ELECTRICITY PRODUCTION IN OFFGRID REMOTE AREAS

Is solar really the best alternative?

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Presented by Enerdeal
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INTRODUCTION

Remote areas such as islands, rural regions in Africa, agro-food industries in the middle of nowhere or even some large city centers in developing countries often face a major challenge to get access to a cheap and reliable source of electricity. To date, most of them rely on diesel generators or heavy fuel engines. Now that recent competitive business cases are arising from miscellaneous renewable energy technologies together with an ever longer period of high volatility in oil price, we can observe growing concerns from governments, industries, touristic sector and even some local communities to progressively change their opinion on the energy mix. There are now serious alternatives worth considering!

CHAPTER 1

HEAVY FUEL

and the drawbacks of diesel

Heavy fuel offers a cheaper OPEX costs than diesel but requires heavy infrastructure (concrete foundation, power building ...), appropriate access roads for heavy engines delivery, and strict maintenance. Additionally, heavy fuel is appropriate for MVA-size engines with a quite flat production/consumption profile, thus for consumers with a constant energy need.

Diesel generators, ranging from some kVA to several MVA (when in parallel), present by far the cheapest CAPEX costs, but also the highest OPEX costs. More convenient for backup but also appropriate for constant low-to-medium capacity power generation, they offer a reliable source of supply and probably the fastest lead time from acquisition to operation.
They represent up to 80% of the power supply in offgrid areas. There are however several major drawbacks with diesel generators: poor quality of diesel and limited maintenance generate higher consumption rates and often lead to failures; delivery can be very expensive and thefts are frequent; hard currency payments generate important cash drains; noise and pollution are less and less accepted by clients and international organizations; and most important, the energy cost is one of the highest, ranging from minimum 0,25$/kWh to 0,50$/kWh with an average at 0,30$/kWh (and even much more in some remote areas). It is important, when estimating the total cost of energy, to consider actual data and not on theoretical ones from datasheets and to include the CAPEX depreciation and the maintenance costs.

CHAPTER 2

ALTERNATIVE (RE)SOURCES

weigh your options

When considering the available alternative sources of renewable energy (for electricity generation at least), we can consider **solar, wind, hydro and geothermal:**

- **Geothermal**, with the exception of niche geographical markets or heavily subsidized and large capacities, **cannot realistically be considered as a promising solution** for the massive, fast growing and disseminated needs of power generation.

- **Hydro offers interesting opportunities in different regions of Africa**, based on two technologies: micro-turbines (from 5 to 50 kW) in rivers with moderate flow and larger turbines (from 100kW to multi MW) operating with dams:

  - Micro turbines offer indeed an attractive solution and can provide a quite stable production profile 24/7 which could depend on seasonality according to the location. They necessitate however to either develop a local grid which can be costly or to get the consumption very close to the river.

  - **Dams and larger turbines present the best technological solution and the cheapest unit cost of electricity generation but require major environmental impacts** and, which is the key issue, huge CAPEX for medium-to-high voltage grid development. By definition, they often do not represent realistic solutions for remote areas.

  - **Water is definitely not available in all regions** and the level of available capacity can strongly depend on the season, which hardly represents a self-sufficient technology.

- **Wind power is often promoted as the best solution for islands and sea-side areas.** High and stable wind levels, availability night and day, limited seasonality, low cost of energy. But technology evolution and experience demonstrates numerous drawbacks refraining from a strong development in remote areas. Such as for hydro, we find two main categories, with micro-turbines and MW-scale turbines:

- **MW-scale turbines, which are the most widely developed solution we use to find on islands, can be appropriate for only a limited part of the energy mix** and only when there is an existing grid. On top of it, with their ever growing standard size, from the 0.8MW turbines available 10 years ago, the new standard is now closer to 3 MW, meaning a significant power input, not obvious to absorb in micro-grids and, given the quantity of energy produced, storing it in batteries is - and will still be for long – very expensive. Such turbines also require high pre-investment costs for feasibility studies (wind, and environmental impacts). Developers require therefore often to install 5 or 6 units to offset legal and financial charges linked to the dedicated project finance company (SPV) which needs to be set up. And obviously, given the high investment costs, a take-or-pay power purchase agreement must be signed to secure the business case, meaning long-term commitment.

  Accessibility is also critical for the development of such MW-scale turbines: pylons and blades need to be transported through appropriate roads on huge trucks, lifted up by huge cranes and fixed on heavy reinforced concrete foundations; not common to find in remote areas and if technically possible, very expensive. As for maintenance purpose, the only possibility is through expert maintenance teams often coming from overseas.

- **Micro wind turbines can be adequate for small to medium size needs.** Some are specifically adapted to be mounted without cranes and laid down in case of heavy storms or hurricanes. Given their limited height and rotor dimension, the LCOE will be very expensive and sometimes much more than with diesel generators.

CHAPTER 3

"SOLAR PHOTOVOLTAIC"

cumulative benefits

Solar photovoltaic appears to remain the most appropriate solution for islands and rural electrification. The cost of panels has been keeping decreasing for years, representing now only one third of the project cost, leading to an LCOE (Levelized Cost Of Electricity) below 0,3 €/kwh for projects under 1 MWp and around 0,15 €/kWh for projects between 1 and 5 MWp, thus much competitive compared to both heavy fuel and diesel.

But the major advantage of solar is not its price... It is rather the cumulative advantages of:

- **Availability:** the sun is everywhere. Unlike wind, hydro or geothermal, solar energy can be generated everywhere on the planet. One just need enough room for ground or roof-mounted installations.
- **Competitive:** whatever the size, solar is immediately competitive as of the first kWp compared to all other micro and medium size sources of energy production, taking into account all CAPEX and OPEX costs, whereas for the other renewable energy sources, medium to large size matters to reach competitive levels.
- **Scalability:** industrial solar photovoltaic power plants allow to start with 100 kWp, then progressively upgrade to 1 MW or more depending on the growth of the electricity needs. No need therefore to draw hypothetical projections in the long term and take a risk on the initial sizing.

- **Reliability:** Among all renewable energy sources, photovoltaic is by far the most reliable one as there isn't any moving part and a very limited number of key components. In markets where political or economic stability is quite uncertain, solar photovoltaic projects can (when appropriately designed) be dismantled and reinstalled while saving up to 80% of the material costs. Compared to any other renewable energy source, only solar can allow this, meaning a substantial risk reduction in the project financing scheme.

- **Easy installation:** no need of cranes or heavy trucks, nor of tens of experts for installation. The heavier part of a 1MW system can weight up to 100 kg whereas most of the panels, inverters and mounting systems can be handled with a single person. Assembly needs to be supervised by an experienced site manager but workforce can easily and rapidly be trained.

- **Easy maintenance:** major maintenance operations are panel cleaning and inverter replacement, when installation has been realized correctly. Remote monitoring and remote maintenance support are managed most of the time by the developer or equipment supplier. Spare parts are not expensive and can be easily replaced, meaning a limited outage impact.

- **Storage capacity:** given small affordable initial size and progressive expansion, coupling industrial solar to battery solutions can be easily developed. Battery capacities ranging from 100 kWh to 2-3 MWh are now available fully packaged in robust containerized solutions.

The development of micro-grids is definitely the growing trends to energize large, remote or highly decentralized regions. Hybrid technical architecture will be essential to provide/secure the best level or reliable power availability: a combination of grid, diesel, solar and batteries for micro-grid needs (0.5 to 5 MW) and heavy fuel coupled to wind or hydro when appropriate for larger needs. Let's keep in mind that key decision criteria in these regions are not OPEX-based only but rather robustness, reliability, ease of implementation and lowest total cost of ownership.

THE RIGHT TIME FOR SOLAR IS TODAY!

Enerdeal is specialized in large scale photovoltaic power plants for either on-grid systems in Europe as well as off-grid or hybrid installations in remote areas such as Central Africa and the Middle East. With over 500.000 m^2 of solar panels installed, Enerdeal has become a major player in the solar energy market. Since we offer a fully integrated solution from development to operation and financing, Enerdeal is uniquely positioned to help companies and investors develop solar energy plants for industrial, commercial, real-estate projects.

Interested in addressing your solar potential?

CONTACT US

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