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Making the case for green and cost-effective Hybrid Wind Diesel electrical power generation

MAN Diesel & Turbo SE
Teglholmsgade 41
DK-2450 Copenhagen SV
DENMARK
www.mandiesel.com

Group Marketing
Further information:
Peter Dan Petersen
Tel.: +45 33 85 14 70
peterd.petersen@man.eu

Graphics and images:
Mia Glarborg
Tel.: +45 33 85 15 90
mia.glarborg@man.eu

No other energy generating solution has enjoyed a stronger growth rate over the past 15 years than environment-friendly wind power; and no other prime mover technology has as much operational flexibility, high availability and reliability in electricity generation as an internal combustion engine.

The economic and environmental merits of combining the two technologies in Hybrid Wind Diesel power systems was presented by MAN Diesel & Turbo specialists, Carsten Dommermuth and Josef Dorner, Business Unit Power Plants, MAN Diesel & Turbo SE, Augsburg, Germany, at the Power-Gen Europe conference in Amsterdam (8-10 June). Such systems can typically be exploited parallel to a grid or as decentralised stand-alone facilities in areas of Alaska, Africa, Canada and Caribbean or other remote regions with suitable wind conditions.

In modern electricity grids, the authors explain, a Transmission System Operator (TSO) takes responsibility for transmitting electrical power from generating plants to regional or local distribution operators. Among the worst-case scenarios for TSOs is when wind capacities are reduced to zero output through windless or stormy conditions. Backing up wind installations - which, in some countries, may aggregate 20GW or more - and avoiding grid failure is a major challenge.

Diesel engines offer a significant advantage over other prime movers, such as gas, coal-fired or combined-cycle plants, as back-up or parallel power installations for grids. A typically high efficiency in part-load and full-load operation is complemented by a swift response to load changes; diesel engines also provide the grid with stabilising spinning and non-spinning reserves in fluctuating wind conditions.



Driving synchronous generators, such engines are also solely responsible for controlling voltage, reactive current and frequency in a grid-connected wind-diesel installation, and secure a high quality service for the TSO.

A capability to burn a variety of fuels - natural gas, distillate oils, bio diesel and bio oils from diverse sources - that foster cleaner exhaust gas and lower greenhouse gas emissions is another advantage of diesel engines for electricity generation. Such flexibility makes generating systems less sensitive to fuel price fluctuations than a single-fuel solution, adding an economical bonus to the environmental benefit.

Investment in power generation based on diesel engines and wind turbines for supplying grids thus promises an environment-friendly solution with a high degree of system flexibility compared with huge wind installations without suitable grid servicing and base-load capabilities.

MAN Diesel & Turbo's presentation reviewed the key commercial and technical issues, with detailed cost calculations and case studies, and discussed:

- Changes in worldwide energy and environmental policy and their influence on national power systems
- Electricity markets
- Fundamental challenges for power systems
- Engines to support renewable energy solutions: a challenge for internal combustion engines in grid parallel
- Grid servicing
- Internal combustion engines in supporting wind power
- Electricity generating costs
- Operating flexibility of internal combustion engines
- Ancillary services

An exclusive concluding update was provided on service experience with the world's largest hybrid wind-diesel project, Ecopower Bonaire, which was recently commissioned on an island in the Netherlands Antilles. Managed in a consortium embracing MAN Diesel & Turbo and Enercon, the installation generates CO2 emission-free electricity from bio fuel-burning diesel engines (aggregating 13MW) and wind turbine power (aggregating 11MW).

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MAN Diesel & Turbo SE, based in Augsburg, Germany, is the world's leading provider of large-bore diesel engines and turbomachinery for marine and stationary applications. It designs two-stroke and four-stroke engines that are manufactured both by the company and by its licensees. The engines have power outputs ranging from 47 kW to 87 MW. MAN Diesel & Turbo also designs and manufactures gas turbines of up to 50 MW, steam turbines of up to 150 MW and compressors with volume flows of up to 1.5 million m³/h and pressure levels of up to 1,000 bar. The product range is rounded off by turbochargers, CP propellers, gas engines and chemical reactors. MAN Diesel & Turbo's range of goods also includes complete marine propulsion systems, turbomachinery units for the oil & gas as well as the process industries and turnkey power plants. Customers receive worldwide after-sales services marketed under the MAN PrimeServ brand. The company employs around 12,500 staff at over 100 international sites, primarily in Germany, Denmark, France, Switzerland, the Czech Republic, Italy, India and China. MAN Diesel & Turbo is a company of the Power Engineering business area of MAN SE which is listed on the DAX share index of the 30 leading companies in Germany.