Case Study: La Rance Barrage

<table>
<thead>
<tr>
<th>Project Name</th>
<th>La Rance Barrage</th>
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<tr>
<td>Location</td>
<td>The Rance estuary in Brittany, France</td>
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<tr>
<td>Installed capacity</td>
<td>240MW</td>
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<td>Technology Type</td>
<td>Tidal impoundment barrage</td>
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<td>Project Type/Phase</td>
<td>Full scale experimental power plant</td>
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<td>Year</td>
<td>Operational since 1967</td>
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Project Description
The Rance tidal power plant is located on the estuary of the Rance River, in Brittany, France (Figure 1).

Following twenty-five years of research and six years of construction work, the 240MW La Rance Barrage became the first commercial-scale tidal power plant in the world. It was built as a large scale demonstration project for low-head hydro technology. The construction of the tidal power plant started in 1961, and was completed in 1967.

The Rance estuary has one of the highest tidal ranges in the world (an average of 8 meters, reaching up to 13.5 metres during equinoctial spring tides) which makes it an attractive site for tidal impoundment power generation. The complete barrage is 750m long and 13m high with a reservoir of 22km² capable of impounding 180 million cubic meters.

The structure includes a dam 330m long in which the turbines are housed, a lock to allow the passage of small craft, a rock-fill dam 165m long and a mobile weir with six gates. Before construction of the tidal barrage, two temporary dams were built across the estuary in order to create a dry construction site; an effort which took two years. In July 1963, the Rance was cut off from the ocean and construction of the tidal barrage commenced. This took another three years. A road across the barrage connects the towns of Dinard and Saint-Malo. Boats can pass the barrage via a canal lock at the west side and there is also a drawbridge which can be raised to allow larger vessels to pass.

In 1996, after 30 years of operation, Électricité de France (EDF) carried out a general and preventive overhaul of all equipment. This refurbishment programme was spread out over ten years. The plant is now operating successfully and generates on average 600 million kWh of electricity per year.

Technology
The plant uses 24 10-megawatt low-head bulb-type turbine generator sets. The new bulb-type turbines, developed by EDF, were designed to generate energy on either the incoming (flood) or outgoing (ebb) tide, and to pump in both directions to raise (high tide) or lower (low tide) the basin level to add to the energy potential of the subsequent generating phase.
The barrage was originally planned for two-way generation, using the new bulb-type turbines, but the turbines were less efficient in reverse. Pumping extra water into the impounded area during high tide (when the height difference is small) gives extra volume to drive the turbines when the height difference is large. It is therefore predominantly operated on ebb-tide generation with flood pumping. This helps to minimise progressive disruption of the intertidal zone that would eventually lead to the silting up of the head pond\textsuperscript{2}.

**Figure 1: Location of the La Rance Tidal Barrage.**

**Project Partners**
The plant is owned and operated by \textit{Électricité de France}.

**Cost and Financing**
The total cost of the barrage was 620 million Francs (94.5 million Euros)\textsuperscript{4,5}.

**References**
4. La Rance Tidal Power Plant. [http://www.reuk.co.uk/la-rance-tidal-power-plant.htm](http://www.reuk.co.uk/la-rance-tidal-power-plant.htm).