Hybrid Power Plants: Securing Returns in off-grid Energy Investments

Siemens Hybrid Power Solutions
Agenda

→ Off-grid Energy Investments: Definitions and Market
→ Success factors in off-grid Energy Projects
→ Conclusions
Off-grid Investments: Definitions and Markets

What is an off-grid energy investment?

For this session: energy is defined as electrical power

Investment into:
- Projects with no access to an integrated large scale power grid
- Single or limited number of power generation plants
- Isolated microgrid or minigrid power distribution
- Special cases: systems with weak grid connection

For this session: off-grid energy investment is defined as a hybrid power plant with integration of renewable sources

What markets of off-grid energy investments exist?

Off-grid power systems are found as:
- Utility projects for remote islanded grids
- Utility projects for community grid
- Utility projects for geographical islands
- Industry projects in different sectors: e.g. mining, oil processing, etc.
Market development for off-grid energy investments

Challenges in the off-grid investment market:
- Fuel costs
- Weak / inexistent grids
- Emission restrictions
- Logistic costs

Changes in Technology:
- Generation Costs
- Renewable Systems
- Fuel costs
Essence in Off-grid Energy Investments for all involved Parties: Equalized Risk Distribution

- **Know-how**
- **Technology**
- **Finance**
- **Service**
- **Licensing**

- Utility
- Investor
- IPP

- End User / Beneficiary

- Owner

- Full Ownership
- Partial Ownership
- Leasing Model

IPP = Independent Power Producer

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Success factors in Off-grid Energy Investments

1. Project Development
2. Technology
3. Financing
4. Execution
5. Social Economical Setting
Success Factor 1:
Project Development

Forming a sound project setup with fully committed parties

Important elements of Project Development are (selection):

- Offtake
- Design according to demand
- Location
- Renewable resource exploration & definition
- Interconnection to distribution of the Microgrid
- Supply of fuel and other relevant consumables, incl. fresh water
- Community interaction and licensing
- Technology supply
- Logistics
- Labor & training

In Off-grid Investments everything is about **reliability of supply** → there is no grid to safeguard operation!
Success Factor 2: Technology

Technology Risk Minimization

Selection of knowledgeable & experienced technology provider:

- Knowledge in power system design
- Knowledge in plant control design
- Knowledge in special requirements of hybrid power plants
- Experienced in execution of complex projects
- Experienced in operation of complex projects
- Financially strong to accompany the owner reliably throughout the lifetime of the project
- etc.

Uniqueness of each Off-grid investment needs special attention and **tailor made design**!
What’s different in a Hybrid Plant?

Wind Plant

PV plant

Storage

Control Center

Industrial Load

Residential Load

Diesel generators

MW

Load

Time

00:00  06:00  12:00  18:00  24:00
What’s different in a Hybrid Plant?

- Wind Plant
- PV plant
- Storage
- Control Center
- Industrial Load
- Residential Load
- Diesel generators

Graph showing:
- Load vs. Time
- PV Power vs. Time
- Diesel Gensets vs. Time
What’s different in a Hybrid Plant?

Wind Plant

PV plant

Storage

Control Center

Industrial Load

Residential Load

Diesel generators

Graph showing the different loads and power sources throughout the day:

- **PV Power**: Orange line indicating PV power generation.
- **Diesel Generators**: Black line indicating diesel generator output.
- **Load**: Grey line indicating total load.

The graph illustrates how these components interact to meet the energy demand at different times of the day.
Technical challenges within a Hybrid Plant project
Success Factor 3: Financing

New Challenges in Financing

New market with much higher risk adversity from financing institutions than in established power markets, e.g. thermal plants:

- Little knowledge in financing market about Off-grid Investments
- Small size of Off-grid Investments
- Small number of implemented projects
- Many projects realized under a pilot investment character, with support from government of development funds, hence only little financing market feedback
- Perception of technology as embryonic in the financing market

Gain trust in the financing community through transparency by early involvement!
Success Factor 4: Implementation

Focused interpretation: Implementation is the execution phase of the construction and erection of an Off-grid Investment

Important aspects to consider in Off-grid Investments:

- Complex projects with high level of interaction and interfaces
- Single point of contact on any project implementation aspect
- Guarantees encompassing the overall plant and its function and not only components, leaving the implementation risk with the owner
- Single responsibility to meet the requirements of all components and the overall integrated plant
- Single responsibility to meet the implementation schedule
- Comprehensive support beyond construction phase

Best suited approach for Off-grid Investments: Turnkey implementation!
Success Factor 5: Social Economical Setting

**Sustainable Embedding of the Project**

- Support the government to introduce high penetration hybrid power technology: adaption of mindset
- Support to the government to define suitable technical, commercial and legal framework
- Open and transparent communication with affected or benefitted community
- Support of local capacity building
- Usage of labor of the region to implement the project
- Usage of local staff for operation
- Accompany the customer in commercial operation: careful and supportive aftersales services

A comprehensive project approach beyond pure business is needed!
Conclusions:
To secure returns in Off-grid Investments it is mandatory …

1. … to care for a sound and strong project setup
2. … to have a strong involvement with local Community and the Beneficiaries of the project
3. … to contract with a Turnkey Supplier with experience in Off-grid Investments / Hybrid Plants
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The information in this document contains general descriptions of the technical options available which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.

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