Decentralized Electrification of Suyuek in Xinjiang

EDF Solution for Decentralized Rural Electrification

Asia Pacific Branch, EDF R&D, EDF Group
• Brief introduction of EDF Activities

• EDF’s solution for Decentralized Electrification

• Introduction of Suyuek Decentralized Rural Electrification project
Brief Introduction of EDF

- Public Electrical Company, be responsible for power generation and distribution of electricity.
- Public service mission
- Power Installation 120GW
  (101.2GW in France)
  * Nuclear 62.3%
  * Hydro 20.1%
  * Thermal 17.6%
EDF’s solution for decentralized electrification

• Situation in France

* 10000 isolating sites far from the grid

* Most of these isolated sites have been electrified by EDF through decentralized electrification
EDF’s solution for decentralized electrification

• Programme ACCESS

* 4 existing Projects:
  - 2 projects in Mali in Africa
  - 1 project in Morocco
  - 1 project in South Africa

* Supplied population 100,000 (still augment)

* Under developing projects
  - Laos
  - Madagascar
  - Philippines
Suyuek decentralized rural electrification project

• Background of the project
• Participants of the project
• Project Description
ENR conference in Bonn, June 2004, China’s declaration:

“By 2010 the capacity of renewable energy will total about 60 GW and account for 10% of China’s total installed power generation capacity, this include small scale hydropower (50 GW) wind power (4 GW) biomass power generation (6 GW) solar energy (450 MW). By 2020 the installed capacity of power generated by renewable energy will reach 121 GW, accounting for about 12% of China’s total installed power generation capacity.”
Suyuek Decentralized Rural Electrification project

• **Background of the project**

  * Cooperation agreement between EDF and MOST

  * EDF R&D’s study of Xinjiang rural zones without electricity
    (incl. inhabitants’ payment ability)

  * Select the location of demo project, make the feasibility study
Suyuek Decentralized Rural Electrification project

- Participants of the project
  
  - EDF ACCESS, EDF R&D Division, Asia-pacific Branch
  
  - MOST (MOST Xinjiang), XNERI (Xinjiang Renewable Energy Research Institute), Xinjiang government office of help for the poverty
MOST + EDF R&D cooperation 2002 – 2004:
Electrifying Suyuek village in Xinjiang, and operating in a sustainable way the micro network, in partnership with XNERI.
Geographic and social conditions of Suyuek village:
Remote village 2h30 away from Kashgar, in the Pamir mountains on the banks of a mountain river
300 families involved, sheep and goats cattle raising is main economic activity
Contrasted weather: hot summers, and cold winters (minus 20°C)
An EDF sustainable methodology for the O&M of micro-networks

Phase 1: Social, technical and economical study in the village:
- How much is spent monthly for candles, fuel…? From 50 to 100 yuans
- What are the needs for electricity appliances? Lighting, radio, TV, VCD, waterpump
- What are the local RES resources? 2 x 30 kW hydroturbine (microhydraulics), PV solar cells for isolated houses
- What kind of network is needed? 10 kV network from microturbine station to Suyuek village and 220 V network inside the village,

Phase 2: delivering an overall service and reaching economical balance:
Service defines the level of electrical power delivered, including
- replacement of low consumption light bulbs
- local O&M of network, safety of installations, O&M of generation
- free kWh distribution to school, community office, water pumping station
Service level from 36 yuans per month up to 70 yuans per month, contract signed per family.
Generation Station
Microhydraulics: 2 x 30 kW

Electricity Generators

Checking voltage and frequency

Water channel to microturbines

2 microturbines of 30 kW
Civil Works leading water to the micro-turbine, from the river

Collecting water from river

Water basin following water collection and beginning (left) of water channel (1 km long)

Water channel ends to pipe, 10 m down lies the microturbine
Micro-network in Suyuek

Generation site substation

In house

Village of Suyuek substation

Village of Suyuek

2 km

10 kV

220 V

220 V
Photovoltaic solution for isolated hamlet downstream of Suyuel village

PV pannels are installed on the roofs, allowing low consumption light bulbs and TV sets.

PV pannels charge batteries. Those have to be exchanged every two years, which is part of the overall service of XNERI in Suyuek. It avoids also pollution, often generated by carelessly throwing away batteries in the environment.
Economical balance with sustainable O&M is achievable
Suyuek villagers pay for the service and sign contracts with XNERI
High local motivation for the success of the decentralized electrification project,

Robust design is strongly recommended in order to facilitate maintenance
Specifications for deep cold days are to be applied in order to avoid freezing water in turbine
XNERI O&M team in Suyuek has to rent a car and spend a day just to find spare parts in Kashi.

Distribution means awareness of safety and quality
Safety of network and distribution in houses is important, and can be achieved locally through
detailed specifications.
Suyuek next steps for progress

Breaking through the deep cold days

* Two solutions are studied by EDF R&D and XNERI to insure permanent electricity generation:
  - Steady circulation of waterflow should be sufficient for the turbine to be ice free
  - Installation of a small diesel. Investment is small, but fuel is costly.

Electrifying shepherd families’ yurts while pasturing their sheep in the mountains

* From June, half of the Suyuek population leave the village for mountain pastures
  They are strongly interested in moving along with their PV house installation.
  But it risks to be broken during transportation, and electricity safety has to be insured.

Solution:
XNERI has developed small portable PV pannel, sufficient to supply power for a radio set and one lamp
This device can be added in the contract of service, allowing the shepherds families to benefit during their errants from electricity.
The local grocery has light

XNERI office, including a yurt

New houses are built in Suyuek

Baking « nangs » in the oven