



Use case I Vietnam Remote Village

Configuration for the self-sufficiency case



Off-grid

2.4 MW



Diesel genset

5 MWh / 5 MW



BESS

2 MW



PV

Benefits: microgrid vs. conventional

CAPEX (in € millions)

Microgrid 3.54

Conventional 0.8

OPEX (in k€/p.a)

Microgrid 357k

Conventional 1,160k

-69%

€ 0.334

-48%

€ 0.173

Levelized cost
of energy* (€/kWh)

3.3

Years

Break even compared
to conventional (2021 costs)

CLEAN, AFFORDABLE AND RELIABLE ENERGY SUPPLY FOR REMOTE VIETNAMESE VILLAGE

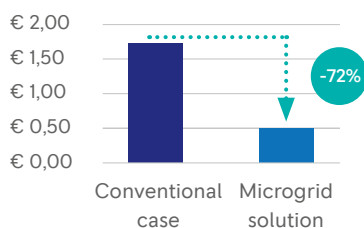
Microgrids deliver cost effective and sustainable off-grid solutions
for remote locations

Executive summary

Remote towns and villages often do not have access to a suitable grid connection and are traditionally tied in to using expensive and carbon-intensive diesel generation. This Use Case shows an example of how a remote village in Vietnam can cut energy costs by 48%, whilst at the same time generating over 56% of their energy from renewables.

Environmental impact

Diesel Consumption [million litres/yr]



56%

Annual Energy
Generation
from renewables

Who:

Local utility / network provider currently supplying a village with 100% diesel generation

Where:

Vietnam

Why:

Looking for an off-grid energy supply that is a reliable, affordable and green alternative to conventional diesel-only generation, with a focus on reducing energy costs and carbon emissions.

Main benefits:

- Access to power
- Energy cost optimization
- Positive environmental impact



A Rolls-Royce
solution

OPTIMIZING ENERGY COSTS WITH MICROGRIDS

To demonstrate the potential for savings with microgrids, we have calculated an example business case for a village in Vietnam using HOMER GRID™ simulation software.*

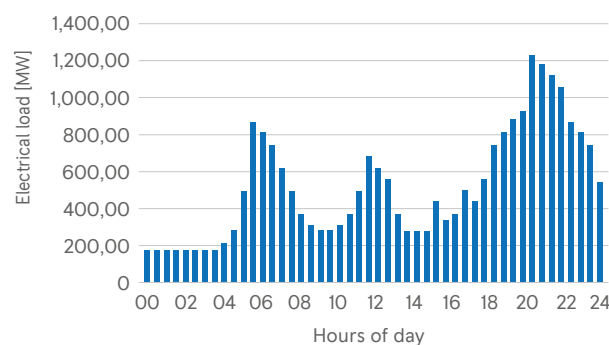
Fluctuating demand throughout the day represents an opportunity for energy storage to smooth the demand profile

Due to the lack of grid connection in remote locations, an off-grid energy supply is required. The conventional diesel solution produces excessive amounts of carbon and is expensive. Costs are driven by high fuel costs (transport and storage), and operational / maintenance costs on genrators.

In our example in Vietnam, the village has plenty of space to install Photovoltaics (PV) and take advantage of plentiful cheap renewable energy. With a fluctuating demand profile and high annual peak, a combination of Battery Energy Storage (BESS) and traditional diesel generation is required to provide a stable and reliable supply.

Typical daily load profile

Annual Electricity demand: 4 GWh Annual Peak Load: 2.1 kW



Base Case

A remote village in Vietnam, powered by diesel generation. It is assumed the village is about to invest in a new energy solution, and therefore capital costs (CAPEX) for the diesel generator are also included in the base case.

100% Diesel:

2.4 MW



Levelized cost of energy**

€ 0.334 per kWh

Annual operating costs:

€ 1,160k per year

Microgrid Solution:

Reduced Energy Costs & Emissions

-69%
OPEX

-72%
Emissions

The village produces 56% of its own energy from PV enabling significant operational cost (OPEX) cost reductions. The remaining energy is generated from diesel generators, sized the same as in the base case, to be used for back-up power and for periods when there is no sun. A BESS is used to store PV energy, provide grid stability and optimize operation of the diesel generators.

Diesel:
PV plant:

2.4 MW
2 MWp

BESS:

5 MWh
5 MW



Levelized cost of energy**

€ 0.173 per kWh

Costs per year:

€ 357k

Savings per year:

€ 803k

* Numbers are indicative based on simulation in Homer GRID software

ANALYSIS OF THE BUSINESS CASE

In this use case we compare the conventional case, where 100% power is supplied by diesel generation, with an optimised microgrid solution.

Investing in microgrid solutions with PV and BESS

Conventional case:

The conventional case consists of 2.4MW diesel generation providing all of the energy for the village.

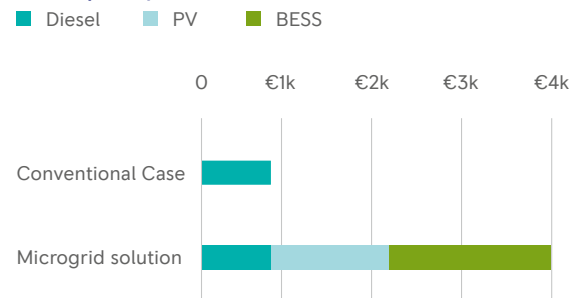
Total capital investment: € 804k

Microgrid solution:

The microgrid solution requires a large capital investment with 2MWp PV generation and a large 5MWh battery to balance the load. In addition, the same-sized diesel generator as in the conventional case is also required for back-up power, peak load and extended periods with less sunshine (e.g. over night, winter).

Total capital investment: € 3.54M

CAPEX (in k €)



Significant operational cost savings

Conventional case:

In the conventional case, all energy is generated by diesel with an assumed cost of €0.60/liter. Operating and maintenance (O&M) costs of the diesel generators are also high due to the high running hours (24/7 operation).

Total operating costs: € 1,160k / year

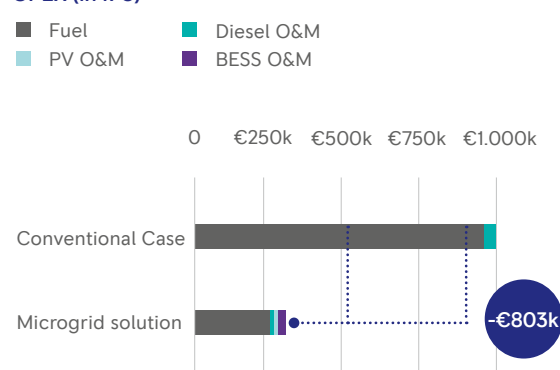
Microgrid solution:

In the microgrid case, 56% of the annual energy generated is produced from the PV panels resulting in reduced operating hours of the generators and therefore reduced O&M costs. The additional use of the battery to enable the generators to run at more efficient operating point, enables an overall fuel reduction of over 70%.

Operating costs of the BESS and PV installations are relatively small allowing significant annual operational savings.

Total operating costs: € 357k / year

OPEX (in k €)

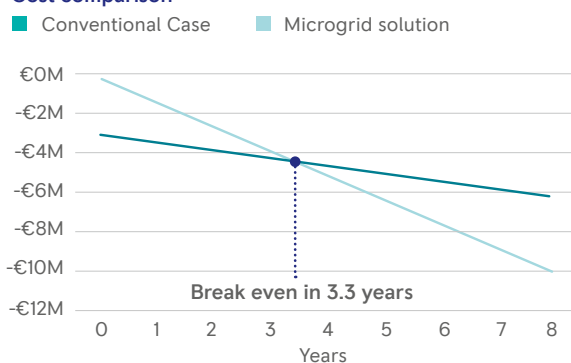


Payback Period

Despite a larger upfront capital investment of €3.5m, 4.4 times higher than the base case, the microgrid solution delivers a very fast pay back period of just 3.3 years.

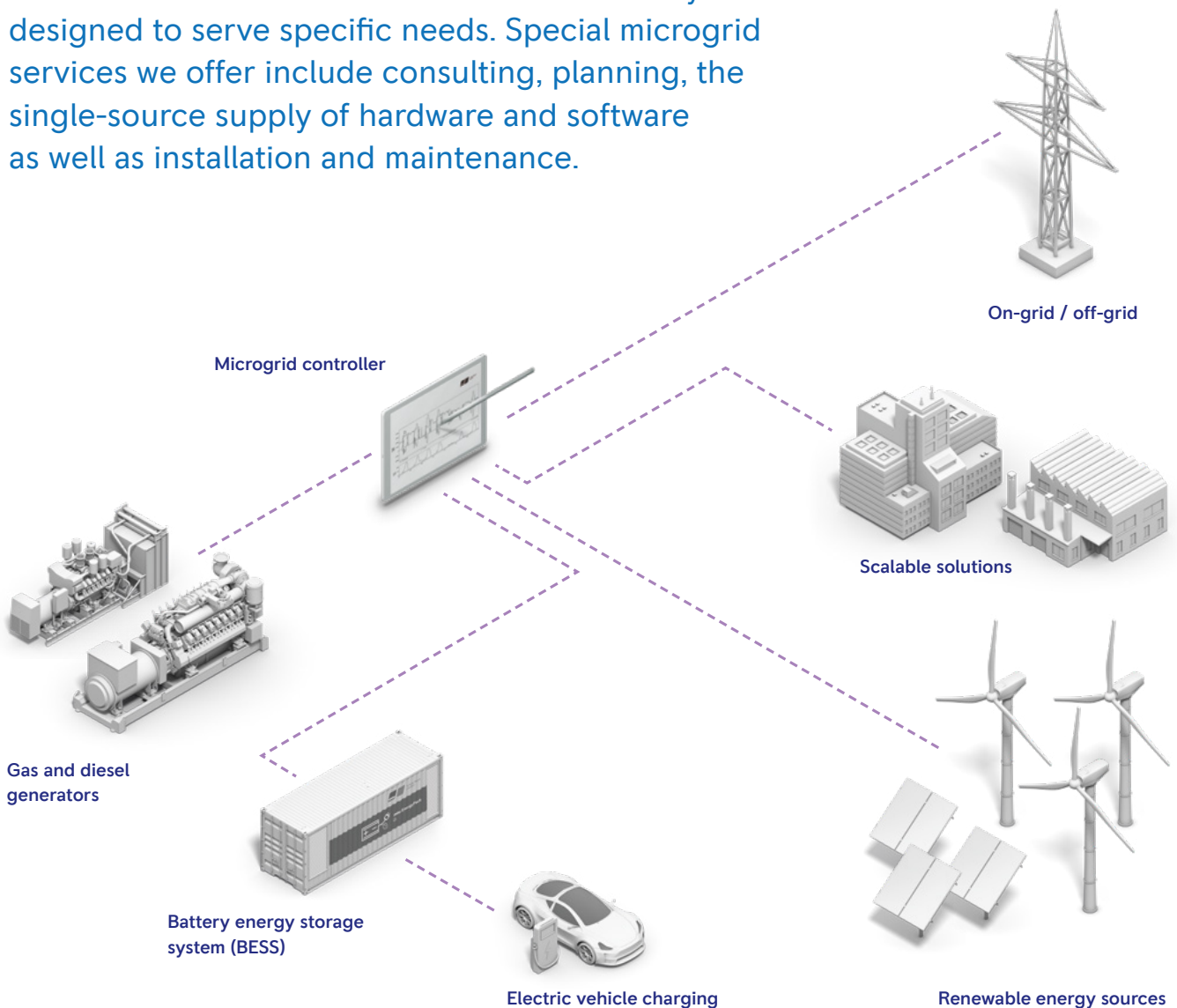
This is mainly achieved through the low energy costs from the PV enabling significant operational savings of €803k per year. Across the lifetime of the installation (>20 years), this provides a well worthwhile investment.

Cost comparison



MICROGRID SERVICES, SYSTEM INTEGRATION AND SMART CONTROL

Our microgrid systems offer a wide variety of solutions and services. Each can be individually designed to serve specific needs. Special microgrid services we offer include consulting, planning, the single-source supply of hardware and software as well as installation and maintenance.



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