

Long Period Swell Waves, Found All Over The World, Lift Up The Flat Bottom Super Watt Wave Catcher Barges[©] And Their Mooring Legs Turn The Generators

Normal Swell Wave Operation:

Swell waves cause high loads in the SWWCB's vertical mooring belts. As the barges are lifted up, the mooring belts turn unidirectional pulleys, like those used in lawnmower rope starters. The unidirectional pulleys then wind recoil springs inside flywheels storing torque in both. The flywheels keep turning large direct drive wind turbine type generators during the entire wave cycle thanks to the stored torque. Unidirectional pulley recoil springs rewind the mooring belts maintaining mooring belt top tension.

Power generation and 100 year storm survival:

The SWWCB's vertical mooring system is for power generation during normal sea conditions and the SWWCB's horizontal mooring system is for storm survival and position maintenance. The horizontal mooring system imposes minimum vertical load on the barge during normal sea conditions allowing maximum power output.

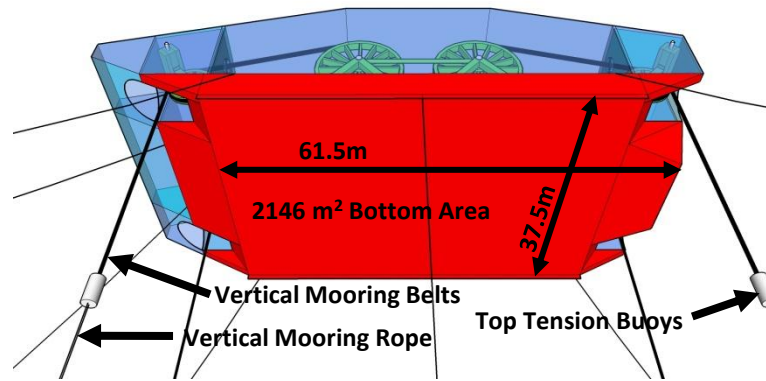
SWWCBs can use both passive or active methods to insure the vertical mooring leg loads do not exceed their design working load during storm events:

Passive options include :

- vertical mooring belt high load release connector at the top tension buoys.
- gravity weight anchors designed for seabed lift off when vertical mooring loads are exceeded.

Active options include the use of:

- clutch type disengagement of the power system under high mooring line loads leaving the uni-directional pulley's recoil springs to maintain minimum top tension on the vertical mooring lines. Power system disengagement also prevents damage to mechanical equipment onboard from high mooring line loading, high equipment RPMs and high vessel accelerations.
- Like in the US Gulf Of Mexico, where platforms are shutdown remotely prior to an approaching major storm, SWWCBs can also be shut down remotely and the vertical mooring belts made slack by reversing the uni-directional pulleys.



Bottom of Hull View-Looking Up

It roughly requires a force of 535 metric tonnes in each of the 4 mooring legs to pull the barge underwater 1 meter. 1m H_s swell will lift the barge approximately 1m x 1.67 meters. This will store ~3,000 metric tonne-meters of torque in the flywheel's recoil spring, which is ~6 times the 500 MT-m torque required for 6 mw direct drive wind turbine generators to reach their maximum output. The recoil spring continuously releases its stored torque to the flywheel and the generators during wave cycle. Half the stored energy will be used during trough unloading leaving 3 times the torque requirement for inertia and mechanical losses.

The SWWCB is US Patent Number 8823196 and titled "Apparatus of Wave Generators and a Mooring System to Generate Electricity". The Patent has also been approved in Taiwan, Korea, Japan and soon China. The Marine Energy Corporation also holds other patents in Marine Current Power generation which are all illustrated on the www.marineenergycorp.com website. As with the SWWCB patent, the Marine Current Power generation patents use accessible proven existing generators for maximum reliability, lowest CAPEX and lowest OPEX cost per megawatt.

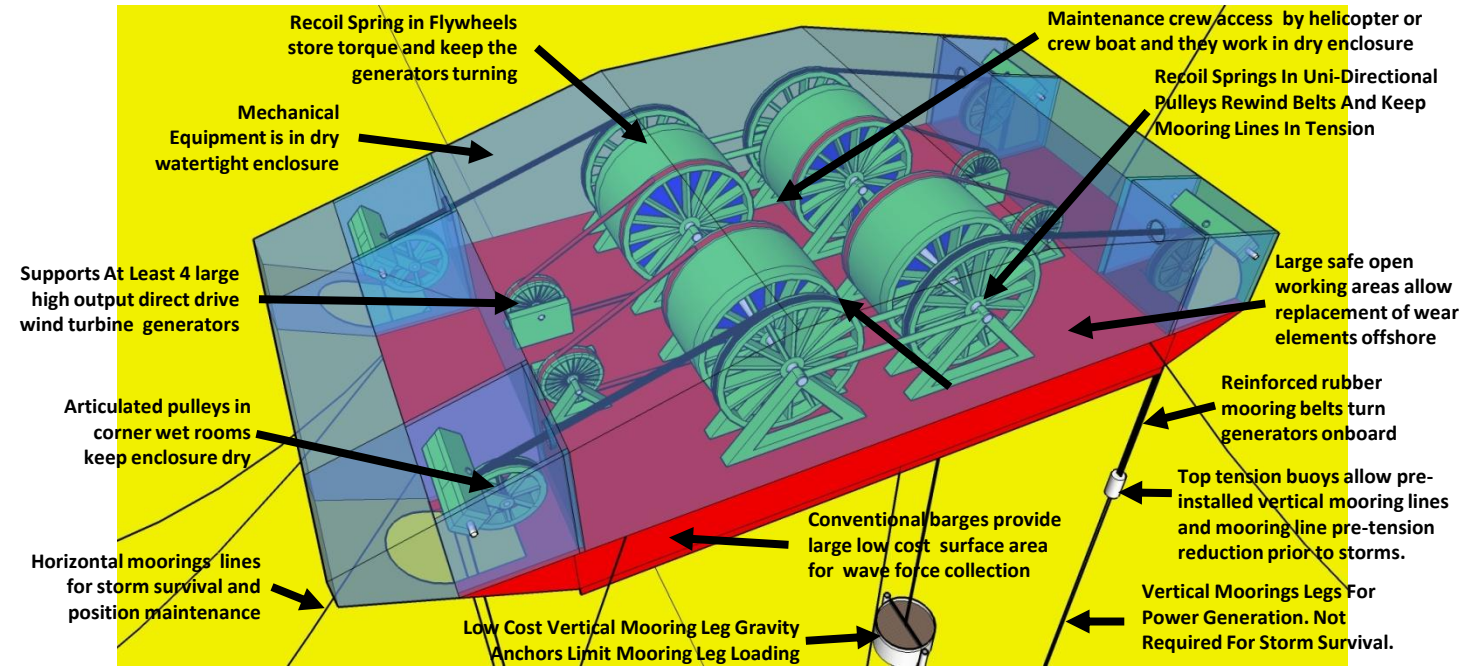


Marine Energy Corporation, 1302 Waugh Drive, PMB #465, Houston, Texas 77019 USA
 +1-832-654-4003 – USA, www.marineenergycorp.com, dgehring@marineenergycorp.com
 Marine Energy Corporation Limited, Suite 312a, Cotton Exchange, Bixteth Street, Liverpool, L3 9LQ, UK Company Reg. No. 09722662, Vat Reg. No. 226 1263 36

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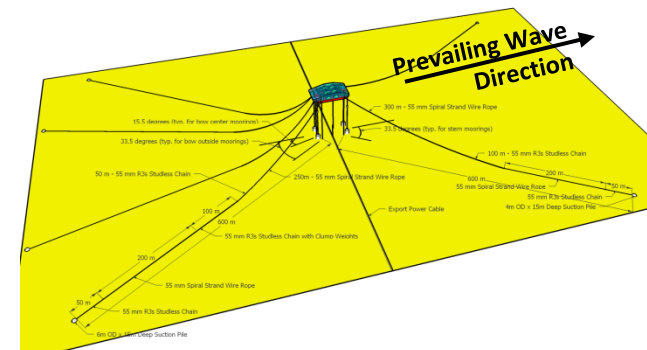


Super Watt Wave Catcher Barges[©] Estimated To Have Lower LCOE Than Onshore Wind Power and Gas Power

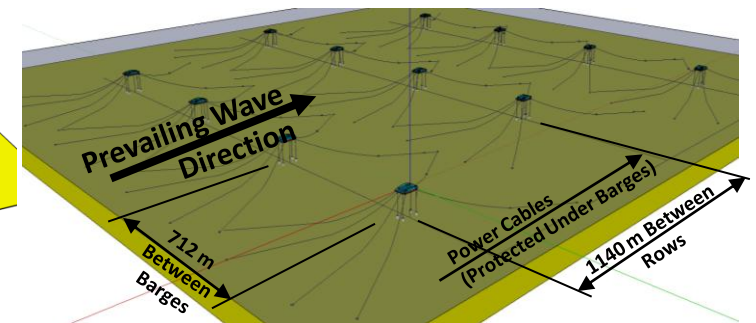


Super Watt Wave Catcher Barges (SWWCBs) use conventional flat bottom barges that provide large low cost high drag coefficient surface areas to catch very high vertical and horizontal wave forces which are transferred to their vertical mooring legs. SWWCBs use other proven existing components including high power output capacity direct drive wind turbine type generators, conventional mooring systems and mooring components, flexible power cables, etc. Minimizing the number of Wave Energy Converter (WEC) units minimizing: installation costs, seabed foot print, export power cable costs, support system costs, etc. The vertical mooring system is for power generation and the horizontal mooring system is for storm survival and position maintenance. The vertical mooring legs turn large diameter uni-directional pulleys that "high stored torque" in recoil springs located inside large diameter flywheels during wave crest loading and uniformly unload this "high stored torque" to high output direct drive wind turbine type generators during the whole wave period. The barges can export power by flexible power cables to a seabed power network or to an adjacent barges and to a local power hub for further conversion, control, monitoring and transmission. Vertical mooring system overloads are prevented by slacking mooring lines prior to an approaching major storm. The SWWCBs ride out major storms on their horizontal mooring systems. After the storms pass, the vertical mooring system is re-tensioned and the power generation restarted. SWWCBs support at least 4 high output direct drive wind turbine type generators. Current costs estimates indicate SWWCBs will have lower LCOEs than onshore wind power and gas powered generation plants.

The SWWCBs are towed to location and connect to their pre-installed moorings and export power cable in less than a day. Personnel can access the SWWCBs by helicopter or crew boat and work in a safe dry above water enclosure. All wear element replacements can be done offshore including the mooring leg, bearings and recoil springs. The barges can be disconnected in a day if major hull repainting, if required ever 15 years. However, advanced coating systems and impressed current corrosion protection system should allow the SWWCBs to stay offshore for more than 15 years. Power farms, as illustrated below, allow maintenance vessel access and maximum power generation from all barges.

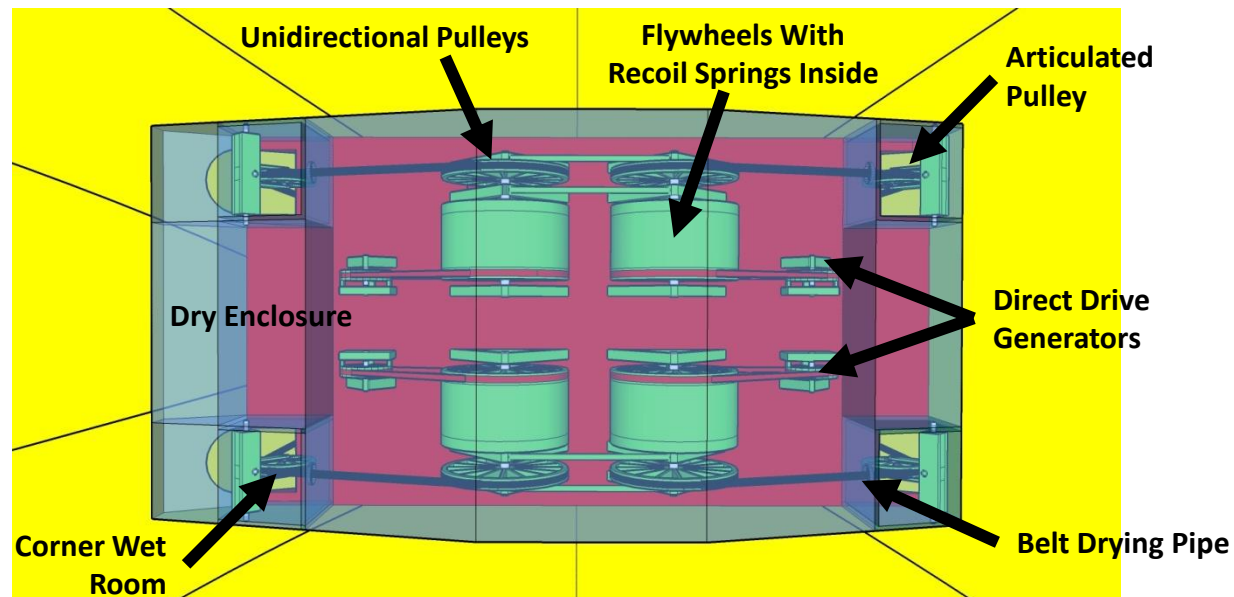


Catenary Mooring System Layout. Max. 100 Year Line Load 185 MT.

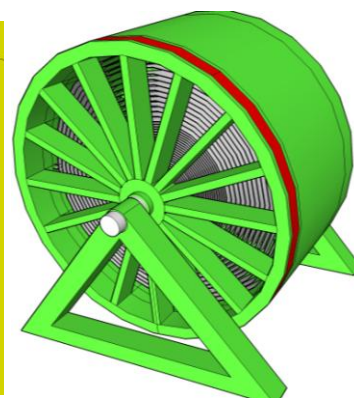
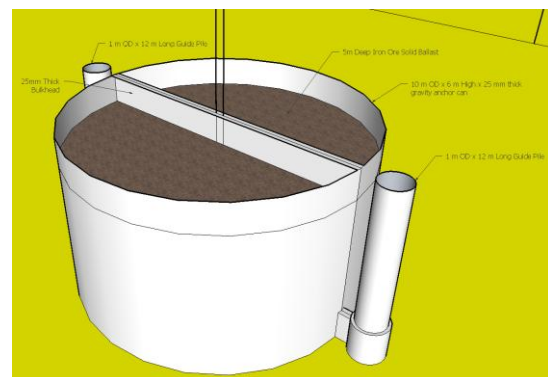
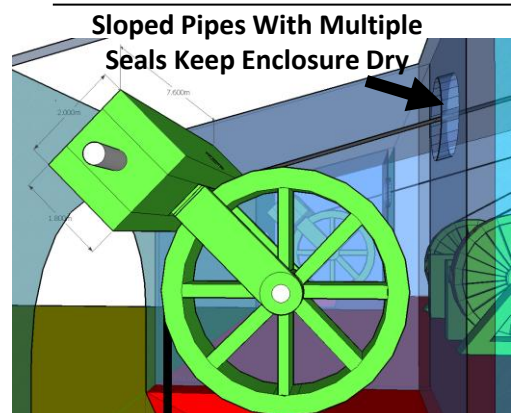
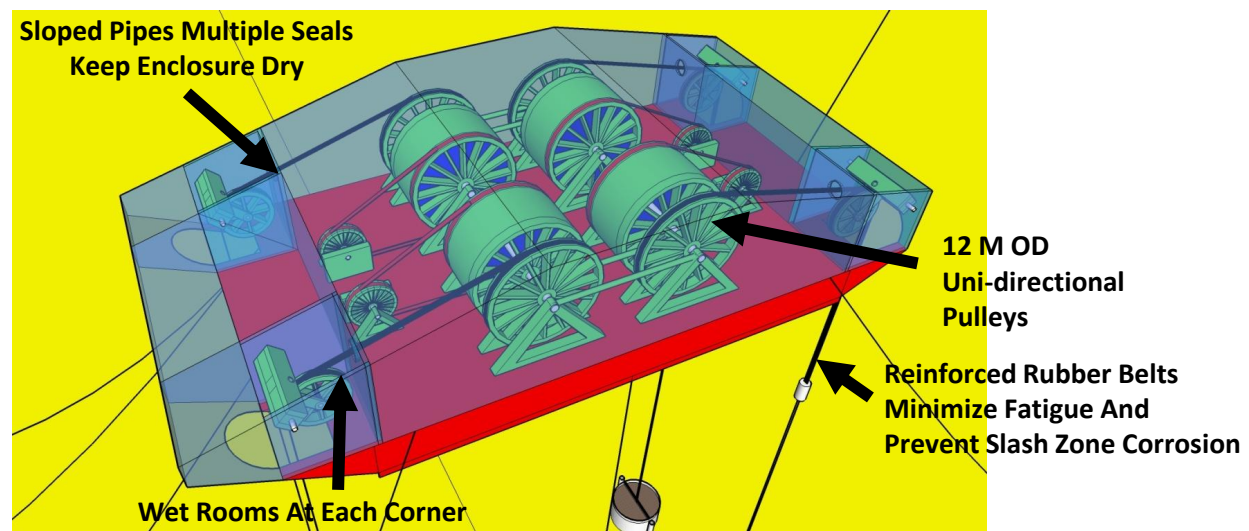


Farm Layout Without Shadowing and Good Installation & Maintenance Access

Super Watt Wave Catcher Barge[®] Components

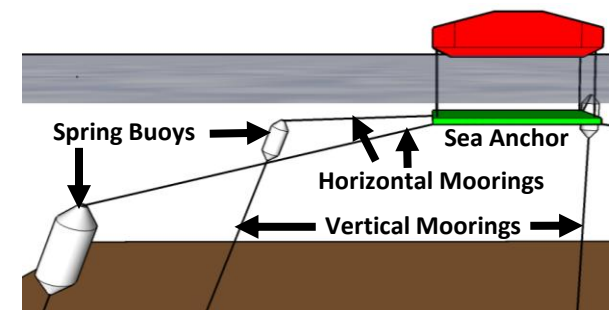


The Dry Enclosure Houses Mechanical and Electrical Equipment Including Transformers, Control Rooms, Switch Gear, Emergency Equipment, Etc.

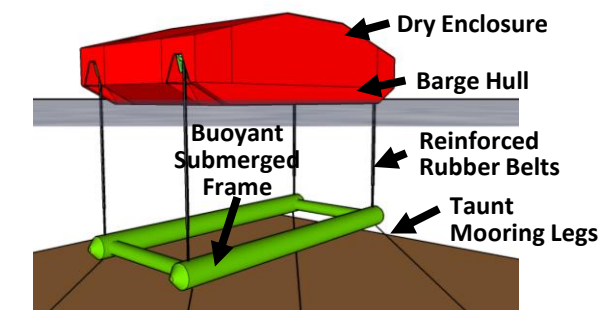


Super Watt Wave Catcher Barge[®] Fixed Mooring Systems Below

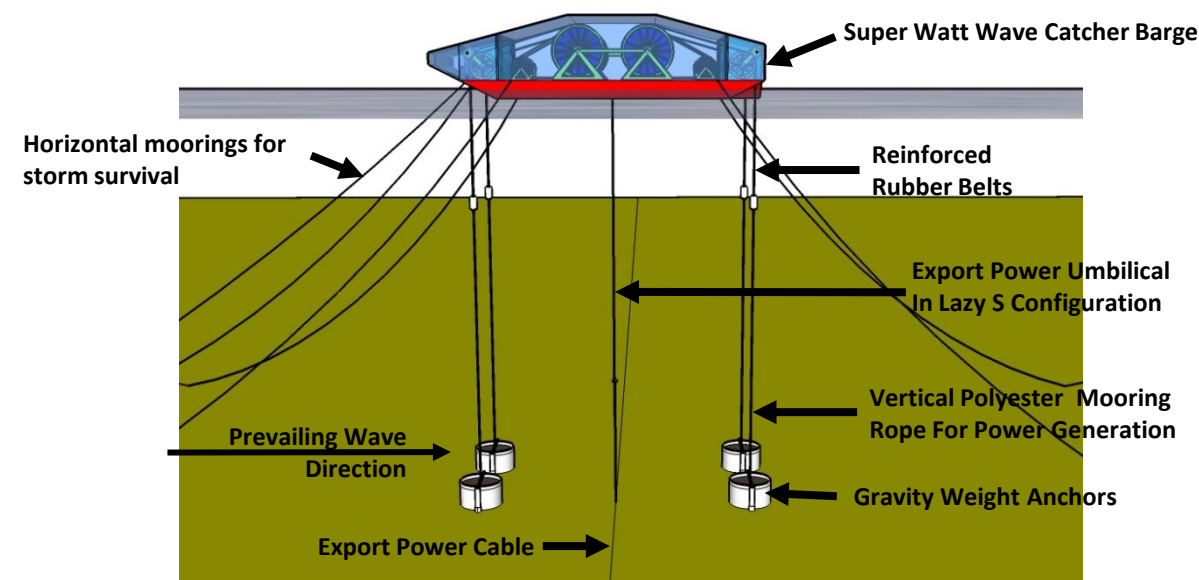
Fixed Heading Moorings



Horizontally Moored Sea Anchor



Taut Moored Submerged Frame



Vertically Mooring For Power Generation & Horizontally Mooring For Storm Survival

Super Watt Wave Catcher Barge[®] Weathervaning Mooring Systems Below

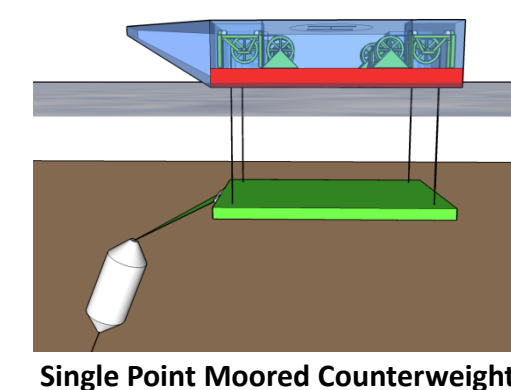
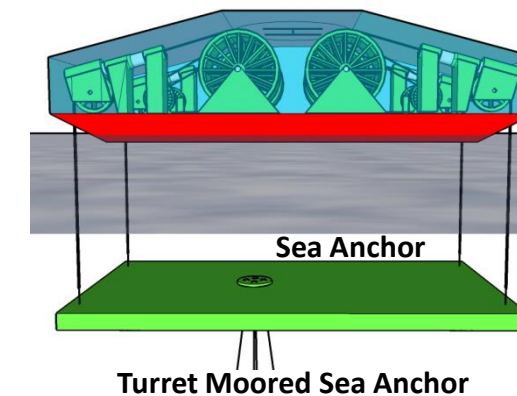


Photo To The Left Is From Load Case M5s 40 (Hs=5.58m/ Tp=12 sec) Of The Stevens Institute 1/50th Scale Model Test Which Recorded a 650 Metric Tonne Change In Mooring Line Load.