

## **Introduction**

Among renewable energy sources wind energy is generally considered one of the most inexpensive. Furthermore it is today commonly recognised that wind turbines connected to a strong grid controlling the power quality, are economical competitive to traditional energy sources. This possibility has unfortunately not been open for remote areas and islands, due to lack of strong grids.

Wind/diesel (WD) standalone systems are now offering remote areas and islands the option to utilise wind energy by means of efficient power control and backup electricity production, when wind production is not sufficient to meet consumer demand.

But like wind turbines, wind-diesel systems can only be considered a feasible solution, if they are economical competitive and viable. Therefore it is extremely important to consider specific system requirements when examining the option for WD standalone power systems in remote areas and on islands.

Below basic requirements for competitive and viable WD systems are suggested.

## **Requirements to a wind/diesel system**

The following requirements for a WD system could be defined as best available technology or state of the art for an efficient and viable alternative to traditional energy sources:

- 1. Safety**
  - WD systems must be based on proven technology - securing reliability of operation and service.
- 2. Simplicity and robustness**
  - making it possible for existing operating staff of diesel generators to operate and maintain the plant after a short introduction and training.
- 3. Automated operation**
  - the WD system must operate automatically and continuously, often replacing manually and periodically operated power station.
- 4. Optimized wind penetration**
  - the system must be able to run with more than 100% wind penetration, meaning wind turbine(s) supplying 100% electricity consumption at relevant wind speeds.
- 5. Fuel saving**
  - in order to secure maximum fuel saving the diesel engine(s) must be stopped when wind penetration is more than 100% With decreasing wind penetration or increasing consumer load the diesel engine(s) immediately starts again without disruption of electricity supply or of power quality within predefined limits.
- 6. Variable back-up**
  - the diesel generators must be able to backup the wind turbine(s) within loads from 0% to 100% of full capacity in order to secure 100% balance between power production and consumer demand at all times, thus preventing unnecessary fuel consumption.
- 7. Economy**
  - the WD system shall reduce the fuel consumption to the extent that savings can finance the extra costs for wind turbine(s) and WD equipment. Experience shows that this can be obtained when annual wind penetration is higher than approximately 50%.
- 8. Power Price**
  - the WD system shall produce electricity at competitive prices compared to traditional diesel generation systems.
- 9. Environment**
  - noise and environmental impact shall fulfil official requirements.

**10. Waste heat recovery**

- options for increased system efficiency by utilising surplus coolant heat from engine and power from wind turbines for desalination or other local applicable processes.

**11. Life time**

- the design life time of the complete WD system is 20 years.

**12. Payback time**

- the payback time of the WD project will in most cases be 8 to 12 years, which is commonly acceptable to investors and financiers.