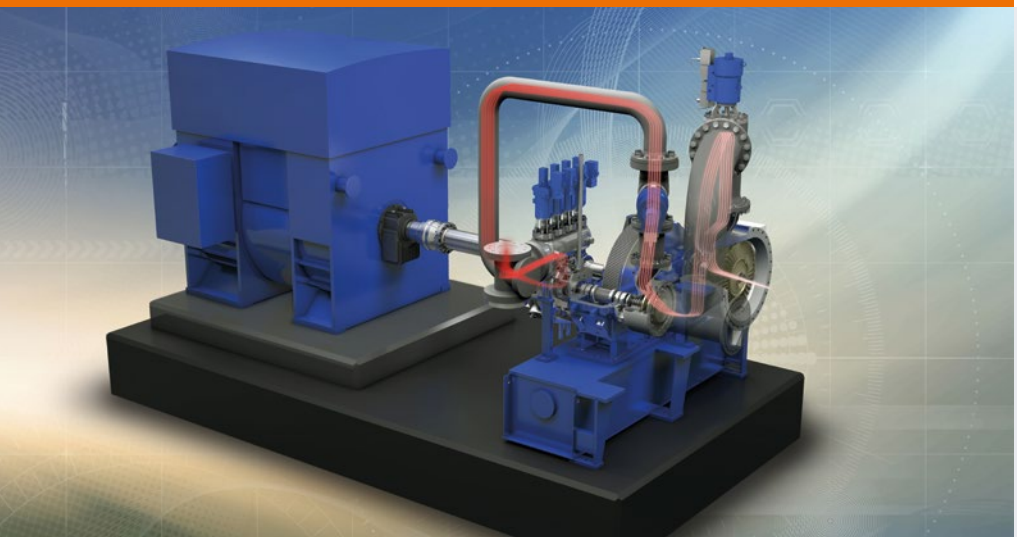
Howden's range of KK&K® steam turbines for renewable energy solutions



Flexible concept for renewable power generation.

In an age of renewable energy sources, new solutions for the industrial use of thermal energy and regenerative power generation are required.

Using the TWIN or TRI steam turbine, waste heat can be utilised to generate electrical output.

This turbine operates exceptionally well with small biomass power plants or waste and refuse incineration plants for distributed power generation. With the TWIN and TRI it was possible to achieve a high degree of flexibility and closed-loop control with only low investments, enabling the advantages of a single-stage steam turbine to be combined with the high efficiency of a multi-stage turbine.

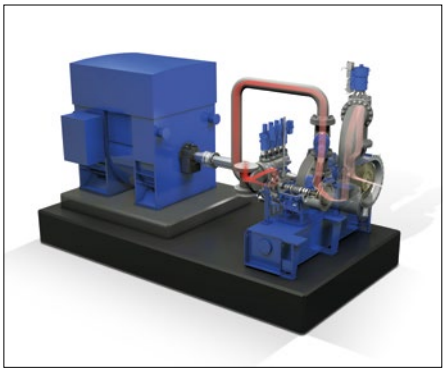
In line with its development, this type of turbine should be characterised as a modular and flexible solution with a high efficiency, fast startup capability and simple activation and maintenance. The TWIN and TRI turbine combines the robustness and the adaptability of an industrial single-stage turbine with the higher efficiency of a multi-stage steam turbine.

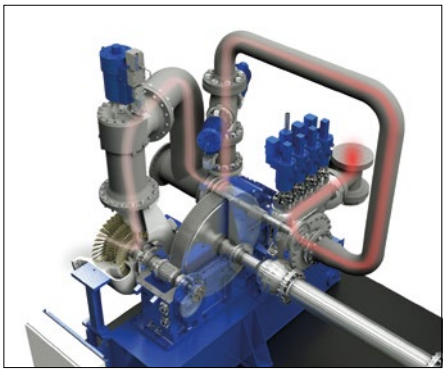
Application examples

A turbine generates power by utilising the steam produced from industrial waste heat generated by exothermal processes. As steam production varies according to the process involved, this application focuses on high profitability and flexible performance.

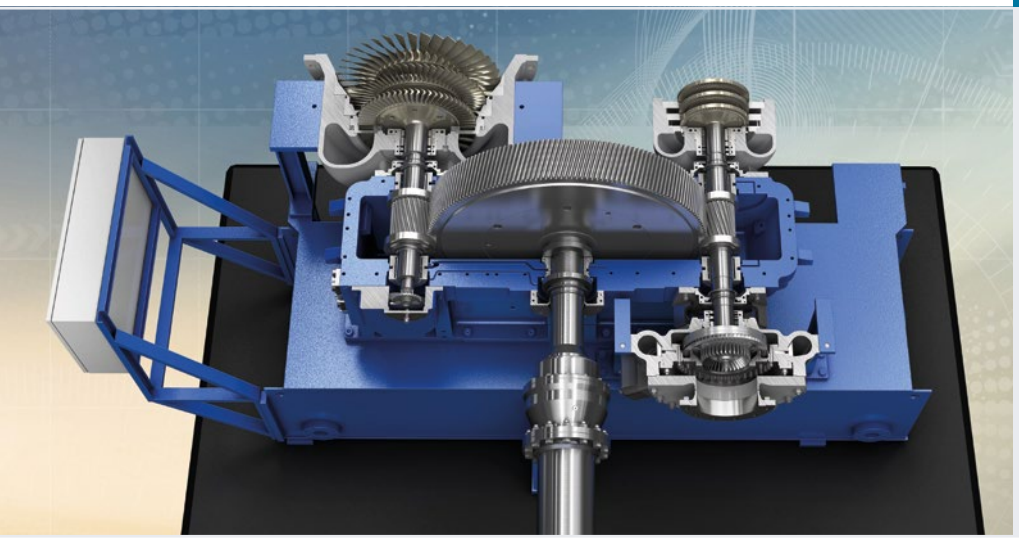
Thermal waste recycling is not government funded, which is why compensation for electricity fed into the grid from these types of plants is still relatively low. Consequently, this application focuses on low investments and a high degree of reliability and availability. As the energy value of the waste concerned and the amount of waste available can vary, it is important that the turbine can be operated within a range of different steam parameters.

Biomass power plants are government subsidised in many countries, which is why one objective for this turbine is high efficiency, while also focusing on operation at different steam parameters and/or with varying amounts of waste material. In many cases steam extraction is necessary to dry the biomass or to run a district heating grid.





Design of a TRI steam turbine.



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Reference projects in Turkey and Great Britain

In 2012 it was possible for the first time to implement projects involving a two-casing turbine consisting of a single-stage high-pressure section and a single-stage low-pressure section. The sales release for the three-casing version, which includes an intermediate-pressure section with three stages, followed a year later.

The first dual-casing steam turbine was handed over to the energy supplier HG Enerji in September 2013. This industrial steam turbine has an electrical generating capacity of 5300 kW and produces electricity for the local grid in western Turkey. Waste heat from the six gas engines installed in the power plant is used to produce the steam.

In May 2014, the second turbine was handed over to the Groupe Tiru in Great Britain. With a capacity of 4700 kW, its output is somewhat lower, although it also produces electricity for the local grid. Heat from a thermal waste recycling plant is used to produce steam.

The turbines are designed for operation with varying steam parameters. Based on the application at hand, the first turbine in Turkey is designed for low live steam parameters as follows: 17 bar(a) live steam pressure and 355°C live steam temperature. A suitable single-stage axial turbine is available as the high-pressure section. Condensing pressure is 0.115 bar(a).

The turbine in use in Great Britain is designed for the following live steam parameters: 40 bar(a) and 375°C. These data are typical for thermal waste recycling plants. This turbine expands the steam in two steps to 0.08 bar(a).

Both turbines have low mass flow extraction pressure. The first one at 3.3 bar(a) and the second one at 4.0 bar(a). This mass flow is used in the deaerator.

The assembly and the test run proceeded as planned. The vibration tests and the balancing quality were especially well-received.

Managing of the commissioning of both turbines also went according to plan. The anticipated short assembly and commissioning period for single-stage turbines, as pretested in the factory in Frankenthal, was also able to be implemented for the turbines.

The contractually fixed power output was achieved by both turbines, with this output even being exceeded, in particular in the part-load range.

Both steam turbines proved their robust mechanical behaviour – above all thanks to their good vibration response.

Source: VGB PowerTech 5/2015
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