



Impulse vs Reaction Turbines: Understanding the Differences

This presentation will delve into the world of turbines, exploring the fundamental differences between impulse and reaction turbines. We will analyze their working principles, key differences, applications, and efficiency considerations, ultimately guiding you towards making informed decisions for your specific needs.



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Introduction to Turbines

Definition

Turbines are devices that extract energy from the flow of fluids, like water or steam, by converting their kinetic and potential energy into mechanical energy.

Two Main Types

Impulse and reaction turbines are the two primary categories, distinguished by how they extract energy from the fluid and the pressure changes that occur.

Impulse Turbines: Basic Principles

High-velocity Fluid Jet

Impulse turbines function by directing a high-velocity fluid jet onto the blades, converting the kinetic energy of the fluid into mechanical energy.

No Pressure Change

A distinctive characteristic of impulse turbines is the lack of pressure change across the moving blades. This implies that all energy conversion happens solely due to the fluid's velocity.

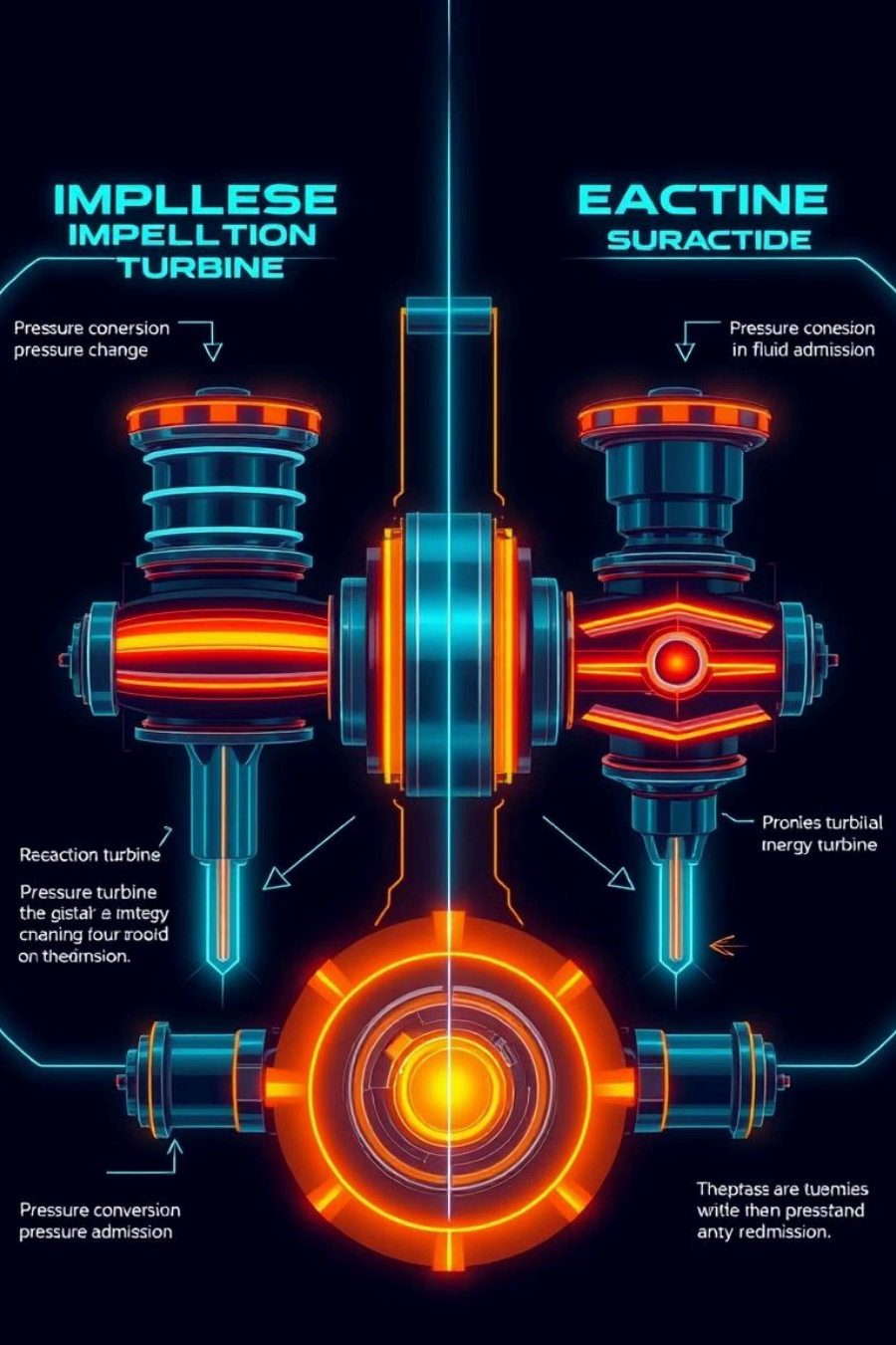
Reaction Turbines: Basic Principles

Continuous Pressure Drop

In contrast to impulse turbines, reaction turbines experience a continuous pressure drop as the fluid flows through both the stationary and moving blades.

Fluid "Reacts" Against Blades

The energy conversion in reaction turbines is a combination of kinetic and pressure energy, with the fluid "reacting" against the blade surfaces, causing them to rotate.



Key Differences

Energy Conversion	Kinetic only	Kinetic and Pressure
Pressure Change	No change in runner	Pressure drops in runner
Fluid Admission	Partial or full	Full circumference
Casing	Not required	Pressure casing needed
Typical Applications	High head, low flow	Medium to low head, high flow



Applications and Examples

1

Impulse turbines are commonly used in hydroelectric power generation in mountainous regions where high head differences are available but flow rates are relatively low. One prominent example is the Pelton wheel, often employed in applications with heads exceeding 300 meters and flow rates under 30 cubic meters per second.

2

Reaction turbines are widely used in large-scale hydropower plants, leveraging their ability to efficiently handle high flow rates at moderate to low head differences. Another example is the Francis turbine, which excels in situations with heads between 40 to 600 meters and flow rates ranging from 2 to 800 cubic meters per second.

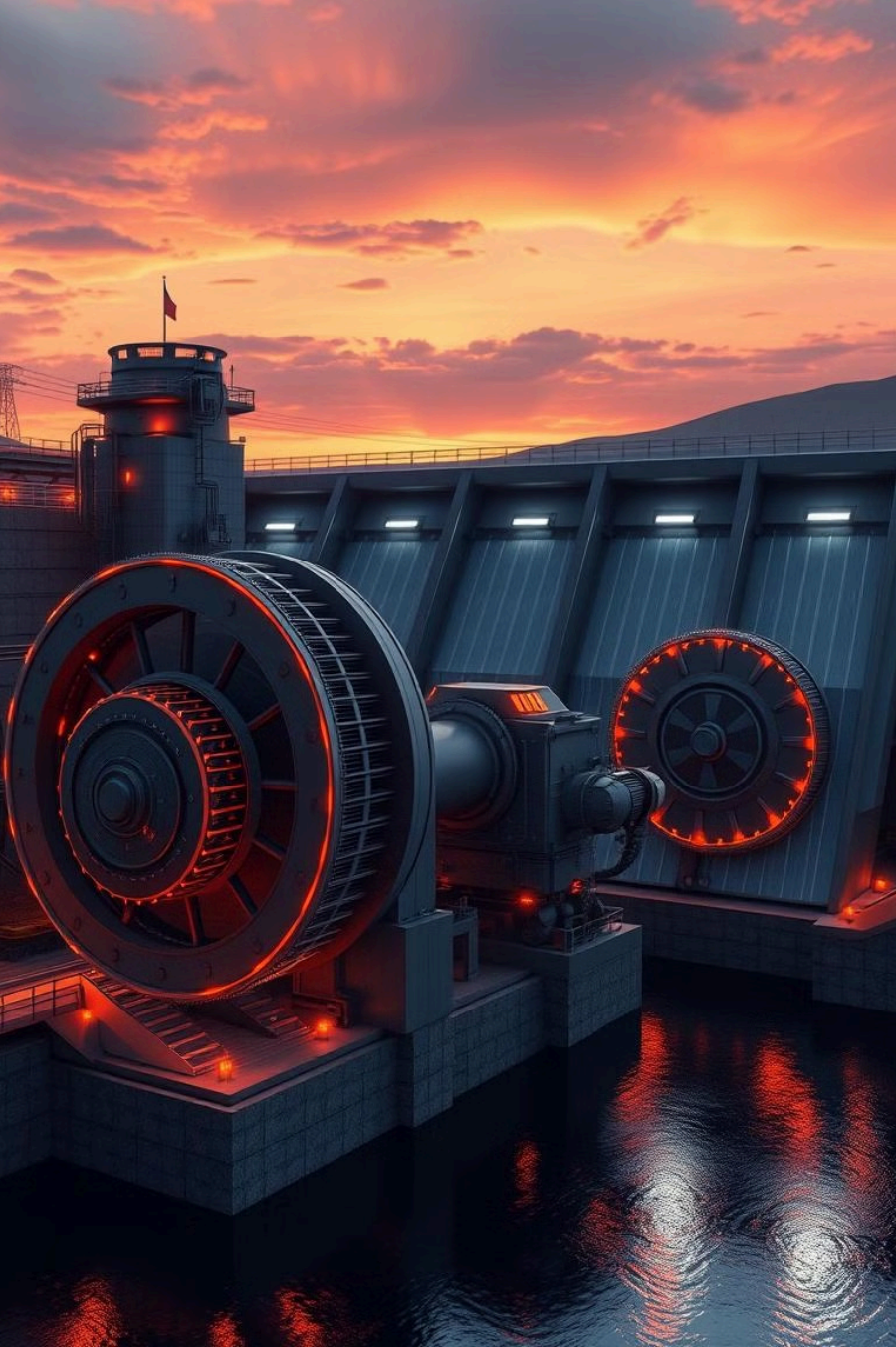
Efficiency Comparison

Impulse Turbines

Impulse turbines typically achieve peak efficiencies between 70% and 90%, showcasing their ability to maintain high efficiency over a wide range of flow rates.

Reaction Turbines

Reaction turbines generally boast higher peak efficiencies, ranging from 80% to 95%, but are more sensitive to variations in flow rates. Their optimal efficiency is often attained at a specific design flow rate.



Conclusion: Choosing the Right Turbine

The decision to select the appropriate turbine type depends on the specific characteristics of the site, including head, flow rate, and power requirements. Impulse turbines excel in high-head, low-flow scenarios, while reaction turbines are ideal for medium to low-head, high-flow applications. The choice of turbine ultimately determines the efficiency and effectiveness of your energy generation system, both of which are crucial for sustainable and reliable power production.