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Sustainable energy regulation and policymaking for Africa

Training manual



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

renewable
energy
& energy
efficiency
partnership

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Most African governments have seen in recent years the establishment of energy sector regulatory institutions as part of a broader reform process aimed at improving the performance of their national economies and to address major developmental challenges, such as the need for private sector investments in the area of infrastructure development in Africa. Experience from other developed and developing countries shows that energy sector regulatory institutions can play a critical role in paving the way for sustainable energy development both at the national and the regional level.

African developing countries typically exhibit two main energy characteristics, the first of which is that a large majority of the population lack access to modern energy services, as they live in rural and remote areas far from electricity distribution networks. This segment of the population also generally exhibits the lowest energy demand and lowest ability to pay. Considering these factors, grid-extension to rural areas does not necessarily represent the most economically sound proposition. In many cases, renewable energy technologies along with appropriate mini-grid designs would prove and have proven, to be the most cost effective and sustainable solution.

The second main energy characteristic in many African countries is that industry is often inefficient in terms of energy utilization. Industry and commercial sectors drive economic growth and account for major portions of national GDP in the majority of African countries. Industry and commercial activities rely on energy and energy services, hence the cost of energy represents a significant component of the cost of production and therefore overall competitiveness. The cost of supplying energy is rapidly increasing both for liquid hydrocarbon fuels and electricity generation. In the light of this situation, national governments, power utilities and regulatory institutions are

beginning a concerted effort to reach cost-reflective energy tariffs, and this in turn will result in energy efficiency becoming an increasingly important factor for the sustained growth and the competitiveness of industries/commercial sectors as well as for energy consumers at large.

However, policymakers and regulators in many developing countries, including Africa, often experience a lack of capacity and knowledge on how to foster a regulatory and policy environment that will better aid the adoption of more economically and environmentally sustainable methods of energy utilization, generation and supply, both in the industrial sector and the rural energy environment. In order to help address this situation, UNIDO and the Renewable Energy and Energy Efficiency Partnership (REEEP) have initiated the project "Capacity Building in Energy Efficiency and Renewable Energy Regulation and Policymaking in Africa".

The project

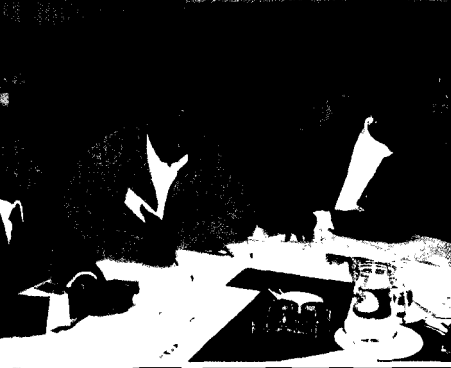
The final goal of the project is to help increase the capacity of the energy regulatory and policymaking bodies in African countries in creating policy and regulatory frameworks capable of promoting and supporting sustainable energy development. The project takes three main focuses; firstly on energy regulation and power sector reform, secondly on the sustainable use of energy through energy efficiency in residential, commercial and industrial sectors, and thirdly on increased renewable energy technology penetration for rural electrification. The mechanism with which the project aims to achieve a positive input in these two energy related areas is through the development of a comprehensive training package on policymaking and regulation for sustainable energy.

Development of the UNIDO-REEEP training package

In 2004, REEEP commissioned the Sustainable Energy Regulation Network (SERN) located in the Centre for Management Under Regulation (CMUR) at Warwick University, United Kingdom. to develop a training package entitled "Regulation and Sustainable Energy". Completed in April 2005 the training package provides an introduction to key issues in energy markets and monopoly regulation and how they affect the development of sustainable energy through a number of case studies from Europe, the United States and Australia.



... increasing the capacity of the energy regulatory and policymaking bodies in African countries in creating policy and regulatory frameworks capable of promoting and supporting sustainable energy development ...



*UNIDO, REEEP and SERN
view the training package
as a living document,
a starting point for
addressing the capacity
constraints of energy
regulators and
policymakers in
African countries.*

REEEP then requested UNIDO to adapt the training package in order to make it responsive and appropriate within an African developing country context, in the light of present sustainable energy policymaking and regulation experiences and constraints.

In November 2005, UNIDO commissioned IT Power, the African Energy Policy Research Network (AFREPREN) and SERN to assist UNIDO in adapting and completing the training package by developing new material and a new comprehensive training course on Energy Regulation, Renewable Energy and Energy Efficiency.

The first draft of the new UNIDO-REEEP training package was produced in July 2006. In August 2006, UNIDO organized in Johannesburg, South Africa, a regional workshop entitled, "Sustainable Energy Policy and Regulation in Africa". More than 40 participants comprising of policymakers, energy regulators and experts, and representatives of the private sector convened in Johannesburg from a number of different sub-Saharan countries. The objective of the workshop was to build capacity by offering a platform for dialogue and exchanging experiences between the different country practitioners while presenting, testing and getting feedback on the draft training package.

Overall, the training package was well received and the workshop participants provided constructive and useful inputs to be used in the refinement and finalization of the training package.

UNIDO, REEEP and SERN view the training package as a living document, a starting point for addressing the capacity constraints of energy regulators and policymakers in African countries with respect to the key issue of sustainable energy development. The next stage for UNIDO is to seek government partners in Africa with which to implement the training package within those countries' energy regulatory and policymaking institutions. In addition, UNIDO is also seeking partner with learning institutions in Africa so as to provide the training package with a firm mechanism for dissemination and continued development.

The training package version presented on the CD accompanying this brochure is also available on the Internet websites of UNIDO (<http://www.unido.org/energy/toolkits>) and of REEEP (<http://toolkits.reeep.org>).

Suggested target groups for the training package

The training package is relevant to the needs of developing country governments, policymaking bodies and regulating institutions responsible for the development and functioning of the national energy sector and their staff. The training package should be particularly useful for staff in regulatory agencies and government departments who are new to regulation or to the ways that regulation can affect sustainable energy.

The main beneficiaries of the training package will be the policymakers and regulators of the energy sector in African countries, however many of the modules contain generic information on sustainable energy which can be useful to energy policymakers and regulators in all developing countries.

Although policymakers and regulators are the principal target audience for the training package, it will also be useful to others who need to understand sustainable energy regulation, particularly energy companies. It therefore has the potential to benefit a wide variety of governmental and non governmental organizations in the energy sector, including private companies, utilities, universities, research institutes, developmental agencies, NGOs and others, which are involved in policy making, policy analysis, regulation and standard development.

As interested parties take up this "Sustainable Energy Regulation and Policymaking for Africa" training package, it can be developed further or used for a variety of training purposes at regional and national level in Africa and other developing countries.

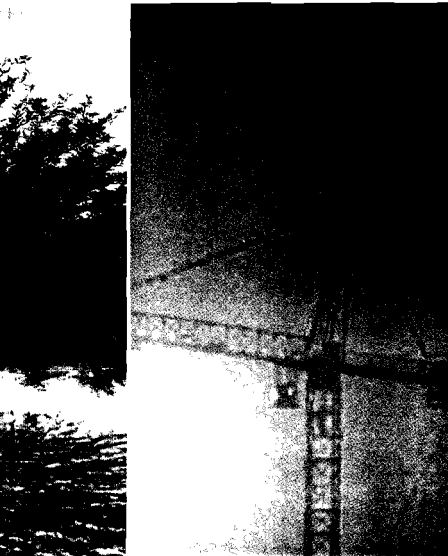
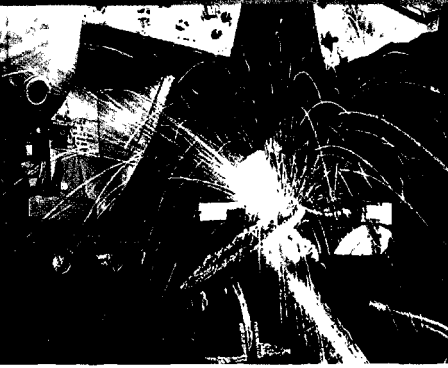
The structure of the training package

The training package provides an introduction to the key issues relating to the energy market and energy regulation, as they affect sustainable energy (energy efficiency, co-generation and renewable energy). The training package focuses mainly on the policies and regulation relating to the generation, transmission, distribution and consumption of electricity and the opportunities and barriers in developing renewable energy and energy efficiency in these sectors. It is stressed that the training package is intended as an introduction to the subject and each module contains references to sources of more in-depth information.

There is no "perfect" generic way of designing or implementing regulation or policies for sustainable energy development. Each energy national



The main beneficiaries of the training package will be the policymakers and regulators of the energy sector in African countries



...aiming to provide examples of where regulation and/or policies have proved effective (or harmful) for the development of sustainable energy technologies.

sector differs—for example, in patterns of ownership, the degree of integration of energy companies, the level of competition and the maturity of a particular energy system. This training package does not set out to prescribe or recommend models of regulation or policies, which should necessarily be copied, but instead aims to provide examples of where regulation and/or policies have proved effective (or harmful) for the development of sustainable energy technologies.

The modules of the training package are therefore designed to:

- Provide an introduction to energy regulation, focusing on the electricity market, and how it relates to power sector reform;
- Provide an introduction to renewable energy and energy efficiency technologies and programmes;
- Outline issues affecting the implementation of sustainable energy technologies;
- Highlight useful examples of “good practice” and explain why they are effective;
- Provide an indication of more detailed studies elsewhere;
- Provoke discussion amongst participants.

The training package consists of a user manual and four separate “sub-packages”. These sub-packages cover:

- Introduction to renewable energy and energy efficiency and the energy sector in Africa;
- Energy regulation (mainly covering electricity);
- Renewable energy;
- Energy efficiency.

In addition to the above sub-packages, an additional final module (module 19) examines the issues, barriers, challenges and opportunities surrounding the financing of renewable energy and energy efficiency projects and programmes.

The first sub-package provides an overview on renewable energy and energy efficiency and the energy sector in Africa. The second sub-package on energy regulation is an opening section introducing the basic concepts of energy regulation; the third and fourth sub-packages on Renewable Energy and Energy Efficiency respectively cover the fundamentals of today’s commercial renewable energy and energy efficiency options. The four sub-packages together give good theoretical grounding in sustainable energy policy and regulation as well as a critical analysis of practical and proven examples of sustainable energy policy and regulations in developing countries through a number of case studies focusing on Africa.

The training package is designed to be used as a set of presentations and written material for a course that can be run over a few days or as a longer, more in-depth course over weeks or months. Each module contains a “core” text that covers the main topic of the module. Each module also has attached to it case studies (where appropriate); a Power Point presentation; examples of thematic discussions; references to further written materials and web sites and a glossary. The case studies are drawn from all over the world and from both developed and developing countries.

Training package contents

The training package breaks down into the following sub-packages and modules listed below. For each module a summary of its contents is shown.

User manual

- A few words on UNIDO and REEEP
- Development of the training package
- Training package aims
- How to use the training package

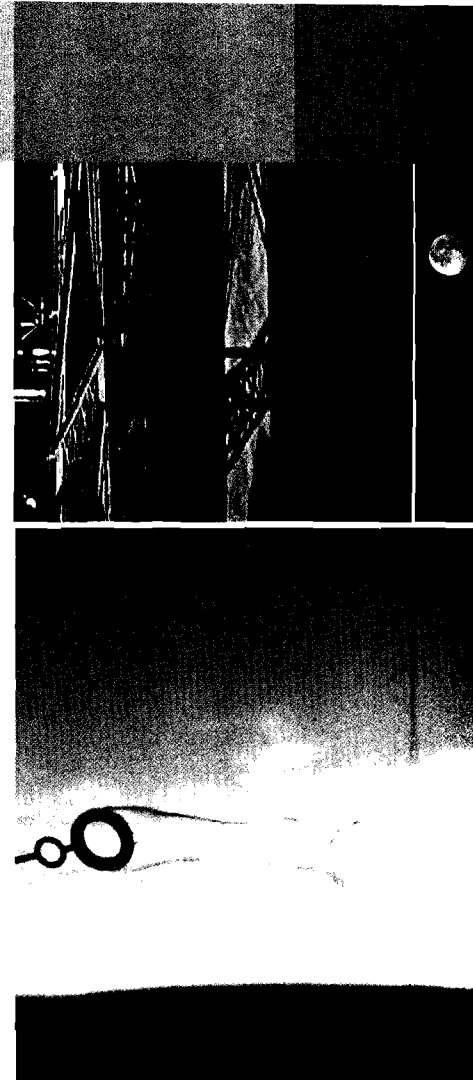
I. Introduction sub-package

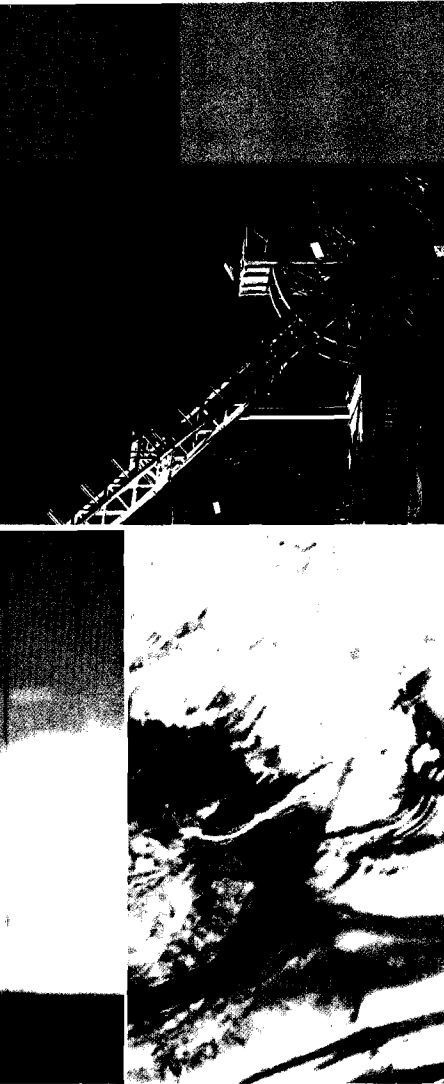
Module 1: Overview of renewable energy and energy efficiency

- Status of renewable energy and energy efficiency in Africa
- Why should Africa promote renewables?
- Why should Africa promote energy efficiency?

Module 2: The energy sector in Africa

- Power sector
- Renewables energy
- Energy efficiency





II. Energy regulation sub-package

Module 3: Introduction to energy regulation

- Why regulate?
- What can be regulated: electricity system structures
- Who regulates?
- Types of regulation
- Regulation issues for sustainable generation

Module 4: The reform of the power sector in Africa

- Reforms in the African energy sector
- Possible reform options—experiences in Africa
 - Corporatization
 - Management contract
 - Unbundling (vertical and horizontal)
 - Independent power producers
 - Electricity law amendment

Module 5: Structure, composition, role of an energy regulator

- Principles of regulation
- Different bodies involved in regulation
- Role of a regulator
- Setting up a regulator
- Building a credible regulatory arrangement

Module 6: Formulating regulatory scenarios and national self-assessment

- Power sector reform
- Regulatory framework
- Integrating renewable energy in the regulatory framework
- Integrating energy efficiency in the regulatory framework
 - Self-assessment tools

III. Renewable energy sub-package

Module 7: Renewable energy technologies

- Overview of renewable energy technologies
- Overview of costs of different technologies
- Overview of common barriers and issues limiting widespread use/dissemination of renewable energy

Module 8: Impact of different power sector reform options on renewables

- Impact of Electricity Law Amendment and unbundling on renewable energy
- Impact of independent power producers on renewable energy
- Impact of corporatization on renewable energy
- Impact of management contracting on renewable energy

Module 9: Regulatory and policy options to encourage development of renewable energy

- Design issues for regulatory/support mechanisms
- Types of regulatory and policy support mechanisms
- Examples of regulatory and policy support mechanisms in Africa and other developing countries
 - Methodology and examples on how to calculate the level of feed-in tariffs

Module 10: Increased access to energy services for rural areas

- *Approaching energy services for rural areas of developing countries*
- The Millennium Development Goals
- Linkage of energy to the MDGs
- Policy options for increasing access to energy services in rural areas
- Different models for increasing energy services in rural areas
- Experiences with increasing energy services in rural areas

Module 11: Distributed generation: options and approaches

- Electricity supply scenarios
- Options for mini-grid systems
- Planning the approach
- Institutional issues
- Frameworks

IV. Energy efficiency sub-package

Module 12: Energy efficiency technologies and benefits

- The benefits of increased energy efficiency
- Where does energy efficiency fit into the overall energy mix?
- Target sectors
- Overview of energy efficiency actions
- Common barriers to implementation of energy efficiency measures
- Combining renewables and energy efficiency together to improve sustainability of energy development

Module 13: Supply-side management

- Supply-side management options and opportunities
 - Resource and resource preparation
 - Power generation and energy conversion
 - Transmission
 - Distribution
 - Transport of fossil fuels
- Constraints and challenges of supply-side management

Module 14: Demand-side management

- Why promote demand-side management?
- What drives demand-side management?
- Types of demand-side management measures
 - Industrial and commercial DSM practices
 - Energy auditing
- Information dissemination of DSM
- Challenges of implementing DSM programmes

Module 15: Impact of different power sector reform options on energy efficiency in Africa

- Impact of unbundling on energy efficiency
- Impact of Electricity Law Amendment on energy efficiency
- Impact of corporatization on energy efficiency
- Impact of independent power producers on energy efficiency
- Impact of management contract on energy efficiency

Module 16: Regulatory and policy options to encourage energy efficiency

- Institutional considerations
- Policy options for increasing energy efficiency in targeted sectors
- Regulatory options: demand-side management
- Regulatory options: supply-side management

Module 17: Industrial energy efficiency and systems optimization

- Why industrial energy efficiency?
- What motivates industry to become energy efficient?
- Promoting industrial energy efficiency
 - Energy management
 - Systems optimization
- Getting started
 - Building a market for industrial energy efficiency services
 - Programme design
 - Developing enabling partnerships
 - Financing considerations
- Pulling it together
 - Industrial standards frameworks

Module 18: Energy efficiency in buildings

- Energy efficiency in buildings methodology
- Energy efficiency measures for buildings
- Financing energy efficiency in buildings
- Developing and implementing policy on energy efficiency in buildings
- Policy tools to promote building efficiency

V. Financing

Module 19: Financing options for renewable energy and energy efficiency

- The financiers' perspective
- Basic types of financing
- Types of financing models
 - Government-led models
 - Market-based models
- Existing policies and regulations
 - Fiscal measures
 - Subsidies
 - Market-based instruments
 - Energy audits and feasibility studies
 - Institutional finance
- Design aspects for measures to attract private investment
- List of potential donors and funds
- Examples

Case studies

Each of the above modules has included in it a number of relevant case studies. The list of case studies is given here in full by package, module and by country or area. It is hoped that new case studies will be added to each module in the future, as more experience is gained.

Module #	Case study #	Country/Area	Case study title
2	1	Mauritius	Cogeneration in Mauritius

Energy regulation

Module #	Case study #	Country/Area	Case study title
3	1	Zambia	Zambia energy regulation board
	1	Zimbabwe	Power sector reform in Zimbabwe
4	2	United Rep. of Tanzania	Electricity regulation in the United Republic of Tanzania: moving from government regulation to an independent regulatory body
	3	Ghana	Power sector reform and regulatory institutions of Ghana

Renewable Energy

Module #	Case study #	Country/Area	Case study title
7	1	Denmark	Wind power in local government: Denmark's renewable energy island
	2	UK	Solar water heating in local government in the UK
8	1	Kenya	Geothermal development in Kenya
9	3	Denmark	Denmark: support mechanisms for wind energy
	1	Germany	German feed-in mechanisms
	2	Spain	Spain: support mechanisms for wind energy
	4	Ghana	Renewable energy in Ghana
	5	Zambia	Zambia: institutional framework and status of renewable energy
	6	UK	UK renewables obligation
10	1	Ghana	Ghana: East Maprusi solar project (RESPRO)
	2	Ghana	Ghana wind energy project
	3	Zambia	Zambia PV energy services companies
	4	Brazil	Brazil's rural electrification programmes
11	1	Eastern Caribbean	Policies for sustainable energy solutions—geothermal power development in the Eastern Caribbean
	2	Mexico	Mexico encourages renewables
	3	China	Huarci, Barkol, Xinjiang, China: a wind power village system project developed by harnessing a poverty alleviation loan

Energy efficiency

Module #	Case study #	Country/Area	Case study title
13	1	China	EU-China partnership on climate change—clean coal technologies
	1	United Rep. of Tanzania	Lighting retrofitting in Tanzania
	2	United Rep. of Tanzania	Tanzania: power factor correction
14	3	Zambia	Zambia: automatic load control and alternative energy supply at Lusaka water and sewerage company
	4	Zambia	Zambia: university energy assessment
	5	Ghana	Why DSM initially failed in Ghana
15	1	Ethiopia	Solar water heaters in Ethiopia
	2	Tunisia	Institutional framework and power sector reform working for Tunisia energy efficiency
	1	Japan	Japan: overview of energy efficiency measures
16	2	Rep. of Korea	Rational energy utilization act of Rep. of Korea
	3	China	China's energy conservation policy
	4	Denmark	Denmark: electricity distribution companies as key actors in energy efficiency policy
17	5	Belgium	Flanders' energy savings obligations on electricity grid operators
	1	U.S.A	Companies forge individual paths to energy management
	1	Australia	Sustainable energy authority in Australia
18	2	South Africa	Improving energy efficiency in Ekurhuleni Metropolitan Municipal (EMM) Buildings, South Africa
	3	Latvia	Efficient lighting in Latvian Academy of Sport Education (LASE), Latvia
	4	Ireland	Passive solar design in local government offices in Ireland

About UNIDO

The United Nations Industrial Development Organization (UNIDO) was set up in 1966 and became a specialized agency of the United Nations in 1985. UNIDO has responsibility for promoting sustainable industrialization throughout the developing world, in cooperation with its 171 Member States. Its headquarters are in Vienna, and it is represented in 35 developing countries through its field offices. UNIDO helps developing countries and countries with economies in transition in their fight against marginalization in today's globalizing world.

UNIDO focuses its technical cooperation activities on three main thematic priorities, which directly respond to international development priorities in line with the Millennium Development Goals (MDGs):

Poverty Reduction through Productive Activities—Distinctively different from other agencies and institutions, UNIDO addresses Poverty Reduction (MDG1) by focusing on enabling the poor to earn a living, rather than providing help to deal with the symptoms of poverty. As such, UNIDO focuses on micro, small and medium scale enterprise development; rural and agro-industrial development (as well as “rural energy for productive use”); and women in development.

Trade Capacity Building—Open borders and markets are essential; still, additional measures are required to increase the participation of developing countries: UNIDO thus combines building up the technical infrastructure required to participate in international trade (i.e. standards, quality, metrology, accreditation and certification) while strengthening key export sectors that require support services in strengthening/upgrading productive and export capacities.

Energy and Environment—While energy is a prerequisite for Poverty Reduction (MDG1), environmental sustainability, as stipulated in MDG7 (Ensuring Environmental Sustainability) is one of today's greatest challenges: UNIDO therefore assists countries in the implementation of activities related to the multilateral environmental agreements; the promotion of energy efficiency; and the promotion of sustainable energy production and consumption practices.

Industry and energy has been a central theme of UNIDO's work for over 25 years. The Organization's technical cooperation programs address both the supply and demand-side in developing countries through provision of energy for industry and by improving industrial energy end-use efficiency. UNIDO also promotes the adoption of renewable energy technologies within the rural regions of developing countries as well as promoting renewable energy technologies for industrial applications. Between 1987 and today, UNIDO has implemented a wide-range of projects in developing countries, at the policy, institutional and enterprise levels.

*Further information
on UNIDO can be accessed
at www.unido.org*

About REEEP

The Renewable Energy and Energy Efficiency Partnership (REEEP) is a global public-private partnership and was launched by the United Kingdom along with other partners at the Johannesburg World Summit on Sustainable Development in August 2002. It has been developed via an intensive consultation process in 2003 covering a wide range of stakeholders at the national and regional levels. In June 2004, the REEEP was formally established as a legal entity in Austria with the status of an International NGO.

Further information on REEEP can be accessed at www.reeep.org

REEEP actively structures policy initiatives for clean energy markets and facilitates financing mechanisms for sustainable energy projects. By providing opportunities for concerted collaboration among its partners, REEEP aims to accelerate the marketplace for renewable energy and energy efficiency. REEEP's goals are: to reduce greenhouse gas emissions, deliver social improvements to developing countries and countries in transition; by improving the access to reliable clean energy services, by making renewable energy technologies more affordable; and to bring economic benefits to nations that use energy in a more efficient way and increase the share of indigenous renewable resources within their energy mix.

The partnership is funded by a number of governments including: Australia, Austria, Canada, Ireland, Italy, Spain, the Netherlands, the United Kingdom, the United States and the European Commission. REEEP's regional secretariats provide access to best practice in policy and finance to promote renewable energy and energy efficiency. REEEP's International Secretariat engages political, financial and business support to reduce the risk inherent in implementing new policy and financing initiatives.

About SERN

The Sustainable Energy Regulation Network has been set up as part of REEEP for those involved in energy regulation (within regulatory agencies or government departments). Membership is also open to other stakeholders with an interest in energy regulation. The network is coordinated by the Centre for Management under Regulation at Warwick University in the United Kingdom.

Further information on SERN can be accessed at www.reegle.info

SERN promotes and accelerates the development of regulatory frameworks and mechanisms that incentivize sustainable energy, particularly localized and distributed energy sources, demand management response and energy efficiency. SERN activities include: facilitating exchange of experience and knowledge between regulators and government officials on the policy and regulatory mechanisms that will promote and accelerate the development of sustainable energy. Producing good practice guides for regulators and policymakers on subjects such as: renewable energy, energy efficiency and CHP/co-generation support mechanisms; regulatory approaches to social, environmental and energy security issues; regulating networks for distributed energy. Conducting training courses, seminars and meetings for regulators, government officials and parliamentarians on regulating for sustainable energy.

About IT Power

IT Power Ltd is an international consultancy organization specialized in energy, climate change and international development, including the Clean Development Mechanism (CDM) and CDM related project work. IT Power's head office was established in 1981 in the United Kingdom and has carried out over 900 projects in over 100 countries.

IT Power's mission is to support sustainable energy development worldwide and currently runs offices in India, China, Mongolia, Kenya, South Africa, United States, Australia and the Pacific, employing over 70 staff worldwide. Clients include private companies and banks, United Nation Agencies, Multilateral Finance Institutions (World Bank, International Finance Corporation and Regional Development Banks), the government of the United Kingdom, the European Union and bilateral agencies.

IT Power's experience covers the whole range of sustainable energy related topics, including strategic business advice, development of policy and regulation, design of financing options, capacity building, technical assistance and the full carbon credit cycle for CDM.

Further information on IT Power can be accessed at www.itpower.co.uk

About AFREPREN/FWD

The Energy, Environment and Development Network for Africa (AFREPREN/FWD) is an African initiative on energy, environment and sustainable development. It brings together 115 African energy researchers and policymakers who have a long-term interest in energy research and the attendant policymaking process. AFREPREN/FWD has initiated policy research studies in 19 African countries: Angola, Botswana, Burundi, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Rwanda, Seychelles, Somalia, South Africa, Sudan, the United Republic of Tanzania, Uganda, Zambia and Zimbabwe. The network also maintains close collaborative links with energy researchers and policymakers from Côte D'Ivoire, Ghana, Nigeria, Sierra Leone and Senegal. The key objective is to strengthen local research capacity and to harness it in the service of energy policymaking and planning. Initiated in 1987, AFREPREN/FWD is a collective regional response to the widespread concern over the weak link between energy research and the formulation and implementation of energy policy in Africa.

Further information on AFREPREN/FWD can be accessed at www.afrepren.org

About ESD

Energy for Sustainable Development Limited (ESD) is a leading international consultancy providing the specialist expertise and experience to help deliver climate change and sustainable development solutions. These range from support on climate change and energy policies, through to planning and design for sustainable energy systems (for buildings or communities), to the implementation of renewable energy and modern energy services, sustainable land use projects as well as ongoing carbon management with public and private sector organizations.

Further information on ESD can be accessed at www.esd.co.uk

ESD was established in 1989 to provide consultancy services as well as to develop projects and joint ventures. ESD has wide international experience of successfully delivering energy projects from inception to completion with skills ranging from strategy, planning and finance to technical design, engineering and procurement. ESD works with a wide range of client groups including international organizations, national governments, donor agencies, corporate entities and non-governmental organizations. With offices in Bath, London, Sheffield, Edinburgh, Sofia, Beijing, Nairobi, Dar es Salaam and Johannesburg and partners throughout the world, ESD has leading expertise to deliver sustainable development solutions across the globe.

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