

A Typical IMW Hidro+ module

Equipment Description	Quantity
Water Tower / Reactor and Dimension	13 Reactor Towers each 2.75m in diameter x 12.5m in height. Each Reactor consists of 2 capsules and 1 Hammer
Buoyant Capsules	65 (5x 225kVA)
Weight / Hammer / Rotor Δ	65
Reverse Thruster (RTPE) Chambers	65
Rack and Pinion Geared Wheels / Hydraulic / Pneumatic Cylinders [* if applied]	65
Stator-Banks Δ	65 (only applicable when Rotor or Translator is used)
Generators if applied (*)	5
High Voltage Switchgears	1
Low Voltage Power Supply	5
PLC based control panel	1
Area required	750m ² (excluding provision for sub-stations)
Lighting	Night lighting by the movement of Weight/Rotor across the tower.
Capital Cost	Budget at USD2million/MW. Excluding site and site works, interconnection, engineering and technical services
Cost of Production	USD0.01cents/kWh reflected as costs for equipment replacements and relevant trades.

Hidro+™ Technology Engineering, Energy and Mass Balance.

The technology Energy and Mass Balance is represented as $E_i + E_c = E_o + Acc.$

[Nett Electrical Energy Output = $E_o - E_i - Losses$]

Where:

E_i = Energy Input; being actual external power used or parasitic energy/load.

E_c = Energy Conversions; being converted nature-energy into potential energy.

E_o = Energy Output; being the nett electrical energy generated.

Acc = Accumulation Energy; being other energy converted and/or losses due to mechanical friction and drag.

The Potential Energy of the Weight is $E = M.G.H$ (refers as PE on free-fall which later converted onto F or Thrust Force; and PE converts into Kinetik Energy).

Where;

E = Potential Energy in Nm (Joule); and the Rate of work is $J/s = \text{Watt (W)}$.

M = Mass of Weight in Kg.

G = Acceleration due to gravitational force 9.81 m/s^2 .

H = Tower height in metres.

The Weight Freefall Velocity from the top of the tower is derived from $V = a \times t$; and $t = \text{SQRT} 2S / a$

Where:

V = Terminal Velocity (neglecting air resistance) in metres/second (m/s).

a = Acceleration due to gravity 9.81 m/s^2 .

t = Time in seconds.

S = Flight distance in metres.

The Thrust created by the Weight on impact or at the start of stator-bank (distance $[d]$ in meter) is $F = PE/d$; which gives the total Thrust in Newton (N). The Thrust (N) \times Velocity (m/s) = Watt (W) of power. These formulas are in accordance with Newton's 1st and 2nd Laws. This is Energy Generated or Energy Output (E_o) at a rate of per second on a full power-cycle of 17 seconds.

Power created by Rack and Pinion geared arrangement is $P = W \times T [2\text{Phi} \times N \times T]$

Where:

P = Power in Watt (W).

$\text{Phi} = 3.14$

N = Revs/sec

T = Torque in Nm

W = Radians/sec.

The Buoyancy energy converted is based on density of the water being $1,001 \text{ Kg/m}^3$ and the Deep-Water Pressure energy converted is based on 10 kPa (10 kN/m^2) per One (1) meter of water depth; thus in a water tower of 20m in height the pressure gradient is 200 kPa at the bottom of the tower. These figures are in accordance with Archimedes Principles.

The Drag in water is $E = \{C \times \text{Rho} \times \text{Area} \times V^2\}/2$ in Newton (N) of pressure force. This drag is substantially avoided as Buoyant's relatively low velocity flights.

Where:

C = Coefficient of material specific.

Rho = Density of medium (water).

A = Projected area of the object in medium.

V = Velocity of the object in medium.

The Hidro+™ World Patent Pending includes the unique “Reverse Thruster Pressure Equalizer [RTPE]” system that allows air inflation at the bottom of the tower to be “assisted” where higher pressures (pressure gradients resulting from varying heights) within the tower are introduced in the RTPE chambers, equalizing the high pressure that is to be overcome in the air transfer cylinder). Parasitic energy on this instance, as well as on instrumentations and controls, is thereby greatly reduced.

The Energy Input (Ei) is: $P = F \times Va$ (Nm/s) being displacement of the piston at the air transfer speed in Watt (W) of electrical power, which represents approximately 10-21% of Power Generated as parasitic load which includes mechanical losses.

The air transfer flow rate designs vs required is defined using Bernoulli's equations $P = V^2 / 2g$ and Air transfer in Duct is:

$$Q = A \times Vt.$$

Where:

P = Head in metres.

Va = Flow Velocity in m/s.

G = 9.81 m/s².

Q = Quantity of Air in m³.

A = Effective Area of Duct in m².

Vt = Velocity of Air transfer in m/s.

The Nett Energy Output and Plant Efficiencies described in table below:

Nett Plant Performance Efficiencies (*) = excludes potential energy conversions; includes parasitic losses.	Percentage
Actual Energy Input (*) / Nett Electrical Energy Output	~ 25%
Actual Energy Input (*) / Gross Electrical Energy Generated	~ 20%
Nett Electrical Energy output / Actual Energy Input (*)	~ 400%
Nett Electrical Energy Output / Gross Energy Generated	~ 80%

The Hidro+™ technology is protected under World Patent Pending numbers: AU2007/906961 and PCTAU2008/001888. The International Preliminary Examining Authority Reports, dated 23/6/2009, have issued statements under Article 35(2) for the total Patents due to Novelty, Inventive Steps and complete Industrial Applicability. The World Intellectual Property Organisation (WIPO) has on 25/6/2009 published the International Hidro+™ Patents Publication Number WO2009/0876727.