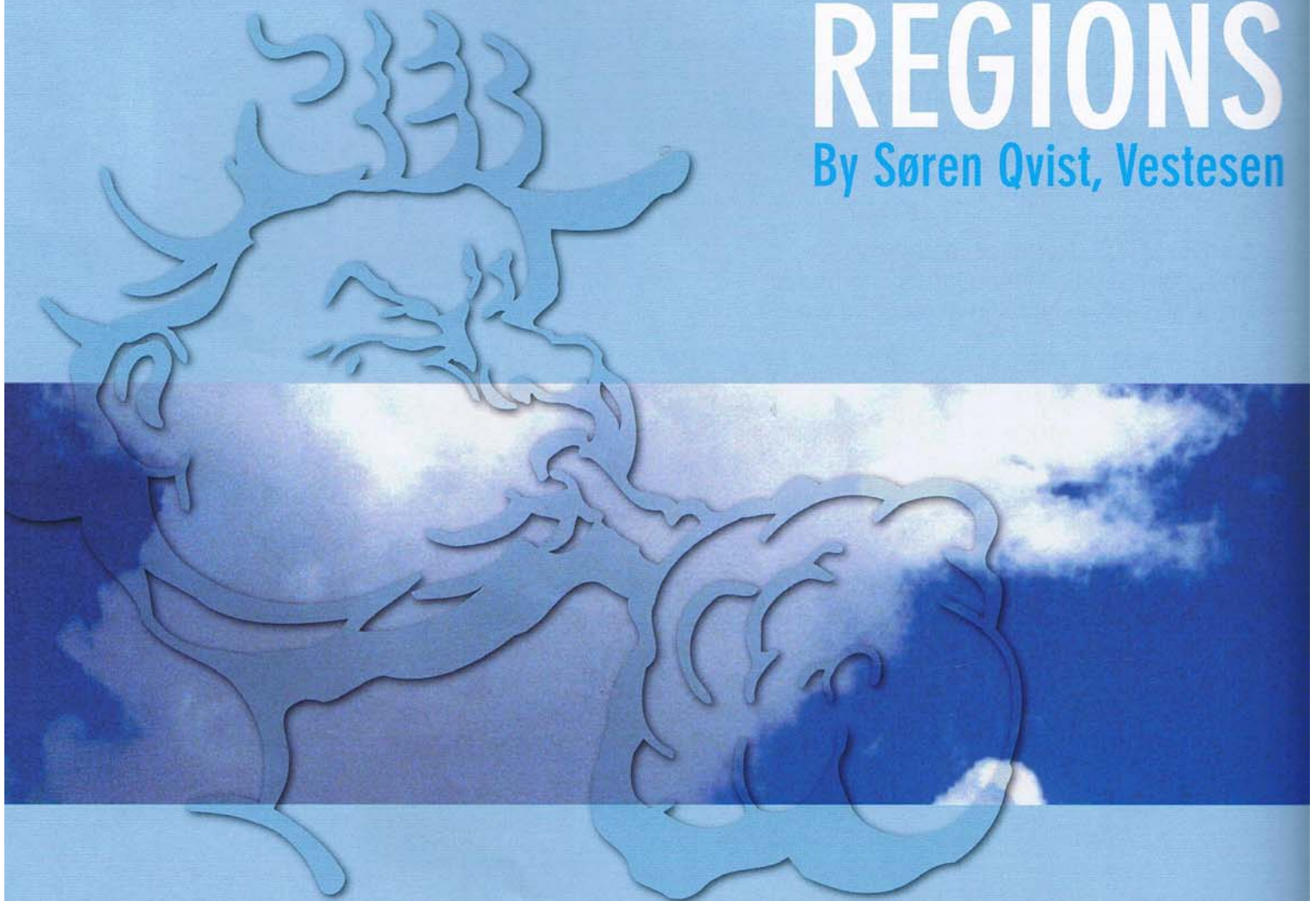


# WIND-DIESEL ENERGY FOR REMOTE REGIONS

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Remote parts of the world that are not connected to an electricity grid face many problems. The electricity can be unstable or very expensive and they are often difficult to get to and qualified staff may be in short supply. Vestesen (formerly Danvest) is one of the world's leading providers of wind-diesel systems with high wind penetration and helps to address these issues.

Vestesen's systems range from 100 to 10,000kW and deliver inexpensive quality electricity 100 per cent of the time. Normally wind turbines will reduce the diesel consumption by 50-80 per cent. Beyond producing electricity, the system can be made to produce fresh water from seawater or similar such as at Bønnerup Harbour,

Denmark. Fresh water production capacity is in the order of 7 to 120m<sup>3</sup> per day at low performance and 50 to 1,000m<sup>3</sup> per day at high performance.

Danvest wind-diesel (WD) systems with high wind penetration for off grid operation are based on normal diesel generator sets. They are fitted with Danvest WD equipment for backing up wind turbines from 0 to 100 per cent wind energy supply in automatic and continuous operation... a major consideration in non connected areas.

When the wind energy is sufficient to supply all consumption, the engine is clutched out and stopped. The alternator remains connected to the bus bar to control reactive

power, voltage and frequency (dump load controlling) and functions such as flywheel in the rotatory system.

When the wind is decreasing or consumption is increasing, the engine is started and the clutch in automatic again in one to three seconds.

#### Dump load controlling

Fast dynamic load balance between the fluctuating wind energy and the variations in consumer supply thus having stable voltage and frequency – 50/60 Hz ± 0.1-0.3 Hz – so that the resulting fluctuations are negligible.

Fitted with the Danvest W/D equipment, engines are able to operate at low load for longer periods thus maintaining normal

service. With a yearly fuel system, savings of up to 50-90 per cent can be obtained, thus saving fuel and helping to cover the cost of the turbines and the WD equipment.

The cooling system obtains all waste and surplus wind energy for water desalination/purification or central heating and in this way the highest plant efficiency is obtained. Raw water feeding systems are integrated in the total cooling system and both reverse osmosis and distillation processes and central heating can be combined for obtaining the high plant efficiency.

The Danvest WD concept is especially designed for remote areas and are containerised and simple to install and operate, thus overcoming many of the difficulties in getting to remote areas. Danvest systems offer a complete infrastructure solution with electrical energy, pure water and/or central heating in one compact turnkey system.

Existing wind power installations can be converted to WD systems for grid stabilisa-

tion and backup with continuous power supply of highest quality. Installations can be extended with water purification/desalination and central heating production.

without adequate wind conditions.

The preconditions for introducing wind energy conversion systems in isolated grids is a financial motivation to search for alternative technology that can replace energy production based on expensive fuel.

Vestesen has extensive know-how, based on experience with design, engineering (diesel engine know-how), production, installation, operation and implementation of WD systems, and has been in the forefront of innovative developments and the designs of WD concepts to a viable and commercial extent.

Many of the unique features of the Danvest WD system have convinced power suppliers – who are often sceptical about implementing new technologies for power supply – that high reliability of operation and maintenance is also secured by the Danvest W/D system.

- Existing wind power installations can be converted to WD systems for grid stabilisation and backup with continuous power supply of highest quality. Installations can be extended with water purification/desalination and central heating production.
- The basis diesel generator sets operate independently, but in parallel with the W/D system. This means that if a breakdown occurs in the W/D equipment, it is cut out and the diesel-based generator sets continue operating.
- The WD system must be simple and robust – making it possible for existing staff to operate and maintain after a short introduction and training.
- The W/D system including wind turbines are based on known and proven technology guaranteeing high reliability of the operation and maintenance.
- The W/D system operates automatically and continuously – often replacing manual and periodic operation.

Danvest dynamic dump load controlling ensures a governing of the total rotatory system, where heavy masses from the wind turbines and diesel generator comprises a dynamic frequency system with the following aims:

- Minimising inertia gust.

- Minimising wearing on bearings, couplings and gear wheels.
- Minimising transients in the electric system.
- Stabilising fluctuations from wind and consumers.

There is also a PC-based remote monitoring system for remote controlling via phone parallel with the systems for the wind turbines. In this way the WD plant – engine condition – can be controlled from in a service centre by skilled engineers, overcoming the inevitable staff shortages in remote locations.

### Optimal design

With unique experience in the field of wind/diesel installation for given locations, Vestesen has the tools to calculate which is the optimal system design and combination of wind and engine power for the local installation to obtain the lowest kWh price. Feasibility studies – yearly wind penetration and fuel saving is calculated and amount of waste heat and surplus wind energy are

calculated for utilisation. Furthermore, the systems' main components including the diesel engine last up to 20 years.

For more information visit [www.danvest.com](http://www.danvest.com).



**Wind-diesel system  
at Bønnerup Harbour, Denmark**

Power quality at any operation mode is within predefined limits:

Frequency: 50/60 Hz  $\pm$  0.1- 0.3 Hz  
Voltage: 400/480 volt  $\pm$  3-6%  
Power factor: 0.8-0.98

### Desalination systems

The desalination systems are designed as containerised modules with production capacities from 10 to 3,800m<sup>3</sup>/day per unit. The modules can supply fresh water for irrigation, municipal basis water supply, industrial process water and drinking water of high quality.

The desalination modules are based on state of the art technologies within reverse osmosis processes, ultra filtration, distillation and disinfection. Vestesen also offers standalone high efficient diesel-based containerised water purification systems for remote areas