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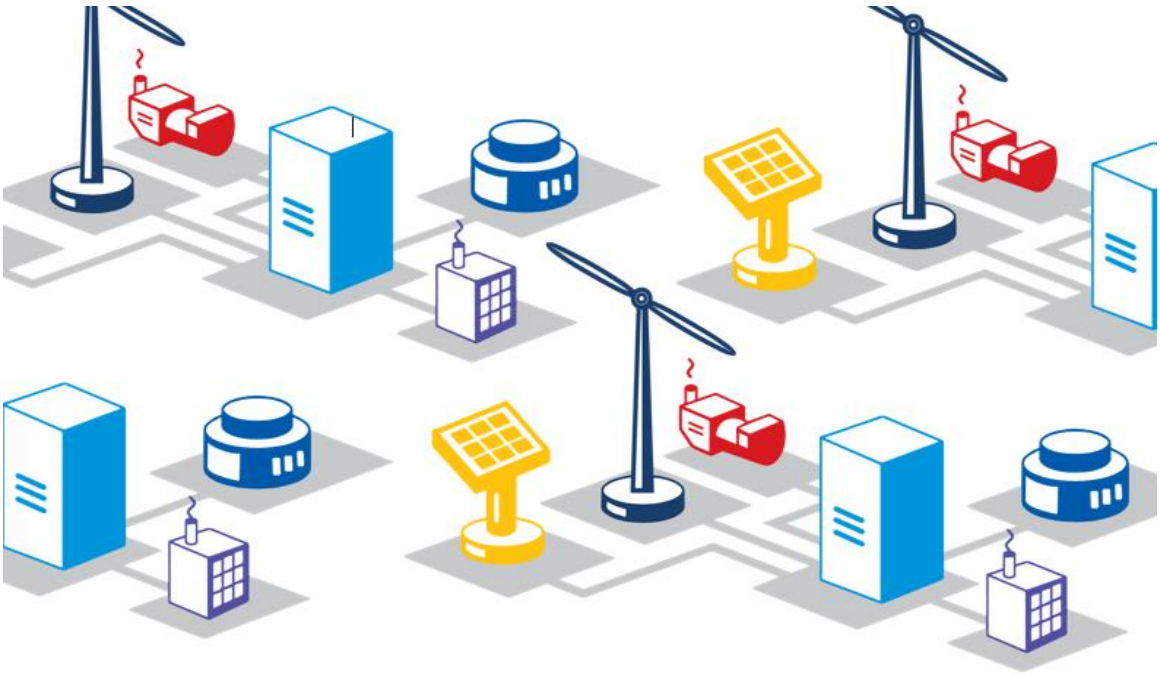
European Regional Development Fund

Decentralised Hybrid Energy System

OFF-GRID TEST CENTER



Blueprint / 100 households

Project: Saint-Martin

Date: november-19

Site information - Location data

Name
General Case Saint-Martin

City
Saint-Martin

Country
Saint-Martin

Address

Zip code

Average wind speed

6,67 m/s

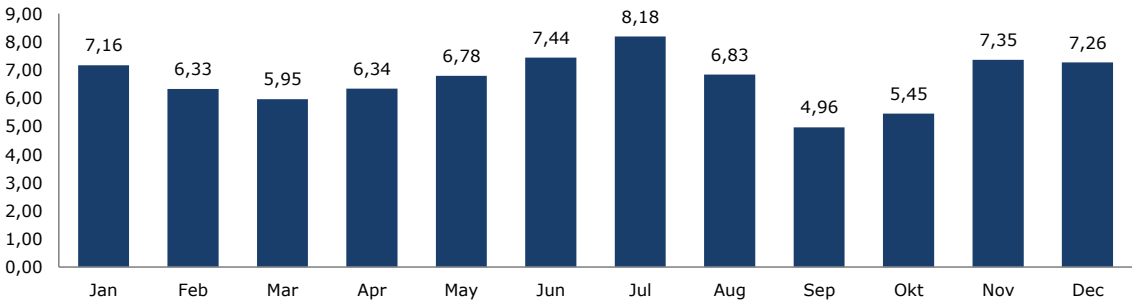
Reference height

30 m

PV (kWh/kWp per year)

1453

Wind speed per month (m/s)



Note: Wind assumption is constant

What if there is no reliable energy supply?

High (hidden) losses

What a DHES can do for you - you will discover in this business case

There are a lot of losses if there are power outages. Think about the costs you make and profit you lose, if you don't have energy supply. The icons you see above illustrates the losses you make. OGTC can help you to create an energy supply you can trust and that helps you to reduce the costs you will make in the current situation.

Besides the problems we illustrate above, the cost of energy in the new situation will be low, because of low maintenance and the profit from the natural resources. To make this even better, you will help to build on a better future for this planet!

Current situation

Energy consumption per day	1.000	kWh
Energy consumption per year	365.250	kWh

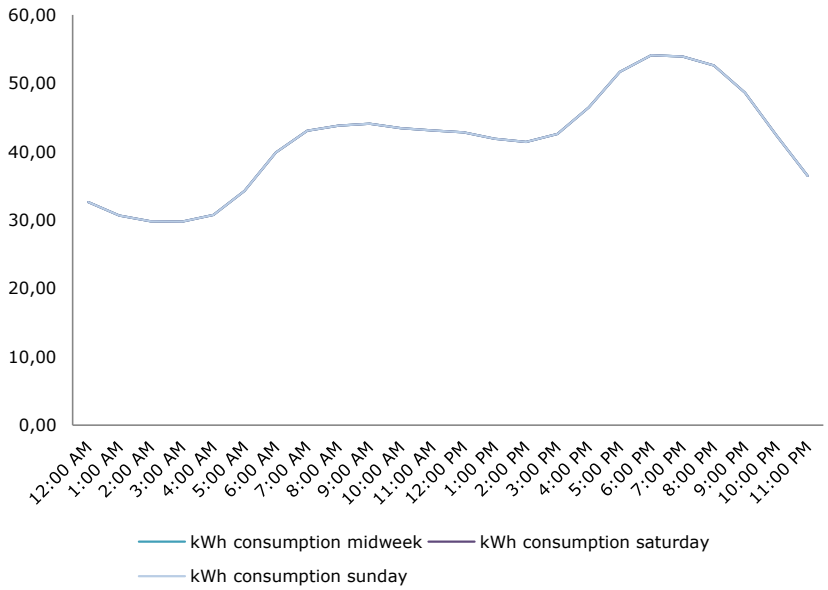
Cost of energy per kW/h - total consumption

€ 0,5640

0,637 USD

Percentage grid energy

0%



Percentage diesel generator

100%

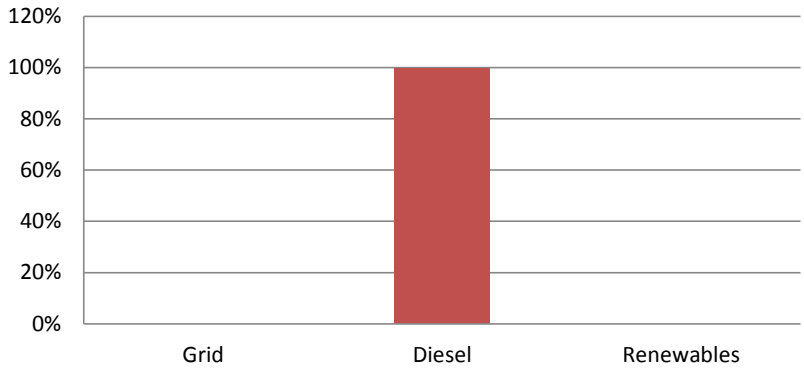
Percentage renewable

0%

Liters diesel per year

1.241.850

Current sources



There is a lot to win in the current situation. In addition to the problems that can arise if the energy supply fails. The renewable percentage is:

0%

Renewables

New situation

Energy consumption per day	1.000	kWh
Energy consumption per year	365.250	kWh

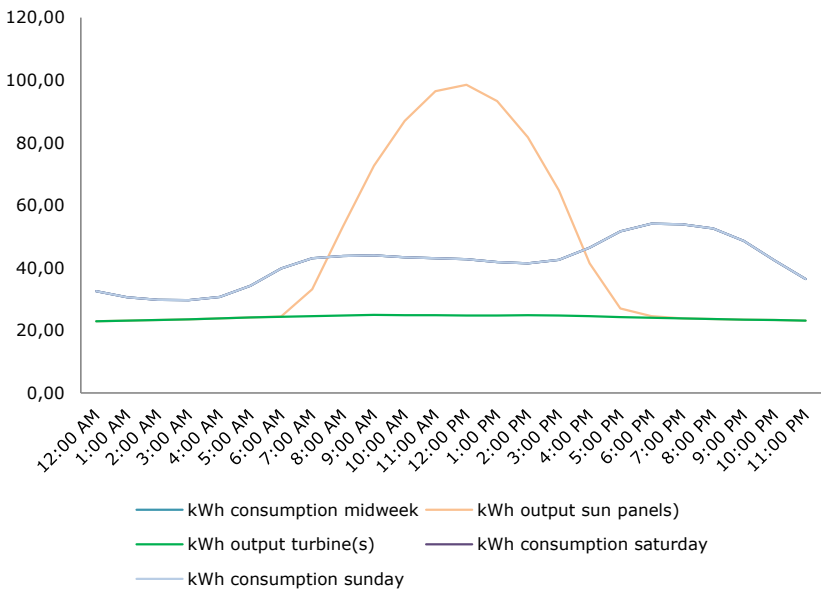
Cost of energy per kW/h - total consumption

€ 0,2086

0,236 USD

Grid energy

0%



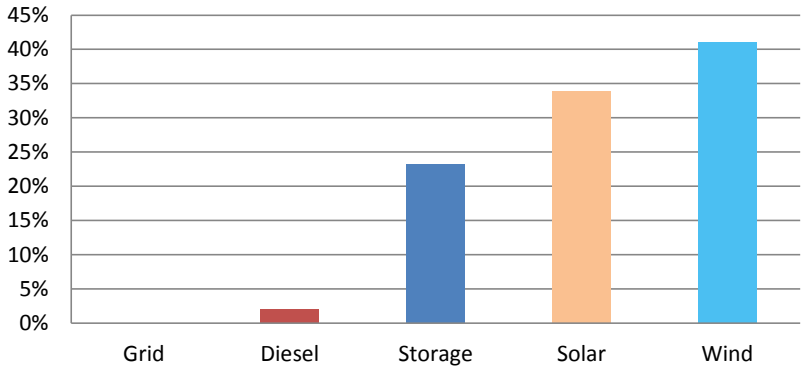
Percentage diesel generator

2%

Solar power

34%

New sources



Wind power

41%

Battery storage

23%

Balancing grid energy:

Export to grid (other):	0 kWh	
Import from grid (other)	-84.418 kWh	100% green energy

The energy supply will be very reliable in the new situation. Besides that the energy consumption will become considerably greener. By switching to this solution, your energy consumption will be:

98%

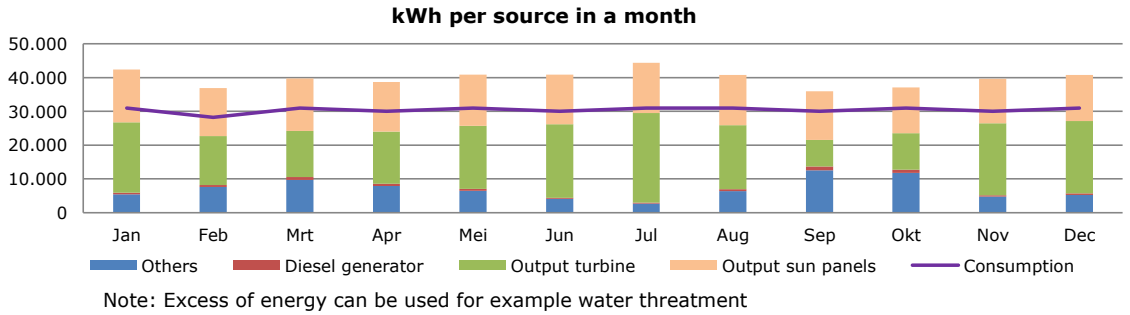
Renewable*

* Exclusive delivery of excess energy to others!

Solution

Wind Turbine			
1 x	72 kW	Hub height	30 meters
		Output	211.686 kWh

The other sources of energy:		Project Period
Sun panels	**Output**	20 years
120 kWp	174.391 kWh	
Diesel generator	**Output**	**Liters diesel saving per year**
100 kW	7.341 kWh	**1.216.892**
Battery	**Output**	
700 kW	84.418 kWh	



Note: Excess of energy can be used for example water threatment

Solution

How the energy system will look like - Two key elements:

100% availability of electricity due to the use of renewable sources and a diesel backup. In many situations the grid is the only source of energy. The costs of a power outage are enormous! The smart combination of both a diesel generator and renewable sources will lower the cost of energy but more important, energy is available at any time.

Low cost due to the use of a DC based 'smart grid'. Microgrids have been around for many years. Most of those microgrids use the diesel generator as the main source of energy, where the diesel engine is 'making the grid'. The diesel acts as the 'master' and the other sources act as 'slaves'. As a consequence of this configuration, the diesel has to run all the time. This means that the diesel runs when there is no need for electricity of the diesel and that the diesel runs very inefficient at low RPM (idling). In a DC based system the diesel is not needed to make the grid and will only be used when electricity of the diesel is needed. This saves a lot of fuel!

The ideal hybrid system: DC based system

DC based system - Summary

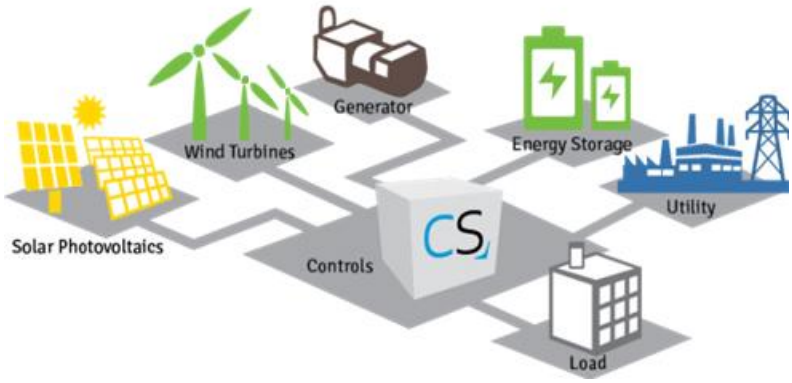
The diesel generator(s) only runs if nessesarry

Low maintenance cost > decrease cost of energy

Low fuel cost > decrease cost of energy

100% reliable

Efficient communication between sources



Financials

Capex		
€	633.930	USD 716.341

Opex		
€	31.717	USD 35.840

Payback Period in years
3,03

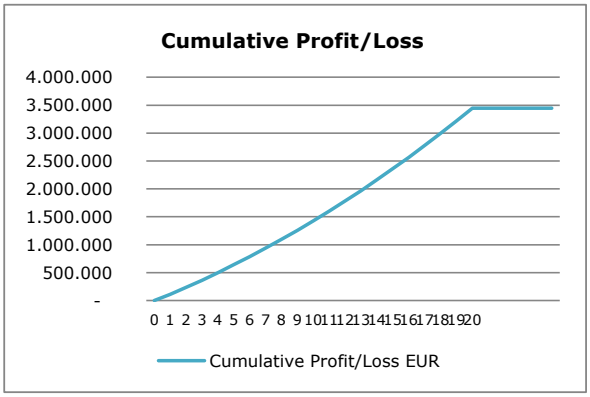
IRR on investment
34,3%

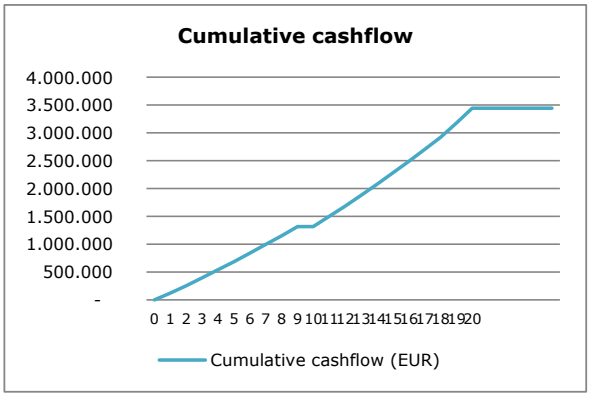
Turnover per year		
€	206.001	USD 232.781

Profit/Loss after period		
€	3.444.637	USD 3.892.439

Inflation rate:		2,00%		
Tax rate:		0,00%		
Export tariff:	EUR	-	USD	-
Exchange rate:	EUR	1,00	USD	1,13

	Commercial loan	**Crowd funding**
Amount debt	€ 476.850	€ 84.150
Repayment period	18	10,00
Interest	4,0%	6,0%
Delay repayment	0,00	0,00
Type of repayment	Annuity	Annuity





The 'cumulative profit / loss' and 'cumulative cash flow' is based on a comparison with the costs of the current situation

Sources in a solution

Diesel

Several diesel producers have developed systems to combine wind and/or solar power with diesel generators. By applying the reliability of diesel generators in a smart way, these diesel generators maximise renewable power utilization and minimizes diesel fuel consumption. An energy management system will distribute the available power.

Wind

Wind is an intermittent energy source, which cannot make electricity nor be dispatched on demand. It also gives variable power, which is consistent from year to year but varies greatly over shorter time scales. Therefore, it must be used together with other electric power sources or batteries to give a reliable supply. As the proportion of wind power in a region increases, more conventional power sources are needed to back it up (such as fossil fuel power and nuclear power), and the grid may need to be upgraded.

Solar

Solar is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

Storage

In DHES, energy storage is able to perform multiple functions, such as ensuring power quality, including frequency and voltage regulation, smoothing the output of renewable energy sources, providing backup power for the system and playing crucial role in cost optimization. It includes all of chemical, electrical, pressure, gravitational, flywheel, and heat storage technologies. When multiple energy storages with various capacities are available in a DHES, it is preferred to coordinate their charging and discharging such that a smaller energy storage does not discharge faster than those with larger capacities

Glossary

(Average) Wind speed:	This is the average wind speed taken over a day has blown at the location of the wind turbine. The more specific the wind speed per period, how better the case can be calculated.
Full load hours:	This is a value of the hours the sun panels will do there work at full strenght, based on the average solar radiation on the location. With this value you can calculate the production of the sun panels.
Reference height:	This is the reference height of the wind speed that has been measured to calculate the output of the wind turbine.
Energy consumption:	This is the energy need for which a solution has to be found.
Energy loads:	This is the fluctuation over a day in the energie need. The more specific the energie need per period, the better the case can be calculated.
Capex	The capex is the initital investment. In other words the cost that has to be made at the beginning of the project.
Opex	The opex are the (yearly) costs that will be made when the wind turbine is working. Costs like maintentance and insurance are part of it.
Feed in	This is the tarif that (most of the time) the goverment will pay tho renewable projects to stimulate a greener world.
Inflation:	Inflation is the sustained increase in the general price level of goods over a period of time.
IRR:	Internal Rate of Return (IRR) is a metric used in capital budgeting to estimate the profitability of potential investments. Internal rate of return is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero.
DSCR:	The Debt-Service Coverage Ratio (DSCR) states net operating income as a multiple of current debt obligations due within one year.
Payback period:	The payback period is the length of time required to recover the cost of an investment.