

BLADE LOSS OR FAILURE

Contrary to what the wind industry would like us to believe, loss of or damage to a wind turbine blade is not a rare occurrence. The table below is a non-exhaustive list of incidents which have been reported to have occurred in Europe over the last 10 years, including the most recent, and closest to home; the failure of a blade at Crystal Rig near Dunbar. It is likely that there will be many more similar incidents in other continents with considerable numbers of wind turbines. For obvious reasons, not all incidents are reported and obtaining full information not an easy task.

Loss of structural integrity of a blade following a lightning strike is a common cause of failure and combustible material used in the manufacturing process is often ignited. Very often, the turbine continues to turn, fanning the flames as it does so until the blade disintegrates, throwing large pieces of burning material a considerable distance. Because of the height, there is normally no way to extinguish the fire and it is left to burn out, and all that the authorities can do is withdraw to a safe distance.

Failure of the brake mechanism or gearbox is another common cause of blade failure. The brake mechanism is designed to stop the turbine turning when the wind is at a level such that the turbine has to shut down for safety reasons. The gearbox is used to develop useful electricity from the turbine as it turns at relatively low revolutions. If either of these fail, the turbine is able to revolve at many times its normal speed, which imposes loads on the blades well in excess of what was designed. The tips of a blade rotating out of control could be travelling at almost 1000 mph, and when suddenly detached from the rotor have an enormous amount of kinetic energy and momentum. There are many instances of large sections of broken blade being thrown 400m to 600m, and in one incident, a piece of blade was found almost 1000m from the turbine.

Offshore wind farms have a mandatory safety zone of 500m all around the site. In Germany, the authorities are in the process of introducing regulations for a 600m safety zone. In the United States, some wind farms must maintain a half-mile safety zone from public areas or buildings.

Fault	Year	Location	Report
Blade Failure	1992	Delabole, Cornwall	Blades damaged by lightning
Blade Failure	1993	Cemmaes, Wales	Blade parts thrown over 400m
Blade Failure	1995	Rudersdorf, Germany	11m long piece of blade landed next to childrens nursery
Blade Failure	1995	Tarifa, Spain	2 separate occurrences of blades breaking off
Blade Failure	1995	Greece	Cracked blades
Blade Failure	1996	East Friesland, Holland	Parts of rotor blade reported landing in peoples garden
Blade Failure	1996	Eesmond, Holland	2 blade failures in September
Blade Failure	1996	Schllewsig-Flensburg, Germany	Turbine blades broke and fell. Pieces landed on road and damaged adjacent turbine
Blade Failure	1997	Nordstrand, Germany	2 of 3 blades fcame off. Parts flew over 300m , across a road
Blade Failure	1997	Waldaubach, Germany	Blade flew off. Parts found 400m to 500m away. Parts landed in summer house
Blade Failure	1997	Kaiser Wilhelm Koog, Germany	Blade parts flew up to 500m . 1 person killed
Blade Failure	1997	Wanderup, Germany	66% of blade flew 50m . Road only 20m away
Blade Failure	1997	Taff Ely, Wales	Lightning strike
Blade Failure	1997	Four Burrows, Cornwall	Lightning strike
Blade Failure	1998	Goonhilly, Cornwall	Lightning strike
Blade Failure	1999	Lower Saxony, Germany	Blade parts blown off. Parts found 100m away
Blade Failure	1999	Brandenburg, Germany	At least 20 separate blade parts up to 1m long, blown more than 300m
Blade Failure	1999	Hachenburg, Germany	Blade parts flew almost 40m onto heavily used footpath. lightning strike
Blade Failure	1999	Burmonken, Germany	Blade broke. Parts flew off
Blade Failure	1999	Lower Saxony, Germany	Frozen blade detached and disintegrated. Parts flew 100m
Blade Failure	1999	Wijnaldum, Holland	lightning strike destroyed turbine blades
Blade Failure	1999	Lelystad, Holland	Blades from 4 turbines badly damaged by lightning
Blade Failure	1999	Segladera. Sweden	Blade parts flew almost 150m
Blade Failure	1999	Sustrum, Germany	7m long blade section flew more than 200m and 10 other pieces up to 1m long were recovered
Blade Failure	1999	Allstedt, Germany	2 blade parts more than 20m long blown off and flew more than 150m
Blade Failure	1999	Blankenheim, Germany	Blade fell to the ground
Blade Failure	1999	Germany	lightning strike damaged blades
Blade Failure	1999	Schleswig-Holstein, Germany	Brake failure. Turbine turning 4x normal speed. 60 residents within 500m evacuated
Blade Failure	1999	Cuxhavn, Germany	Blade blown off. Parts flew 200m
Blade Failure	1999	Zennhusen, Germany	2 turbines damaged by lightning. One lost a blade and 2 others shattered
Blade Failure	1999	Lower Saxony, Germany	Blade destroyed by lightning
Blade Failure	1999	Stoffin, Germany	Blade bent, hit tower. Debris over 50m circle
Blade Failure	1999	Leewarden, Holland	Sereious damage to blades following lightning strike
Blade Failure	2000	Samsø, Denmark	Complete rotor and housing broken. 1 blade piece went through a window and landed in swimming pool. Another piece was thrown 600m
Blade Failure	2000	Lower Saxony, Germany	Storm tore nacell cover off. 1 blade flew 150m to 200m hitting factory and house, piercing 24cm thick stone wall, timber floor and roof. Turbines subsequently shut down following court ruling on safety grounds.
Blade Failure	2000	Lower Saxony, Germany	21m blade section weighing 2t flew approx 100m
Blade Failure	2001	Lower Saxony, Germany	33m blade piece broke off and flew 100m
Blade Failure	2001	Lower Saxony, Germany	33m blade piece weighing 4t broke off and ffell to ground
Blade Failure	2001	Hessen, Germany	4m x 1m blade piece broke off and flew 150m
Blade Failure	2001	Bad Doberan, Germany	Turbine blade broke off. Nearby motorway closed off
Blade Failure	2002	Blyth, Northumberland	Broken blade on UK first offshore turbine
Blade Failure	2002	Lower Saxony, Germany	Blade shattered with an audible crack. Debris scattered across surrounding fields
Blade Failure	2002	Wormhout, France	Blade torn off during a storm
Blade Failure	2002	Aachen, Germany	Turbine blade torn off during storm. 7.5m section flew 40m
Blade Failure	2002	Westfalia, Germany	Loss of blade. 30m long section weighing 5.5t fell off. Smaller blade parts covered an area to 400m from tower
Blade Failure	2002	Westfalia, Germany	lightning strike broke off 1m of blade
Blade Failure	2002	Saxony, Germany	Technical defect led to blade damage
Blade Failure	2002	Westfalia, Germany	Blade broke off during storm
Blade Failure	2002	Westfalia, Germany	Blade bent and fell to ground. Local farm evacuated
Blade Failure	2002	Kaiserslautern, Germany	Blade broke off due to storm damage
Blade Failure	2002	Brandenburg, Germany	2 of 3 turbine blades tore off in a strom and thrown "far"
Blade Failure	2002	Westfalia, Germany	Blade bent then broke in a storm
Blade Failure	2002	Austria	Turbine blades damaged during storm
Blade Failure	2002	Esbjerg, Denmark	3 blades experienced damage during commissioning
Blade Failure	2003	Aude, France	3 blades from 3 separate turbines broke off during storm. 7 out of 10 turbines on this site were shut down and dismantled
Blade Failure	2003	Lower Saxony, Germany	Lightning damage. Blade parts scattered over 150m
Blade Failure	2003	Lower Saxony, Germany	Lightning strike broke off blade tips
Blade Failure	2003	Rheinland-Pfalz, Germany	Lightning strike to 2 turbines damaging multiple blades on each
Blade Failure	2003	Saxony, Germany	Lightning damage to blade tips
Blade Failure	2003	Westfalia, Germany	Lightning damage to blade
Blade Failure	2003	Westfalia, Germany	37m long blade section bent in storm
Blade Failure	2003	Saxony, Germany	Lightning strike destroyed blade, started fire and damaged turbine housing. 1 blade bent. Another fell off.
Blade Failure	2003	Boulogne sur Mer, France	Blade parts weighing several tons fell into an area used by fishermen and walkers
Blade Failure	2004	East Belgium	Lightning strike led to exploding blade
Blade Failure	2004	Zeeland, Holland	3 blades exploded ue to lightning strike
Blade Failure	2004	Lower Saxony, Germany	2t piece of blade broke off and flew 66m
Blade Failure	2004	Hessen, Germany	Blades torn off in a storm
Blade Failure	2004	Saxony, Germany	10m section of blade flew 20m. 6m piece flew 40m. Smaller pieces flew out to 200m . Suspected lightning damage a week earlier.
Blade Failure	2004	Saxony, Germany	Rotor bent during storm, some pieces flew off
Blade Failure	2004	Saxony, Germany	10m blade section broke off
Blade Failure	2004	Lower Saxony, Germany	Lightning strike destroyed blades close to motorway
Blade Failure	2004	Rheinland-Pfalz, Germany	Broken rotor
Blade Failure	2004	Brittany, France	Blade bent and damaged tower
Blade Failure	2004	Brittany, France	2nd incident in 10 days. 2.5m long pieces of blade found in field
Blade Failure	2004	Zeebrugge, Belgium	3t rotor blade became detached and flew 100m landing not far from nearby gas terminal

Blade Failure	2004	Mecklenburg, Germany	Blade thrown from turbine
Blade Failure	2004	Montjoyer, France	Turbine caught fire followed by all 3 blades falling off
Blade Failure	2005	Udby, Denmark	Turbine lot control. 3 blades broke off. Pieces thrown over large area. Residents evacuated
Blade Failure	2005	Crystal Rig, Berwickshire	40m blade shattered. Parts thrown hundreds of metres
Component Failure	2000	Schleswig-Holstein, Germany	Failed valve caused overspeed and unable to shut down due to wind. 20 houses evacuated
Driver Distraction	1997	Westfalia, Germany	3 separate fatalities occurred at spot on road where turbines first become visible
Driver Distraction	1999	Westfalia, Germany	3 separate fatalities occurred at spot on road where turbines first become visible
Driver Distraction	2000	Hamm-Sieg, Germany	73 distraction related accidents in 4 years over 4km stretch of road where turbines are clearly visible Components and ice thrown over 400m onto and over road
Driver Distraction	2003	Westfalia, Germany	3 separate fatalities occurred at spot on road where turbines first become visible
Environmental Damage	2001	Rheinland-Pfalz, Germany	Leak of hydraulic fluid polluted surrounding area
Environmental Damage	2003	Rheinland-Pfalz, Germany	Leaking oil from turbine onto surrounding land
Environmental Damage	2003	Saxony, Germany	Oil spilled from damaged turbine polluted large area including drinking water supply
Environmental Damage	2003	Westfalia, Germany	Oil leaking onto ground reported over several days
Environmental Damage	2003	Westfalia, Germany	160 litres hydraulic oil leaked down tower and along blades so pollution spread over a large area.
Environmental Damage	2005	Hessen, Germany	Hydraulic fluid leaked onto surrounding ground
Fatal Accident	2000	Schleswig-Holstein, Germany	Parachutist blown 4km off course into turbine blades
Fire	1997	Powys, Wales	Turbine overheated and caught fire. Burning debris thrown 150m from turbine setting fire to hillside and public right of way
Fire	1998	Saron, Germany	Turbine housing completely destroyed by fire - also car destroyed
Fire	1999	Eemerdijk, Holland	Turbine caught fire
Fire	1999	Lower Saxony, Germany	Turbine completely burnt out. Fire crew could not approach due to falling debris
Fire	2000	Lower Saxony, Germany	Turbine caught fire and could not be shut down. Burning blades rotated uncontrollably for several hours
Fire	2000	Paderborn, Germany	lightning strike followed by fire then structural failure of tower
Fire	2000	Burgenland, Austria	Suspected lightning strike started fire destroying turbine
Fire	2001	Lower Saxony, Germany	Technical defect caused fire. Fire crew unable to reach 75m high nacelle so burned out. A natural gas plant stands 200m from turbine. Turbine was never replaced.
Fire	2002	Gronigen, Holland	Fire caused total loss of turbine
Fire	2002	Bavaria, Germany	Lightning strike set turbine blades alight. Several burning blade parts reported flying several hundred metres, and not extinguished by driving sleet
Fire	2002	Oostburg, Holland	Lightning strike caused fire. Burning debris destroyed nearby transformer, blacking out nearby town
Fire	2002	Yttre Stengrund, Sweden	Fire burnt out turbine
Fire	2002	Sachsen, Germany	Fire could not be extinguished due to height and left to burn out. One of 6 fires in this manufacturers turbines in Germany this year
Fire	2002	Paderborn, Germany	Turbine fire 300m from motorway. Motorway closed for over 12 hours
Fire	2002	Saxony, Germany	Loss of turbine through fire during commissioning
Fire	2002	Schleswig-Holstein, Germany	Burning debris from blades dropped over local environment
Fire	2002	Schleswig-Holstein, Germany	Heavy lightning. Total loss
Fire	2002	Denmark	Elsam 2mw turbine
Fire	2002	Lower Saxony, Germany	Flaming debris from burning turbine set fire to nearby hay
Fire	2002	Rheinland-Pfalz, Germany	Turbine caught fire in strong wind. Sparks and broken rotor parts reach main road. Road closed for 11 hours
Fire	2003	Schleswig-Holstein, Germany	Turbine and tower destroyed by fire
Fire	2003	Thuringen, Germany	2 fires in the same turbine within 3 weeks
Fire	2003	Thuringen, Germany	Lightning strike. 4m section of blazing blade reported to fall off.
Fire	2003	Schleswig-Holstein, Germany	Brake failure caused fire and subsequent explosion which destroyed the turbine
Fire	2003	Saarland, Germany	Turbine fire at 60m height. Fire left to burn out
Fire	2003	Westfalia, Germany	2 blazing blades fell off. Burning debris reported to travel several hundred metres
Fire	2004	Schleswig-Holstein, Germany	Lightning strike caused fire. Federal highway closed for some time. Burning debris spread across area
Fire	2004	Westfalia, Germany	Fire at 95m height. Area closed and fire left to burn out.
Fire	2005	Schleswig-Holstein, Germany	Major fire with burning blades scattered over a wide area. Residents told to stay indoors and close windows due to poisonous fumes
Ice Throw	1996	Benseriell, Germany	Ice throw. Public injury case before Crown Court
Ice Throw	1996	Borgholzhausen, Germany	30cm lumps of ice landing on footpath and damaging trees
Ice Throw	1996	Krummendeich	In winter, rotors sling lumps of ice through the air, News article
Ice Throw	1996	Werdum, Germany	1kg lumps of ice landing in street
Ice Throw	1997	Bayern, Germany	0.5 kg lumps of ice thrown 85m
Ice Throw	1997	Westerwald, Germany	"Bigger than A4 paper" lumps of ice thrown 80m . Missed people by 2m
Ice Throw	1997	Willmandinger, Germany	Tennis ball size lump of ice damaged car passing on road
Ice Throw	1999	Rucken, Germany	Car damaged by approx 20 lumps of ice thrown from a turbine 100m away
Ice Throw	1999	Grebeshain, Germany	Pieces of ice thrown 70m to 80m
Ice Throw	1999	Hessen, Germany	Large ice plates thrown 80m
Ice Throw	2000	Westfalia, Germany	Person injured by ice thrown 50m from turbine. Damaged cars-holes in roofs
Ice Throw	2002	Rheinland-Pfalz, Germany	Ice thrown during site inspection with members of state parliament
Ice Throw	2002	Heinsberg, Germany	Ice lumps up to 1.6kg thrown 130m from turbine
Ice Throw	2004	Westfalia, Germany	4 out of 5 turbines shut down 2 to 3 days due to 50cm pieces of ice thrown into public area.
Ice Throw	2004	Brandenburg, Germany	30cm pieces of ice thrown 75m onto road
Ice Throw	2004	Westfalia, Germany	30cm long and several cm thick ice thrown onto road and cycle track. Turbine shut down
Ice Throw	2004	Westfalia, Germany	5 turbines on site, despite being fitted with ice sensors throw ice. 50 pieces of ice found up to 100m from turbine. Some sharp pieces of ice embedded in the ground
Ice Throw	2005	Hessen, Germany	1.5m x .45m pieces of ice thrown 140m onto local road. Traffic now banned from using road
Structural Failure	1993	Cold Northcott, Cornwall	Complete blade and rotor broke away from tower
Structural Failure	1998	Husum, Germany	Rotor and housing fell off
Structural Failure	1998	Dyfed, Wales	2 blades ripped from hub. Tower bent. Blade pieces travelled 500m
Structural Failure	1999	Rebgeshain, Germany	Turbine and blades fell off tower
Structural Failure	1999	Helpershain, Germany	Blades and turbine fell off tower. 17 turbines shut down
Structural Failure	1999	Bochoit-Hemden, Germany	Turbine tip flew off and travelled more than 50m over road

Structural Failure	1999	Jutland, Denmark	Storm destroyed 8 turbines. Brake failure caused overspeed followed by fire
Structural Failure	1999	Eemshaven, Holland	2 rotor blades fell off. 94 turbines shut down
Structural Failure	1999	Westfalen, Germany	60m Tower broke 10m above ground. Rotor parts travelled up to 200m
Structural Failure	2000	Port La Nouvelle, France	Turbine tower broke during a storm
Structural Failure	2000	Jutland, Denmark	Storm destroyed 3 turbines. Brake failure, overspeed and fire
Structural Failure	2000	Wittmund, Germany	Sudden and total collapse of tower. 44 turbines shut down
Structural Failure	2000	Gronigen, Holland	Tower collapsed during storm. 44 similar turbines shut down
Structural Failure	2000	West Friesland, Holland	Tower collapsed during storm
Structural Failure	2000	Cold Northcott, Cornwall	22 turbines shut down due to metal fatigue
Structural Failure	2000	Powys, Wales	Entire wind power station shut don due to metal fatigue
Structural Failure	2000	Dyfed, Wales	Entire wind power station shut don due to metal fatigue
Structural Failure	2000	Burgos, Spain	Tower fractured after being struck by blade. Blade parts travelled almost 1000m
Structural Failure	2001	Castile, Spain	Nacelle fell off tower
Structural Failure	2001	Leon, France	Tower damaged
Structural Failure	2002	Husum, Germany	Turbine destroyed during a storm
Structural Failure	2002	Lower Saxony, Germany	Blades and turbine blown off tower during a storm. Large parts of blade flew 235m
Structural Failure	2002	Hessen, Germany	lightning strike
Structural Failure	2002	Westfalia, Germany	Lightning strike led to complete loss of plant
Structural Failure	2002	Helpershain, Germany	Rotor broke off at hub and fell 50m onto local track. 6 turbines shut for safety checks
Structural Failure	2002	Lower Saxony, Germany	Complete turbine tower and concrete base toppled in storm
Structural Failure	2002	Norway	Nacelle and rotor severed from tower during a storm following problems with control system
Structural Failure	2002	Schneeberg, Germany	Complete collapse of tower. Faulty welding blamed
Structural Failure	2002	Nevian, France	Blade torn off and tower collapsed
Structural Failure	2003	Saxony, Germany	Turbine destroyed in a storm. Blade pieces found 500m from turbine. Surrounding roads closed off.
Structural Failure	2004	Boulogne sur Mer, France	Turbine tower collapsed
Structural Failure	2004	Dunkerque, France	Turbine collapsed during storm. Turbines later dismantled for safety reasons