Turbines and its types

They all use turbines—machines that capture energy from a moving liquid or gas. In a sandcastle windmill, the curved blades are designed to catch the wind's energy so they flutter and spin. In an ocean liner or a jet, hot burning gas is used to spin metal blades at high speed—capturing energy that's used to power the ship's propeller or push the plane through the sky. Turbines also help us make the vast majority of our electricity: turbines driven by steam are used in virtually every major power plant, while wind and water turbines help us to produce renewable energy. Wherever energy's being harnessed for human needs, turbines are usually somewhere nearby.

A **turbine** is a rotary engine that extracts energy from a fluid flow and converts it into useful work. The simplest turbines have one moving part, a rotor assembly, which is a shaft or drum with blades attached. Moving fluid acts on the blades, or the blades react to the flow, so that they move and impart rotational energy to the rotor. Early turbine examples are windmills and water wheels.

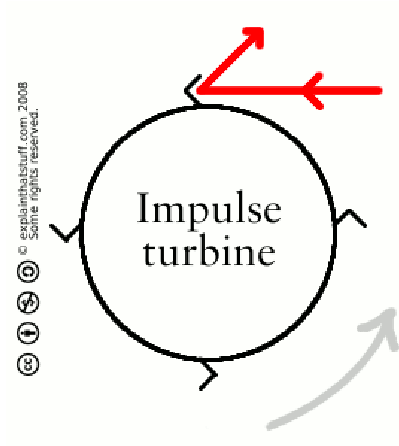
Gas, steam, and water turbines usually have a casing around the blades that contains and controls the working fluid. Credit for invention of the steam turbine is given both to the British Engineer Sir Charles Parsons (1854–1931), for invention of the reaction turbine and to Swedish Engineer Gustaf de Laval (1845–1913), for invention of the impulse turbine. Modern steam turbines frequently employ both reaction and impulse in the same unit, typically varying the degree of reaction and impulse from the blade root to its periphery.

Impulse and reaction turbines

Turbines work in two different ways described as impulse and reaction—terms that are often very confusingly described (and sometimes completely muddled up) when people try to explain them. So what's the difference?

Impulse turbines

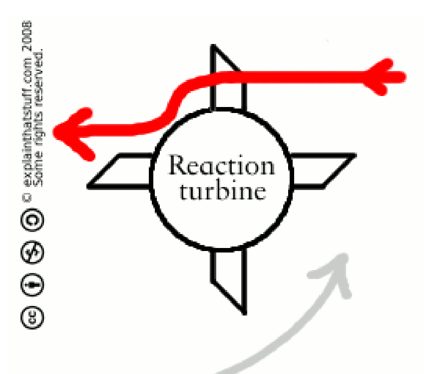
In an impulse turbine, a fast-moving fluid is fired through a narrow nozzle at the turbine blades to make them spin around. The blades of an impulse turbine are usually bucket-shaped so they catch the fluid and direct it off at an angle or sometimes even back the way it came (because that gives the most efficient transfer of energy from the fluid to the turbine). In an impulse turbine, the fluid is forced to hit the turbine at high speed. Imagine trying to make a wheel like this turn around by kicking soccer balls into its paddles. You'd need the balls to hit hard and bounce back well to get the wheel spinning—and those constant energy impulses are the key to how it works.



Reaction turbines

In a reaction turbine, the blades sit in a much larger volume of fluid and turn around as the fluid flows past them. A reaction turbine doesn't change the direction of the fluid flow as drastically as an impulse turbine: it simply spins as the fluid pushes through and past its blades.

If an impulse turbine is a bit like kicking soccer balls, a reaction turbine is more like swimming—in reverse. Let me explain! Think of how you do freestyle (front crawl) by hauling your arms through the water, starting with each hand as far in front as you can reach and ending with a "follow through" that throws your arm well behind you. What you're trying to achieve is to keep your hand and forearm pushing against the water for as long as possible, so you transfer as much energy as you can in each stroke. A reaction turbine is using the same idea in reverse: imagine fast-flowing water moving past you so it makes your arms and legs move and supplies energy to your body! With a reaction turbine, you want the water to touch the blades smoothly, for as long as it can, so it gives up as much energy as possible. The water isn't hitting the blades and bouncing off, as it does in an impulse turbine: instead, the blades are moving more smoothly, "going with the flow".



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