

## **Overview**

- **Hydraulic Turbines (water wheels) have been in use for centuries.**
- **Hydraulic Turbines convert the potential energy of water into work.**
- **Basic Turbines are either Reaction or Impulse.**
- **First developed in the mid 1800's.**
- **Power outputs range up to 1,000 Mw.**
- **Included are Tidal and Wind Turbines.**

## Early Hydraulic Turbines

Amount of power depended on wheel diameter and height of water.

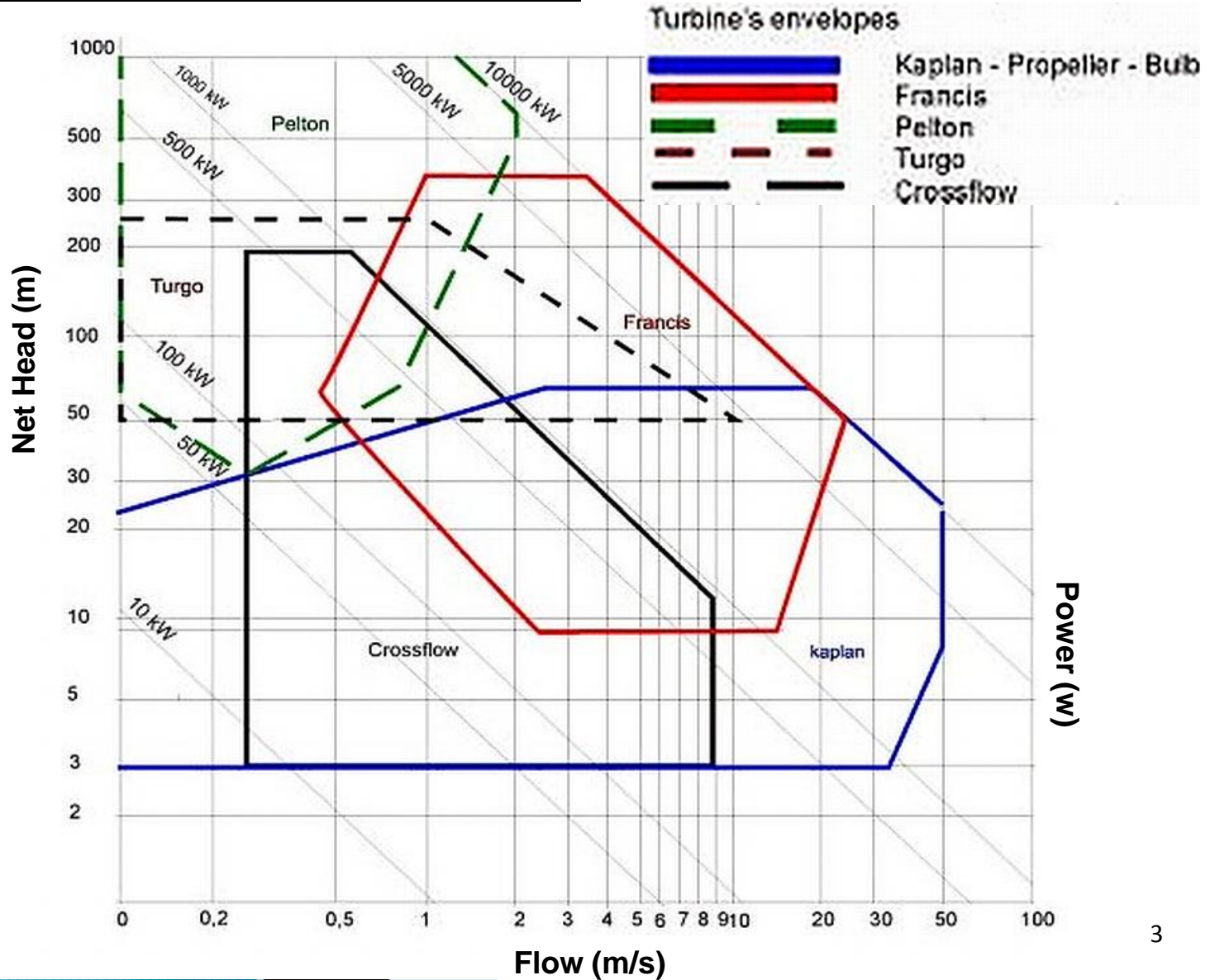


**Undershot Style**



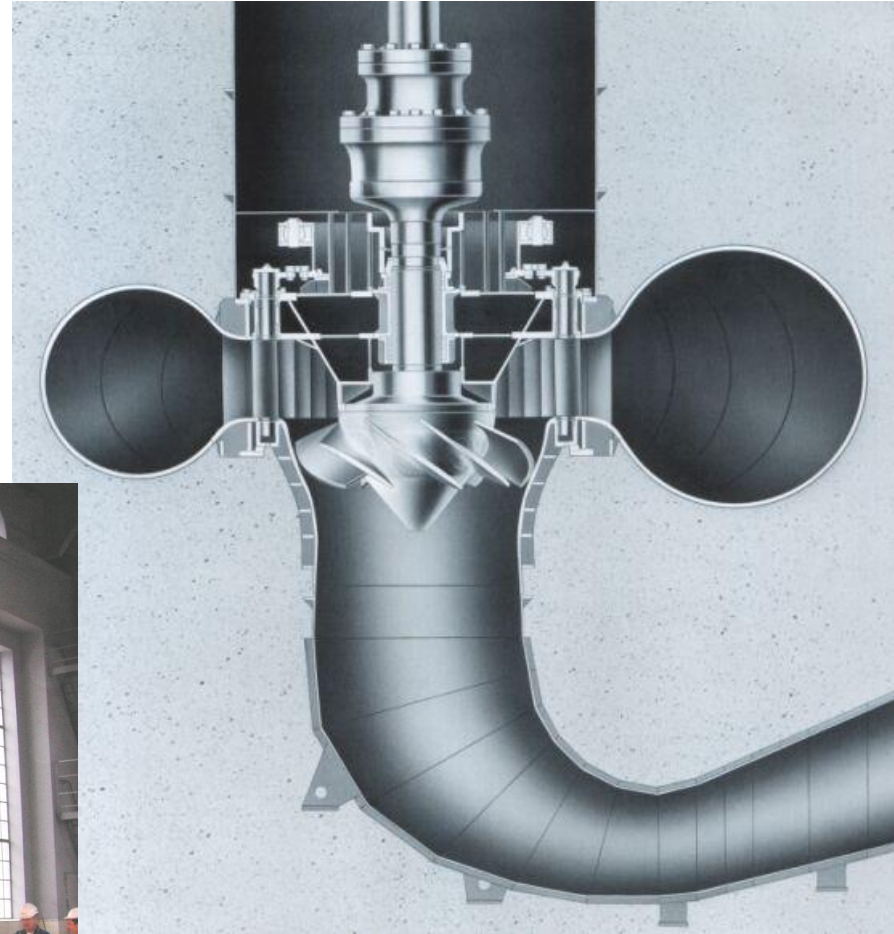
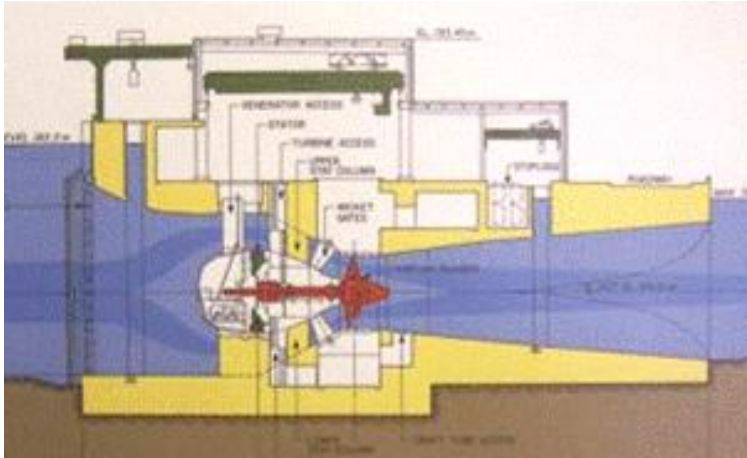
**Overshot Style**

# Hydraulic Turbine Types



## Section 3.5 – Hydraulic Turbines

# Hydraulic Turbine – Kaplan - Reaction



**Propeller**

**Bulb**

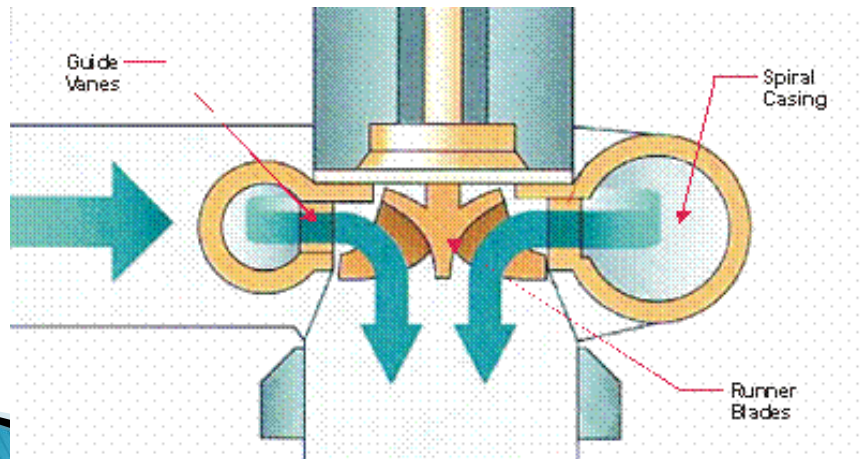
## Section 3.5 – Hydraulic Turbines

# Hydraulic Turbine – Francis - Reaction



**Volute**

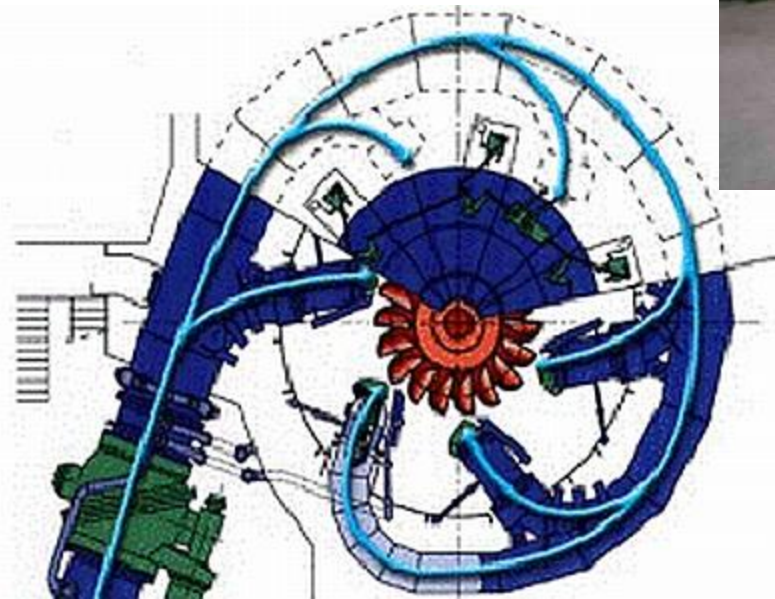
**Runner**



**Configuration**

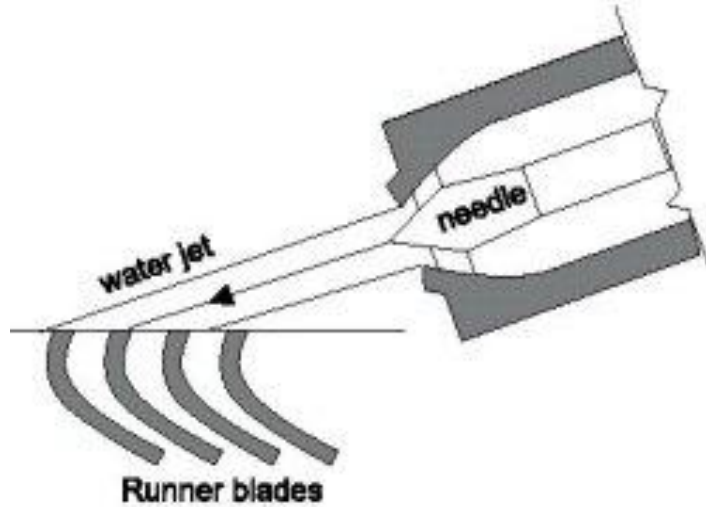
## Section 3.5 – Hydraulic Turbines

# Hydraulic Turbine – Pelton - Impulse



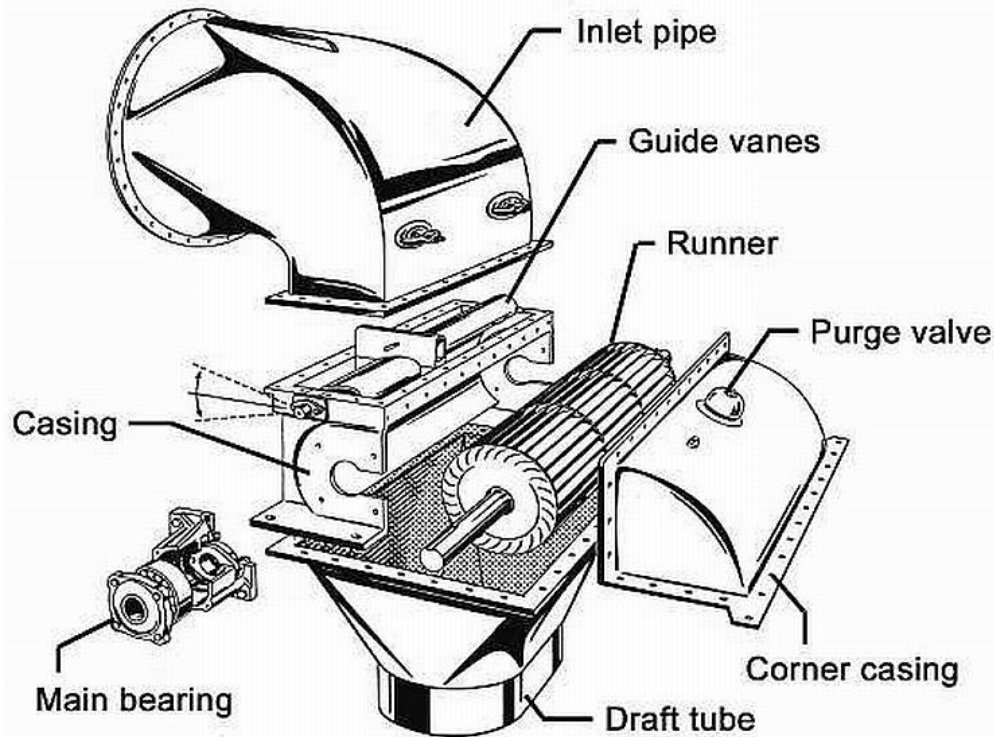
## Section 3.5 – Hydraulic Turbines

# Hydraulic Turbine – Turgo - Reaction



## Section 3.5 – Hydraulic Turbines

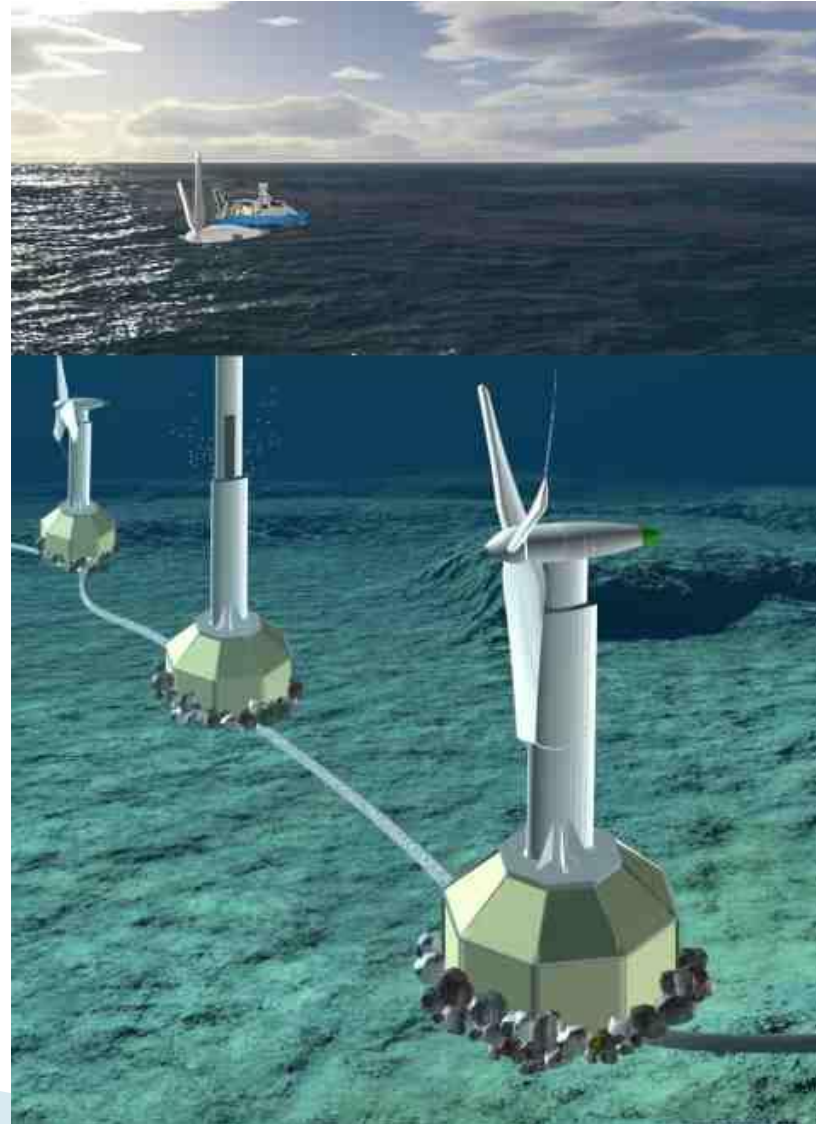
# Hydraulic Turbine – Cross-flow - Impulse



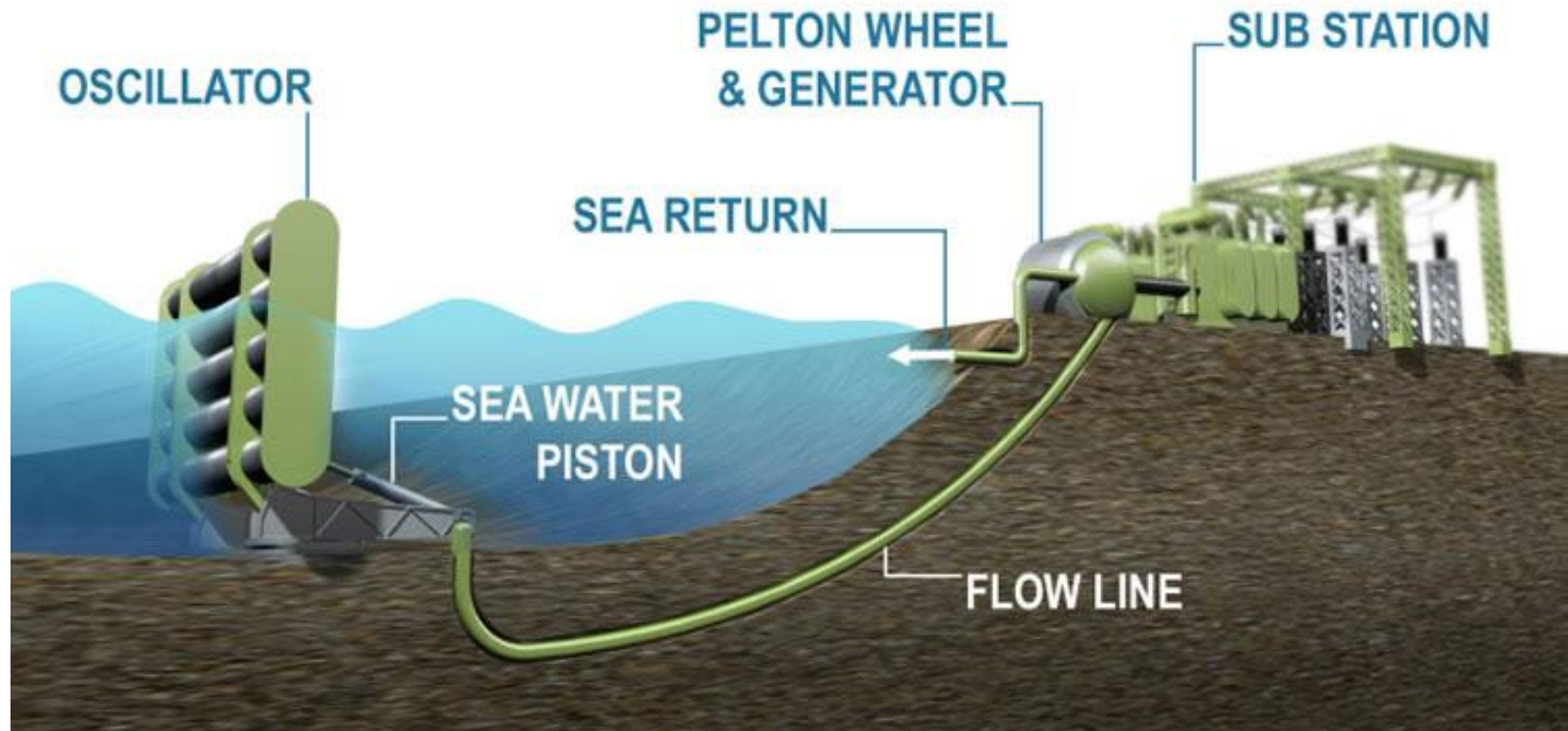


## Hydraulic Turbine – Tidal Power

**Water Flow  
In and Out**



## Hydraulic Turbine – Wave Power



**Wave Height**