Harnessing Tidal Energy In Developing Countries

We live on a beautiful, vibrant planet that rotates around our bright Sun, with our own satellite, the Moon, rotating around us. The gravitational forces of both the Sun and the Moon, along with Earth's rotational motion, cause tides. In fact, tides are long-lasting waves that start in the ocean and move towards and away from coastlines, resulting in the familiar cycle of the ocean's surface rising and falling. Indeed, harnessing tidal energy, the power created from the tides, has the potential to produce affordable and clean energy for all who live near oceans.

Harnessing tidal energy in developing nations.
Source: Pixabay.

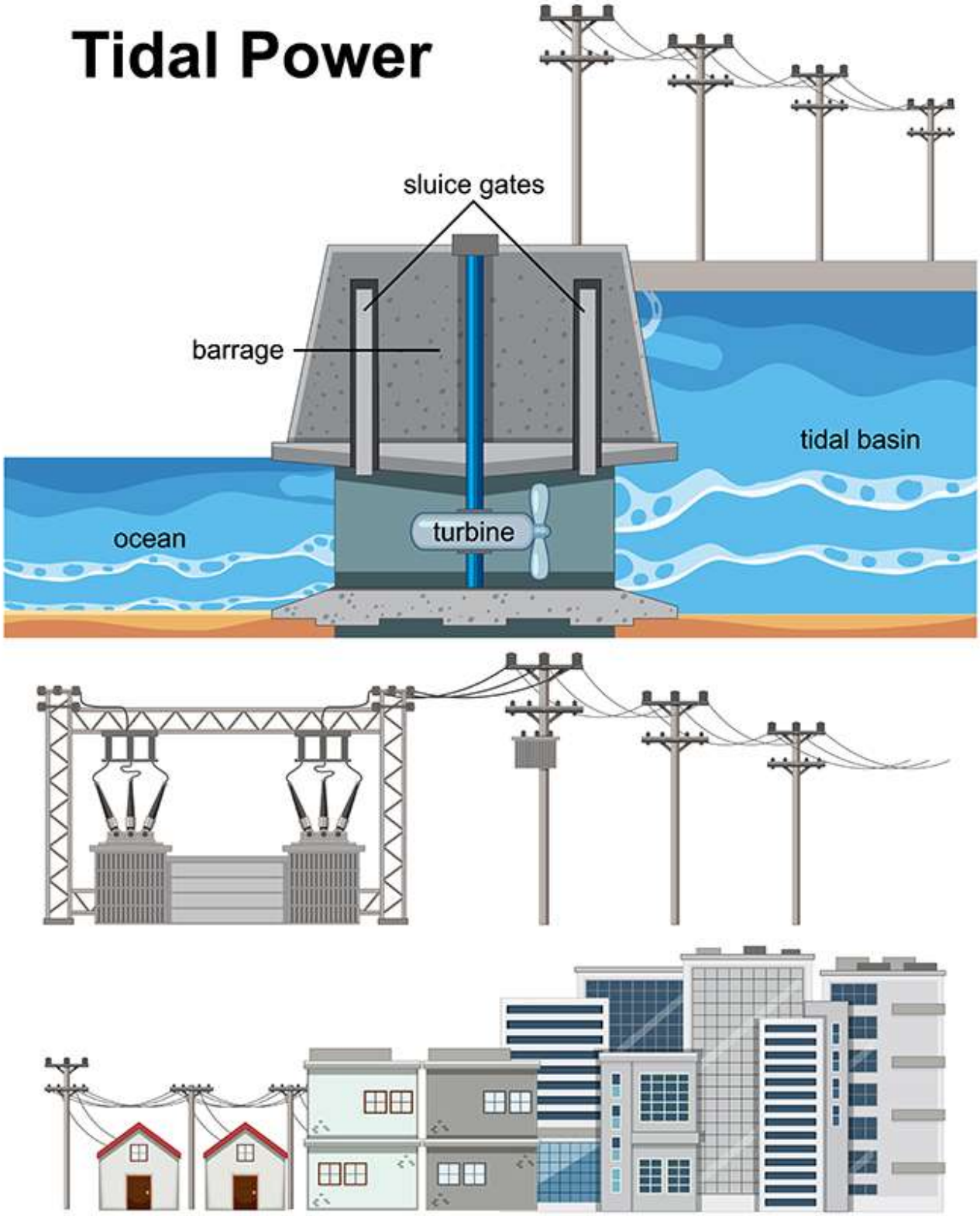
What is Tidal energy?

Tidal energy is a form of hydropower produced by the rise and fall of Earth's tides. Hydropower is a renewable energy source that uses the energy of flowing water to produce electricity. Humanity harnesses tidal energy by capturing the kinetic energy generated as water moves due to these tidal fluctuations. Tidal energy has both benefits and drawbacks.

Some benefits to harnessing tidal energy include cleanliness, consistency, permanence, energy efficiency, and long-term economy, once it is established. However, there are also a number of drawbacks to harnessing tidal energy. These include the intermittence due to the nature of tides, exorbitant start-up costs, biofouling, environmental risk, and the fact that there are a very limited amount of locations that have a tide powerful enough to generate enough electricity to make it viable.

harnessing tidal energy

Harnessing tidal energy means using the energy created by the tides. There are several methods of doing this. For instance, tidal barrages, turbines, and fences are three different ways of harnessing tidal energy. Furthermore, to use tidal energy, grid connections are necessary, power stations will need monitoring and controlling, and environmental impact will need mitigating.



Renewable energy concept harnessing tidal energy.
Source: Freepik.

Tidal Barrages

Tidal barrages are big dams built at the entrance of bays or tidal areas. They have

gates and turbines. When the tide comes in, water goes into the bay, and when it goes out, water flows out. The moving water turns the turbines, making electricity. These produce a lot of steady power.

A secondary use of tidal barrages is to reduce flooding in low-lying areas. The barrages, being dams, are able to withhold or release water as necessary. Indeed, this is vital when considering rising sea levels due to climate change.

Some of the considerations with tidal barrages are that they can alter estuary water flow, affecting seawater quality and local marine life. Also, these projects are costly to build, making it hard to justify the investment, especially given the environmental risks.

Tidal Turbines

Tidal turbines are underwater turbines placed on the ocean floor where the currents are strong. Similar to wind turbines generating electricity via the wind moving them, they use the energy from moving water to make electricity. Places with strong tides are ideal locations for these.

Environmental worries centre on the possibility of marine creatures colliding with the blades of underwater turbines. These blades are large and rotate on the bottom of the sea floor. The movement of these blades creates a potential hazard for aquatic organisms, including fish and marine mammals.

Another concern relates to the electromagnetic fields produced and the underwater sounds generated during the building, running, and dismantling of tidal systems and how these might affect marine animals. However, it’s challenging to measure underwater sounds in tidal areas. Also, to date, there haven’t been many studies on how tidal turbines affect marine life acoustically.

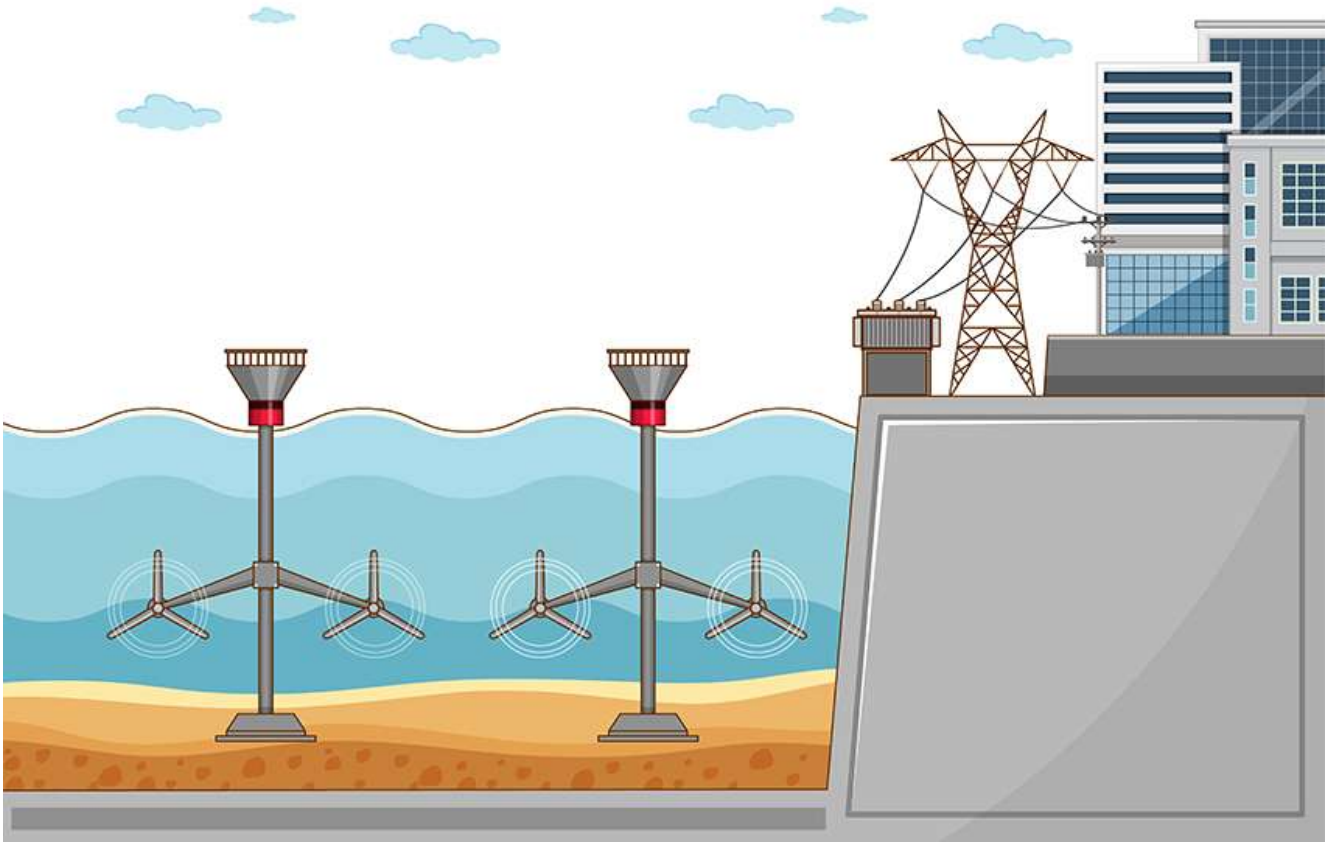


Diagram showing water power harnessing tidal energy to power cities.
Source: Freepik.

Tidal Fences

Tidal fences are rows of underwater turbines placed across the direction of strong ocean currents. When water moves through or around them, it makes the turbines turn and create electricity. This works best where tides flow really fast. For instance, they can be used in a channel between two landmasses.

A Success Story in Harnessing Tidal Energy

South Korea has had a huge success with the Sihwa Lake Tidal Power Station. As the largest tidal power plant globally, it boasts an impressive output capacity of 254MW. The station cost approximately USD300 million and took more than 7 years to build starting in 2003. Utilising a 12.5km seawall built in 1994, originally for flood control and agricultural needs, this power plant harnesses the energy from tidal inflows into a 30km^2 basin. It accomplishes this through ten 25.4MW submerged bulb turbines, while the outflow of water from the barrage is regulated by eight culvert-type sluice gates.

moving forward

In conclusion, harnessing tidal energy represents a promising avenue for sustainable and renewable power generation. This clean energy source capitalises on the predictable and consistent rise and fall of ocean tides, offering numerous advantages, including reliability, minimal greenhouse gas emissions, and reduced dependence on finite fossil fuels. There are challenges and environmental considerations to address. However, ongoing research, innovation, and responsible project planning can help maximise the benefits of tidal energy while mitigating its drawbacks. As we continue to explore and develop this resource, tidal energy stands as a key contributor to a greener and more sustainable energy future, offering an opportunity to reduce our carbon footprint and advance the global transition to clean, renewable energy sources.

Why is it essential that we focus on Harnessing Tidal Energy in developing countries?

There are many developing nations that border the ocean. Harnessing tidal energy in developing countries is crucial for several reasons. It provides reliable and affordable electricity to communities lacking access to power, reducing energy poverty. Also, it reduces reliance on imported fossil fuels, improving energy security. Furthermore, tidal energy is eco-friendly, aiding in the transition away from fossil fuels and aligning with climate goals. Moreover, it creates local jobs and stimulates economic growth. It has a smaller environmental impact compared to other energy sources. Additionally, it fosters local development, attracting investments and sustainable revenue for coastal communities. In conclusion, it helps create a greener and more prosperous future in developing nations.

achieving the United Nations Sustainable Development Goals (SDGs) and how they

link to Tidal energy in developing countries

Sustainable Development Goal 7 is to "ensure access to affordable, reliable, sustainable and modern energy for all." Harnessing tidal energy is not only clean, it's sustainable and modern. Indeed, the tide moving the ocean back and forth up and down the coastline is as reliable as the Earth spinning. It is something that will always be for as long as we have a planet.

Harnessing tidal energy ties into other SDGs, as well. SDGs 8 and 9 are about economic growth, industrialisation, innovation, and infrastructure. In fact, with infrastructure for tidal barrages, turbines, and fences needing building and maintenance, this provides plenty of opportunity for economic growth, innovation, and sustainable industrialisation. This is necessary to turn developing nations into developed ones.

The intention of SDG 11 is to "make cities and human settlements inclusive, safe, resilient, and sustainable". Harnessing tidal power is sustainable because it relies on the predictable and consistent natural phenomena of ocean tides. This ensures a constant and renewable energy source. Also, it has a minimal environmental footprint, generating electricity without greenhouse gas emissions or air pollution, contributing to cleaner and more sustainable energy production. Tidal energy's longevity, low ecological impact, and reduced dependence on fossil fuels make it a sustainable choice for meeting long-term energy needs. Furthermore, it contributes to mitigating climate change.

SDG 13 focuses on taking climate action and life below water. Transitioning to tidal energy addresses taking climate action by reducing the reliance on fossil fuels. Tidal energy has the potential to replace fossil fuels for countries bordering oceans.

A Thrivable Framework

At THRIVE, we believe that humanity can thrive by harnessing the knowledge and resources at our disposal. In fact, our framework extends beyond sustainability to embrace the concept of "thrivability". THRIVE not only educates, but advocates, by being the voice for those who have no platform.

Harnessing tidal energy builds into the renewable energy pool already being used, such as solar and wind. Renewable energy comes from natural sources that renew faster than they get used up. Transitioning to renewables is important because it reduces pollution, stabilizes energy costs, and creates jobs. Additionally, it ensures a long-term and sustainable energy supply. Furthermore, it helps combat climate change, improves public health, and enhances energy security. Transitioning to renewables is vital to build a "thrivable" future for humanity.

Humanity can do better than survive by embracing tidal energy, along with other renewables. By transitioning to renewables humanity can slow down, stop, and eventually reverse climate change. Indeed, the THRIVE Framework examines issues and evaluates potential solutions to climate change. Harnessing tidal energy has both advantages and disadvantages. Therefore, transitioning to tidal energy, using wisdom, is a step forward for humanity on the path of 'thrivability'.

THRIVE's logo, a ciambella chart, outlines two important boundaries for humanity to adhere to. These boundaries are – a social floor, denoting the minimum for humanity's survival; and an environmental ceiling, where humanity takes too much from the environment. In fact, by harnessing tidal energy, humanity reduces what they take from the environment, remaining beneath the environmental ceiling.

As part of THRIVE's commitment to advocate, research, and educate you will find our podcast series, blog, YouTube channel, and webinars valuable resources. For regular updates, you can sign up for our newsletter.