

Project Planning and Preparation

A2WH (Air to Water Harvest)
Harvest Water from Air without electricity or fuel
Correct-Energy-Solutions LLC 800-658-8745 or 206-601-2985 USA

Project Preparation and planning

See Also: [FAQ](#),

These questions help customers planning for success early in the deal cycle.

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Preliminary questions which must be answered

Where will the system be installed?

Confirm the location of installation. We must validate the location can provide sufficient humidity for the system to operate effectively.

If the humidity is too low or the area too cool then system production will be lower. Some options are available that can

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help production even in very dry locations like the Las Vegas desert.

Try to find out where the closest meteorological station on <http://www.wunderground.com/> We use this data to look at the weather history so we can recommend the options most appropriate for the location.

Water flowing downhill represents energy which can be harvested to pressurize water systems. It is generally preferable to install the system on hills above the point of consumption so the water can self pressurize using gravity.

By the time walkways and maintenance alleys are added 50 acres is a reasonable estimate for a 1 million square foot system. Additional space will be needed for the storage tanks unless the tanks are installed below ground under our units.

How will the water be used?

If the water is used for human consumption extra care must be taken to ensure it stays safe all the way to the point of consumption. Governmental regulations require most water inserted into public water systems to be treated to prevent bacterial growth. Water used for animals agriculture can be treated less carefully.

The water will be quite pure when it exits the system but it contains no chemicals to prevent bacterial growth when in storage. If the water will not be chemically treated a ozone trickle can help prevent bio-growth. Ozone does a good job of keeping water safe for both short and long term storage but is unnecessary if chlorine will be added downstream.

If the water will be fed into an existing municipal treatment system the municipal system will take responsibility for final treatment.

How will the water be stored?

Will the water be stored on site? in a surface reservoir? or in existing municipal storage tanks?

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What precautions are taken to ensure the safety of the water? including the prevention of bacterial growth while in storage?

Are there any plans for treating the water after it leaves storage and before it is consumed?

Production will vary with fluctuating humidity and other environmental factors as explained in the FAQ. As a result the system may not deliver full capacity on some days and may over produce on others. We recommend 60 days of storage capacity to help smooth out weather induced variations.

We go to a lot of effort to produce very pure and safe water and encourage customers to plan storage and delivery in a way that retains these benefits.

How will the water to be delivered to end consumers?

We are producing pure water but it does not include chemical additives to prevent bacteria growth while in storage and transit.

In the USA it is generally mandatory to treat any water which is delivered through shared pipes with Chlorine or other bacterial agent. The treatment must be sufficiently strong to prevent bacterial growth in the water for the amount of time the water is expected to remain in transit. Laws vary from state to state. There are exceptions for smaller systems and some cities are piloting the use of ozone instead of chemical treatments. Check with state and local agencies for local regulations. There are severe penalties for feeding untreated water into municipal systems. We recommend that customer's world wide follow the EPA guidelines as a minimum for keeping water safe for delivery.

There are two sets of pipes required. The first set of pipes delivers the water from our point of production to the storage tanks.

The second set of pipes delivers the water from the storage tanks to the point of consumption possibly individual homes.

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An important aspect of delivery to the point of consumption is ensuring that right away needed for the pipes have been secured. Obtaining the right away is not difficult but does require time and an inability to obtain the right away may require choosing a different installation location.

Is altitude available?

The system should be installed at an altitude above the point of consumption so gravity can pressurize the feed from the storage tanks down to the village or town.

If sufficient altitude is available a small hydro electric generation system can be used to generate electricity as the water flows down hill. This may be important especially in remote areas or those areas which are burning expensive diesel fuel for electricity. In some instances the electricity generated in this fashion can help pay for the system.

An ideal location will be a few hundred feet high on a hill or mountain where the units receive consistent 1MPH humid breeze. Breezes over 5MPH can be harnessed to increase airflow through the system which can increase production. Regular winds over 10MPH can multiply system performance.

Altitude can also provide some of the air chilling prior to the air reaching our units. In some instances altitude based cooling can increase the production of the unit especially if the air moving off the ocean is at or near the fog point due to altitude based cooling.

If it becomes a trade off between lower humidity and higher altitude then higher humidity should generally be given priority.

Which ocean port will the system be delivered to?

To develop an accurate delivery cost we will need to know which ocean port the units will be shipped into.

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If the customer can not get them cleared through customs and picked up immediately there will be additional storage charges at the port which are paid by the customer.

We can arrange for inland delivery but it is more expensive and must be requested at the time of order.

How will local installation be handled?

Installation is not difficult but it must be planned in advance. Larger systems will require more planning to allow appropriate pipes and any booster pumps needed to overcome hilly terrain.

Correct-Energy-Solutions provides training for installers and supervisors who manage local installation.

Our smaller 22 liter per day systems are designed to be installed by the property owner and only need two adults.

Can the system be cleared for import?

We generally write the contracts so the customer pays the export taxes from the USA and import taxes into their destination country.

Correct-Energy-Solutions will obtain clearance for export in the USA and the customer must obtain clearance for import into their country.

Correct-Energy-Solutions only ships to countries where our patents have been filed. Initial shipments to countries outside our filing zones may be delayed and will incur additional expenses.

Do you have a clear view Sun and sky?

The A2WH solar system depends on a clear view of sky and requires full sun exposure. Production will be lower in areas where the sun is frequently obscured by clouds or fog.

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The units are tilted slightly south to maximize winter exposure. Anything such as mountains, trees or buildings that obscure this view will negatively impact performance.

Areas that are frequently fog bound or experience frequent heavy clouds at night will experience lower production.

Areas that have consistent winds above 10MPH can use special options to increase production.

The system generates a waste product of air that is drier than ambient air. Dry air tends to be heavier than moist air so this air can accumulate in low lying areas causing the system performance to decrease. The system requires a continuous supply of ambient air. The easiest way to ensure this is to install the system on a hill or in an area with a regular breeze. Even light breezes of 1/2MPH are generally sufficient to ensure a continuous supply of moisture.

In very large systems care must be taken to ensure that units downwind of other runts are receiving new air and not air that has been previously de-humidified by upwind units. Areas with average winds over 5 MPH typically experience sufficient mixing that the downwind issue is not a problem.

Calculating loaded costs

Please contact Correct-Energy-Solutions or call 206-601-2985. Loaded costs are predominantly driven by the size of the installation and local climate conditions. Larger installations benefit from economies of scale especially when the orders are large enough for Correct-Energy-Solutions to order

Climate For example a system operating at 90F and 70% relative humidity will produce nearly double the water the same system operating at 65F and 70% RH.

Planning for Operations

See FAQ under section regular maintenance

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What is the life span?

The system is designed for a 10 to 20 year life and comes with a 8 year warranty for factory service on non moving parts and a 5 year warranty for moving parts. Field warranty service is available at additional costs.

I would be surprised if you do not substantially exceed the design life and personally expect the system to operate effectively up to 40 years although the number of replacement parts required in the 2nd 20 years may increase.

The part of the system which will wear out first is the plastic surface which is aimed up into sky. The plastic being used is polycarbonate which has been demonstrated to have a 20+ year life in outdoor applications.

The mounting system is painted steel which can corrode over time but in most climates will exceed a 20 year life span. Aluminum is available as an option which will last even longer but costs more. You have the option of having the mounting system fabricated from local parts and local materials and we would remove that amount of the system cost.

The system includes photo voltaic panels to operate various sensors, pumps and the micro controller. Similar panels have been demonstrated to exceed 20 year life spans. The electronic micro controller should have an indefinite life span and will average over 20 years. The electronic motors used for moving air and the associated electronic solenoids have a design life over 20 years and are operating at under 50% of the design capacity but there will be failures.

Depending on options chosen the system will include a number of replaceable or washable filters. These must be serviced on a periodic basis.

What regular maintenance does it need?

In any system like this the standard recommendation is to plan on a maintenance and repair rate of 3% to 7% per year as

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compared to your capital investment We have designed to try and keep this under 5% and this number is mitigated by the local environment. In most instances 3% per year should be adequate to pay for both labor and parts during the 20 year design life.

The top surfaces will need to be washed on an occasional basis. The frequency of washing will vary depending on the dust load and composition in the region. Polycarbonate is easy to wash and system performance is not affected by minor scratches which makes washing easy. The units are tilted to allow natural rain to perform the washing function so this may not be needed.

The system should be periodically inspected for units that have been damaged. In most instances such damage is readily visible. If the top surface is damaged or punctured it can be easily replaced or repaired with thermal welding or solvent bonding.

The mounting system if steel should be repainted once every 5 years.

As in any system there will be some failures of fans and batteries. These units have visible indicators which show current operating state as detected by the local micro controller.

Correct-Energy-Solutions offers an additional cost option which uses low power RF radios to report the state of these systems so the entire set of units can be viewed from a single console and which will generate alarms if any fans, batteries or micro controllers fail.

What is the fully loaded Cost per Liter?

This will change based on the region deployed and size of installation. Smaller installations do not gain the same economy of scale as large installations but even those are highly competitive. When evaluating loaded costs for water systems you have to include capital costs, installation, power or fuel, chemicals and net land costs.

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Environmental costs and sustainability should be factored in but this technology is so much better in these categories and these measurements are fairly subjective so they are left out for the purposes of this document.

The land the system is installed on will most likely appreciate during the time of use by more than the cost of money and is likely to produce a net profit when sold at the end of the system life.

Industrial systems must include plans for the pipes needed for delivery to final consumers and any intermediate storage. Most municipal systems will require final treatment of the water before it is fed into the municipal system. When no municipal final treatment is available we suggest a continuous ozone trickle through the storage tanks to keep the water sterile until it is consumed.

In many countries the ideal installation sites will be several hundred to several thousand feet above the point of consumption where natural cooling of the air brings it close to the dew point. When used in this mode there will be considerable gravitational energy present in the water as it runs downhill to its point of consumption. This gravitational energy can be reclaimed as electricity by small hydro plants and either sold or used to operate the system. In some cases the revenue produced from this electricity will bring the total cost of the water per liter to under \$0.00 .

Operating costs

- The majority of operating costs will be in three areas.
 1. The upward facing surface of the plastic should be periodically washed to remove accumulated dust because a sufficiently thick layer of dust will inhibit radiant cooling. In areas with regular rains this is pretty much automatic but in dusty areas it will be needed. The units are installed with a slight north tilt which helps encourage the dust to run off with any rain water and HDPE is extremely slick which also helps.
 2. There will be some damage over time caused by vandalism, extreme weather, etc. The system will need to be inspected and damaged units replaced or repaired. with 1 million

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square foot you are talking about about 50 acres of units which will require non trivial time for regular inspections. Polycarbonate is amenable to field repair using hand thermal welding tools and relatively unskilled labor can be trained to conduct field expedient repair. Standard sheet obtained from local suppliers can be used for most repairs while you will need to come back to us for repair parts on the electronics and motors.

3. The water produced does not contain any bacterial inhibitors which means that bacteria and viruses could grow while it is in storage. In the USA this has been historically prevented using a chlorine additive. In the recent past Chlorine has been increasingly replaced with Ozone and UV treatments neither of which provide leave a chemical residue. We generally recommend a ozone trickle in the storage tanks for this purpose. We can supply the Ozone trickle system but you can probably get it cheaper from other sources. Plan on the Ozone system with the associated PV panels adding between 1% and 8% to the cost. If you have existing municipal systems then this stage is not needed.
4. You will need to plan on a storage tanks and pipes to deliver the water to the final consumers. We recommend a minimum of 10 days storage capacity with 60 days ideal. These can generally be installed by local contractors cheaper than we can provide them. We like epoxy lined concrete tanks that are sprayed in place using shot Crete techniques but your local architects will have the best information. Note: Some tanks are not compatible with Ozone use.

Negative operating costs

When installed at an elevation above the point of consumption gravitational energy can be reclaimed from the water as it flows down hill and used to generate electricity using small hydro electric plants. This electricity can be sold to offset other operating costs. A 35,000 gallons per day system produces about 291,900 pounds of water per day which when dropping several hundred feet can pick of a significant velocity and hence has a high energy potential.

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Thanks, Joe Ellsworth
CTO of Correct-Energy-Solutions
206-601-2985 main
info-@-Correct-Energy-Solutions.com
[Remove the dashes to make the email work](#)