation, political as well as institutional challenges. Stakeholders perspective plays an important role in understanding and overcoming such challenges. A summary of the outcome from stakeholder surveys is presented below.

Drivers and Key Stakeholders:

The most important drivers that support implementation of the suggested policy are identified as,
(i) Overall energy saving
(ii) Reduced pressure on groundwater reservoirs
(iii) Ability to manage tariff subsidy
(iv) Transparency and accountability
(v) Facilitate appropriate tariff design

State governments are identified as the most important actors, followed by the distribution companies, central government and regulatory institutions.

Barriers:

The most critical barriers for implementing this policy are ranked below:
(i) Financing
(ii) Policy Implementation
(iii) Institutional/political
(iv) Project Operation
(v) Monitoring
(vi) Technical

The higher price of efficient pumps coupled with the existence of the flat tariff, which is not reflective of electricity consumption, leads farmers to buy cheaper but inefficient pumps. Clearly, financing is the most important barrier identified for implementing the policy.

Effective Policy Implementation

For effective implementation, replacement of inefficient pump sets should be supplemented with metering the electricity supply. As a long-term policy objective, it is envisioned that supply to agricultural consumers would be based on metered tariffs. Given the political sensitivities, such an objective can be achieved by creating awareness, providing incentives and through a political consensus.
International Cooperation

The role of international cooperation is highlighted for financial assistance as well as capacity building. However, it is noted that such cooperation often did not deliver much in terms of technology transfer. Three important areas identified for international cooperation are financial support, technology cooperation and capacity building (Figure 2).

Policy Indicators

Indicators are useful for monitoring progress and have been widely used in the power sector for setting targets, quality monitoring, tariff fixation as well as for programme implementation. The Accelerated Power Development and Reforms Programme (APDRP) and, now, Restructured Accelerated Power Development and Reforms Programme (R-APDRP) present a good example of how indicators are used for designing investment programmes and providing financial incentives for improvement in the performance of distribution segments across states in the country. The Aggregate Technical and Commercial losses (AT&C) is one of the key indicators used in the R-APDRP.

Figure 2: Need for international cooperation

It is noted that international cooperation, especially in the form of financial support and capacity building, has been effective, and involvement of multilateral/bilateral agencies seem to be an effectively delivery mechanism for such support (Figure 3). Programmes supported through international cooperation yield results when financial transfers are linked to achievement of milestones.

Figure 3: Components of international cooperation that enhance policy success

Table: Suggested key indicators to measure progress of policy implementation

<table>
<thead>
<tr>
<th>Program initiation</th>
<th>Deployment of efficient pumps</th>
<th>Appropriate tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies by SERCs</td>
<td>Policies by SERCs</td>
<td>Policies by SERCs</td>
</tr>
<tr>
<td>Survey of pump sets</td>
<td>Monitoring the sale of pumps</td>
<td>Government policy guidelines</td>
</tr>
<tr>
<td>Order issued by executive/state utilities</td>
<td>Decrease in consumptions at rural feeders</td>
<td>Reduction in Govt. subsidy</td>
</tr>
<tr>
<td>Policy / programme announcement by central/state govts.</td>
<td>load reduction, pf improvement</td>
<td>Improvement in revenue</td>
</tr>
<tr>
<td>Metering of pump sets, a pre-requisite for any progress</td>
<td>no. of pumps deployed</td>
<td>Regulatory orders for agricultural tariff</td>
</tr>
<tr>
<td></td>
<td>variation in demand, system stability, reduction of losses</td>
<td>Appropriate regulations</td>
</tr>
<tr>
<td></td>
<td>Number of of efficient pumps</td>
<td>Reduction in gap between cost to serve and tariff</td>
</tr>
<tr>
<td></td>
<td>Share of efficient pumps</td>
<td>Reduction of cross subsidy to comply with tariff policy</td>
</tr>
<tr>
<td></td>
<td>Changes is consumption pattern once metering is done</td>
<td></td>
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</tbody>
</table>

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Climate Strategies aims to assist governments in solving the collective action problem of climate change. It connects leading applied research on international climate change issues to the policy process and to public debate, raising the quality and coherence of advice provided on policy formation.

We convene international groups of experts to provide rigorous, fact-based and independent assessment on international climate change policy. To effectively communicate insights into climate change policy, Climate Strategies works with decision-makers in government and business, particularly, but not restricted to, the countries of the European Union and EU institutions.

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