# Tidal Power Generation

*Project Stage-I*

*Report submitted*

*in*

*partial fulfilment of requirement*

*for the award of degree of*

**Bachelor of Engineering**

**in**

**Electrical Engineering**

***Submitted by***

**KSHITIJA MANYAR**

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***Under The Guidance of***

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Anjuman-I-Islam's Kalsekar Technical Campus, Panvel
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**Manyar Kshitija (16EE02)**
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**Kalsekar Technical Campus**

# REPORT OF PROJECT WORK

**NAME OF THE PROJECT: -** "TIDAL POWER GENERATION".

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# CERTIFICATE

This is to certify that the dissertation titled "**TIDAL POWER GENERATION**", which is being submitted herewith for the award of the, '**Bachelor of Engineering'** in **Electrical Engineering** of Anjuman-I-Islam's Kalsekar Technical Campus, New Panvel .This is the result of the original research work and contribution by **'Miss. Kshitija Manyar, Miss. Maheen Lanjekar, Miss. Jyoti Waghamare, Miss. Naaz Borkar '** under my supervision and guidance. The work embodied in this dissertation has not formed earlier for the basis of award of any degree or compatible certificate or similar title of this for any other diploma/examining body or university to the best of knowledge and belief.

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# CERTIFICATE OF APPROVAL

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# DECLARATION

I hereby declare that I have formed, completed and written the dissertation entitled "**TIDAL POWER GENERATION**". It has not previously submitted for the basis of the award of any degree or diploma or either similar title of this for any other diploma/examining body/university.

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# ABSTRACT

Our project is based on prototype Tidal Barrage. Water is filed manually in the sea side section of the tank to represent the high tide until the water reaches the maximum height a gate is used to block the water once the gate is opened the water flows throw the turbine into the lagoon section. The turbine rotates the rotor of the dynamo to generate dc output and the water level equalizes then the water is poured in to the lagoon section to represent low tides and the gate is closed until the water reaches the maximum height the gate is opened and water flows through the turbine in the reverse direction again to generate DC output. This project is about Tidal Power Generation which mentions the method of utilizing tidal power to producing electricity. This project focuses on the potential of this method of generating electricity and why this could be the common way of generating electricity in future. Now, new energy technologies (NOT dams) that generate electricity from tidal currents could help produce as much electricity as the largest hydroelectric dams or nuclear and fossil fuel generating stations, without producing greenhouse gases or harming the environment. Our project synapsis also gives brief information of construction, basic components and types of tidal power plants. Information regarding turbines used in tidal plants are also given. Advantages and disadvantages of tidal power plant is also discussed. Renewable like this (tidal energy) can be used to decrease global dependence on natural resources, and tidal power can be the primary form of renewable power utilized. Built upon stream turbine and tidal barrages knowledge, tidal turbines draw on innovative technology and design to operate on both the inflow and outflow of water through them. Tidal power plants are capable of producing reliable and efficient power.

## ACKNOWLEDGEMENT

We are very grateful to head of the department *Prof. Sayyed Kaleem* for the valuable guidance and support in making this report. We would like to express our sincere thanks to *Prof. Tahoora Qureshi* for all the valuable inputs and suggestions shared for making this report. We are immensely thankful to all the faculties and staff members of Electrical Engineering for their cooperation.

## LIST OF FIGURES

# 1. INTRODUCTION

## 1.1 Introduction

Tidal power, also called tidal energy, is a form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity. Although not yet widely used, tidal power has potential for future electricity generation. Tides are more predictable than wind energy and solar power. Among sources of renewable energy, tidal power has traditionally suffered from relatively high cost and limited availability of sites with sufficiently high tidal ranges or flow velocities, thus constricting its total availability. However, our project work on technological developments and improvements, both in design (i.e. prototype tidal barrage) and turbine technology (e.g. new axial turbines, cross flow turbines), indicate that the total availability of tidal power may be much higher than previously assumed, and that economic and environmental costs may be brought down to competitive levels.

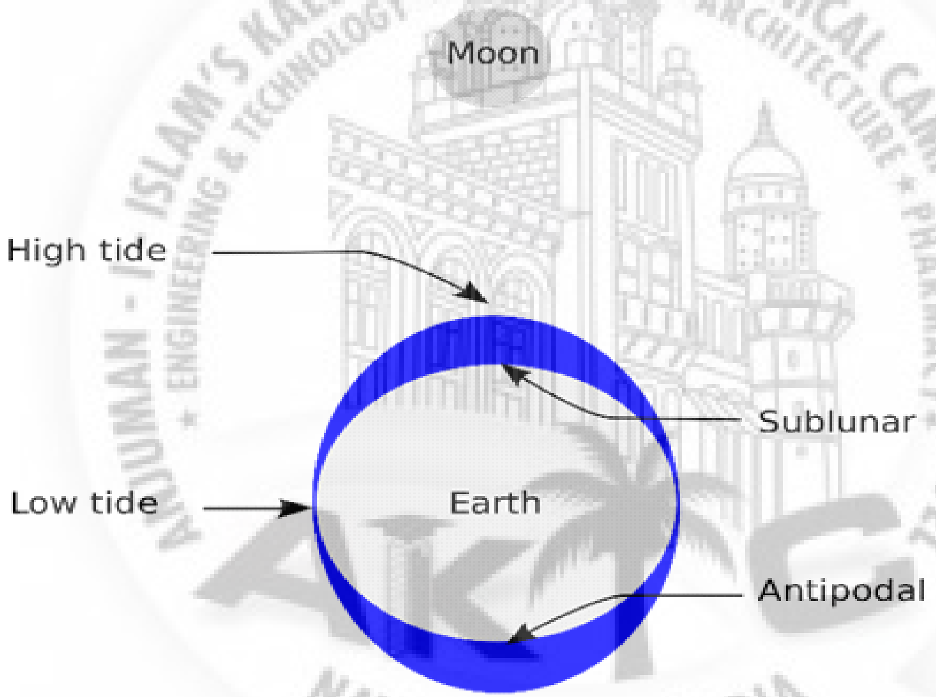



**Fig 1.1 Tidal layout**

## 1.2 Necessity

Tidal power is the only form of energy which derives directly from the relative motions of the Earth–Moon system, and to a lesser extent from the Earth–Sun system. The tidal forces produced by the Moon and Sun, in combination with Earth's rotation are responsible for the generation of the tides. Tidal power is the only form of energy which derives directly from the relative motions of the Earth–Moon system, and to a lesser extent from the Earth–Sun system. The tidal forces produced by the Moon and Sun, in combination with Earth's rotation, are responsible for the generation of the tides.

## 1.3Objectives

This project describes how tides develop in particular places and how the energy could be extracted by building suitable barrages. The principal features of a barrage and possible methods of operation are described in detail. Although a tidal power barrage would be non-polluting, the resulting changes in the tidal regime would have important environmental effects. These are discussed together with the economics of tidal power. Methods of assessing the likely cost of electricity from any site are set out and applied to possible sites around the world.

# 2. LITERATURE REVIEW

## 2.1 HISTORY

Humans have studied and exploited the tremendous power of the tides for millennia, believe it or not, tidal power is nothing new. In fact, most of what we use today to generate electricity, be it coal, solar, wind, or tide, was conceived of in the later part of the nineteenth century. In Europe, 'tide mills' show in fig 1.2 to turn millwheels for grinding flour and metal cutting that date back to the Middle Ages can still be found, indicating that this is a very old technology indeed. In Suffolk, England, there is a tide mill that dates back to 1170. The oldest known reference to a tide mill dates back to 787. The mill us a tiny canal and pond that is in land. As the tide changes the water flows in and out the canal and the mill would rotate.

**Figure 2.1 Tidal mill**

Forty years ago, the first tidal dams were constructed to convert tidal power into electricity. The first tidal power station was the Rance tidal power plant built over a period of 6 years from 1960 to 1966 at La Rance, France. It has 240 MW installed capacity Now, new energy technologies (NOT dams) that generate electricity from tidal currents could help produce as much electricity as the largest hydroelectric dams or nuclear and fossil fuel generating stations, without producing greenhouse gases or harming the environment.

**Figure 2.2 The first tidal power plant in Rance (France) also used as bridge**

## 2.2 Science behind tides

### 2.2.1 Effect of the moon on the ocean

Twice each day, thanks to a gravitational pull on earth from our rotating Moon and, to a lesser extent by the Sun on the world's oceans there are tides. Two high tide and two low tide the change of level of tide is like sine wave. The Earth's rotation is also a factor in the production of tides, the world's oceans produce powerful water currents and rising and falling tides. Gravitational force is force attractive force between two exerted on objects with certain mass Thus moon and the earth are attracted to each other but centrifugal force acting in the opposite balances the resultant force.

The ocean being viscous and free from land movement thus, the ocean experiences a separate gravitational force of the moon as given in equation.

**Equation of gravitation Force on the Ocean**

$G_1$ = the gravitational force exerted by moon

$G_2$ = the gravitational force exerted by water

M = Mass of moon

m = mass of water per molecule

$d_1$ = distance from Centre of moon

$d_1$ = distance from water

G = Total Gravity (Combine Gravity)

$G_1 \alpha m/d_2$………………………………….... (1)

$G_2 \alpha M/d$…………………………………….... (2)

$G = G_1G_2$…………………………………... (3)

Distance $d_1$ $d_2$ are the same as in diagram 1.4 by (1), (2) and (3)

$d_1=d_2=d$……………………………………... (4)

by (1), (2) (3) and (4)

$G \alpha m/d_1 \times M/d_2$

$G \alpha mM/d^2$………………………………..… (5)

Mass is constant (moon size does not change) Mass of water is constant by (5)

$G \alpha 1/d^2$ …………………………………... … (6)

Thus, the force gravity is inversely proportional the distance from the moon

Thus, water will experience force away or toward the moon depending on perpendicular line from earth centre and line from earth centre to the moon Fig 1.4

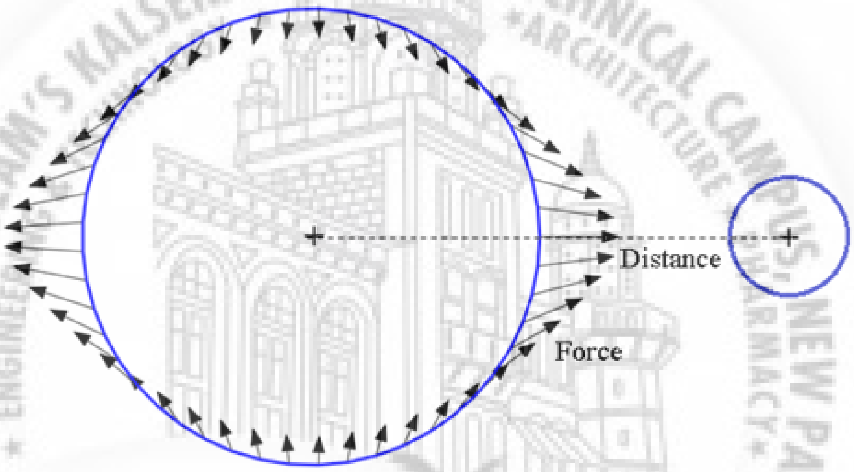
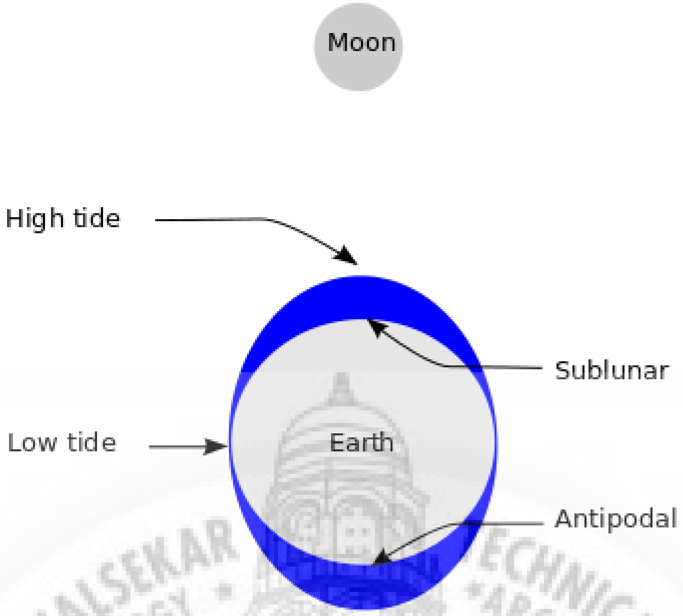



**Figure2.3 Tide generating force**




e

**Figure 2.4 The** resultant Tide

When the ocean closer to the moon, compared to earth experiences greater gravitational force there the water rises this is known as sublunary tide. Fig 1.5. When the ocean further to the moon, compared to earth experiences lesser gravitational force there the water rises this is known as antipodal tide. Fig.1.5. Whereas water which is at the same distance from moon as that from the centre of the earth, the lunar gravity differential field at the Earth's surface is known as the tide-generating force. This is the primary mechanism that drives tidal action and explains two equipotential tidal bulges, accounting for two daily high waters the tide generating force of the moon produce the resultant tide in the fig 1.5

## 2.2.2 Effect of the sun

The is sun has similar gravitational effect on earth but the force is lesser due to large distance from the sun

### A) Spring tides

During full or new moon, which occur when the Earth, sun, and moon are nearly in alignment average tidal ranges are slightly larger. This occurs twice each month. The moon appears new (dark) when it is directly between the Earth and the sun. The moon appears full when the Earth is between the moon and the sun. In both cases, the gravitational pull of the sun is "added" to the gravitational pull of the moon on Earth, causing the oceans to bulge a bit more than usual. This means that high tides are a little higher and low tides are a little lower than average. These are called spring tides, a common historical term that has nothing to do with the season of spring. Rather, the term is derived from the concept of the tide "springing forth." Spring tides occur twice each lunar month all year long, without regard to the season.

### B) Neap tides

Seven days after a spring tide, the sun and moon are at right angles to each other. When this happens, the bulge of the ocean caused by the sun partially cancels out the bulge of the ocean caused by the moon. This produces moderate tides known as neap tides, meaning that high tides are a little lower and low tides are a little higher than average. Neap tides occur during the first and third quarter moon, when the moon appears "half full."

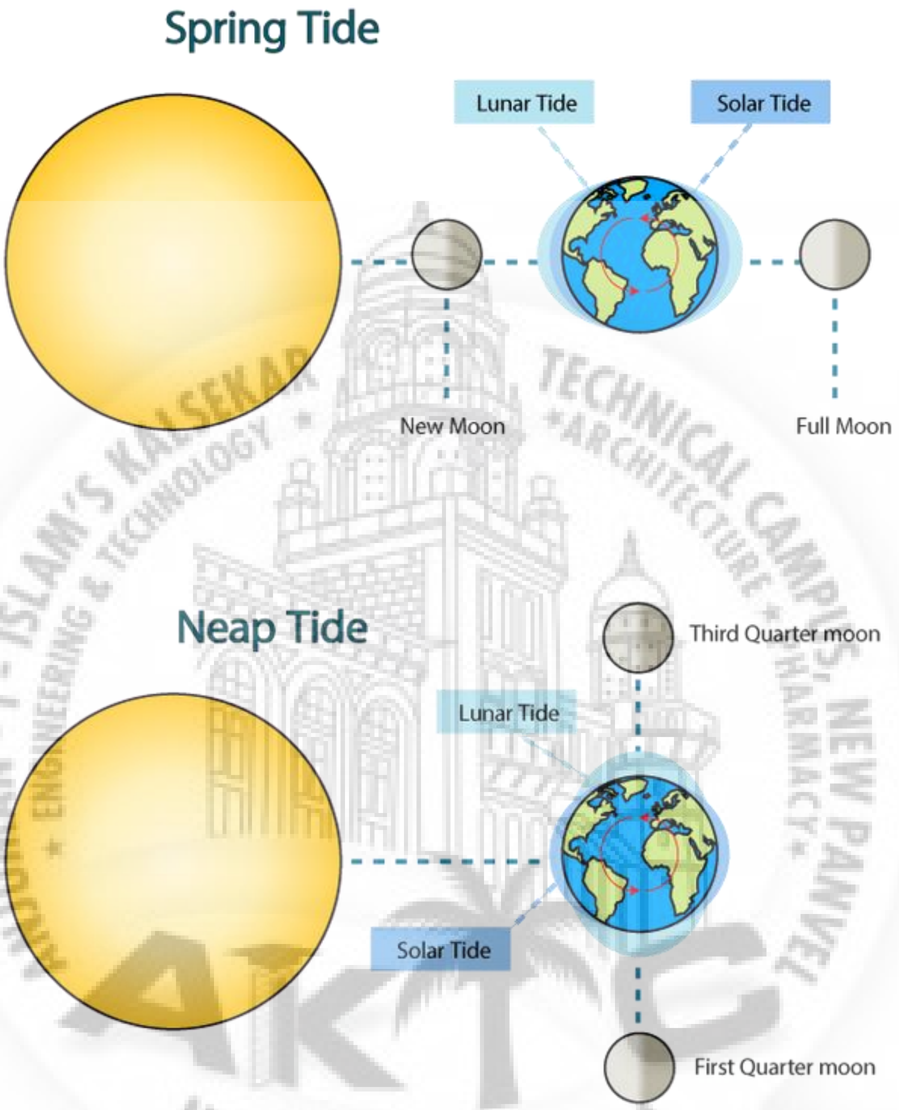



**Figure 2.5 Effect of sun one tide**

### 2.2.3 Tides as per location on the earth

As the moon and sun changes location the tides moves with these celestial objects. Thus, the tides of water or tidal currents flows throughout the earth but the earth's land mass and oceanic mountains blocks the current of tides producing different tides level or tidal range as per locations shown in figure 1.8. The location in which the difference maximum high tide to minimum low tide (or high peak to low peak) is 15m is favourable fig 1.7. Thus, states like Gujarat, Tamil Nadu and west Bengal are suitable for tidal power generation

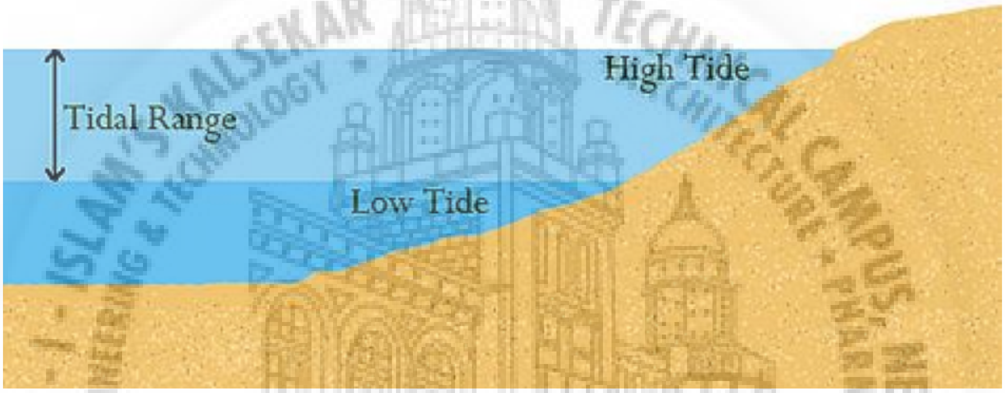



**Fig.2.6 Tidal range**

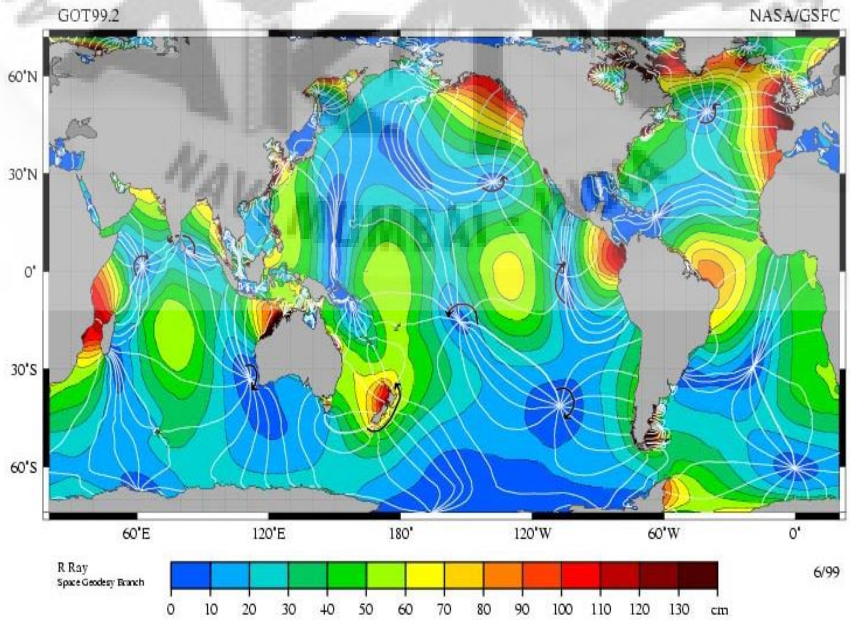



**Figure 2.7 Tide as per location in diagram indicates change water level in cm per hour**

## 2.3 Types of tidal power facilities

### 2.3.1 Tidal current turbine

Tidal stream generators (or TSGs) make use of the kinetic energy of moving water to power turbines, in a similar way to wind turbines that use wind to power turbines. Some tidal generators can be built into the structures of existing bridges or are entirely submersed, thus avoiding concerns over impact on the natural landscape. Land constrictions such as straits or inlets can create high velocities at specific sites, which can be captured with the use of turbines. These turbines can be horizontal, vertical, open, or ducted. Power is transferred through cables

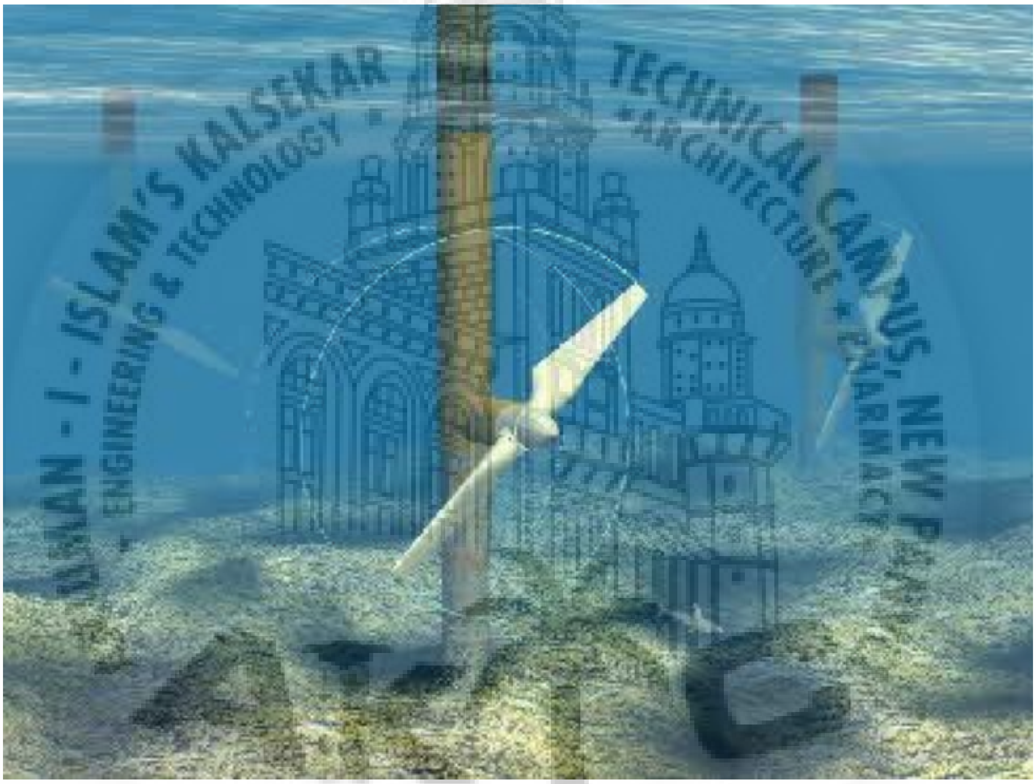


**Figure 2.8** Tidal current turbine

## 2.3.2 Dynamic tidal power plant

Dynamic tidal power or DTP is an untried but promising technology for tidal power generation. It would involve creating a long dam-like structure perpendicular to the coast, with the option for a coast-parallel barrier at the far end, forming a large 'T' shape as in figure 2.19. This long T-dam would interfere with coast-parallel tidal wave hydrodynamics, creating water level differences on opposite sides of the barrier which drive a series of bi-directional turbines installed in the dam. Oscillating tidal waves which run along the coasts of continental shelves, containing powerful hydraulic currents

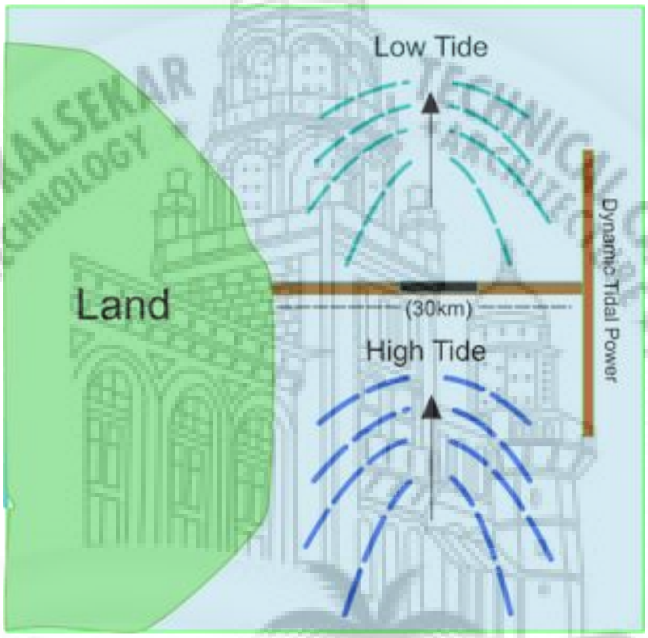



**Figure 2.9** Dynamic tidal power

# 3.SYSTEM DESIGN

## 3.1Basic construction of barrage style power plant

In very simple terms a barrage is built at the entrance of a gulf and the water levels vary on both sides of the small dam. Passages are made inside the dam and water flows through these passages and turbines rotate due to this flow of water under head of water. Thus, electricity is created using the turbines. A general diagram of the system is shown in Fig 3.2. What follows will be a description of a general tidal power station with its components. Also, many systems of power generation will be described. In Figure 3.1 the tide is blocked by barrage to create potential energy by opening the gate the water flows through turbine in form of kinetic energy and is converted into mechanical rotation for generator to generate electricity

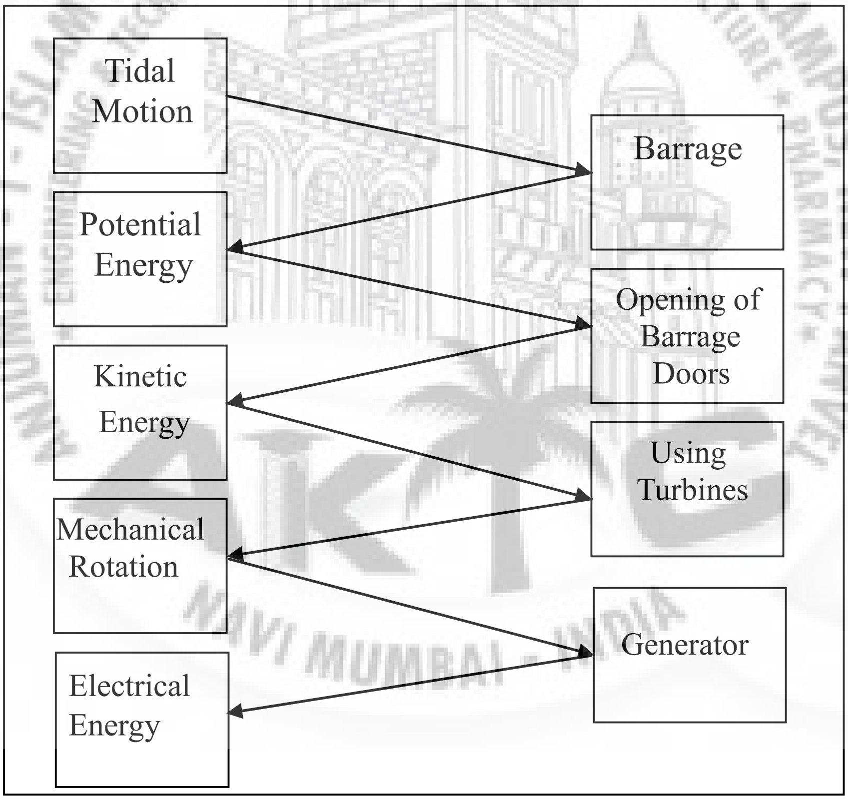



**Figure 3.1 Energy flow diagram**

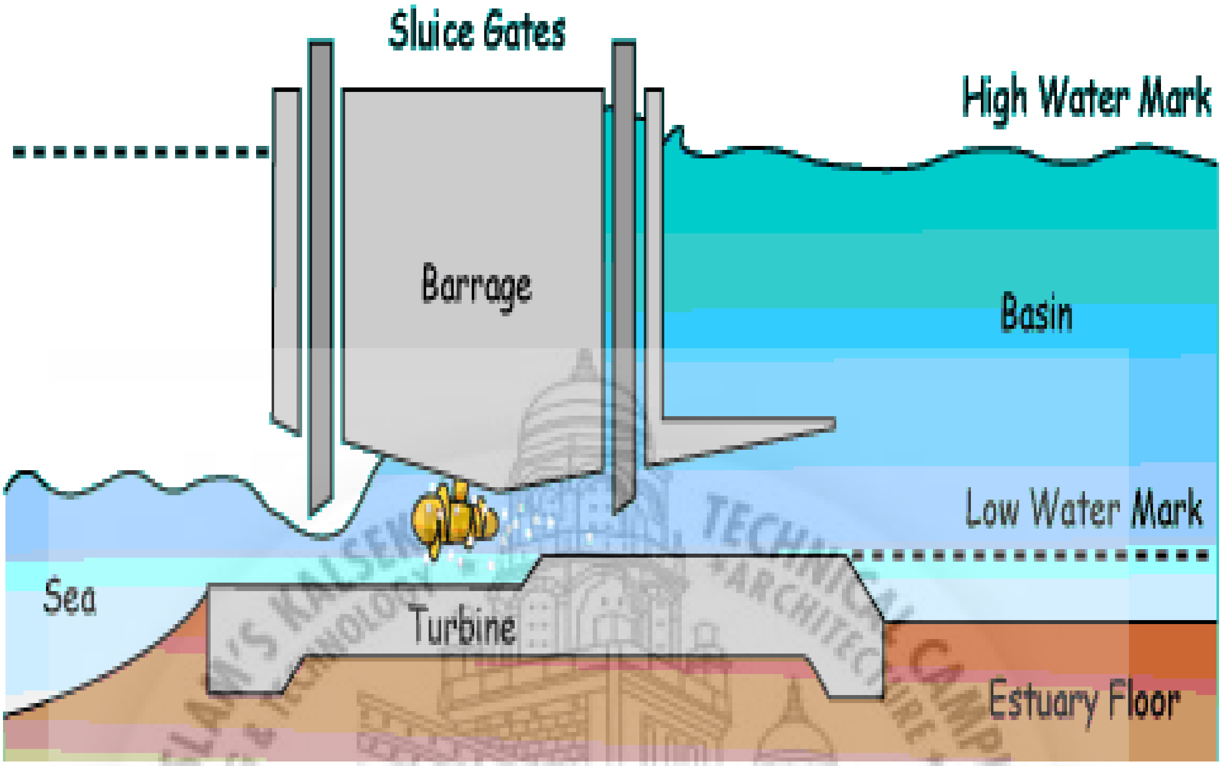



**Figure.3.2 General scheme of the tidal power station.**

## 3.2 Tidal barrage

Tidal barrages or dam make use of the potential energy in the difference in height (or hydraulic head) between high and low tides as shown in fig1.1. When using tidal barrages to generate power, the potential energy from a tide is seized through strategic placement of specialized dams. When the sea level rises and the tide begins to come in, the temporary increase in tidal power is channeled into a large basin behind the dam, holding a large amount of potential energy. With the receding tide, this energy is then converted into mechanical energy as the water is Barrages are essentially dams across the full width of a tidal estuary or creek.

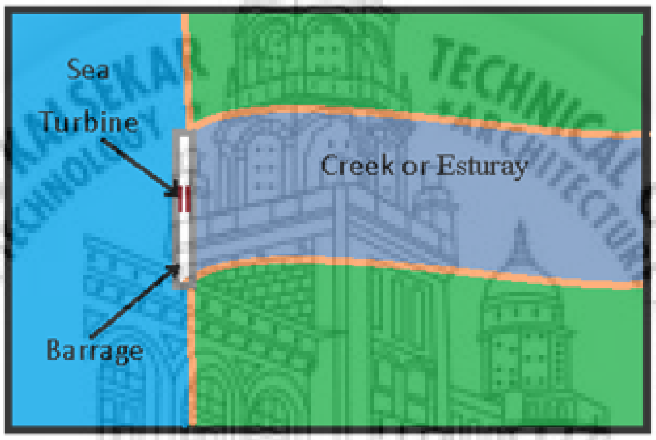



**Figure 3.3** Tidal Barrage

### 3.2.1 one way generation (Ebb generation)

Ebb tide is the falling tide. The basin is filled through the sluices until high tide in fig 1.2. Then the sluice gates are closed fig 1.3. (At this stage, there may be "Pumping" to raise the level further (Refer2.2.2Barrage Pumping). The turbine gates are kept closed until the sea level falls to create sufficient head across the barrage, and then are opened so that the turbines generate until the head is again low. Then the sluices are opened, turbines disconnected and the basin is filled again. The cycle repeats itself. Ebb generation (also known as outflow generation) takes its name because generation occurs as the tide changes tidal direction.

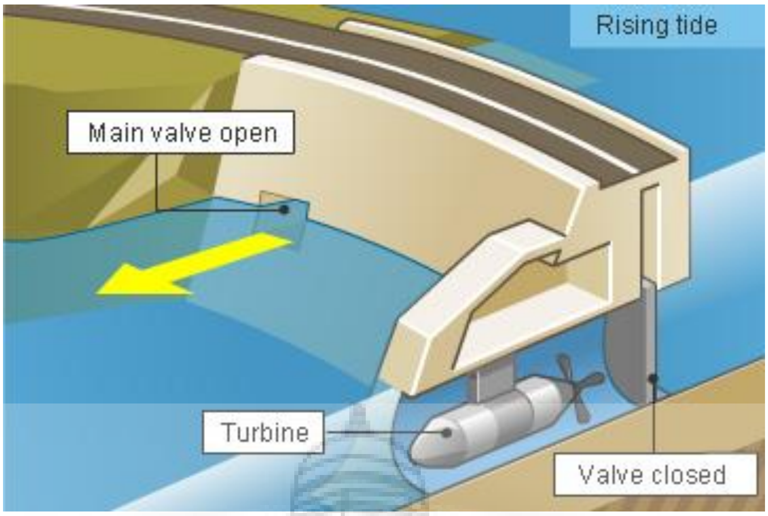



**Figure 3.4 Ebb Generation (Rising tide)**

### 3.2.2 Barrage Flood generation (one way generation)

This is opposite to Ebb generation. Flood tide is the rising tide

The basin is filled through the turbines, which generate at tide flood. And gate is open at low tide This is generally much less efficient than ebb generation, because the volume contained in the upper half of the basin (which is where ebb generation operates) is greater than the volume of the lower half (filled first during flood generation). Therefore, the available level difference – important for the turbine power produced – between the basin side and the sea side of the barrage, reduces more quickly than it would in ebb generation. Rivers flowing into the basin may further reduce the energy potential, instead of enhancing it as in ebb generation. Of course, this is not a problem with the model, without river inflow “lagoon".

### 3.2.3 Two-way Generation

We have seen above that both Flood Tidal Barrage and Ebb Tidal Barrage installations are “one-way” tidal generation schemes, but in order to increase the power generation time and therefore improve efficiency, we can use special double effect turbines that generate power in both directions. A Two-way Tidal Barrage Scheme uses the energy over parts of both the rising tide and the falling tide to generate electricity.

Two-way electrical generation requires a more accurate control of the sluice gates keeping them closed until the differential head height is sufficient in either direction before being opened. As the tide ebbs and flows, sea water flows in or out of the tidal reservoir through the same gate system. This flow of tidal water back and forth causes the turbine generators located within the tunnel to rotate in both directions producing electricity in figure 2.4 and 2.5.

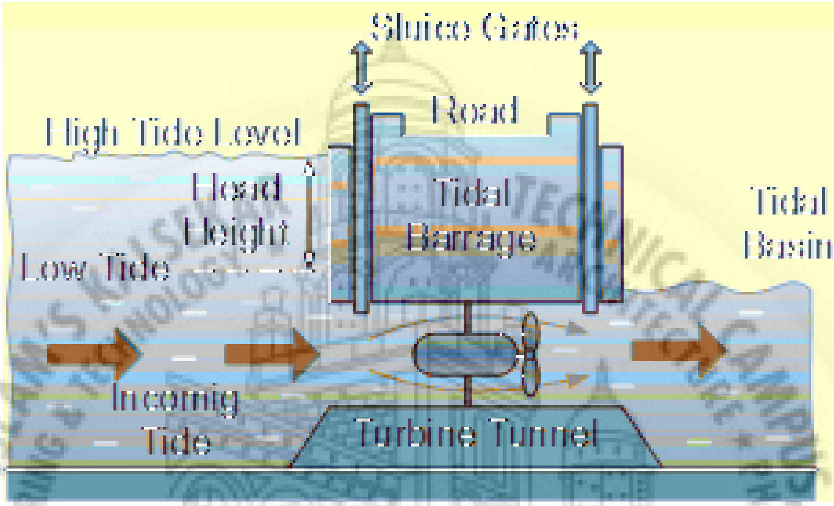



**Figure 3.5 Two-way Generation (Flood Generation)**

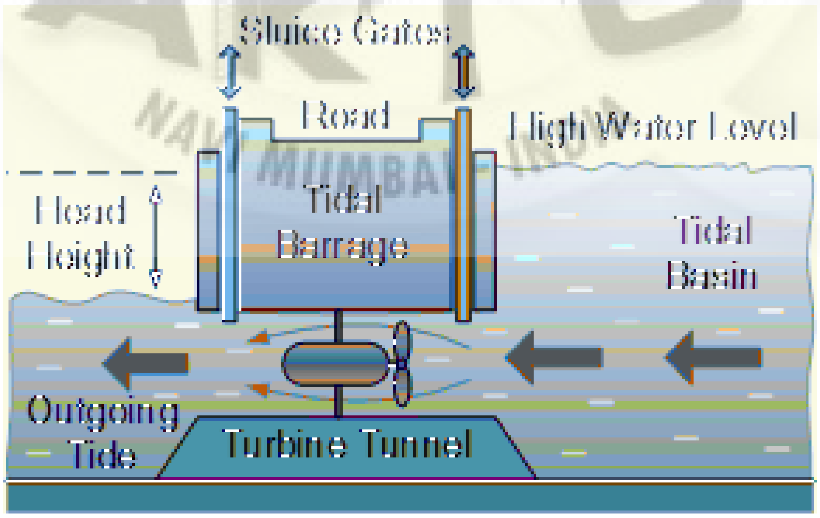



**Figure 3.6 Two-way Generation (Ebb Generation)**

However, this two-way generation is in general less efficient than one-way flood or ebb generation as the required head height is much smaller which reduces the period over which normal one-way generation might have otherwise occurred. Also, bi-directional tidal turbine generators designed to operate in both directions are generally more expensive and less efficient than dedicated unidirectional tidal generators. One way of improving the operating time and efficiency of a two-way tidal barrage scheme is to use individual one-way unidirectional tidal turbines inverted along the barrage.

By controlling their individual sluice gates, one set of turbines can be made to operate on the flood tide between points E - B in figure 2.6 and the other set operate on the ebb tide between points C - D. While this method increases the total number of tidal turbines located along tidal barrage, it has the advantage that the generation period is greatly extended.

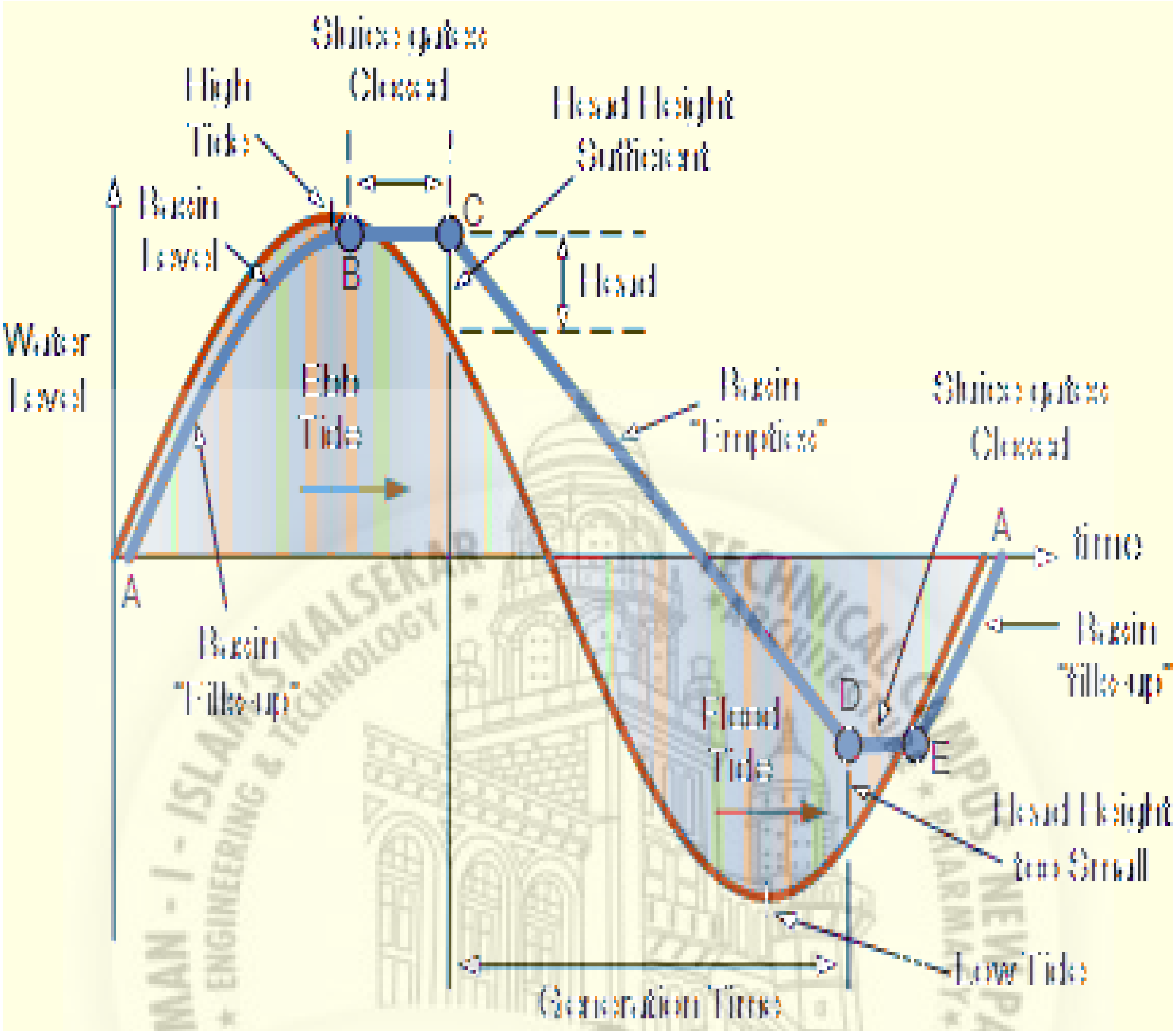



Figure 3.7 Graphical representation of two-way generation

## 3.3 Turbines

They are the components responsible for converting potential energy into kinetic energy. They are located in the passageways that the water flows through when gates of barrage are opened. The type of turbine used can be any of the current turbine given in the earlier chapter but is not suitable with a barrage

The best and the most efficient is the horizontal axis turbine. The shape of blade can vary from curve shape, plane shape or propeller shape. The problem with tidal barrage is the generator is also located under water thus creating problem for maintenance. The various type of generator- turbine sets is shown next

### 3.3.1 Bulb turbines

The most commonly used turbine is bulb turbine tidal power. In the Bulb turbine type the generator is place next to the turbine the appearance of this type of construction is like a bulb thus it is called bulb turbine. Bulb hanger are used to support generator as shown in Fig. 3.3 and 3.4 Bulb casing is used prevent losses in water flow and the distributor to equalize the pressure on turbine. This turbine type is difficult to maintain as water flows around them and the generator is in water.

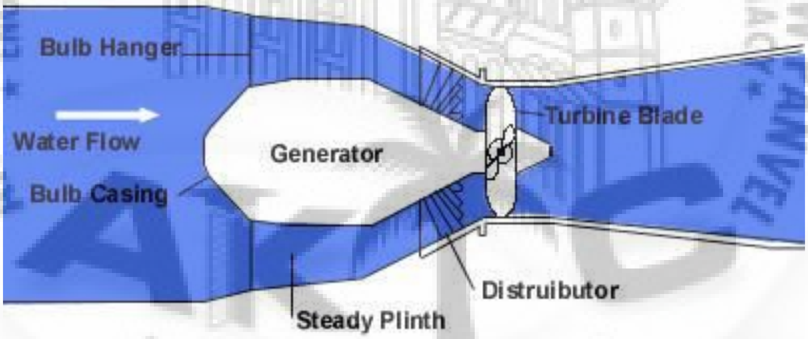



**Figure 3.8 Bulb turbines**

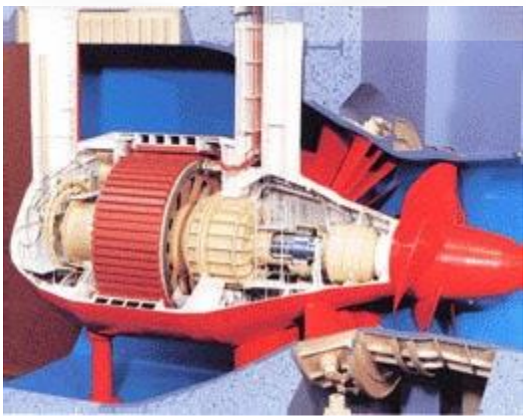


Figure 3.9 Bulb Turbines Cut Open

### 3.3.2 Rim turbines

In rim turbine, the generator is mounted at right angle to the turbine.as shown in fig 3.5 the turbine shaft is connected to the rods that are connected circular rotor case rotor connected around turbine the stator is fixed surrounding the passage way. Thus, these are better maintained than the bulb turbines but are hard to regulate as generator is fixed in barrage in figure 3.6 but pumping and power regulation is difficult.

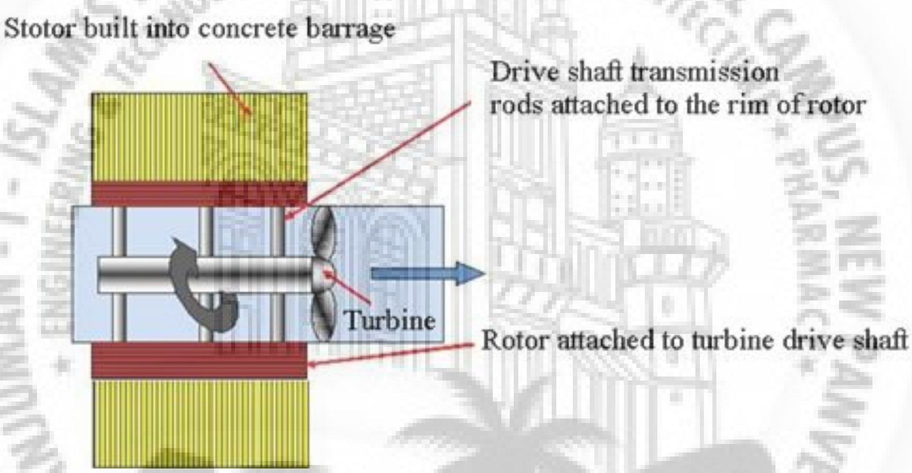



Figure 3.10 Rim Turbine Straflo Type

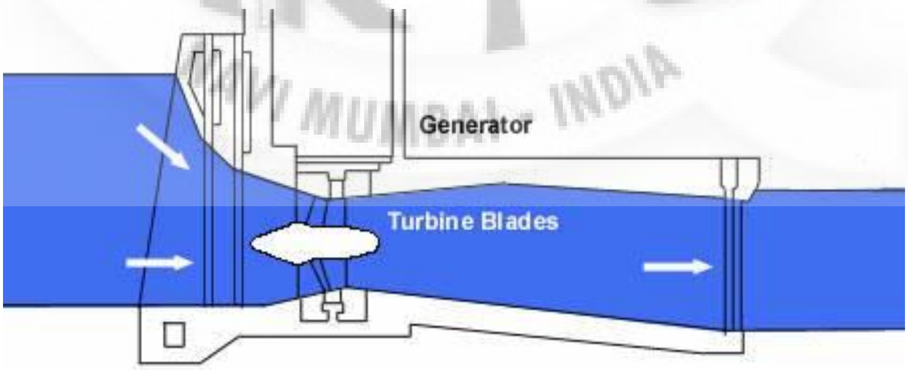



Figure 3.11 Rim turbines

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## 3.4 Sluices Gates

Sluice gates are the ones responsible for the control flow of water through the barrage they could be seen infig.3.1. It is made of a flat rectangular plate slide on slots. They can be manually operated or motor operated

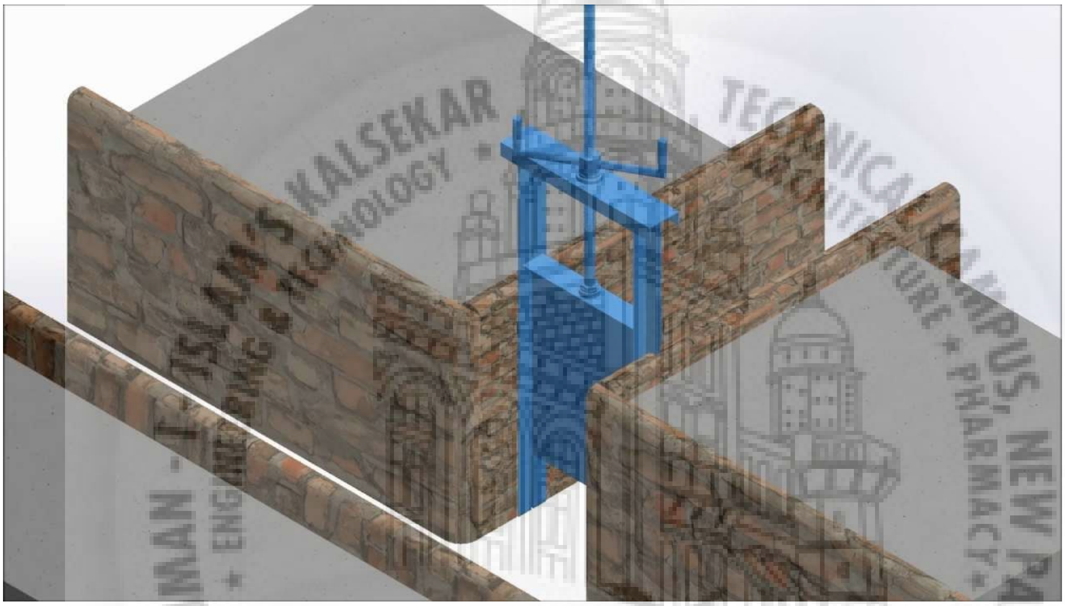


**Figure 3.12** Sluices Gates

## 3.5 Ship lock

A lock is a device used for raising and lowering boats, ships and other watercraft between

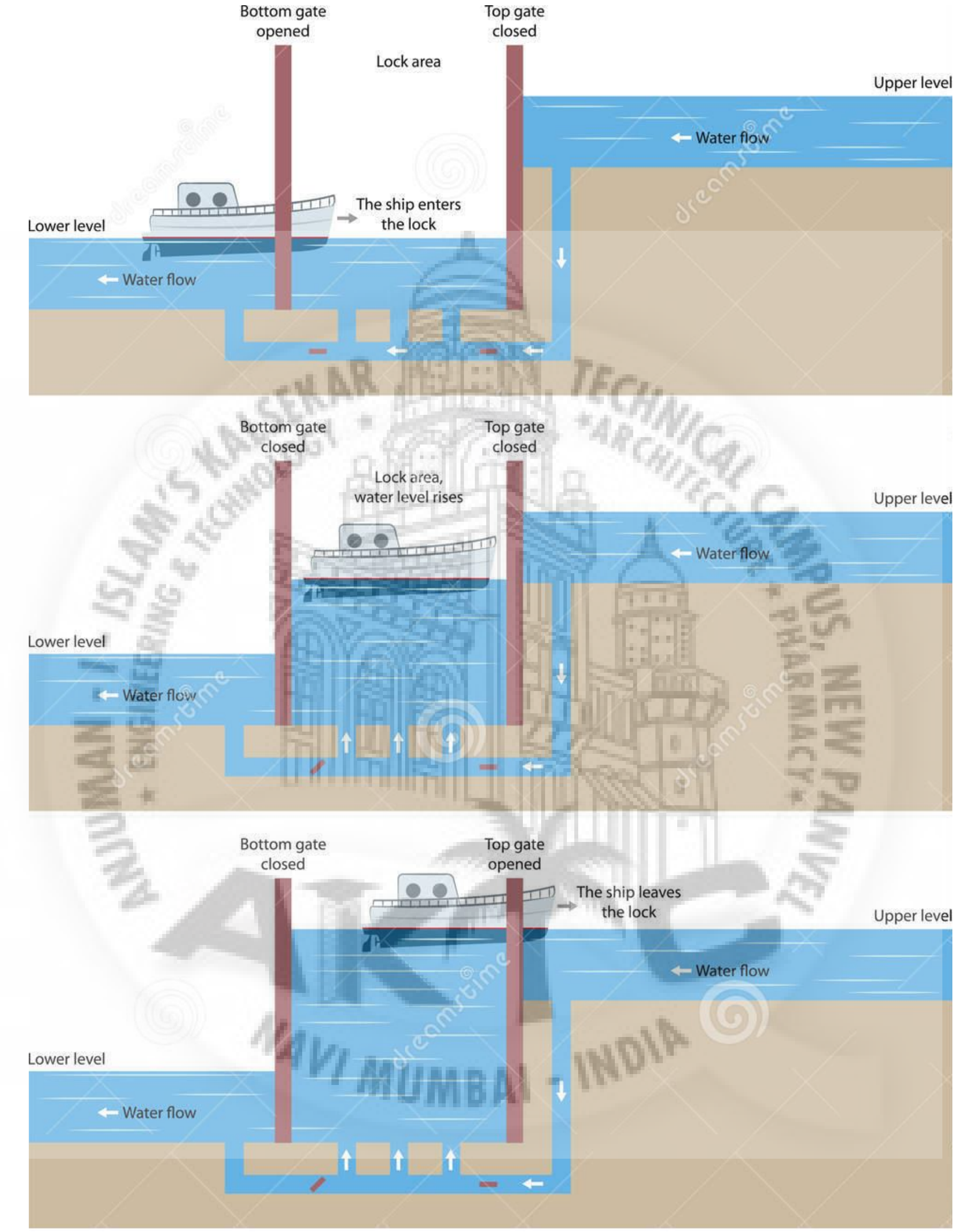



**Figure 3.13** Ship Lock operation

stretches of water of different levels on river and canal waterways. The distinguishing feature of a lock is a fixed chamber in which the water level can be varied.

## 3.6 Embankments:

They are caissons made out of concrete or some times of rock to prevent water from flowing at certain parts of the dam and to help maintenance work and electrical wiring to be connected or used to move equipment or cars over it. A caisson foundation also called as pier foundation is a watertight retaining structure used as a bridge pier, in the construction of a concrete dam These embankments are shown in Fig 3. 9

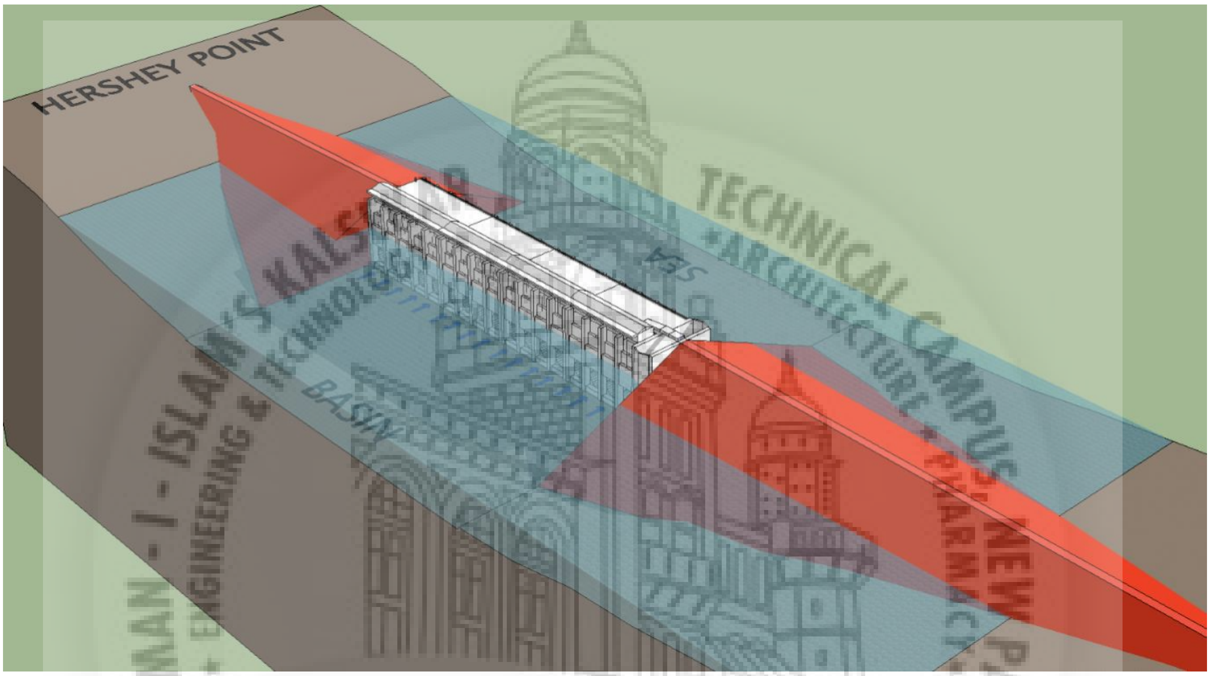



**Figure 3.14 Embankments**

## 3.7 Construction of tidal lagoon

Construction techniques are proposed that use dredged sandy materials from a relatively thin layer the sea bed within the lagoon, which are then hydraulically filled into long geotextile casings known as Geotubes On top of these Geotubes and compact sand fill are placed small rocks and on top of this the larger rock armour to protect against degradation in figure 3.10.

The generating equipment of bulb hydro turbines have been used for many years on run-of-river hydro power schemes as well as some landmark tidal barrages. The hydro turbines are mounted inside concrete turbine housings and are permanently submerged so the resulting view is of a ring-shaped harbour wall with one section of concrete casing. The proposed turbines will have a runner diameter (span of the turbine blades) in the region of 7m and will be permanently submerged below the low water level in Swansea Bay.

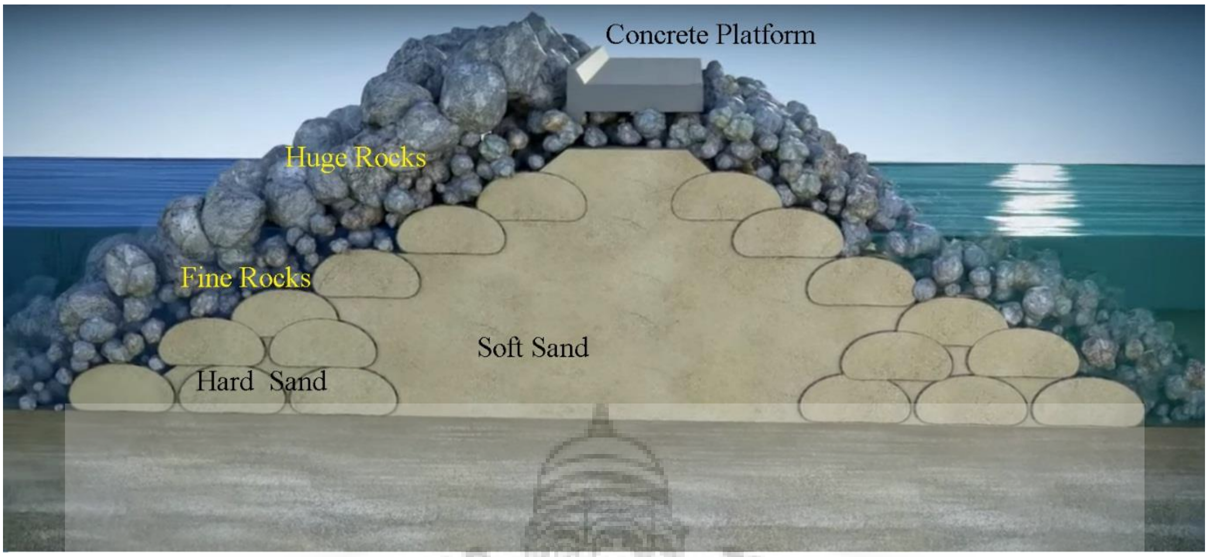



**Figure 3.15 Lagoon wall side view**

**Figure 3.16 Lagoon wall side view**

# 4. Overview of Project Model

## 4.1 Objective of Prototype Project Model

Our project is a working model of tidal power plant. The project represents a two-way tidal barrage or tidal lagoon, which is explained in earlier chapter. Two-way generation that is it can generate power both at high tide and low tide. Two-way generation is commonly not used for barrage since most of the constructed barrages have rivers on one side. A river reduces the efficiency of two generation because during flood generation the water at the river side should be low so that when high tide occurs there will be high difference. However, the river fills up the water at the river side of the barrage. Thus, one way generation is preferred at river site. Two-way generation is tried at very few places in the world. Two-way generation is efficient a t non-river barrages in fact its power output is higher than one way generation. Two-way generations also used for lagoon tidal power plant.

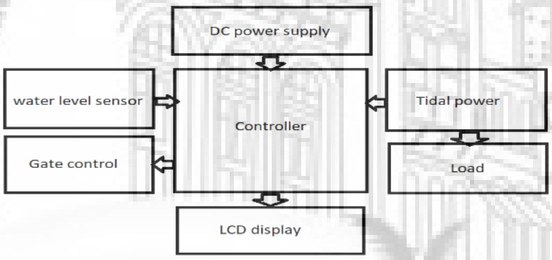



**Fig.4.1Block diagram of Project Model**

## 4.2 Construction & Operation of major Equipment used in Model

### 4.2.1 Partition

Partition represents barrage in the project. The model is divided into two section with a partition. The partition was not fixed during the construction since the size of the hole for the turbine could only be decided after testing. Tiny slots were placed at the centre of both side and bottom of the tank. Temporarily a wooded plank was used for partition.7cm diameter hole gave the best result. Thus, a hole of diameter 7cm was laser cut 2cm from bottom. Then the partition is fixed.

4.2.1 Partition of Model

## 4.2.2 Sluice gates

Sluice gate" refers to a movable gate allowing water to flow under it. When a sluice is lowered, water may spill over the top, in which case the gate operates as a weir. Usually, a mechanism drives the sluice up or down. This may be a simple, hand-operated, chain pulled/lowered, worm drive or it may be electrically or hydraulically powered. Here we have made the sluice gate with the help of DVD drive. This sluice gate allow water to flow through the turbine and generate electricity. The gate allow the basin to fill on the incoming high tide and the empty through the turbine system on the outgoing tide. Each time when water passes through barrage, turbine spins and the electricity generated.

**Fig.4.2.2 Sluice Gates of Model**

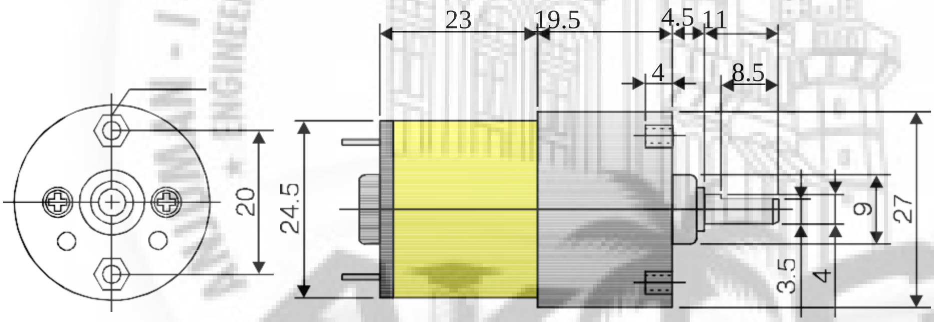
### 4.2.3Turbine

In the Model Turbine pleased horizontal in between the sluice gate. Turbine is mechanical device which converts kinetic energy from water into mechanical rotation to give input power for dc generator. This turbine blades are made by plastic & that blades look like plastic spoon. These blades connected to the one circular plastic as shown in the model. The turbine placed horizontal because we need to rotation of turbine both Tides that is High tide & Low tide we get power 2.5watt to 5watt.When starting the 230v supply then sluice gate open, then start throwing water through the pipe by hand on the turbine blades after water logging activate the sensors & turbine will be start rotating then we get energy by the HT similarly for the LT we get double power from both side. In water having a kinetic energy & by the help of turbine rotation that energy will be converted into mechanical energy and this energy save in the generator power house. If there is no energy that time you can use this saved energy from the power house.

**Fig.4.2.3 Turbines of Model**

### 4.2.4 Motor

I. OUTER DIMENSIONS




II.SPECIFICATIONS

1. Testing Conditions: Temp: 25° Celsius Humidity: 60%
   Motor Orientation: Horizontal
2. Rated Voltage: 12vdc
3. Voltage Operating Range: 6-12vdc
4. Rated Load at 12vdc: 400g Do not exceed rated load. Damage may occur!
5. No Load Speed at 12vdc: 290 RPM + /- 10%
6. Speed at rated load(400g-cm):251rpm+/-10%

### 4.2.5 Soldering on PCB

Cleaned the component legs and PCB with sandpaper before soldering as oxide layer on PCB results in cold solder. Then followed the steps below:

- Use connectors for easy connections. Always mark the positive and ground side with marker.
- Use standard coloured wires for making supply and signal connections. Red for positve and black for ground preferred.
- Choose wire size as per the standard wire guage (SWG). It depends on how much current flows through it.
- Preferably use multi strand wires for soldering as single strand wire breaks up while handling PCB.
- While insering jumpers, you can use single strand wires with insulation. Advantages are, it prevents rusting in long run and accidental shorting of components.
- You can check your soldering by trying to pull out the wires after wiring.
- Use the continuity test (using multimeter in diode mode) to make sure the adjacent pins of IC's are not shorted while soldering.
- Clean the flux between pins

### 4.3 Overall List of Equipment

| Sr no | Quantity | Items |
|---|---|---|
| 1 | 1 | Plastic model |
| 2 | 1 | Metallic model |
| 3 | 2 | DVD RAM |
| 4 | 2 | Float sensor |
| 5 | 1 | Voltage sensor |
| 6 | 1 | Power cable |
| 7 | 1 | Switch |
| 8 | 1 | Transformer 230v-12v 1A |
| 9 | 2 | LED |
| 10 | 2 | LCD display & cable |
| 11 | 5 | Scrow connecter |
| 12 | 4 | Diode 1n4007 |
| 13 | 1 | Voltage regulater 7812 |
| 14 | 1000 uf :5 & 100uf:3 | Capacitor |
| 15 | 1 | Resister |
| 16 | 1 | Motor driver 1293d |
| 17 | 1 | Aurdino uno |
| 18 | 1 | PCB |

# 5.CONCLUSIONS

## 5.1 Conclusions

Tides play a very important role in the formation of global climate as well as the ecosystems for ocean habitants. At the same time, tides are a substantial potential source of clean renewable energy for future human generations. Depleting oil reserves, the emission of greenhouse gases by burning coal, oil and other fossil fuels, as well as the accumulation of nuclear waste from nuclear reactors will inevitably force people to replace most of our traditional energy sources with renewable energy in the future. Tidal energy is one of the best candidates for this approaching revolution. Development of new, efficient, low-cost and environmentally friendly hydraulic energy converters suited to free Snow waters, such as triple-helix turbines, can make tidal energy available worldwide. This type of machine, more over can be used not only for multi-megawatt tidal power farms but also for mini-power stations with turbines generating a few kilowatts. Such power stations can provide clean energy to small communities or even individual households located near continental shorelines, straits or on remote islands with strong tidal currents.

## 5.2 Future Scope

As given in the table 5.1 there are some tidal power plants with similar capacity to that of conventional thermal power plants these power plants are tried and tested. And is found be reliable and ready to accepted by the market. Many countries have proposed the possibility of construction of tidal power plant as given in the table 5.2 and the Map figure 5.1 shows the places with the best potential for tidal power. Thus, the world has huge potential for tidal power generation. And Tidal energy could be the primary source of energy in the future.

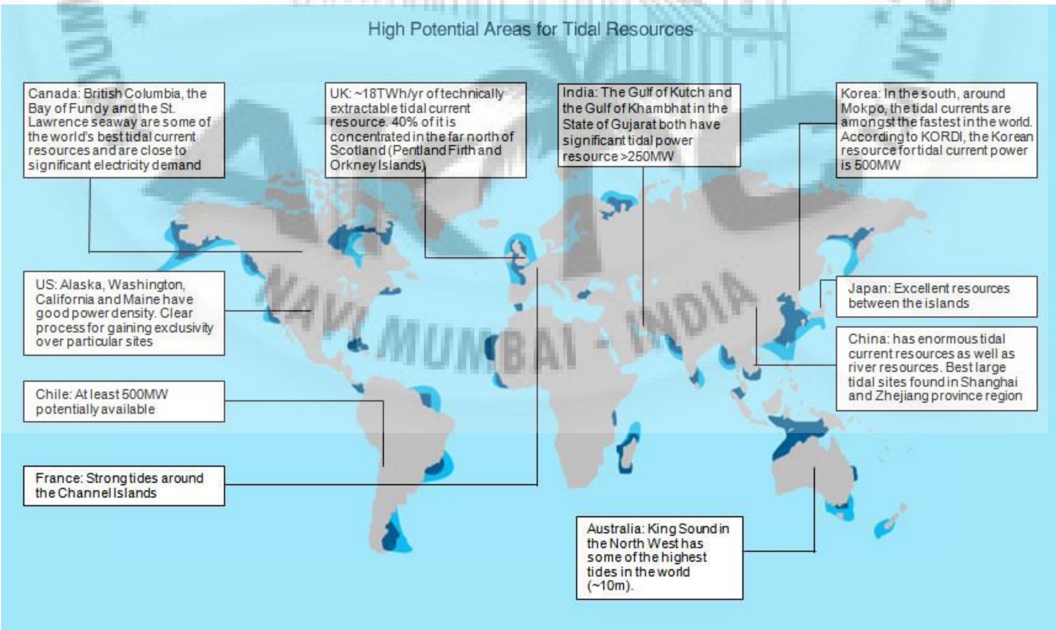



**Figure 5.1** Map showing the places with the best potential for tidal power.

### 5.2.1 Probable sites in India

The states of Gujarat, Tamil Nadu and West Bengal are favourable for tidal energy. Whereas Gujarat is the chief of all of them

1) **Gulf of cambay:**

The range is 10.8m. Some of the sites on western banks are Sonari and Bhavnagar creek and sites on eastern bank are Dhodar and Kim river outfalls. His potential estimate is around 15MW. The major problem is high sliy index. 5000ppm causing erosion of barrage.

2) **Gulf of Kutch:**

The maximum range is 7.5M. Lara creek and Wank creek near Navlakhi are of attraction. Power potential is greater than Cambay. Slit charge is much smaller than Cambay.

A 50 MW tidal power project, proposed to come up in Gulf of Kutch, Gujarat, India. The proposed project will be Asia's first commercial scale tidal power plant. The project's developer is Singapore-based Atlantis Resources Corporation. The 50 MW project is estimated to cost around Rs450-500 crore. The project can be completed within 18-20 months and can be scaled to more than 200 MW capacity

3) **Sundarban area in West Bengal:**

The tide range 4.8m. Power of 40MW can be produced in this area.

4) **Tamil Nadu:**

Tamil nadu has strict of manar at the coast that has huge tidal currents. A current turbine is prefect for that area

## 5.3 Advantages

1) Exploitation will in no case make demand for large area of valuable land, because they are on bays.
2) It is free from any pollution as it does not use any fuel.
3) It is much more suitable than hydropower plant as it is independent of rain.
4) It is independent on season cycle.
5) It has unique capacity to meet the peak power demand effectively when it works in combination with thermal or hydroelectric.
6) Tidal power is a Renewable resource
7) More efficient than wind because of the density of water
8) Predictable source of energy vs. wind and solar
9) High capacity depending on location



## 5.4 Limitations

1) Can only be developed if natural sites are available.
2) Transportation cost is more as sites are away from the load center.
3) The navigation is obstructed (For ships and boats).
4) The output is with varies with lunar cycle.
5) Capital cost is considerably high.

## 5.5 Applications

1) Tidal Electricity – Like other forms of Energy, the main usage of Tidal Energy is in the generation of Electricity.
2) Grain Mills – Tidal Energy has been used for hundreds of years.
3) Tidal Barrage- Rance Tidal power Station in France opened 1966(World first and Largest Tidal power station until the one in Korea is installed.
4) Stream Generator-Seagan in Strangford Lough in the U.K.
5) Tidal Lagoon-Swansea by Project Construction is scheduled for Completion in U.K by 2017.

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