Turbine Halls and Operating Floors

The turbine operating deck differs depending on the type of plant. In the case of the BWR design, radioactive steam passes through the turbine, thus the turbine equipment is behind shield walls. In the case of the PWR, CANDU, VVER, and RBMK designs, the steam passing through the turbine is not radioactive. The photos in this section illustrate both designs.

Turbine units typically consist of a single high pressure (HP) unit connected to 2 or 3 low pressure (LP) units in tandem. The LP turbines are connected to the generator, which is connected to the exciter.

In many power plants the **Turbine Deck** has lots of room to allow for storing the large components when the turbine is disassembled during the outages conducted every 12-24 months. Turbines and generators are disassembled infrequently (usually every 5 years).

PWRs, CANDU, VVER, and RBMK

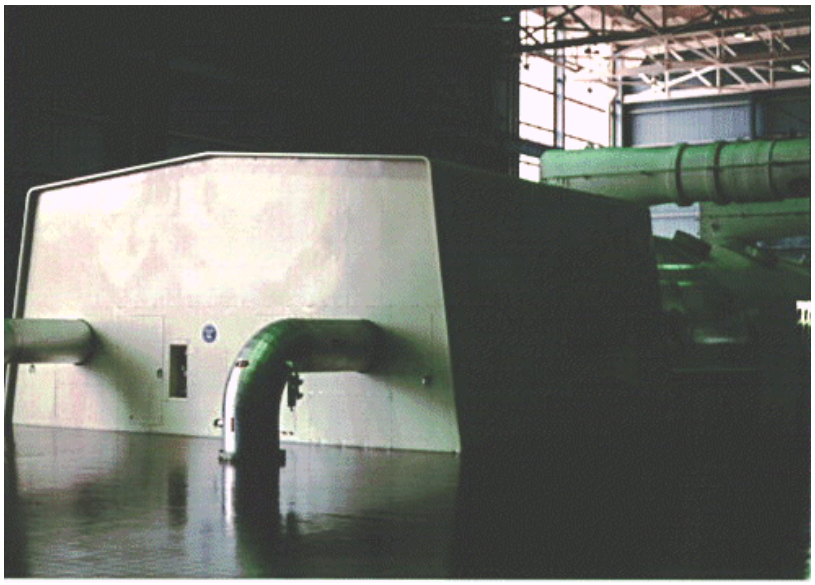
Photo by J.A. Gonyeau

The **Exciter** is the nearest 'orange colored" component. The exciter together with the rotating generator causes the generation of electricity that then is routed through "bus bars" in air cooled piping or "bus duct" to the **Main Generator Transformer** which is generally located just outside the plant. Some electrical power is directed back to the plant for use by plant pumps, motors, fans, etc (also called "house loads", which may be 5 % of a plant's output).

The cylindrical **Moisture Separator** can be seen on the left hand side with the piping above going to the **Low Pressure Turbines.** The moisture separators take the steam that

exhausts from the **High Pressure Turbine** at about 125 pound per square inch pressure and remove the moisture in the steam so that it can be sent to the low pressure turbines. Water removal is important since it can cause very severe erosion of the large blades.

The water used to produce the steam must be very pure, since even trace amounts of sand or silica can cause deposits on the blading which can damage the blading. ***Millions*** of pounds per hour of steam passes through the turbines.



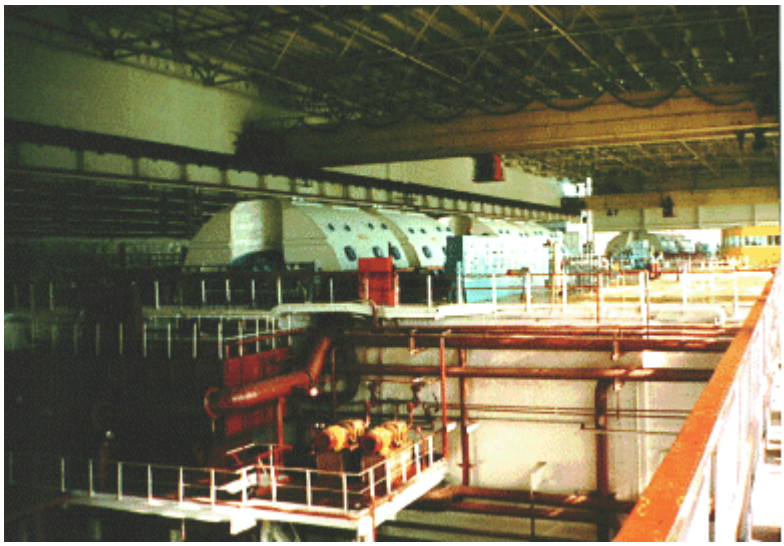
The high pressure turbine consists of a very small unit located on the housing, sometimes called the "dog house". Steam pipes are seen coming up from the floor to admit steam through the stop and governor valves to the turbine.

The piping visible in the overhead behind the doghouse is that which goes from the moisture separators to the low pressure turbines.

Some, but not all, power plants have windows in the turbine hall. This plant's windows look out toward a lake that provides the cooling for the condenser.

This photo shows the Turbine Hall of a U.S. Pressurized Water Reactor facility where steam is being supplied to the **Low Pressure Turbines** from the large **Moisture-Separators** on the right hand side. The steam is supplied to the Moisture-separators from the exhaust of the **High Pressure Turbine**.

RBMK



Turbine-generator sets usually have 2 bearings for each major component - high pressure turbine, low pressure turbines, generator - and 1 end bearing for the exciter. The turbines have an extensive oil system which provides lubrication for those bearings.

This picture at a RBMK facility shows a turbine generator set with a lubricating oil system located in the pit area below the turbine. There are usually a large storage tank, coolers to remove heat from the oil, pumps to circulate the oil, and filters and

purifiers to keep the oil clean and free from chemical and particle impurities.

Photo by J.A. Gonyeau

Most turbines also have a separate hydraulic oil system used for operating the valves that admit steam to the turbine. Stop valves are either open or closed - and are upstream from the control, governor, or throttle valves that regulate how much steam goes to the turbine.

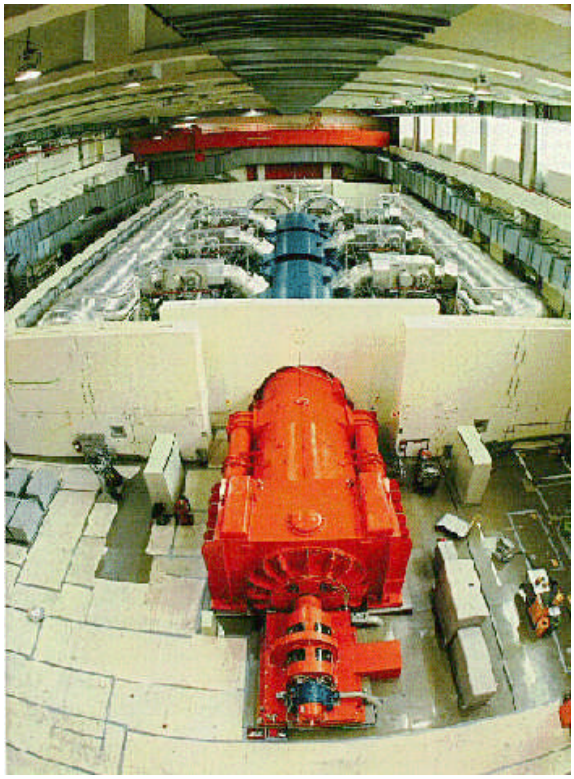
This photo shows one of four turbine-generators in the large Turbine hall of a RMBK style plant. The **Exciter** is the closest component located in the rectangular housing on the right hand side. The **Generator** is in the cylindrical chamber. The generator produces the electricity at approximately 20, 000 volts. The generator is usually cooled by hydrogen gas, which is, in turn, cooled by sea, lake, or river water. There are usually 2 or 3 **Low Pressure Turbines** in large housings. The steam that drives the large blades is usually at a pressure of 125 to 150 pounds per square inch (psi).

Photo by J.A. Gonyeau

At the far end of this turbine is a small **High Pressure Turbine**. The steam comes directly from steam separators that remove moisture from the steam produced in the RBMK reactor. The steam supplied to the High Pressure Turbine is usually at a pressure of approximately 1000 psi. Outside the United States, many power plants use two

generators per generating unit.

BWR



This photo illustrates the Turbine hall in a BWR facility. Closest to us in the photo is the exciter, generator, 3 low pressure turbine stages, and the high pressure turbine. On either side of the turbine can be seen the moisture-separator reheaters.

Note the shielding around the turbine. Shielding is needed because the steam from the BWR contains radioactive N-16, which decays with 7 second half-life.

Courtesy KKN - Liebstadt NPP