# Specified System Requirements

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## Annual Energy Production

Various elements have been optimized to achieve the annual yield of 60%. These include:

- Turbine Efficiency - High efficiency of 75% (increased from 68%)
- Effective servo control strategy based on torque and speed sensing
- Meantime between failure 25 months
- Maintenance Downtime Maximum 3 days
- Planned Maintenance – once every 12 months, reducing to once every 24 months
- Severe weather conditions necessitating shut down of turbine

Based on Wave Rider Data for the WETS in 2013 (supplied by OE) the total pneumatic power available to the HydroAir PTO over a year is 1150030 kWh. Taking into account the peak efficiency of the HydroAir PTO of 75% an average turbine efficiency of 68% has been assumed for the annual yield analysis. Based on an average efficiency of 68% and an estimated 95% availability (taking into account downtime and shut downs due to weather) representing a downtime of 18.25 days the estimated annual yield is 742919 kWh which equates to a yield of 64.6%. Taking a more conservative approach and estimating a 90% availability representing a downtime of 36.5 days of the HydroAir PTO the annual yield is still estimated to be 61.2%. In both cases the HydroAir PTO exceeds the targeted annual yield of 60%.

## Capital Cost

Please refer to Cost / Budgetary Data in subsequent sections

## Availability

Target Availability >=85%

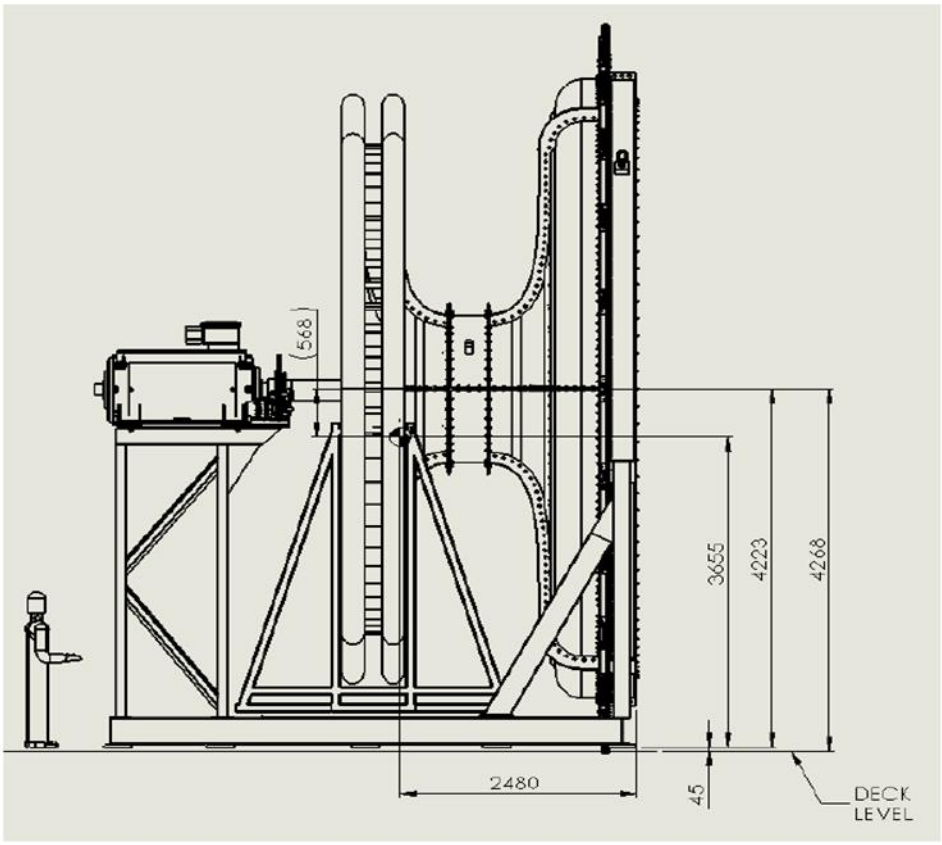
## PWR

Weight Ratio (Watt/kg) Turbine and generator target: 59.01

Turbine capable of delivering 1MW but electrically limited to 500kW due to low wave energy / sea states at WETS. For 1MW, the PWR is 71.8 based on Turbine and generator weight of 13,920 kg. The skid / supporting structure is excluded since its application dependent.

## Critical dimensions and weights (e.g. center of gravity and center of buoyancy, capture length)

**Turbine Centre of Gravity**




Weight = 22,000 kg complete skid

## Noise levels

| | |
|---|---|
| Environmental Impact | Noise attenuation: sound levels of HAT <100 dBa, due to low running speed of shaft<br>Electromagnetic Compatibility (EMC) is ensured by designing Electromagnetic Field (EMF) shields, grounding etc. wherever applicable |

## All Grid requirements (e.g. tolerance to variation in frequency output, flicker, etc.)

Hawaiian Electric Company Rule 14H Grid Connection lists the respective requirements. Please refer to Hawaii's Electric website for further details: Siemens meets requirements and test results have been provided to HECO and are available at DoE's request.

https://www.hawaiianelectric.com/products-and-services/customer-renewable-programs/private-rooftop-solar/customer-energy-resource-(cer)-equipment