Learning from emerging energy innovations in Asia: Contributing to the discourse on an institutional framework for sustainable development

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ABBREVIATIONS

ADB	Asian Development Bank
AGECC	Advisory Group on Energy and Climate Change
AEI	Asian Energy Institute
AEPC	Alternative Energy Promotion Centre
APEC	Asia Pacific Economic Cooperation
AP-Net	Asia-Pacific Network on Climate Change
APP	Asia Pacific Partnership
ASEAN	Association of South East Asian Nations
BCF	Biogas Credit Fund
BEE	Bureau of Energy Efficiency
BEMS	Building energy management system
BMZ	Federal Ministry for Economic Cooperation and Development, Germany
BSP	Biogas Support Programme
CAPaBLE	Capacity Building for Sustainable Development in Developing Countries
CBOs	Community Based Organizations
CDM	Clean Development Mechanism
CEMS	Community energy management system
CERC	Central Electricity Regulatory Commission, India
CERS	Certified Emission Reduction Savings
CRED	Center for Renewable Energy Development
CREIA	Chinese Renewable Energy Industry Association
CSD	Commission on Sustainable Development
DATe	Development and Appropriate Technology, Cambodia
DDC	District Development Committee
DGIS	Directorate General for International Cooperation
DSM	Demand Side Management
EASE	Enabling Access to Sustainable Energy
ECOSOC	Economic and Social Council
ECT	Energy Charter Treaty
EITI	Extractive Industries Transparency Initiative
ESCOs	Energy service companies
ESMAP	Energy Sector Management Assistance Programme
FITs	Feed in Tariffs
GDP	Gross domestic product
GEA	Global Energy Assessment
GEF	Global Environmental Facility
GERES	Groupe Energies Renouvelables, Environnement et Solidarités
GGC	Gobar Gas and Agricultural Equipment Development Company
GHG	Greenhouse Gas
GoB	Government of Bangladesh
GTZ	German Technical Cooperation
HEMS	Home energy management system
IAEA	International Atomic Energy Association
ICOPRODAC	Improved Cookstoves Producers and Distributors Association
IDA	International Development Agency
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Agency
IEF	International Energy Forum

IFSD	Institutional Framework for Sustainable Development
IGCC	Integrated Gasification Combine Cycle
IIASA	International Institute for Applied Systems Analysis
IPR	Intellectual Property Rights
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Agency
JODI	Joint Oil Data Initiative
JPOI	Johannesburg Plan of Implementation
KFW	Kreditansalt fur Weideraufbau
LDCs	Least Developed Countries
LIRE	Laos Institute of Renewable Energy
LPG	Liquefied petroleum gas
MARD	Ministry of Agriculture and Rural Development
MDBs	Multilateral development banks
MDGs	Millennium development goals
MFIs	Micro-finance institutions
MNRE	Ministry of New and Renewable Energy
MoEST	Ministry of Environment, Science and Technology
MoP	Ministry of Power
MOU	Memorandum of understanding
MTEE	Market Transformation for Energy Efficiency
NABARD	National Bank for Agriculture and Rural Development
NAPCC	National Action Plan on Climate Change
NBPA	Nepal Biogas Promotion Association
NCE	National Centre of Excellence
NDRC	National Defence and Reform Commission
NEA	National Energy Administration
NEC	National Energy Commission
NEET	Networks of Expertise in Energy Technology
NGO	Non-governmental organization
NMEEE	National Mission for Enhanced Energy Efficiency
NVVN	NTPC Vidyut Vyapar Nigam Ltd.
OECD	Organisation for Economic Co-operation and Development
OLADE	Latin American Energy Organization
OPEC	Organization of Petroleum Exporting Countries
PAT	Perform Achieve and Trade
PHP	Pico-hydro power
PMO	Project Management Office
POs	Participating organizations
PRC	People's Republic of China
R&D	Research and development
RE & EE	Renewable Energy and Energy Efficiency
RECs	Renewable Energy Certificates
REDP	Rural Energy Development Project
REEEP	Renewable Energy and Energy Efficiency Partnership
REIL	Renewable Energy and International Law
RPO	Renewable Purchase Obligation
RREP	Rural Renewable Energy Programme
SAARC	South Asian Association for Regional Cooperation

SD	Sustainable development
SEAI	Sustainable Energy for All Initiative
SELCO	Solar Electric Light Company
SEPA	State Environment Protection Administration
SERC	State Electricity Regulatory Commission
SERN	Sustainable Energy Regulators Network
SHS	Solar Home Systems
SIDS	Small Island Developing States
SIPs	Special Incentive Package
SME	Small and medium enterprises
SNV	Netherlands Development Organization
SPC	State Power Corporation
TEPCO	Tokyo Electric Power Company
UNCSD	UN Conference on Sustainable Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VAT	Value added tax
VDC	Village Development Committee
WB	World Bank
WEEE	Waste Electrical and Electronic Equipment
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization

Executive Summary

Energy and the discourse on IFSD at Rio+20

The UN Conference on Sustainable Development (UNCSD Rio+20) in June 2012 will deliberate on developing an 'institutional framework for sustainable development (IFSD)'. Recent IFSD discussions (as of December 2011) have mainly focused on reform of the UN structure, particularly UNEP, and also the CSD, but not energy related institutions. By the end of 2011, however, many countries felt it desirable to broaden the discussion at Rio + 20 to include several specific topics, including energy, and this was mentioned in many country statements of Nov. 1, 2011, to contribute to the outcome document. According to the structure of the outcome document as of January 2012, one section will be devoted to priority issue areas, including but not limited to energy.

Clean Energy and energy access, however, are important sectors to be addressed at Rio + 20 as they have relevance to the three pillars of sustainable development: **Economy:** the move to renewable resources, replace exhaustible resources; **Society:** these new forms of energy address energy poverty and access issues and the **Environment:** renewable energy reduces pollutants and carbon emissions.

Energy sector developments are important to the IFSD discourse because many of the interventions are addressing the implementation deficit in governance and providing energy access through different actors and sources. UN agencies are focusing on the new global initiative – Sustainable Energy for All. The Initiative brings all sectors of society to the table: business, governments, investors, community groups and academia and seeks to (a) Ensure universal access to modern energy services. (b) Double the rate of improvement in energy efficiency (c) Double the share of renewable energy in the global energy mix. These goals are to be achieved by 2030.

The discussions at the international level on a framework for sustainable development are around the need for a more distributed rather than supranational governance given the adaptive nature of responses required, the differential capacities involved and the need for a wider participation to improve effectiveness and responsiveness to ground realities. This study seeks to contribute to this discourse.

Asia, Clean Energy and Energy Access

Asia will have witnessed one of the highest growth rates in GDP as 3.5% of average annual growth rate is projected till 2030 for Asia and the Pacific that eventually would raise the energy demand at 2.4% per year between 2005 and 2030 (Asian Development Bank, 2009). Asia is also witnessing a significant development in the area of energy trade with many

countries exporting or importing electricity from neighbouring nations – ensuring a robust utilisation of the region's resources as well as energy security of energy deficit nations. As energy demand increases, the focus would be on access, availability and affordability of the fossil fuels with equal emphasis on diversification to other energy sources such as renewable energy to ensure energy security.

675 million lack access to electricity and there are around 1.9 billion people in developing Asia dependent on traditional biomass for cooking out of which 840 million reside in India with around 100 million each in Pakistan, Bangladesh and Indonesia – a major concern for a region that is attempting to fulfil the MDGs by 2015. (IEA, 2011)

The challenge of energy access has paved the way for many opportunities especially in the clean energy sector. The large population of energy unserved in Asia is also transforming the region into adopters of various energy interventions at the grassroots level based on clean energy technologies at low costs. Biomass gasifiers, solar, wind and small hydro are some of the energy technologies that have led to significant changes in many countries.

Countries of the region are at different stages of energy market development and hence have varied energy policy frameworks. Few countries thus have regulatory frameworks in place for promoting RE and EE and there is a lack of private sector participation as the energy sector is still dominated by government/ public sector entities. However there are some decentralized initiatives emerging which are of interest.

In Asia, various approaches – of top down policy diffusion as well as bottom up policy absorption are evident. The traditional approach to top down policy diffusion emphasizes economies of scale, most clearly demonstrated by traditional 'hard paths' of fossil fuel based grid connectivity. This process has mostly taken a top down approach with little feedback in planning stage leading to copying of external (western) models. The national level energy policy making has been mostly a central government enterprise leading to less socially acceptable decisions, absence of effective delivery institutions and less transparency leading to policy inattention or deliberate non-action. But today there are more and more examples of bottom up - decentralized efforts to provide energy access at the local level that are taking centre stage in financing and energy policy circles. Many of these examples use the non-traditional 'soft path' to energy access contributing to the larger goal of sustainable development.

About this study

This study has been undertaken by TERI, IGES and the AEI, and was supported by ADB's Energy for All and Energy for All Partnership. It focuses on what Asia has to offer by way of practice in addressing energy access and expansion of clean energy to the international dialogue on an institutional framework for sustainable development (IFSD). It contributes well to the UN Sustainable Energy for All initiative.

The study examines selected examples that demonstrate project and policy innovations and impact in the energy sector. The source and criteria for selecting the projects are briefly described below:

- A database was created for these documented projects sourced from regional and national level compendiums like the ADB's Clean Energy in Asia, Renewable Energy for Urban Applications in APEC, EASE Business Models for Energy Access (Enabling Access to Sustainable Energy), UNDP's Energy Services for Poverty Reduction, ADB's Powering the Poor, Cases from TERI's studies on Decentralized Electricity Solutions and MacArthur Foundation's Project on Energy Governance in Asia.

- The projects were selected based on (a) their having been implemented at the national, regional and local level for at a decade or so and have successfully diffused the technological solutions through innovative social practices. (b) The projects cater to a variety of purposes from residential/household energy demands, energy requirements for livelihood generation, commercial or business activities and provision of public services. This process resulted in a short list of 16 cases. Post this selection, a consultation was carried out with experts from the field of energy access and clean energy and 5 cases of projects operating at the local level were selected for detailed study. These include energy access and clean energy initiatives of SELCO in India, Solar Home Systems in Bangladesh, Vattanak Palm Sugar Cook stoves in Cambodia, Pico-hydro systems in Laos and the Vietnam Biogas Programme. These projects have their challenges and failures, but the focus was on understanding what worked and how they contributed to delivery of outcomes.

The study also considers selected policies and programmes that have been influential in policy diffusion or have high potential for influencing future policy processes for promoting clean energy and providing energy access. Examples of policy diffusion include Nepal Biogas Support Programme, Renewable Energy Development Project in China, National Mission on Enhanced Energy Efficiency and the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) in India. The study also includes policy reviews of Japan's Shift of Energy Policy toward Decentralized Renewable Energy System after Fukushima, their experiences of feed-in tariff, management of future electronic waste of Solar PV panels and their Cool Biz and Super Cool Biz campaigns.

Selected projects for study

S.no.	Project	Achievement in terms of providing energy access or promoting clean energy	Impact of the achievement

S.no.	Project	Achievement in terms of providing energy access or promoting clean energy	Impact of the achievement
1.	SELCO, India	SELCO has sold solar lighting to more than 110,000 rural homes and to 4,000 institutions such as orphanages, clinics, seminaries and schools in the Indian state of Karnataka.	An impact assessment study by World Resources Institute in 2007 reported that 86% of SELCO's poor customers cited significant savings in energy costs as their primary benefit of using SELCO products, while the rest pointed to their children's education as the primary benefit.
2.	SHS Bangladesh (IDCOL)	645,033 SHSs were installed by August 2010.	The project has positively impacted access to reliable off-grid energy for poor households, generated employment in the form of POs and distributors of SHS equipment as well as local jobs for maintenance and installations of SHS and promoted income generation among SHS households as shops remain open for longer hours. Lighting has enhanced security of women improving their involvement in community activities and children can study for longer hours.
3.	Vattanak Cook Stoves, Cambodia	200 stoves already installed with a commitment to install 5000 by 2014	The project impact has led to the increase in government participation as a major stakeholder as well as focusing on forestry management to reduce illegal logging for fuel purposes.
4.	Pico Hydro Systems, Lao PDR	While official figures on the number of pico hydro systems owned by people in Laos is not available, an estimated 60,000 pico-hydro power units are in operation	The project electrified rural households and provided them with a source of lighting and basic entertainment. It is a most interesting example of people's own ingenuity to use locally available resources to increase their access to energy.
5.	Vietnam Biogas Programme	The project was implemented in 12 provinces in the Phase I with the construction of 18,000 biogas plants. Phase-2 is focusing on 58 provinces with 140000 biogas plants.	The project has been able to reduce pollution from the animal husbandry sector, improve sanitation as well as enhance rural electrification.

Selected programmes for study

S.no.	Policy/National level Programmes	Achievements in providing energy access or promoting clean energy	Impact of the project
1.	Nepal Biogas Support Programme	Installation of over 200,000 domestic biogas plants in 75 districts of Nepal between 1992 and 2009	The programme would become integrated into a larger government programme - Rural Renewable Energy Programme (RREP), which is expected to start from July 2012 for 5 years.
2.	Renewable Energy Development	400,000 solar home systems	The project benefitted 2

S.no.	Policy/National level Programmes	Achievements in providing energy access or promoting clean energy	Impact of the project
	Project, China	were sold in north western China, adding 11.1 MWp	million individuals with better energy access in remote China and avoided GHG emissions
3.	National Mission on Enhanced Energy Efficiency, India	The mission targets saving 10,000 MW by 2012 using market mechanisms	The mission will reduce the energy demand and intensity of the country and effectively reduce the resulting GHG emissions
4.	Renewable energy and rural electricity access project, Mongolia	REAP has done a remarkable job of distributing about 50,000 SHS and WTS to rural users in Mongolia	It would displace 184,000 tons of carbon dioxide emissions over the next 15 years from the SHS and WTS already installed
5.	Rajiv Gandhi Grameen Vidyutikaran Yojana (Rural Electrification Programme), India	The programme targets to provide electricity connections to 23.4 million households in rural India	The programme will add to important infrastructure in providing energy access to the poor

The researchers consulted project managers from SELCO (India), Grameen Shakti (PO for IDCOL's SHS Bangladesh programme), GERES (Cambodia), SNV (Vietnam, Bangladesh and Nepal), technical experts from BEE and independent researchers for Pico-hydro systems in Laos, REDP (China), REAP (Mongolia). TERI used its own research to assess RGGVY as did IGES for the Japanese case. A Regional Consultation was held on 31 January 2012 to share the draft report and validate some of the findings and arguments.

Key messages for the IFSD discourse: Cases and Policies

The detailed case studies undertaken comprising various projects, programmes and policies offered a diverse overview in terms of scope, nature and reach. However, some important themes string together key messages that emerged from different case studies. The most important of these are diversity and dynamism. The projects and programmes involve and engage with a diverse set of institutions and stakeholders. They are dynamic and flexible in design and therefore incorporate the lessons from experience and evaluation based on feedback and monitoring from time to time.

Based on the institutional analysis framework by Healey et al. (2009), three sets of resources have been identified for the institutions involved in the energy interventions:

- *Knowledge resources* comprise the entire range and frames of reference that shape interventions, integration, and capacity to absorb ideas that lead to innovation

- *Relational resources* comprise stakeholders involved and their interaction with each other, the extent of their integration, power interest groups and embedded relations within the network of stakeholders

- *Mobilization resources* that include enablers such as critical change agents, financial resourcing, incentives and opportunity structure.

Our cases showcase that the informal arrangements are producing solutions of collaborative dialogues, informal policy networks, CBOs - NGO partnerships and energy networks. The close grass root orientation is enabling greater sociological input that is being sought in rethinking institutional and technical design for energy delivery. This suggests that to address energy access and clean energy needs, we need a distributed strategy not just across technological developments, but also across governance levels and frameworks for clean energy development that will link what is happening in the market and at the grassroots back to the lab and to those who make policies based on such feedback loops. It is important to not try to develop "one-size-fits-all" policies. As our cases showed, market conditions have to be considered by the project developer to be successful. Local market conditions are highly variable, even within specific countries, so policies need to be flexible. For example, in some countries, domestic manufacturing capacity for renewable energy equipment needs to be strengthened.

Traditional 'hard' paths to energy provision have high costs and need economies of scale for their success, but the new 'soft' paths emphasize customization according to need, and yield long term benefits albeit at a higher upfront cost borne by the customer. In a way reduced scope is what promotes more innovation in implementation of clean energy. Most of the programmes studied show some degree of decentralisation. In some cases, the bottom up approach is stronger, while the top down orientation has been stronger in others. Hence, there is a mix of top down and bottom up approaches with a need for each feeding into the other.

The effectiveness of the cases that we have studied highlighted actions across two fronts: many actors and multiple mechanisms. While the cases seemed to be a —bottom up participatory approach at first glance, the detailed studies suggest that these were in fact —multi level, multi actor approaches. The cases suggest that a bottom up approach may not be enough by itself, but it may need to be accompanied by national or global support measures & coordination.

In the analysis of energy access projects, the observations imply that multilateral institutions and bilateral institutions have played a key role in financing of initiatives in conjunction with the national governments. What is also seen is the emergence of new financing institutions such as microfinance that have involved women self-help groups and farmers. It is also seen that non-governmental organizations that are often the implementers of the project assume a multi-dimensional role of coordination, awareness and technology development to suit the local needs.

Specific lessons

More specifically, our cases suggest that the following mechanisms have been important in achieving improved energy outcomes

Innovative financing mechanisms: One of the recurrent observations from the project cases was the presence of an innovative finance mechanism. The financing mechanisms itself varied from project to project and were tailored in view of the needs and prevailing situation in each case. A lot of emphasis was given on self-sustainability, with a move away from a grant based approach. Even where grants have been crucial and instrumental, the objective has been to ensure that the local population has the capacity to take the project further. The informal and self-financing model of Vietnam biogas programme led to greater involvement of various credit lending groups. The focus on having a major component of expenses to be covered by users has ensured a longer term sustainability and greater ownership. The importance of different stakeholders was realised in the Bangladesh SHS case where the financial support was provided not only to users but partner organisations as well. Having tailor made solutions further enhanced uptake of the model. For instance, in the case of SELCO, access and affordability were taken note of and an appropriate payment schedule matching the income streams of the target groups were developed in close association with the rural banks. In the case of palm sugar cook stoves in Cambodia, a barter system was adopted to reduce the burden on beneficiaries and enhance uptake. New financing models such as carbon financing are being explored to ensure self-sufficiency and financial sustainability.

Needs based customized approach to energy service delivery: A needs based approach has been useful in financing as well as technology adoption and energy access. Traditional models of energy delivery require standardization of products; however delivery of energy services requires customization of services based on individual needs. SELCO case demonstrates that customization is key when it comes to serving rural markets and provides lessons for replication in other parts (in similar conditions). In the Cambodian palm sugar cook stoves, greater emphasis has been placed on modifying the technology to suit local needs and utilising locally available materials and local people. In the case of Pico hydro, ethnic communities with enterprising and entrepreneurial abilities have successfully driven the market for small scale locally adaptable and useful technologies, facilitated through the presence of robust distribution networks.

Capacity building for technology absorption: Capacity building is important for introducing or developing a technology as well as absorption of the technology introduced. For instance, in Bangladesh, since the solar energy technology brought to the communities was fairly new, the partner organisations invested time and resources in training people for installation and maintenance of SHS. This has also resulted in availability of local manufacturers of batteries, charge controllers, inverters etc. Even in the Vietnam biogas

project, self-employed masons and technicians are trained to install and maintain the biogas plants. In the Nepal biogas programme, emphasis was also laid on enhancing after sales service capacity to ensure successful absorption. Even in Palm Sugar cook stoves of Cambodia, investments have been made in capacity building of the entire value chain.

Mechanisms for cooperation and coordination: In all of the cases studied, an important feature contributing to success has been the coordination and cooperation amongst different agencies or stakeholders. In all the cases studied, existence of different stakeholders with clear roles and mechanisms for interaction and coordination across the value chain was a key observation. The role of different players varies from project to project and stage to stage within the project cycle. In some places, introduction of new actors or networks such as cooperatives and associations further intensifies cooperation and initiates coherence with the larger community in the area.

User buy in: More than making a technology or measure available, it is important to ensure that it enjoys acceptability and a buy-in from the target group. In the Asian case studies, either the user buy in element has been built in from the start or introduced later. To this effect, substantial investments are made to understand the user requirements and customize the products, as in the case of SELCO. Customer feedback and review process has been integral to programmes such as REDP China, Nepal BSP and Vattanak cook stoves through means such as end user satisfaction surveys and customer feedback processes. Periodic consultations and evaluations has ensured in better design and evolution of the Nepal biogas programme, which has a greater ownership and buy-in from the users. In Vietnam, potential users are involved from the demonstration stage itself.

Market development strategies and market driven programmes: An important observation from completed projects and programmes reviewed for this study was that success of a project in large part depends on the ability of the project participants to take forward the initiative even without backing from government institutions especially in the form of funding. Projects that are able to create a market value chain around their products (like the ones described in PV solar systems under SHS program in Bangladesh and REDP in China) are far more independent than purely government supported programmes. Creation of this value chain requires more participation from businesses, final consumers, financing entities (government or independent banks) and market regulators that can provide benchmarking standards to main product quality and ensure technology delivery. Initial funding in the form of innovative financing (like microfinance in Bangladesh and GEF-World Bank funding in China) when supported by market development strategies could prove immensely helpful to energy access projects.

Risk management: The management of wastes from solar PVs is important for emerging and developing Asia that are embarking on massive solar energy programs. As a growing policy focus in Japan, there is need for an appropriate international risk regulatory

framework to be set up as early as possible so that manufacturers can design solar modules, which are safer and easier to reuse and recycle, and markets to be developed for the same. The mix of top down regulatory measures and bottom up voluntary response in non-Asian countries are also worth studying in this context.

On the policy front, our key observations are as follows:

- Energy policies are basically national, and most countries are already prioritizing energy, especially energy security. In countries such as China and India, there is a key emphasis on RE or Energy efficiency as these are seen as supplements not substitutes to fossil fuels, since there is still a large unserved demand.

- Success of RE/EE tends to depend first on national regulatory frameworks, which are politically related to energy market structures. RE/EE policy also is connected to economic competitiveness, trade issues (including technology transfer and intellectual property), and industrial policy, so win-win strategies may be tricky. But countries like China with strong first mover (early mover) strategies are developing competitive advantages.

- Renewable energy and energy efficiency are the two key axes around which —co-benefits strategies are being developed – they add to energy supply but also are less carbon intensive.

- The potential for intra-regional technology cooperation and learning is significant and is critical for addressing energy security in the region.

- Financial sector policies or banking practices would need to be more sensitive to energy access and RE&EE initiatives. Perhaps need for some risk funds to help support such decentralized, customized initiatives. MFIs can provide matching funds such as co-financing, loans or direct equity co-investment to be directly involved in the project.

- International mechanisms, such as the CDM, have been successful in the region. However, these mechanisms need to be strengthened and streamlined and simplified for a more effective impact. CDM rules & procedures are too complicated for local entrepreneurs and CDM consultants are not available in all countries.

Participation, energy institutions, and Rio+20

The success of these energy interventions highlighted actions across two fronts; multiple actors and mechanisms. The case studies discussed in the report are summarized using an abacus framework.

	SELCO India	SHS Bangladesh	Vattanak Cookstoves Cambodia	Pico Hydro Laos PDR	Biogas Vietnam	Biogas Nepal	REDP China	RGVY	REAP Mongolia
UN and multilateral organizations	F P	F					F P		F
Bilateral	F	F C	F	F	F T P	F T P			
Member States		F T P	P		T P	F C T P	F C P	F C P	F C P
Women groups	F C				F	F			
Youth groups									
Indigenous people									
NGOs	C T	C	C T	C	C	F			
Farmer groups	F		C		F	F			
Trade unions					F	F			
Business & industry	F C T		F	F T		T	C T	T	C T
Scientific and technological community									
Local authorities (including subnational)	F	C			F	C	C	C	

F= Finance C = Capacity Building T = Technology P = Policy

Key roles and multi-actor involvement according to CSD major group typology

At a macro-level, it is seen that SELCO was primarily a private entrepreneurship driven initiative, SHS Bangladesh was developed with the involvement of the Government and the World Bank. The Cambodia Vattanak cook stoves initiative was a Major Group (NGO) led – GERES. Laos PDR pico-hydro developed informally with the involvement of local traders and beneficiaries. Vietnam biogas programme developed with the help of bilateral and an NGO. Nepal biogas programme was made possible with the help of bilateral funding and government management. REDP China came into operation with the help of World Bank and the Chinese government.

It is observed that UN and international bodies (including international finance institutions and bilateral arrangements) have played a central role in supporting projects financially. There has been an increasing role in bilateral partnerships (North-South). Other emerging sources of financing – albeit small – include micro-finance institutions (MFIs). MFIs have been able to mobilize women, farmers as well as trade unions. Insofar, the discussions around IFSD may not really have grass-roots representatives from developing countries to voice their concerns. A question that may be asked is whether voices from these major groups representatives have been an adequately part of the Rio+20 deliberations?

It is also seen that non-governmental organizations have had a multi-dimensional role in terms of awareness, capacity building as well as in developing science and technology. This is especially observed in the case of Cambodia cook stoves and the Vietnam Biogas project. In case of SELCO, a business entity like SELCO assumed a multi-faceted role. Business groups were important actors in providing technology and finance. This is especially in the case of biogas projects in Nepal and Vietnam. The role of the science and technology community was absent, but local authorities did play a role in some of the projects.

Addressing Barriers and Challenges

The key challenges that could be linked to the IFSD in the context of this report also include addressing barriers and challenges around capital access and mobilization, utilizing local financing mechanisms, developing innovative financing mechanisms and accessing carbon finance to support early stage innovation. The energy innovation case studies analysed in the study finds that larger government projects (with the exception of SHS Bangladesh) in Asia were able to benefit from carbon finance by organizing themselves to take advantage of CDM. In the context of IFSD, this points to the need of strengthening horizontal linkages within the UN system (UNFCCC and GEF) and vertical linkages (capacity building of national and local governments for programmatic CDM mechanism).

Our research also reinforces our earlier suggestions for the IFSD and also serves as important messages for existing international financial and implementing institutions.

Firstly, implementation of energy interventions could be made more effective through better **coordination mechanisms**. These could take the form of **"International Clearing houses"** for ideas, science, experience, technologies, and local knowledge that can be used to address global national and local energy access concerns; **"Centers for transfer of green technology"** and improved energy practices; **"Light Houses and early warning systems"** to warn and steer development that is off-course through the use of tools that measure energy related environmental degradation and energy access indicators; **"Incubators of energy innovations"; "Financial match making"** between project developers and commercial banks, corporate investors, clean energy equity funds and carbon funds; **"Learning networks or Institutionalized Communities of Practice"** to share experiences and knowledge.

Secondly, a **multi-actor process and frameworks of cooperation** between state actors, non-state sectors, business and the donor community; issue specific task forces are required to ensure coordination between agencies at different levels: global, regional, national, local. In the light of natural or man-made disasters (such as terrorism), the concept of 'smart community', that has been proposed as a model for the Japanese future energy system is worth considering. This takes energy from a diverse set of renewable sources locally and is decentralized, autonomous, and thus resilient to disasters.

Thirdly, there is need to support networks of institutions who would work to strengthen the linkages between energy and development through a **focus on learning and capacity building**, sharing experiences and knowledge bases among various relevant stakeholder groups. It is also important to keep in mind wide differences among developing countries, some of which have already developed considerably more capacity than others. This also includes supporting innovative and responsive approaches through use of IT and social networks better not only to diffuse technologies, but also to create a demand for technology from the grassroots and local governments.

Fourthly, **Innovative Financing** to support local level capacity building to access finance for risky, less proved investments in more sustainable energy systems, respond to the greening of markets, especially by SMEs; acquire information and increase the effectiveness of government, especially local, in addressing ecologically sustainable development objectives.

Fifthly, UN and multi-lateral institutions need to **significantly strengthen the call for clean energy transitions** through financing to provide more support for clean energy, strengthening capacity building for its adoption, coordination of existing energy related institutions and reemphasizing existing proposals to reduce and eliminate fossil fuel subsidies (and shift the revenue to RE/EE promotion).

Our cases flag the following questions for further consideration in the IFSD debate:

- How can interactions among all stakeholders be strengthened and enhance the legitimacy of voices of local authorities in global policy making?
- How can finance and developmental mechanisms such as the CDM be made simpler for smaller projects?
- How can energy linkages with sustainable development be strengthened with the help of agencies like CSD?
- How can we accelerate transfer of technology for clean energy?
- How can coordination among stakeholders at the project level be strengthened from an early stage?
- How should information and communication technology tools be deployed at the grass-roots level?
- How could enabling frameworks work for small scale innovations?
- What could be the linkages of such frameworks to existing regional mechanisms such as Clean Energy Ministerial, IRENA, APEC, APP, ASEAN, and Energy Ministers Meetings?

As a part of this study, a regional stakeholder consultation was conducted at New Delhi on January 31st, 2012 to share the analysis and findings from the project to concerned stakeholders. The key takeaways from the day-long event were as follows -

- The discussion at the workshop highlighted that there is a need to distinguish between rural and urban energy when costing electricity provision in grid connected and off grid areas. Rural residents are expected to pay for the entire cost of generation (especially from off grid sources) while grid connected urban residents enjoy subsidies.
- The participants highlighted that there are several unknown and invisible facts that play an important part in scaling up successful examples. This not only requires enabling frameworks but also innovative solutions and a better understanding of both.

- Multi-stakeholder involvement at various levels has been agreed as key in achieving sustainable energy access. There is a need for increased involvement of business, a stronger government-industry interaction and a more robust state-national interaction. A wider consultation is required, including with the industry, social entrepreneurs and the banking sector, for policy making in the field of renewable energy that utilizes the mix of financing options.
- Even though innovations take place in the industry sector, the real challenge however lies in linking it to the policy. Sub national level scanning and integration of policy, programmes and innovative solutions would be most appropriate, but these too have to be designed in ways that don't prioritize a set of technologies over others and promote technological innovation that suits the needs of the people.
- It is important that the central apparatus in national governments and international agencies not have a fixed approach towards technology. There is a need to be open to technological solutions and apply them fully understanding their implications.

Introduction

The international community is preparing for the UN Conference on Sustainable Development (UNCSD Rio+20) in June 2012 the key themes for deliberation in this summit are going to be 'green economy in the context of sustainable development and poverty eradication' and 'developing an institutional framework for sustainable development'.

The sustainable development governance discourse has become increasingly oriented towards engaging with institutions at multiple levels – global, regional, national and local- and the implementation of post-Rio initiatives have demonstrated that while governments themselves are agents of change and play a facilitative role in furthering green growth and sustainable development; non-state actors, and local communities in particular, are critical to the design and implementation of such initiatives. A key mandate of the Commission on Sustainable Development (CSD) is the facilitation of partnerships between major groups – both governmental and non-governmental so as to enhance system-wide coordination towards the implementation of Agenda 21 as well as the Johannesburg Plan of Implementation (JPOI) at the local, national, regional and international levels. The Second Session of the Preparatory Committee of the UNCSD recognizes the importance of integrating formal and informal processes at all levels that work towards implementing the three pillars of sustainable development: economic growth, social equity and environmental protection. Section C of the Zero Draft Outcome document also highlights the role of major groups and stakeholders at various levels including the role of civil society and the private sector in moving towards sustainable development. (UNCSD, 2012)

Energy within the sustainable development discourse

Energy is closely linked with key contemporary challenges globally – climate change, food security, poverty and livelihoods, local environmental degradation, and social conflicts. Issues surrounding energy may well be one the key challenges for generations to resolve. The Rio+20 process has recognized "energy" as one of the seven critical issues along with jobs, cities, food, water, oceans and disasters. UN agencies are focusing on initiatives for access to energy as well as clean energy that mitigate climate change and are environmentally sustainable. (UNCSD, 2012)

UN agencies, governments and major groups including the business and civil society have been working together to catalyse scaling up of renewable and low-carbon technologies, removal of market barriers to the effective delivery of energy services and adoption of new technologies and innovative financial and business models to support progress on the energy targets. As recognized in multi-lateral fora, the following considerations form the motivation for energy related interventions:

- More than 1.3 billion people worldwide have no access to electricity, and 1 billion more only have intermittent access.

- Some 2.7 billion people – almost half of humanity – rely on traditional biomass, such as wood or plant residues, for cooking and heating, with consequent health impacts.

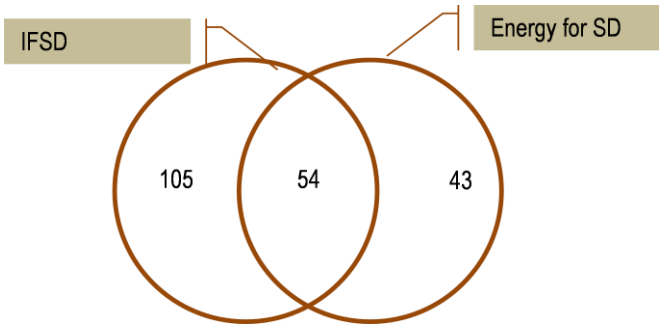
- Energy – supply, transformation, delivery and use – is the dominant contributor to climate change, accounting for around 60 per cent of total global greenhouse gas emissions.

- Reducing the carbon intensity of energy – that is, the amount of carbon emitted per unit of energy consumed – is a key objective in reaching long-term climate goals. (From the UN resolution at the Sixty Fifth General Assembly, Sustainable Energy for All Initiative) (United Nations, 2011).

According to the Global Energy Assessment (2011), providing universal access could save up to 2 million lives annually; the cost of providing modern energy access for all was not only achievable but affordable in the medium term with co-benefits in terms of air quality and related health issues, and climate change. (UNIDO, 2011)

The UN Secretary-General Ban Ki-moon, with support from UN-Energy and the United Nations Foundation, is leading a new global initiative – Sustainable Energy for All. This initiative will engage governments, the private sector, and civil society partners globally with the goal of achieving sustainable energy for all, and to reach three major objectives by 2030:

Around 58% of the partnerships, 202 out of 348, registered with CSD fall under the themes of Institutional Framework for Sustainable Development (IFSD) and/or Energy for Sustainable Development (see Figure 1). Most of these projects include large collaborative networks such as the REEEP and sector-specific capacity building projects.



Source: Based on data from CSD website; http://www.un.org/esa/sustdev/csd/csd14/matrix.htm; as on 19 December 2011.

Box 1 CSD registered partnerships with IFSD and Energy as themes.

- ensuring universal access to modern energy services
- doubling the rate of improvement in energy efficiency
- doubling the share of renewable energy in the global energy mix

Other proposed sustainability targets called upon include the adoption of a target to achieve universal access to modern energy services and for a 40 per cent reduction in energy intensity by 2030. In recognition of the importance of energy for sustainable economic development and supporting achievement of the Millennium Development Goals, the United Nations General Assembly resolution 65/151 has designated 2012 as the

"International Year of Sustainable Energy for All". Initiatives within the UN system are increasingly focusing on energy and aim at promoting action at the local, national, regional and international levels. The UNGA resolution also mentions of creating an "enabling environment" at all levels for the promotion of access to energy and energy services and the use of new and renewable energy technologies, including measures to improve access to such technologies.

In order to address energy issues such as household and community level electrification, incorporating specific market-based applications for health, agriculture, education, small business, communities and household solutions, a global network is established -- "Energy Access Practitioner Network". The network will bring together practitioners from the private sector and civil society and work towards delivery of energy services and solutions related to electrification in a range of developing country contexts to develop a more integrated approach to energy.

The literature suggests that to effectively address energy concerns of developing countries, both access and transformations to clean energy, it becomes essential that the international community facilitates financial flows, builds capacity at the local level, develops partnerships and participation, provides technological assistance, and an enabling environment for replication and up-scaling of successful business models. The current list of CSD-registered partnerships, however, reveals that the scope of partnerships is mostly at the global, sub-regional and regional level – there exists a gap at the local level. Effective mechanisms for addressing energy concerns need to move beyond statist decision-making to include dispersed centres of authority and community initiatives. The Commission for Sustainable Development instituted at the Rio Summit, defines a sustainable development strategy as a "participatory and iterative" process. It also signifies a strategy's significance in helping "institutionalize processes for consultation, negotiation, mediation and consensus building on priority societal issues where interests differ" (Strandenaes, 2011). In the same vein, consultations across multilateral, regional, national and local levels need to be institutionalized, bringing together actors who may differ in their nature and organization.

"Energy for Sustainable Development" was one of the themes of the Commission for Sustainable Development (CSD) Implementation Cycle 2 – CSD-14/15 (2006-2007) – with the other three related themes being Industrial Development, Air Pollution/Atmosphere, and Climate Change. According to the CSD, it is important to find ways to reconcile the necessity and demand for energy with its impact on the natural resource base in order to ensure that sustainable development goals are realized.

Energy and the Institutional Framework for Sustainable Development – the Rio+20 agenda

In general, the architecture of the Institutional Framework for Sustainable Development (IFSD) as it stands within the UN-system is multi-agency. With increasing partnerships and

the growth of knowledge networks including the UN-Energy, REEEP, IRENA, partnerships under the SEAI, and partnerships under the CSD – the architecture is also multi-actor at least in terms of participation. With respect to the institutional framework within the UN system, while the decision-making authority lies with the ECOSOC and the General Assembly, agencies such as the UNFCCC, UNIDO and UNEP are linked to implementation of programmes linked to modern energy services, renewable energy projects, industrial energy efficiency projects, and reducing GHG emissions through capacity building projects for climate change in general and Kyoto Protocol mechanisms in particular.

With the rationale that no single entity in the UN system has primary responsibility for energy, UN Energy – initially appended with the CSD – aims to promote system-wide collaboration in the area of energy both in regard to policy development in the energy area and its implementation as well as in maintaining an overview of major on-going initiatives within the system based on the UN Energy work program at global, regional sub-regional and national levels. UN Energy functions as an inter-agency mechanism to ensure coherence in the UN system's multi-disciplinary response to the World Summit on Sustainable Development (WSSD) and to ensure the effective engagement of major groups in implementing WSSD energy-related decisions.

The energy sector also faces challenges of energy security, energy access and affordability that require addressing the implementation deficit in governance using collaborative dialogue and informal policy networks. Clean energy is a key sectoral example of where the three pillars of sustainable development interface as it is able to

(i) Meet energy needs for growth where fossil fuel is increasingly in short supply,

(ii) Address energy poverty and access issues, and

(iii) Mitigate environmental and climate concerns.

The institutional discussion at Rio+20 has been rather top down, focused on UN institutions. So some combination of top down and bottom up approach may be desirable. Energy governance innovations can have both decentralized as well as top down approaches, not only at the global level but also at the regional, national, and local levels. The sector can provide important insights for the development of a multi-actor, multi-stakeholder institutional framework for sustainable development, with financing, technology, capacity building and risk management as important elements of such a framework.

As comments on the Rio+20 conference topics, several countries have submitted statements highlighting their positions on Green Economy and IFSD. These statements have also addressed issues other than the two conference topics and numerous countries – both developed and developing – have highlighted energy issues as priorities. Countries from Asia like Japan, Philippines, Singapore, Sri Lanka have stated their need to promote

renewable energy and energy efficiency; India and Pakistan have emphasized the universal access to modern energy services as a priority; Indonesia and Thailand expect Rio+20 to address energy security as an emerging challenge with Indonesia suggesting sustainable energy goals to be included in SDGs and Pakistan stating that it would welcome energy related targets at Rio+20; South Korea has given its support to the Sustainable Energy for All initiative and Japan has also supported UN-Energy's 2030 targets.

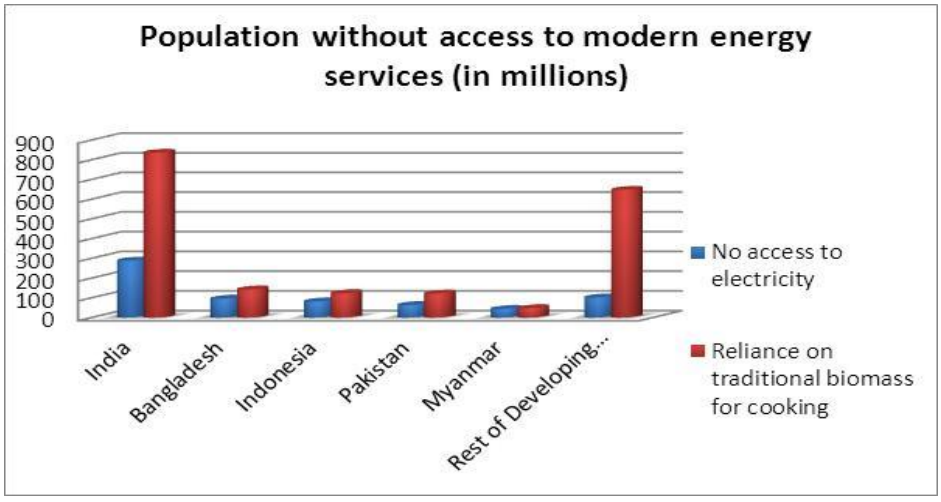


Figure 1 Population without access to modern energy service, Source: WEO 2011- Energy for All-Financing access for the poor

These statements are a precursor to the discussions that are going to take place at the Rio+20 forum and a study of these statements establishes that energy and related issues are being seen as an important factor in countries' policy formulation towards sustainable development, poverty eradication, achievement of millennium development goals and transform to a green economy.

Clean Energy Access in Asia

Around 1.3 billion people across the world lack access to electricity with 84% of them residing in rural areas; a significant majority of this unserved community is located in Asian countries (IEA, 2011). Though various Asian countries are experiencing an economic boom, the profound concern with creating access to energy and energy resources will pose risks to the development opportunities of the continent in the near future. 675 million people lack access to electricity and there are around 1.9 billion people in developing Asia dependent on traditional biomass for cooking out of which more than half reside in South Asia.840 million reside in India with around 100 million each in Pakistan, Bangladesh and Indonesia (See Fig 1) – a major concern for a region that is attempting to fulfil the MDGs by 2015 (IEA, 2011).

With energy access as a major concern for developing nations and increasing challenges in securing and supply of fossil fuels along with the rapidly progressing climate change debate, the focus on clean energy solutions has accelerated. With oil prices surpassing the $100 dollar a barrel mark and the rising challenges around coal access as well as concerns of GHG, clean energy solutions are being encouraged globally. As a fossil fuel driven region, a major issue for Asia is diversification of its energy sources, focusing on energy efficiency as

well as promoting cleaner mechanisms for the continuing use of fossil fuels. Integration of energy access and clean energy has been encouraged within Asia due to the large unserved population, lack of infrastructure development required for grid based solutions, increasing competitiveness in securing fossil fuels and rapidly rising energy demand that necessitates supplementing fossil fuels with other forms of energy.

This study looks at developing Asia focusing on select countries from South Asia, South East Asia and East Asia. Japan has been included as a special country case as a major developed economy facing unique energy access issues in the post-Fukushima phase. The case is particularly relevant to understand sudden or major transformations in energy choices and perceptions of nations. As Asia is home to diverse economies with different economic structures, development priorities and corresponding energy needs- clean energy forms are adopted and implemented depending upon geographical locations, socio-economic structure as well as energy access requirements. Most nations are adopting and implementing both energy efficiency and renewable energy mechanism for rapid escalation of energy access. For instance, the focus of countries such as Japan and South Korea is on securing access to energy resources and enhancing energy efficiency, while countries such as China and India among other developing economies are working towards providing energy for all. Asia is also witnessing a significant development in the area of energy trade with many countries exporting or importing electricity from neighbouring nations – ensuring a robust utilisation of the region's resources as well as energy security of energy deficit nations. Regional cooperation through the Mekong Basin, ASEAN, and APEC along with bilateral energy trade highlights the role of institutional cooperation in the energy sector.

Asia will witness one of the highest growth rates in GDP as 3.5% of average annual growth rate is projected till 2030 for Asia and the Pacific that eventually would raise the energy demand at 2.4% per year between 2005 and 2030 (Asian Development Bank, 2009). The energy consumption in Asia is increasing rapidly with many developing nations such as

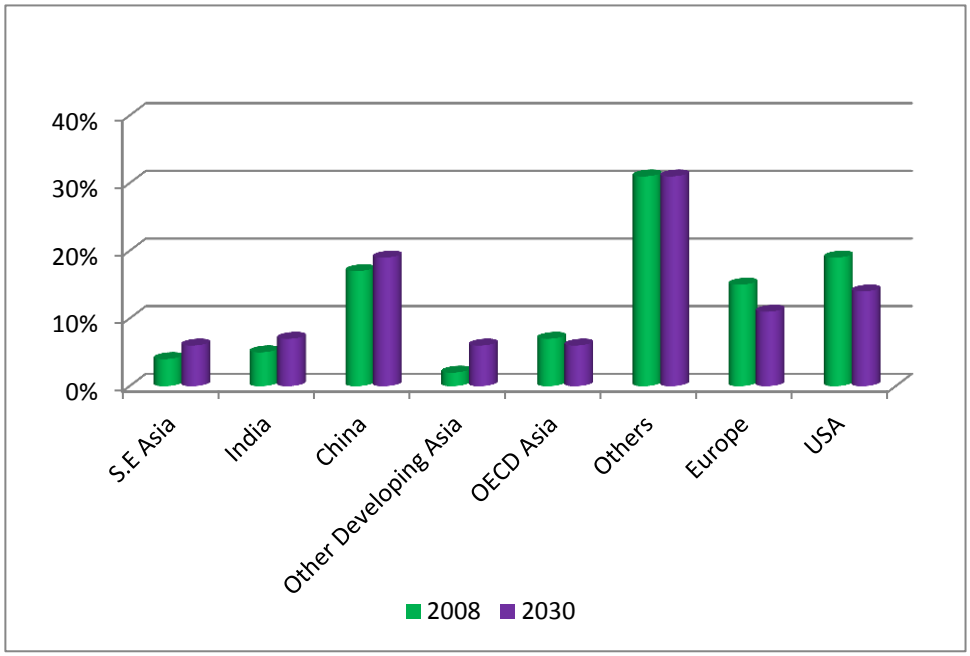


Figure 2 Energy demand regional breakdown for 2008 & 2030. Source- Energy Trends in Developing Asia: Priorities for a low carbon future.

China, India, Indonesia, and Vietnam showing steep surge in their consumption besides underscoring the significance of fossil fuels in their energy profiles.

According to the WEO 2008, global primary energy demand is projected to grow at 1.6% to 17,014 mtoe (2006-2030). The demand in China and India is projected to grow much faster (at 3%, 3.5% respectively); the Asian region (including India and China) is projected to account for 38.5% of the global demand for primary energy in 2030. The regional demand for energy highlights the increase of energy demand in developing Asia as well as South-East Asia, India and China, however the developed Asian countries (OECD Asia) is projected to reduce its demand by 2030.

As energy demand increases, the focus would be on access, availability and affordability of the fossil fuels with equal emphasis on diversification to other energy sources such as renewable energy to ensure energy security. However, only a few countries in the region have integrated energy policies/ energy security policies and different drivers exist for different countries in the region to promote RE & EE. (Asian Development Bank, 2009) With increasing debate on climate change and the volatility of the fossil fuel market has increased the movement towards renewables as well as energy efficiency mechanism. From improved cook stoves, biogas to Solar PV and geothermal energy- all aspects are being pursued extensively in Asian countries. For instance, in Cambodia, the focus is on enhancing energy access through distributed generation e.g. through Renewable Electricity Action Plan (2002 - 12); in India, the focus has been on ways to address increasing energy shortages e.g. energy efficiency program in India; in Japan and Korea, the focus is on an energy efficient or green economy to decrease dependence on imported fuels; In Nepal, the biomass program seeks to utilize available resources efficiently.

Energy efficiency and renewable energy are the co-benefits that bridge climate change and energy security. Additionally, both RE & EE provide the required impetus for scaling up modern energy services for unserved Asia. Adoption of energy efficient practices would minimise and lead to energy saving, necessary for growing Asia and the development of renewable energy is critical for the region that has significant number of poor population with lack of access to grid power connectivity.

Since 1990 renewable energy has been growing annually at an average of 2.7% per year. To reduce the current CO2 emissions by halve by 2050, the growth in renewable energy needs to increase at double digit rates with wind power witnessing an average annual growth rate of 17% and solar power 22% (IEA, 2011).

According to REN 21 2011 report, in 2009 renewable energy supplied 16% of the global final energy consumption (Including traditional biomass, hydropower, wind, solar, geothermal, modern biomass and biofuels). From Asia, China and India appeared in the top five countries for installed renewable power capacity. Both China and India added 50 GW and 16 GW respectively in 2010 with wind power, biomass power and solar PV with major shares

in renewable power capacities. Region wise, Asia leads in the total installed global power capacity of Hydropower - with Vietnam beginning the partial operation of South-East Asia's largest hydropower station at 2.4 GW – and biomass power is particularly growing in China, India, Japan, Thailand and Malaysia where various forms the power (sugarcane bagasse, solid biomass, organic waste, grid connected biogas power plants among others) are being adopted.

Electricity generation from renewables is projected to grow at an average rate of 5 per cent on annual basis, with the region's share in renewables is said to increase from 15% in 2007 to 20% in 2035. The installed wind capacity in the region has been growing with China and India having 26 Mw and 11 Mw installed in 2009 with Philippines leading with 33 Mw in 2008 itself. Solar PV is still to develop in the region; in 2005 the total installed capacity was 70 MW with most of it powering rural areas in China. Most of the region is lagging in Solar PV and considerable impetus is required to increase its share. In the biofuels sector Thailand, China and India are leading and figure in the top 15 countries producing biofuel in the world.

Regional cooperation on clean energy has been increasing as well especially amongst South Asia, East Asia and South-East Asian countries. Countries have initiated bilateral as well multi-country programmes and projects in renewable energy, for instance Japan and Malaysia have initiated an $308 million bio-fuel joint venture while Malaysia and Thailand have joined hands for grid connected biomass based renewable energy programmes. Increasing investments in the clean energy sector are visible with countries as well as multilateral institutions providing financial impetus to the region. From 1990-2005, World Bank has invested $5.9 billion in the region for various sectors including clean energy. (Thavasi V, 2009).

Energy efficiency measures are key areas of concern for most developing Asian countries. With increasing share of fossil fuels and rising energy demand, energy efficiency has become integral part of energy policies of most countries. Reductions in energy demand and energy intensity are being pursued by most Asian countries as well. For example, Vietnam's goal is to reduce energy consumption by 5 to 8 per cent by 2015, while on the other hand Indonesia is set to reduce energy intensity of 1 per cent annually till 2025 (USAID, 2011). Furthermore, pledges to reduce GHG emission will also contribute to the clean energy initiatives of most countries. For instance, between 1990- 2008, the CO2 emission per unit of GDP has decreased by 50 per cent in China, 15 per cent for India and 2 per cent for Philippines (USAID, 2011). Across Asia Clean development Mechanism projects are projected to contribute 37 per cent of the region's cumulative CO2 emission reductions of 2012 touted around 2.29 billion metric tons (USAID, 2011). Such figures highlight the growing adoption of renewable energy in the region and the co-benefits its offers Asia from both energy and climate perspective.

Clean energy is a pertinent solution for a growing Asia with high energy demand – a combination of energy efficiency mechanisms and renewable energy would be critical for fuel diversification as well as to supplement the fossil fuels. Renewable energy is significant for energy access as large parts of Asian countries are inaccessible or lack basic infrastructure necessitating the development of off-grid, clean and sustainable solutions. Developing Asia requires energy to face significant challenges of poverty and inequitable development both within countries and across the region. To address the critical issue of energy access, most developing countries have to devote considerable finances to meet the needs of the unserved- a challenge for a largely poor Asia . Concurrently, creation of physical access to electricity and improvements in the quality (frequency or length of outages etc.) of electricity provision among other issues would also be vital to enhance energy access in the region with many countries facing resource scarcity and lack of energy infrastructure among other issues.

The challenge of energy access has paved way for many opportunities especially in the clean energy sector. The large population of energy unserved in developing Asia is also transforming into adopters of various energy interventions at the grassroots level based on clean energy technologies at low costs. Biomass gasifiers, solar, wind and small hydro are some of the energy technologies that have led to significant changes in many countries. There is also increasing focus on the effective utilisation of bridge fuels such as natural gas. In addition, the shift to efficient cook stoves within rural households accustomed to utilising traditional biomass is also increasing in the region leading to energy efficiency. Urban areas in many developing Asian countries are also undertaking energy efficiency measures in commercial to household applications both on mandatory and voluntary basis. However, RE & EE are not first choices but substitutes to fossil fuels. Countries of the region are at different stages of energy market development and hence for energy policy frameworks. Few countries thus have regulatory frameworks in place for promoting RE and EE and there is a lack of private sector participation as the energy sector is still dominated by government/ public sector entities. There are some emerging decentralized initiatives which are of interest and are the subject of this study.

In an attempt to contribute to the international dialogue on an institutional framework for sustainable development, this study seeks to identify and gather learning from the Asian countries' experience of improving energy access and availability by expanding the use of clean energy through the involvement of multiple stakeholders and institutions.

Aims and objectives of the project

The project focuses on what Asia has to offer by way of practice in addressing energy access through the expansion of clean energy to the international dialogue on an institutional framework for sustainable development. What new mechanisms are observed for the introduction of, improved coordination and coherence in the design of policy, delivery and absorption of clean energy services to the unserved population in countries of Asia that can contribute to the larger discourse on institutional framework for sustainable development?

The project addresses the above questions through the following specific objectives -

1. Map effective experiments and practice – social, technological, institutional and policy – around the addressing of energy access needs in Asia through clean energy solutions and understand what works and does not work.

2. Draw lessons from such experiments and innovations and policies and institutions in place that support or constrain them, and

3. Provide inputs for the Rio+20 deliberations on an international framework for sustainable development (IFSD) that will support a more distributed energy governance through a focus on some key aspects: technology, finance, institutional diversity and engagement of major groups, mechanisms for co-ordination and risk management.

Methodology

In order to understand the aforementioned approaches towards diffusion and absorption of innovative energy practices, this project involves reviews of

(i) Select projects that demonstrate the bottom up approach of using and adopting innovations in the energy sector.

(ii) Select policies and programmes that have been influential in policy diffusion or have high potential for influencing future policy processes for promoting clean energy and providing energy access.

Selecting Projects and Policies

(i) Projects

The source and criteria for selecting the projects are briefly described below -

- A database was created for these documented projects sourced from regional and national level compendiums like the ADB's Clean Energy in Asia, Renewable Energy for Urban Applications in APEC, EASE Business Models for Energy Access (Enabling Access to Sustainable Energy), UNDP's Energy Services for Poverty Reduction, ADB's Powering the

Poor, Cases from TERI's studies on Decentralized Electricity Solutions and MacArthur Foundation's Project on Energy Governance in Asia.

- The projects were selected based on (a) their having been implemented at the national, regional and local level for at a decade or so and have successfully diffused the technological innovation. (b) The projects cater to a variety of purposes from residential/household energy demands, energy requirements for livelihood generation, commercial or business activities and provision of public services. This process resulted in a selection of 16 cases.

Table 1 Short Listed Projects

S. No	Projects	Country	Level	Links/Related Resources
1.	Cheaper, better lighting	Across region (Pakistan, Philippines)	National (Residential/Commercial)	http://www.adb.org/documents/Books/Clean-Energy-Case-Studies/clean-energy-case-studies.pdf
2.	Large scale industrial biogas program	PRC	(Commercial/Industrial)	http://www.iadb.org/intal/intalcdi/PE/2010/05217.pdf
3.	Improved palm sugar stove	Cambodia	State (Commercial)	http://www.ease-web.org/wp-content/uploads/2010/11/EASE-Business-models-for-energy-access-sm.pdf
4.	Pico Hydro innovations	Laos	Local (Residential/ Livelihood)	http://www.ease-web.org/wp-content/uploads/2010/11/EASE-Business-models-for-energy-access-sm.pdf
5.	Biogas market development	Vietnam	Local (Residential/Livelihood)	http://www.ease-web.org/wp-content/uploads/2010/11/EASE-Business-models-for-energy-access-sm.pdf
6.	Community based micro hydro project	Nepal	National (Residential)	http://content.undp.org/go/cms-service/stream/asset/?asset_id=2095738
7.	Bachat Lamp Yojana	India	National	http://emt-india.com/BEE-BLY/BhachatLampYojna.pdf
8.	Solar Home Systems	Bangladesh	National	
9.	Solar lighting in remote villages	Bhutan	Local (Residential/Livelihood)	http://www.adb.org/documents/books/powering-the-poor/Powering-the-Poor.pdf
10.	Micro Hydro project	Philippines	Local (Residential/Livelihood)	http://www.adb.org/documents/books/powering-the-poor/Powering-the-Poor.pdf
11.	RE and energy access	Mongolia	National (Residential)	http://www.spp.nus.edu.sg/docs/energy-case/%233-gers-just-want-to-have-fun.pdf

S. No	Projects	Country	Level	Links/Related Resources
12.	Minigrids in Sunderbans	India	State (Residential/Small scale)	
13.	Selco India Pvt. Ltd.	India	State (Residential/Small scale)	http://www.selco-india.com/
14.	Energy Clinics	Kerala, India	State (Residential)	http://www.keralaenergy.gov.in/emc_energy_efficiency_16.html
15.	Cinta Mekar Microhydro	Indonesia	Local (Residential)	http://en.iesr-indonesia.org/2011/01/case-study-cinta-mekar-micro-hydro-power-plant-giving-power-to-the-people/
16.	Sun Labob	Lao PDR	Local (Residential)	http://www.sunlabob.com/

Post this selection, a consultation was carried out with experts from the field of clean energy and a shortlist of 5 cases of projects operating at the local level has been finalized.

Table 2 Selected projects for study*

S.no.	Project	Achievement in terms of providing energy access or promoting clean energy	Impact of the achievement
1.	SELCO, India	SELCO has sold solar lighting to more than 110,000 rural homes and to 4,000 institutions such as orphanages, clinics, seminaries and schools in the Indian state of Karnataka.	An impact assessment study by World Resources Institute in 2007 reported that 86% of SELCO's poor customers cited significant savings in energy costs as their primary benefit of using SELCO products, while the rest pointed to their children's education as the primary benefit.
2.	SHS Bangladesh	645,033 SHSs were installed by August 2010.	The project has positively impacted access to reliable off-grid energy for poor households, generated employment in the form of POs and distributors of SHS equipment as well as local jobs for maintenance and installations of SHS and promoted income generation among SHS households as shops remain open for longer hours. Lighting has enhanced security of women improving their involvement in community activities and children can study for longer hours.
3.	Vattanak Cook Stoves, Cambodia	200 stoves already installed with a commitment to install 5000 by 2014	The project impact has led to the increase in government participation as a major stakeholder as well as focusing on forestry management to reduce illegal logging for fuel purposes.
4.	Pico Hydro Systems, Lao PDR	While official figures on the number of pico hydro systems owned by people in Laos is not available, an estimated 60,000 pico-hydro power units are in operation	The project electrified rural households and provided them with a source of lighting and basic entertainment. It is a most interesting example of people's own ingenuity to use locally available resources to increase their access to energy.

S.no.	Project	Achievement in terms of providing energy access or promoting clean energy	Impact of the achievement
5.	Vietnam Biogas Programme	The project was implemented in 12 provinces in the Phase I with the construction of 18,000 biogas plants. Phase-2 is focusing on 58 provinces with 140000 biogas plants.	The project has been able to reduce pollution from the animal husbandry sector, improve sanitation as well as enhance rural electrification.

*Detailed case studies are discussed in Annexure I.

In order to trace components which can contribute to more region-wide policy direction, the project uses the conceptual framework for diffusion of innovations described by (Wejnert, 2002). The case studies are discussed based on this framework.

- Characteristics of the Innovations (what makes it work?) –. This involves assessing public vs. private consequences and the benefits and costs of the innovations as determinants in its diffusion.

  - Public vs. private consequences - Innovations that benefit the well-being of adopters that are individuals or small entities such as organizations, peer groups and rural communities are called innovations with private consequences. These innovations typically improve the quality of individual lives or reform organizational and social structures. Examples include new medical practices, improving agricultural technologies. Innovations with public consequences are the ones that benefit society at large and involve collective actors such as countries, states within countries and organizations and social movements. Such innovations are mostly concerned with issues of societal well-being. For example, welfare and education policies, state laws, political models of democracy.
  - Benefits vs. costs of adoption - There are two types of costs – direct costs and indirect costs. Direct costs are usually clear, while indirect costs are not often clearly identifiable and add to the risk of adoption. The rate of adoption depends on the costs incurred by the adopters, and indirect costs significantly modulates rate of adoption.

- Characteristics of the Innovators (What is the integration observed?) – The characteristics of the actors (or adopters) and innovators may also influence the perception towards and innovation and its costs and benefits. Some of the variables related to actors and innovators have been included in the conceptual framework-

  - Societal entity of innovators involved - The entity of innovators affects factors such as the type of innovation selected for adoption, and the nature of interactions between the source of an innovation and an adopter. Thus, the nature of diffusion process differs depending on the societal entity since the adoption process is

different for different actors—large collective actors are concerned with large-scale historical changes, while individual actors are concerned with innovations with private consequences.

- Familiarity with the innovations - The rate of adoption of any innovation is inversely proportional to its novelty (all other factors being equal). If the people adopting the innovation are familiar with it, it certainly helps in the diffusion of innovation.
- Status characteristics - According to Wejnert, an actor's high social position significantly influences the likelihood of adoption. For example, large collective actors with high status such as governments, large corporations usually adopt an innovation first and then impose adoption of innovation on lower actors.
- Socioeconomic characteristics - The socioeconomic characteristics of an actor such as education level, economic well-being and cosmopolitanism impact the rate of diffusion of innovation. For example, the rate of diffusion of innovations such as democracy is correlated with a country's overall economic development.
- Position in social and institutional networks - The actor's position in social networks plays a key role in the diffusion of innovation. Network connectedness is directly proportional to network closeness and inversely proportional to network size. Thus, larger the network size, lesser the network connectedness.
- Personal Characteristics - Personal characteristics such as self-confidence and independence or 'psychological strength' also impact the rate of diffusion of innovations. However, personal characteristics do not develop in a sociocultural vacuum, but are fairly modulated by societal culture.

- Environmental Context (Are they replicable or scalable?) – The diffusion of innovations is dependent on the socio-economic and cultural context that they evolve in and their success may also depend on the suitability of the innovation in their environments.

- Geographical settings - Some of the innovations are adopted only when it is suitable to an actor's ecological conditions and geographical proximity. This is because proximity (distance) affects the frequency of communication and the personal nature of interactions between actors. The socioeconomic settings are also another factor.
- Societal culture - Different variables such as belief system, cultural traditionalism, cultural homogeneity and socialization of individual actors influence adoption of innovations.
- Political conditions and enabling environment- Political conditions such as political systems, along with regulations and norms in the legal systems, play a significant role in the adoption of innovations. Political situations can prevent or postpone adoption of some innovations.
- Global uniformity - According to Wejnert, variables such as standardization, global connectedness through communications systems, and global technology boost the rate of adoption of innovations

The diffusion of innovations is an interactive dynamic process between the actor and the environment and several variables influence it.

(ii) Policies

Concurrently with the study of decentralized energy access interventions used in effective energy practice, the second work component reviews selected formal policies and national programmes that represent approaches of policy diffusion in the energy sector. (Annexure 2) These policies are assessed for

- The planning processes – the motivation behind introducing a particular policy or programme, the objectives for the same, the stakeholders involved in the planning process, the existing policy regime in the country and how the programme or policy fits into the overall picture and finally the intended effects of the policy/programme under review.

- The implementation process – the process flow, the key factors that contribute to an inclusive and efficient implementation, the innovative aspects of the process and the different interactions between actors during this process.

- The overall sustainability of the planned interventions – the performance of the programme or policy if its implementation is completed, if not then the expected performance and review of current achievements. Also a review of issues that might pose challenges to the implementation of a new initiative or impede the achievement of objectives by actors and stakeholders involved and the management of risks within the larger framework of the programmes and policies (these could be financial, environmental, technological, institutional or other risks).

The programmes and policies studied under this component are –

Table 3 Selected programmes for study*

S.no.	Policy/National level Programmes	Achievements in providing energy access or promoting clean energy	Impact of the project
1.	Nepal Biogas Support Programme	Installation of over 200,000 domestic biogas plants in 75 districts of Nepal between 1992 and 2009	The programme would become integrated into a larger government programme - Rural Renewable Energy Programme (RREP), which is expected to start from July 2012 for 5 years.
2.	Renewable Energy Development Project, China	400,000 solar home systems were sold in north western China, adding 11.1 MWp	The project benefitted 2 million individuals with better energy access in remote China and avoided GHG emissions
3.	National Mission on Enhanced Energy Efficiency, India	The mission targets saving 10,000 MW by 2012 using	The mission will reduce the energy demand and

S.no.	Policy/National level Programmes	Achievements in providing energy access or promoting clean energy	Impact of the project
		market mechanisms	intensity of the country and effectively reduce the resulting GHG emissions
4.	Renewable energy and rural electricity access project, Mongolia	REAP has done a remarkable job of distributing about 50,000 SHS and WTS to rural users in Mongolia	It would displace 184,000 tons of carbon dioxide emissions over the next 15 years from the SHS and WTS already installed
5.	Rajiv Gandhi Grameen Vidyutikaran Yojana (Rural Electrification Programme), India	The programme targets to provide electricity connections to 23.4 million households in rural India	The programme will add to important infrastructure in providing energy access to the poor

*Detailed case studies are discussed in Annexure II.

(iii) Japanese experience

Two innovative approaches and emerging issues based on the Japanese experience with the case of solar PV were studied. Innovative approaches involve ways to reduce costs through a package approach and enhanced capacity building. Moreover, waste management is an important emerging issue for solar PV, which will generate waste such as glass, chemicals, electronics, and metals.

- The basic information was collected through a literature review, and in particular, materials discussed at the Research Committee on New Energy Industries under the Japan's Ministry of Economy, Trade and Industry.

- Implications for Rio+20 are developed based on an analysis of existing renewable energy institutions using a literature review as well as primary documents. This may be supplemented with interviews of companies or other stakeholders as necessary.

The study explores these projects, policies and programmes, analyses the institutional arrangements in these examples and derives learning from the analysis to contribute to the sustainable development discourse.

Understanding emerging energy practice and innovations in Asia

Energy is a good policy space to assess issues around sustainable development. The sector poses challenges of availability, access, affordability and sustainability. Clean energy, both moving to renewable energy and energy efficiency, has relevance to the three pillars of sustainable development: to the Economy- the move to renewable resources, replace exhaustible resources; to Society- these new forms of energy address energy poverty and access issues; to the Environment- renewable energy reduces pollutants and carbon emissions. Moreover, there is increased evidence of an increased integration of pillars in energy practice. Energy sector developments are important to the discourse because many of the interventions are addressing the "implementation deficit" in governance – providing energy access through different actors and sources. The transient and informal arrangements are producing solutions: Collaborative dialogues; informal policy networks, CBOs- NGO partnerships, energy networks. The close grass root orientation is enabling greater sociological input that is being sought in rethinking institutional design for energy delivery. Energy practices that are emerging are between "institutional layers of the states and between state institutions and social organizations". (Hajer & Wagenaar, 2003)

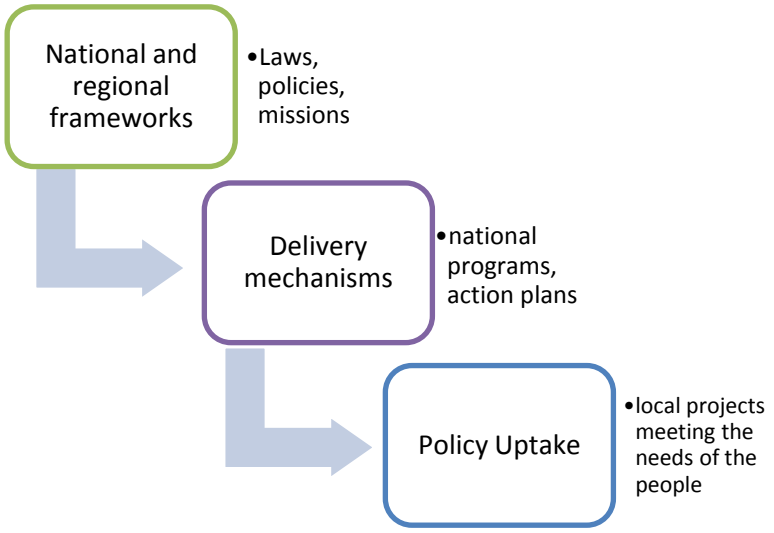


Figure 3 Policy diffusion process

In Asia, both approaches – of top down policy diffusion as well as bottom up policy absorption are evident. Figure 3 represents the more traditional way of policy diffusion in the energy sector (and numerous other sectors) which has been prevalent in the Asian context in many countries for a long period of time. The method emphasizes economies of scale, most clearly demonstrated by traditional 'hard paths' of fossil fuel based grid connectivity. This process has mostly taken a top down approach with little feedback in planning stage leading to copying of external (western) models. The national level energy policy making has been mostly a central government enterprise leading to less socially acceptable decisions, absence of effective delivery institutions and less transparency leading to policy inattention or deliberate non-action.

But today there are more and more examples of bottom up - decentralized efforts to provide energy access at the local level that are taking centre stage in financing and energy policy circles. (Figure 4) Many of these examples use the non-traditional 'soft path' to energy access contributing to the larger goal of sustainable development.

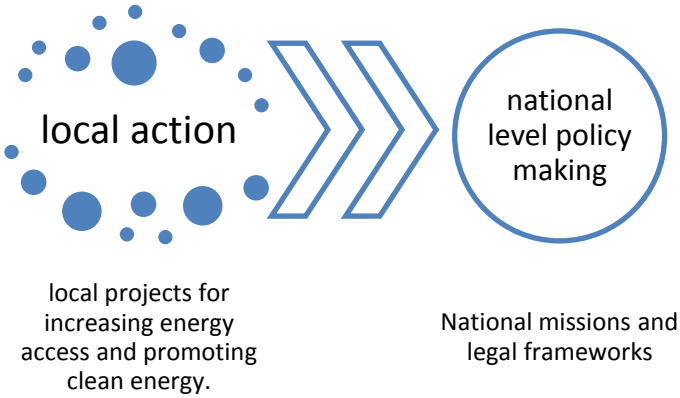


Figure 4 Policy absorption in a bottom up approach

While these local efforts are receiving recognition from multilateral funding agencies, even government subsidies in some cases, they need to directly affect the larger policy processes at a national or regional level. The absorption of local innovations to the national/regional scale processes may require more coordination among agencies, better network management and coherence in policy making processes. Different policy regimes and institutional set-ups exist in the countries where these case projects and programmes are operating.

National policy regimes

China

Historically, energy policy in the PRC has been highly reliant on thermal power generation – sourced with coal or oil – and prior to 2002, the State Power Corporation monopolized the power sector in the country. After the reforms of the electric power industry, the government has made efforts to diversify the sources of energy and include cleaner energy sources. (Su, Hui, & Tsen, 2010) The national level RE framework comprises laws, policies, plans, strategies. At a subnational level, the governments are responsible for providing more specific incentives, measures and guidelines. The energy regulation in China, like many other Asian countries and the RE sector in general, is marked by a multiplicity of agencies and stakeholders. However, the energy regulation has been centralised with new entities such as National Energy Administration (NEA, for energy in general) or the State Electricity Regulatory Commission (SERC, for electricity). Lack of clarity in roles and existence of multiple government agencies such as the Ministry of Energy, the Ministry of Environmental Protection, the Ministry of Science and Technology, or the Ministry of Finance are common in the Chinese RE institutional framework. Institutions like SERC are faced with challenges such as lack of clearly defined roles and limited authority in matters of investment. (Garcia, 2011) The National Development and Reform Commission (NDRC) is the key agency for drawing national policies and the National Energy Administration was

formed under the NDRC in 2008 to administer energy related activities. In 2009, The National Energy Conservation Centre was formed in the NDRC to implement energy efficiency measures.

The Renewable Energy Law of 2005 came into effect in early 2006 and now serves as the legal framework for renewable energy development in the country. Enacted with a goal to promote the development and utilization of renewable energy, improve the energy structure, diversify energy supplies, safeguard energy security, protect the environment, and realize sustainable development, the Act primarily deals with resource survey and development plans, industry guidance and technology support, and price management and incentives. Notable under the RE law are provisions for compulsory interconnection of renewable energy into the grid (similar to Renewable Portfolio Obligations) and the development of a renewable energy development fund. The Law also provides cost sharing agreements through feed-in tariffs. The draft amendments to the Renewable Energy law in 2009 were to address the issues related to coordination of National Renewable Energy Development Strategy, guaranteed grid connection of renewable energy generators and the sources and targets for the renewable energy fund in the country. (Su, Hui, & Tsen, 2010)

Cambodia

The Ministry of Industry, Mining and Energy is the key agency implementing energy related measures in Cambodia. The energy sector is primarily dominated by biomass with only 20% of the households connected to grid electricity. The electricity infrastructure in the country is still underdeveloped and fragmented with most power plants working on imported diesel. The key energy source within the country is its hydropower potential followed by reports of recently discovered resources of coal, oil and gas. Cambodia is currently dependent on imported energy especially in context to oil wherein the country does not have refining capacity. The focus is on increasing the hydropower based electricity generation to reduce the dependence on oil based electricity which dominated with a 95% share in 2005. The government is also focusing on reducing the use of or shifting towards efficient utilisation of biomass with significant emphasis being laid on diversifying fuels and efficient cook stoves (Asian Development Bank, 2009). Cambodia is also focusing on promotion of renewable energy technologies including solar heating, biogas for cooking, solar and wind power generations especially in rural areas that are lack electrification. The Ministry of Industry, Mining and Energy is the key agency for planning, introducing and implementing energy related measures. The Electricity Authority of Cambodia is the independent regulatory agency in charge of tariffs and charges for electricity supplied by both public and private players.

Bangladesh

The Ministry of Power, Energy, and Mineral Resources is the main government ministry responsible for various forms of energy and electricity in Bangladesh. Some of the activities are undertaken by the government, while some are carried out in coordination with business and civil society. Bangladesh, with a huge share of population in rural areas without access to electricity, has a separate institution for rural electrification, the Bangladeshi Rural Electrification Board (REB) . Hugely reliant on support from donor agencies, the cooperatives formed under the Board are not financially supporting. (REEP, 2011) While MPEMR is the most important institution for Bangladesh renewable energy, other ministries, agencies, and institutions, such as IDCOL, grameen shakti etc. are also involved in the process of introducing and promoting uptake of RE.

Vietnam

The RE sector in Vietnam is governed by the Law on Electricity 2004, Law on Energy Efficiency and Conservation 2010, and Law on Environmental Protection 2005. The national Ministry of Industry and Trade of Vietnam, and its agencies such as the Office of Energy Efficiency and Conservation and Electricity Regulatory Authority, have the overall responsibility for the energy sector, including renewables and fossils. Any investment and financing aspects of energy projects are the domains of the Ministries of Planning and Finance. Designated as the nodal agency under the Electricity Law of 2004, the Ministry of industry is responsible for administering electricity services, besides running energy efficiency and conservation programs and campaigns. At a sub-national level, the Provincial People's Committees administer electricity related activities.

Established in 2005, the Electricity Regulatory Authority of Vietnam regulates different aspects of energy, including the regulation of electricity tariffs. There seem to be some overlaps in the roles and functions of different agencies such as the Ministry of Industry and Trade and the Electricity Regulatory Authority. Studies show the need for technical assistance and capacity-building for RE energy on areas such as feasibility and preparation of clean energy projects, policy frameworks for encouraging renewable energy project development, action planning, labelling, market development, and pricing (United States Agency for International Development (USAID), 2007). Lack of capacity, both technical and financial has been largely responsible for not a very successful uptake of clean energy technologies. (REEEP, 2009)

India

With the second largest population in the world that has been growing at the rate of 1.7% per annum for 1990-2007, India is one the fastest developing countries in the world with still 44% of the total households lacking access to electricity and is ranked 134 in the HDI index

of 2011 The per capita energy consumption in 2006 was 510 kgoe in contrast to 5416 Kgoe of high income countries. Out of India's total energy use 23% accounts for net energy imports. Coal accounts for 53% of the total commercial energy supply in the country. India is the third largest consumer of coal behind China and USA. It also appears in the top five countries with high reserves, production and consumption of coal in the world (BP, 2011). Oil accounts for 33% commercial energy consumption followed by natural gas at 8%. Renewable energy's contribution to electricity in India has increased in the past few years. India has separate ministries for coal, petroleum and natural gas as well for new and renewable energy. The India government published its Integrated Energy Policy in 2006 and energy related mechanisms were also integral to its National Action Plan for Climate Change released in 2008 delineating the solar energy and energy efficiency missions. The recent Jawaharlal Nehru Solar Mission with target of 20000Mw by 2022 is a key policy for expanding solar energy in the country. India also has a coal cess as well as has implemented the Renewable Purchase Obligation that requires electricity distribution entities to purchase between 1-10% of energy from RE sources.

Japan

Japan is one of the most developed nations in the Asia region and the third largest economy in the world ranking 12th in the HDI index of 2011. Japan is endowed with limited natural resources and hence imports almost all of its energy requirements. In 2008, oil had the largest share in the total primary energy supply with 45% followed by coal accounting for 22% and natural gas with 16%. Net imports of energy sources accounted for 85% of the total primary energy supply in the same year, with more than 95% of the oil, coal and gas being imported. Electricity generation is dominated by thermal (includes oil, coal and gas) with 70% followed by nuclear with 20% and hydro with around 6% share (Asia Pacific Energy Research Center, 2010). The primary energy demand of Japan is stated to grow annually at the rate of 0.2% through to 2030 (Asian Development Bank, 2009). The rest of the electricity is generated through solar, geothermal and wind technologies. With the recent Fukushima accident, the share of electricity generation from nuclear has reduced due to rotational safety checks being conducted on all nuclear power plants resulting in lack of electricity output. As the Japanese energy policy emphasizes on energy supply security greater significance is provided to energy efficiency and conservation that has led it to be a leader in this field. The Ministry of Economy, Trade and Industry is the key agency formulating energy policies. The aim of Japan's energy policy is to achieve three goals- energy security, economic growth and environmental protection (3E). (Asia Pacific Energy Research Center, 2010)

Lao PDR

Laos is a landlocked country with a population of 6.3 million people with annual average growth rate in population of 2.1% between 1990 and 2009. It is a low income country with GDP per capita $2255 (2011) that ranks 138 in the HDI index (2011). The country has

abundant resources of coal and hydropower. It has been exporting coal as well as hydropower electricity to neighbouring Thailand, however as the country lacks any refining capacities, its imports oil from other nations. The primary energy demand of the country is projected to grow at an annual rate of 5.3% through 2030.Most of the electricity to be generated from coal as well as hydropower has been allocated for exports- hence country's abundant coal resources are being developed to enhance its role as an electricity exporter. Till 2005, only 45% of the population had access to electricity services, hence the government intends to pursue the development of both on grid as well as off grid solutions for enhancing access with a focus on hydropower - mini and micro, solar and wind energy. The energy policy of Vietnam focuses on development of coal and hydro for generation and exports besides aiming to increase electrification rate to 90% by 2020. The country is also in the process of initiating a energy efficiency and conservation programme. The key agency involved in energy policy is Ministry of Energy and Mines. (Asian Development Bank, 2009)

Mongolia

Mongolia's population in 2008 was estimated at 2.6 million people, making Mongolia one of the least densely populated countries in the world (World Bank, 2009). It is ranked 110th by the United Nations on comprehensive human development index (UNDP, 2011). Mongolia's energy sector is dominated by wood and coal. Solar, wind and hydropower is also used for power generation depending on the region. In Mongolia, renewable energy (solar, wind, and hydro) represents about 3 percent of the country's total electricity generating capacity (APCTT-UNESCAP, 2009). The Parliament of Mongolia in recent years has adopted several significant legislations and national programs for the promotion of renewable energy. The Energy Law of Mongolia approved by the Parliament creates independent regulatory mechanism and legal environment for promoting competition in the sector. The Renewable Energy Law regulates generation and supply of energy utilizing renewable energy sources. The National Renewable Energy Program promotes renewable energy development in Mongolia and set a national renewable portfolio standard with a target of 3-5 percent of renewable energy supply by 2010 and 20-25 percent by 2020. The National Renewable Energy Center in Mongolia was established in 1998 and its main goals are to introduce sustainable development principles to Mongolia, achieve the goals of the National Renewable Energy Program, introduce new renewable energy technologies to Mongolia, and develop Mongolia's technical capacity. The other key players which help achieve the goals of the National Renewable Energy Policy include the Mongolian Ministry of Fuel and Energy (MOFE), the Ministry of Finance, and the Ministry of Environment and Resources.

Nepal

Nepal is a low income country with an population of 29.3 million in 2009 with an average annual growth rate of 2.3% between 1990-2009 and ranks 157th in the HDI index of 2011. Nepal's primary energy demand is projected to grow at an annual rate of 2.3% through 2030.

Energy demand from sectors such as agriculture, commercial and residential will account for the largest share with 89.8% followed by industry and transport at 6% and 4% respectively. Nepal's energy profile is dominated by biomass that accounts for around 86% of the total final energy demand with coal and oil having a minor share in it. Nepal is well endowed with water resources; hence the government intends to focus on developing hydropower for electricity generation. Efforts are being undertaken by the government to reduce the use of firewood in rural areas while simultaneously introducing clean and energy efficient mechanism for utilisation of biomass that dominates in the country. The share of coal, hydro and oil is expected to increase to 21% in 2030 from 17% in 2005 and in contrast the share of renewable energy is expected to reduce from 86% to 78% in the same projection period. With around 70% of the population living in rural areas, traditional sources of energy would remain significant in the energy matrix of Nepal. Its rural energy policy would enable in enhancing the utilisation of clean and energy efficient mechanisms for the use of these traditional sources and there is significant emphasis on the development of hydropower for country's energy requirement post the national power crisis in 2008. (Asian Development Bank, 2009) The ministry of energy is a key agency undertaking energy policy measures in the country accompanied various other departments and agencies. Other agencies such as Ministry of Science and technology among others also work on areas such as Alternative energy. (Asian Development Bank, 2009)

Learning from case material

Our cases suggest that the following mechanisms have been important in achieving improved energy outcomes such as improved energy access and clean energy transitions.

Innovative financing mechanisms

One of the recurrent observations from the project cases was the presence of an innovative finance mechanism. The financing mechanisms itself varied from project to project and were tailored in view of the needs and prevailing situation in each case. A lot of emphasis was given on self-sustainability, with a move away from a grant based approach. Even where grants have been crucial and instrumental, the objective has been to ensure that the local population has the capacity to take the project further. The informal and self-financing model of Vietnam biogas programme led to greater involvement of various credit lending groups. The focus on having a major component of expenses to be covered by users has ensured a longer term sustainability and greater ownership. The importance of different stakeholders was realised in the Bangladesh SHS case where the financial support was provided not only to users but partner organisations as well. Having tailor made solutions further enhanced uptake of the model. For instance, in the case of SELCO, access and affordability were taken note of and an appropriate payment schedule matching the income streams of the target groups were developed in close association with the rural banks. In the case of palm sugar cook stoves in Cambodia, a barter system was adopted to reduce the

burden on beneficiaries and enhance uptake. New financing models such as carbon financing are being explored to ensure self-sufficiency and financial sustainability.[1]

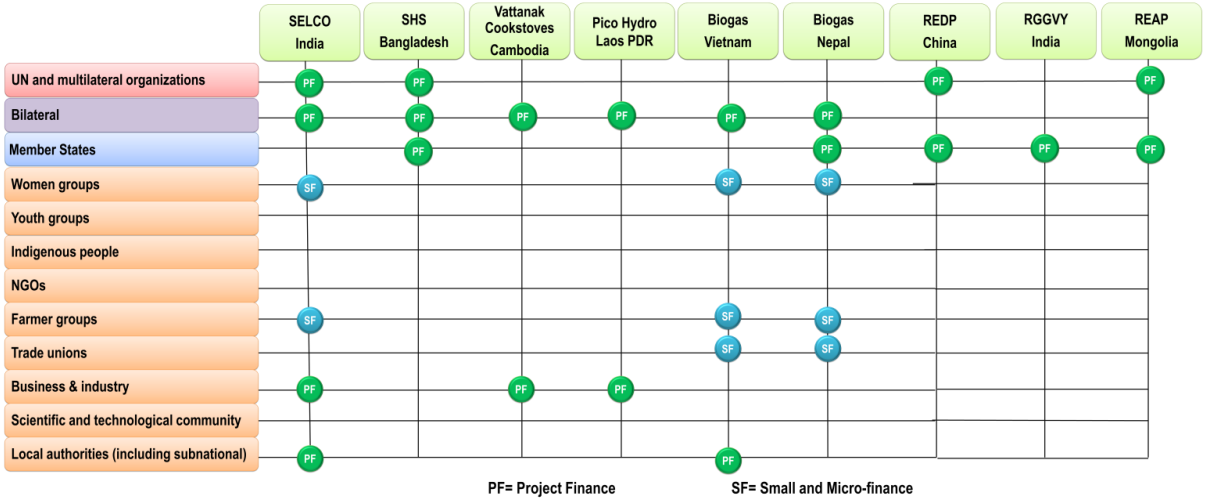


Figure 5 Financing support in selected case studies according to CSD major group typology

Key finding: This depicts that the major source of financing (gap financing) has been multilaterals, bilaterals, business and industry and sometimes sub-national level (Figure 5). The initiatives have been supplemented with small sources of finance including micro-finance. However, to kick-start such initiatives, the major source of feasibility-viability gap financing have been multilateral and bilateral funding.

Needs based customized approach to energy service delivery

A needs based approach has been useful in financing as well as technology adoption and energy access. Traditional models of energy delivery require standardization of products; however delivery of energy services requires customization of services based on individual needs. SELCO case demonstrates that customization is key, when it comes to serving rural markets and provides lessons for replication in other parts (in similar conditions). In the Cambodian palm sugar cook stoves, greater emphasis has been placed on modifying the technology to suit local needs and utilising locally available materials and local people. In the case of Pico hydro, ethnic communities with enterprising and entrepreneurial abilities have successfully driven the market for small scale locally adaptable and useful technologies, facilitated through the presence of robust distribution networks.

[1] An abacus framework was conceptualized by The Energy and Resources Institute for the Ministry of Environment and Forests; the abacus summarized involvement of actors concerned with the Institutional Framework for Sustainable Development. "India and Sustainable Development: Stocktaking in the run-up to Rio+20"; Prepared by The Energy and Resources Institute for the Ministry of Environment and Forests; available from http://www.uncsd2012.org/rio20/content/documents/Sust_Dev_Stocktaking.pdf
http://www.cleanegroup.org/assets/Uploads/2011-Files/Reports/CEGInternationalClimateTechnologyInnovationProposal12.01.09.pdf,
TERI 2011, study on International Environment Governance for the Government of India; Clean Energy Group, 2011

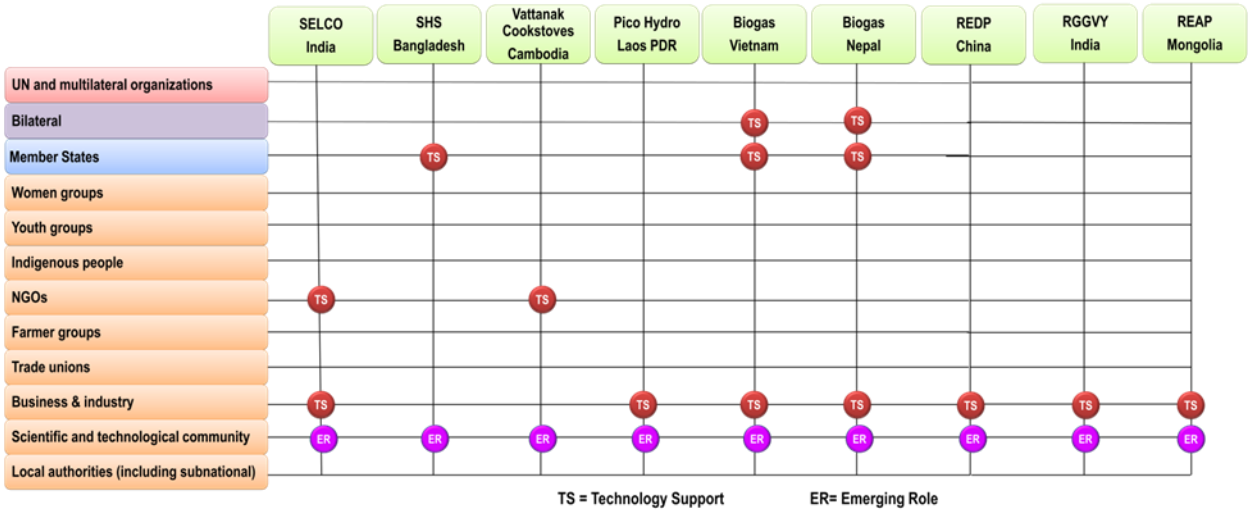


Figure 6 Technology support in selected case studies according to CSD major group typology

Key finding: Technology support has come primarily from bilaterals, member states and NGOs (who have also helped in adopting technology to local conditions). Technologies for energy access project have been indigenous. (Figure 6)

Capacity building for technology absorption

Capacity building is important for introducing or developing a technology as well as absorption of the technology introduced. For instance, in Bangladesh, since the solar energy technology brought to the communities was fairly new, the partner organisations invested time and resources in training people for installation and maintenance of SHS. This has also resulted in availability of local manufacturers of batteries, charge controllers, inverters etc. Even in the Vietnam biogas project, self-employed masons and technicians are trained to install and maintain the biogas plants. In the Nepal biogas programme, emphasis was also laid on enhancing after sales service capacity to ensure successful absorption. Even in Palm Sugar cook stoves of Cambodia, investments have been made in capacity building of the entire value chain.

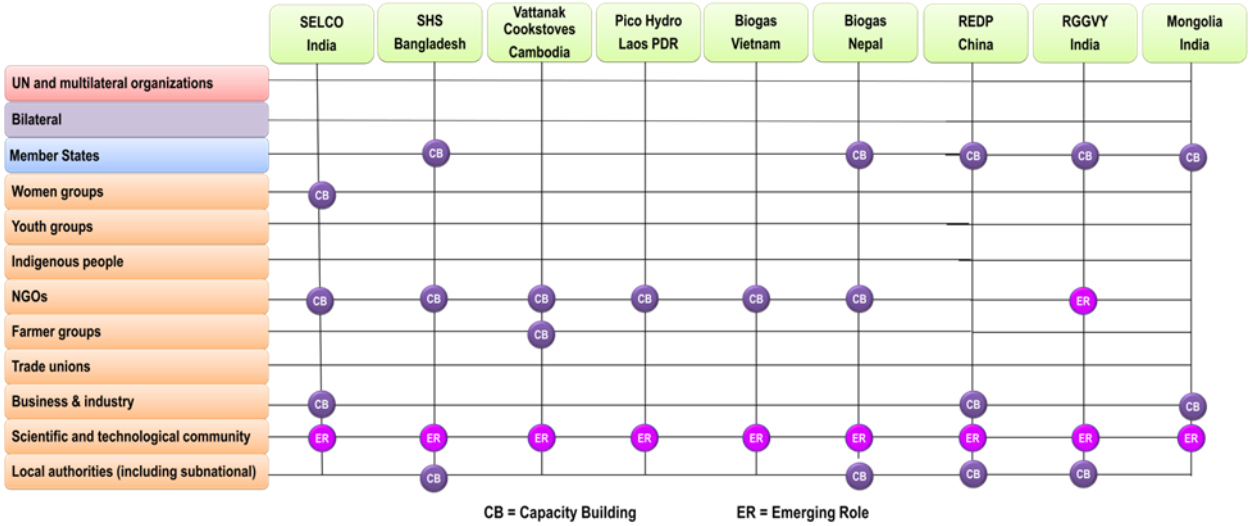


Figure 7 Capacity building support in selected case studies according to CSD major group typology

Key finding: NGOs have played a major role in capacity building along with national, sub-national levels and industry (Figure 7). The scientific community has played an indirect role; a potential emerging role for the scientific and technological community would be risk assessment (LCA approaches etc) approaches for technologies involved. Scientific and technological community need to work with NGOs and consider approaches such as LCA and socially acceptable approaches. Moreover, scientific and technological community can facilitate dialogues with all stakeholders especially with policymakers and grassroots community.

Mechanisms for cooperation and coordination

In all of the cases studied, an important feature contributing to success has been the coordination and cooperation amongst different agencies or stakeholders. In all the cases studied, existence of different stakeholders with clear roles and mechanisms for interaction and coordination across the value chain was a key observation. The role of different players varies from project to project and stage to stage within the project cycle. In some places, introduction of new actors or networks such as cooperatives and associations further intensifies cooperation and initiates coherence with the larger community in the area.

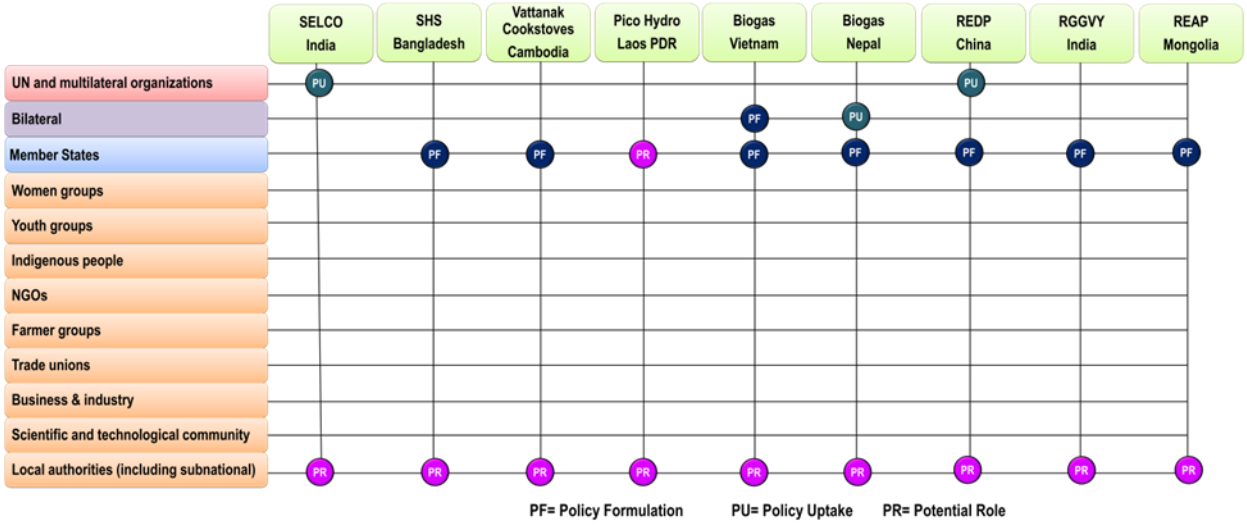


Figure 8 Policy formulation and uptake in selected case studies according to CSD major group typology

Key finding: Good practices such as SELCO and REDP have resulted in policy uptake by the multilateral community to inspire international programmes related to clean energy access (Figure 8). Biogas Nepal served as a model to formulate SNV's programme in Vietnam. Policy uptake of good cases at national level and subnational level is not seen in the selected cases.

User buy-in

More than making a technology or measure available, it is important to ensure that it enjoys acceptability and a buy-in from the target group. In the Asian case studies, either the user buy in element has been built in from the start or introduced later. To this effect, substantial investments are made to understand the user requirements and customize the products, as in the case of SELCO. Customer feedback and review process has been integral to programmes such as REDP China, Nepal BSP and Vattanak cook stoves through means such as end user satisfaction surveys and customer feedback processes. Periodic consultations and evaluations has ensured in better design and evolution of the Nepal biogas programme, which has a greater ownership and buy-in from the users. In Vietnam, potential users are involved from the demonstration stage itself.

Market development strategies and market driven programmes

An important observation from completed projects and programmes reviewed for this study was that success of a project in large part depends on the ability of the project participants to take forward the initiative even without backing from government institutions especially in the form of funding. Projects that are able to create a market value chain around their products (like the ones described in PV solar systems under SHS program in Bangladesh and REDP in China) are far more independent than purely government supported programmes. Creation of this value chain requires more participation from businesses, final

consumers, financing entities (government or independent banks) and market regulators that can provide benchmarking standards to main product quality and ensure technology delivery. Initial funding in the form of innovative financing (like microfinance in Bangladesh and GEF-World Bank funding in China) when supported by market development strategies could prove immensely helpful to energy access projects.

Risk management

The management of wastes from solar PVs is important for emerging and developing Asia that are embarking on massive solar energy programs. As a growing policy focus in Japan, there is need for an appropriate international risk regulatory framework to be set up as early as possible so that manufacturers can design solar modules, which are safer and easier to reuse and recycle, and markets to be developed for the same. The mix of top down regulatory measures and bottom up voluntary response in non-Asian countries are also worth studying in this context.

Participation, energy institutions, and Rio+20

The success of these energy interventions highlighted actions across two fronts; multiple actors and mechanisms. At a macro-level, it is seen that SELCO was primarily a private entrepreneurship driven initiative, SHS Bangladesh was developed with the involvement of the Government and the World Bank. The Cambodia Vattanak cook stoves initiative was a Major Group (NGO) led – GERES. Laos PDR pico-hydro developed informally with the involvement of local traders and beneficiaries. Vietnam biogas programme developed with the help of bilateral and an NGO. Nepal biogas programme was made possible with the help of bilateral funding and government management. REDP China came into operation with the help of World Bank and the Chinese government.

It is observed that UN and international bodies (including international finance institutions and bilateral arrangements) have played a central role in supporting projects financially. There has been an increasing role in bilateral partnerships (North-South). Other emerging sources of financing – albeit small – include micro-finance institutions (MFIs). MFIs have been able to mobilize women, farmers as well as trade unions. Insofar, the discussions around IFSD may not really have grass-roots representatives from developing countries to voice their concerns. A question that may be asked is whether voices from these major groups representatives have been an adequately part of the Rio+20 deliberations?

It is also seen that non-governmental organizations have had a multi-dimensional role in terms of awareness, capacity building as well as in developing science and technology. This is especially observed in the case of Cambodia cook stoves and the Vietnam Biogas project. In case of SELCO, a business entity like SELCO assumed a multi-faceted role. Business groups were important actors in providing technology and finance. This is especially in the

case of biogas projects in Nepal and Vietnam. The role of the science and technology community was absent, but local authorities did play a role in some of the projects.

Enhanced multi-stakeholder participation is an important theme in the discourse on IFSD at Rio+20, starting with strengthened representation of CSOs at the Rio+20 conference. Therefore, it is also relevant to consider how to strengthen multi-stakeholder participation in energy institutions. This is probably easier at the international level. At the national level, this is up to the governments of individual countries. It is probably unrealistic to expect Rio+20 to reach a binding agreement on national-level participatory decision making, some coordinated voluntary suggestions could be considered. Many energy case studies of specific projects emphasize the importance of multi-stakeholder participation for various reasons, but this does not necessarily translate directly into a recommendation for the policy process. Nevertheless, lessons from specific projects can provide clues for how to modify national regulatory frameworks, and this could be discussed and encouraged at Rio+20.

Understanding institutional capacities to facilitate energy access and clean energy interventions

Energy is an important driver of industrial development and economic prosperity. The last few decades have seen an increase in energy demand worldwide - as industrialized countries moved towards higher standards of living, newly industrialized countries used more energy to fuel their growth engines and developing nations demanded more energy to achieve developmental objectives. These trends have led to an overall rise in investments for securing energy resources. Another result of this increasing demand for energy resources has been increasing technological innovation to use current and new sources of energy efficiently (making do with whatever is available) and this has also led to institutional innovation to better manage the challenges related to optimum development of the energy sector. The growing interest in various dimensions of energy access and sustainability is evident from the fact that the United Nations General Assembly declared 2012, the year that marks completion of 20 years of Rio declaration, as the 'International Year of Sustainable Energy for All'. (United Nations, 2011)

Global energy governance is very diversified. There is a wide range of international organizations involved, as well as public-private networks, NGOs, businesses, and other stakeholders. However, unlike in many other areas, there is no comprehensive global institution for energy, except for possibly UN Energy, which is more of a coordination network rather than an organization, which mainly focuses on coordination among UN bodies. A few global institutions focus on specific aspects of energy such as renewable energy (IRENA) and nuclear energy (IAEA), or climate change (UNFCCC). There are also some regional organizations such as the IEA and OPEC. Some organizations are extensively involved in energy (although not necessarily renewable energy) as an important part of their work, although they do not focus exclusively on energy, particularly the multilateral development banks such as World Bank and the Asian Development Bank, but also involved are various other UN organizations such as UNDP, as well as other intergovernmental frameworks such as APEC and G20. The private sector and many NGOs also play a large role.

The last 60 years have seen the rise of several global/international institutions to govern energy and related challenges. They can be seen as formal organizations that exist at inter-governmental levels whose larger mandate is to address the energy sector and other formal institutions that deal with numerous issues but have important repercussions for the energy sector. Apart from these international institutions, the energy governance is also framed by the various interactions between institutions at the regional, national and sub-national levels.

The first category of formal organizations include the International Energy Agency, OPEC, International Energy Forum, IRENA, REEEP, Energy Charter Treaty, IAEA, the newly

formed UN Energy and other source specific associations. The second category of formal institutions include economic, political and other cooperation such as the G groupings, OECD, WTO, energy working groups of ASEAN, APEC, SAARC, multilateral development banks like the World Bank, ADB, initiatives like the EITI, Joint Oil Data Initiative, carbon disclosure programs and mechanisms under the UNFCCC that relate to mitigation of carbon emissions from energy sources.

Since fossil fuels have dominated the energy scene for a long period of time, governance of the sector has also been source specific with only the largest players participating in decision making - whether producers or importers (e.g. OPEC, IEA and OECD). Increasingly though, the focus of discussion has moved to countries that have traditionally not been the largest producers or importers of fossil fuels but have seen a meteoric rise in their demand for energy to power their rapid industrialization (like China, India and other emerging economies). As more developing countries become industrialized and graduate to emerging economies, the pre-existing global energy governance architecture seems to be lacking in relevant initiatives leading to more important roles being played by national and sub-national institutions. The recent focus of most institutions has been on greening the energy sector and securing the energy options for member countries. In this context, the energy access agenda of the international institutions may not necessarily integrate fully the concerns and needs of countries or regions that belong to the current consumer driven energy architecture seeking access to energy. While, many existing interventions and institutions have proved successful in energy access at the grass root, however more is required to integrate consumer perspective that also encompasses clean energy. This project has reviewed some examples where innovative approaches have been adopted in projects, policies and programmes to facilitate energy access and the role that institutional capacity and interaction has played therein. Institutions are central to explaining the varying results that innovations have in different contexts. Such innovations emphasise interdependence and nonlinearity. (Edquist, 2004) To this effect, this chapter reviews the institutional arrangements and interactions along with their actual and potential influence on achieving the goal of enhanced access to clean and renewable energy.

Institutions for energy governance

The need for energy governance has arisen owing to four broad-based concerns that have increasingly captured countries' interests. These concerns are that of energy supply security, energy poverty, environmental stability and domestic management of energy deposits (Dubash & Florini, 2011). The rise of these concerns can be attributed to particular events like the oil crisis of the 1970's or as components of interlinked agendas like development goals, sustainable development, climate change or increase in awareness of issues like corruption and the need for higher transparency in managing resources of the world. Also these concerns prove to be conflicting in some instances especially when environmental sustainability is under consideration. As and when these concerns came into the limelight,

new institutions and inter-governmental arrangements have arisen. Currently these governance structures engage in issues related to financing, investments, ensuring adequate supply of fossil fuels, technology development and very recently information disclosure.

It is interesting to compare the situation of international energy governance with international environmental governance (IEG). In the Rio+20 discussions, the current structure of IEG governance has been criticized as being fragmented, lacking coordination, with weak institutions, and the central global institution lacks authority and capacity, and the question of how to reform it is one of the central questions of Rio+20. International energy governance, suffers from these same problems although to a larger degree. Nevertheless, energy governance has not been the focus of Rio+20, and there have not been prominent voices calling for broad institutional reform of international energy governance. Energy may be even less institutionalized than the environment. The environment has a global organization, UNEP, even though it may be considered in need of reform, but energy has no comprehensive global institution. Energy governance is fragmented among many organizations with overlapping functions, although there are no loud calls for streamlining and coordination, or reform. To be sure, there is much dissatisfaction with climate change governance, which is closely linked with energy, but this is considered to be a much broader problem than just energy. Energy also enjoys significantly more financial resources than the environmental area, including through multilateral development banks, national governments, as well as the private sector, so this may offset the problems of institutional fragmentation to some extent.

Nevertheless, similar to the environmental area, the current energy governance structure has not achieved the energy related goals in the JPOI, although some progress has been made. Despite the important progress made by renewable energy, its expansion needs to be significantly accelerated. Likewise, in the area of energy access, again, although a certain amount of progress has been made, much more still needs to be done, including especially greater efforts to link expanded energy access and poverty reduction with renewable energy. So on the occasion of Rio+20, it is certainly worthwhile to consider how energy governance could be strengthened to accelerate the achievement of global energy related goals.

It is no surprise that most of the energy governance structures were initiated by developed countries (EU and North America). As developing countries' demand for energy increased over the years, some of these institutions have included new members while new institutions have sprung up to manage the needs of the 'south'. As mentioned above, the energy sector has been privileged enough to be placed at the agendas of informal governance institutions as well as studies by institutions dedicated solely to the sector. Some of these institutional arrangements have been discussed below.

The G8 group had come into existence to respond to the economic crisis of the 1970's triggered by the oil crisis. This group has graduated to include more emerging players in the last decade and the group has increased to G20 whose 'Leaders' Summit' had a mission of economic governance post the2008 crisis triggered by the housing bubble and resulting in an on-going global recession. The inclusion of emerging economies and governance not only by the developed countries signifies the increase in multi-polarity and the importance of multiple actors in not only economic issues but also other related issues such as energy (Van de Graaf & Westphal, 2011). The function of a **G-group** translated to the energy sector is to promote dialogue between multiple strategic actors, encourage them to coordinate national policies towards a common goal and mobilize resources for capacity building. The G20 group has a very strong influence on global energy and carbon trends with the group accounting for 75% of all energy consumption and 80% of all carbon emissions from fuel consumption.

Other **economic cooperation arrangements** that have also had an impact on regional energy policy in Asia include the Energy Working groups under the Asia Pacific Economic Cooperation (APEC), Energy Dialogues and working groups on Energy Trade and Investment and Electricity under the South Asian Association for Regional Cooperation (SAARC) and the policy working groups and Ministers on Energy Meeting under the Association of South East Asian Nations (ASEAN). Like the G-groups these also have great impact on the governance of energy as the countries (some of them large consumers and suppliers) deliberate and coordinate their policies and set the regional agenda for the energy sector. The dialogues and working groups for these cooperative arrangements cover issues related to energy security, development of energy resources in the region (including renewable sources), energy trade and investment, climate change, clean development and energy efficiency.

International Energy Forum is a recurring gathering of energy ministers of 87 countries that account for more than 90% of global oil and gas supply and demand. Member countries include not only the members of IEA and OPEC but also emerging and newly industrialized economies. The purpose of the forum is to promote global level dialogue in the energy sector to discuss global energy security in neutral settings. One of the most significant initiatives of IEF is the Joint Oil Data Initiative (JODI) that has been formed with cooperation between APEC, Eurostat, IEA, OLADE (The Latin American Energy Organization), OPEC and the United Nations (Statistics Division). This database covers 90 countries where partner organizations submit monthly data on production, refining, trade, demand and stocks of seven product categories – crude oil, LPG, gasoline, kerosene, diesel oil, fuel oil and total oil. Along with promoting the dialogue on energy security, this initiative is an important tool for increasing transparency among members and partner organizations to support better co-ordination.

The Energy Charter Treaty with more than 50 signatory members provides a framework for energy trade, transit and investments. It was one of the first multilateral treaties that imposed binding commitments in the area of energy. The ECT insured open, competitive markets and sustainable development while strengthening the rule of law on energy issues. It sought to bring together resource-rich and demand-heavy nations of continental European and beyond and provided a level arena for debate to reduce non-commercial risks attached to energy security, ensuring energy trade to be non-discriminatory and consistent with WTO guidelines (TERI, 2010).

The International Energy Agency established in 1974 with its 28 members was initially formed to co-ordinate responses to major disruptions in oil supply by release of emergency oil stocks. The IEA has had to intervene in international oil markets thrice in its history – during the 1991 Gulf War, in 2005 post Hurricane Katrina and to offset disruption in oil supply during in 2011 during the Libyan Civil War. The mandate of IEA has widened to include energy security, economic development, environmental awareness and worldwide engagement for shared energy and environment concerns as its focus areas (Florini, 2011). The agency designated Standing Groups and Committees that work on issues of long term energy cooperation, global energy dialogue and research in energy policy and technology. The agency has promoted forums like the International Partnership for energy efficiency Cooperation and Networks of Expertise in Energy Technology (NEET) and has also become a repository of world energy statistics. Outreach under this include the publications for emergency preparedness, oil and gas markets, Key World Energy Statistics, World Energy Outlook, global energy dialogues, research publications on energy and environment, energy efficiency and deployment of renewable energy. The IEA has worked closely with G8 countries in conducting research and analysis for energy policy and has also contributed to the increasing multi-polarity in energy discussions by engaging with non-members such as India, China and Russia.

One of the important links in the institutional architecture for global and regional energy governance in Asia is the **multilateral development banks (MDBs)** – most prominent in Asia being the World Bank and the Asian Development Bank (ADB). These institutions have impacted the national, regional and global policies for energy resources development as well as made huge capital investments in new energy infrastructure in developing Asian countries. These institutions have been highly influential in providing technical expertise, innovative regulatory approaches for policy and development of the energy sector (Nakhooda, 2011) – resulting in them playing very important roles in national energy policy making debates. In the 1990's the MDBs supported various restructuring initiatives that promoted private sector involvement. Historically, the MDB energy portfolios in Asia have consisted of large scale fossil fuel based projects (Nakhooda, 2011). In the light of climate change considerations, the mix is now changing towards more financing and support for renewable energy and energy efficiency. Lately, MDBs are facing numerous challenges as

developing Asian countries have maintained that they need MDB financing for securing energy supply of conventional fuels to meet their energy access targets and global imperatives are forcing MDBs to reduce their financing of conventional fuels.

Since these institutions are also involved in multiple international processes, they can be effective in steering both the global and domestic energy governance issues. But this also implies that their processes can in turn be affected by the global discourse as well as the stands of their member countries. Nevertheless, these institutions have supported developing countries in filling financing gaps.

UN-Energy was established in 2004 post the World Summit on Sustainable Development (WSSD) to promote collaboration within the United Nations system in the field of energy and the thematic areas of energy access, renewable energy and energy efficiency. The role of the body is to share information, co-ordinate and facilitate joint programming in the energy sector within the UN as well as engage with non UN agencies. The activities of the agency include capacity building, developing enabling environments to promote energy access and clean energy, assist in financing, knowledge sharing and conduct research, technology development and demonstration.

Beyond these institutions working at the global level, there are also **source specific organizations** like the IAEA and OPEC whose mandate is limited to the governance of civilian nuclear energy in the case of IAEA and represent oil producing countries in international forums in the case of OPEC. Their work has important implications on the security and supply of energy sources and these organizations have played important roles in the energy debates surrounding the traditional fuel of oil and fissionable materials.

There may be some fragmentation and overlap in the current institutional set up for energy, but there isn't much movement to reform global energy governance or create a world energy organization, unless this is considered as part of the climate change issue. Large corporations also play a major role in informal global energy governance and some already participate to some extent in efforts to expand energy access. Other than the institutions mentioned already, there are some making large efforts to promote renewable energy.

One of the recently formed organizations in the renewable energy sector is **International Renewable Energy Agency (IRENA)** whose mission is to promote the adoption and sustainable use of all forms of renewable energy. The agency has 149 signatories to its statutes and 85 members. IRENA works with member states to assist them in promoting renewable energy in their national policies and through international cooperation. Other activities of IRENA are directed towards facilitating access to renewable energy information like technical, economic data, potential for renewable resource development; facilitate technology transfer, development of local capacity and encouraging research in the field of renewable energy technology development, deployment and related socio-economic issues.

It is important to consider the role of IRENA, and how it can be strengthened, even though it is very new, as its activities only started in 2011. IRENA is not a direct focus of at Rio+20, although discussions on IFSD will need to address the issue of how to coordinate among existing institutions. Moreover, IRENA is quite likely to become a key player in the energy area, so it is important to consider its role in international energy governance regardless of the direction of discussion at Rio+20.

Because of its short history of existence and also its small size (it has only 72 posts of which only 42 posts have been filled as of October 16, 2011 and a budget of only about 25 million dollars in 2011) (IRENA, 2011), IRENA's role has not been as prominent as the IEA and IAEA in its respective field. Nevertheless, it has been gradually enhancing its staff base and expanding its influence. During the TERI/ADB/IGES Roundtable on Energy Innovation, several participants raised the point that the many officials in governments of Asian developing countries often lacked confidence in deciding on the most suitable renewable options for their countries and tended to simply adopt technologies promoted elsewhere by donors like the World Bank, despite differing conditions between and within countries. To avoid these kinds of situations, IRENA could play an important role in Asia by assisting Asian developing countries to identify the most appropriate renewable technology, fostering information sharing on good practices and the latest renewable technologies through various means, such as the organization of expert/practitioner workshops, compilation and sharing of essential data on the website, and providing technical/policy advice.

IRENA has started trying to provide these services already but most of the products/services seem to be in the process of preparation. One example is that IRENA started to develop a global renewable energy atlas on wind and solar potential in collaboration with the Clean Energy Ministerial (CEM), which includes the World Meteorological Organization (WMO), the German Aerospace Centre (DLR), the National Renewable Energy Centre (CENER) of Spain, the National Renewable Energy Laboratory (NREL) of the United States, and the Danish National Laboratory for Sustainable Energy (Risø/DTU). (IRENA, 2011) IRENA's approach to rely on partnerships with these leading institutes is appropriate and probably necessary as it needs to provide credible, reliable and authoritative data for its member countries with its limited human resources and budget. IRENA is not expected to be an implementing or funding agency but instead focus on providing intellectual and advisory assistance.

Another important endeavour in this sense is its collaboration with the IEA to establish a joint IEA/IRENA Global Renewable Energy Policies and Measures Database. (IRENA, 2011) During the TERI/ADB/IGES Roundtable on Energy Innovation, an expert participant pointed out the unavailability of reliable data on such critical issues as the price of electricity in Asian countries. IRENA's work to facilitate access to relevant renewable energy related information, including technical and economic data, for example, renewable resource potential, is of paramount importance. IRENA could share experiences on best practices and

lessons learned regarding policy frameworks, capacity-building projects, available finance mechanisms and renewable energy related energy efficiency measures.

At the grassroots level, in cooperation with E+Co and SELCO of India, IRENA organized a grassroots workshop and a practitioners' meeting to provide training and foster learning among participating entrepreneurs from Africa, Asia and Latin America (IRENA, 2011). These types of workshops could be useful for raising awareness at the grass roots level and should continue to be carried out, but they should not be an end in and of themselves, for often a policy and regulatory framework is necessary to support this kind of grassroots entrepreneurship to take root and not end up as isolated cases. IRENA should therefore engage, advise, and raise awareness of the governments to create conditions conducive to further renewable energy penetration supported by these grassroots entrepreneurs.

The limited membership of IRENA is an issue in Asia. IRENA is mandated to serve member countries, and since there are many Asian countries which are not members of the Organization, its activities are not particularly focused on Asia. In Southeast Asia, only Malaysia and the Philippines are full members, and Cambodia and Singapore are signatories/applicants, which are expected to become members later (IRENA, 2011). There could be various reasons for the relatively low participation rate of Asian countries, such as the cost of joining (i.e. assessed contributions) and a concern for overlapping mandates, and inability to see added value given there are other international organizations, networks, and initiatives such as the IEA, UNEP, UNDP, and World Bank doing similar types of work. By joining IRENA, an applicant country has to 'pledge to advance renewables in their own national policies and programs, and to promote, both domestically and through international cooperation, the transition to a sustainable and secure energy supply.' In countries where fossil fuels are abundant and cheap and the relative cost of the transition to renewable energy supply is much higher than other countries without such resources, joining the Organization might be too high a hurdle.

IRENA will have to find its niche and fill in the gaps of current renewable energy governance. These gaps exist, but they are hard to fill. Considering the fact that energy there are already many international actors in the field of renewable energy promotion assuming similar roles, IRENA should be a slim, efficient and focused organization working extensively through partnerships, providing reliable, authoritative data, and high quality intellectual advisory assistance for member countries.

Another important organization in the clean energy sector is the **Renewable Energy and Energy Efficiency Partnership (REEEP)**. This is a non-profit organization that works to promote the marketplace for renewable energy and energy efficiency. It was launched at the World Summit on Sustainable Development (WSSD) at Johannesburg in 2002 and its official goals include reduction of greenhouse gas emissions, improving clean energy services and increase the share of renewable energy in countries' energy mixes. REEEP has funded 150

projects in the fields of policy and regulation and innovative financing to support market development. Other initiatives from REEEP include the Renewable Energy and International Law (REIL) network, the Sustainable Energy Regulators Network (SERN), Energy Efficiency Coalition and the clean energy information portal 'reegle'.

REEEP is an innovative type of public-private partnership, which is comprised of '400 partners including 45 governments as well as a range of private companies and international organisations' and 'supported primarily by governments (Australia, Austria, Canada, the European Union, Germany, Ireland, Italy, Netherlands, New Zealand, Norway, Spain, the US and the United Kingdom.' (REEEP, 2012). REEEP is unique in its targeted approach to initiate and fund projects. Its two focus areas are 1) assisting governments in creating favourable regulatory and policy frameworks, and 2) promoting innovative finance and business models to activate the private sector (REEEP, 2012).

A potential problem here is that these areas of activities are not the sole property of REEEP and there are many global players/networks/initiatives wanting to do and doing the same type of work. Fully aware of this situation, to minimize overlaps, REEEP has collaboration agreements with similar partnerships like GVEP, GNESD, CLASP, ICLEI, EEP and MEDREP, and is working closely with the International Renewable Energy Agency (IRENA) as its work programme takes form (REEEP, 2012).

The level of funding per project given by REEEP is relatively low at €150,000, and there are several conditions for each project to meet to be funded. For example, projects where the majority of the requested resources are for workshops, seminars, study-tours or conferences and awareness creation/information dissemination are not to be funded and neither are projects that support hardware or infrastructure (REEEP, 2012).

Each partnership/initiative/network for renewable energy promotion like REEEP has its own priorities, approach, geographical/operational focus and criteria for funding, and the level of funding is neither high nor adequate considering the magnitude of challenges of energy access and renewable energy penetration in most parts of the world, particularly in developing countries. This kind of participation by diverse actors in a distributed manner and fragmentation of implementation are inevitable and need not be overly controlled or coordinated by governmental bodies or UN organizations in a 'top-down' fashion. Rather, REEEP seems to be relatively effective at leveraging the diverse strengths of other actors. Each actor including the UN agencies should identify its comparative advantage and niche as part of distributed energy governance and contribute to the common objectives/goals which could be set at Rio in the form of SDGs. For coordination, it is important for the UN to provide the fora where these actors could discuss and share information and coordinate their operations in rather loose and a distributed manner and these fora could be provided by a regional sustainable development council which could be created under the Sustainable Development Council in New York.

The evolving role of these two institutions (IRENA and REEEP) could do a lot to promote clean energy for increasing access in developing nations where they could be involved in identifying most appropriate technologies, information sharing on good practices through their own offices or by cooperating with other environment or energy governance institutions. The way these new institutions interact with the already established UN institutions and other international bodies like the multilateral development banks would affect the progress of these institutions.

Perspectives on institutional capacity

Various approaches to institutional analysis exist. While some literature adopt a linear approach (Williamson, 2000), others emphasise on the relational aspect of institutions (Healey, de Magalhes, Madanipour, & Pendelbury, 2003). Some authors have emphasised the dynamism and heterogeneity of institutions rather than the rigidity and independence of social structures (Rohracher, Truffer, & Markard, 2008). An important classification of institutional analysis by Hollingsworth comprises institutions, institutional arrangements, institutional sectors, organisations and outputs (Hollingsworth, 2000). This classification is very comprehensive but is deficient in tapping the interrelationship amongst the five components in the above classification. Despite covering the various networks and communities amongst other things, it does not delve into the cross institutional relations.

This project, recognizing the diversity and heterogeneity of institutions in the energy sector, seeks to take a more dynamic approach and analyse the institutional capacities based on the classification by Hailey et al in terms of knowledge resources, relational resources and mobilisation capacity. Knowledge resources comprise the entire range and frames of reference that shape interventions, integration, and capacity to absorb ideas that lead to innovation. The second pillar concerning relationship comprise stakeholders involved and their interaction with each other, the extent of their integration, power interest groups and embedded relations within the network of stakeholders. The third pillar comprises enablers such as critical change agents, financial resourcing, incentives and opportunity structure. (Healey, de Magalhes, Madanipour, & Pendelbury, 2003) In this analysis, we recognise three main levels of institution – Informal institutions or the social embeddedness level; formal institutions and rules; and the structural level or the governance structure, such as governments, markets etc. (Williamson, 2000) (Andrews-Speed, 2010)

Institutional diversity

The institutional diversity evident in improving electricity access through clean energy may be instructive (box below). The establishment of linkages across these levels, in many cases, has helped foster collaboration and resource sharing. More specifically then, in the context of energy access and clean energy needs, we need a distributed strategy not just across technological developments, but also across governance levels and frameworks for clean energy development that will link what is happening in the market and at the grassroots back to the lab and to those who make policies based on such feedback loops. (Clean Energy Group, 2009) It will involve the linking of various groups – state and non-state, institutions – formal and non-formal; the linking of global finance and expertise with local knowledge and experience to address energy needs. To design such a framework we need to have an idea of

Box 2 Institutional diversity and levels

International/Multilateral: At the international level, the International Renewable Energy Agency (IRENA) is an inter-governmental organization working towards accelerated development and development of renewable energy. The International Energy Agency (IEA), a grouping limited to OECD members, is increasingly engaging with the developing world to enhance R&D in clean fossil fuels as is the Renewable Energy and Energy Efficiency Partnership (REEEP)

Regional: In Asia, through the Asia-Pacific Economic Cooperation (APEC) Energy Working Group, countries share information on energy planning and investment. The Renewable Energy Development Initiative (REDI) of APEC includes projects "to build a web-based tool to facilitate renewable energy project development, develop a renewable energy financial roadmap, and assess renewable energy training and accreditation needs for the region. 'The Energy for All Partnership', steered by ADB, is focused on action, with a goal to provide access to energy to 100 million people in Asia and the Pacific region by 2015. The South Asian Association of Regional Cooperation (SAARC) Energy Charter marks renewable energy development as a significant area of regional cooperation. Regional trade arrangements may also be employed to encourage clean technology transfer.

National: At the domestic level, countries are implementing renewable energy power projects, often in areas not connected to the grid. A number of Asian countries, including India are tapping renewable energy sources for rural electrification through distributed generation.

Local: At the level of communities, project developers and NGOs are working together to deliver decentralized electricity solutions and develop innovate financing models. The provision of solar lanterns for lighting in rural homes is one such example.

what grassroots initiatives are taking place, what kind of policy and practices support their success or constrain their adoption; what are the specific technology transfer and IPR issues around clean energy technology from an Asia perspective, what are issues and practices for

capacity building across the value chain especially for the SME sector; what are the types of financing support required; how can local government be better involved in all of this?

Besides the territorial levels ranging from global to local, the institutional diversity exists in the nature of different components of an institutional framework. Some authors have assigned levels to these horizontal classifications of institution as well. For example, Williamson places embeddedness at the highest, followed by the institutional environment and governance. If we place the territorial hierarchical diversity in the horizontal classification, we find that a range of informal, formal and structural institutions spread across global, regional, national and sub national terrains are linked to each other in an intrinsic manner. It is not possible to place them in a hierarchical vertical scheme as suggested by Williamson. The case studies and the review in the previous section show that interplay of various factors is important in enhancing energy access and ensuring adoption and uptake of cleaner energy.

In the case of SHS Bangladesh, close collaboration and coordination of six different organisations at various levels – from international to local have been instrumental. Each partner, whether the Government of Bangladesh, IDCOL, the donor agencies (World Bank's IDA, GEF, and others), Participating Organizations, manufacturers/suppliers, or the professionals/experts have a distinct role in the network. The Government of Bangladesh is responsible for sourcing necessary funding for the project; IDCOL covers project finance and management; donor agencies provide additional funding through grants and soft loans; participating organizations extend micro-credit to customers, select areas and customers, install SHS and provide after-sales service; manufacturers sell SHS components to the POs; professionals/experts provide technical specification and impact assessment. Discussed in the next section, it emerges that this rich network with a strong role for local partner organisations helped in ensuring that the informal institutional aspects such as the local needs and circumstances are accounted for.

Market structure has been an important facet, both as a determinant as well as a consequence of the various examples of innovation in the energy sector. Existence of well-established supply chains and trade networks developed over the last 20 years in Lao PDR drove the Pico hydro market in the absence of any government support or donor agencies. This has been complemented by strong linkages of suppliers/traders with the local shopkeepers. The policy instruments and formal institutions are increasingly recognizing the role of markets and developing strategies to strengthen markets. For example, The Rural Energy Development Project in China was designed to develop market driven approaches to RE development. The Bureau of energy efficiency in India has designed its schemes and initiatives to be highly market oriented in terms of participating actors, financing and their resultant benefits. Similar trends can be seen in the Nepal Biogas Programme, where the focus of the programme was on development of the market resulting in the presence of about eighty companies in a market that was catered by a single company in the past.

The informal institutional aspects or the socially embedded features were key in the Pico hydro innovation of Laos. The Pico-hydro units are installed, maintained and repaired by the end-users themselves. They rely heavily on sharing experiences with and talking to other villagers, friends and relative and rely on their word. Despite the lack of formal training on installation (most of the units do not even come with user manuals and the others usually have Chinese manuals, not understood by the local population), the end users have introduced several innovative adaptations to their systems and spread it through word of mouth. The introduction of new actors or networks such as cooperatives and associations in Cambodian example, like ICROPRODAC has further intensified the cooperation and coherence with the larger community in the area, involving traders, government officials, and other small scale entities.

In a sector or scenario characterised by diversity, each institutional arrangement is configured with another, even though one may be more dominant than the others and may constraint or contribute to the other (Hollingsworth, 2000). There is more to institutional dynamics than simple definition of roles. The process or the manner in which the institutional framework operates is equally important and therefore, it is important to understand the interaction amongst institutions. The following section delves into these relational aspects.

Box 3 Scaling up innovations

Scaling up innovations

The stakeholder workshop conducted for this study highlighted the need for standardization of processes that can be instrumental in scaling up successful projects and practices from one developing country/region to another. Though this subject matter has not been explored independently within the study, one example has been highlighted in the following section.

Learning from Lighting a Billion Lives Initiative

The task of providing sustainable energy to all massive but solutions often come from small, localized initiatives. Lighting a Billion Lives (LaBL) is one such initiative for providing clean lighting to billions that are at the bottom of the pyramid, but has adopted a localized, bottom-up approach to address it. LaBL focused on solar lanterns as the means to penetrate the darkness within millions of homes, unfolding many opportunities for their socio-economic development, while at the same time, ushering in an ecosystem for solar enterprises to grow. It worked with product designers and system manufacturers to improve upon their products and systems, customized to the needs of the people and aligned with the latest technological developments; it partnered with local institutions and NGOs and built their capacities to implement energy access projects; and it worked with several public and private sector programmes, integrating a variety of services that aim at achieving MDGs. In its journey of 4 years, LaBL has covered more than 1500 villages across India and is taking its footprints overseas. It has created a state-of-the-art solar lighting lab supported by MNRE and has facilitated establishment of Technology Resource Centers that are local institutions providing after-sales service to off-grid energy projects supported by DFID.

While innovations struggle to scale up, LaBL has focused on standardization of processes and knowledge management systems that have helped in increasing the efficiency and effectiveness of operations. These processes, though specific to LaBL, are generic enough to be adopted by other similar energy access initiatives. Some of these processes are enumerated below:

1 Standard designs of products and systems – LaBL developed design specifications for solar lanterns and central charging station that were optimised for giving reliable performance in most parts of the country. The designs were modular and components used were standardized. This helped in streamlining the procurement process, installation and servicing requirements, and also provided a brand familiarity with the initiative. While the designs are generally frozen for one year, the team constantly works at new designs and specifications which get inducted into the procurement process after successfully completing the testing, validation and approval stages of LaBL product cycle.

2 Enrolment of Partner Organizations – The implementation of LaBL critically depends upon the partnership that it creates with grassroots organizations and other local institutions. LaBL has developed standard procedures for enrolling a Partner Organization (PO) in implementing this programme. These procedures include, among others, accepting expressions of interests, due diligence, evaluation of strengths and commitments, selection guidelines, etc. The procedures provide clarity on roles and responsibilities of TERI as well as that of the PO, and spells out the benefits that the PO would get by participating in this programme. This process helps in streamlining the implementation of LaBL and facilitates in forging long term partnerships with local institutions that are capable of executing energy access programme of different nature.

3 Project Management System (PMS) – In order to effectively manage the database as well as monitor various stages of implementation, TERI using its in-house expertise, developed a PMS that not only stores and manages baseline information regarding the village, but it also helps in planning and monitoring various stages of implementation. The system provides MIS reports for in-house analysis, as well as for providing a regular feedback/ progress to sponsors, funders, etc.

4 Solar Lighting Lab – LaBL adopted a process of working with lantern designers, PV system integrators, etc. to jointly develop new/ customized designs for solar lanterns, central charging stations and other lighting products. Over the years this process has been standardized through the creation of a Solar Lighting Lab which gets into strategic tie-ups with different types of Technology Partners (TPs) for new design development, up gradation and customization, etc. The Lab also works as a testing and validation centre which regularly collects feedback from the users and field operators to improve upon the designs.

5 Technology Resource Centres (TRCs) – One of the larger challenges in scaling up off-grid energy access programmes is to provide efficient maintenance and aftersales services. While the conventional practice is to engage original suppliers and installers through maintenance contracts, LaBL learnt that this process was not very effective in providing routine maintenance and trouble-shooting. Hence, it conceptualized and created an institution called Technology Resource Centre which is trained to provide aftersales service and stocking of spares to start with, but would eventually be developed as training-cum-resource center for managing off-grid energy access programmes in totality in the region.

6 Mainstreaming with national programmes – TERI enrolled itself as a channel partner for MNRE and implemented the solar lantern charging station model, as a pilot within the national solar mission. Upon seeing the efficacy of this model, MNRE has approved it as one of the models that can be implemented by other organizations as well and seek MNRE's funding. Similarly, some of the new donor initiatives – for instance the Business Partnership Fund proposed by DFID and the Norwegian government – have also specifically mentioned solar lantern charging station model piloted under LaBL, as a viable business model and have included it in their programme of support targeted at the private sector.

7 Connecting with the masses through national and international media – For 3 years in a row, the national TV channel (NDTV) dedicated and aired a 24 hour show in disseminating information about LaBL and engaging masses in supporting it, both tangibly and intangibly. This programme has given a fillip to LaBL by creating awareness about challenges of clean lighting among masses and garnering support from across different segments of the society.

While there are many other steps that LaBL has taken in streamlining its operations, the above have been found to be effective in pushing the initiative from a mere pilot to a larger scale implementation programme.

Institutional capacity dimensions

Institutional capacity has several dimensions based on the different approaches towards institutional framework. Focussing on a process approach, the three main components are – Knowledge resources, Relational resources and mobilisation capacity (Healey, de Magalhes, Madanipour, & Pendelbury, 2003).

Knowledge Resources

The knowledge dimension is important in analysing an institutional capacity building in any sector, more so in the case of energy sector where access to the right knowledge and the ability to absorb new ideas and knowledge is crucial. In our energy innovation case studies, knowledge resources have been important in developing institutional capacity for the innovations in question.

In the Bangladesh SHS, lack of awareness, both at the level of policy makers as well as rural households was a big hindrance faced by the participating organizations. The efforts for filling in the informational gap were targeted towards political leaders as well as households. Given the difference in perceptions and conceptions of different stakeholders, the programmes on educating about renewable energy were especially responding to the knowledge needs of the target groups. At the level of households, the acceptance of SHS was possible only after several visits to demonstration facilities.

Capacity to absorb new ideas and learn may not be present at all institutional levels but such absorption and adaptation of new ideas at any one level can influence the entire institutional framework. The SELCO example of headlamps for midwives shows how adapting the innovation to the needs of the users helps in greater absorption of the new ideas amongst the target usergroups. In Cambodia, the users themselves had the knowledge and capacity, thereby making absorption easier. The Palm sugar producers, craftsmen and middlemen were already familiar with the Traditional cookstoves leading to an easier adoption of the improved Vattanak cookstoves. Certain new additions in the traditional cookstoves required

additional expertise for installation and utilisation which was addressed through specific training and capacity building initiatives. This information or knowledge has been lacking in the Laos Pico hydro systems case, where the local shopkeepers had limited knowledge about the systems and their technical specifications. The role of foreign traders or distributors remains large in assessing the market and introducing the relevant hydro-units.

Relational Resources

Relational resources encompass the networks in which actors are embedded and the interaction amongst them, including the rights, obligations and trust (Healey, Maghales, & Madanipur, 1999). It therefore includes different morphologies of social networks and power relation (Healey, de Magalhes, Madanipour, & Pendelbury, 2003).

Networks are crucial to understanding the way institutional capacity develops, progresses and delivers in the Asian energy sector. With the diversity of institutions, the embedded relations, power, interest and trust amongst different actors play an important role in strengthening institutional capacity. Social networks played a key role in the diffusion as well as uptake of palm sugar cook stoves in Cambodia. Three types of social networks were vital– 1) the use of different groups such as women or individuals within the homogenous group to diffuse the project, 2) establishment of new entities or encouraging participation in existing social networks for diffusion and sustenance and 3) Use of media and other informal networks to establish the programme at the national level.

The Bangladesh SHS programme is a collaborative effort of six partners, which includes, Government of Bangladesh, IDCOL, foreign and multilateral donor agencies (World Bank's IDA, GEF, and others), Participating Organizations (POs), manufacturers/suppliers, and professionals/experts. Each partner has a distinct role in the network and is equally involved. Of these, IDCOL is most active in facilitating the transfer of funds from the donor agencies to the implementing partner organisations. There are about 30 POs, including Grameen Shakti and the Bangladesh Rural Advancement Committee. These institutions have gained the confidence of the rural residents and thus function as trusted sources of SHS delivery.

In Laos, the interaction amongst different groups – traders, sellers and end users - in the service delivery chain influenced the diffusion of Pico hydro systems. Since the main distributors were traders from China and Vietnam, the role of local sellers was integral in ensuring that Pico hydro units penetrate the market. Generally, the traders sold the units to provincial/ district shops, which in turn sold it to village shops selling it the units to end users. However, since the local sellers had limited technical knowledge and no influence on determining the choice of product, it has resulted in a more dominant position for traders in the network. The shopkeepers merely act as an interface between the traders and the consumers. The trader network is highly dispersed throughout Laos, a factor which has played a key role in the mass uptake of the innovation.

The Indian National Mission for enhanced Energy Efficiency is heavily dependent upon the participation of different stakeholders to propel the mandate of energy efficiency. BEE has been leading the task of coordination through its various schemes and programs. BEE also enjoys the trust of stakeholders in terms of sharing expertise and experience in furthering the mandate of energy efficiency, even when such initiatives do not originate in the BEE itself. It is important to note that in addition to BEE's coordination and initiated interaction with multi-level stakeholders from the government (national, state and local bodies) and non-governmental actors like private enterprises, industries, civil society etc., there is interaction and support for BEE initiatives from these actors as well.

Mobilization capacity

Mobilization capacity refers to the opportunity structure that exists and the space occupied by actors to take advantage of this opportunity, including the power relations. It is the ability to activate knowledge and relational resources in a proactive manner (Rydin & Falleth, 2006). It also includes any external critical change agents that influence, either negatively or positively, the institutional capacity.

In SHS Bangladesh, Grameen Shakti played an active role in diffusion of the innovation. One of the factors that worked to their advantage was that Grameen Shakti was viewed as a 'progressive' and 'internationally recognized' development institution, which enjoyed the confidence of the rural households as well as the PO Selection Committee. There were other enablers, such as waiver of duties, tax benefits, etc. that allowed greater adoption of solar home systems. There are also incidents where such enablers from the government have not been required at all. For example, even without policy support Pico-hydro has a vibrant market in Laos highlighting the fact that context specific locally appropriate technologies have market potential. There has been in fact a negative change agent in Laos where small hydro has been ignored in the policy scenario due to an overt focus of the government to attract investments in large hydro. Thus, the uptake of Pico –hydro systems happened without any external policy and financial support from the government and the multilateral funding agencies.

In Cambodia, the role of global institutions such as World Bank and ESMAP that were involved due to provision of financing for the initiation and establishment of the project was significant for the inception of the project. The initial thrust from the global institutions has also led to national level entities such as the Ministry of Industry, Energy and Mines to engage in the improved cook stove programme at the national scale. Collaborative financing model helped in high feasibility of projects reach to different provinces in Vietnam biogas programme. The integration of the Biogas support programme with the Rural Development Policy as well as its contribution to the Renewable energy Action plan further strengthened the programme.

Box 4 Financing for Energy Access

Financing for energy access

To achieve the goal of universal energy access by 2030, a rough estimate of US$ 35-40 billion of investment per year is needed as per the IEA and AEGCC. However as per the latest figures available, the level of investment towards provision of energy access in 2009 was much lower at a level of US$ 9.1 billion. It is evident that a substantial increase from the current investment levels is needed to attain the objective of universal energy access by 2030.

What are the existing sources of finance?

The main sources of finance for energy access projects are multilateral and bilateral sources, country governments and private sector sources. This is also clearly evident from the fact that in 2009, of the total investment of $9.1 billion for energy access, 34% came from multilateral organizations, 30% came from domestic government in the form of subsidies, grants, etc. and, 22% from private investors including private banks, micro-finance institutions and 14% from bi-lateral organizations (ibid). It has been observed that though separate financing sources exist, but in practice two or more often work more in conjunction to finance energy access projects such as multilateral banks generally enter into partnerships with domestic country governments and/or private sector to deliver energy access projects. Also, different sources can play complementary roles in different stages of a programme for example in the case of a programme for small hydro systems in rural areas of Nepal, where 90% of funding came from public sources in the beginning, which was substantially reduced to 50% at a later stage.

What are the existing financing mechanisms?

At present there are different instruments sourced by different organizations, as discussed above, which are used to finance energy access projects at different stages. The major financing instruments used are in the form of grants, concessional loans and investment guarantees. Carbon financing is an instrument which has begun to be utilized for energy access projects under which the revenue is raised by sale of carbon credits within clean development mechanism and voluntary mechanisms. Further subsidies are also provided by government from budgets, sometimes supported by donor funds to support energy access projects.

What is needed?

To achieve universal energy access a scale up in financing is required at two broad levels i.e. project financing for energy service delivery and end-user financing for making energy service affordable.

Project financing:

Government funding: Commitment from national government reflected in policy documents and supported by budgetary allocations and sub-national strategies is necessary for success of energy access project.

Carbon markets as a source of finance: There is a need to provide upfront grants to meet CDM project development and transaction costs and to simplify the approval procedures.

Providing start-up and working capital loans: Financial support to technology suppliers to develop the market and for working capital has proved a useful strategy in the initial stages of market development. Capital subsidies on investment such as working capital loans extended to biogas companies to purchase plant accessories and appliances have proven useful.

Credit guarantee scheme to offset risks: A credit guarantee scheme can also play an important role to facilitate access to financing for energy enterprises without adequate collateral. A credit guarantee scheme is usually supported by government which acts as a reinsurance mechanism to ensure viability of the project. For example the credit guarantee scheme set up by SIDBI and Govt of India for micro small and medium enterprises could be considered for the clean energy. The Credit Guarantee scheme (CGS) seeks to reassure the lender that, in the event of a MSE unit, which availed collateral free credit facilities, fails to discharge its liabilities to the lender, the Guarantee Trust would make good the loss incurred by the lender up to 75-85 per cent of the credit facility (depending on certain conditions).

End user:

Locally appropriate financing options: There is a need to design financing mechanisms in a way that it aligns repayment amounts and schedules with consumers' incomes and expenditure cycles. They should provide alternative collateral requirements and have simple loan application procedures. A combination of subsidies with some form of micro-financing is needed to meet the costs of the projects.

Sources: (IEA, 2011) (UNDP, 2012)

CDM Mechanisms and Energy Projects

UN Secretary General's High-level Advisory Group on Climate Financing recognized carbon offset development as a stimulant for private sector investment. Moreover carbon finance offers a possible source of income for clean energy access projects with the revenue being raised through the sale of carbon credits within Clean Development Mechanism (CDM) and

voluntary mechanisms. Small projects have been facing constraints in benefitting from the CDM mechanism – a statement made by the Women Major Group Representative at the 1st Preparatory Committee Meeting of the UNCSD says, "The global funding programmes such as CDM or GEF are hardly accessible for local community or women's organisations. There is one first CDM accredited energy efficient stove project for women in North Nigeria, which took more than 2 years to get funded."

The energy innovation case studies analyzed in the study finds that larger government projects (with the exception of SHS Bangladesh) in Asia were able to benefit from carbon finance by organizing themselves to take advantage of CDM. GERES, for example says, "CDM methodology was not suited; intensive lobbying was needed" .

They had to instead resort to the voluntary emissions market instead. Other analyses (Parthan et al 2010) also find that projects that are mainly grid-connected renewable energy projects and industrial energy efficiency projects are able to benefit from CDM. As demonstrated in the study cases, small projects were able to benefit from the voluntary carbon markets. While there have been partnerships that have facilitated CDM capacity building activity in the study countries – as seen in Table 4 – small energy projects have not benefited from CDM.

Analyses finds that CDM has not succeeded in making any significant difference to smaller renewable energy and energy efficiency systems, such as small and household renewable energy and end-use energy efficiency. The reasons attributed are the following:

- Rigorous CDM modalities and procedures, especially the additionality testing.
- Geographical dispersion of low-carbon options in Least Developed Countries (LDCs) and Small Island Developing States (SIDS).

Table 4 Illustrative projects involving CDM capacity building in study countries

Partnership name	Governments	UN System	Inter-governmental organizations	Major Groups
Asia CDM Capacity Building Initiative	X		X	
Enhancement of regional strategy on climate change through the Asia-Pacific Network on Climate Change (AP-Net)	X	X		X
Partnership on Sustainable, Low Carbon Transport		X	X	X
Regional Partnership for Poverty Alleviation and Environmental Protection through Green Productivity - Integrated Community Development and Clean Development	X		X	X

Partnership name	Governments	UN System	Inter-governmental organizations	Major Groups
Renewable Energy and Energy Efficiency Partnership (REEEP)	X	X	X	X
Scientific Capacity Building for Sustainable Development in Developing Countries (CAPaBLE)	X		X	X
Methane to Markets	X	X	X	X
Sino-Italian Cooperation program for Environmental Protection towards Sustainable Development	X	X	X	X

Source: Compiled from CSD registered partnerships

What may be said is that while implementers of these energy projects are willing to bear the costs involved in CDM processes such as verification, the actors have still not been able to avail of the benefits from CERS. The UNFCCC CDM board has recognized obstacles faced by small projects and has taken steps to simplify requirements by small-scale projects, establish standardized project baseline and promoting the development of "programmatic CDM". Such programmatic CDM approach would be a cluster-based approach where smaller energy projects can organize themselves and benefit from CDM. This also points to the fact that capacity building for programmatic CDM would be required.

Insofar, while the discussions have centred around the Rio conventions, UNFCCC has not made any official statements in the Rio+20 discussions. Along with improvisation of mechanisms, another relevant aspect in context of IFSD is strengthening horizontal linkages within the UN system. Vertical linkages can be strengthened by involving national CDM authorities and also sub-national governments and municipal authorities.

Contributing to the discourse on an institutional framework for sustainable development

Given the above discussion, what kind of proposals could be made at Rio+20 based on this study? This kind of global meeting is one of the few opportunities to propose global institutional changes, such as creating new institutions or giving existing institutions new mandates, or to propose new global agreements. However, these options seem difficult. There have been no proposals for new energy institutions, and many countries seem to oppose new institutions at all, as a matter of principle, regardless of merit. No potential multilateral energy agreements are being considered (unless proposed climate change agreements are considered to be energy agreements).

Moreover, energy issues tend to be high priority in most countries, and are usually seen as related to national security. Success of renewable energy and energy efficiency initiatives tends to depend first on national regulatory frameworks, which are politically related to energy market structures. In most countries, this is beyond the potential reach of Rio+20.

Although we are not aware of any evaluation of international energy institutions in terms of effectiveness or other criteria, it would be better if any Rio+20 recommendations could be based on such an evaluation. Nevertheless, in contrast to the environmental field, in energy, there have not been so many vocal complaints or calls for institutional upgrading after the establishment of IRENA, so there is a question about what more should be done institutionally at the global level.

The Johannesburg Plan of Implementation (JPOI), adopted at the World Summit on Sustainable Development in 2002, list seven action points relevant to Energy for Sustainable Development:

1. Improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services - para. 9(a)

2. Recognize that energy services have positive impacts on poverty eradication and the improvement of standards of living - para. 9 (g)

3. Develop and disseminate alternative energy technologies with the aim of giving a greater share of the energy mix to renewable energy and, with a sense of urgency, substantially increase the global share of renewable energy sources - para. 20(c)

4. Diversify energy supply by developing advanced, cleaner, more efficient and cost-effective energy technologies - para. 20(e)

5. Combine a range of energy technologies, including advanced and cleaner fossil fuel technologies, to meet the growing need for energy services - para. 20(d)

6. Accelerate the development, dissemination and deployment of affordable and cleaner energy efficiency and energy conservation technologies - para. 20(i)

7. Take action, where appropriate, to phase out subsidies in this area that inhibit sustainable development - para. 20(p)

The case studies considered in this report address some of the above action points. All the projects studied contribute in one way or another towards enhancing access to clean and affordable energy services, for example, through solar home systems, small-scale biogas installations, improved cook stoves, Pico hydro units. In most of these cases, the focus has been on meeting energy needs of the unserved. By providing clean energy options to people with inadequate or no access to energy, these cases have contributed to introducing renewable energy in the off grid energy mix of the countries studied. Energy efficiency and saving has been the thrust of activities of the BEE in the Indian case.

Current discussions at the international level on a framework for sustainable development are veering towards the need for a more distributed rather than supranational governance given the adaptive nature of responses required, the differential capacities involved and the need for a wider participation to improve effectiveness and responsiveness to ground realities. The research discused here provides evidence that distributed strategies instead of a supra governance would be better as an institutional framework for Sustainable Development to deliver sustainable development outcomes.

The following key elements are relevant to the evolving discourse on sustainable development:

- Strengthening each pillar of Sustainable Development through more effective functioning of international institutions – this involves the strengthening of UNEP, increased democratization of economic institutions and a greater attention to social issues

- Balancing the three pillars of Sustainable Development and their increased integration through better coordination that strengthen the interfaces between green economy, social ecology and distributive justice over time (intra-generational and inter-generational) and across levels (global, regional, national and local)

- Achieving Sustainable Development goals through key Agencies that are responsible for implementation, financing, conventions and knowledge transfer

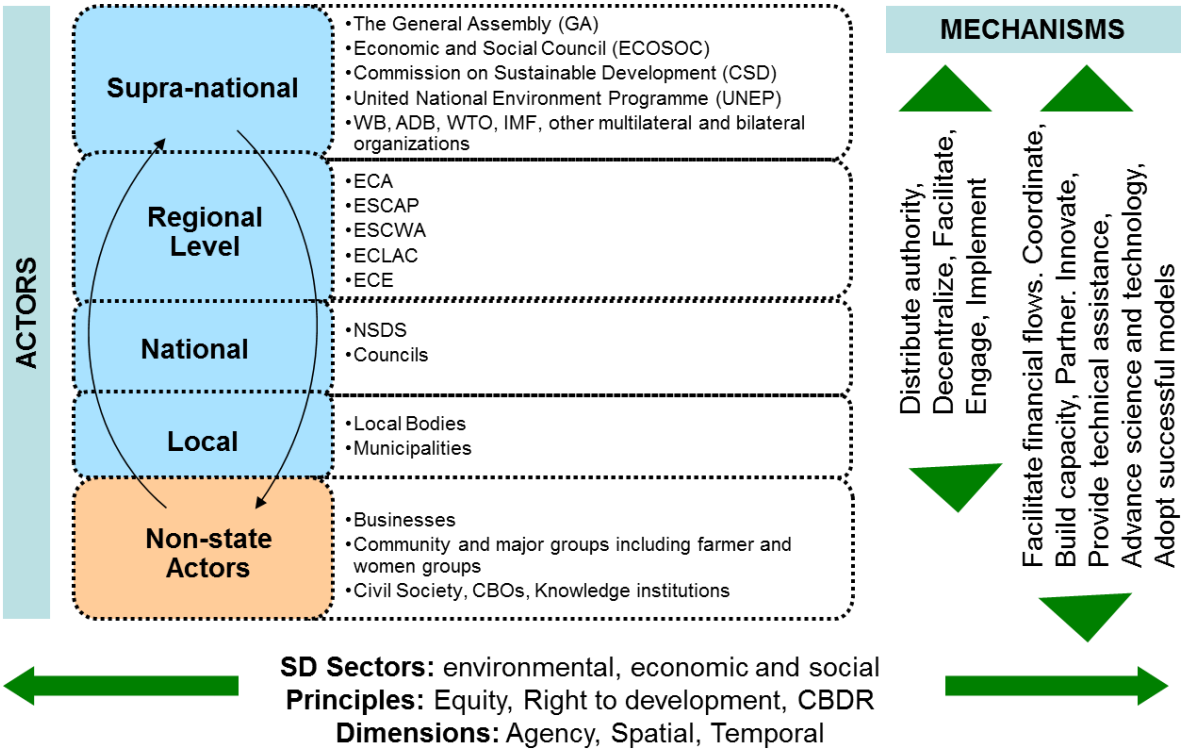


Figure 9 A multi-level, multi-actor framework for sustainable development

Our earlier research on the IFSD highlighted that the UN system does not lack institutions to deliver on sustainable development (MoEF, 2011). What it does lack is coordination and coherence within the system. Both coordination and improved coherence calls for working with specific actors, issues, tasks, and the strengthening of inter-agency and inter-sectoral mechanisms. Coordination and coherence is emerging as a key attribute of an IFSD, a coordination that is issue specific, with a targeted coherence across specific actors, issues, tasks. Coordination for achieving outcomes also needs to be at the pre –feasibility stage and amount to joint programmimg with clearly defined tasks for all partners (Desai, 2011). We also established that there is a need of mechanisms to address different issues and suit different actors at different levels. The current international discussions are around technology, financing institutional diversity (including engagement of groups), and mechanisms of co-ordination across institutions and emerging risk management issues. (UNCSD, 2011) Some recent discussions and submissions by countries at the 2nd Inter-sessional meeting have highlighted issues important for energy governance. Similar issues have also emerged in our case studies with respect to inter-agency and inter-level coordination, financing, capacity, technology transfer etc. The following table lists the key views and positions of the select Asian countries and the corresponding issues emerging from our study of projects and programmes.

Table 5 Views on IFSD and comments with respect to case projects

Views at the 2nd Inter-sessional meeting	Member state/ political group	Corresponding issues emerging from our case material
"Effective institutional frameworks at all levels strengthen the role of governments, at all levels, with fundamental lead of States, and encourage the participation of major groups and other stakeholders for the implementation of the sustainable development agenda"	G77 and China statement, para 14a	The study case studies demonstrate that in small scale energy innovations have the fundamental lead of NGOs as well as businesses. While the role of UN agencies for financing energy projects emerges, North-South collaborations between countries and major groups are observed. The question: How to strengthen interactions among all stakeholders?
Summary: Strengthening UNEP, reforming CSD, suggestion of SDC, Bretton Woods Institutions, and GEF	India, para 14-16	The question: How to facilitate financing and developmental mechanisms like CDM? How to make processes simpler for smaller projects?
"The institutional framework for sustainable development should meet four requirements: it should fully demonstrate the central and leading role of the UN; it should help reinforce the function of existing mechanisms such as the ECOSOC and the CSD; it should encourage the international financial institutions, the WTO and multilateral development banks to incorporate the agenda of sustainable development into their planning and programming, and cooperate with relevant UN agencies to maximize effectiveness; and it should help increase the voice and decision making power of the developing countries in mechanisms for sustainable development."	China, pg 2,para 4	Strong linkages in terms of financing with the multi-lateral system is seen. How to strengthen linkages with sustainable development with the help of agencies like the WTO and CSD?
"Finance, transfer of technology and capacity building for mountain countries are therefore crucial to reduce poverty and build resilience, promote sustainable development and pursue a low carbon and greener path. They have to be	Nepal, pg 2, para 7	Transfer of technology have taken place in larger government project like the biogas projects. Technology was then adapted to suit local conditions. How to

Views at the 2nd Inter-sessional meeting	Member state/ political group	Corresponding issues emerging from our case material
pursued in a coherent manner. Partnerships and collaboration with all Major Groups and financial institutions should also be strengthened"		accelerate transfer of technology for clean energy?
"Speeding up the process of MDGs achievements at the national level, and also defining the sustainable development goals as well as strengthening the UN Delivered One Programme, based on sound governance structure and further institutional coordination and cooperation"	Cambodia, para 4	The case studies demonstrate a distributed governance. There also exists inter-agency mechanism within the UN system. How to facilitate coordination at the project level from early stage?
"Whatever format IFSD is to take, we will want to see a full participation of major groups and of course special recognition of local and regional authorities as a sphere of government with a particular role to play, at national, regional and world level. Sub-national governments are crucial for successful implementation and should also have a voice in global policy making."	Local Authority Major Group statement	Sub-national level and cities play an important role in energy related projects. How to enhance the legitimacy of voices of local authorities in global policy making?
"Regarding energy, we demand an abolition of subsidies to fossil fuels and other harmful causes"	NGO Major Group	This is being considered by many domestic governments including China and India. This is sector specific and could be the mandate of national governments.
"Interdisciplinary and scientifically rigorous research, monitoring, observing, and indicators will be needed for all priority areas, such as food security, water security, energy for all and others."	Scientific and technological community	In general scientific community conducting global assessments and informing policies at the macro-level. How to deploy information and communication technology tools at the grass-roots level?
"…the Conference focus on stimulating innovation, specifically in the deployment of new knowledge and technology, as much as pure research and development. We already have the majority of the technologies, financial resources, and management skills necessary to	Business and Industry	How could enabling frameworks work for small scale innovations?

Views at the 2nd Inter-sessional meeting	Member state/ political group	Corresponding issues emerging from our case material
make the green economy a reality. The enabling policy framework, and the investment funds available, must be directed at the innovation gap in order to change the pace of sustainable development efforts."		

Role of Rio+20 in strengthening energy governance and linkage with sustainable development

Identifying the best way to address the topic of energy within the Rio+20 discussions is relatively complicated. Energy itself is not one of the main topics, and while the promotion of multi-stakeholder participation is one of the main undercurrents of the meeting, the discussion of IFSD up to now has focused more on the reform of UN institutions, which gives an impetus to top down and organizational thinking, although that is not necessarily the intention of the conference.

After countries and other stakeholders submitted their ideas in November 2011, it became clear that many countries were interested in expanding the scope of the Rio+20 agenda to consider specific topics, and energy was one of the more popular ones. At this stage (spring 2012), a list of priority issues has emerged, and Brazil has added several days to the Rio+20 schedule to discuss them. This interest by many countries in many specific sustainable development issues is very encouraging, and hopefully indicates a desire to make more significant progress.

Another point to consider is how all of the different topics of sustainable development, including energy, relate to each other. Energy is a key crosscutting issue, linked with all three pillars of sustainable development, including many environmental issues such as climate change and air pollution (which in turn also relate back to the economic and social pillars of sustainable development). Indeed, one of the most difficult issues of sustainable development and its governance is how to address multiple, complex, and specialized but related areas into an integrated coherent strategy. Because of this special position of energy, it is important to consider how to address energy as part of the larger whole of sustainable development, and not just as a standalone topic, although, to be sure, it is also important to address specialized energy related issues.

Therefore, IFSD may be the logical place to address energy issues in a more systematic way, in conjunction with other sustainable development issues. Two major reforms of overall sustainable development governance are on the table, which have a visible critical mass of support, are the creation of a Sustainable Development Council (SDC), and the adoption of

Sustainable Development Goals (SDGs) to be related to the upcoming renewal of the Millennium Development Goals (MDGs). "Sustainable energy for all" is already mentioned as one of the potential SDGs in the Rio+20 Zero Draft document.

Regarding the potential SDC, there are three main options, a) creating a completely new body, b) transforming ECOSOC into the SDC, and c) transforming the CSD into the SDC. The last option may be more politically feasible, since there is little enthusiasm among countries to create new bodies without eliminating existing ones, and a change in ECOSOC would require an amendment to the UN Charter. This is also reflected in the zero outcome documents. (UNCSD, 2012) Despite the interest in a potential SDC, there has been little time for a thorough analysis of its potential scope, focus, and organizational structure. We would argue that given the importance of distributed strategies and arrangements to enhance effectiveness on the ground, the SDC could be an umbrella organization that serves to coordinate, through key agencies, the mechanisms required to bring that greater integration across pillars.

In addition, it also seems clear that the SDC needs to incorporate significant multi-stakeholder participation. At this stage, we can still say that it should not be a top-down organization, and it should allow ample scope for customized solutions to take into account differences in local circumstances, both within and between countries. Consideration will need to be given to how a new SDC relates to other international organizations and bodies related to energy (and all other areas). Consideration of how the SDC will relate to regional and national bodies including the regional commissions and regional and country offices of other UN bodies. Would the SDC itself have some kind of regional component? For energy, it is particularly important to consider how the SDC would be related to IRENA and the multilateral development banks.

At this stage, it is difficult to assess how an SDC could be organized to best address energy issues, especially in connection with all three pillars of sustainable development, and in conjunction with other substantive issues that should also be on the table.

Some of the key challenges that could be linked to the IFSD in the context of this report also include addressing barriers and challenges around capital access and mobilization, utilizing local financing mechanisms, developing innovative financing mechanisms, and accessing carbon finance, supporting early stage innovation (UNIDO).

Our cases flag the following questions for further consideration in the IFSD debate:

- How can interactions among all stakeholders be strengthened and enhance the legitimacy of voices of local authorities in global policy making?
- How can finance and developmental mechanisms such as the CDM be made simpler for smaller projects?

- How can energy linkages with sustainable development be strengthened with the help of agencies like CSD?
- How can we accelerate transfer of technology for clean energy?
- How can coordination among stakeholders at the project level be strengthened from an early stage?
- How should information and communication technology tools be deployed at the grass-roots level?
- How could enabling frameworks work for small scale innovations?
- What could be the linkages of such frameworks to existing regional mechanisms such as Clean Energy Ministerial, IRENA, APEC, APP, ASEAN, and Energy Ministers Meetings?

Concluding observations

In this study we sought to study the evidence from innovative and effective energy practices in Asia on mechanisms that can achieve sustainable development outcomes such as energy access and clean energy transitions, and which could have some lessons and recommendations to the discourse on IFSD around financing, technology and capacity building, institutional diversity and engagement of stakeholders, improved mechanism for coordination and management of risks of clean energy.. We did this through selecting from data bases on innovative and deemed successful energy practices in Asia, and studying them for what makes them work, who are the actors that make them work and whether they are replicable and scalable. The study also examined policy innovations in the energy context for their planning process, implementation process and overall sustainability of interventions.

This study has identified several important ways in which international energy governance could be strengthened.

First, governance needs to promote decentralized rather than centralized solutions. Renewable energy comes in a variety of forms, and it often needs to be customized to local conditions in order to be effective.

Second, in order to effectively develop and implement customized local solutions, multi-stakeholder participation is required – not only in the implementation stage but also in the planning stage. This requires knowledge sharing and cooperation at an international level, which will assist in identifying the suitable technology for such customisation.

Third, additional capacity building is needed for all actors. In many developing countries, policymakers need practical knowledge about what kinds of policies could be effective in promoting renewable energy and energy access taking into account the diversity of local conditions in their countries. They also need knowledge about how to effectively manage multi-stakeholder participation processes. Many policymakers are accustomed to more traditional top-down decision making processes for large scale fossil fuel energy projects.

These points have important implications for the best form of strengthened energy governance; taken together, they suggest that a more distributed governance structure may be more appropriate and effective than one that is more centralized and top-down.

Specific lessons for the IFSD discourse from our cases

- The detailed case studies undertaken comprising various projects, programmes and policies offered a diverse overview in terms of scope, nature and reach. However, some important themes string together the abovementioned key messages that emerged from different case studies. The most important of these are diversity and dynamism. The projects and programmes involve and engage with a diverse set of

institutions and stakeholders. They are dynamic and flexible in design and therefore incorporate the lessons from experience and evaluation based on feedback and monitoring from time to time. A flexible approach helps the programmes and projects to ensure that the methods of operationalization are not rigid enough to come in the way of attaining the objectives of providing energy access or promoting clean energy, as the case may be.

- It is important to not try to develop "one-size-fits-all" policies. As our cases showed, market conditions have to be considered by the project developer to be successful. Local market conditions are highly variable, even within specific countries, so policies need to be flexible. For example, in some countries, domestic manufacturing capacity for renewable energy equipment needs to be strengthened.

- Traditional 'hard' paths to energy provision have high costs and need economies of scale for their success, but the new 'soft' paths emphasize customization according to need, and yield long term benefits albeit at a higher upfront cost borne by the customer.

- Most of the programmes show some degree of decentralisation. While in some cases, the bottom up approach is stronger, the top down orientation has been stronger in others. Hence, there is a mix of top down and bottom up approaches with each feeding into another.

- The effectiveness of the cases that we have studied highlighted actions across two fronts: many actors and multiple mechanisms. While the cases seemed to be a "bottom up" participatory approach at first glance, the detailed studies suggest that these were in fact "multi-level", multi actor approaches. The cases suggest that a bottom up approach may not be enough by itself, but it may need to be accompanied by national or global support measures & coordination.

- Our cases suggest that the following mechanisms have been important in achieving improved energy outcomes

    - **Innovative financing mechanisms**
    - **Needs based customized approaches**
    - **Capacity building for technology absorption**
    - **Mechanisms for cooperation and coordination**
    - **User buy in**
    - **Market development strategies and market driven programmes**

- **Risk management**

On the policy front, our key observations are as follows:

- Energy policies are basically national, and most countries are already prioritizing energy, especially energy security. In countries such as China and India, there is a key emphasis on Renewable Energy or Energy efficiency as these are seen as supplements not substitutes to fossil fuels, since there is still a large unserved demand.

- Success of RE/EE tends to depend first on national regulatory frameworks, which are politically related to energy market structures. RE/EE policy also is connected to economic competitiveness, trade issues (including technology transfer and intellectual property), and industrial policy, so win-win strategies may be tricky. But countries like China with strong first mover (early mover) strategies are developing competitive advantages.

- Renewable energy and energy efficiency are the two key axes around which "co-benefits" strategies are being developed – they add to energy supply but also are less carbon intensive.

- The potential for intra-regional technology cooperation and learning is significant and is critical for addressing energy security in the region. In this regard, IRENA could play an important role in Asia by assisting Asian developing countries by fostering information sharing on good practices and the latest renewable technologies through various means, such as the organization of expert/practitioner workshops, compilation and sharing of essential data on the website, and providing technical/policy advice.

- Financial sector policies or banking practices would need to be more sensitive to energy access and RE&EE initiatives. Perhaps need for some risk funds to help support such decentralized, customized initiatives.

- International mechanisms, such as the CDM, have been successful in the region. However, these mechanisms need to be strengthened and streamlined and simplified for a more effective impact. CDM rules & procedures are too complicated for local entrepreneurs and CDM consultants are not available in all countries.

Our research also reinforces our earlier suggestions for the IFSD and serves as important messages for existing international financial and implementing institutions like the WB, UNDP, and ADB (MoEF, 2011):

Firstly, **improved implementation through better coordination mechanisms** such as:

- "**Clearing houses**" internationally of ideas, science, experience, technologies, and local knowledge that can be used to address global national and local energy access concerns.
- **"Centres for transfer of green technology"** and improved energy practices;
- "**Light Houses**" and early warning systems to warn and steer development that is of course through the use of tools that measure energy related environmental degradation; energy access indicators
- **incubators of energy innovations**;
- **Institutionalize Communities of Practice** or **learning networks** to share experiences and knowledge. Learning networks should have multiple foci - global, regional and local. Global, so to be able to transfer good practices where they exist, and local, to ensure relevance to local concerns and stresses. Given the nature of the linkages, the understanding and solutions suggested would be sensitive to livelihood issues, using a diversity of approaches and case studies.
- **"Recover the local"** in International Energy Governance systems to ensure better adaptive responses to socio-ecological change.

Secondly, a **multi-actor process and frameworks of cooperation between state actors, non-state sectors, business and the donor community**; Issue specific task forces are required to ensure coordination between agencies at different levels: global, regional, national, local;

Thirdly, **mechanisms to improve Capacity building:** Capacity building and technological support that responds to and addresses the present and future challenges needs to be provided to help strengthen a national energy governance system. There is need to support networks of institutions who would work to strengthen the linkages between energy and development through a focus on learning and capacity building, sharing experiences and knowledge bases among various relevant stakeholder groups Fourthly, **Innovative Financing** to support local level capacity building to access finance for risky, less proved investments in more sustainable energy systems, respond to the greening of markets, especially by SMEs; acquire information and increase the effectiveness of government, especially local, in addressing ecologically sustainable development objectives.

Fifthly UN and multi-lateral institutions, need to significantly **strengthen the call for clean energy transitions** through the following:

- Financing (including shifting more existing financing away from fossil fuels to RE/EE) and strengthening capacity building and coordination of existing energy related institutions.

- Reemphasizing existing proposals to reduce and eliminate fossil fuel subsidies (and shift the revenue to RE/EE promotion) are also relevant.

- Supporting innovative, responsive and partnering approaches. It will need to use IT and social networks better not only to diffuse technologies, but also to create a demand for technology from the grassroots, from local governments; it will need to set up innovation platforms, and support for energy problem solving shops.[2]

Energy is being addressed through top down as well as bottom up grassroots level solutions and it is important that IFSD discussions recognize this phenomenon. There is an important role of sub-national entities in propagating clean energy access and the global and regional institutions have to play their part in supporting these endeavours.

2 TERI 2011, study on International Environment Governance for the Government of India; Clean Energy Group, 2011

Annexure 1: Understanding and documenting emerging energy practice and innovations in Asia

SELCO India

Brief description

SELCO India is a for-profit social enterprise[3] which provides energy services through solar PV technology to households as well as commercial and industrial establishments, though the main target market is rural households. It offers a number of products such as Solar Home Systems (SHS), solar water heaters, lanterns etc. however it started with SHS in 1995 (the year of its inception), which even today is its core business. It sources its components for SHS from outside (95% of its panels are from Tata BP and electronic parts are sourced from local vendors). It sells the SHS, installs them in the households and charges them a fee for servicing and maintenance which is done every six months. Its distribution model is closest to that of an interior decorator or kitchen remodeler: salespeople go to a client's house, discuss their power needs, and determine how many lights, plugs, etc. are right for them.[4]

Its success lies in an innovative financing mechanism through which it is able to sell SHS to low-income households. While SELCO itself doesn't finance the systems, it has built up strong relationships with commercial banks and regional rural banks (called Grameen banks) that finance the systems. As SHS are expensive and most consumers cannot afford to pay upfront, it has devised a financing scheme with financial institutions, wherein loans are provided to households so as to break the cost barriers into staggered payments over a 3-5 year period. It has turned out to be a win-win situation for households as well as SELCO. The household gets clean, safe light at an affordable price while SELCO is able to sell its products and make a profit.

It has partnered with local technicians who handle the installation and the maintenance of the systems. These technicians, all hired locally, are trained and work for SELCO on an income cum-commission basis. This also serves as a critical link between SELCO and the rural consumers as the technicians understand the language and their needs better. In addition, it also partnered with institutions such as SEWA Bank, to provide customized products for rural women and street hawkers. It has recently tied up with Prakti which designs biomass cookstoves for the rural households. Prakti promotes its cookstoves using SELCO's retail channel.

Figure below shows the business model of SELCO.

3 Social enterprises are new types of business which may earn profit but are focused on their social goal. These organizations lie somewhere between the market and the state and are often associated with concepts such as 'third sector' or 'non-profit sector, though may not be necessarily one.

4 http://energymap-scu.org/selco/

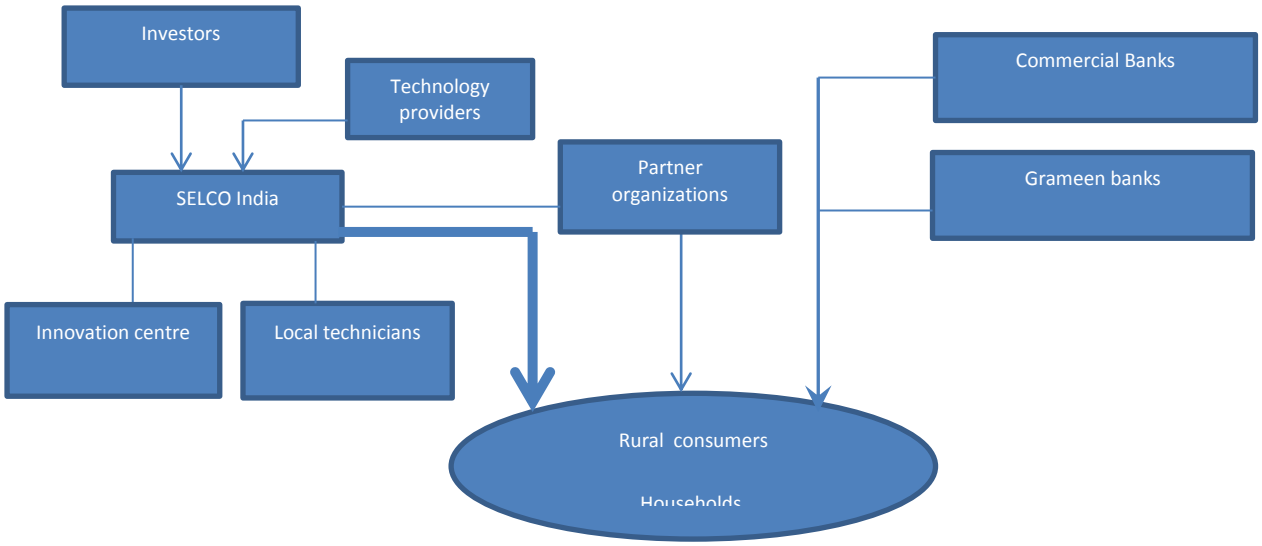
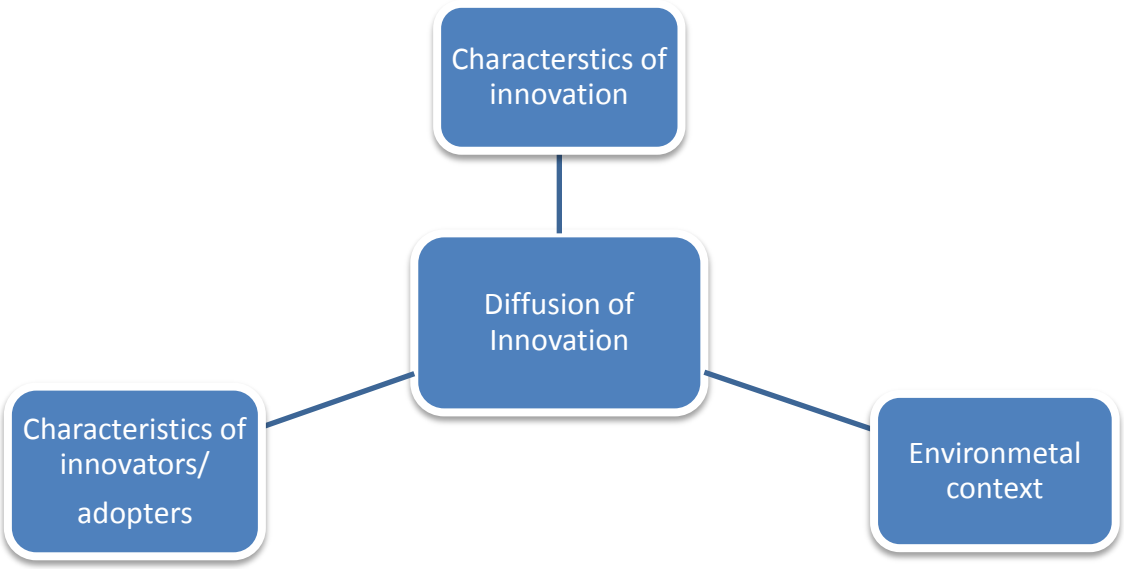


Table below shows the mapping of actors connected with the SELCO model.

Level	Technology provider/ Suppliers	Enabler	Financier*	Business/ Market entity	Knowledge provider	Target	Partner organization
Global	Tata-BP	UNEP					
Regional							
National		MNRE					
State							
Local	Local electronics vendors		Commercial Banks, Grameen banks	SELCO India		Rural and peri-urban households, small commercial establishments, institutions	SEWA Bank, local technicians

**Financier here refers to the financier for the target population and not SELCO*



Characteristics of the Innovation

Private versus public benefits

The SELCO model largely has private/ individual benefits where the individual households, commercial establishments, rural communities who bought the systems have benefitted from the improved lighting- in terms of better illumination and better health. The substitution of smoky kerosene lamps with solar lights has led to safer and healthier environment. For example, for vendors, produce from stalls is displayed better, and they do not have to work with the smell and heat from kerosene lamps. By providing income generating opportunities, the model has also resulted in increasing the disposable income of the consumers, essentially improving their state of well- being.

The benefits are not just restricted to the individual household but also impact the larger social unit, the community. Clean and safe solar lighting also has tangible benefits for the community such as better education and health, effectively addressing their social needs.

At the larger level, the model indirectly contributes towards the social goal of providing clean energy access to the unserved segments of the population while simultaneously improving the electrification rate of the households in the country. Secondly, by using clean technology, there is a positive impact on the environment.

It is evident that in the SELCO model, the larger benefit has been greater than the sum of individual benefits.

Costs incurred

Costs of an innovation can be defined in two ways – a) direct and indirect costs incurred by the innovator, b) direct and indirect costs incurred by the adopters. In the SELCO case, apart from the direct costs which the consumer incurs on purchasing the system, there are certain indirect costs as well. The SHS are purchased on credit from micro-finance institutions, the

transaction costs involved in paying at the nearest centre, learning how to handle the systems can also be termed as indirect costs. While these costs may not be significant as typically door-step financing is provided for most of the households barring few[5], they are in fact costs incurred for the adoption of the innovation.

SELCO also incurs costs apart from the direct costs (sales, maintenance, salaries, overheads etc)[6]. As it customizes each system as per the energy needs of the consumer, the transaction costs involved in understanding the users requirement and customization are significant. For eg, SELCO devised a customized product for mid-wives in the rural communities namely, solar headlamps. Mid-wives who deliver children in rural areas, in the absence of hospitals balanced a candle or a lantern with one hand during the delivery. SELCO designed solar head lamps for them suiting their requirements and facilitating the process of child delivery. There are numerous other cases as well.

Having said that, the diffusion of innovation mainly depends on the costs incurred by the adopters, in this case the rural consumers. Since costs were much lower than the benefits in this case, the consumers adopted the new systems faster, which helped SELCO in expanding its business significantly.

Characteristics of the adopters/ actors

Societal entity

The adopters of the SELCO model were mainly small collective actors such as households, communities, banks, small enterprises etc. In the beginning, SELCO mainly targeted rural households. It later added small commercial establishments (small shops, street hawkers, bidi makers etc) and institutions (banks, schools, religious organizations etc.) as its customers. It is evident that adopters of this model were not a homogenous group. While most of them belonged to the 'bottom-of –pyramid' or the underserved community with fluctuating income streams, their energy needs were different from one another.

The adoption of an innovation is also influenced by the communication channels used by a societal entity. Small collective actors typically use direct interactions and social networks as the mode of communication, which aids in the diffusion of innovation in such closely knit communities. The same has been observed in this model, where it mainly relies on word of mouth marketing from satisfied customers. The MD of SELCO, Mr Harish Hande says *"We do not have any marketing budget. We put all our efforts into pre sales and post sales services, which is marketing for us. All our customer service agents don the mantle of marketers when they are*

[5] Payment mechanism depends on the type of financial institution. In case of commercial banks, consumers pay at the nearest branch while those who have availed loans from Grameen banks pay their agent (door-step payment option).

[6] The total costs incurred by SELCO on a four light SHS is about Rs 17,000. The systems are sold at a sale price of Rs 20,000 (approx.).

dealing with the customers. We encourage them to interact with the neighbors, the local community so that they have a deep understanding of the problems that the people face."[7]

Status characteristics

The innovation literature suggests that an actor's social position in a network significantly modulates the likelihood of adoption (Wejnert B., 2002). This particular aspect has been found to be true for the SELCO case as well. SELCO initially had a difficult time convincing banks to provide credit to the "non-bankable" strata of the population. After two and a half years SELCO was finally able to convince the Malaprabha Grameen Bank, to sanction INR 1.5 million for financing 100 solar lights. It got hold of the bank's internal notice, informing its branches about their decision to finance solar lights and went with it to other rural banks. Since Malaprabha Grameen Bank was viewed as a progressive bank in rural Karnataka, some of the other rural banks did not hesitate to emulate them, convinced that Malaprabha Bank would have done their due diligence (Mukherji S, 2011).The rural household similarly emulated the other families in their community adopting SHS provided by SELCO.

Socio-economic characteristics

As pointed out previously, SELCO mainly targeted the underserved communities and small commercial establishments with very limited financial resources, who could not afford the down payment of SHS. On the other hand, there were micro enterprises such as weavers, farmers etc who had cyclical cash flows. In fact there were vendors who said they could manage 10 Rs a day but not Rs 300 a month. Taking into account these factors, SELCO worked with rural banks for an appropriate payment schedule matching the income streams of the target groups. However, pre-dominantly SELCO has sold systems to rural consumers who could pay for the systems. It has not targeted the poorest of the poor consumers residing in very remote locations with poor terrain, limited transport access. It only services consumers in those areas which are within 3 hours of travelling distance from the service centres. This is a key factor which is responsible for SELCO's growth, which reiterates the fact that economic situation of actors is an influencing factor in the up-take of the innovation.

Familiarity with the innovation

SELCO had to tackle some challenges in securing its first customers. While it was difficult convincing the first few households about getting SHS installed in their premises, once it managed to establish the fact that the systems work, later it was easier to sell it to others. One of its early customers was a wealthy, but skeptical, areca-nut farmer. The farmer's mother, however, showed interest in the proposition. She gave SELCO Rs. 15,000 and told them to install the solar panels and lights on the sly. That night, when there was a power outage, the farmer saw his field lit up, and his reticence to embrace solar lighting turned into enthusiasm (Wharton, 2010). After initial hurdles, securing customers was not difficult, as

[7] Mukherji S, 2011

the households increasingly saw their neighbors; friends use the systems and the learning through such observations facilitated adoptive behavior through a large extent.

Similarly SELCO was able to sell SHS to banks which faced power cuts and unreliable power supply. It immensely helped in removing the doubts which the banks had about the viability of SHS and encouraged them to provide finance after they experienced the benefits themselves. The adoptive behavior was facilitated once the perception of risk was substantially reduced.

Environmental context

Geographical settings

SELCO mainly concentrated on Karnataka before spreading out to other states in India. The reason for basing its model in Karnataka was because it was a hub of financial activity, being the birthplace of five of India's largest banks- Syndicate bank, Vijaya Bank, Canara Bank, Corporation Bank and Karnataka Bank (SELCO, ___). It also helped that the state utility had not provided grid extension to the areas, which SELCO was targeting.[8]In addition, there were frequent blackouts and brownouts. These factors created a conducive environment in establishing a base in Karnataka.

Another key factor, influencing the rate of adoption is geographical proximity because proximity can affect the frequency of communication and facilitate imitative behavior. Taking SELCO's example, neighboring states of Maharashtra and Andhra Pradesh and Gujarat have also adopted the model.

External environment

SELCO assumed largely a free market for service in India (Rogers J et al, 2006). India's liberalization in early 90's helped SELCO to attract foreign investment. Additionally GoI's thrust towards renewable energy especially promotion of indigenous manufacturing companies, further increased its opportunities of sourcing components locally.

Some of the global institutions such as the UNEP's programme on solar loans, were influenced by the SELCO model .The Indian Solar Loan Program launched by the UNEP in 2003, was successful in accelerating consumer financing for solar PV systems in South India. The program used an interest rate subsidy and a very small per transaction grant to ramp up consumer lending activities for solar PV systems in south India. The program engaged five banks including Syndicate Bank and Canara Bank and their rural affiliates with which SELCO was working and provided them with a combination of vendor qualification, interest subsidies and market support which in turn were fully passed on to the consumer.

[8] 50% of households in Karnataka have little or no electricity access

UNEP's subsidies allowed lenders to reduce end-user interest rates from a new standard of 12.5 percent to a special 5 percent rate.[9]

Challenges

While the SELCO model has been widely recognized as a successful model, there are a few challenges that SELCO faces in terms of scaling up the traditional way. Since the products are customized as per individual needs and local contexts, it is difficult to scale up as it requires standardization, which is antithetical to SELCO's business philosophy. SELCO stresses on the "replication" of specific processes in other geographical regions rather than scaling up, where the aim is to create small SELCOs in different parts of the country. Secondly, SELCO's target market is not the poorest of the poor rather the uppermost strata of the poor population who are able to afford the SHS. SELCO still has not penetrated deeper into the BoP market.

SELCO faced some setbacks in 2005, where it struggled to align the interest of its investors with its social mission. This highlights the fact that structuring a social enterprise as a business or as a nonprofit is an important one for many entrepreneurs with a humanitarian mission. For example, SELCO's management faced pressure from its investors when supplies of photovoltaic panels declined. The resulting crisis was resolved through a "cramdown" of existing investors and the recruitment of fresh capital from investors more aligned with the company's mission. (Beck, 2010)

Key takeaways from the case:-

- ***Innovative financing*** **-** Innovation is not necessarily about creating something new, rather it is about doing things differently. This can be seen from the SELCO case. While the solar PV technology was already prevalent in the market, SELCO helped in devising innovative financing schemes tailored to the needs of the rural markets which played a pivotal role in the uptake of the model. It also highlights that access and affordability for energy can be addressed simultaneously given appropriate financing mechanisms and mobilization capacity of the entrepreneur.

- ***Sustainability*** **-** Market driven programs which are less reliant on government subsidy are sustainable in the longer run. While subsidies are required in the initial stages, they can stifle the development of a commercial market and create a "subsidy mindset" in the consumer where he/she purchases the system only because it is subsidized but not because it is preferred option of energy supply. SELCO example proves that market oriented approaches are stable, growth oriented and can create an impact at the grass-roots level. It also highlights that sustainability of an innovation also depends on its dynamism, in other words how well it can adapt to changing conditions. This is because an innovation introduced earlier may not be innovative in

[9] http://nexus.som.yale.edu/design-selco/?q=node/108

the current scenario and may eventually become obsolete with no takers. In SELCO's case, it managed to adapt well to the changing conditions and it has slowly diversified into selling other products as well, such as improved biomass cookstoves to the rural population.

- ***Needs based approach-*** Traditional models of energy delivery require standardization of products, however real delivery of services requires customization of services based on individual needs. SELCO case demonstrates that customization is key, when it comes to serving rural markets and provides lessons for replication in other parts (in similar conditions).

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Solar Home Systems Bangladesh

Background

Over 58 percent of Bangladesh's population was not connected to the electricity grid in 2006.[10] The Infrastructure Development Company Limited (IDCOL), a nonbanking financial institution, established by the Government of Bangladesh, started its solar energy program in January 2003. This project was initially set up through a loan and grant program supported by the World Bank's International Development Agency (IDA) and Global Environment Facility (GEF). IDCOL promotes dissemination of solar home system (SHS) in the rural areas of Bangladesh through this project.

This program is a collaborative effort of six partners, which includes, Government of Bangladesh, IDCOL, the donor agencies (World Bank's IDA, GEF, and others), Participating Organizations, manufacturers/suppliers, and professionals/experts.

The donor agencies provide grant and soft loans through IDCOL. IDCOL offers participating organizations (POs) -- microfinance institutions, nongovernmental organizations and private-sector institutions that meet program eligibility criteria, both credit and GEF grants to purchase solar home systems. IDCOL also provides grants to reduce SHS cost as well as to support the institutional development of the POs.

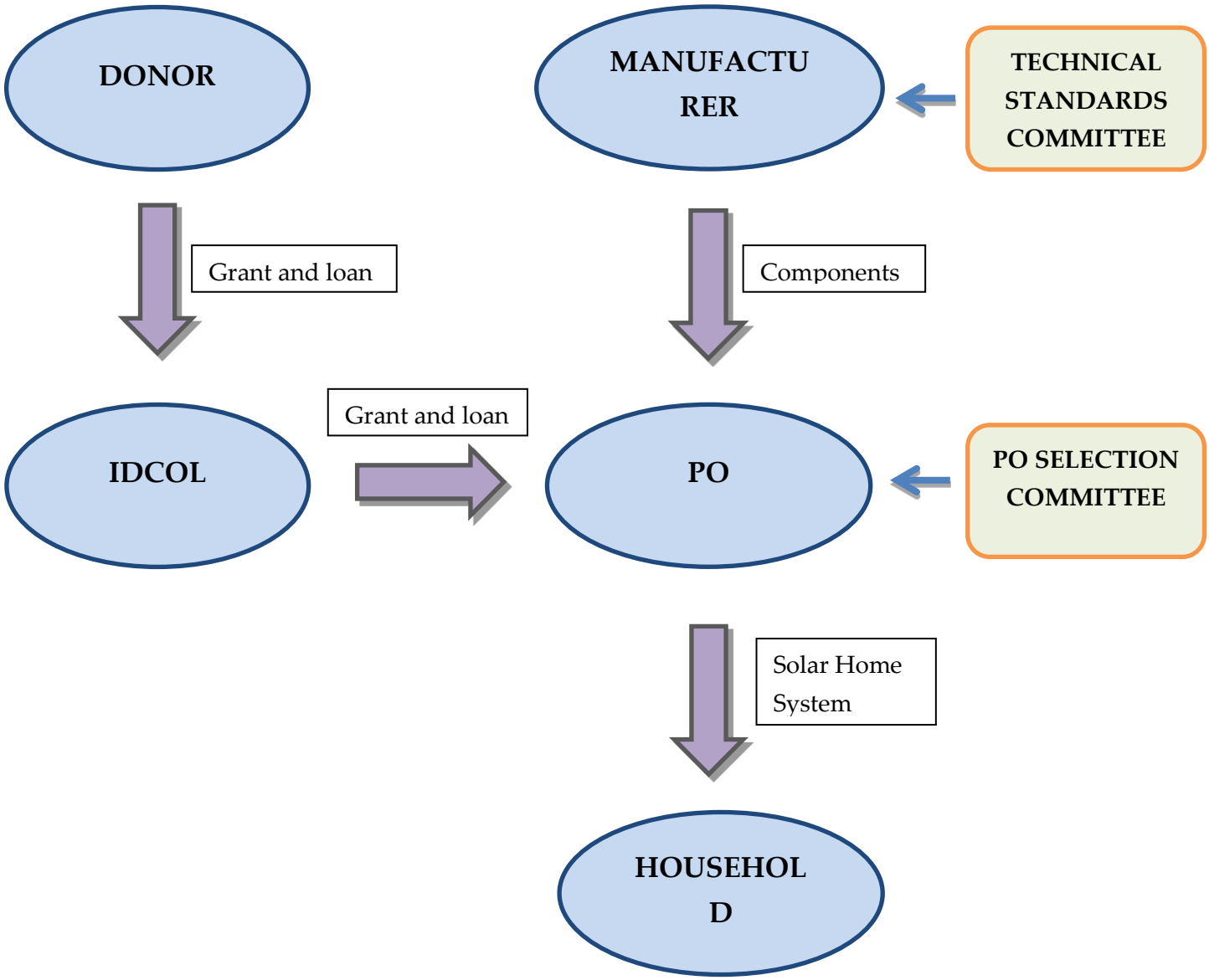
POs receive down payments covering at least 10 percent of the system costs from the households interested in purchasing SHS, and enter into a lease agreement with these households and install the system. IDCOL implements this project through 30 POs -- key POs include, Grameen Shakti and the Bangladesh Rural Advancement Committee. These institutions have gained the confidence of the rural residents and thus function as trusted sources of SHS delivery. The POs use a small portion of the grant for institutional development, while the rest is directed towards capital cost buy-down. The key duties of the POs include selecting the areas and households to install SHS extending micro-credit to the rural households; and installation of SHS and provide after-sales services.

The initial installation target set was 50,000 SHS in off-grid areas by 2008, but the target was achieved much ahead of time. More than 179,000 SHS were installed by 2008, far exceeding the expected target. Also, the original target was met at a cost savings of about US$ 2 million.[11] Following the success, German Development Cooperation (KfW), German Technical Cooperation (GIZ), Asian Development Bank, and Islamic Development Bank have extended their support.

Project layout

[10]Jamaluddin, 2008.

[11] Planned IDA/GEF program funding was US$ 18 million, which included US $ 2.87 for technical assistance



The table below shows mapping of actors connected with this project:

Level	Technology provider/ Suppliers	Enabler	Financier*	Business/ Market entity	Knowledge provider	Target	Partner organization
Global	Japan, India, China		IDA, GEF, German Development Cooperation, German Technical Cooperation, ADB, Islamic Development Bank,				

Level	Technology provider/ Suppliers	Enabler	Financier*	Business/ Market entity	Knowledge provider	Target	Partner organization
			USAID, International Finance Corporation				
Regional							
National		Government of Bangladesh (GoB)	IDCOL				
State							
Local	Local manufacturers who manufactured tubular plate batteries, flat type batteries and fluorescent lamps.					Rural households	30 Participating Organizations (Grameen Shakti, Bangladesh Rural advancement Committee, etc.)

Characteristics of the Innovation

Public versus private consequences

SHS is replacing the regular kerosene lamps in rural households. This avoids the fumes and fire-risk associated with such lamps. Also, kerosene prices are continuing to increase due to rising world oil prices and higher transport costs. Typically, rural households in Bangladesh have six to eight members and spend 600 Taka per month on kerosene for lighting. Instead of using kerosene, the families are now using 40 Wp SHS which allows them to use 4 lights and a TV. Their monthly installment for SHS is 600 Taka, and three years after installation of

SHS, they are the proud owners of the SHS and enjoy electricity for at least 17 years.[12] Thus, the economic benefit of owning a solar home system would only continue to increase.

SHS has significant income-generating potential. Many businesses can remain open for longer hours; these include tailoring shops, restaurants and grocery shops. SHS has also led to increased production in areas such as fishing, rice processing, poultry farming and handicraft. Clearly, this program has private/individual benefits.

Having said that, the solar home systems also bring significant social benefits – many clinics use them to provide lighting during check-ups and/or surgeries; schools use them for lighting, and children have better environment for studying at home in the evening. Availability of power to charge mobile phones has made it possible for more people to maintain contact with family members. Women feel more secure after dusk and are more mobile. Thus, apart from private benefits, this project also has multiple public benefits.

Benefits versus costs of adoption

There are two types of costs that are associated with adoption of an innovation – direct costs, and indirect costs. In this program, the rural households incur direct costs on purchasing the SHS (down payment, regular monthly fee towards loan repayment). The households enter into a lease agreement with the POs, and the system is purchased on credit. However, something worth stating is that the installment based financial scheme works has reduced the cost of a system to what the household would have spent on monthly kerosene cost.

The direct costs that the POs incur include installation of SHS and after-sales service. The POs receive a capital buy down grant which enables them to sell SHS at a slightly reduced price, i.e. helps POs to sell technology at more affordable rates.

For diffusion of innovation, the benefits must be greater than the costs incurred. In this case, the rural households enjoy multiple benefits, and this surpasses the costs incurred, which aides in the diffusion of innovation.

Characteristics of the Innovators

Familiarity with Innovation

One of the major challenges that the POs confronted was the awareness gap among rural households and the policy makers in Bangladesh about SHS. This is evident from the fact that some clients visited demonstration facilities 40 times before they were convinced a SHS would work since most people could not believe a solar panel can provide light or energy. They wanted to see it, to believe it, and were convinced only when it was demonstrated to them repeatedly. Such gaps existed not only among rural households but also political leaders. These leaders did not know much about renewable energy, and it was necessary to

[12] http://www.rightlivelihood.org/grameen_shakti.pdf (accessed February 21, 2012)

educate them along with the households through workshops, television ads, training campaigns, etc.

Thus, initially, it was a difficult task to convince households to install SHS up until the first few households in a community installed the system.

Status characteristics

The PO Selection Committee, which consists of representatives from IDCOL and relevant government ministries and organizations, select POs to implement the project on the basis of micro-finance experience and financial strength. The POs that are selected are quite innovative and are organizations known for providing finance and technical assistance for not just renewable energy projects but also wider range of concerns such as water supply for agriculture, post-disaster relief, etc. to the rural population of Bangladesh. For example, one of the key POs, Grameen Shakti, promotes solar home systems and provides SHS on credit with flexible repayment options. By October 2011, Grameen Shakti had installed over 718,000 SHSs which mitigates approximately 166,000 tons of CO2 emission per year.[13]

According to Wejnert, an actor's high social position significantly modulates the likelihood of adoption of an innovation. This is absolutely true when it comes to solar home systems in Bangladesh. The POs viewed as "progressive" and "internationally recognized" development institutions helped in diffusion of innovation. These POs have been successful in gaining the confidence of the rural households as well as the PO Selection Committee and therefore function as a trusted source of SHS delivery.

Socioeconomic characteristics

One of the striking features of this project is that IDCOL redesigned the program to target the 'ultra-poor' households -- those living on less than $1 per day. They did this by promoting cheaper, smaller 10 Wp and 20 Wp systems. The poorest households in the community could purchase this and benefit from it.

The average rural households used 40 Wp and 50 Wp systems, which generated enough electricity to run four lights, and possibly a black and white television, while the lower middle class of Bangladesh used 130 Wp systems.

Thus, this project targeted not just the average rural households and the lower middle class, but also the poorest households to ensure that the wealthier families in the community do not take undue advantage of this project.

[13] Mohammad R Islam; Impacts of Grameen Shakti Solar Home System Program; 2011

Environmental Context

Societal culture

The POs had a tough time convincing the clients that the components and panels produced in Bangladesh and China would function properly since Chinese electronics and Bengali technology were widely believed to be of universally poor quality. It was challenging to get people to buy a domestically manufactured system or a Chinese made system. The communities preferred the more reliable 'western' or 'Japanese' systems because of the negative reputation of local technology. The POs spent significant amount of time and effort to overcome this cultural barrier where equipment produced in the home country is valued less.

Political conditions

The Government of Bangladesh played an important role in the case of adoption of solar home systems. The government sourced necessary fund for the program and created incentives such as waiver of duties, tax benefits to promote this project.

Also, the Government took extra care to ensure that the POs selected were trust worthy and the components and equipment used in SHS met certain standards – PO selection committee which selects POs to implement the program consists of representatives from relevant government ministries and IDCOL; Technical Standards Committee which determines technical standards, reviews product credentials of dealers, and approves eligible equipment consists of experts from some of the engineering departments of the government, university and IDCOL. Thus, the role of the Government of Bangladesh in diffusion of innovation cannot be ignored.

Challenges:

- ***Lack of awareness among the end users and politicians:*** There is a huge awareness gap that exists among the rural households, with some of the clients visiting demonstration facilities 40 times before they are convinced a SHS would work since most of the people do not believe a solar panel can provide them light or energy.

The political leaders also do not know much about renewable energy, and need to be educated along with the households through workshops, television advertisements, billboards, and training campaigns.

- ***Technical challenges:*** Better batteries, warranties on imported solar panels, recycling and disposal of panels are concerns that still need to be addressed**.** These issues are intensified by the lack of opportunity for local research institutes to become more involved in SHS research and development.

Key lessons learned:

- ***Innovative financing model:*** This project is different from the previous approaches, which were largely grant-based. This program involves an innovative financing model not only for the poor rural households, but also the partner organizations. The idea was to get rid of the grant component at some stage and to ensure support to POs that could run like a business. The POs made sure that they did not give technologies away for free, and had a strict but humane form of collection of payments. Usually, when something is given away for free, people have the tendency to care less. This model is successful because everyone has a stake, and everyone is accountable.

- ***Emphasizes Institutional diversity/ mechanisms of cooperation and co-ordination:*** This program requires the collaboration of six different partners -- Government of Bangladesh, IDCOL, the donor agencies (World Bank's IDA, GEF, and others), Participating Organizations, manufacturers/suppliers, and professionals/experts. Each partner has a distinct role in the network and is equally involved. The Government of Bangladesh is responsible for sourcing necessary funding for the project; IDCOL covers project finance and management; donor agencies provide additional funding through grants and soft loans; participating organizationsextend micro-credit to customers, select areas and customers, install SHS and provide after-sales service; manufacturers sell SHS components to the POs; professionals/experts provide technical specification and impact assessment.

- ***Technology and capacity building:*** Since the solar energy technology brought to the communities was fairly new, the POs spent significant amount of time and money to train the people. For example, Grameen Shakti set up Grameen Technology Centers (GTC) to train women to become renewable energy technicians and entrepreneurs. Over 9,000 women technicians have been trained to assemble systems' accessories, as well as install and provide after sales service support for SHS. These young women earn on an average 8,000 Taka/month. This makes them independent and they live with dignity and hope, and thus contribute to decision-making at both household and community level.

Another interesting feature is that at the start of the project, almost all technology had to be imported from Japan, India and China and there were few domestic manufacturers of components and almost none for panels and assembly. However, today we have over thirty suppliers of SHS components with facilities in Bangladesh from twenty countries. Local manufacturers also produce batteries, charge controllers, and inverters. Tubular plate batteries and flat type batteries and three quarters of the fluorescent lamps used are now made in Bangladesh.

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Vietnam Biogas Programme

Project Brief

Biogas programmes in Asia have been significantly successful in many countries and has been considered a vital energy source for agrarian economies in the region. SNV (Netherlands Development Organization) is an international development organization that has been undertaking biogas projects in various Asian and African countries. Its national biogas programmes in Nepal and Vietnam are successful case studies of wider stakeholder participation and the implementation self-sustaining model for creating energy access opportunities for rural and semi-rural population. SNV biogas programmes are largely national level programmes with multi-actor engagement from global to local level. SNV began its biogas programme in Vietnam after signing a memorandum of understanding with the Government of Vietnam, Ministry of Agriculture for the Animal Husbandry sector financially endowed by the Government of Netherlands, Directorate General for International Cooperation. The Biogas Project Office was formed under the MOU as the executing agency with the provincial governments managing the programme. To further the programme, provincial Biogas Project offices were also established with provision of staff by the Department of Agriculture and Rural Development and the Agriculture Extension Center, Vietnam. The Vietnam biogas programme began in 2003 with the Phase-I being completed in 2006 and the Second Phase is currently underway (2007-2012). Animal husbandry is a significant part of Vietnam's agrarian structure; however the waste from livestock had become a serious threat to the country's environment by polluting water resources, degrading health and effecting sanitation. As the rural areas in Vietnam were facing energy access issues, the use of animal waste for generating biogas for cooking and lighting purposes was considered to be viable option. The project was implemented in 12 provinces in the Phase I with the construction of 18,000 biogas plants and the Phase-2 is focusing on 58 provinces with 140000 biogas plants.

The programme largely is designed around a self-financing mechanism wherein the end users of the biogas (rural population) pay for the installation of a biogas plant with a government subsidy covering approximately around 15% of the cost that is returned to the end user post the certification of the plant by a technician from the Ministry of Agriculture and Rural Development (MARD). The subsidy is provided through the Government of Netherlands grant and the finances provided by the provincial authorities. The programme also encouraged the expansion of private biogas plant developers and masons to directly deal with the end user. Though, the programme framework requires rural households to sign up for the subsidized plant, but in recent years due to the success of the programme, end users directly employ manufacturers and certified masons to construct the plants showcasing the commercial expansion of the initiative. Local and provincial bodies are the key implementers of the programme working in association with local postal services that are being utilized for subsidy transfers due to their door-to-door delivery system.

Due to the high rate of success of the programme, the Asian Development Bank and the World Bank have also extended their financial support to the Biogas support programme. The project is also contributing to the Action Plan of Renewable Energy by the Ministry of Industry besides being integral to the Rural Development of Policy 2006-2015 of the Government of Vietnam due to its role in expanding rural economy, livestock production, managing animal waste among others.[14]

Level	Technology provider/ Suppliers	Enabler	Financier*	Business/ Market entity	Knowledge provider	Target	Partner organization
Global	SNV	SNV, Netherlands, Ministry of Agriculture, Government of Vietnam	Government of Netherlands, ADB and other donors,		SNV		
Regional							
National	Government of Vietnam						
State			Provincial authorities	Private biogas construction companies			
Local			Local cooperative trade unions, women groups etc			Rural / semi-rural population	

Characteristics of the Innovations

Private vs Public Benefits

The biogas programme is a significant instance of disseminating larger public benefit due to its national impact on the rural population of Vietnam; however the implementation of the project focuses on each individual household highlighting private benefits. The utilization of Biogas has ensured the sustenance of Livestock farming in Vietnam, it is also enhancing agriculture and other activities from public benefit perspective. In terms of private benefits to rural households, the biogas programme enhanced the rural livelihoods by providing energy access, raising standard of living, reducing costs incurred through purchase of fuelwood and Charcoal and enabling the expansion of economic opportunities. One of the major beneficiaries of the programme is women who received a non-polluting environment

[14] Biogas programme for the Animal Husbandry Sector in Vietnam

as well as reduction in their workload (eg. gathering fuelwood) leading them to pursue other socio-economic activities.

At the global level, the linkage of the biogas programme to CDM activities also ensures the reduction in GHG emissions that would have long term impact on the national as well as global environment leading to larger public benefits.

Costs Incurred

SNV and the Government of Vietnam, Ministry of Agricultural and Rural Development (MARD) incurred certain direct costs for the employment of technical advisors, training biogas installers and masons, the establishment of training schools and the outreach activities. The creation of Biogas Project Division by the government along with the formation of provincial biogas divisions is a direct cost incurred by the enablers. The Government of Netherlands also provided the initial investments for project initiation and also provided grant for the Phase II with a certain percentage of the entire project costs undertaken by the Provincial authorities; however, the majority of the direct costs are incurred by the end user of the biogas (Rural farmers/livestock owners) providing the finances for the construction of the biogas installations.

A key cost was the provision of the subsidy by SNV and Government of Vietnam in collaboration with the Government of Netherlands that was transferred to the end users through the project offices and the postal services serving as the link for disbursement.

The indirect costs that the end users have to bear includes the cost of switching to biogas based stoves or LPG burners and transformations in existing infrastructure like piggeries, toilets etc to link them to the installations. The end users is also benefitted by the reduction in costs incurred in buying fertilisers as the bio-slurry from the biogas plant could be utilised as manure for agricultural land, fisheries among others or sold to other farmers. In addition, there is a reduction in fuelwood or charcoal expenses.

The indirect costs for the MARD and provincial authorities are the costs on conducting regular quality control on biogas plants.

Characteristics of Innovators

Societal entity

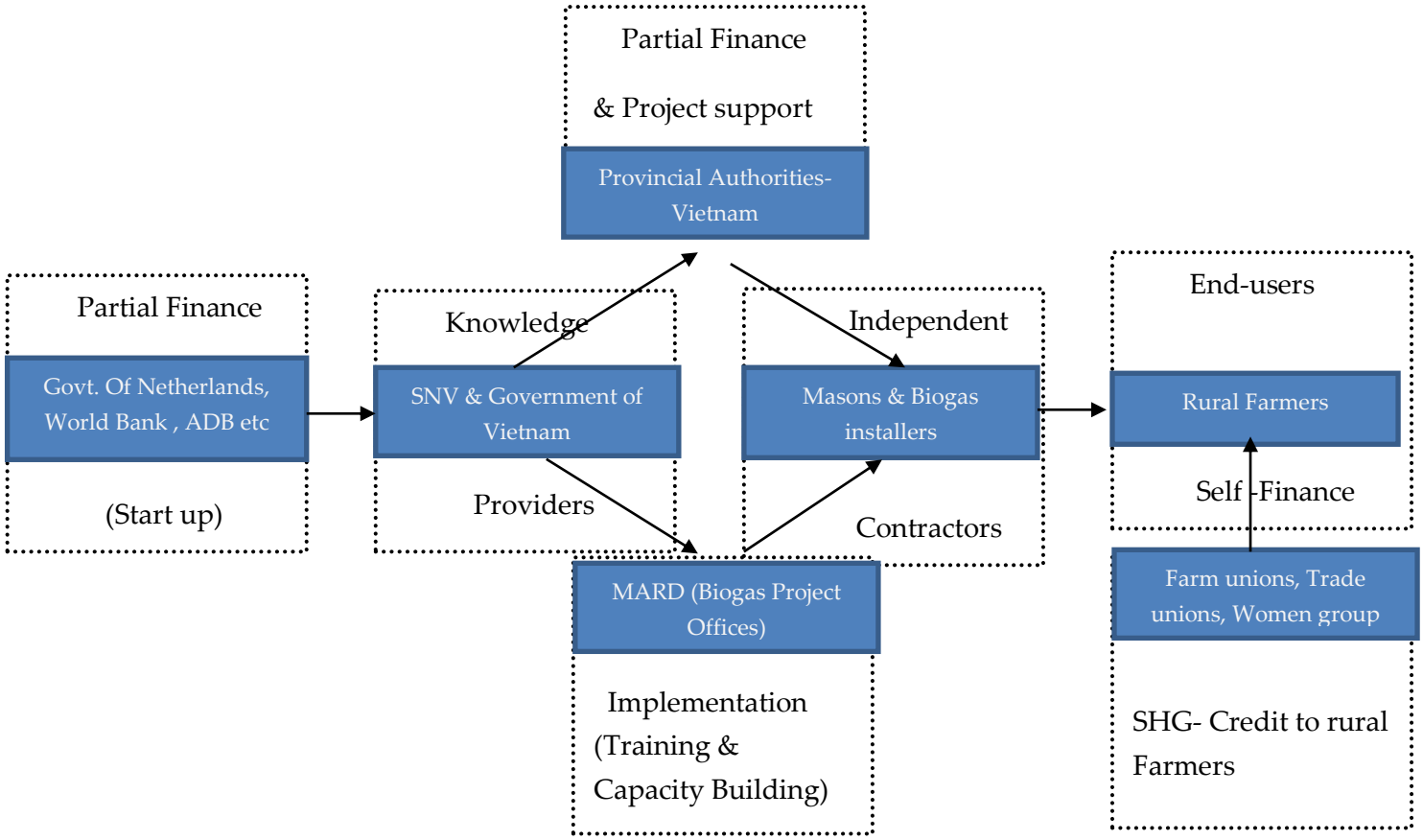
The target beneficiaries of the programmes aren't a homogenous group. The entire rural population of Vietnam in the selected provinces will directly and indirectly benefit from this intervention. The programme was largely focused on providing biogas for cooking and lighting needs, however in accordance to income streams of the rural population, the biogas plants and other amenities in individual households also led to further enhancement of the living conditions of individual households.

The programme was initiated at the national level with significant outreach activities that were undertaken including media as well as word of mouth dissemination. A key part of the programme was media dissemination including the use of television, radio, newspapers and so on.

Familiarity of the adopters

As the programme was being implemented in number of provinces, familiarity of the intervention was conducted through workshops, tours to pilot biogas plants, training for biogas users, masons as well as technicians of the biogas project offices. Promotional films about the programme were prepared and distributed to selected provinces. As the materials and system design was local to the country, its adoption by masons was feasible besides engaging self-employed masons who would have the benefit for independently working on other projects as well. With each biogas plant being installed, word of mouth was considered vital for the project's success for scale up. Potential users were also invited for meeting where the technology and its implementation were demonstrated. Thus significant amount of time and costs were directed towards creating favourable environment for the programme, however the benefits accrued by individual households became a significant indicator for its further adoption in villages and provinces.

Project Layout



Socio-economic characteristics

The rural population of Vietnam largely involved in livestock farming and agriculture was the major target of the programme. As majority of the rural population was engaged in this activity, therefore the target beneficiaries is a large group, however, socio-economic parameters such as standard of living, income level or current status on energy access were not considered in the selection of the rural households. During the first phase of the project, the selection criteria for the installation under the government programme was an expression of interest by the end user besides evidence of meeting financial and technical criteria required for the implementation.

Diffusion through social networks

The use of media- television, radio and advertisements was consistently and regularly undertaken to disseminate about the innovation. The word of mouth approach was heavily relied upon especially post the beginning of the Phase I of the programme with individual households utilising the biogas plants disseminating its benefits.

In the beginning of the Phase-I, the first 12 provinces that attained training and have been extending their support to other provinces that have become part of the Phase-II programme

by offering training to masons and biogas technicians. The networks of actors are engaging amongst themselves without the enabler supporting the intervention besides the self-employed masons are independently constructing biogas plants for other rural households that have shown interest in financing the entire installation without applying for the subsidy provided by the government. As the model is a largely self-financing model with the subsidy acting more as an incentive for adoption, it therefore has led to groups such as Farmers union, Women unions, Veteran union's etc to provide credit to farmers sans the role of government. This emphasises the growing role of groups and networks already in place in rural areas for the expansion of the programme.

Environmental Settings

Geographical Proximity

SNV has been implementing the project in Asian and African countries that are agrarian economies facing energy access issues. While the biogas programme by the development organization has been modified to suit the needs of the local people, however, the programme is currently being replicated in other countries such as neighboring Cambodia as well. As the biogas installations are developed indigenously and the focus is on self-financing and commercialization of biogas, the replication is highly feasible in the Asian region with similar economies.

Political conditions

As the inception of the project was due to a collaboration between the development organisation SNV and Government of Vietnam with Government of Netherlands as the primary financier of the project, the project's reach in different provinces became highly feasible. The integration of the Biogas support programme with the Rural Development Policy as well as its contribution to the Renewable energy Action plan further strengthened the programme. For the initiation of the programme, government and provincial authorities offered to extend financial assistance and its infrastructure for the implementation as well.

Challenges

The Vietnam biogas programme is a good case study highlighting the impact of large scale programme percolating from a top down approach that is implemented from bottoms up effort. The project has the potential to move beyond the animal husbandry sector in Vietnam. One concern that the project has is the number of people opting out of applying for subsidies due to cap on numbers and the significant time required for processing subsidies. Though, the switch of project adopters to self-financing shows keen interest as well as self-sufficiency in the funds, however this may affect those who may be require the subsidy in the long term. The programme has been replicated but customised for Vietnam's needs and has some major takeaways to initiate public and non-government institution partnerships that focus on capacity building at the grass root level for undertaking responsibility for the implementation and management of the programme.

Key Takeaways

Financing- Though the project received a grant from the Government of Netherlands besides certain investments from the Government of Vietnam and its authorities, the project emphasizes on the rural household being responsible for more than three-fourth of the expenses making the programme effectively sustainable in the long term. Due to Self-Financing model, the progamme has also paved away for various informal groups- farmer groups, women's union etc to extend credit to farmers leading to the formation of informal financing mechanisms without the long procedures involved in government provided loans. With private investments at the heart of the programme, both the Ministry of Agriculture and SNV are looking for other funding sources like carbon finance to reduce the existing dependence on grants for the subsidy.

Technology and Capacity Building- As the programme has been training self-employed masons for constructing the installation as well as technicians, the team of masons are in a position to undertake constructions that are independent of the government/provincial authorities creating the opportunity for the development of a commercial market for biogas. Many masons have indicated that they have built as many biogas plants outside of the programme as within it.[15] Along with this, the use of local technology and materials from the country creates further increases its rate of adoption.

A mechanism for Cooperation/Coordination – The programme is a relevant instance for institutional coordination especially amongst international governments, organizations as well as national and provincial authorities. The rural population as the end user was receiving the benefits in the first phase of the programme, however due to the financing mechanism and the growing interest in installing biogas projects- the end-users have become significantly active in engaging with rural stakeholders like unions, farmer groups, masons among others to attain the benefits of the installations. The provinces are also engaging with each other independently and building a local network.

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Pico Hydro Systems in Laos

Project Brief

Pico hydro systems (below 5 kW) are extremely common in Laos PDR, particularly in the Northern provinces, where the terrain is mountainous and there is no grid-electricity. These systems are used primarily for lighting and entertainment purposes. The technology is completely market driven without any external support from the government or donor agencies, despite which it is thriving in the country. An estimated 60,000 lowhead pico hydropower units provide electricity to about 90,000 households. (LIRE,2010). These units are installed and maintained by the households themselves, as it doesn't require much technical knowledge for installation.

The pico-hydro market is controlled by a highly dispersed network of traders from China and Vietnam who sell the turbine and associated components. Since the pico-hydro market is an informal market, there are no standard guidelines for safety and reliability of the systems. LIRE, a non-profit organization with grant support from ETC (Netherlands) stepped in in 2008, to improve the quality, safety, efficiency and reliability of pico-hydro power (PHP) systems. This intervention is aimed at direct capacity building of all actors in the supply chain: traders, shopkeepers, end users, govt staff.

Despite the lack of policy support to pico-hydro systems, this intervention embedded in a self-sustaining market environment has helped in further mainstreaming this technology.

Table below shows the mapping of actors connected with the pico- hydro value chain.

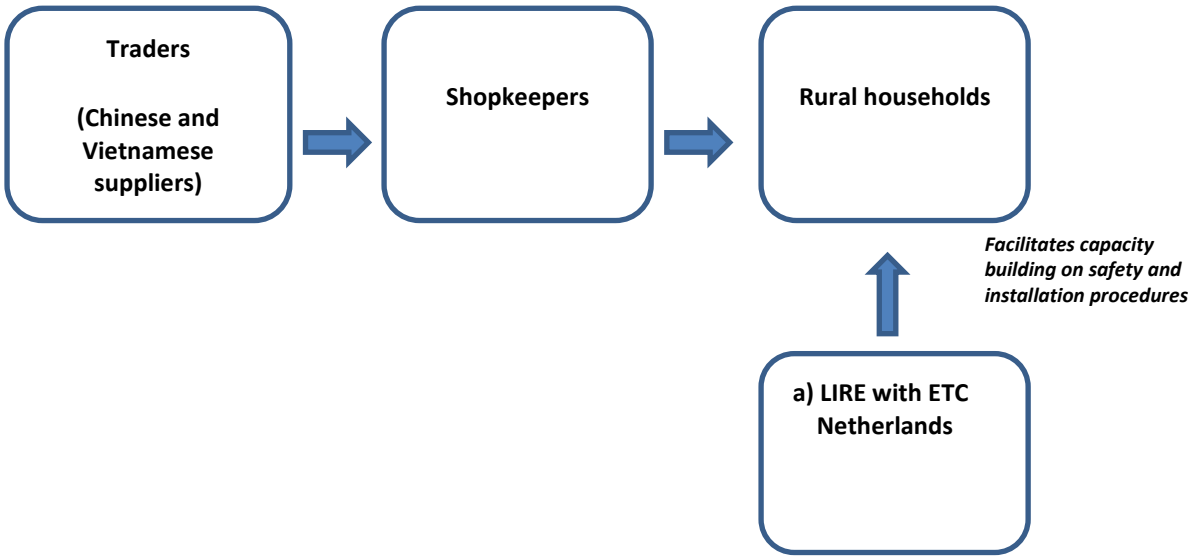
Level	Technology provider/ Suppliers	Enabler	Financier*	Business/ Market entity	Knowledge provider	Target	Partner organization
Global							
Regional	Chinese and Vietnamese suppliers*						ETC, Netherlands
National							
State							
Local		LIRE		Village, town shops selling pico hydro systems	LIRE	Rural consumers	

**There is no formal regional agreement between Laos and China/Vietnam. Chinese and Vietnamese suppliers transport the goods across the borders without registration, making it an informal market.*

Characteristics of the Innovation

Private versus public benefits

The pico hydro systems have benefitted households which adopted this technology mainly for lighting and entertainment purposes, characterizing it as an innovation with private benefits. The electricity generated is also used for income generating activities at a very small scale (e.g. weaving bamboo mats etc.)Typically households use the energy for their



own consumption and sometimes also share it with their relatives, though examples of community based systems are rare. The indirect benefits arising from access to electricity are not restricted to the households and flow into the community as well, thus enhancing the well-being of community as a whole. In addition to environmental benefits, time saved in collecting firewood facilitates engagement in productive activities. It increases trust and improves interactions amongst the members of a community as houses with electricity and entertainment sets become places of social gathering. This enhances the solidarity in the community and strengthens social ties. While these are significant benefits, they are not quantifiable.

Costs incurred

In this particular case, while direct monetary costs incurred on procuring the systems and maintaining them are clearly identifiable, it is difficult to discern the indirect costs incurred by the community or other actors associated with the pico hydro delivery model. The main costs incurred are towards maintenance of systems, which is a labour intensive process. The systems require daily cleaning and preventive maintenance. The systems are repaired by the people themselves, who despite lacking the technical know-how manage to fix their systems

by asking for help from other villagers. In terms of indirect costs related to the innovation, accidents and injuries caused due to electrocution have not been carefully accounted for however have been reported in impact assessment studies undertaken by agencies like LIRE.[16]

To address these challenges, LIRE a local NGO targeted an intervention to build the capacity of all key stakeholders involved in the pico hydro service delivery chain such as shop keepers, villagers etc[17]. LIRE has also trained govt employees to act as technical advisors that can give paid advice to households on installation and safety (Vries et al). While the intervention is at a nascent stage, it is a promising option which has the potential to significantly reduce indirect costs related to safety and quality and increase benefits.

Characteristics of the adopters

Societal entity

Pico hydro units have been adopted by the Laotian community mainly the rural households residing in the mountainous northern provinces. In other words, adopters were a homogenous group of small collective actors with similar energy needs. As noticed in many localized innovations, the manner in which the innovation gained traction in the market was chiefly through direct interactions between people, as is typical for any closely knit and socially dense group.

Familiarity with innovation

The diffusion of the pico-hydro innovation was based on word-of-mouth. Familiarity with the innovation increased as the perception of risk reduced with many people adopting these systems for electricity generation. The pico-hydro units are installed, maintained and repaired by the end-users themselves. Many users do not have the knowledge as to where to install their units, what specification to buy etc. Instead they use experience, talk to other villagers, friends and relative and rely on their word. Despite the lack of formal training on installation (most of the units do not even come with user manuals and the others usually have Chinese manuals, not understood by the local population), they manage to fix their systems relying on trial and error methods. In fact, end-users have introduced several innovative adaptations to their systems and spread it through word of mouth. While on the one hand, the proliferation of pico-hydro systems exemplifies the entrepreneurial abilities of the Lao people, it also gives clear signals about the diffusion process which was facilitated through learning by doing and emulative behavior.

[16] Anecdotal stories of accidents and deaths have been recorded but exact figures are not known. The dangers of pico-hydro are the also one of the most dominant narratives brought forth by policymakers and donor agencies against providing support for mainstreaming this technology in Lao PDR (Smits and Bush, 2010).

[17] ETC-LIRE's Picohydropower Innovation and Capacity Building Program is aimed at improving the use, quality and safety of pico-hydropower turbines in the Lao PDR.

Position in social networks

The diffusion of an adoption depends a lot on the interaction of social units in a process of communication. Considering this case, we can identify three groups in the service delivery chain namely- a) Traders b) Shopkeepers c) End –users. The degree of interaction between these groups is an important factor influencing the diffusion of pico-hydro units in the market.

Traders from China and Vietnam are the key actors in the distribution network of the pico hydro units. They sell the units to provincial/ district shops, which in turn sell it to village shops. The traders sometimes also directly sell the units to consumers. Traders regularly visit the shops at intervals ranging from a few days upto a month during which the shopkeepers place the order for pico hydro units. Shopkeepers, the next level in the network sell the units to consumers. The shopkeepers generally have limited technical knowledge and influence regarding the products they sell. It is the traders who determine the kinds of pico hydro units that will be sold in Laos. The limited and opaque information about the quality of units confuses the shopkeepers and favours the position of the traders even more in the network (Smits and Bush, 2010). The shopkeepers merely act as an interface between the traders and the consumers. The trader network is highly dispersed throughout Laos, a factor which has played a key role in the mass uptake of the innovation.

Environmental context

Geographical proximity

The proximity with Vietnam and China and its trade networks facilitated the availability of low cost and low quality products in Laos. Most of the units are produced in China and in Vietnam and units and spare parts are sold through trade networks extending through China, Vietnam, Cambodia and Myanmar to Laos.

Political environment

Interestingly, the uptake of pico –hydro systems happened without any external policy and financial support from the government and the multilateral funding agencies. As the market is largely informal and there is limited knowledge and information (in terms of statistics on pico-hydro based electrification), limited interest of donor agencies, it has not been recognized so far in the policy narratives. The nature of this largely invisible system of provision makes it difficult to monitor and control the sales of this technology and in turn the revenues. Only at border crossings an occasional small amount of tax is paid of which only a fraction makes it to the centre.

The endemic lack of information coupled with the orientation of the government to facilitate large scale foreign investment in large hydropower dams and the broader state agenda of centralisation and control over service provision to remote upland areas has resulted in marginalization of pico hydro in policy making (Smits and Bush, 2010).

However, even without policy support pico-hydro has a vibrant market in Laos highlighting the fact that context specific locally appropriate technologies have market potential, which may not always be recognized in the policy arena.

Key takeaways:-

- ***Technology and capacity building*** -Energy solutions for rural populations may not necessarily be simple, ready to use sort of technology. Most governments and multilateral agencies push for universally applicable technologies like solar PV citing the reason that rural consumers are not educated, unaware and lack skills to operate complex technologies however the Lao pico hydro case shows that even slightly complex technologies such as pico hydro can effectively provide energy access and find a thriving local market. In this case, ethnic communities with enterprising and entrepreneurial abilities have successfully driven the market for such small scale locally adaptable technologies, which was also facilitated through the presence of robust distribution networks.

We also find that despite strong evidence of benefits, improvement in well-being as a result of certain technologies such as pico hydro, local action sometimes fails to influence policy making. To create a significant impact, policy incentives, support and capacity building is required for mainstreaming technologies. While capacity building efforts by NGOS such as LIRE are promising, lack of political will and appropriate institutional mechanisms to can prove to be bottlenecks for increasing energy access to the off-grid communities.

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Vattanak Palm Sugar Cook Stoves Cambodia

Project Brief

GERES (Groupe Energies Renouvelables, Environnement et Solidarités) is a French NGO operating since 1976. The primary focus of GERES is on innovative and sustainable development projects. It is involved in providing engineering solutions, technical expertise for environmental conservation, climate change mitigation and adaptation, reducing energy poverty and enhancing livelihoods. The NGO has been working in various Asian and African countries and has been active in Cambodia since 1994 working on energy efficient solutions. It has been running an improved cook stove programme for households and under this larger improved cookstove initiative; Geres developed a cookstove for palm sugar production in the country. Cambodia is a significant producer of palm sugar in the South-East Asian region with around 20,000 families engaged in this small business activity within the country. Palm sugar producers in the country were utilising highly intensive fuelwood based stoves that did not ensure high quality production leading to inefficiency, wastage of palm sugar besides impacting health and environment. The Vattanak stove was developed by GERES, in collaboration with Planete Bois (the technology provider for this post combustion stove) with specific modifications for the Cambodian Palm sugar producers in 2005.(GERES, nd).

The stove was introduced in Cambodia in 2007 and since then 200 stoves have been installed and GERES is committed to install 5,000 by 2014[18]. The project has focused on the entire value chain of Palm sugar production by providing the initial financial impetus as well as simultaneously focusing on capacity building and training of – Palm sugar producers (Families that extract palm sugar and produce it- end users of the stove), stove producers (traditional ceramic workers who build the stove parts) and Stove installers (Primarily traditional stove makers who install the ceramic parts) and training of entrepreneurs (Selected stove installers responsible for marketing and selling of the Vattanak stoves). Along with the emphasis on training all the major stakeholders in the industry, GERES also encouraged the integration of stove producers, distributors and entrepreneurs into associations for enhancing the commercialization of the stove. To initiate the First phase of the project, an innovative financial mechanism of a barter trade or cash system for the stove installation to Geres by the sugar producers was also envisaged for the absorption of the cookstove by the sugar producers.

The Vattanak stove is part of the larger initiative of GERES in the country; GERES began with the introduction of the national level efficient cookstove programme (Asia Regional Cookstove Programme, nd)that has been well received with improved household cookstoves already surpassing the 1 million mark in sales (HEDON, 2011). Initially, the

[18] According to the GERES Cambodia (Iwan Baskoro) over skype 1 Nov 2011, GERES has revised the plan and would focus on installing a number less than previously envisaged by the same target year.

programme wasn't part of any national policy, however in recent years the cooperation of the national government and its agencies has increased and enhanced its effectiveness (Asia Regional Cookstove Programme, nd). GERES cookstove programme has received political endorsement besides specifically in the case of Vattanak, cooperation with the Department of Institution of Standards under the Ministry of Industry is being pursued to enhance palm sugar business with focus on packaging, hygiene along with market development.[19]

In December 2010, GERES was reviewing its Vattanak cookstove programme to address the technical challenges and other socio-economic challenges after conducting end-user satisfaction survey and is set to start the next phase of stove installation from December end 2011, in the Palm sugar season. The technical challenges faced with a stove have been addressed besides the Research and Development for another prototype is being conducted in France for a new stove.[20]

Level	Technology provider/ Suppliers	Enabler	Financier*	Business/ Market entity	Knowledge provider	Target	Partner organization
Global	Planete Bois	GERES	World Bank-ESMAP, Foundation Ensemble, EASE		GERES		
Regional				ECO-BIZ			
National							DATe
State				ICOPRODAC			
Local				ECO-BIZ		Palm Sugar Producers, Cook stove manufacturers, Vendors, Entrepreneurs	

[19] Stakeholder consultation with GERES Cambodia Coordinator Iwan Baskoro 1.11.2011
[20] Stakeholder consultation with GERES Cambodia Coordinator Iwan Baskoro 1.11.2011

Characteristics of the Innovations

Private vs Public Benefits

The Palm sugar cook stove project has provided private benefits to the community of Palm sugar producers, Stove makers, installers and entrepreneurs. It has led to increased energy efficiency by 30% and improved the quality of palm sugar besides reducing the amount of fuelwood that needs to be purchased. The producers have received an overall benefit from producing and delivering improved quality of palm sugar while reducing their expenses incurred through a traditional stove. Along with the improvement in palm sugar production, the associated expanded market including the craftsmen, middlemen, stove repairers also were benefitted from the utilisation of the cookstove due to the enhancement of the value chain. The families of palm sugar producers were also benefitted with cleaner environment as well as efficient cooking mechanism that could also be utilised for other household purposes.

As wood burning accounts for 90% of the total energy consumption in Cambodia with around 2.1 million rural population utilising inefficient cookstoves (ESMAP, 2009-10), the reduction in utilisation of fuelwood would have larger public benefits by reducing deforestation and indoor as well as outdoor air pollution that are both adding to the woes of the environment. GERES Cambodia is also seeking funds to co-finance the commercialisation of the Vattanak stove and forestry management- a larger public benefit that would contribute to curtailing emissions in the long term. Under forestry management, community contributions for tree planting from Palm sugar producers are also being planned for long term benefits for the producers (GERES, The Vattanak stove: A low cost continous gasifier burner for palm sugar production in Cambodia, nd).[21]

Costs Incurred

The direct costs incurred by GERES were the employment of experts for the construction of the stoves, the training of the producer, entrepreneurs and middlemen along with initial investments in the establishment of necessary facilities such as material for stove production. GERES is also facilitating the construction of the fixed Vattanak stoves through a barter system which is a direct cost for producers installing the stove. Prior to the construction of a stove, the $5 has to be paid as a deposit by the sugar producer (end user of the stove) and for the rest of the total cost of $70, the payment would be done by paying in kind with 1 kg sugar per day for the remaining amount. GERES launched the stove at a promotional price of $45, with $5 as first deposit and 45 Kgs sugar sold back to them free of charge (GERES, Sustainable Dissemination of Palm Sugar Cookstove- Vattanak, 2010).

[21] As told By Iwan Baskoro, GERES Cambodia over Skype

The producers had the option of either paying in cash or kind by giving EcoBiz- a company established by Geres for marketing of the produce- 1 kg sugar every day for a stipulated period of time. After the settlement of the price of the stove, Geres does not buy sugar from the producers and links them to markets and buyers to continue their business and encourages inclusion in cooperatives.

The marketing entity EcoBiz acquires the palm sugar from the producers and provides a premium or normal price on spot depending upon the source of the fuelwood. The collected sugar is processed and packaged and sold as an organic product. The provision of payment depending on fuelwood source ensures that rampant and illegal cutting of forests is not carried out by farmers as the premium price ensures a fairer incentive to go through certified community forests.[22][23]

The basic aim for creating EcoBiz was to create a trigger in the market, however the entity is small and not in a capacity to upscale. Geres has been reducing its activities since mid-2010 to increase independence of the community and intends to close it down by end of 2011.[24]

In terms of indirect costs, Geres had to establish a marketing enterprise to sell the sugar and the adopters especially the producers had to provide sugar in kind. For the adoption of the new stove, farmers, producers, middlemen and traders had to undertake training as well initiate certain transformations in their practices for smoother adoption such as enhanced maintenance of the stove, cleanliness and ensure hygiene and high quality production. Reduction in fuelwood use also led to savings for the palm sugar producers, hence reducing their indirect costs on a long term basis.

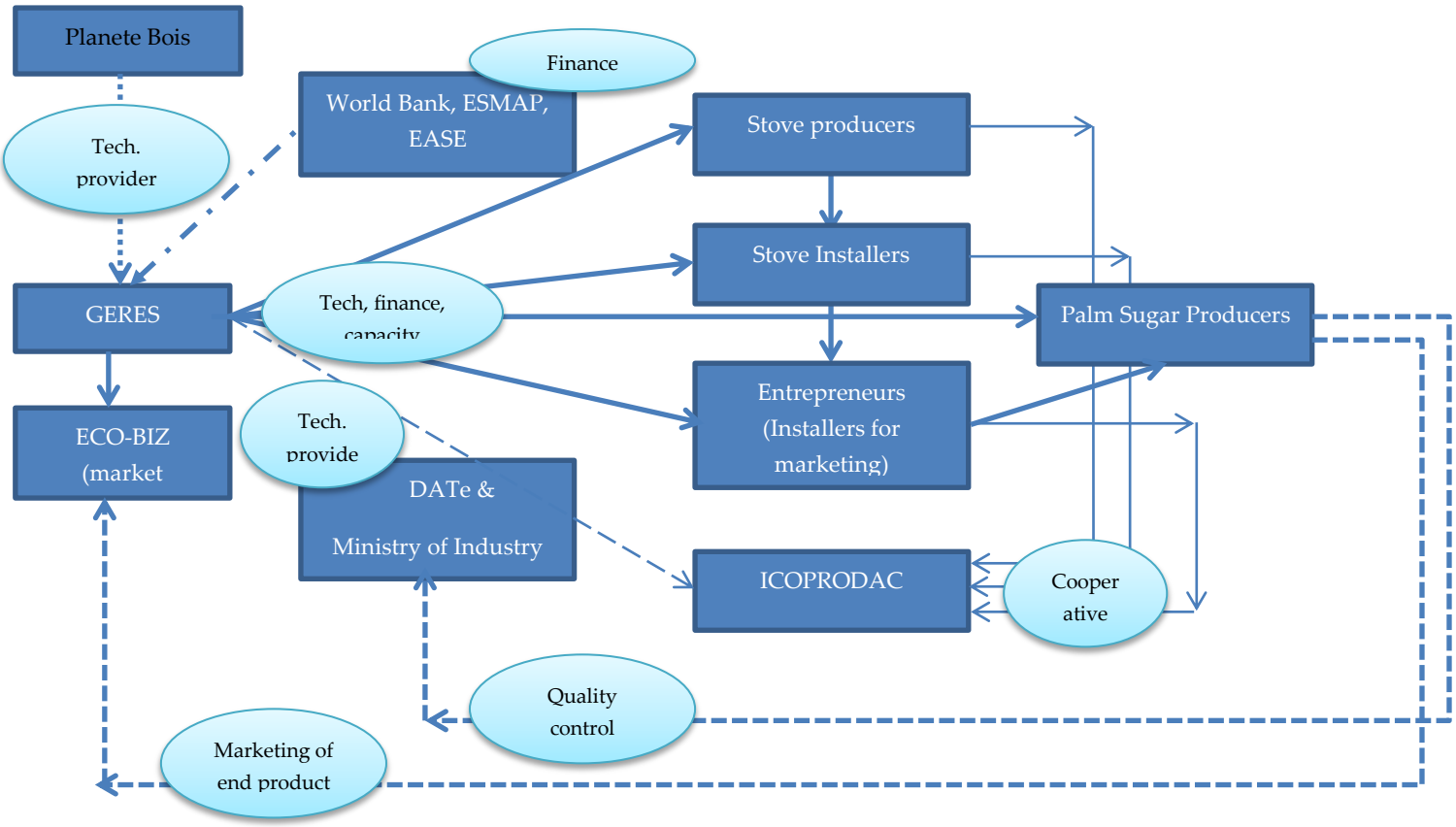
Currently as GERES provides the financial impetus through subsidising the stove as well as providing the Barter systems, the palm sugar producers are financially linked to the entity, however, GERES is working towards addressing the financial aspect. The key challenge is for introduction of independent financial system where in micro-finance institutions, private sugar traders and money lenders could be linked to the producers. Though the producers prefer micro-finance institutions, creating the linkages have been challenge for GERES as palm sugar production is a seasonal practice.[25]

[22] Each Kg of sugar is sold at $1.25 domestically and $2 Internationally. http://www.yslme.org/doc/Fundraise/ppt/Tang2_sample%20business%20plan.pdf

[23] Eco-Biz co Ltd, Executive Summary. Available at http://www.slideshare.net/skmadapatu/executive-summarymay-081000am

[24] As told by Iwan Baskoro, GERES Cambodia over Skype

[25] As told by Iwan Baskoro, GERES Cambodia over Skype



Characteristics of Innovators

Societal entity

The project has been established in key palm sugar producing provinces in Cambodia. The provinces have – significant number of Palm sugar growers as well as sugar producers in the area. As the producers as well as the growers are in closer proximity to each other hence craftsmen and cookstove producers were also established in the areas, leading to high probability for the adoption of the project

The target group of the programme was the Palm sugar Producers (Farmers and the sugar makers), the craftsmen and stove makers and the middlemen involved in the sale, distribution and repair of these stoves. The beneficiaries are homogenous group- rural families involved in palm sugar production and its associated activities. As the targeted beneficiary in the programme is a small scale industry, hence, the group of actors were a tightly knitted group or community with palm sugar activities as source of income.

Familiarity of the adopters

As part of the implementation, community involvement was stressed prior to the inception through a Methodology Participatory assessment before introducing the cookstove to understand the needs and the demography of the beneficiaries. Community gathering were conducted wherein consensus was reached upon the community resources and wealth classification of families to select the target beneficiaries for the implementation of the programme. To assist the familiarity of adoption, meetings with head of villages were

undertaken and field trips to pilot cookstoves were also part of the project initiation. Head of villages or certain influential voices among the community were also considered key for the diffusion of the innovation and involved in the project from its inception.

The Palm sugar producers, craftsmen and middlemen were already familiar with the Traditional cookstoves and the materials utilised to make them. The improved Vattanak cookstove was an advancement of the existing cookstove making it easier to adopt and conform to due to prior experience. However, as the stove had certain new additions that required improved techniques in both installations of the stove and its utilisation, training and capacity building initiatives were held for increasing familiarity with the innovation.

Diffusion through social networks

Social networks played a key role in the diffusion as well as uptake of the innovation. Three types of social networks were vital within the Vattanak project – 1) the use of different groups such as women or individuals within the homogenous group to diffuse the project, 2) establishment of new entities or encouraging participation in existing social networks for diffusion and sustenance and 3) Use of media and other informal networks to establish the programme at the national level.

Within the Vattanak cookstove programme, at the middlemen/entrepreneurial level, women who could speak well were encouraged to undertake the activities and increase the commercial activities with neighbours as well. Trainings were conducted by employing traditional producers and stove makers who were earlier trained by Geres to conduct sessions for their fellow producers, stovemakers and installers. This was primarily undertaken due to the fact that producers felt more at ease in interacting with their co-workers rather than outsiders.

The stovemakers and distributors were also encouraged to become members of the Improved Cookstoves Producers and Distributors Association (ICOPRODAC) to gain knowledge, establish networks for ceramics and manage prices among other issues. ICROPRODAC facilitates the stability in market prices of cookstoves, focuses on raw material management, quality control, labelling system, and is working with government for setting standards besides providing credit to members. The association during its meetings also invites other significant rural stakeholders including stove installers, policemen, village chief, commune council representatives, district governor and donors for enhancing coordination (GERES, Sustainable Dissemination of Palm Sugar Cookstove- Vattanak, 2010). The inclusion of other relevant stakeholders from the society ensures greater diffusion of the innovation besides furthering cooperation among community members.

For the dissemination of the Vattanak stove, the same platform of logical planning and dissemination was utilised, however the nature of the stove is different and difficult from the national improved cookstove. As the Vattanak is a fixed stove besides being a seasonal practice along with uncertainties associated with sugar prices, the dissemination was a challenge. A significant part of the dissemination has been based on close interactions with communities and sugar producers.

The membership to the ICROPRODAC ensures Vattanak stove installers and entrepreneur's access to credit- access to savings at low rate of 12% per annum. By 2011, significant numbers of Vattanak producers are set to become its members and each member is obliged to put in savings of 20,000 Riels ($5) every month which would be accessible as credit after 12 months of savings. (GERES, Sustainable Dissemination of Palm Sugar Cookstove- Vattanak, 2010)

Currently one Vattanak stove producer is a executive member and assists in the production of stove, however its role is limited to assuring quality control and maintaining good standards for parts.

External Environment

Role of global institutions such as World Bank and ESMAP that were involved due to provision of financing for the initiation and establishment of the project was significant for the inception of the project. While Vattanak stove are part of GERES larger cookstove programme, the financial aid provided by global institutions has enabled its widespread dissemination. The involvement of global institutions also resonates the trust that bottom up or grassroots level projects have gained in terms of absorption as well as replicability along with the assurance of serving the bottom of the pyramid. The initial thrust from the global institutions has also led to national level entities such as the Ministry of Industry, Energy and Mines to engage in the improved cookstove programme at the national scale.

Challenges

The Vattanak cook stove programme is designed to inclusively address the entire value chain of stakeholders involved in this small scale industry in Cambodia, however there are a few challenges that it faces in adoption as well as scale up of the programme. As palm sugar is a seasonal industry the cookstove is only suitable for certain period of time within a year, posing initial hurdles for adoption. Currently, there isn't a formal credit structure in place due to the small number of cookstoves installed and this need to be addressed

Replication of the Vattanak is also being pursued by GERES, the possibility of using it in the Brick as well Smoked Fish production (family based) in Cambodia is being examined. GERES is gearing up to replicate the Vattanak in other Cambodian provinces with GIZ as partner. GERES has also indicated willingness to share the technology as well as the learnings with other entities if they are interested in replicating it in other countries.

for longer viability. But there are significant learnings from the case that would be relevant for other energy innovation practices across Asia and the globe.

Key Takeaways

- ***Coordination mechanisms-*** The inclusion of all relevant stakeholders at the level of planning and consideration of their needs is essential for successful implementation of a project. Utilising existing social networks such as village networks and community chiefs ensures the trickle down of the innovation to the target beneficiaries at the local level. On the other hand, the involvement of multilateral agencies, national and local governments, NGO's, technology providers and the target beneficiaries presents strong institutional diversity within relevant actors and also enhances the percolation of the framework to other nations as well as sectors.

  Ensuring coordination among all stakeholders from the inception to implementation enhances the socio-economic structure prevalent in the target group by enhancing livelihoods and raising awareness. The introduction of new actors or networks such as cooperatives and associations like ICROPRODAC further intensifies cooperation and initiates coherence with the larger community in the area that includes other stakeholders such as traders, government officials, and other small scale entities.

- ***Capacity Building-*** A major thrust on capacity building from the inception of project is beneficial in reducing the enabler's (Geres) responsibilities and offering an opportunity for the target group to independently undertake activities in future thus reducing dependence on a single entity as well as increasing its opportunities for replication in other areas. Investments in capacity building of the entire value chain leads to easier adoption of a technology.

- ***Technological intervention-*** Greater emphasis on modifying the technology to the local needs and utilising locally available materials and local people (Craftsmen/tradesmen) ensures the easier adoption of the innovation without requiring the target beneficiaries to make significant changes in their lives or community's functioning.

- ***Financing mechanism*** such as a barter system reduces the burden on the targeted beneficiary and also increases the rate of adoption. The enhancement of the entire value chain and focus on commercialisation is crucial for the uptake of the project. In addition, the assurance of a market as well as access to finance sans the enabler ensures institutional sustainability in the long term. While for the inception of the project, the system works however there is a need for financing mechanism independent of the facilitator.

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Annexure II: Reviews of energy programmes

Programme: Nepal Biogas Support Programme (BSP)

About the programme

Pre BSP

Although use of biogas technology in Asian countries like India and China was introduced in the early 20th Century itself , it was introduced in Nepal only in 1955. Even in 1955, the use was driven by an individual's initiative which resulted in a single plant in a school.[26] Government of Nepal took note of the technology only in 1974-1975, as a technology with a potential for improving manure quality and reducing fuel wood consumption. This period coincided with the World energy crisis of 1970s and saw a gradual, but slow, popularisation of biogas plants as a result of promotion by Nepal Government's Department of Agriculture and Asian Development Bank. The Gobar Gas and Agricultural Equipment Development Company (GGC), which introduced the modified Chinese fixed dome design to suit the country's needs, was the only company responsible for construction of biogas plants for around two decades leading to a skewed balance of demand and supply.

Launch of BSP

In light of the demand supply gap, lack of capacity and slow uptake, the need for an innovative comprehensive government programme for biogas was realised. It was also noted that there is an acute shortage of technical and supervisory capacity. In order to mobilise the technical, operational and financial support for such a nation-wide programme, the Directorate General for International Cooperation (DGIS) of the Government of the Netherlands was approached through SNV Netherlands Development Organization. In 1992, the Nepal Biogas Support programme (BSP) was formally launched with the support from Dutch and Nepalese governments. The programme essentially promotes, supports and manages installation of domestic biogas plants as a renewable energy solution in Nepal through a multi-actor approach.

Structure and design of the programme

The BSP was spread over 4 phases and the fifth phase is being developed. The first two phases for five years each were supported by Netherlands Development Cooperation in Nepal and the Government of Nepal. The third phase had a new donor, German Government, through Kreditansalt fur Weideraufbau (KFW). The three phases were directly implemented by SNV Nepal and the fourth phase by an autonomous NGO, Biogas Sector Partnership – Nepal.

As a continuation to the programme, there may not be a phase V of the project. However, the biogas programme would become integrated into a larger government programme on

[26] Father BR Saubolle set up a biogas plant in St Xaviers school, Godavari

renewable energy called the Rural Renewable Energy Programme (RREP), which is expected to start from July 2012 for 5 years.

Planning of the programme

Dynamism and flexibility

One of the most remarkable features of the planning of Nepal BSP has been its dynamism. The planning as well as the programme itself has been dynamic and responded to the needs of the time and as highlighted by the mid-term reviews. Biogas plant manufacturing in the first phase, from 1992 to 1994, was restricted to GGC alone, but was opened to private companies in the next phase as the midterm review showed that it was not possible for GGC to cater to all the demand for construction, operation and maintenance of biogas power plants. Similarly, it was soon realised that loan from ADB wold not be sufficient for biogas installations and it was decided to rope in other banks and agencies for the purpose. Thus the programme has been receptive and responsive to the needs and feedback of the target groups.

With respect to technological innovation, research and experiments were carried out on different models of biogas plants, such as floating drum, concrete fixed dome, precast tunnel, plastic biodigester, ferro-cement gas holder, brick mortar dome. (Sidgel, 2007:36) For the past 20 years, however, the fixed dome design has been most popular and accepted. Recent evaluations have highlighted the need to come up with new designs for biogas plants. (SAESUp, 2010:8) This could be considered in areas where the fixed dome design is expensive.

Innovative and diverse financing mechanisms

Although Nepal biogas support programme began with seeking financial support from the government of Netherlands, it has incorporated a mix of financing options over time. A key characteristic of Asian innovation is diversity and this is reflected in the financing structure of BSP. The programme is based on a three pronged approach towards financing - investment subsidies, credit support and carbon finance. (SNV, 2010: 3) This has been complemented by market mechanisms in the sector.

When the programme started, in early 1990s, it was realised that the cost of a biogas plant could not be reduced without compromising on the quality. Therefore, financing mechanisms to reduce the cost to consumers were resorted to. Grants from the Government of Netherlands, through SNV, and German development bank (KfW) along with the Government of Nepal have been responsible for providing funds for the programme in the form of subsidies and credit support. Over time the share of Nepalese government has increased and it accounts for 28% of the total subsidy contribution now. The subsidy to purchase biogas plants takes into account the diverse capabilities of the user groups. In order to make the programme inclusive, low penetration districts receive additional subsidies. The scheme encourages use of smaller size systems, which are more amenable to

household use. This keeps purchase of large biogas plants by rich farmers out of the purview of the subsidy scheme. The scheme provides subsidies to biogas construction companies as well for ensuring quality control.

Although subsidies exit, there is still a big need for loans to purchase and install biogas plants. These loans are provided by micro finance institutions, which borrow from Biogas Credit Fund (BCF) at a mere 4% interest rate. BCF is a revolving fund set up by KfW and managed by Alternative Energy Promotion Centre (AEPC).

Gradually the grant subsidy component is expected to decline and be replaced by revenue generated out of carbon finance. In the fourth phase of the BSP, two CDM projects were registered covering 19, 396 plants. (Biogas Sector Partnership-Nepal, 2009: 12) These two projects have generated annual carbon revenue (net of verification expenses) of approximately 600,000 USD. (Biogas Sector Partnership-Nepal, 2009: 12) The annual CDM revenue is expected to rise to 3 million USD. This revenue could support BSP in becoming self-reliant eventually.

A broad-based approach through policies

Besides interest free loans and subsidies, the thrust for biogas has been provided through the overall policies of the government as well. The Eighth and the Ninth plans set a target of 30,000 and 1, 00,000 biogas plants respectively. Linking it to poverty alleviation, the Tenth plan set a target of 200000 biogas plants, including some community plants.

Following the emphasis laid by the eighth five year plan on institutional framework for alternative energy, Alternative Energy Promotion Centre (AEPC) was established under the Ministry of Environment, Science and Technology (MoEST) to provide inputs and recommendations for promotion, development and dissemination of renewable energy technologies in Nepal. In order to encourage uptake and entry of private companies in the business of manufacturing of biogas power plants, systems and accessories were exempted from value added tax during 1998 – 99.

By putting the next phase of the biogas programme under the Rural Renewable Energy Programme, an additional thrust and integration into the national energy framework can be envisaged.

Implementation of the programme

Institutional partnerships and collaboration

Implementation of the Nepal BSP is characterised by a multi-stakeholder approach, which is modelled on efficient public private partnership for development of a sector. The primary responsibility of implementation for the first three phases of the Programme was with SNV/Nepal and the fourth phase with a non-government organisation called Biogas Sector

Partnership Nepal. The implementation builds on existing and new partnerships and collaborations between international and domestic stakeholders.

The Federal Ministry for Economic Cooperation and Development - BMZ of Germany and the Directorate-General for International Cooperation of Netherlands are the main foreign donor agencies. Collaboration with BMZ was established later in 1997 during the subsequent phases. Initially, ADB played a key role in providing loans for purchase and installation of biogas plants. This role has gradually been taken over by a number of MFIs. Given the emphasis of the programme on developing the sector and the market, a sustainable role for biogas construction companies in the entire institutional framework is ensured. After the existence of a single company in the form of GGC, the biogas sector in Nepal has around 80 companies involved in construction of biogas plants.[27]

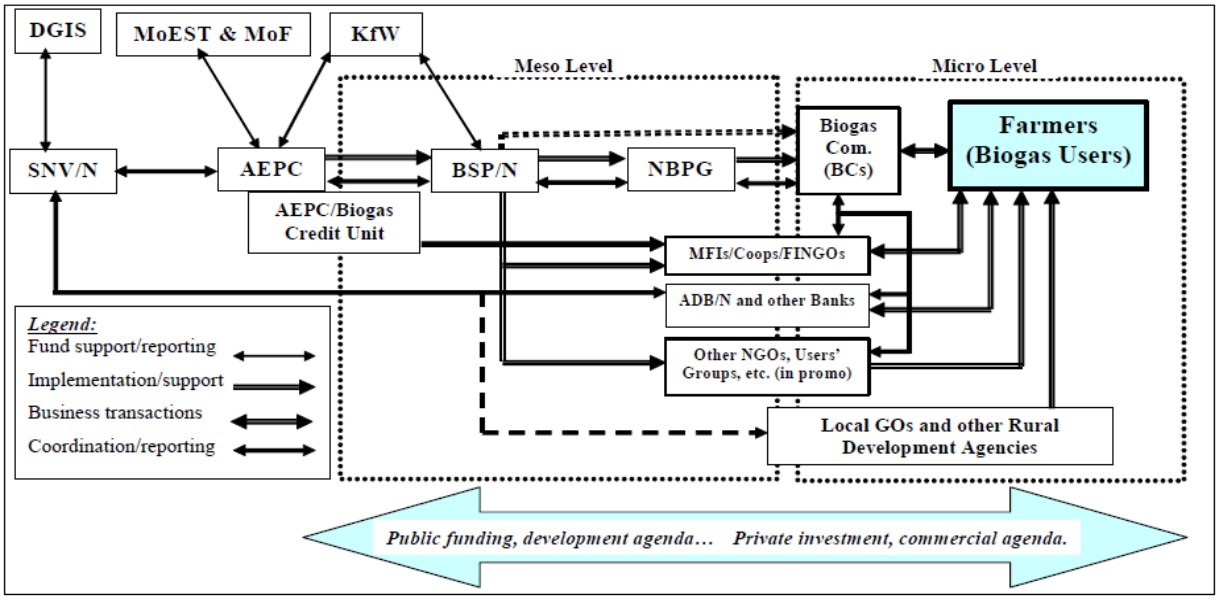
As mentioned earlier, the programme is modelled on public private partnership where the public sector facilitates and coordinates the activities of the private sector, which include construction, installation and service. (SAESUp, 2010:1) The Government of Nepal through its ministries and agencies, such as Ministry of Environment, Science and Technology, and AEPC are the nodal institutions for promotion of renewable energies and the biogas support in government policies. AEPC also performs the role of coordinating different aspects of the programme, for example the Biogas Credit Fund. The role of Ministry of Finance is also crucial in providing the subsidies for investment in biogas technology.

The programme involves local agencies, such as the District Development Committee (DDC) and the Village Development Committee (VDC). Environment and energy units have been established in DDCs for promoting and monitoring the programme at local levels. Some of the DDCs have gone further and provide additional subsidies and support for biogas plants.

For ease of implementation, BSP has a comprehensive implementation modality where roles and responsibilities of different roles are clearly defined. (Rai, 2006: 13) The institutional interaction between the various stakeholders at international, national and local levels is described in figure XX.

[27] As on February 15, 2011.

Institutional structure of Nepal – BSP



Capacity enhancement

Capacity enhancement is an important component of the programme and several workers as well as users have been trained. The programme's approach towards strengthening capacity is also different from traditional capacity building approach. Workers nominated by biogas construction companies are trained in dedicated theoretical and hands-on programmes organised by Nepal Biogas Promotion Association. Training of masons employed in biogas construction companies are done with the objective of ensuring that the trained workforce is able to use the skills gained for development of biogas sector and service of biogas consumers. Companies are also imparted training on issues like operations and quality. There is also a scheme of certification of biogas companies in order to make them eligible for receiving subsidies.

Monitoring and evaluation

The BSP follows a monitoring and quality system developed on its own which corresponds to ISO 9001 – 2000 system. At the level of plants, the monitoring is carried out by companies and reported to AEPC, NBPA and Biogas Sector Partnership. In some cases DDCS are entrusted with the responsibility of monitoring. The companies have to check the plants during the guarantee period. The monitoring scheme ensures that companies take advantage of the subsidies only after the plants have been successfully installed and AEPC has validated it.

Sustainability of the programme

Focus on sector development

BSP has focussed on the sector development rather than relying on support for mere individual projects. The activities are designed towards a commercially viable biogas sector

that is not dependent upon aid by government and multilateral agencies. Therefore, while on the one hand efforts are made for mobilising funds to support the programme, efforts to reduce the need for external funds are made on the other.

Due regard is given to the fact that for long term sustainability of the programme and achieving the target number of installations, development of supplier capacity is crucial. As a result, as many as eighty private Biogas Companies have been strengthened in the process of promoting biogas technology in all the seventy five districts of Nepal. A market approach, supported by quality control and research and development, has led to a 50 per cent decline in the overall cost of a biogas plant. (SNV, 2010a: 4)

In order to develop the sector, comprehensive approach is needed that gives due regard to existing and potential linkages to other sectors and initiatives. In this context, the programme has elements of health and sanitation, utilisation of waste and by-products, poverty alleviation and gender mainstreaming.

User Consultation and Buy-in

One of the main reasons for a slow uptake of biogas plants prior to the BSP was the inability of GGC to cater to the growing demand, not only for manufacturing but also for service and maintenance. As opposed to this approach, under the BSP the needs of the users and responses were built into the design itself. Consultations with the users, at the time of sale as well as operations, along with user surveys is instrumental in providing constructive feedback, which can be used to mould the project to ensure sustainability. Such consultations and evaluations after each phase of the programme have been used to improve the programme while ensuring that there is ownership and buy-in from the users. This buy-in is also attributable to the emphasis on quality control and monitoring.

The programme has been received well by consumers on account of multiple benefits, such as saving of fuel wood, smoke free cooking, saving of time for education and other chores, better toilets etc. (Sidgel, 2007:11)

Institutional and financial sustainability

In addition to a multi actor institutional framework with clearly defined roles, the sustainability of the programme lies in involving local institutions such as VDCs, forest officials, cooperatives and NGO networks. (Maharajan:2005) Institutions working at ground level are better exposed to the ground realities and have an edge in terms of promotions and mobilising use of renewable energy. Thus the institutional framework goes beyond just donors, companies and consumers, generating a greater sense of ownership from a diverse group of stakeholders. (Maharajan, 2005: 15)

Evaluation and innovation are two main characteristics of the Programme. This is reflected in institutional structure as well, where after successful completion of three phases, concerns about independence of the programme were raised. In order to attain long term

independence, the task of implementation of the programme was given to a new autonomous body with a legal recognition of its own. (SAESUp, 2010: 11)

Towards financial sustainability, Nepal BSP has been increasing the share of government of Nepal in the investment subsidies, thus reducing the reliance on overseas aid. Besides, subsidies are only a portion of the entire cost which is supported through micro finance. Currently, the MFIs receive loans at a low interest rate of 4 per cent. This is not sustainable in the long run and acts as a barrier for private banks to become a part of the financing structure of the programme.

Key take-aways

Mechanisms for operationalization

The programme engages with a range of groups performing different functions and at different levels. Right from local to global, institutions of a diverse nature are involved in different aspects of the project planning and implementation. The institutional diversity, as discussed in this case study helps in bringing on board a range of skills and strengths as well as a greater ownership of the project amongst different stakeholders.

Market development

The focus of the programme has been on development of the biogas sector and the market. A market approach has been strengthened and is evident in the fact that from a single company led sector to a presence of around 80 companies. Capacity building workshops, emphasis on after sales service and certification are other tools that have been made use to make the programme independent.

Financing

The Nepal Biogas Support Programme adopts a mixed approach to financing as well. It provides subsidies to support the initial purchase of biogas plants. However, the majority of the cost is still borne by the consumer, who is helped by MFIs. The subsidy scheme takes into account the different capabilities and conditions of recipients. The last and most recent phase has linked the programme with carbon financing to reduce the reliance on official aid.

Technology

The technology for biogas uses organic material to convert it into biogas and slurry. Use of cattle dung cakes for fuel had already been an accepted practice in most of Nepal villages. The biogas technology uses a biogas digester to produce biogas. BSP uses a modified Chinese fixed dome design for the plant. After being used for twenty years, innovations are being made to address the problems faced with the existing design. In this context, new designs are being developed and piloted. For example, the modified slurry outlet is designed to address the problem of sedimentation at digester bottom and insufficient gas storage.

Capacity building

Under the BSP, programmes are organised for capacity enhancement of workers in biogas construction companies for both installation as well as after installation service. Certain training programmes are organised for users as well. Therefore, the capacity to introduce as well as absorb the technology is developed.

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RET Development for Rural Electrification in remote China

Overview of China's Energy Sector

China's main sources of energy are fossil fuels accounting for 93% of total energy consumption in 2007 with other fuels such as nuclear power and renewable energy accounting for the rest of the energy mix. Growing concerns about carbon emissions in China, air pollution issues and concerns of over reliance on imported oil have left China with 3 options of either slowing economic growth and reducing overall energy consumption or reducing the energy intensity or rapid development of renewable energy. Since the country is not keen on the first option and recent reports have revealed that carbon intensity has been increasing since 1998 and slated to rise at least until 2020, policy makers have turned to the rapid development of renewable energy capacity.

Renewable energy policy regime in China

Historically, energy policy in the PRC has been highly reliant on thermal power generation – sourced with coal or oil – and prior to 2002; the State Power Corporation monopolized the power sector in the country. After the reforms of the electric power industry, the government has made efforts to diversify the sources of energy and include cleaner energy sources (Su, Hui, & Tsen, 2010). The reform policy for the power sector restructured the regulatory bodies, established electricity markets, introduced tariff reforms and disintegrated the State Power Corporation (SPC) into power generating, grid and service companies (Baker and Mckenzie, CRED, CREIA, & Renewable Energy Generators Australia Ltd., 2007). In terms of renewable energy, notable measures by the government of PRC include guidelines for wind farm development in 1994, electric power and energy conservation laws in 1995, renewable portfolio standards models in 2000 and measures for feed-in-tariffs in 2002.

The National Defence and Reform Commission (NDRC) is the main institution that deals with energy policy. The newly instituted National Energy Administration (NEA) has replaced the Energy Bureau under the NDRC and its mandate includes formulations of energy plans and policies. To strengthen the management of the sector, National Energy Commission (NEC) has also been formed to coordinate energy development in the country. It is interesting to note that in the last few years there has been increased participation of the State Environment Protection Administration (SEPA) in the policy discussions related to the energy sector.

Formation of RE Law

The Renewable Energy Law came into effect in early 2006 and now serves as the legal framework for renewable energy development in the country. The overarching framework provides provincial governments with mandates to develop renewable energy capacity. Notable under the RE law are provisions for compulsory interconnection of renewable energy into the grid (similar to Renewable Portfolio Obligations) and the development of a

renewable energy development fund. The Law also provides cost sharing agreements through feed-in tariffs. The draft amendments to the Renewable Energy law in 2009 were to address the issues related to coordination of national energy development strategy, guaranteed grid connection of renewable energy generators and the sources and targets for the renewable energy fund in the country (Su, Hui, & Tsen, 2010). The RE Law aims to increase the share of renewable energy in the total energy production from 3% currently to 16% by 2020.

Renewable Energy Development Project, China

Along with addressing the challenges of energy security, China has also been concentrating its efforts towards increasing electrification and access to modern energy especially in its far flung rural areas. According to the World Energy Outlook (2010) by the International Energy Agency, the electrification rate in China stands at 99.4% with 8.1 million people remaining without access to electricity. (International Energy Agency, 2010) This is an impressive improvement since the 1970's, when in 1978 only 63% of the population had electricity access (Jiahua, et al., 2006). A majority of the people who lacked access to electricity were located in the western mountainous, grassland and plateau areas (Wang, Gao, & Zhou, 2006). The nine provinces of the west and North West China have been underdeveloped and poor with most of the population involved in nomadic animal husbandry. The region has very low population density (only 0.2 people per km^2 in some areas) with very limited access to goods and services. Grid electricity is limited to a few villages and kerosene and butter lamps are the main source of lighting (Xinlian & Wei, 2008).

The Rural Energy Development Project (REDP) in China was started in 2001 with one of the aims as providing photovoltaic solar home systems to these remote off-grid homes. The project was setup by the National Development and Reform Commission (NDRC) and the World Bank with international grant financing from the Global Environmental Facility (GEF). The project was designed to develop market driven approaches to renewable energy development that focused on

i. promoting commercial or near commercial applications,

ii. combined international advances in technology with demonstrated Chinese low cost production capabilities

iii. and served the potentially large demand for electricity by lowering costs and improving products, system reliability and consumer service (World Bank, 2001).

The overall project supported the two most promising renewable energy technologies - grid connected wind farms in coastal regions and solar photovoltaic for rural application. The solar photovoltaic component is considered a best practice example for its role in SHS deployment because of its large scale and unconventional target customers.

Planning for the project

Before the introduction of REDP in China, several other renewable energy promotion programmes had been initiated by the Chinese government and supported by bi/multi-lateral agencies, which were mostly under the scope of poverty alleviation. Notable projects include the Brightness Rural Electrification Program (1999-2010), the Township Electrification Program (2001-2005 and a second round until 2010) and several other short term projects that focused on providing Renewable Energy Technologies (RETs) to rural consumers (Sovacool & D'Agostino, 2011). The REDP stood out from all the other projects as it was targeted to the areas that are inaccessible for grid connectivity.

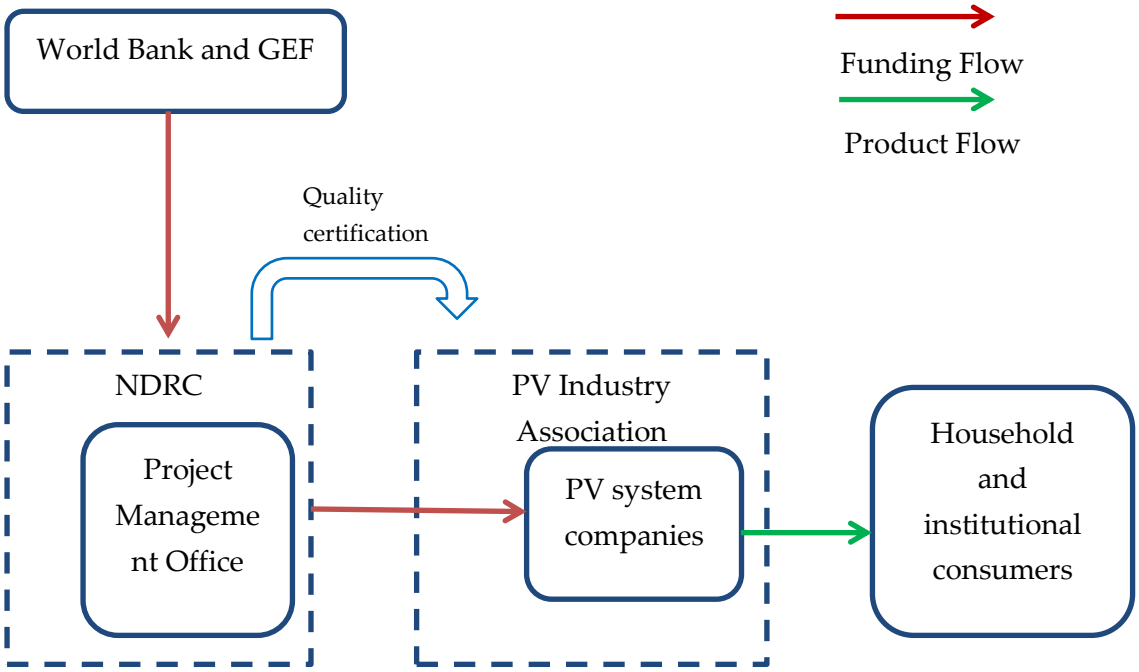
The project was designed to address the challenge of inadequate electricity access in remote areas and remove barriers to private investment in renewable energy manufacturing. The project developers integrated learning from renewable energy programs in other countries (like India and Indonesia) and instituted safeguards to avoid problems of poor equipment performance and lifetime and poor credit access to customers (World Bank, 2001). The project served the nine provinces of Inner Mongolia, Gansu, Qinghai, Western Sichuan, Tibet, Xinjiang, Shanxi, Ningxia and Yunnan (Sovacool & D'Agostino, 2011).

The coordination of REDP was undertaken by the Project Management Office (PMO), under the NDRC, that was responsible for all decisions related to selection of participating companies, authorizing payments, certification procedures, promotional activities and capacity building for quality improvement and management (World Bank, 1999).

Implementation of the project

The small scale PV industry was fairly established in the country before the introduction of the REDP, but many of the companies were on the brink of collapse due to the lack of enterprise capital. Under the REDP's company led SHS promotion model and the technology improvement component, several companies were able to ramp up their businesses. The main feature of the project was the incentives mechanisms for the participating companies that were offered subsidies up to 20-25% production costs. A direct grant was provided to PV system companies to market and sell solar home systems to households and institutions in the isolated areas of the nine provinces. Under this mechanism, the PV component targeted a total capacity installation of 10 MWp over the course of 2002-2007 which was surpassed by the 28 participating companies that sold 11.1 MWp of SHS units in 400,000 verified sales. Units of 10 Wp and larger were eligible for sub-grant support (Sovacool & D'Agostino, 2011).

Value chain for REDP China



An integral part of the project was institutional strengthening to remove barriers to market development and commercialization of the technologies. Under this component national standards were developed for PV system and components (the Golden Sun Label) and centres were established for PV testing and certification for standards that ensured quality control from suppliers (World Bank, 2001). The follow-up feature under the PV component was the SHS quality certification which was also rewarded with a rebate of $1.50/Wp (increased later to $2/Wp) for standard compliance post verification by the PMO (Sovacool & D'Agostino, 2011). The financial support was instrumental in improving the PV product quality, improve warranties and after sales service and increase marketing efforts on the part of the companies.

Sustainability of the project

The PV component benefitted more than 400,000 households in six provinces of North-western China and apart from installing PV SHS systems in remote areas of the country, the project was also instrumental in improving the quality of production of SHS components, providing information about PV and facilitating cooperation between PV sector in China and the rest of the world. The project concluded in 2008 and has been taken forward by the China Photovoltaic Industry Association (Xinlian & Wei, 2008).

REDP has been hailed as a successful PV deployment case which was possible only by identifying stages of the product life cycle and designing project components that match stakeholder needs. The RE law in China based itself on the successes of the REDP, in establishing financing systems to ensure RE development. The RE law has made use of

funding arrangements and cost sharing systems based on particular energy systems as was used by the REDP along with mechanisms for research and development of technical standards. These arrangements have facilitated private enterprises and industrial associations to take the project forward ensuring sustainability even when the government pulls out. The takeover by the industry from government is in itself ensuring independency of the project.

In the light of these achievements, it is interesting to note that despite China being a leader in RET market development, the share of renewable energy is low in the country's energy mix owing to its inertia of producing energy with fossil fuels. But the development of RE technology and the market value chain around it will assist the country in a smooth shift towards renewable sources, once there is political momentum behind it.

Key Takeaways

Market Development to ensure independency of solutions - The most important feature of the REDP was the combination of technological improvement and market development to support the flow of improved products for energy access. Not only was the choice of technology suited to the remote off grid conditions of the target customers, the project implementation was also supported by a market supply chain that ensured successful deployment of the technology.

Financing – The financial support to the PV companies in the form of grant support and additional rebates on certified and standard compliant products was an important incentive for the companies for both promoting/delivering the products as well as maintaining requisite quality of the product. The financing not only incentivised the companies it also supported the companies with much needed enterprise capital.

Monitoring and co-ordination mechanism – While market development was planned in detail, the project management office also ensured mechanisms of monitoring the activities of the PV companies through verification of sales and customer feedback processes to understand their needs and the gaps in the market structure.

Technology and Capacity Building – Appropriate importance was given to the capacity development of the institutions that were involved in the project. These institutions were able to understand the technology and develop the standards for product quality which in turn helped to increase the life of the PV components.

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Renewable Energy and Rural Electricity Access Project (REAP), Mongolia

Background

Mongolia is one of the least developed countries in Asia (World Bank 2006a). Mongolia's transition to an increasingly free market economy after the collapse of the Soviet Union has been accompanied by rapid growth of urban centers which has led to remarkable stress on the energy sector. One-third of the population in Mongolia lacks access to electricity and about 43 percent lack access to central heating (United Nations Economic and Social Commission for Asia and the Pacific 2004).

Mongolia's population in 2008 was estimated at 2.6 million people, making Mongolia one of the least densely populated countries in the world. Roughly half of the population lives in the capital, Ulaanbaatar. Out of the 43 percent population that is rural, two-thirds is engaged in livestock herding. (World Bank 2009; World Bank 2004).Extremely cold winters in Mongolia coupled with higher elevations make demand for energy much higher in the winter than the summer (Mehta et al. 2007). Mongolia is comprised of 21 provinces, called *aimags*, within which there are 329 *soums* (A *soum* is roughly equivalent to a county in the United States). Hundreds of thousands of Mongolians depend directly upon animals for their own livelihood (Economist 2010). Most of the herders live off-grid in *gers* - collapsible tents that can be easily dismantled and move according to weather and grazing conditions, while others live in permanent *soum* centers that include hospitals, school, and banks to serve the nomadic herders.

The Renewable Energy and Rural Electricity Access Project (REAP) in Mongolia provides energy services to the nomadic herders by providing solar home systems (SHS) and wind turbine systems (WTS). This internationally sponsored $23 million project has distributed over 50,000 SHS and small-scale WTS to herders, who constantly keep relocating and are highly dispersed. REAP thus enables Mongolian herders to rely less on the conventional sources on energy, and improves their quality of life by making lighting, communication, television, refrigeration more accessible.

Renewable energy policy regime in Mongolia

In 2001, the Government of Mongolia (GoM) approved a Sustainable Energy Sector Development Strategy Plan to promote electrification and renewable energy. This required government commitment to expanding access to energy services for herders and reforming *soum* electricity markets to make them more competitive and profitable.

Furthermore, the Parliament approved the National Renewable Energy Program in 2005 which set a national renewable portfolio standard with a target of 3-5 percent of renewable energy supply by 2010 and 20-25 percent by 2020. In 2008, the Parliament approved the Law

of Mongolia on Energy which includes a German-style feed-in tariff for solar and wind energy which passes on premium costs for renewable electricity among all rate-payers.

The National Renewable Energy Center in Mongolia is REAP implementing agency and its main goals are to introduce sustainable development principles to Mongolia, achieve the goals of the National Renewable Energy Program, introduce new renewable technologies to Mongolia, and develop Mongolia's technical capacity. This Center has a facility for assembling PV modules and since its establishment in 1998, it has produced 350 kWp solar panels and installed 700 kWp stand-alone PV systems for the telecommunication offices, hospitals and schools in offgrid *soum* centers, TV repeater stations, as well as PV home systems for nomadic households.

Planning for the project

About 170,000 herders in Mongolia are nomadic and 182 *soum* centers are not connected to the grid (GEF 2006a). These *soum* centers rely on small diesel generators with high system losses and reasonably high generation costs. Some of the *soum* centers do not operate their generators during summer months to keep fuel costs low, while in winter months only one-third of *soums* can afford to operate generators continuously (World Bank 2006b).

The fundamental objective of REAP is to increase energy access for off-grid rural areas by delivering SHS and small-scale wind turbines to herders and nomads, who continue to reside with no fixed location. Also, connecting the 182 *soum* centers to the grid would be "cost prohibitive" (GEF 2006).

The project was divided into three components aimed at herders, *soum* centers, and national capacity building. The three components within the project include $11.6 million herder electrification program, $10.09 million *soum* center electrification program, and $1.31 million national capacity building program. REAP is financed by International Development Agency, Global Environmental Fund, Government of Netherlands and Government of Mongolia.

The key stakeholder is the National Renewable Energy Center (NREC), which oversees contracting, procurement, monitoring, and reporting. It also implements the capacity building component. The other stakeholders include the Mongolian Ministry of Fuel and Energy (MOFE), which serves as the project coordinator; the Ministry of Finance, and the Ministry of Environment and Resources. The entire project is managed by a Steering Committee consisting of key staff from Ministry of Finance, Ministry of Environment and Resources, and MOFE.

Implementation of the project

The objective of the first component of the REAP project is to strengthen solar home system supply and small-scale wind chains. It includes training certified suppliers and installers, offering seminars for *soum*-based technicians, improving testing and standardization, and

providing business development loans to certified suppliers so they can increase sales, conduct field visits, and diversify the market. This component administered subsidies to cover up to fifty percent of the cost towards first time buyers of SHSs and wind turbine systems. This component also aggregated the purchase of SHS parts that were imported primarily from China, with the aim of achieving better prices due to bulk purchases. Thus retailers had the option of buying their parts from the REAP program office at better prices than if they imported directly on their own.

Funds were enabled to generate public awareness and consumer engagement through preparation of sales catalogs, display of sample systems, provision of after-sales service, and establishment of warranties. Thus this component also provided marketing and sales support to companies to help them enhance sales and commercialize SHS and WTS technologies.

The second component of the project is improvement of *soum* center electricity services with the aim of providing technical assistance for small-scale grid suppliers. Activities include analyzing needs of *soum* utilities, understanding the barriers to grid electrification of rural areas and offering business development loans and access to financing. This component attempted to build capacity within *soum* electric utilities, and restore their transmission and distribution networks. Part of this component involved engaging the private sector to participate and invest in *soum* utilities, designing a regulatory framework conducive to more economically sound tariff setting, metering, and billing. This component was targeted to benefit 200,000 herders through improved electricity services offered at *soum* centers by 2011.

The objective of the third component of REAP is to provide training, monitoring, and evaluation. The institutional capacity building component was established to strengthen the capacity of NREC to carry out the project -- it covers technical and management training for NREC staff. Such capacity-building could assist Mongolia in developing a more robust regulatory framework at the national level for promoting renewable energy. Part of the capacity building also includes extensive consultation with donors, banks, and solar and wind equipment suppliers.

Sustainability of the project

REAP's integrated approach of coupling rural electricity services with development makes it truly remarkable. It focuses not only on deploying SHS and wind units to nomadic herders, but also on rehabilitating electricity grids and shifting from diesel-produced electricity to hybrid diesel-renewable and fully renewable energy micro-grids. The project undertakes efforts to improve technology through certification, standardization, and after-sales service along with efforts to improve regulatory frameworks, build institutional capacity, train workers, and demonstrate solar and wind applications for herders.

Key lessons learned

Emphasizes Institutional diversity/ mechanisms of cooperation and co-ordination

REAP requires the collaboration of different stakeholders – National Renewable Energy Center (NREC), Mongolian Ministry of Fuel and Energy (MOFE), Ministry of Finance, Ministry of Environment and Resources, suppliers and installers, professionals and experts.

The private dealers, who have to import SHS equipment from China, have the option of buying their equipment from the REAP program office at better prices than if they were to import directly on their own -- good example of how partnership has helped private retailers.

Technology and capacity building

GoM set aside $1.31 million for national capacity building program. It includes providing training, project monitoring and evaluation, and reporting. It also includes the technical and management training for NREC staff so that this could assist Mongolia in developing a more robust regulatory framework at the national level for promoting renewable energy.

REAP also established technical standards and procedures for testing the quality of SHS and WTS equipment and required that only qualified systems could receive the subsidy.

Challenges

- ***High upfront cost of renewable energy:*** Even with the financing provided by REAP (subsidies to cover up to fifty percent of the cost towards first time buyers of SHSs and wind turbine systems), herders still have to provide fifty percent of the system costs themselves, which amounts to half of their annual income. The winter of 2009 was unusually cold because of which the nomadic families lost more than 4.5 million livestock and thus have fewer assets on which to draw from to pay for the SHS and WTS (Economist 2010).

- ***Lack of awareness:*** Most of the herders lack information and understanding about what SHS can do. Some herders have unrealistic expectations about the capacity of SHS to power an entire *ger* with lavish appliances, television, refrigerator, and electric stove – an idea that solar panels can do everything.

- ***Lack of institutional capacity:*** There is a lack of institutional capacity within and between the government planners, development agencies, *soum* centers, and the retailers. The current Mongolian energy planning processes also suffer from inconsistent policies and poor coordination between different ministries and a lack of transparency.

Conclusion

The Mongolian market for SHS and WTS is currently dependent on imported Chinese technology and has huge potential to become a robust and self-sustaining part of the local economy with the help of institutional support.

Despite some of the challenges such as high upfront cost for SHS and WTS units, lack of public awareness, and dependence on Chinese technology, REAP has done an outstanding job of distributing about 50,000 SHS and WTS to rural users in Mongolia. It serves the needs of nomadic herders, who continue to reside with no fixed location. Thus, grid electrification efforts should be complemented with targeted policies aimed at supporting these herders.

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Energy Efficiency in India

India's per capita consumption of energy was quite low at 530 kg of oil equivalent per person of primary energy in 2007 as compared to a world average of 1820, China's 1480 and the US's 7750 (International Energy Agency, 2009). Despite the concerns over the inequitable access to modern energy, this low per capita consumption is also a result of policy and institutional initiatives towards energy efficiency in the country. Policy evolution spread across the last decade has made energy conservation and efficiency important parts of India's energy planning process.

Institutional and policy frameworks

The energy policy regime in India has revolved around fuel conservation since the mid 1970's and the heightened focus on energy efficiency can be traced back to the formation of the Bureau of Energy Efficiency (BEE) under the Energy Conservation Act that was passed in 2003. The Energy Conservation Act introduced energy consumption norms like the Energy Conservation Building Code and identified designated consumers (mostly large energy intensive industries and facilities) to follow each of these norms. The BEE was created to implement the provisions of the Act in the form of new policies and initiatives on energy conservation and energy efficiency (Government of India, 2001).

The mandate of BEE is to provide all institutional support for energy efficiency services in all sectors of the economy. The bureau works on the mission of reducing the energy intensity of the economy through interaction with different types of stakeholders like the private sector, non-governmental agencies, technical agencies, research institutes and civil society organizations.

The Bureau created different standards for energy efficiency in the industrial sector, consumer appliances, commercial buildings; created guidelines for capacity building of energy managers and auditors and created energy performance codes. The BEE has taken the lead as a government body to prepare and participate in energy efficiency programs. The Conservation Act also required states to create designated agencies for the implementation of the regulations under the act and policies by the BEE. The various schemes of the BEE have been designed in a way to involve maximum participation from the private sector and reduce any kind of dependence on government subsidies. To win support of the private sector for its different schemes, the BEE first introduced voluntary programs and then converted them into mandatory schemes. One of the main activities of the BEE is capacity building and training in the field of energy management and auditing. The EC Act defines the functions and powers of energy auditors and managers and makes provision for their training and accreditation by the BEE.

The eleventh plan targeted a 5% reduction in energy consumption by 2012. Some of the initiatives to achieve this target are

- Bachat Lamp Yojana – distribution of compact fluorescent lamps at a subsidized rate to grid connected households
- Standards and Labelling schemes – for high energy end use appliances to induce the consumer to make an informed choice of energy efficient products
- Energy conservation building codes – set energy standards for new commercial buildings and energy service companies (ESCOs) for existing buildings.
- Demand side management measures – in the agricultural sector through public private partnerships to enhance pump set efficiency and up gradation; and in the municipalities to increase energy efficiency in the local water and energy supply systems.
- Energy efficiency enhancement in small and medium enterprise clusters.
- Energy conservation information centres

The presence of BEE as an institutional mechanism played a key role in the formulation and introduction of the National Mission on Enhanced Energy Efficiency as a part of the National Action Plan on Climate Change. The mission depends highly on the participation of different stakeholders to propel the mandate of energy efficiency and the BEE is playing its role in the coordination of different stakeholders through its various schemes and programs.

National Mission on Enhanced Energy Efficiency

Background

The fast growing economy of India has seen a rapid increase in modern energy consumption. Still, India has a long way to go in terms of providing adequate and equitable access to modern energy services to its masses. The per capita commercial energy consumption of the country is lower than other emerging economies and only 66.3% of the population has access to electricity (International Energy Agency, 2010). The primary commercial energy consumption has increased by 77% in the last decade, and the increasing demands of a growing economy have made India a major importer of fossil fuels, especially oil (BP, 2011).

While moving away from fossil fuels has been seen as a long term goal for the country and being materialized through strategies like the JNNSM, in the immediate future energy efficiency improvements represent the largest and least cost opportunity to meet the growing energy needs. As Parikh and Parikh (2011) explain, a unit of energy saved by a user is greater than a unit produced as it saves on production, transport, transmission and distribution losses (Parikh & Parikh, 2011). The major sectors where higher energy efficiency can make a substantial impact are mining, electricity generation, electricity transmission,

electricity distribution, pumping water, industrial production and processes, transport equipment, mass transport, building design, construction, heating ventilation and air conditioning, lighting and household appliances. The potential of some of these sectors has been identified by the government and policy actions have been directed towards them.

Planning and implementation of the NMEEE

The integrated energy policy (2006) identified some of the barriers to increasing energy efficiency in the country and these barriers were connected with energy pricing especially in the rural areas and asymmetric information to consumers who are not aware of opportunities to conserve energy (Balachandra, Ravindranath, & Ravindranath, 2010). With increasing demand for energy to fuel the growing economy combined with the country's commitments to move towards a greener economy, policy makers have been faced with challenges to provide cleaner energy solutions to the masses. With the formulation of the National Action Plan on Climate Change (NAPCC), a mission approach has been adopted for energy efficiency for the role it is expected to play in meeting the country's energy demands.

The National Mission for Enhanced Energy Efficiency (NMEEE) under the NAPCC targets savings of 10,000 MW by 2012. The plan is to introduce several market based mechanisms and support other on-going measures directed towards energy consumption reductions. The following activities would be introduced under the NMEEE –

1. Perform Achieve and Trade (PAT) – a market based mechanism to enhance energy efficiency of 'designated consumers' with specific steps of goal setting of a specific energy consumption target for each facility, reducing of energy intensity according to the goal in a three year period and trading of energy permits with other designated consumers who were unable to achieve their targets.

2. Market Transformation for Energy Efficiency (MTEE) – are a set of demand side management measures, supported with CDM financing. The initiatives include charting a national CDM roadmap under which programmatic activities like the Bachat Lamp Yojana and DSM schemes in the Agricultural, Municipal, SME, commercial transformer and commercial building sectors would be promoted. Other initiatives include standard setting and mandatory labelling of an array of end use products, rules to govern public procurement, technology programs to reduce transmission and distribution losses, energy conservation building code for new and existing buildings, ESCOs promotion and capacity building programmes.

3. Financing energy efficiency – The mission also focuses on mechanisms that would help finance demand side management activities. The initiatives include fiscal instruments of tax exemptions on energy efficiency projects by ESCOs and venture capital funds, reduction of VAT for energy efficient products, a revolving fund to

promote carbon finance and a Partial Risk Guarantee Fund to cover risk exposure of loans made for energy efficiency projects.

4. Power Sector Technology Strategy – for increasing the energy efficiency of power plants by adopting efficient generation technologies in new and existing plants, development of know-how for super-critical boilers and roadmaps for IGCC demonstration plants and an overall fuel shift.

5. Other initiatives – to support the aforementioned activities are setting up of a public sector company to facilitate investments in energy efficiency projects, strengthening of state designated agencies and the BEE to improve institutional capacity for energy efficiency regulation and country wide awareness programs.

Key takeaways

Capacity building for technology absorption – The policy framework for energy efficiency in India has given a lot of importance to the training and capacity development of energy managers and auditors within the public as well as the private sectors. These trainings have been instrumental in the development of expertise in various industrial sectors (private as well as state owned enterprises) of the country.

Financial innovations and incentives – The BEE designed its programs to utilize fiscal instruments that incentivised private players to participate in its programs and schemes. Along with this, some schemes also utilize CDM financing to support participating entities. These were conscious decisions to ensure that schemes and programs are not dependent on government subsidies for their success and sustainability.

Coordination and coherence – The bureau interacts and coordinates with multi-level stakeholders from the government (national, state and local bodies) and non-governmental actors like private enterprises, industries, civil society etc. Without their support and cooperation, BEE schemes would not be successful. There are also provisions under international bilateral cooperation for sharing of learning and experiences from different countries.

Market oriented strategies for technology dissemination – As has been mentioned above, the Bureau has designed its schemes and initiatives to be highly market oriented in terms of participating actors, financing and their resultant benefits, thus ensuring that systems are set in place for taking forward the mandate of energy efficiency even in the absence of any regulatory body.

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"Japan's Shift of Energy Policy toward Renewable Based and Distributed Energy System after Fukushima – Its Efforts and Challenges"

Introduction

Japan had overcome the issue of energy access and electrification in rural areas during the last century by establishing its extensive national grid network and regionally concentrated large-scale power generation mainly based on fossil fuels and nuclear energy. The Fukushima nuclear disaster, however, newly raised the issue of energy access at the time of emergencies when the mega power plants are shut down. The Japanese experience would provide some valuable lessons for the rest of Asian countries which have yet to devise a fixed and inflexible energy generation system with widespread national grid networks like Japan thus they have more room and potentials for introducing the most innovative type of decentralized renewable energy based system, skipping the developmental phase that Japan had to go through.

For this kind of new, distributed and renewable based energy system to function as intended, local participation and financial incentives are key as it, by definition, requires effective participation of small scale power producers and this would be unlikely without long term financial incentives. Also as renewable electricity technology has still limited capacity and cannot generate a large amount of electricity as cheaply as fossil fuel and nuclear based energy, energy conservation is the norm.

In this connection, this study takes up three sample cases of Japan's efforts to transform its energy system to a newly liberalized, distributed and cleaner energy system. The first example is to demonstrate how a mix of bottom up and top down measures is taking place in Japan, such as collaboration projects between private companies and municipalities for creating smart communities and feed in tariffs, which are designed to boost these efforts toward distributed renewable energy system.

As an example of emerging challenges to a large scale deployment of renewable energy technology, the issue of waste of end-of-life solar PV modules is taken up as the second example and discussed to highlight the importance of their effective management. Also to demonstrate how a simple top down voluntary initiative set off a positive response from businesses and the public and brought about a drastic change of Japanese work style, which contributed to much needed energy saving is to be presented.

From Monopolized, Concentrated Power Generation to Liberalized, Distributed, and Renewable Based Power Generation

Background

The major shifts of Japan's energy policy have been made a few times since 1950's, often provoked by major events such as the oil shocks and the Fukushima nuclear disaster, trying to accommodate prevailing domestic and international energy crisis and more recently environmental concerns. Japan's main sources of energy had traditionally been hydraulic, coal and shifted to oil during its high economic growth in the 1960s but since the two time oil shocks in 1970's increasingly natural gas and nuclear power have provided the base load to rectify its excessive reliance on oil. As a result, its reliance on oil has gradually decreased but its dependence on fossil fuels, for majority of which Japan relies on import from Middle East remains high at over 80% and Japan's energy self-sufficiency rate was 18% in 2007, which is a major concern from its energy security point of view. [National Policy Unit, Cabinet Secretariat of Japan, 2011]

Until last year, Japan's energy policy was to rely on nuclear energy for 50% of its electricity by 2030 [National Policy Unit, Cabinet Secretariat of Japan, 2011] in an effort to supply cheap and stable energy and to reduce GHG emissions at the same time but the Fukushima nuclear disaster caused most Japanese to lose trust in the safety and credibility of its nuclear plants. Japan's energy system has been regionally concentrated with large scale hydro, nuclear and fossil fuel based thermal plants where electricity demand is far from the power sources, the system of which has been proven vulnerable by the Tsunami and its subsequent nuclear disaster and power cuts.

So far, Japan's energy policy has aimed at supplying cheap and stable energy for its economic growth and has not paid adequate considerations to give people incentives and means to restrain demand for electricity despite its advanced technology in energy saving electric goods. The Fukushima disaster exposed the critical need to conserve energy, especially significantly reduce electricity consumption at peak time. But under the current system, there was not right pricing for consumers to reduce the overall level of electricity consumption at a peak time and they were not informed of when the demand of electricity was highest and when there was therefore most need for energy conservation. The consideration of supply side alone cannot solve the problem of energy shortage given a potential phase out of nuclear power generation in Japan and the high cost and limited capacity of renewable energy in the near future.

Moving From Nuclear to Renewable

Japan is now at a critical juncture for its major energy system transformation, backed by unprecedented momentum for de-nuclearizing and greening its energy system. Although the government has not made a decision officially to opt out of nuclear power generation, its planning documents suggest considering the best energy mix with a clean slate is the way

forward. [Japanese Agency for Natural Resources and Energy (ANRE), 2011] Recent opinion polls show that 74% of Japanese want to phase out nuclear power generation. [SciencePortal , 2011] At the time of writing, only 3 out of 54 existing nuclear reactors are operating in Japan [JAPAN ATOMIC INDUSTRIAL FORUM, INC., 2012] as most of them have been stopped for their renewed inspection in recognition of the need to assume much higher level of risks.

It seems likely that Japan will need to phase nuclear energy out or at the very least significantly reduce it by replacing it with other sources of energy, which, given Japan's obligations to further reduce its GHG emissions, should be clean and renewable. Also new energy should be economical and reliable enough not to harm Japanese industries and chase them away to countries where electricity is more affordable.

Exposed Vulnerability

The vulnerability associated with Japan's regionally centralized, large-scale power generation with ten regional electric power monopolies covering each region has been exposed by the Tsunami and the nuclear disaster in March 2011. The biggest among those monopolies is Tokyo Electric Power Company (TEPCO), which nuclear reactors in Fukushima were severely damaged by the Tsunami and lost their capacities. The capacity of electricity provision by TEPCO after the earthquake has decreased 40% from 52 million kW to 31 million kW and lacked about 10 million kW to meet the estimated peak electricity demand (about 41 million kW) in the season. [Agency for Natural Resources and Energy , 2011]

Under the jurisdiction of TEPCO and the Tohoku Electric Power Company, there was a blackout of about 8.7 million households right after the quake. [Agency for Natural Resources and Energy , 2011] In the following weeks, to keep the balance in supply and demand for electricity and to avoid extensive and unpredictable blackouts, those electric companies introduced planned power cuts, which disrupted the activities of manufacturing sectors of mechanical parts in the region and companies directly or indirectly dependent on those parts for their products were also forced to stop or reduce production and as a result, the disruption had not only domestic but also significant international repercussions.

As mentioned above, according to the recent opinion polls, majority of Japanese (74%) want at least a phase out of nuclear power generation and 64% of them want an increase in the share of renewable energy based electricity generation even if it comes with an increase in the electricity price [Asahi Shimbun, 2011], although the survey didn't specify the exact amount of a potential increase. The Japanese government is revising its basic energy plan, which has been adopted in 2010, to reflect lessons learned from the Fukushima disaster and seems to be heading in the same direction as the opinions of the Japanese public. There seems a common ground among the majority of Japanese and decision makers alike that in order to overcome the vulnerability of the Japanese energy system, increasing renewable

energy based, distributed power generation and promoting energy conservation as much as possible is the way forward and therefore should be the core of a new Japanese energy policy.

Japan's share of nuclear based electricity consumption is 29% and renewable based electricity is 9% (2009), out of which, only 1% is due to non-hydro renewable such as solar and wind energy. [National Policy Unit, Cabinet Secretariat of Japan, 2011] This 1% figure is among the lowest among developed country counterparts. This low level could be due to the existence of regional monopolistic power utilities in charge of power generation, transmission and distribution, high costs of renewable energy technologies especially solar PV, and geographical constraints such as lack of suitable land for wind energy and solar panels.

But even if Japan successfully deployed renewable based electricity generation to cover a substantial portion of its electricity demand, it would still need base-load electricity, which would back up unstable renewable energy sources. And unlike Germany, Japan cannot import base-load electricity from a neighboring country, which makes it harder for Japan to give up nuclear power generation entirely.

Smart Community

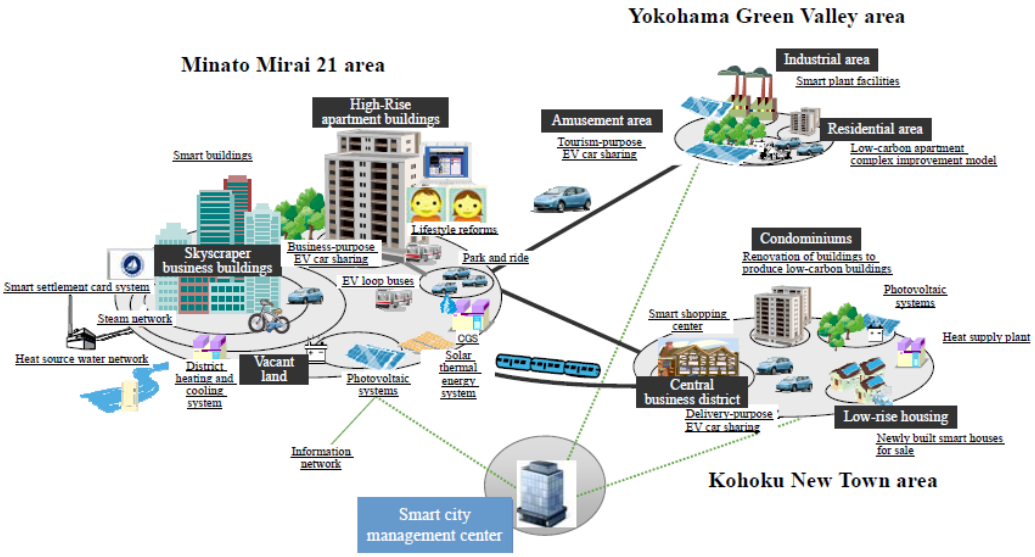
The concept of 'smart community', that takes energy from a diverse set of renewable sources locally and that is decentralized, autonomous, and thus resilient to natural as well as manmade disasters (e.g. terrorism), has been proposed as a model for the Japanese future energy system. [Japanese Agency for Natural Resources and Energy (ANRE), 2011] For the smart communities to take roots to replace the current regionally concentrated system, a radical increase in renewable energy power generation is necessary and to achieve that, financial incentives such as feed in tariffs and subsidies for renewable energy related products and strengthening the existing grid networks to address fluctuating backward flows (e.g. maintaining the quality of fluctuating frequency and voltage) from dispersed renewable electricity producers will be a prerequisite.

Collaboration between Private Sector and Municipalities

There have been some pilot initiatives by local municipalities and the private sector to create smart communities, one such example is 'Fujisawa Sustainable Smart Town' led by Panasonic and 8 other companies[28] in collaboration with the city of Fujisawa near Tokyo. [PanaHome Corporation , 2011] The concept is to create a smart community for 1,000 households supported by solar PV electricity generation system and storage batteries placed in every household and public facility.

[28] Accenture Japan, Orix, Nihonsekkei, Sumitomo Trust and Banking Co., Tokyo Gas, Panahome, Mitsui Fudosan, and Mitsui Bussan

Similarly, the city of Yokohama in collaboration with leading companies in their respective fields[29] has developed a project to make three of its wards model smart communities supported by a smart grid system, which is to introduce, inter alias, a large-scale renewable energy system, community, home & building energy management system (CEMS, HEMS & BEMS) as well as a large quantity of electric vehicles and their charging stations. [City of Yokohama , 2010]



Yokohama Smart City Project

These initiatives can be useful to test various hypotheses of proposed models such as the lease model of solar panels aimed at reducing financial burdens of their initial investment on consumers and at accelerating the deployment of solar based electricity generation. They are also useful to identify potential problems and obstacles to further deployment of community based renewable energy. But these local level initiatives are a few isolated pilots and cannot be expected to scale up on their own without governmental support until these systems become commercially viable and people as well as business start to see the advantages and benefits of the system.

Japan is now faced with the most challenging task to find a cleaner and safer way to cover 30% of its electricity consumption, which nuclear reactors had been providing but this challenge can be a golden opportunity, which Japan has needed for a long time to get out of its old energy system and move toward cleaner and safer mode of electricity generation.

Feed in Tariffs in Japan

Considering the fact that 94% of Japan's nuclear power generation is down and not expected to resume its operations soon, the need to increase alternative forms of electricity generation

[29] Accenture Japan, Tokyo Gas, Tokyo Electric Power Company, Toshiba, Nissan Motor, Panasonic, Meidensha and others

is urgent. To radically increase the share of renewable energy based electricity to achieve its renewable energy target of 20% by 2030, Japan needs to introduce sustainable financial incentives to encourage the generation of renewable based electricity in a distributed manner and needs technical and regulatory adjustments to allow this to happen.

As a promising market based instrument, Japan passed the feed in tariff law in 2011 aiming at 30,000MW within 10 years and it will be implemented from 2012. This is based on the good practices of European countries, especially Germany and Spain that have increased the share of renewable based electricity generation drastically in a short period of time.

In Japan its grid networks have been designed to accommodate one way electricity flows from large-scale conventional power utilities to consumers via grid operators but FITs assume the opposite direction of electric flows from small-scale electricity producers to the grid operators. In Japan, the service of electricity generation and grid operation have been monopolized and treated as inseparable, which has been proven not conducive to distributed electricity generation as other electricity generators do not have free and fair access to the grid.

The details of the Japanese FITs are yet to be worked out but the basic features are the same as the European FITs in that the government sets the rates per unit renewable based electricity per technology and utilities will have to purchase all the excess electricity renewable electricity generators i.e. households and businesses generated at those above market rates. It will be designed so that there would be incentives for electric companies like TEPCO to gear up their renewable energy generation. It is expected to trigger a radical increase in renewable electricity generation at local level.

It remains to be seen whether they could transform Japan's current regionally concentrated energy system and achieve comparable results that European feed in tariffs have achieved as its success depends on a number of other technical as well as governance factors. For example, the areas which have favorable conditions for renewable electricity generation could be far from the urban areas where the demand for electricity is the highest and this would require long distance and robust grid networks and the cost could be substantial.

Other technical challenges include addressing fluctuating electric backflows and loop flows caused by renewable energy electricity generation, which cause damage to the grid and to prevent these from happening, it requires a substantial amount of investment to increase the grid network capacity and to build substations to control excessive flows.

More critical is the government's commitment to end the old regional monopolistic energy system and liberalize the electricity market, separating the functions of electricity generation, transmission and distribution, ensuring open and fair access to the grid networks by all electricity producers. And upgrading the existing grid to a smart grid can facilitate the balancing of electricity demand and supply minute by minute and would be

desirable. Liberalizing the electricity market in combination with feed in tariffs would decentralize energy system to promote renewable energy need thus these measures should go hand in hand.

The Japanese government is on the right track to have taken measures to liberalize the electricity market since 1995 and as a result, 60% of its market has been liberalized but still this liberalization applies only to big consumers such as factories and office buildings and households still cannot negotiate the electricity price and choose the source of electricity freely. [Ministry of Economy, Trade and Industry , 2011]

Even in the event that Japanese electricity market is fully liberalized, as renewable energy based electricity is still substantially more expensive than fossil fuel or nuclear based electricity, it would be attractive only for fossil fuel based power producers and suppliers (PPS) to participate in the market and therefore a high level of feed in tariffs is essential to boost the participation of renewable energy based PPS. Too high level of tariffs would be politically unfeasible as it could result in a significant increase in the price of electricity as the additional costs to support FITs are born by electricity consumers. Too low tariffs would be similar to having no tariffs as they wouldn't attract any investments. Determining the level of tariffs is the most challenging part of FITs implementation and frequent adjustments of tariffs are necessary.

As seen above, the combination of regulatory and financial policy measures by the government are indispensable to stimulate the bottom up participation of businesses and households in renewable energy generation, which would lead to more distributed and cleaner energy system. Once the deployment of renewable energy technologies is widespread, their cost would be expected to go down due to the economies of scale and with the assistance of other subsidies for their research and development, Japan could gain a competitive industry of renewable energy technology, which could create jobs and stimulate its economy.

Japan needs to act quickly for renewable energy to cover the loss of electricity due to the shutdown of most nuclear reactors. Although relying on natural gas or clean coals to supplement its electricity generation capacity would be inevitable in an immediate future, it is of paramount importance for the government to prevent the lock-in of further fossil fuel based electricity generation.

The transition of the Japanese energy system can be a good lesson learned for emerging and developing Asian countries and provide a caveat to those who plan to develop nuclear power plants hastily without a long term vision. Despite the high cost and technical challenges associated with renewable energy technologies, they have a number of outweighing advantages (safe and resilient, no pollution and no cost for fuels etc.) for developing countries.

Management of Future Electronic Waste of Solar PV Panels

Background

Solar PV panels typically contain toxic materials such as silicon tetrachloride, cadmium, selenium, sulfur hexafluoride (A Silicon Valley Toxics Coalition, 2009) but their long life span (usually 20 years or more) makes their waste management seem less urgent and the issue has not been given adequate attention. If not properly addressed, however, the green credentials of solar panels will be put into question and wider use of solar PV could be rather detrimental to the environment and an innovative approach is required to address this issue at an early stage.

Although not yet widespread, there have already been some reports of illegal dumping of harmful byproducts of solar panel production. Washington Post reported in 2008 that a Chinese manufacturer of polysilicon destined for solar panels had dumped silicon tetrachloride, which is a highly toxic substance. [Cha, 2008] It is reported that due to the lack of technology and the high investment costs and time for the recycling of the silicon tetrachloride, many factories in China have not installed technology to prevent pollutants from getting into the environment. [Cha, 2008] New York Times reported in 2011 on a demonstration in Zhejiang in China which took place against JinkoSolar Holding Company, which contaminated a nearby river with 10 times acceptable amount of fluoride and the Chinese government eventually suspended production at the solar panel factory. [Jacobs, 2011] It also reported that protests over pollution are on the rise.

In Japan, such illegal dumping of solar panels or their byproducts has not been a major issue but the Ministry of Economy, Trade and Industry of Japan has conducted studies on the issue proactively although actual preparation for their reuse/recycling system has not started yet. In Japan, solar PVs have started being deployed gradually since 1992 and most solar modules are still in use and considering the typical life span of 20 years of the panels, end of life modules are expected to increase gradually from now. At the moment, there are only few companies which can perform re-use and recycling of end-of-life solar modules in Japan but this is not a major problem yet.

It is imperative for the government to devise an appropriate regulatory framework as early as possible so that manufacturers can design solar modules, which are safer and easier to reuse and recycle. This includes coordination of existing related legislations in the case of Japan, such as 'Law for Recycling Specified Home Appliances' and 'Law for the Promotion of Effective Utilization of Resources'. Solar panels and battery modules are not specifically designated by neither of the above legislations while the latter legislation could be applicable, which general clause obligates manufacturers 'to ensure the effective utilization of resources and to take necessary measures to reduce the generation of Used Products, etc. and By-Products and promote the utilization of Recyclable Resources and Reusable Parts in order to contribute to waste reduction and environmental preservation.' [Japan, June 7,

2000] This kind of legal ambiguity as to the object of the legal application may provide a room for 'convenient' interpretations and lead to weak legal enforcement thus should be clarified as early as possible well before an emerging wave of end of life modules.

Creating a Market for Reuse

Like most electronic products, reuse would be the best solution for end of life solar modules both from the perspectives of efficient use of resources and lowering the cost of renewable electricity generation and accelerating its deployment. If one could sell her solar panel at the end of its use, it would be similar to a lease arrangement and the cost would be cheaper.

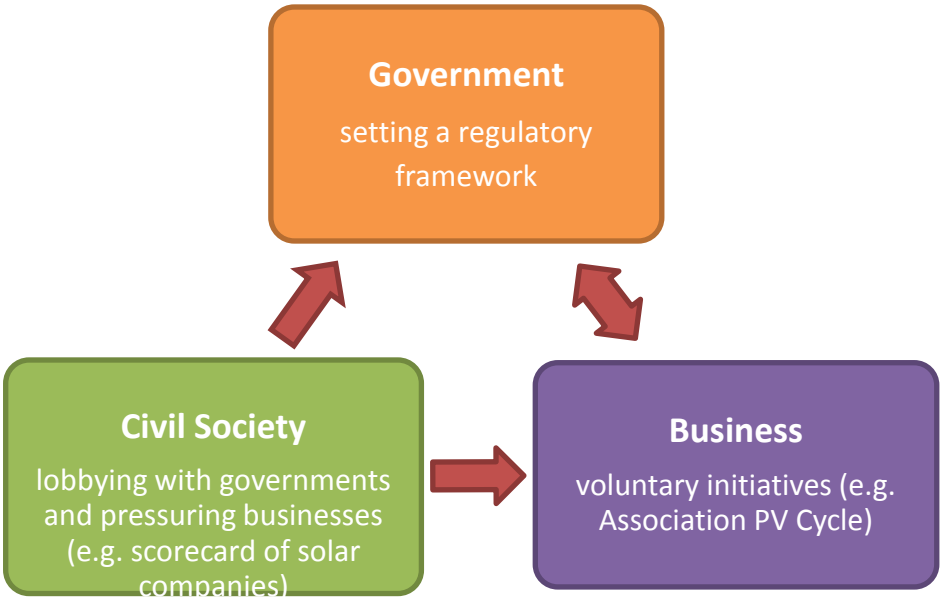
For a second hand market for used solar modules to function, consumers' trust in the goods sold in the market is essential and defected or low quality modules should effectively be removed from the market. It will also be important to clearly label modules as per their capabilities and harmful substances contained and appropriate methods to dispose them. The system of warranty would be desirable to increase the confidence of consumers in the use of second hand solar modules. Once the market for second hand solar modules is established, it might also be possible for a developed country to export more affordable second hand solar modules to emerging and developing countries where there is a high demand for such products but their supply is in short. This should, however, be pursued with caution so as not to lead to the export of e-wastes and their inappropriate disposal in the emerging and developing countries.

Governance Models in Other Countries

Although in Japan, a governance framework for the management of end of life solar modules is still emerging and related efforts have been rather top-down and government-driven, the examples of governance in other regions of the world show the mix of top-down regulatory measures and bottom-up voluntary response.

In the case of the US, as far as a legal framework is concerned, Federal as well as Californian waste management related laws (e.g. Federal Resource Conservation and Recovery Act and California's Hazardous Waste Law) which require toxicity tests can be applicable to the disposal of solar battery modules, (A Silicon Valley Toxics Coalition, 2009) although neither legislation has been designed specifically for end-of-life solar PV modules. In California, the issue of e-waste of solar modules was first raised as such by civil society organizations and a scorecard of solar companies has been published by a leading NGO coalition to raise awareness and to put pressure on potential environmentally irresponsible companies. A leading solar PV manufacturer in the US, First Solar, has set a benchmark for environmentally responsible product life cycle management by introducing a prefunded, comprehensive collection and recycling program for solar modules. [First Solar , 2012] The waste issues of solar PV panels have been somewhat low-key because of the positive traits of solar PVs being clean and renewable, therefore, being welcomed in most places, the existence of such a powerful NGO coalition is of paramount importance to raise awareness

not only among the general public who would be a pressure to the business but also the government officials who can take action to enhance regulatory framework.



Governance Framework of Waste Management for End-of-Life PV Modules

The EU has Waste Electrical and Electronic Equipment (WEEE) as well as Restriction of Hazardous Substances (RoHS) Directives to manage e-waste of solar battery modules although there had been no specific mention of their legal application to used solar modules. However, in January 2012, the EU Parliament has adopted amendments to include PV modules as part of the obligation under WEEE and now PV modules must be collected and recycled. [Kuehnle, 2012]

In anticipation of and prior to this legislative development, EU PV manufacturers have already formed a voluntary association (Association PV Cycle) designed to implement the producer responsibility by adopting the take back and recycling scheme for end-of-life PV modules and now it represents more than 90% of European PV market in EU 27 and EFTA countries. The service of take back and recycle is free of charge and open to anyone who wants to dispose of PV modules bought from the members of the association and it established 173 collection points. [Association PV Cycle]

While these above mentioned countries are in different phases of development for soon to be serious e-waste management of solar PV modules, a common feature of at least Japan and the US is that both countries have relevant 3R and hazardous waste management laws which could be applicable to end of life solar modules even as they are but that there is no specific mention of solar PV modules in these laws. As the number of end-of-life solar modules increase, it will be increasingly important for these legal frameworks to be clear

and enforceable, which is likely to require the legal incorporation of PV modules. Even the anticipation of this legal incorporation had a very positive effect of creating a voluntary association like PV Cycle in Europe so the actual legal incorporation of solar PV modules is expected to have more drastic results.

These examples demonstrate the top down governance in the form of legislations to get a positive bottom up response. In developing and emerging countries, it remains to be seen whether private actors i.e. solar module manufacturers would move voluntarily to create a reuse, recycle scheme as seen in Europe and the US even in the anticipation of legally binding instruments but it is crucial to send them appropriate signals as early as possible.

As a concrete step, it is critical to have legislations applicable to end-of-life solar PV modules based on the principle of extended producer responsibility ready as early as possible so that there would be incentives for manufacturers to reduce or eventually eliminate the use of toxics in their production and to design their modules, which are easier and safer for them to recycle. If there are already legislations on the 3R of other e-wastes, it is important to include solar PV to be regulated under these legislations. A level playing field with said regulations must be ensured so as to encourage environmentally conscientious manufacturers and discourage unscrupulous manufacturers.

A positive response to e-waste management laws from the private sector is not automatic and depends on the level of awareness and the sense of responsibility of manufacturers, which are mirrored by their consumers' awareness and preference. In this sense top down governance is an indispensable first step yet not sufficient and a way to encourage bottom up response by companies and consumers is critical. Non-state actors could play an important role in raising awareness and educate general public, businesses as well as government officials.

And this process is expected to be more challenging in the context of emerging/developing countries where a relative weight of priority placed on economic growth is more dominant than environmental protection and the capacity of civil society organizations is limited. There is room for international cooperation in this field.

In addition to awareness raising, for consumers to become responsible actors and to exert sound pressures on solar manufacturers, it is important for manufacturers to be obliged to disclose information on toxic materials used throughout the lifecycle of their products and to that end, a legal instrument, which requires toxic material reporting by states, local government and industry should be put in place.

Cool Biz & Super Cool Biz

'Cool Biz' is a campaign led by the Japanese government to promote casual and lighter clothing at work during summer, with which one can work comfortably in the air-conditioned office maintained at 28 degree Celsius, which could be felt as fairly unpleasant for those in suits with a tie given high humidity characterized by Japanese summer. The temperature in most Japanese offices used to be set at 26 degree Celsius or even lower. 'Super cool biz' extended the scope and it suggested even lighter and more casual clothing at work, early working hours, working at home, longer summer vacations, and keeping room temperature at 28 degree Celsius at home, among other things. 'Warm biz' has also started calling for 20 degree Celsius to be the standard temperature for heating the office during winter.

'Cool biz & super cool biz' has triggered a widespread behavioral change among Japanese and helped to reduce the electricity demand since its inception. 61.8 % of Japanese companies have increased the thermostat of air-conditioners to 28 degree Celsius, which allegedly resulted in the emission reduction of 1.72 million tons of CO2 equivalent in 2008. Equally, as a result of the 'warm biz' campaign, 56.1% of Japanese companies lowered the office temperature to 20 degree Celsius and 1.43 million of CO2 equivalent was estimated to be saved. [Ministry of the Environment of Japan]

Although these figures are only estimates and also very small in the overall picture of the Japanese emission reduction targets, it is remarkable that simple effort by individual to adjust his/her outfits can have such significant impacts when it is done collectively. 'Cool Biz' is innovative in that it was an initiative from the top i.e. then prime minister and his cabinet members but it has become popular and participatory at the bottom even though it was a voluntary initiative. It wouldn't have happened without top-down governance as the tradition of wearing suits and tie at work was deeply rooted and it was necessary for then prime minister and his cabinet members to lead by example and for the Ministry of Environment to spread the initiative.

It is interesting to note that even if the majority of people used to think it would be better to change the status quo, the desired change would not have happened without the cool biz & warm biz campaign because of their tradition, inflexible hierarchical governance, and lack of awareness among other things. In this case, what people needed was an ice breaker from the top to break their business tradition to reduce CO2 emissions. Another key to success was that thanks to the efforts by major apparel companies, participating in cool & warm biz was regarded as 'cool' and fashionable and not something 'provincial'.

Each country has different circumstances and perceptions, e.g. as to climate and the appropriate temperature and this Japanese model needs not be applied as it is but it provides a useful model which is not difficult to be replicated with some adjustments in other Asian countries. Energy conservation is the norm rather than the exception in today's

world where there is the shortage of affordable and sustainable energy, this cool & warm biz could be a relatively easy first step for energy conservation in emerging and developing Asia.

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Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)

Under the National Common Minimum Programme (NCMP) of the government of India, the UPA government in May 2004 committed to 'augmenting and modernizing rural infrastructure consisting of roads, irrigation, electrification, and cold-chain and marketing outlets. To fulfill this commitment, the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) was launched in April 2005 by merging all ongoing schemes. The objective of the scheme was electrifying over one lakh un-electrified villages and to provide free electricity connections to 23.4 million rural BPL households (Rural Electrification Corporation Limited). The following provisions have been made for rural electrification of Below Poverty Line Households under the scheme:

"i) BPL households will be provided free electricity connections. The rate of reimbursement for providing free connections to BPL households would be Rs. 2200 per household.

ii) Households above poverty line would be paying for their connections at prescribed connection charges and no subsidy would be available for this purpose.

iii) Wherever SC/ST population exists amongst BPL households and subject to being eligible otherwise, they will be provided connection free of cost and a separate record will be kept for such connection." (Standing Committee on Energy, Ministry of Power, GoI, 2009)

The RGGVY scheme envisages the development of the following infrastructure for the provision of electricity to rural areas in the country-

- Rural Electricity Distribution Backbone (REDB) with 33/11 KV (or 66/11 KV) sub-station of adequate capacity in blocks where these do not exist.
- Village Electrification Infrastructure (VEI) with provision of distribution transformer of appropriate capacity in villages/habitations.
- Decentralized Distributed Generation (DDG) Systems based on conventional & non-conventional energy sources where grid supply is not feasible or cost-effective. (Standing Committee on Energy, Ministry of Power, GoI, 2009)

All the above three are directed towards overall rural development, employment generation and poverty alleviation by facilitating power provision for irrigation, small enterprises, healthcare, education etc.

Planning for RGGVY

RGGVY in the 10th plan

The RGGVY was launched in April 2005 under the 10th five year plan, with 90% capital subsidy from the central government for the overall cost of the project under the scheme.

The remainder 10% funds were provided as loan by the REC to the state governments. A capital subsidy of Rs.5000 crores was released for the implementation of Phase I during the 10th plan. The states were mandated with making adequate arrangements for supply of electricity so that rural areas would receive the same number of hours of electricity as urban areas. States were also required to appoint franchisee and commit revenue subsidy to state utility for providing subsidized power to BPL.

Based on the Census 1991 data, there were 112,401 villages in the country that were un-electrified. With the change in definition of 'electrified village' post 2004, the RGGVY scheme estimated the total number of un-electrified villages as 125,000. A total of 235 projects spread across 234 districts in the country covering 68763 un-electrified villages were sanctioned under the 10th plan.

The scheme envisaged a cost of Rs 650,000 for providing network and last mile connectivity for each village (including connectivity to 10% of households). Amount of Rs 1500 was estimated for providing connection per household. The Cost of intensive electrification was estimated at Rs 1 Lakh village. Overall a cost of Rs 16000 Crore was estimated for the entire programme, of which central government was to provide 90% as grant. Rs 160 Crore was to be set aside for enabling activities including technology development equivalent to 1% of the total outlay.

RGGVY in the 11th plan

The RGGVY scheme was continued under the 11th plan with the objective of providing access to electricity to all households implying electrification of about 1.15 lakh un-electrified villages and electricity connections to 2.34 crore BPL households by 2009. A capital subsidy of Rs.28000 crore has been approved for this plan period (Ministry of Power, GoI, 2008).

A few modifications were introduced in the scheme under the 11th plan. While the scheme earlier required commitment from states to ensure adequate availability to rural areas and not discriminate between rural and urban areas, it now required state governments to commit 6-8 hours of supply. Under the 10th Plan, the scheme stated that the infrastructure created under the scheme would also cater to requirement of agriculture and other activities and would facilitate overall rural development, employment generation and poverty alleviation. This was however modified in the 11th Plan and thereafter it stated that the infrastructure created would only 'indirectly' facilitate power requirement of agriculture and other activities. This modification clarified that the RGGVY scheme's focus was electrifying BPL households.

The cost norms for village electrification were revised upward for the 11th plan. A distinction was made between the cost required for electrifying a village in a normal terrain at Rs 13 Lakh per village and a hilly/tribal/desert terrain at Rs 18 Lakh. The cost of intensive electrification was increased to 4 Lakh per village (and Rs 6 Lakh for difficult terrain).

A three tier monitoring mechanism was introduced that involved independent quality control inspection and monitoring by the Project Implementing Agencies through third party inspection agencies in the first tier, the Rural Electrification Corporation through designated quality monitors for the second tier and independent evaluators engaged by the Ministry of Power for the final third tier.

Following from the 10th plan, 343 projects spread across 312 districts in the country covering 49912 un-electrified villages were sanctioned under the 11th plan. The projects cover 41,553,531 un-electrified households inclusive of BPL households and a total of Rs.33700.23 crore (337 billion rupees) was awarded for project cost (Ministry of Power, GoI, 2012).

The scope of RGGVY includes the construction of substations and lines in blocks where they do not exist, electrification of un-electrified villages, augmentation of distribution transformers in already electrified/de-electrified villages, free connection to electricity infrastructure to below poverty line households and setting up of small generators and distribution networks where grid extension is not cost effective (Decentralized Distributed Generation). The scheme also includes the employment of local franchisees to manage the delivery of electricity services. The franchisee could be an NGO, User association, cooperative, entrepreneurs or the local Panchayat.

Implementation of RGGVY

Under RGGVY, state governments notify the rural electrification plans that are followed by signing of tri/quadripartite agreements between the implementing agencies and governing institutions. The implementation methodology of the RGGVY includes the preparation of District based detailed project reports for execution on turnkey basis. Some of these projects involve central public sector undertakings of power ministry for implementation while others involve state level institutions. The village level Gram Panchayat certifies the electrification of the village to mark the completion of the project. The scheme also favours the deployment of franchisees for the management of rural distribution for better consumer service and reduction in losses. Different franchisee models have been suggested to ensure commercial viability of the operations.

Before implementation of the projects, states have to make provisions for the requisite revenue subsidy and provide an undertaking for the supply of electricity with minimum daily supply of 6- 8 hours of electricity in the RGGVY network. The eleventh plan mandates a three tier quality monitoring mechanism to assess the activities under the RGGVY projects also including conditions of performance based payments for contractors. Under this monitoring mechanism, the project implementation agency conducts the first tier of monitoring and performance evaluation followed by the Rural Electrification Corporation conducting the second tier of monitoring by employing designated quality monitors and finally the Ministry of Power conducts the third tier of monitoring through designated National Quality Monitors.

Sustainability of the scheme

The Quarterly report on the project performance to the nodal agency shows that 102280 villages have been electrified providing electricity connections to 18280527 below poverty line households showing 73.9% achievement from target (Ministry of Power, GoI, 2012). An evaluation study conducted by TERI for the Rural Electrification Corporation (the nodal agency) reveals that the scheme has helped to speed up the formulation and notification of Rural Electrification plans by states and along with the plans, several states have initiated state sponsored electrification programmes or schemes that have added to the electrification level. The study observed that the supply of electricity is varied in different parts of the country and supply hours range from 18 to 4 hours per day. The main cause for unsatisfactory supply hours is the lack of availability of energy supply with the distribution utilities in those areas. While electrification of BPL households is on track as per targets with provisions of metering devices, the actual number of BPL families in some areas might be more than the number assumed before the launch of the projects.

Different evaluations of the scheme point out varied challenges to the distribution utilities in implementing and maintaining assets due to technical challenges; and introducing franchisees due to the lack of relevant capacities. The scheme has emphasized top-down planning with uniform target driven approach that does not work well in areas that are at different stages of development. One of the mid-term evaluation studies states that sufficient attention was not placed on the availability of person-power, materials, land for infrastructure augmentation, actual estimation of the number of target households, strengthening distribution utilities and training of quality monitoring agencies (Prayas Energy Group, 2011).

While there is a distributed generation component within the scheme, there is a clear support and push for grid connectivity over that of decentralized solutions to energy access. The scheme has been envisaged to transform rural areas and bring people out of poverty through energy access and if implemented adequately can achieve its goals.

Key takeaways from the programme

Multi-level mechanisms for operationalization – the scheme has attempted to involve institutions at different levels in the implementation of the programme and also be involved in monitoring of programme activities. The various national and state agencies are

Monitoring mechanisms – the scheme has introduced a three tier monitoring mechanism for the installation of infrastructure involving self-monitoring by the implementers followed by monitoring by the nodal agency REC and then by the ministry of power. The scheme also involves district and village level committees to monitor the actual installation and decide if it is satisfactory.

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Annexure III: Stakeholder Consultation Workshop Summary

TERI, in collaboration with IGES and supported by the Asian Development Bank (ADB) has undertaken the study "Learning from emerging energy innovations in Asia with a focus on energy access and clean energy: Contributing to the discourse on an institutional framework for sustainable development". The specific objective of the project is to map effective experiments and practice – social, technological, institutional and policy – addressing energy access and clean energy needs in Asia. The project has drawn lessons from such experiments and innovations, from the relevant policies and institutions in place that support or constrain them, and provide inputs for the Rio+20 deliberations on an international framework for sustainable development (IFSD) and a more distributed energy governance through a focus on some key aspects of technology, finance, institutional diversity and engagement of major groups, mechanisms for co-ordination and risk management. The study showcases significant examples of multi-actor, multi-stakeholder participation processes that contribute to the integration of local and regional energy networks.

A regional consultation supported by both the ADB and AEI was organized at New Delhi on **January 31st, 2012** to share the analysis and findings from the project to concerned stakeholders.

The event commenced with a welcome address from Rajendra Pachuari (Director General, TERI) and he stressed on the importance of institutional and financial innovations in ensuring energy access. He spoke about the cultural dimension of innovations and the need to involve multiple stakeholders and agencies in the process of providing energy access. The welcome address was followed by opening remarks by Gil Hong Kim (Director, ADB) who expressed his hopes of the contributions of the day's deliberations and that the study would make to the discussions around Institutional Framework for Sustainable Development at Rio+20.

The project overview was presented by Ligia Noronha (Director, RGS Division, TERI). She highlighted the specific objectives of the project, the key research question with a background on the discourse around IFSD. The project aims to assess and provide the evidence that distributed strategies work in delivering sustainable development outcomes; that successful energy interventions require considerable support and the study derives mechanisms that are needed to catalyse and strengthen sustainable energy for all. These mechanisms highlighted in the study are –

- Technology and capacity building
- Financing
- Institutional development and diversity
- Mechanisms of cooperation and coordination

- Engagement of major groups/stakeholders

She highlighted the role of these mechanisms in south-south cooperation, customization of solutions to meet current needs and the importance of distributed over supranational arrangements of governance. Her presentation touched upon the background and rationale of the project – the energy poverty situation in Asia, the methodology followed by the project – and the key observations derived from the case studies on -

- Diversity and dynamism of bottom up approaches to energy access
- Varied financing mechanisms used in the cases studied
- Demand based approach of customizing solutions to needs and user buy-in
- Capacity building for the introduction of an intervention
- Market development strategies to propagate solutions
- Role of multiple actors and stakeholders

As a precursor to the discussions to follow in the day, she posed the questions on enhancing stakeholder participation for energy governance and the relevant institutional capacities. The presentation received comments from participants pertaining to the role of governments in providing clean subsidised energy in the areas that are not connected to the grid. Prof. Ijaz Hussain (BUET) said that this study needed to be done, pointing out the good practices in energy and its links to the international community. He said that there is a need to highlight energy efficiency. It would be good for studies to come with specific points to policy makers, which can be integrated with targets. Though many examples are quoted as success stories, there is a need to see how much is achieved on the ground as compared to what is quoted in the figures. He also said that especially in the case of Bangladesh, when people did not expect grid connectivity in the near future, they adopted SHS leading to its success. There are challenges in the provision of clean energy due to the skewed pricing system of subsidised energy.

There was discussion on the cases studied under this project and their performance against targets. While most cases adequately demonstrate bottom up approaches to energy access, others have not had the envisioned success as initiatives that culminate into policy and practice changes. Some examples like the rural electrification experience in Mongolia and RGGVY were highlighted in this discussion. There were some concerns about Jawaharlal Nehru National Solar Mission (JNNSM) of India and that it is unfolding as a top down approach which is not engaging sufficiently with developing a distributed strategy.

Participants also highlighted the need to have businesses on board while adopting a multi-actor approach. Jiwan Acharya from ADB stated that projects catering to poor people in rural areas with no grid access compare their feasibility to projects for areas with grid access

and the resulting assessment makes for higher payments from the poor. He stated that there is a need for fundamental change in the way business is conducted, institutions are shaped and the ways they function in the energy access scenario to take into account these disparities. There was also need for thinking on how energy innovations can be standardized.

The workshop moved towards the first session on 'emerging energy innovations and practice' chaired by Veena Joshi (Embassy of Switzerland). The presentations in this session described the bottom up project cases that can be highlighted as evidence of distributed strategies for delivering sustainable development. P R Krithika (TERI) presented a brief on the projects studied under this study – SELCO India, SHS Bangladesh, Pico Hydro Laos, Palm Sugar cook stoves in Cambodia and Vattanak Cook Stove Program in Vietnam. This was followed by a presentation from Harsha Meenawat (TERI) presenting a brief about the national programme and policies studied under this project – Nepal Biogas Programme, Renewable Energy Development Project China, National Solar Mission India and National Mission to Enhance Energy Efficiency India. Following these, the session included in depth presentations on the initiatives of disseminating palm sugar cook stoves in Cambodia presented by Iwan Baskoro of GERES, Small Scale Sustainable Infrastructure Development Fund in India presented by Hari Natarajan, Biogas Support program of SNV in Nepal, Bangladesh and Vietnam presented by Rajeev Munankami of SNV, smart distributed energy systems in Japan after Fukushima, the solar green credentials initiative and the Cool biz, Warm Biz and Super Cool biz initiatives in Japan presented by Tetsuro Yoshida of IGES and project overviews of initiatives like Bush light India, efficient brick kilns and solar water heating presented by Sameer Maithal of Greentech Knowledge Solutions.

The key points emerging from this session were that there is a challenge in connecting technology with policy to solve issues. The success of cases discussed lies in the details and successful models need to be highlighted and their experiences shared with wider audiences. The participants felt that there is a need to strengthen state level processes for scanning and integrating technological progress with policy through greater interaction between government and industry.

The next session chaired by Wan Portia Hamzah (ISIS, Malaysia) focused on institutional experiences on energy governance and the challenges in providing energy access and clean energy. Arunabha Ghosh (CEEW) spoke of the four imperatives for the clean energy debate – environment, technology, economy and trade. He said that there are numerous sources of financing – like climate financing and government R&D spending – but their governance has been messy resulting in a fragmented regime for clean energy finance.

Binu Parthan (REEEP) spoke of the challenges of lack of coordination at an institutional level due to the lack of frameworks to coordinate local initiatives. He alluded that it is difficult to have a single framework that provides insights into institutions but there is scope for a

performance measurement framework at an intergovernmental level. The private sector is making large contributions to this sector but there is a need to leverage this funding through global rules. Prof. Wei Zhihong spoke about the importance of domestic frameworks working along with international frameworks for energy governance.

Commenting on strengthening of institutional capacities for energy interventions, Mark Elder (IGES) provided an overview of multi-level governance in the institutional framework for energy. He said that while energy may be less institutionalized than the environment without comprehensive global organizations leading to a lack of coordination; yet it is given a lot of importance in national discussions (higher priority than environment in some cases) and is linked with economic development. He also spoke of the important link between the institutional perspective of project proponents and the corresponding perspective of policy making and the key institutional capacities needed thereof.

Most of the discussion in this session revolved around fragmentation and lack of coordination at an institutional level. The need for a coordinated decentralisation was emphasised upon. While the roles of national and subnational levels were seen as crucial, the session also underlined the need for international cooperation.

The final session chaired by Nitin Desai (TERI) focused on the learnings to communicate to the Rio+20 debate surrounding IFSD and the governance of energy. Gauri Singh (IRENA) highlighted that there are incentives for sustainable energy for all but most of these are in silos. There is a need for agencies involved in livelihood projects to connect to the issue of energy access and at a national level there is a need for broad policies that create resource pools for combined purposes. She also suggested that business models should be tailor-made to suit policies instead of the other way round and the focus should shift towards practitioners.

Addressing the challenge of financing, Shirish Garud (Greenenergy Renewables Pvt. Ltd.) highlighted the importance of economic viability to attract investors. Though investments in distributed energy should have lower risks, most investors have invested in mega power projects that have high risk. He also stated that once business finance comes into the sector, the technological advancements will also follow.

Harish Hande (SELCO) noted that there is an absence of practitioners within the energy policy making process from the initial stages which has become a deterrent to innovations in the clean energy access sector. He pointed out that non-English speaking practitioners are ignored even further. This is one of the reasons of policy failure because the most important target groups are not taken on board during policy formulation and too much focus has been laid on equipment manufacturing rather than practice. He also pointed out that some of the problems of propagating clean energy also lies in the way case studies are taught and disseminated with most focus on organizations rather than processes.

Soma Dutta described the recent study undertaken for the UNDP which reviews 17 projects and programmes in the Asia Pacific region. She highlighted that generally programs have a minimalistic approach towards energy access and with these programs the poor without energy access become poor with energy access. Addressing a combination of energy access and livelihood issues would be more sustainable. On one hand there is a need to define energy service delivery which includes a tangible product/service that meets the needs of the people, is tamperproof, has been product tested and has relevant feedback mechanisms that involve local communities. On the other hand there is a need to mainstream this service delivery with national development objectives.

Tarun Kapoor (MNRE) highlighted that there is also a need to look at improved biomass and the MNRE is focusing on all forms of bio-energy with uniform efforts. He asked the participants the question if people would be satisfied with off grid energy options or still wait for grid connectivity as this has numerous policy imperatives. Cases have shown that people prefer to be connected to the grid even if it does not provide adequate energy.

The discussions from this session also addressed the difference between scalability and replicability. Participants were of the opinion that it would not matter if the replication is geographical in nature rather focus could be on sectoral replication. In the case of the UNDP study it was pointed out that none of the projects studied might be scalable but all of them contain elements that could be scaled or replicated without copying the entire model. It was pointed out that the focus of upscaling has been entirely on organizations and/ or interventions, whereas the focus should be on processes used in interventions.

Takeaways from the discussion for the project

- The discussion at the workshop highlighted that there is a need to distinguish between rural and urban energy and there is a disconnect between the cost of electricity provision in grid connected and off grid areas. The price for provision of energy for the population in the latter areas has been inflated making it expensive for them, even though they need it the most.

- It was pointed out that it is important to recognize that the cases studied under the project are not necessarily success stories, but are a series of good starters and may have their own set of challenges and failures. In this context RGGVY was mentioned and suggested that be examined.

- The participants highlighted that there are several unknown and invisible facts that need to be found out in order to scale up some successful examples. But scalability will happen where the ecosystem for the same exists. There is a need to preserve and provide incentives for game changing innovation and have an ecosystem that fosters innovation.

- It is important to have business on board. Besides a stronger government-industry interaction, a more robust state-national interaction is needed. Therefore, a multi-actor and multi-level approach is essential. A wider consultation is required, including with the industry, social entrepreneurs and the banking sector is required, for policy making in the field of RE. There are a lot of enterprise and end user financing ideas in the absence of appropriate forms of enterprise capital. Therefore, we need to understand a mix of financing options.

- Even though innovations take place in the industry sector, the real challenge however lies in linking it to the policy. State level scanning and integration of policy, programmes and innovative solutions would be most appropriate.

- It is important that the central apparatus not have a fixed approach towards technology. There is a need to be open to technological solutions and apply them fully understanding their implications.

Annexure IV: Statements of Key Countries and Organizations regarding energy for Rio+20

Countries/Orgs.[30]	Page, Para	Original Statements	Note
Political Groups			
CARICOM	p.2, para. 3		
EU	p.12~23	e. Proposals for actions in specific areas (Green Economy) Sustainable energy 45. Build on the **Sustainable Energy for All initiative** (SE4ALL) launched by the Secretary-General, including its concrete goals	
G77+China			
SIDS			
主要国/Key Countries			
Algeria			原文は仏語
Argentina			原文はスペイン語。IGES独自の翻訳・要約より抜粋。
Australia	p.8, para.5	The centrality of energy to sustainable development has been recognised with the launch of the United Nations Secretary-General's **Sustainable Energy for All initiative**. Rio+20 outcomes should include: • commitment to achieving universal energy access; • commitment to reduce global energy intensity; and • commitment to expand the proportion of renewable energy used in national energy portfolios.	
Bhutan	p.3 p.10	And we know too that this ecological destruction is not separate from global economic realities that are increasingly dividing rich from poor: • that the richest 20% use 58% of all **energy** and the poorest 20% less than 4%; One key feature of the new economic paradigm is also that it will be basically local	

[30] To avoid any substantive categorization of countries and organizations, this paper utilizes alphabetical order according to political groups, countries, regional meetings, and organizations.

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		in scale. We in Bhutan intend to grow enough food to feed ourselves, and it will be healthy and nutritious because we will grow all of it organically. We intend to provide all our basic **energy** domestically from **renewable** sources, along with as many of our core necessities as possible. And we intend to be a true 'zero waste' society.	
Brazil	p.28, P3, B	Efficient Energy Consumption Labelling The Rio+20 Conference could promote the energy consumption and energy efficiency labelling programmes employed by various countries, including Brazil…On the basis of the various national energy efficiency initiatives, many of them voluntary, a proposal could be put forward to create an international multi-sector initiative. It would be necessary to examine any existing international standards to see if they could constitute the foundation for such a process.	
Canada			
China	p.4	Many developing countries are now experiencing rapid industrialization and urbanization. They are both faced with the daunting task of eradicating poverty, adjusting economic structure and transitioning to a green economy, and constrained by **energy**, resources and environmental factors. The success of green economy in these countries figures prominently in global sustainable development, and merits the understanding and support of the international community.	
India	p.1 A.a p.2 A.b	An approach to GESDPE has to be based on the following principles: · It is directly related to the overriding priorities for developing countries such as poverty eradication, food security, **universal access to modern energy services**, public health, human resource development and employment generation. As such, Green economy should be seen as one of the means to achieve these fundamental and overriding priorities and not an end in itself. Policy Track 1: Green stimulus packages Governments round the world including	GESDPE (Green Economy in the context of Sustainable Development and Poverty Eradication)

Countries/Orgs.[30]	Page, Para	Original Statements	Note
	p.5 A.b p.5 A.c p.7 p.7 B.b	India have been promoting public and private investment in sectors like **renewable energy**, forest conservation and water management. A variety of policies and tools, as nationally appropriate, may be employed in this regard. A combination of regulatory instruments like feed-in tariff and standards and economic incentives like fiscal incentives, concessional loans and subsidies (for positive externalities) are being used in different countries. Policy Track 11: **Universal access to modern energy services**, food, water supply and sanitation for poverty eradication Poverty eradication measures should consider the multi-dimensionality of poverty and its complexities. This can be tackled successfully only when a multi-pronged approach towards poverty eradication is adopted. **Universal access to modern energy services**, food security, access to water supply and sanitation in developing countries are essential for improving the quality of life of the poor and hence, need focused approach in these sectors. Rio+20 should translate the UN General Assembly's recognition of **access to modern energy services** at affordable prices into concrete mechanisms including financing in a given time frame, facilitate promotion, development and deployment of **renewable energy** for cleaner production and consumption. India's sectoral priorities include…**universal access to modern energy services**… Programmes for off-grid and decentralized rural renewable energy systems help in achieving the goal of **universal access to modern energy services** for the rural people especially in inaccessible areas at lower social costs and provide employment.	
Indonesia	p.2 I.9	I. Report of the High-Level Dialogue on Institutional Framework for Sustainable Development Lessons from Experience: …In addition,	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
	p.4 I.16	institutional changes include the establishment of UN Women and the Human Rights Council, coordinating frameworks (**UN-Energy**, UN-Oceans, and UN-Water), the Delivering-as-One mechanism for coordinating support at national levels, and several models for national and local action.	
	p.6-7 II.B.7.c p.7-8 II.D.10	**Sustainable Development Goals (SDGs)**: There was a significant interest on the discussion on the Sustainable Development Goals. In the context of goals related, in particular, to the **sustainable energy goals** advanced by the SG's Advisory Group, there was a feeling that negotiating specific goals would bog down the negotiations. However, there may be a good chance for an agreement in principle on the development of Sustainable Development Goals.	
		II. Indonesia's Views on the Expected Outcome of the UNCSD 2012 (Rio+20) Indonesia considers that key issues that need to be addressed at the Conference, amongst others are: c. Address emerging challenges: food security, **energy security**, access to water, sustainable management of coastal and marine resources Indonesia is of the view that the transition to the green economy requires behavioral changes across all sectors. Targeted sectors could include among others agriculture, buildings, **urban energy**, fisheries, forestry, manufacturing, tourism and transport. Green economy initiatives should promote economic transformation not only in terms of resource efficiency, but also in building a pathway towards poverty eradication and environmental sustainability.	
Japan	p.3 II(2) p.11 II.3(1)	II. Nine Proposals to achieve Sustainable Development (2) Energy: Toward a Bold Energy Shift Japan proposes that each country agree to start working to promote **energy-efficiency, renewable energy and clean energy**, in order to build a low-carbon society.	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
	p.15-16 II.5(2)	II. Green Economy in the context of Sustainable Development and Poverty Eradication 3. Sharing Policy Toolbox to realize Sustainable Development (1) A Green Economy is the most important tool to realize Sustainable Development. In order to realize a Green Economy, Green Innovation is extremely important. The burden on the environment could be reduced by utilizing advanced environmental and energy technologies. This would also encourage economic development driven by new demand stimulation and the creation of new employment. Technology is the key to Green Innovation. Such technologies include smart-grid system, heat pumps, solar power generation, geothermal power generation, ecological housing, energy-saving electric appliances, light-emitting diodes (LED) lighting, technologies for appropriate resource management and the 3Rs, global observation and climate change projection, and data integration and analysis. Investment to such innovation should be facilitated in order to promote technological development and dissemination, and legitimate legal instruments including measures to protect intellectual property rights should be prepared. Other measures for the transition to a Green Economy, for instance, are as follows. Market-Based Instruments - Introduction of systems which verify the reduction of CO2 emissions as credits and promote facilities with lower environmental burden by utilizing private resources. - Subsidies to forest management - Eco-point systems to promote **energy-efficient electric** appliances and houses. - Gross metering scheme in feed-in-tariffs for **renewable energy** 5. Nine proposals from Japan to achieve Sustainable Development (2) Energy: Toward a Bold Energy Shift	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		To build a **low-carbon society** which emits the minimum amount of CO2 (carbon minimum), all sectors of society including industry, administration and the general public are required to act to encourage **energy conservation and renewable energy**. **UN-Energy** proposes that i) universal access to modern energy should be achieved by 2030, ii) modern energy efficiency ratio to be raised to 40% by 2030, and iii) the share of renewable energy in the global energy supply should be raised to at least 30% by 2030. To realize a **low-carbon society**, **energy-efficiency, renewable energy and clean energy** need to be promoted. Japan considers the measures need to be taken to promote clean energy technology and systems, including i)the reduction of trade and investment barriers against energy efficient products , ii) joint international research and capacity building, iii) the promotion of government-private sector cooperation and the supply of efficient and low-carbon energy, and iv)adequate incentive for construction, industry and transportation sectors. Japan proposes that the Rio+20 agree on the launch of work by each country to realize a **low-carbon society** for promoting **energy efficiency, renewable energy and clean energy**. Energy-efficient technologies are widely available in Japan both in the private and public sectors, and a low-carbon type life style is also widely spread. Various measures have been introduced, including the Top Runner standard which sets a target for each electric appliance that consumes a large amount of energy, in order to promote energy efficiency. These energy-saving efforts greatly helped Japan to deal with power shortages after the Great East Japan Earthquake.	
Kenya	p.2, para.6	Kenya is vulnerable to new and emerging challenges which include but are not limited to economic and financial crisis, climate change, biodiversity loss, water scarcities and energy and food crisis….These challenges undermine Kenya's sustainable development	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		efforts.	
Korea	p.3 III-1 p.5 III-2 p.8 III-2 p.12 IV-3	Bearing in mind the relation between poverty eradication and energy access, we also strongly support the Secretary-General Ban Ki-moon's **'Sustainable Energy for All' Initiative**, namely, ensuring universal access to modern energy services, and doubling the rate of improvement in energy efficiency and the share of renewable energy in the global energy mix by 2030. To defeat poverty and save the planet, we need to put an emphasis on efforts towards ensuring energy access for all and protecting the environment through the sustainable use of traditional energy resources, cleaner technologies, and newer energy sources. Sustainable energy for all would be a central element of GE. Establishing new Sustainable Development Goals (SDGs) that harmonize economic, social, and environmental pillars:…In addition, targeted implementation goals by sectors can include **energy management**, water management, food security, agriculture, fisheries, biodiversity conservation, ecosystem management, and chemicals management, etc. Sectoral Priorities of GGGP: FFEW Key sectors that are particularly important for GGGP include forest, food, (low-carbon) energy, and water. These four sectors (collectively "FFEW") represent pressing and vital priorities for GGGP. **(Sustainable) Energy**: This is to promote efficient and incentive-based methods for making relatively "low-carbon" energy production and consumption, through improving efficiency at all stages of the energy generation process and via the utilization of new and renewable energy sources. The GE system should be used to advance incentives-based regulatory tools to trigger patterns of private action in the direction towards a low carbon energy society. The International Renewable Energy Agency (**IRENA**) may play a valuable role in expanding international competencies to promote unified low-carbon	Korea has a newly submitted document. The document change occurred between GGGP (Global Green Growth Partnership)

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		energy solutions. The ROK reiterates its strong support for the Secretary-General's **'Sustainable Energy for All' Initiative**. [Box 3] Institutional Insights from the ROK's Experience The Korean Government launched the Presidential Committee on Green Growth, consisting of prominent experts from various fields such as climate change, **energy technologies**, industrial development, economic growth, finance, land-use planning, resources, environment, and international cooperation, as well as 14 Ministers representing the relevant ministries. It has a mandate to discuss all subjects relevant to pursuing Green Growth, as well as coordinating government policies and actions.	
Lao PDR	N/A	No related statements. Only submitted the "Request for the support to the Ministry of Natural Resources and Environment of the Lao PDR to prepare the National Report for its upcoming Rio+20".	
Nepal	p.4 II.C.vii p.6 II.C.3.iii p.7 III	Despite many constraints, Nepal has made progress in the implementation of programs related to natural resources management, renewable energy, health and education and poverty reduction. ...the country needs additional support in terms of financing, technology transfer and capacity building. It is necessary to promote community-driven green enterprises such as organic farming, bio-gas and solar energy; and seed-banking, watershed management and on-farm improvement of crop varieties and animal breeds through collective and GESI sensitive value chain approaches. Nepal's sectoral priorities based on good practices and lesson learned are: hydro and renewable energy, food security and sustainable agriculture, community-based forest resources management, sustainable tourism, water resources management, sustainable urbanization including greening of transportation and urban waste	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		management sectors, disaster preparedness and climate change adaptation and value chains that contribute to integrate the three pillars of sustainable development.	
New Zealand			The Pacific Islands Forumの議長国
Norway	p.3, 1b)	**Sustainable Energy for All Energy** is a critical enabler: access to affordable, reliable and sustainable energy services underpins human well-being, the realisation of social and economic human rights, empowerment of women, and economic growth…This offers win-win opportunities by improving energy security and jobs. Increased energy efficiency and renewable energy production capacity can support access to energy whilst limiting greenhouse gas emissions at the same time.	
Pakistan	p.2 10.ii p.5 25.b	Notwithstanding the importance of national actions, we believe that conducive conditions are key to generating economic space for actions at the national level. They also entail <u>evolving and reconfiguring international rules and mechanisms in:</u> i. access to and diffusion of technology; ii. **access to sustainable energy for all** and; iii. provision of financial and technical resources and support. Pakistan believes that Rio+20 should: A definitive plan for ensuring provision of **sustainable energy for all** should be agreed to with a particular emphasis on the availability, access and diffusion of necessary technology. In this regard, Pakistan would welcome **energy related targets** provided they are agreed to with means of implementation.	
Philippines	p.5 III.A.2 p.6 III.A.3 p.7	<u>Financial assistance and green investment.</u> ... For instance, there would still be unviable areas (off-grid areas) within developing countries that would require technological and financial aid from developed countries. Therefore, <u>the effort of developed countries to scale up **renewable energy** in developing countries is a welcome effort.</u> <u>Capacity building</u>. ... This may include <u>technical assistance and technological know-</u>	

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	III.B III.B.3 p.10 III.B.4 p.11 III.B.5	how in developing green and cleaner production technology for energy and industries, institutionalizing environmental accounting, developing green cities and implementing environmentally sustainable transport systems. 5 key sectors of a green economy in the Philippines: (i) agriculture and fisheries; (ii) environment and natural resources; (iii) infrastructure (waste, water and **energy**); (iv) green cities (sustainable transport and urban development); and (v) green industries. Energy: The energy sector is directed towards a low carbon future with **energy efficiency and conservation** as a way of life, and **renewable energy** as an important component of the energy mix. Operational: The triple bottomline approach must be considered in the programs and projects of the energy sector - i.e, economic, social and environmental aspects are all factored-in. Green Cities: Green cities promote Environmentally Sustainable Transport (EST) in order to: - Reduce annual growth rate of **energy consumption** and associated green house gas (GHG) and air pollutant emissions; ... Green Industries: Green industries are "climate-resilient industries". Industries are well-adapted to climate change impacts and pursue a low-carbon development path through **increased use of renewable energy as well as energy efficiency**.	
Russia			原文はロシア語
Singapore	p.1 3(a)	Boosting our resource efficiency. As Singapore has to import most of its resource needs, we have to ensure that we are making the most of what we use. Due to our small land area and geographical position, Singapore faces serious constraints in implementing **renewable energy** (such as wind, geothermal or hydropower). Our alternative energy	

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		disadvantaged status requires a strong focus on pursuing **energy efficiency** as a key strategy. Specific measures to approach energy efficiency include pricing energy appropriately, providing information for better decisions, boosting energy efficiency industry designs, processes and technologies, promoting resource efficient buildings, promoting public transport, improving our water efficiency and enhancing land use planning.	
South Africa			
Sri Lanka	p.1 p.3	Promotion of **renewable energy** sources as opposed to fossil fuel based energy is the better solution for the increasing energy demand and as a climate change mitigation measure. Potential for wind, biomass and solar energy development is significant in Sri Lanka. **Energy efficiency** is another area especially in new constructions, urban energy use and water pumping. It is necessary to develop the innovative investment plans to effectively develop potential renewable energy sources in the country. It is expected that Rio+20 will provide opportunities for increased investment on renewable energy development and use efficiency improvements. **Energy**: Energy is a highly significant sector in development. The main energy resources used in Sri Lanka are Biomass (47%), hydropower (8%) and petroleum (45%) with per-capita consumption about 0.4toe. Sir Lankan government moves to use alternative sources of energy such as coal and renewable sources. In year 2010, Sri Lanka produced 53.38% of the total electricity requirements from renewable energy sources. Ceylon Electricity Board has 16 large hydroelectric power plants of total capacity 1205MW and a wind power plant of 3MW. Considering the need to address the sustainable development and climate change issues, Sri Lanka Sustainable Energy Authority was established in 2007 with a view to promote environmental friendly energy	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		production and consumption in the country by the Ministry of Power and Energy. Further, in order to facilitate conversion to renewable energy sources, the Sri Lanka Sustainable Energy Authority was to realize the necessity of having an apex institution to drive Sri Lanka towards a new level of sustainability in energy generation and usage, through increasing indigenous energy and improving energy efficiency within the country. Further, its objective is to guide the nation in all its efforts to develop indigenous energy resources and conserve energy resources through exploration, facilitation, research & development and knowledge management in the journey of national development, paving the way for Sri Lanka to gain energy security by protecting natural, human and economic wealth by embracing best sustainability practices. The Hiru Saviya project of the Sri Lanka Sustainable Energy Authority aims at providing solar powered electricity for rural villages that have no access to the national grid. The first solar powered village was built in Galgamuwa of Monaragala district and was vested in the public by the Government of Sri Lanka in June 2009. This project has successfully provided electricity to over 260 houses and the village school and solar powered street lamps. The speciality of this project is that it has provided solar powered electricity to the indigenous Veddha community in Rathugala.	
Switzerland	P, 7, para.2	**Proposals for important sectoral and specific areas** • *Sustainable energy* Objective: The transformation of the global energy system to ensure access to affordable, clean and sustainable energy resources for all.	
Thailand	p.1 (2) p.2-3 (A)(3)	In addition, Thailand wishes to express the need for the Rio+20 outcome to be forward-looking and to take into account the new and emerging challenges of the next decades. Particularly important are food and water security issues, which need to be recognized as interlinked with the **energy security** issue.	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		The outcome of Rio+20 therefore should incorporate an enforcing mechanism and incentives to materialize capacity building and transfer of environmentally sound technologies from developed to developing countries. ... Even basic technologies are still lacking in most developing countries, particularly in the fields of wastewater treatment, household and hazardous waste management, **energy efficiency** and integrated water resource management for instance.	
UK	p.13, para.27	27. Some actions are grouped into high level areas in the ETGE. For example, the UK climate change and emissions framework looks at the risks and opportunities presented by climate change and covers areas such as low carbon and renewable energy, greener transport and emissions reduction.	
US	p.2, para.2	Clean Energy, New Infrastructure, and Access for All Energy is a critical component of development, and it is essential that new supplies of energy are generated and delivered in a commercially viable and environmentally sustainable manner. Modern energy services are critical to creating economic opportunities to allow people to rise out of poverty, advance prospects for education and health services, and address climate change…The challenge, therefore, is for the global community to scale up investments in energy efficiency, renewable energy, and energy access by creating a commercial landscape that demonstrates a return on capital and attracts private sector investments to underserved areas and populations. To achieve this, governments must put in place enabling policies and regulatory frameworks, and target public resources carefully, to leverage private capital, reduce the risk and cost of capital, stimulate innovation, and create competitive and viable markets for electricity and energy.	
地域準備会合/Regional Preparatory Meetings			
Africa Region	p.2, II,	7. …new and emerging challenges. Chief	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
	para.7	among these are the adverse impact of climate change, increasing water scarcity, biodiversity and ecosystem loss, desertification, hazardous and electronic waste, low resilience to natural disasters, the energy crisis, the food crisis, rapid and unplanned urbanization resulting from rural-urban migration, piracy, human trafficking, migration and the global financial and economic crises. These challenges have led to the spread of new diseases, worsening poverty, and unemployment, especially of the youth.	
Arab Region			
Asia Pacific Region			サブミッションは、会議報告書、議長サマリー、および、ソウル成果で構成されている。
Europe Region	p.9, para.3	On assessment of progress in the implementation of the outcomes of major summits on sustainable development and addressing new and emerging challenges, the summary highlights: • promoting cross-sectoral approaches, especially in the water, energy and food security nexus; • the role of economic instruments, including taxes, green procurement and phasing out perverse subsidies, especially for fossil fuel; • energy efficiency and security, and access to sustainable energy for the poor, as well as the importance of resource efficiency and innovation;	2011年12月1－2日開催。原文は、ENBサマリーから抜粋。議長サマリーは第2回非公式会期間会合で発表予定。
Latin America Region			
主要機関/Key Organisations			
ADB			
GEF			
IMF			
OECD			
UNDP	p.2, para.1	**Sustainable Energy for All** Access to energy is essential for achieving sustainable human development and accelerating progress on the MDGs…We have learned from experience in many countries that off-grid, decentralized solutions are just as important as large centralized generation	

Countries/Orgs.[30]	Page, Para	Original Statements	Note
		and transmission projects, and we now know that renewable and clean sources are often the most cost-effective.	
UNEP	p.3, A, para.1	h. Launching initiatives on energy; food and nutrition security, land and biodiversity; oceans; and cities, given the urgency and severity of these challenges.	
World Bank	P.3, para.10	11. We support the three global energy goals outlined in the Action Agenda of the UN High-Level Group on Energy and the United Nations "**Sustainable Energy for All**" year 2012: Water and food and energy nexus: A world free of poverty is not consistent with 800 million people without access to safe drinking water, 1.6 billion without access to electricity, and one billion suffering from hunger. Water resources must be allocated between agriculture, energy, urban consumption, mining, and increasingly threatened ecosystems. Population and economic growth are expected to increase demand for food, energy and water further, making the efficient allocation of water absolutely critical.	

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