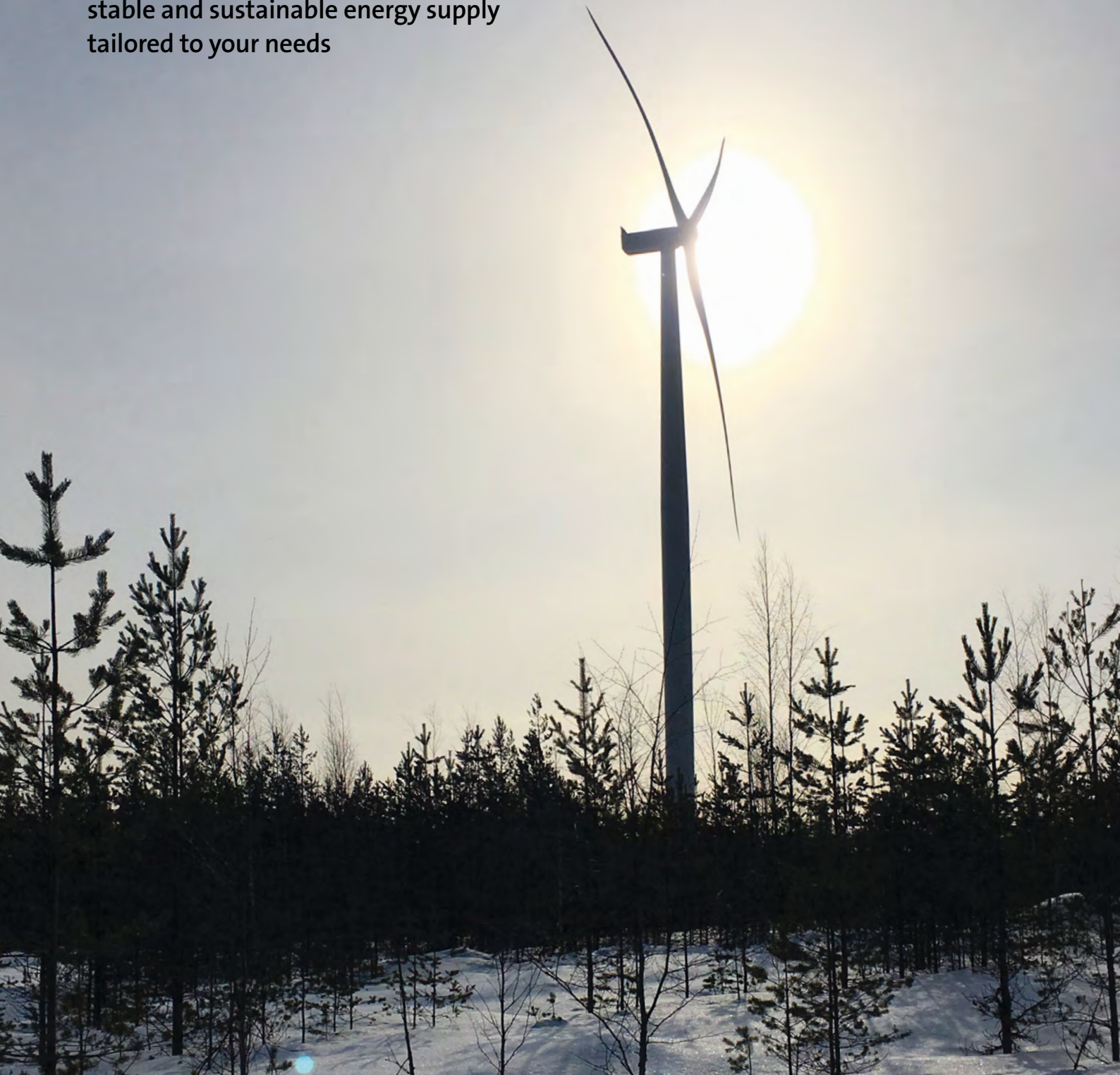


Hybrid Energy and Battery Storage Systems

Reliable and reasonable with renewables

We realize solutions for cost-efficient,
stable and sustainable energy supply
tailored to your needs

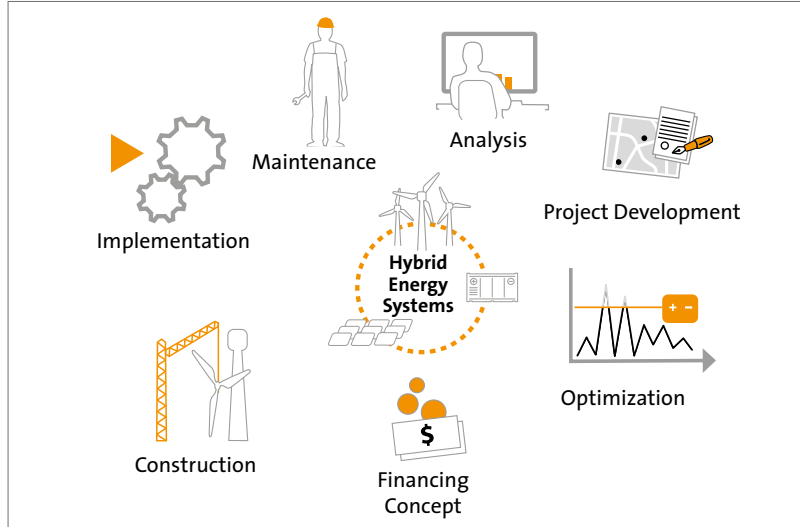


Your Partner for Hybrid Energy Systems

ABO
WIND

Your Partner for Hybrid Energy and Battery Storage Systems

Our services

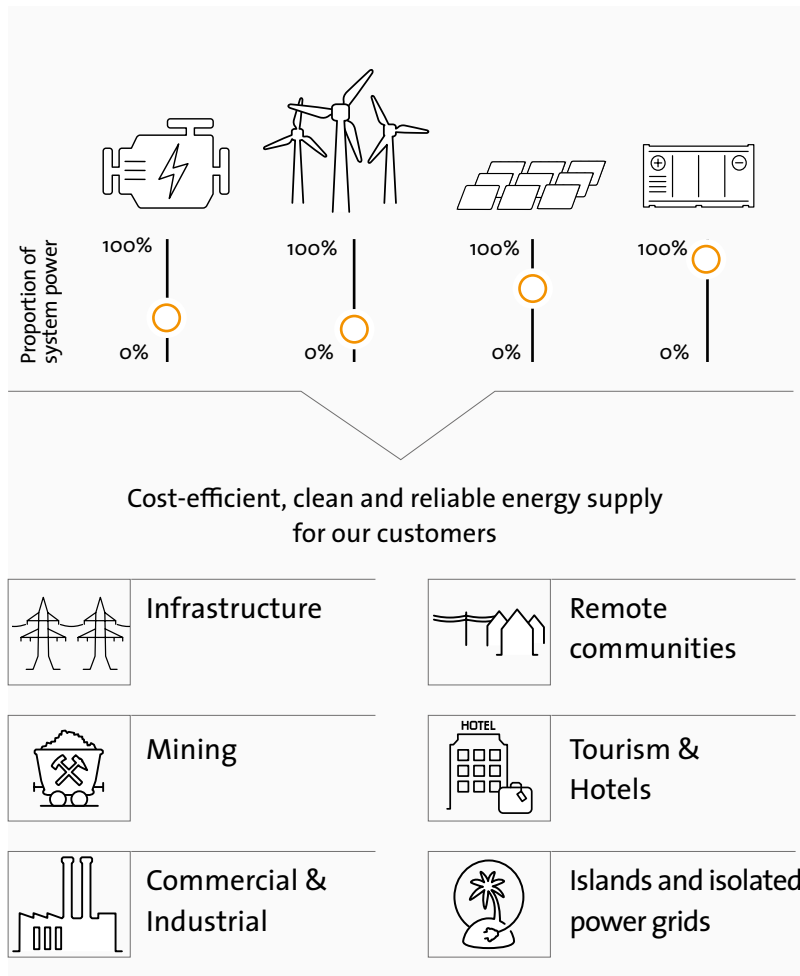


ABO Wind develops, engineers and constructs energy systems combining wind turbines, photovoltaic plants and storage units to reduce the dependency on fossil fuels and to provide reliable electricity supply in areas with no or weak grid infrastructure. These solutions are eco-friendly and often cheaper than diesel-based generation.

We work independently from manufacturers to provide the best solution for our clients. Each project is set up based on in-depth technical and economic analysis.

Thanks to our experience of more than 20 years in the field of renewables, we have the know-how to solve the complexity of planning, building and operating Hybrid Energy Systems (HES). In addition, we provide a broad set of solutions regarding financing and operational business planning.

System configuration optimization



ABO Wind offers modeling and simulation of flexibly designed HES. Our proven model calculates different options for any circumstance. Therefore, the portion of each HES component can be sized independently and in accordance with the system requirements.

The detailed yield simulation of the PV plants and/or the wind turbines are combined with the analysis of the behaviour and specifications of generators and/or storage systems as well as demand forecasts. In this way we find the most economic system design, taking into account technical feasibility and environmental impact assessments.

Furthermore, there are several parameters within the financing model that can be adjusted to reach an optimal solution for each project. We offer this systematic step within our financial system configuration.

Diesel substitution in Micro-Grids

Optimized energy supply with renewable energies

Many isolated grids (municipal or commercial and industrial) in the world operate with old and unreliable diesel generators and are therefore inefficient and expensive. Both these isolated networks have to cope with peak loads at certain times of the day. In municipal isolated grids, this leads to parts of the network being switched off: Consumers are left without electricity and commercial and industrial users are temporarily unable to produce. In addition, dependence on diesel and major transportation efforts lead to high generation costs of USD 0.35 to 1.00 per kilowatt hour. Given the global peak oil scenario, costs will continue to rise besides economically driven dips. Moreover, diesel generators require regular cost-intensive maintenance, adding to the high expenses for these generators. Furthermore, thermal power plant systems are extremely noisy and polluting.

Case: Copper Mine in Canada

Mines are often located in remote areas and therefore have no connection to the main grid or only a weak grid. Therefore, they depend on expensive diesel-based self- or backup-supply. The dependence on fluctuating diesel prices and high outages of the energy supply are the main drivers to search for alternatives. Apart from this, operators are under increasing socio-economic pressure to operate their plants sustainably. One of our project partners, an open-cast mine in Canada, is struggling with both the economic and ecological hurdle.

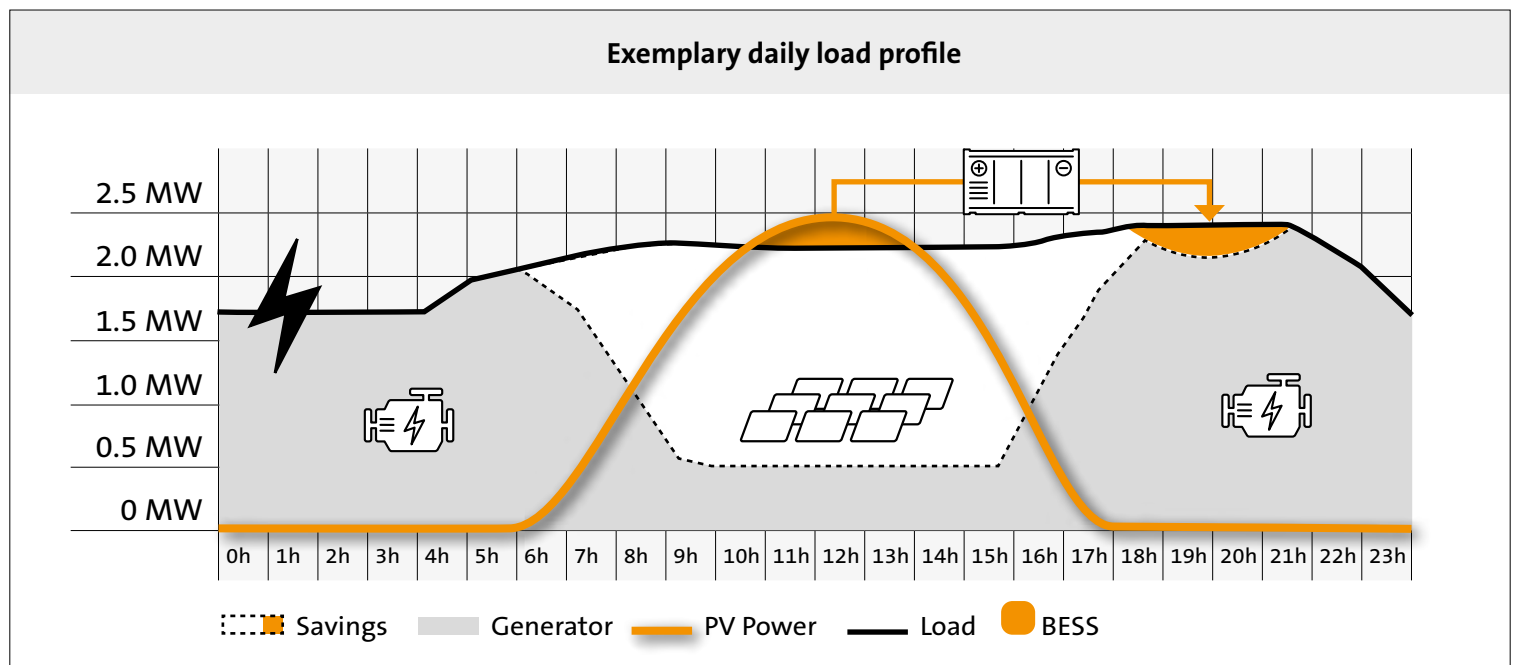
To reduce the need for expensive diesel back-up capacity we offered a HES solution integrating a high proportion of renewables in the existing electricity system. In general, HES based on solar and/or wind energy combined with storage units are key to increasing profitability and reducing local emissions as well as the carbon footprint. In addition, a battery storage system avoids peak loads in energy consumption and thus prevents failures.



Diesel supply in a mine



Strip mining and wind farm in Bedburg, Germany



Diesel substitution in Micro-Grids

Additionally, the operation of the existing gensets can be further optimized to reduce consumption and tear-and-wear. With ABO Wind's individual design solutions, it is possible to expand the supply in a modular fashion as the energy demand grows. Moreover, the operator could involve the First Nations in the supply and thus support socio-economic measures. Energy-as-a-service solutions can be evaluated as well.

Case: Isolated grid in Argentina

Our municipal clients in isolated micro-grids also face a cost-intensive and unreliable supply situation with different load profiles. Our customer in Argentina has so far operated its power plant with a capacity of 12GW with diesel. Here our HES provides the integration of a photovoltaic system with 5 MWp and a 1-MWh lithium-ion storage system into the existing network, saving about 2.9 million litres of diesel each year. More comparables can be seen in the table below. Depending on the diesel prices and the layout of the HES, the investment in such systems can be recouped within five years.





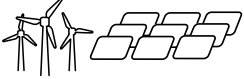



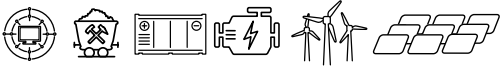

At ABO Wind we have the expertise to provide our customers all over the world with cost-effective, clean HES. Whether remote ore mines in Mali or diamond mines in Canada, farms in Kenya, factories in Tanzania and Argentina or municipal electrification in Cape Verde – we will design and implement an economically suitable system for your operation. ABO Wind provides a one-stop-shop solution from planning, engineering, procurement, construction and financing.



ABO Wind is working to reduce the dependency on diesel generation.



It is also necessary to make the handling of diesel barrels safer.

Legend:				
				
Energy Management System (EMS)	Energy Consumer	Energy Storage System (ESS)	Diesel Genset (DG)	Renewable Energy (RE)
Hybrid Energy Solution	System layout		Fuel savings	Renewable power share
Basic fuel saving potential (EMS for RE only)			7-10%	20-30%
Optimization of power control (EMS for RE + DG)			10-15%	20-50%
Optimized power control with system stabilization function (EMS for RE + DG + ESS)			25-40%	20-80%
Optimized power control system with system and load management (EMS for RE + DG + ESS + load of energy consumer)			60-80%	100%
100 % Renewable energy system with load management (EMS for RE + DG + ESS [short & long term] + load of energy consumer)			100%	100%

Battery storage applications for grid stability

Stabilizing electric grids in rural and urban areas

There are many regions in the world which, due to their conventional, centralized structure, rely on extremely large electricity distribution networks. These networks often operate at the limits of voltage stability, frequent outages are the consequence. Other regions, such as Europe, are in a different situation but do have similar needs for grid stabilization. Storage systems provide a necessary option for flexibilization of such electricity grids at lower overall cost than conventional solutions.

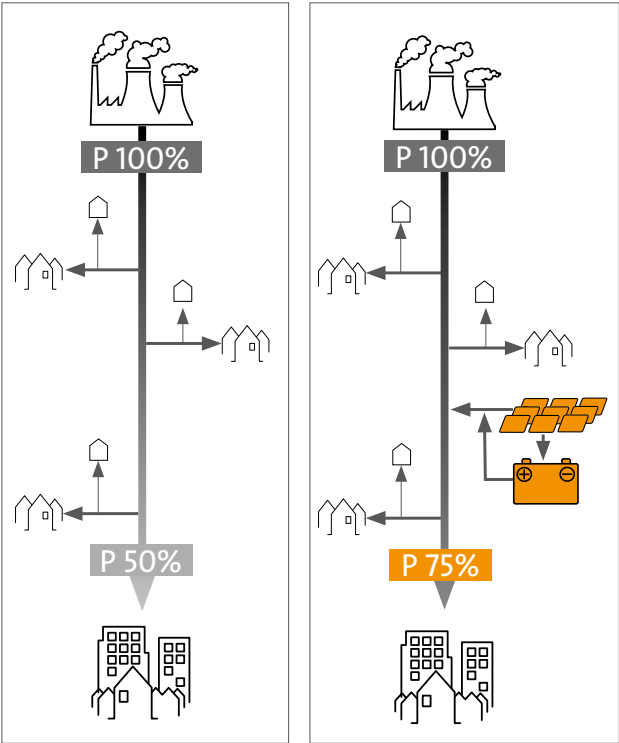
Case: Instable grid in Tanzania

A decentralized region in Tanzania has so far been dependent on a very large and therefore unstable network. As a result, large parts of the electricity fed into the grid are lost on the way to the consumers and power cuts are very frequent. ABO Wind has shown how the long-distance distribution network can be made more stable and efficient by using a HES consisting of a photovoltaic and a battery storage hybrid system. The avoided power losses are shown schematically in the figure on the right. In addition, the integration of the HES enables the operator to connect further consumers at the existing infrastructure. (More examples can be found in the table).

Case: Maintaining high grid stability in Europe

Renewables are on the rise across Europe to meet sustainability and carbon emission goals. Due to the fluctuating share of photovoltaic and wind energy, grid operation must become more adjustable. Many decision-makers and operators are therefore creating framework conditions to make existing markets more flexible. Knowing the Europeans markets, we see the integration of batteries as the best solution in most cases. Placed at a

strategic point in the grid, the storage devices avoid voltage and frequency deviations. The grid is stabilized and operates cost-effectively. Especially in Europe, many battery applications are now quite inexpensive. ABO Wind has the expertise to design stand-alone battery solutions in order to provide Frequency Containment Reserve and develop other products suitable to the market. The technology agnostic approach allows us to offer many different battery storage technologies. Furthermore, ABO Wind sees the co-location of PV and Wind farms in combination with battery storage systems as the energy supply of the future on a large scale.



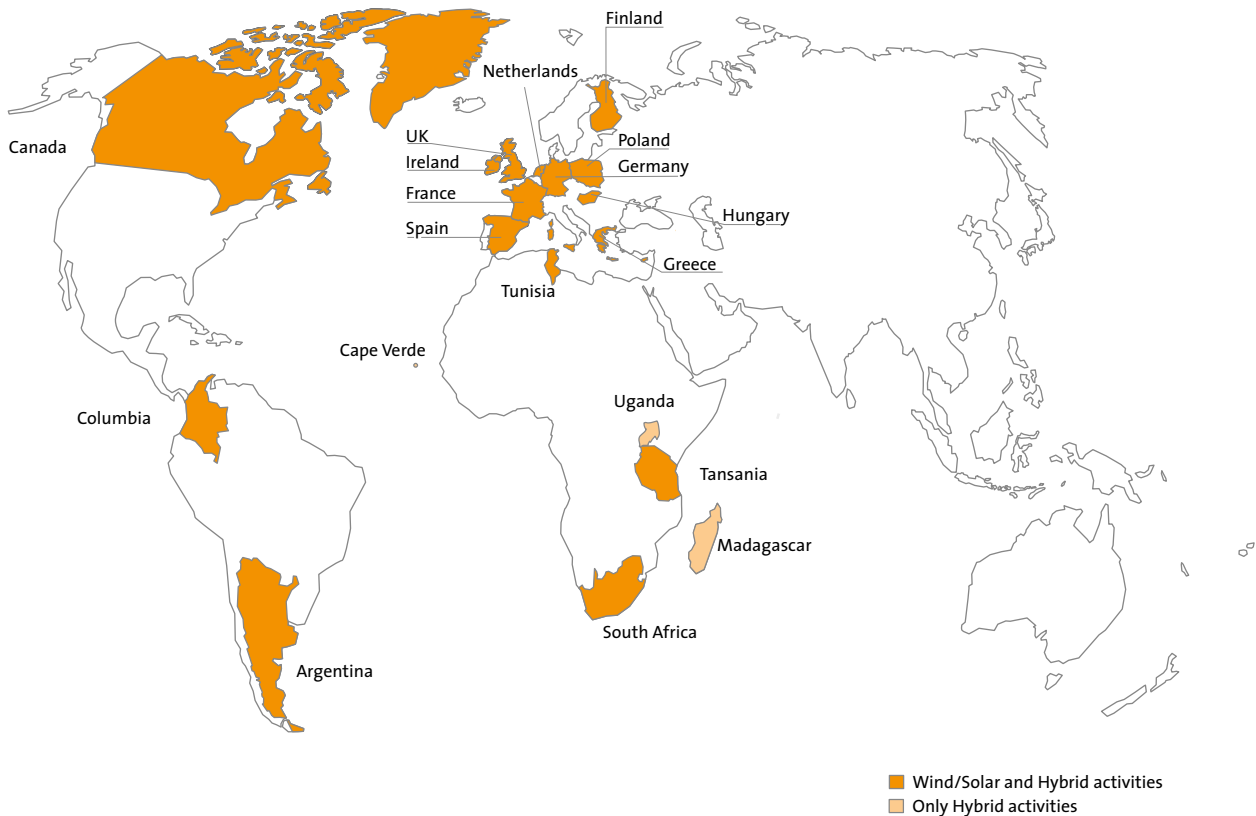
Benefits for our customers		
Energy Supplier	Grid Operator	Energy Consumer
<ul style="list-style-type: none">■ Lower transmission costs■ Increased revenues from additional PV power input■ Improved reliability■ Improved reputation	<ul style="list-style-type: none">■ Enhanced grid performance■ Improved voltage stability■ Reduced expenses for grid expansion■ Increased transmission capacity	<ul style="list-style-type: none">■ Reliable access to electricity■ Lower electricity prices■ Cleaner air and less pollution from diesel gensets■ Progressing electrification in new areas■ Less blackouts

About ABO Wind

Founded in 1996, the German-based company ABO Wind develops and realizes renewable energy projects worldwide. So far, ABO Wind has installed wind farms, solar parks and biogas plants with a total capacity of about 3,000 megawatts. More than 600 employees are realizing projects in 16 countries with an annual investment volume of about 300 million euros.

The core principle of ABO Wind's international activities is to open local offices and hire local staff from the very beginning. ABO Wind develops commercial projects and local expertise at the same time.

As local colleagues build up local contacts and knowledge, they are able to acquire land and projects. International technical, financial and legal experts from the headquarters in Wiesbaden, Germany support the work of the local team. Together they successfully create and deliver renewable energy projects.



Let's discuss your ideas and projects.

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