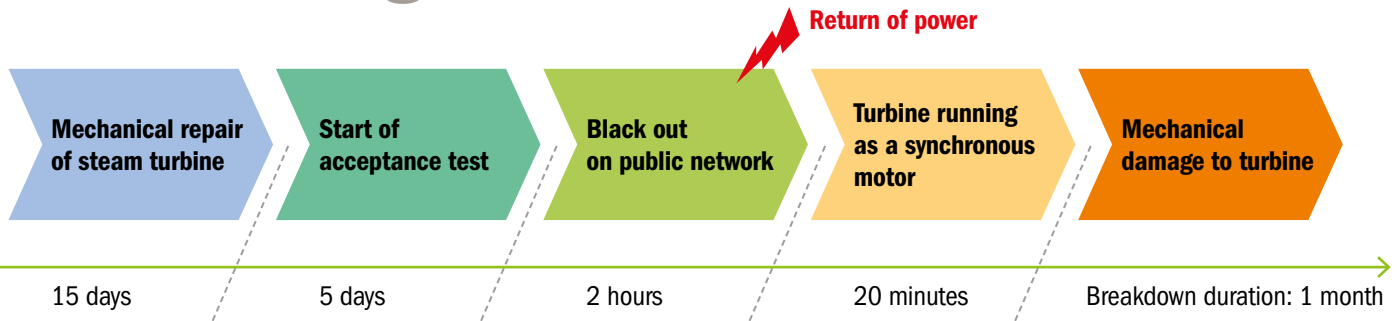
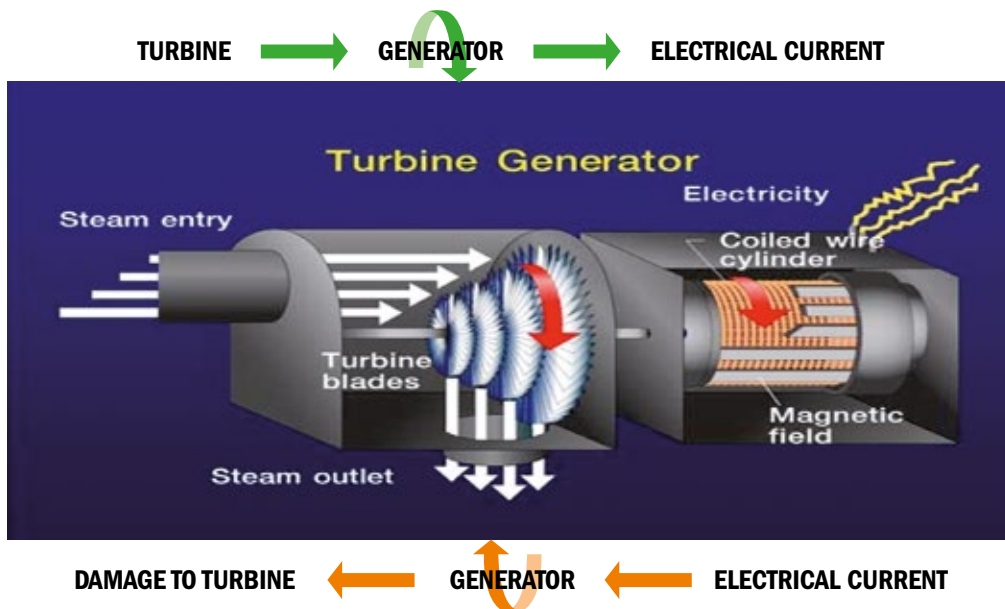




Steam turbine anti-motoring (reverse power) Rotor damage risk



Steam turbine are used to drive synchronous alternators for electricity production.



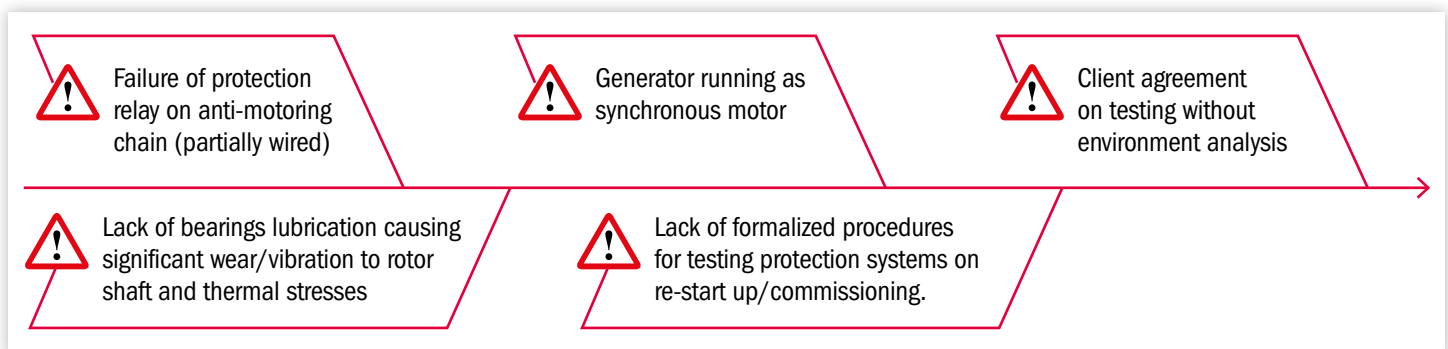
Motoring can happen when a turbine's steam supply is lost whilst the generator is still coupled to a network (or operated in parallel with another generator). The generator will then become a synchronous motor and will actually drive the steam turbine with the potential for significant mechanical damage. A reverse power protection device should be inserted within the generator protection scheme, in compliance with Institute of Electrical and Electronics Engineers standard IEEE C37.102-2006 – Guide for AC Generator Protection (Section 4.5.5).

Facts

1. A large paper mill has a steam turbo-generator connected to the public network or can be operated in island mode.
2. In order to increase its power output, the steam turbo-generator was refurbished/ upgraded in 2012.
3. The upgrade focused on mechanical components, as the electrical components were overhauled/ upgraded some years earlier by another contractor.
4. During re-commissioning; the sequence of power disconnection and power reconnection to the public network induced motoring of the steam turbine.

Total loss amount: several millions euros (shaft, bearings, blades, packing seals)

Main causes



Aggravating factors

- Operator waited more than 15 minutes before calling an electrical technician to open the main generator breaker.
- Lack of a dedicated electrical technician during the commissioning/test procedures.

Suggested recommendations

- Annual testing of reverse power (anti-motoring) protection. It should provide backup for sequential tripping schemes.
- Control the presence of safety chains, test safety valves, surge valves on steam supply, pressure/ level devices on lubrication system, bearing temperature, over speed protection, vibration monitoring, earth fault, loss of field, over voltage/current instrumentation, **including anti-motoring**. Annual testing and calibration is recommended.
- Operators should be trained on identifying generator motoring conditions and on subsequent shutdown/isolation procedures.

