ZIMBABWE INTERNATIONAL ENERGY & POWER CONFERENCE AND EXHIBITION (27-29 SEPT 2011)

RURAL ELECTRIFICATION AGENCY PERSPECTIVES
ISSUES/QUESTIONS TO ANSWER

- Rural Electrification Projects in Zimbabwe?
- How to engage the private sector in Africa rural energy sector?
- Are renewable the immediate solution?
- Investment opportunities available in rural areas?
Availability of adequate and reliable energy has a profound impact on human development aspects (poverty alleviation, gender equity, health, food security, education, etc)

Expanded access to socio-economic infrastructure for the rural people

- **Rural industrialization** leading to improved access to goods and services at economic prices
- **Enhanced educational facilities** (extended learning hrs, retention of qualified trs, computers, etc)
- **Improved health care** due to refrigeration of vaccines, lighting, power for equipment
- **ICT**
- **Clean water supply** for household and irrigation
- **Employment creation**
- **Social equity** with urban counter-parts
## National Energy Profile

<table>
<thead>
<tr>
<th>Type of Fuel</th>
<th>% Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel wood</td>
<td>53%</td>
</tr>
<tr>
<td>Coal</td>
<td>20%</td>
</tr>
<tr>
<td>Liquid fuels</td>
<td>14%</td>
</tr>
<tr>
<td>Electricity</td>
<td>13%</td>
</tr>
<tr>
<td>Fuel wood usage in rural areas</td>
<td>90%</td>
</tr>
</tbody>
</table>
## SELECT COUNTRY PROFILES

<table>
<thead>
<tr>
<th></th>
<th>SOUTH AFRICA</th>
<th>ZIM</th>
<th>TANZANIA</th>
<th>UGANDA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Electrification</strong></td>
<td>74%</td>
<td>40%</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>- Urban</td>
<td>82%</td>
<td>80%</td>
<td>39%</td>
<td>33%</td>
</tr>
<tr>
<td>- Rural</td>
<td>61%</td>
<td>19%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Pop distribution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Urban</td>
<td>72%</td>
<td>80%</td>
<td>23%</td>
<td>12%</td>
</tr>
<tr>
<td>- Rural</td>
<td>28%</td>
<td>19%</td>
<td>77%</td>
<td>88%</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>13 300</td>
<td>500</td>
<td>800</td>
<td>240</td>
</tr>
</tbody>
</table>
MODERN CLEAN ENERGY FORMS

- Grid electricity
- Off-grid electricity services
  - Mini-hydro
  - PV mini-grids
  - Solar Home Systems (SHS)
- Petroleum products (LPG)
- Biogas
- Fuel wood (improved wood burning stoves)
- Ethanol gel and other modern bio-fuels
- Solar thermal (water heaters, solar cookers)
RURAL ENERGY NEEDS

- Ideally, a mixture of energy sources are required to meet energy needs for rural folks for
  - Lighting
  - Household water supply & irrigation
  - Heating
  - Refrigeration
  - Motive power (commerce & light industry)
  - Education and recreation
  - Power Information & Communication Technology
Poor access to quality energy for lighting, heating & cooking, and other socio-economic activities

Heavy reliance on bio-mass eg wood fuel

Supplemented by expensive alternatives such as candles, dry cell batteries, kerosine, etc.

Limited access to grid electricity

Limited affordability of alternatives such as renewables (solar, mini-hydros, wind, biogas, etc.)
Impact on Rural Livelihoods

- High indoor pollution & environmental impact
- Burden women & children with time consuming task of firewood collection and cooking with highly inefficient open fires
  - Inconvenience - prolonged cooking times, cold baths,
- Limits opportunities for small - medium enterprise development eg in agro-processing
  - Cottage industries, or irrigation
IMPACT ON RURAL LIVELIHOODS

- Low productivity due to manual means
- Limits access to wider social services such as health, education and recreation
- Limits use of wireless comms for data & voice for ICT
- Where the energy is acquired commercially, the poor pay the highest prices
Most African countries reviewed either energy industry structure together with national energy policies e.g. Zim or introduced new policies that ushered new industry structures in tandem with national economic restructuring programs.

- Over-aching objective - (a) ensure availability of reliable and affordable diversified energy supplies (efficient production, procurement, transportation, distribution)

- (b) rational & sustainable use with due regard to conservation and environ - DSM
POLICY THRUSTS

- Recognition by governments to:-
  - Place provision of adequate energy at the heart of integrated rural development
  - Strengthen national policy & institutional frameworks
  - Create a conducive investment climate in the energy sector
    - Promote investment and infrastructure development in the energy sector
    - Promote entrepreneurship & private initiative in the production of products & services for rural energy
POLICY THRUSTS

- Strengthening national and local capacity for expanding access to modern energy for the poor
- Catalyze financing through market creation of sustainable energy and its efficient utilization solutions
- Promote renewable energy as eco-friendly option
- Continued electrification of rural economic centers and make electricity affordable
- Establishment of a Rural Energy Fund
<table>
<thead>
<tr>
<th>SA</th>
<th>ZIM</th>
<th>TANZ</th>
<th>UGANDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual fiscal subsidies to Eskom</td>
<td>Annual fiscal subsidies to REA for EREP</td>
<td>Set up Rural Energy Agency (2005)</td>
<td>Low level of grid RE</td>
</tr>
<tr>
<td>100% capital subsidy for connectivity</td>
<td>0% subsidy for connectivity</td>
<td>Rural Energy Fund &amp; EWURA</td>
<td>Private initiative using diesel gensets, PV &amp; car bat</td>
</tr>
<tr>
<td>Prepayment meters for rural connections</td>
<td>50% capital subsidy to villagers for B/B</td>
<td>Tanzania Traditional Energy Dev &amp; Envir. Org- upscale modern energ</td>
<td>1999 Elect Regulatory Board</td>
</tr>
<tr>
<td>Most areas =&lt;20km from grid</td>
<td>6 424 out of 11 000 institutions</td>
<td>Provide business dev services</td>
<td>2001-RE Strategy &amp; Plan</td>
</tr>
<tr>
<td>Integrated Energy Centers</td>
<td>10% households electrified</td>
<td>UNDP/GEF PV market development</td>
<td>-15%existing grid</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-40% grid extension</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-25 %isolated grids</td>
</tr>
<tr>
<td>SA</td>
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</tr>
<tr>
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</tr>
<tr>
<td>Zero rate VAT on paraffin</td>
<td>NGO micro-hydros/PV/Wind</td>
<td>Develop market for pvt</td>
<td>-20% PV</td>
</tr>
<tr>
<td>Schools &amp; clinic off grid PV Systems</td>
<td>Solar Home Systems-pvt initiatives</td>
<td>WB/GEF energy access expansion</td>
<td>Long term-Energy for rural transformation program (ERT)</td>
</tr>
<tr>
<td>Elect End- Use</td>
<td>Provide capital subsidies and bus dev capacity</td>
<td>REMaster Plan-Promotion of RE to pvt developers</td>
<td></td>
</tr>
<tr>
<td>Fee for service utility</td>
<td>National Energy Regulatory Board</td>
<td>Priority Rural Electrification Grid, wood gassification, mini-hydros, LPG</td>
<td>RE Subsidy Policy-capital subsidies to utility &amp; pvt rural energy projects</td>
</tr>
</tbody>
</table>
INTEGRATED RURAL ENERGY SUPPLY MODEL

Integrated Rural Energy Utilities

Utility Head Office
- Management
  - Stock warehousing
  - Procurement
  - Logistics
  - Capital investment (from shareholders)

Local government
- Community structures

National and Provincial Government
- Regulator
- Grid Utility

Capital subsidy
- Auditing
- Tariff setting

FBE payments (if applicable)
- Data, status, application

Liaison, planning, FBE data

Energy Store
- Customer Management, revenue collection, maintenance, inventory management, customer marketing/liaison, thermal energy sales (LPG)

SHS, LPG at households
- fees/repayments
- engineering data, credit
- Maintenance, LPG, other
- Communication

Health and Education Institutions

Figure 3 Off-grid fee-for-service utility infrastructure
Strategies used to meet rural energy needs - African experience

- Grid extension - South Africa, Zimbabwe
  - Grid rural clinic and school electrification (SA)
  - Expanded Rural Electrification (Zim)
    - Target rural institutions with 100% capital subsidy
    - Target villagers with 50% capital subsidy
  - PV electrification of schools (SA, Zim)
  - PV electrification by private contractors - Tanz, Uganda

- Solar Mini-grids
  - 80% project cost Govt funded solar mini-grids to power rural households
  - 20% private equity
  - Contractor installed solar mini-grids (SA)
STRATEGIES USED TO MEET RURAL ENERGY NEEDS-AFRICAN EXPERIENCE

- Solar mini-grids for rural schools and clinics (Zim)

- **Mini/micro hydros**
  - Govt-private capital contribution (SA)
  - Govt - NGO/Institutional capital contribution (SA)
  - NGO - local community capital contribution (Zim)

- **Community Integrated energy centers**
  - Community owned one stop shop for all kinds of energy forms (wood, parafin, ethanol gel, coal, etc)
  - Tanzania Traditional Energy Dev & environmental organization
TANZANIA & UGANDA EXPERIENCES

- Advance popular access to sustainable modern energy technologies in marginalised comm.
  - Adaptation of technologies
  - Capacity building community mobilization
    - Improve living conditions
    - Boost economic activities
    - Provide better social services
      - Provide business dev services to rural entrepreneurs
      - Develop linkages with financial institutions
      - Enhance communication networks for info exchange
Opportunities abound for investment in energy projects in Africa (subject to favourable regulatory & institutional framework for each country).

- **E.g. Clean Development Mechanism Projects**
  - Provide energy efficient technologies for traditional sources (efficient stoves, solar lamps, biogas stoves)

- **Off Grid/Stand alone Systems** (fee for a service utility)
  - PV SHS and mini-grids
  - Mini/micro- hydros
    - Major dams have each a facility for power generation
  - Biogas (Set up commercial biogas for schools, hotels, )
INVESTMENT OPPORTUNITIES

- Packaging of Agro-forestry biomass (sawdust briquets)

- PPP Grid Connected Power Projects
  - (mandatory purchase/Bilateral with wheeling charges)
    - Eg Chisumbanje Ethanol/power project,
    - Hippo Valley/Triangle
    - Mini-hydros in the Eastern highlands
    - Other, e.g. Cross border projects

- Development of methane gas
  - Lupane gas fields

- Exploitation of methane gas from municipal waste to produce power (e.g. Harare)
ARE RENEWABLES THE IMMEDIATE SOLUTION? YES BUT............

- At a glance, suitable in difficult, remote & underdeveloped areas where they have greatest impact and avoided cost for conventional energy (electricity) is high

- SUCCESS FACTORS
  - Renewable Energy Policy
    - Defined national quota for RES in energy mix
    - Clear implementation Strategies
    - Specific programs and Projects
      - Develop renewable projects
      - Promote local manufacturing
      - Create awareness and facilitate technology transfer
      - Channel international assistance
      - Co-ordinate all associated activities
ARE RENEWABLES THE IMMEDIATE SOLUTION? YES BUT.............

- In-feed tariffs
  - *Mandatory utility take off tariff*
  - *Gvt/utility guaranteed bilateral arrangements*
    - Wheeling charges
- Capital subsidies/Financial instruments
  - *Fiscal incentives (tax credits, direct subsidies)*
  - *Commoditized tradable green certificates*
- Clean Development Mechanism
  - eg solar lamps
  - Bio-gas for rural household cooking
REALITY CHECK-STATUS QUO?

- Long standing ZESA System development plan
  - Match or exceed forecast demand
  - Defines Investment requirements
  - Tolerable average tariff
- 20 year new generation investment paralysis
  - Sub-economic tariff
  - Regulation
- Power projects - Long gestation period
  - ZESA SDP has been on the cards for 20 years plus
- Regional deficit vs national self sufficiency
  - Expensive to import (buy at 42c and sell at 7c)
- Renewables have short development paths
  - Implement renewable energy in the interim period
- Backed by World markets for carbon credits
INSIGHTS ON DEPLOYMENT OF RENEWABLE PROJECTS

- Renewable energy need not compete with conventional energies such as grid, oil, coal etc.
- Create a niche in rural areas that are off-grid & have little or no chance for grid reach
- Establish project in area where there is ability to pay (Gokwe, Chisumbanje)
- Localize operation & maintenance by involving local communities
- The project must help communities to help themselves solve social problems
INSIGHTS ON DEPLOYMENT OF RENEWABLE PROJECTS

- Eg wood fired energy efficient stoves in Seke (conservation, efficiency, cost, sustainability)

- Upfront capital costs are a barrier so partner with NGO or micro-finance houses.

- Local financial institutions need to be sensitized about the potential of renewable energy. Increased knowledge about renewable technologies can stimulate investment and lending. Tradable certificates
REA draws its mandate from the Rural Electrification Fund Act 2002 (Chapter 13:20) - REF ACT

The object of the Fund is to facilitate rapid and equitable electrification of all the rural areas of Zimbabwe.

Through appropriate technologies
- Conventional grid,
- Off-grid renewable sources (solar, micro/mini hydros, & where appropriate wind)
Currently seized with the Expanded Rural Electrification Program (EREPI)

REA targets to electrify all rural institutions (i.e. All schools, clinics, govt extensions offices e.g. veterinary, police, community & recreational halls, local govt etc.)
PROJECT IMPLEMENTATION APPROACH

- At inception 10,389 institutions (above) country-wide defined the scope of the EREP.

- To date 6,424 (62%) institutions are electrified.
  - Primary Schools - 41%
  - Secondary schools - 77%
  - Rural Health Centres - 73%
  - Gvt extension offices - 82%
The Projects (numbers & budgets) are evenly distributed across all provinces and districts.

Identification is done in consultation with localized stakeholders such as PAs,

Operating rule - Annual project roll out plan compiled from institutions within 5km from the nearest grid (as much as is practically possible).
PROJECT IMPLEMENTATION APPROACH

- All institutional projects are funded 100% from the 6% levy on electricity consumption and any interest thereon and the occasional fiscal grants/loans.

- Annual budgets - around $24m
PROJECTS IMPLEMENTATION APPROACH

- 1983-1989 ESC/ZESA targeted growth points
  - Only a few electrified (48)

- 90’ decade- ZESA targeted business service centres under the Gvt Rural Electrification Master Plan
  - 1995-1998- 415 Centres electrified (100% capital subsidy)
At inception (2002) REA offered 60% capital subsidy to village group schemes.

Village group schemes of minimum size 10 households each would be required to pay ¼ of the 40% and balance over 5 years.

Set up Z1.5m Revolving Fund from donor for internal wiring.
RURAL ELECTRIFICATION PROJECTS

- Project implementation hampered by hyperinflation and only 2,730 projects are complete.

- 973 village group scheme projects outstanding & 3,043 EREP.

- Capital subsidy, revised to 50% in 2009, but implementation impossible without the other 50%.

- Any non-group scheme and non-institution pays 100% and project is done immediately.
PROGRESS AS AT AUG 2011

Distribution Network

- 33kV lines & 11kV  8 200 km
- Substation Capacity  195 MVA
SCOPE OF OUTSTANDING PROJECTS (EREP & VILLAGE GROUP SCHEMES)

- Total Budget (EREP) $432 million
- Group schemes $ 94 million

Scope of work

- 33kv lines : 14 900 km
- 11kV lines : 9 600 km
- MV lines : 1 400 km
- Substation capacity : 80MVA
IMPLEMENTATION STRATEGIES

- Essentially depends on funding level
  - At current level of funding from 6% levy, REA staff are engaged.
  - At higher funding level, REA and private contractors are utilised for EREP and group schemes.
  - With larger loans and grants, escalated implementation rate, and
  - Private contractors will be engaged on a large scale
RENEWABLE ENERGY INITIATIVES

- Entered into strategic partnership with NGO to develop stand alone micro/mini hydros

- Pursuing partnerships with research institutions (eg SIRDC) to adapt and commercialize renewable energies

- Pursuing grants/soft loans from the East and CDM to upscale solar mini-grids commercially
PACE OF RURAL ELECTRIFICATION

- At current level of funding >10-18 years to electrify the EREP institutions
- $1.2b is required for the 50% capital subsidy for village electrification
- At current level of levy funding, takes 40 years to electrify village group schemes with grid?
- Not all villages will be connected to the grid in this generation
- Opportunities galore
GRID-ONE SIZE FITS ALL??

- Where grid has been deployed extensively (SA), it only meets part of the energy needs
  - *Eg lighting, with coal, firewood, or paraffin still used in the same household.*
- Due to high tariff electricity is not used for cooking, creating a supply gap, and there is
- Continued use of raw biomass in grid areas
  - *Low price or free availability of firewood*
  - *No cash to buy alternative energy forms*
  - *No cash to buy appliances needed for other forms of energy eg stoves, kettles*
  - *Cultural practices (rites/rituals)*
GRID-ONE SIZE FITS ALL??

- Rural lines are invariable long with low load densities raising electrification costs
- Even then there is limited grid coverage
- Low uptake in connections e.g. Zimbabwe
- Very low consumption coupled with slow growth in consumption
- Insufficient generation capacity
- Seldom financially viable
- Barely meets economic viability
NEEDED

- SINGLE RURAL ENERGY PLANNING AUTHORITY
- RURAL ENERGY FUND
- NATIONAL ENERGY REGULATING AUTHORITY
  - Determine rural energy demand forecasts
    - Match forecast demand with available energy sources in an integrated manner at national level
    -Prescribe renewable energy quotas
    - Policy incentives for specific programs and projects
  - Increase access to modern affordable and reliable energy to eradicate poverty
    - Attract private capital in the energy sector
    - Promote competition between energy service providers
Apply subsidies from the REF on capital investments
Apply light handed regulation to stimulate investment
Apply differentiated tariffs for different areas to reflect investment and supply costs
Assist energy consumers to purchase energy efficient appliances
Formulate guidelines on organizing rural communities to enable them access better energy services

- Improve energy governance and admin to compel efficiency
- Place energy provision at the center of national development
- Manage energy related environmental impacts
THE END