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Economics & Environmental Aspects of Renewable Energy

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Renewable Energy

Economics & Environmental Aspects

by

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Needs for RET in achieving sustainable development and energy efficiency

- Growth in energy demand
- Growth in energy service demand

- Renewable energy technologies and development

Growth in Energy Demand

Rapid growth in energy demand (projected 1.7% in primary and final energy demand through 2030)[(1)] increase the pressure on

- Environment
- Natural resources (through their inefficient use/land degradation)
- Development and international relations
- Public health and welfare

Renewable energy technologies contribute to the

- Satisfying growing demand and at the same time protect the environment

Growth in Energy Service Demand

- World electricity demand is projected to double between 2000-2030, growing at annual rate of 2,4% (1)
- Almost 2 billion people has no access to energy in the world, more than half of them live in rural areas.

  Main goal is in achieving energy efficiency: providing same energy services, using less energy, or providing more energy services with same energy
- Renewable's share in total electricity generation grows at an annual rate of 8%. They will provide 4.4% of the world electricity in 2030.(2)
- Growing electricity demand cannot be satisfied by traditional fossil fuels, at the same time, RES which are not exhausted by use over time, can contribute to the energy supply.

Energy service supply in remote areas

Urgent need for additional energy service supply by environmentally sound energy technology, because of:

- increasing energy demand by increase of population mainly in Developing Countries,
- increasing energy demand by including rural areas into national energy service supply strategies,
- pollution caused by using fossil fuels for energy service supply,
- lack of public funds for extending energy service structures to rural areas.

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Feed back relationship between national economy and energy sector

- Energy demand, supply and pricing have influence on social, economic development and living standards
  - Increase in economic activity, economic growth, or increase in GDP, will increase energy demand.
  - Growing demand should be supported with growing energy supply.In order to satisfy growing demand energy could be produced domestically or imported
- Unsufficient energy supply, will cause either increase in country energy dependence on import, or increase in prices, inflation; both have destimulating effects on economic growth and development.
- On the other hand the economic structure and macroeconomic conditions are key determinants of energy demand and supply(1)

Adventages of RET compared with other supply options

- Sustainable energy sources(1)
- Protect the environment - clean technologies,
- Tool for poverty alleviation and growth, improve quality of life especially in developing countries, (2)
- Could be applied in grid, off- grid and rural areas in developing, as well as developed countries, as the most suitable supply solution.(3)
- RET can mobilize private capital and stimulate SME development(4)

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Economic benefits:

- Enable economic growth , offering different energy supply options(1)
- Contribute to employment creation, and new business opportunities, e.g. Energy Service Companies (2)
- Reduce countries dependence on imported energy sources.e.g. petroleum (3)
- Enable regional and local development, and achieving economic and political cohesion nationally, regionally and world wide
- Development of rural areas (4)

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Economic benefits:

- Development of national industries in various sector, and improve their competitiveness on international market. (1)
- Opportunities for export and expansion of renewable technologies industry.
- Technology development in order to promote industrial competitiveness on international level (2)

Environmental Impacts

- Protection of the environment - clean technologies [(1)]
- RET are not emitting green house gases (GHG)
- Rational use of the national recources (Land degradation)
- Bird deaths have been a significant problem
- Can block migration of fishs in the rivers and Hydropower effects water quality, and kill the fish.
- Can couse mercury poisoning.
- Greater environmental impacts created by large dams with reservouirs

Social and Human Security

- Poverty reduction
- Employment opportunities
- Income generation activites
- Improve life conditions and standard and well being of the population
- Education and Health

Obstacles and Weaknesses of RET

Even if the RET are clean technologies they also have environmental impacts:

- RET are generally not emitting greenhouse gases (GHG), but the operation, however, can pollute the environment locally, if those consequences are not considered in the implementation strategy
- Biomass plants produce some emissions, and fuel can be harvested at unsustainable rates.(1)
- Wind farms change the landscape, and some have harmed birds.(2)
- Hydro projects, if their impacts are not mitigated, can greatly affect wildlife (3)
- High capital costs.

Obstacles and Weaknesses of RET

In order to compete with old, mature fossil fuel, RET must overcome existing barrier:

- Commercialization barriers: - undeveloped infrastructure (1)
  - lack of economy of scale (2)
- Higher prices of renewable energy comparing with traditional ones, resulting from high initial investment costs
- Unequal government subsidies and taxes (3)
- Market failure to value public benefit of renewable (4)
- Weak incentives and inconsistent policies (5)

Obstacles and Weaknesses of RET

- Market barriers:
  - Lack of information making these technologies unattractive
  - High transaction costs,(despite they are small projects)
  - High financing costs (1)
  - High transmition costs (2)
- Insufficient human and institutional infrastructure, caused by lack of experience and investments
- Initial lack of confidence on the part of investors, developmental banks, governments and users (3)
- Resistance from the traditional energy sector
- Political interests (4)

Expantion of the markets for RET

- Way to overcome barriers for renewables
- In order to expand the markets for renewable, it is important to understand the market forces that encourage renewables' market deployment, as well as those restraining their entry.
- These market forces can be managed through:
  - national plans, (1)
  - policy reform, (2)
  - financing tools and strategies,
  - and through interaction with the private sector, civil societies, NGO's and other stakeholders (PPP).

Renewable Energy Technology Dissemination

RET dissemination is crossing the border of grant based awareness building and demonstration projects to commercialization and least cost solution strategies

- Thus, competitive energy service provision for Public sector (health, sanitation education administration)
- Industry (SMEs and small scale manufacturing)
- Household sector are in the focus of RET dissemination programmes

Income generation, added value production.

Financing schemes and loan systems are prerequisite for sustainable dissemination of RET

Dissemination Strategies

- **Public Energy Service Supply** (free service or some fee for service, public water tariff system)
- **Private Energy Service Supply** (cost covering price plus profit)
- **PP Partnership** (affordable price for users, income generation for private supplier, incentives and subsidies of the public sector to supplier and/or user)
- **Privately owned appliances** (only recommended in special cases of small enterprises or well off private households

a) Public Energy Service Supply

- Politically motivated part of an overall development and energy supply strategy and protection of environment
- All parts of the society could be equally supplied at equal tariffs but at different costs

BUT

- Exceeding most national budgets by far
- Unsustainable approach
- Ongoing privatization process in the energy sector is neglecting unprofitable demands or needs

b) Private Energy Service Supply

- Attracting investors only for markets where cost covering price plus profit is to be realized (high tariffs)
- neglecting remote areas with low consumption-low demand
- No external costs covered for environmental damages, health damages etc.

c) Public-Private Partnership Approach

- **Public actors (domestic)** are needed to create the appropriate environment for action through policies and incentives.
- **private actors for:**
  - Innovation and efficient delivery (e.g. private companies, entrepreneurs);
  - Local institutional support (e.g. NGOs/CBOs);
  - Flexible financing institutions (e.g. private credit institutions, international financial institutions); and
  - Civil societies and other actors (e.g. NGOs, bilateral & multilateral organizations, research institutions) among others for consolidation of lessons learned.
- **Bilateral & multilateral organizations** for
  - mobilizing finance,
  - building human capacity through technology diffusion and knowledge exchange and supporting interventions at the rural level.

C) cont.Public Private Partnership

- affordable price for users,
- income generation for private supplier
- incentives and subsidies of the public sector to supplier and/or user

➢ **This approach is the most promising, since sustainable development policy together with environmental protection and commercial energy service supply are forming a synergetic effect.**

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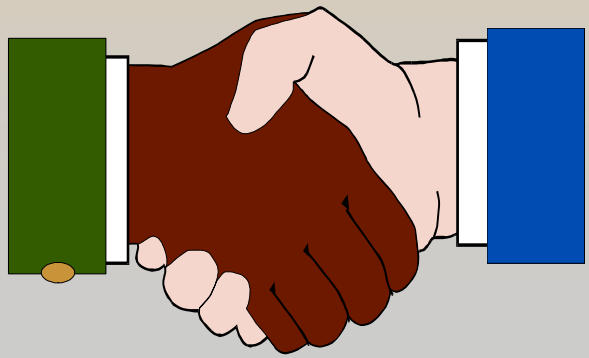
Where do the synergies lie?

Understanding what drives public and private actors to facilitate rural energy provision



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PUBLIC

- National governments
- Local governments
- National and international utilities
- Bilateral & multilateral organizations

PRIVATE

- NGOs/CBOs
- Local and global energy service companies
- Private entrepreneurs
- Local & global financial institutions
- Non-energy companies
- Investors
- Academic, R&D, & research institutions

What drives public actors?

Actor	**Stake**
National governments	Meeting national goals of poverty alleviation, increasing economic growth, increasing energy security
National and international utilities	Exploring an untapped market, commitment to meeting Universal Service Obligations
Bilateral & multilateral organizations	Commitment to ensuring that sustainable development goals are met globally

What drives private actors?

Actor	**Stake**
NGOs, CBOs, village institutions	Environmental, health and social benefits of clean and efficient energy products and services
Energy service and technology providers (including rural energy service companies)	Expanding their businesses
Financial institutions	Expanding their investment portfolios and customer base
Non-energy companies	Exploring complementarities with their own businesses
Academic, R&D and research institutes	Increased understanding and access to information

Economics & Environmental Aspects of Renewable Energy

Where do the synergies lie?

Harnessing the complementary strengths of different stakeholders. Eg. legislative support; public awareness (government), marketing strategies (business), knowledge of local conditions (NGOs).

- **Private partners** should realize the enormous potential of future rural markets and take advantage of type II initiatives through investments.
- **Public partners** need to ensure that the policy environment is amenable to private actors entering and tapping rural energy markets.
- **NGOs, community-based organizations and village institutions** are integral to ensuring the social sustainability and local ownership of projects, as well as the relevance of activities to local conditions.

PPP approach : Role of the Partners involved

1. Public Sector:

- General energy policy including environmental protection
- Budgeting / fundraising for public funding
- Institutional and administrational framework
- Fees and tariff structure

PPP: Role of the Partners involved (cont.):

2. Private Sector:

- Development of a business plan (sustainable business)
- Investment in service infrastructure
- Guarantee of reliable and high standard service
- Water supply service provision on guaranteed standard
- Collection of fees

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PPP: Role of the Partners (cont.):

3. Control body of stake holders:

- development of legal framework (service contracts, quality standards, etc.)
- Tendering of energy service concessions
- Supervision of energy service
- Disbursing subsidies

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IMPLEMENTATION STRATEGIES

Donor Supported Fields of Private Investments

Donors provide support for private investment activities

- shift from “energy service for free” to “fee for service”
- Financial and logistical support to ESPROs (private and public **E**nergy **S**ervice **Pro**viders) rather that to the end user groups directly for an energy service structure
  - ✓ affordable to the users
  - ✓ profitable for the ESPROs.

Ingredients to make partnerships work

- Specify the **goals** and **role** of each public or private partner at the early stages of a rural energy project.
- *Extent and timing* of involvement of each partner is crucial- *i.e.* government should take the role of a "parent figure"; providing the enabling environment and transferring responsibilities when appropriate.
- Each partner should be able to adapt its way of working to suit the needs of the project.
- Partnerships should be forged at the project design stage itself.

Ingredients to make partnerships work…cont'd

- Participation of key members of the community, particularly women
- Open communication and close working relationships
- A transparent working environment
- Follow-up and close monitoring and evaluation
- Knowledge sharing

To keep in mind...

- Ingredients for the different stages of the partnerships vary; from defining roles at the early stages to monitoring and evaluation at the later stages.

- Some roles may not be as direct as others. For example, the national government's role may be to enact policies in a timely manner and introduce incentives for private energy companies wishing to expand to rural areas.

- Partnerships for rural energy development should focus on achieving wider developmental goals – energy for income generation is as such as other services like water and health.

To keep in mind…cont'd

- In all partnerships, building the social (institutional) infrastructure is as important as physical infrastructure.
- Providing energy to rural communities should not be considered an act of charity.
- The cost of inaction is great – e.g the rural poor would be forced to migrate to urban areas, and trouble social conditions and environmental damage.

CONCLUSION

- "Sustainable development is development that meet the needs of the present without compromising the ability of future generation to meet their own needs" (1)
- RET address all three pillars of sustainable development: economic progress, development and social improvement and an improved environment (2)

Economics & Environmental Aspects of Renewable Energy

RET offers environmentally sound energy service supply options

RET is entering the energy market as commercially viable and competitive option in special cases

As PPP approach, energy service supply based on Renewable Sources, is offering commercially attractive options for investment at affordable tariffs

At the same time, extra investments for avoiding external costs (environmental and health damages) are covered by the public sector and/or donor contributions

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EXAMPLE: Off Grid Electrification in South Africa

PROJECT OBJECTIVE

- **Private Electricity Supply by PV-SHS (about 1.5 MW_{peak}) and Energisation for**
  - rural households
  - clinics, schools, community centres
  - small productive activities

not included in the national Grid Electrification Programme

The concession (PPP) approach will be profitable for the concessionaire, if

- **Reasonable investments are provided by the concessionaire**
- **system costs are about 3.500 Rand (500 US$)**
- **Investment subsidies of 80% or more are available**
- **Total number of systems of a concession is 25.000 or more**
- **Cost-effective and reliable fee collection is introduced**
- **Effective prevention of theft and destruction is included**
- **operational costs are minimised**
- **<u>additional profitable energy services are included</u>**

Learning by doing…some examples and lessons

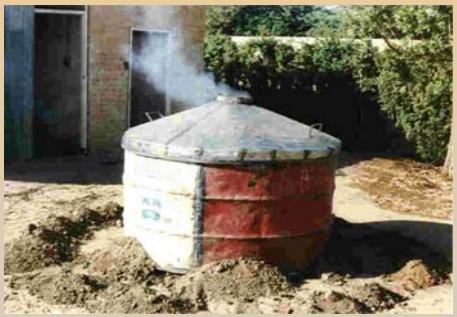
Charcoal production from wood waste and cotton stalks

Partnership model: Public sector unit (LDCs.) – Private sector -NGO - Village Energy Committee

UNIDO project in Guinea-Bissau:

Charcoal production from waste pieces

of a wood working factory and using mobile kilns.



UNIDO project in Sudan has demonstrated

the feasibility of converting an agro-waste

(cotton stalks) into charcoal.

UNIDO's intervention in selected Countries-rural areas, was supported by a national commitment (PEMC). Participation of the local community is crucial for setting up the rural energy technologies and for post-implementation services. A Village –Project Energy Management Committee (PEMC) was instituted in this effort. The PEMC was able to gain from corporate social responsibility recognition.

Tanzania Electricity generation from sisal waste

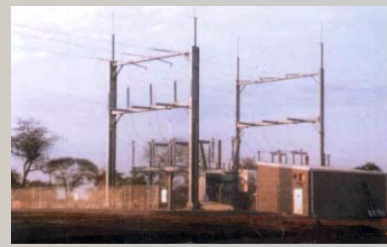
UNIDO and CFC cooperation.

Decorticating

Sisal plant

Biogas from waste and cogeneration plant

Useful waste: fertilizer



Output: electricity

Sisal fibre products

Sisal fibre

West Africa **Multi-functional Platform**

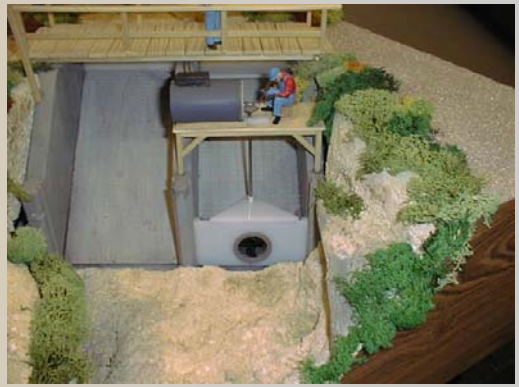
UNIDO, IFAD and UNDP cooperation.






The basic MFP consists of an 8 HP diesel motor running also on biodiesel and a mill for grinding cereals. Additional equipment is added (alternator, dehuller, oil press, welding post, battery recharger, electric water pump, etc.) as required.

Bridging the digital divide: *Zambia* *Renewable powered ICT*



UNIDO-Australia: Centre for Applications of Solar Energy (CASE), Perth, Australia

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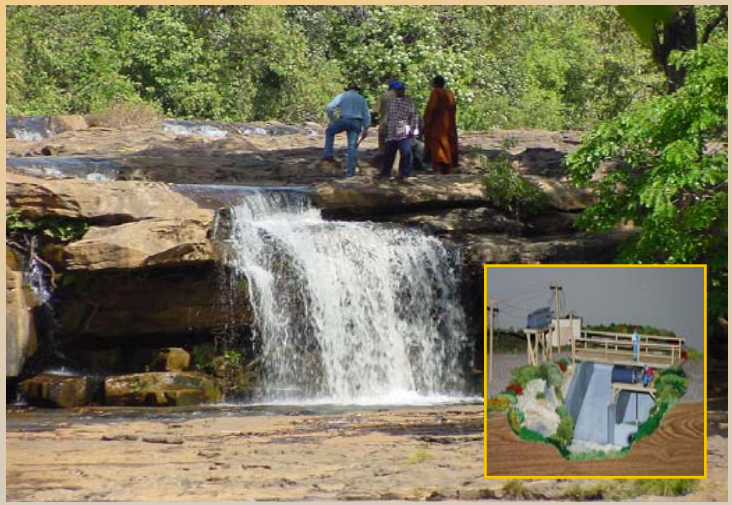
Mini-hydro projects

UNIDO and Government of Austria cooperation.



Mali: Mini-hydro plant with local capacity building and income generation components.

UNIDO-China: International Centre for Small Hydro Power (IC-SHP), Hangzhou, China.

Africa Briquetting of biomass waste, coal dust, etc.provide cooking fuel

Photographs are from UNIDO projects in Ethiopia and Zambia.

Hand-operated briquette press

Automatic briquette press

Different waste material for briquetting

Manufacture of briquette stoves

Productive uses of rural energy

Sustainable Eenergy for Island
Isla de la Juventud-Cuba

Project aims at replacing diesel-based electricity feeding mini-grids with renewable energy (mainly biomass).

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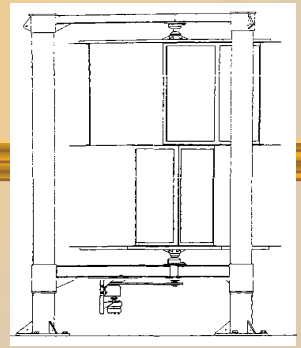
UNIDO and GEF cooperation.

Capacity Building: Local Manufacture of Renewable Energy System Components



Thank you for your attention.

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