

AUTOMATIC FIREFIGHTING
SYSTEMS IN
WIND GENERATORS





Every large investment requires great protection, especially in isolated hazards.

Hazard type

There has been considerable investment in wind power and the sector is in continual expansion and technical innovation.

Turbines generating electrical power satisfy a larger and larger proportion of the grid demand; it is, therefore, a strong niche with high added value growth.

Wind turbines require complex installations and high investments whose profitability depends on a long and constant production cycle. In this sense, protection of equipment is of great importance in insuring both the investment and the power supply over its lifetime.

It consists basically of four parts: nacelle or nacelle, rotor blades, mast or tower and base, of which the first and the last are the main areas for extinguishment. Sometimes electrical substations are located near the base, and these too should be protected.

Most of the components are concentrated in the nacelle: generator, hydraulic systems, brakes, etc., and this is biggest hazard to be protec-

ted. A fire can easily lead to a total loss, and the cost of repair or replacement increases with the installed capacity.

The problem arises from the large accumulation of technical, electrical equipment and combustible material, together with difficult or zero accessibility in case of accident: firefighters' ladders cannot reach from outside, the danger of falling burning objects makes it impossible for them to enter the tower and, in general, the remote location delays their whole operation and limits them to controlling the perimeter and preventing the fire from spreading (consequently leading to environmental damage).

Sources of fire

The fire source in this type of facility may be due to a variety of circumstances: from external factors to internal problems which are intrinsic or specific to this type of equipment.

GENERAL RISK FACTORS

The protection of power generating facilities means the following have to be considered:

- Electrical and/or mechanical equipment faults producing sparks.
- Large quantity and proximity of cables and circuits.
- Existence of hot surfaces
- Accumulation of dust, oil, plastics, etc., next to the hazards.
- Maintenance work involving welding, cutting, assembly/disassembly, etc., or even the lack thereof (neglect)

SPECIFIC RISK FACTORS

The following circumstances are particularly important, which affect the design and show how important it is to tailor protection to needs:

- **Location**, generally remote (mountains, seas), with difficult access.
- **Forest fires** that spread.
- **Lightning**, with the highest incidence at high points and clear, exposed locations.
- **Morphology**, which makes it inaccessible to firefighters: ladders cannot reach from the outside, while inside there is a danger of falling burning objects.
- High fire load due to the large **accumulation of electrical, electronic and mechanical equipment** in the nacelle.
- **Transformers** built into the wind generator, adding the danger of high voltage.

PROTECTION REQUIREMENTS

For the full protection of these facilities, a comprehensive fire prevention system is needed which includes:

- *Early detection and alarm*
- *Continuous monitoring.*
- *Standalone and independent system response.*
- *Equipment shutdown and disconnection from the mains.*
- *Fire extinguishing and/or control using extinguishing agents*
- *Proper maintenance*
- *Specific training of responsible personnel.*



SIEX recommendations

MAXIMIZE THE PROTECTION

Fire prevention strategies should begin by reducing the risk factors which affect the installation (use of materials which are difficult to ignite, the inclusion of lightning arresters, systematic maintenance, etc.). However, the threat of an accidental fire never completely disappears, so protection must be completed with a customized extinguishing system.

DESIGN CONSIDERATIONS

Selecting the right SYSTEM depends on analyzing suitability regarding:

- Effectiveness and application time.
- Quantity Required: volume, weight.
- Storage and distribution.
- Maintenance and reliability (time between inspections)
- Other special factors relevant to the particular hazard.

Basically, the extinguishing system focuses on three sectors: nacelle, base and intermediate levels of the mast.

Each option has features which make it more appropriate in some circumstances than in others, or suffers from application limitations which need to be borne in mind.

Generally speaking, we can classify the systems used in this protection as follows:

Our systems have been tested by internationally recognized laboratories and certification bodies: **VdS, VTT, SINTEF, DNV, Lloyd's Register, Bureau Veritas**, etc.

Furthermore, with our commitment to innovation, our R&D&I department continues to develop, test and make improvements, as testified by complementary certifications as we adapt to the local regulatory framework in different countries. SIEX complies with **ISO 9001:2000 and ISO 14001:2004**.

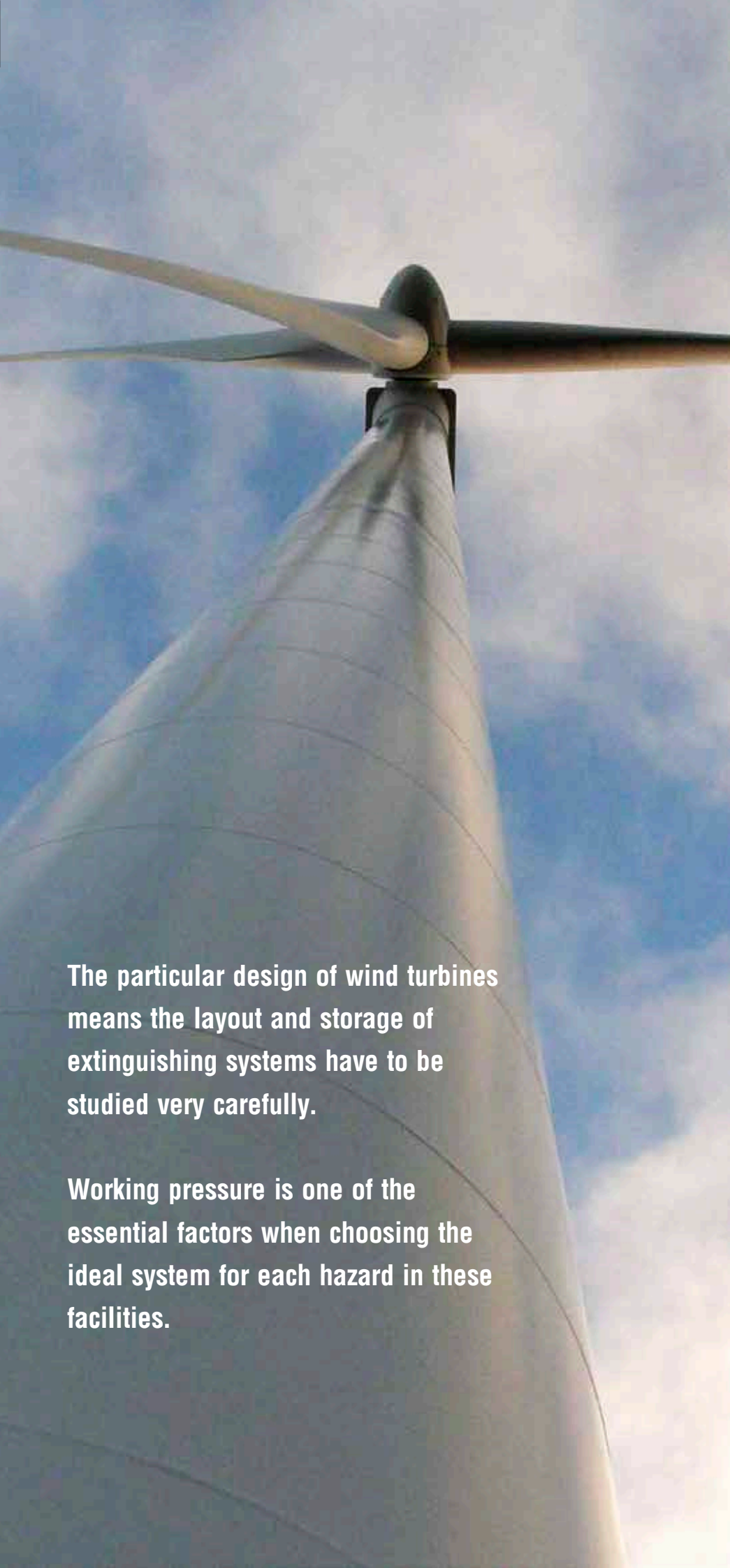
		GAS		WATER			OTHERS	
		CO ₂	INERT GASES	SPRINKLER	WATER MIST	FOAM	POWDER	SPRAY
Room protection	Nacelle with generator, transformer, hydraulic systems, etc.	+	+	+	+	-	-	-
	Rotor/bushing, shafts and generator, if applicable	+	+	+	+	-	-	-
	False floors with oil sump, wiring and electrical installations	+	-	+	+	+	-	-
	Central electrical substation, switch (no transformer)	+	+	-	+	-	-	-
	Base / platforms with installations, if applicable	+	+	+	+	-	-	-
Equipment protection	Control, inverter, closed cabinets	+	+	-	+	-	-	-
	Transformer	+	-	-	+	-	-	-
	Control, inverter, open cabinets	+	-	-	+	-	-	-
	Open hydraulic system	+	-	+	+	+	-	-

⊕ SUITABLE IN GENERAL

⊖ NOT RECOMMENDED IN GENERAL

Indicative table. Source: NFPA-E No. 22:2012 F

Confederation of Fire Protection Associations in Europe, together with VdS



The particular design of wind turbines means the layout and storage of extinguishing systems have to be studied very carefully.

Working pressure is one of the essential factors when choosing the ideal system for each hazard in these facilities.

FEATURES OF SIEX AUTOMATIC FIREFIGHTING SYSTEMS IN WIND GENERATORS

They act directly on the reduction of oxygen (INERT-SIEX™) to reduce the heat of the fire. (SIEX-CO₂™) or both (SIEX™ WATER MIST)

Designed to protect equipment and facilities, as well as people and the environment. The general features of our systems are:

- *Standalone automatic operation.*
- *Prevent spread and damage to adjacent equipment.*
- *Clean agents, with no residue.*
- *Non-corrosive and non-conductive.*
- *Reduce the impact on the environment.*
- *They have all necessary mechanisms for personnel safety.*
- *They comply with environmental regulations.*
- *They have national and international certifications and approvals.*

Solutions



VdS INTERNACIONAL APPROVAL
(SOFTWARE / COMPONENTS / SYSTEM).

WATER MIST

Water mist combines **low cost** with **high performance**, **international approvals** and reduced downtime. It optimizes extinguishment by forming tiny droplets which maximize the surface area of exchange, resulting in very quick heat reduction. As it evaporates, the water expands by a factor of 1,800, displacing oxygen.

The goal is not to flood the entire room with water, but to **quickly cool and extinguish the fire**, which contributes to the damage to electrical equipment being minimal or nonexistent.

Total adaptability to design requirements: The pipework may be dry or wet, with open or closed nozzles and pressurized or unpressurized networks, as appropriate. They can even be installed during the construction of the wind turbine.

Uses:

COMPLETE WIND
TURBINE:
ROOMS AND
EQUIPMENT.

SUITABLE EVEN
WITH OPENINGS
AND/OR
VENTILATION.

OCCUPIED ROOMS:
HARMLESS
TO PEOPLE,
EQUIPMENT AND
THE ENVIRONMENT.

EXTREME
CLIMATES:
ANTIFREEZE MAY
BE INCORPORATED

Benefits:

Maximum extinguishment with minimum water discharge

Smaller storage and installation diameters needed.

Reduces the heat energy, displaces oxygen and cools the fuel.

It remains in suspension a long time
(dragging down particles and preventing reactivation)



Components:

Electrical detection which acts on the pilot bottle and triggers the discharge.

Bank of water cylinders pressurized with nitrogen. Pumpsets may also be supplied to work at high pressures.

Stainless steel pipework.

Nozzles: open or closed with heat-sensitive bulb. They cover from 4.00 to 4.70 square metres at a working pressure of 100 bar. Their design ensures the proper distribution of water mist, even on deep-seated fires and with particles and smoke in the atmosphere.



INERT GASES



Recommended for the protection of rooms, including control rooms, electrical installations and machinery rooms, since the extinguishing mechanism is by total flooding.

Environmentally friendly: Zero ozone depletion potential (ODP) and zero increase in global warming potential (GWP)

Good performance at low temperatures.

Cost effective, widely available worldwide, easy to refill and not subject to trademarks.

No damage to equipment.

Very stable behaviour.

The installation can be housed at the base of the wind turbine to facilitate maintenance. The high pressure (150, 200 or 300 bar storage and 60 bar discharge) make it possible to have long pipe runs and achieve quick discharges.



DIOXIDE CARBONO

Fire suppression using this gas is suitable for the entire protection of both the rooms and the equipment. The properties of CO₂ make it highly recommended for this type of installation: Unlike other gases, it may be used when the design includes openings, either for total flooding or local application of specific hazards.

Areas that may be occupied must incorporate special safety measures. SIEX supplies retarders, odorizers and pneumatic sirens to ensure safe evacuation.

No residue, non-corrosive and electrically non-conductive: does not damage installation or require cleaning.

Immediate, highly effective extinguishment: drastically lowers the temperature..

Low cost and easy to supply, refill and simple to maintain.

Suitable for and stable in extreme climates.

It can be removed simply by dissipation using ventilation



By discharging as a pressurized clean agent, it distributes with no residue through any any gap (such as wiring harnesses, slots, etc.) and can be liquefied to minimize storage volume, under its own pressure.

OTHER SPECIAL HAZARDS PROTECTING BY SIEX:

SERVICE STATIONS

ARCHIVES AND LIBRARIES

DPCs

PAINT SPRAY BOOTHS

ELECTRICAL PANELS

INDUSTRIAL KITCHEN

TURBINES AND GENERATORS

ROAD TUNNELS

NATURAL GAS PLANTS

CLEAN ROOMS

CABLE TUNNELS

TELECOMMUNICATION CENTRES

HOTELS

HOSPITALS

EDUCATIONAL ESTABLISHMENTS

TRAIN AND UNDERGROUND STATIONS

TRAINS

TRANSFORMERS

OFFSHORE PLATFORMS

SOLAR THERMAL PLANTS

MACHINE TOOLS

PRINTING INDUSTRY

HISTORIC BUILDINGS

ROBOTIC PARKINGS

WIND TURBINES

STEEL INDUSTRY

BANKS

OFFICES

LARGE VEHICLES

CONVEYOR BELTS

GAS PUMPS

OIL & GAS

TIMBER INDUSTRY



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