A2WH Analysis for Sydney Australia

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This analysis shows that A2WH can be highly competitive with coastal desalination plants especially when power and membrane replacement costs are factored in over a 20 year period.

It is more eco friendly the most friendly coastal desalination plant even those powered entirely with green energy such as biomass. Depending on the configuration and local weather patterns it can use less than 1/3 the land needed for the best biomass farms to deliver enough energy to run the system and can eliminate millions of pound of nitrogen runoff into the local river system.

When allowed to capture rain in areas with 800mm (2.5 foot) of rain per year it can deliver 103% of the water per $ invested as compared the coastal desalination plant and that is before the 262Gwh per which the A2WH system saves are paid for and without counting the water pressure, electricity generated and cold are benefits of the A2WH system are factored in.

Over 20 years the Desalination plant will consume 5,240Gwh which at a 20 year average of $0.18 AUD per KWh would cost an additional $943.2 million AUD bringing the actual desalination cost to $2.842 billion AUD. The water company has committed to buying all green energy which typically carries a higher price than that readily available from fossil fuel sources so their 20 year average may well exceed the $0.18 AUD per KWH.

The A2WH system is a net carbon reducer where biomass is a slight positive carbon contributor. Over a 20 year period the Sydney desalination plant will consume 5,240Gwh which the A2WH system would eliminate. Using the California average of 639 pounds of carbon emitted MWH consumed the A2WH system will have effectively removed 3.35 billion pounds of carbon as compared to fossil fuel generated electricity. Assuming the equivalent biomass would be used to generate auto fuel if not used for desalination it would remove even more.

22.47 million Litres per billion AUD invested

A2WH direct air to water condensation will average production of 22.47 million liters per day per billion AUD invested. The rainfall collection works out to 45.36 million liters per day per billion AUD with an annual rainfall of 800mm per year.

The nice thing about this approach is that you are guaranteed the 22.47 million liters with the 45 million liters from rain fall as a bonus when if the rains do reach 800mm per year. Bear in mind you need storage for the rainfall since it does not fall consistently through the year.

A2WH averages at 5790 acres per billion AUD. The cost of the land must be added to the system but it will be sold at a profit in the future so you only have to budget for the cost of money as compared to increased capital value.

This analysis was done for the mountains above Sydney specifically targeted at the altitude where they see dew almost every night. This allowed us to plan for 3 gallons per 100 square foot of installed system per night. It is likely the A2WH system would have exceeded that production rate when installed at the right altitude in the mountains around Sydney. In other areas the production could be lower. The production rate depends on the relationship between the coldest 2 hours at night and the highest dew point the next day along with the highest temperature the next day. In Melbourne the production would be about 30% lower.

Using the same panels for rain capture increases ROI

The major question is will we be allowed to capture rainfall and the area where it the system will be installed. The reason this is critical is that in my last set of analysis for Sydney which averaged from 800mm to 1600mm of rain per allowed our production from captured rain to roughly double our production from air to water condensation.

Wind Assist

In areas with an average of 7 hours per day of wind in excess of 8 MPH the system production can be approximately doubled for a cost increase of about 35%. At this rate you would install 35% less system. For example our direct A2WH production would drop from 22.47 to 14.6 billion but that is doubled by the wind assist to 29.2 million liters per day. There is a slight increase in maintenance costs but it is effectively boosting production per AUD by 129.9%. It does this while decreasing land consumption by 35%. The wind assist also allows the system to be used in areas with lower humidity than possible with only the night radiant portion of the system. The wind assist system can generally move a month that was in the marginal category to good or excellent.

Local Testing required

When planning any system of this size we strongly advise customers to install a minimum of 100,000 square foot of system very close to the area where they will be installing the larger system. All production estimates should be considered suspect until proven in a given area. We have seen weird conditions such as where micro climate changes had significant impacts on production that could not be anticipated without empirical tests.

Be aware of local topography

You should also be aware that a system of this size must be planned in accordance with the natural topography to maximize long term production. Each gallon condensed will produce thousands of cubic foot of air that has been dried and chilled to below the dew point. This cold air tends to flow down valleys like an invisible wave. The critical aspect is that we want to avoid where possible having the dehumidified air from upstream panels flowing over the condensing heat exchangers at a lower elevation since there is less water in the air for these panels to extract.

The cold air wast product can be leveraged or sold

This cold air will tend to stagnate and settle in bowl shape valleys until warmed by the sun or until it re-mixes with ambient air. Where ever possible this cold air should be sold as a additional resource since it can turn wind turbines when flowing down hill, chill factories and many other beneficial uses.

Uses less land than it would require to grow biomass to operate coastal desalination

As shown below if the Sydney desalination plant obtained all their renewable power from the highest production and highest efficiency biomass plants and best closed cycle processes the biomass production required to deliver their annual power would consume more acres of land, more labor, more agricultural water and introduce more chemicals into the environment than an equivalent A2WH system.

If the A2WH panels are also used for rain capture they out perform the biomass based system by using less than 1/3 of the land. In addition the land used for A2WH can be in areas where the intensive agriculture techniques required for maximum efficiency biomass would not be viable.

Mountains receiving ocean breezes are ideal locations

The mountains around Sydney represent an ideal climate for deployment of large scale A2WH because wind off the ocean and altitude based cooling can do a large fraction of the work for us.

A2WH Compared to coastal desalination

According to http://www.sydneywater.com.au/EnsuringTheFuture/Desalination/pdf/Factsheet_GreenEnergy.pdf. the 1.9 billion AUD desalination facility will produce 125 million liters per day . As shown below the A2WH system can produce 92% of this with the same capital investment while saving 20 years worth of power. A 1.9 billion AUD investment in the A2WH night radiant system would directly condense an average of 42.7 million liters per day.

At first glance may appear that the coastal desalination plant has a significant advantage for the desalination plant but when you add in 20 years of electricity and membrane costs coupled with reduced environmental impact the A2WH system becomes quite attractive even before we include rainfall collection.

When our air to water production of 42.7 million liters per day is added to the 71.85 million liters per day average rainfall collection the production total is 114.6 million liters or 91.6% of the water production from the coastal desalination plant for the same capital investment.

Depending on the area of installation the rainfall production could be double this estimate which pushes the A2WH system production to well over 100% that of the desalination system with the same investment.

154% the production of coastal desalt when power costs are factored in

As shown below the 126 million liter coastal desalination plant will consume 262GWh per day which has a 20 year cost of 948 million AUD if the 20 year average power costs is $0.18AUD per KWh. Using this money to build additional A2WH system and allowing for rain capture at 800mm per year the A2WH system could produce system 1.5 times the size shown here. Since the base system can produce 103% the desalination plant per $ invested with the 1.5 add on it is bumped to 154% the production per $ invested.

A2WH ecologically friendly

The A2WH system can generate power as the water flows downhill from the mountains while supplying sufficient pressure to completely pressurize the municipal system which saves additional energy.

The A2WH system ends up as a net electricity generator which makes it inherently more green than the most green desalination plant.

The A2WH system does not require any brine disposal so it can not contaminate the local ocean environment or accidentally modify the coastal ecosystem.

A2WH makes water supply more robust

A2WH system is immune to chemical spills, industrial contamination and storm fouling which are major concerns for the coastal desalination plants. Even in areas where large scale coastal desalination or purification from rivers is used. A2WH can provide a critical backup supply that continues operation when major storm fouling and chemical spills take the ocean or river supplies off line.

A2WH Land consumption

The A2WH system would consume about 11,000 acres to produce this amount of water but this land is undamaged and can be resold in the future at a profit. To put this in context 11,000 acres represents 17.2 square miles (a rectangular piece of land 3 miles wide by 5.7 miles long) which is a very small piece of the 308,000 square miles in NSW (North South Wales).

Success requirements for Sydney area

Success for the A2WH system in the NSW region will require installation a 10,000 square foot or larger demonstration system in the mountains above Sydney and publicizing the results. Australia has a very vocal anti nuclear group and a equally strong and rapidly growing group with strong concerns about global warming and greenhouse gas but they need concrete alternative solutions which A2WH can represent.

The A2WH demonstration system will be essential in building strong grass roots support which could end up influencing the elected officials if properly supported and publicized. The nuclear plants and coastal desalination companies have the resources needed to influence politicians. On the other hand A2WH is a better solution and could receive very strong support from the ecology minded portion of the public.

When properly positioned A2WH could actually become a decisive platform for politicians running on a eco friendly platform. Our experience with the press indicates a requirement for a concrete solution they can see, visit and touch and in our case taste to attract press attention hence the need for the demonstration system mentioned above.

See: http://www.smh.com.au/news/opinion/no-time-for-dithering-as-we-wake-to-new-ecoterror/2007/02/27/1172338622612.html, for an example of the green press

Be ready when the opportunity is presented

Coastal desalination plants have a historical record of cost overruns and atomic power plants quite often require 5 to 7 years from approval to start construction. We can have major A2WH systems in place and running in 1 year.

The key for success in this instance is a municipal scale operational A2WH demonstration system must be working with prior press exposure when the atomic power or coastal desalination system run into their major hurtles.

When the desalination plants or atomic or fossil fuel power plants are receiving negative press attentions when the less ecology focused public mainstream will be most amenable to endorsing alternative solutions. The public mainstream will be most amenable when the coastal desalination plants or river purification systems are taken off line due to oil spills, flooding, contamination, etc. A2WH must be locally installed and have some awareness in the press before these events occur to take advantage of the opportunity.

A2WH can augment existing plans

Due to the lead time on these projects there is a very good chance that there will be a demand for more water than can be easily supplied by the coastal project by the time it comes on line which means the A2WH system remains a viable solution even when the coastal desalination plant is deployed and fully operational. 1.9 billion AU converts to 1.5 billion USD. At this scale we could reach installed prices of about $4 USD per square foot. (not counting land) This would allow us to install 376.5 million square foot (8,641 acres) of the A2WH night radiant system . At a production rate of 3 gallons per day per 100 square foot this would produce 11.3 million gallons (42.75 million liters) per day. The wind shields and service access corridors take extra space so the total will be closer to 11,000 acres.

A2WH rainfall collection a cheap option to double water production

According to http://www.worldwildlife.org/wildworld/profiles/terrestrial/aa/aa0402_full.html the mountains around Sydney average between 1600mm and 750mm of rainfall. The most conservative 750mm converts to 2.4606 foot of rain per year. When captured by 8,641 acres of A2WH system this equals 26,262 acre foot of additional water per year or averages of 71.85 million liters per day assuming you have adequate storage.

The rainfall based collection is not as clean as the main A2WH production but it can easily be treated for municipal consumption. This capture rainfall is an ideal source for use in replenishing freshwater aquifer in the region.

A2WH condensation + rain capture can produce 103% as much water per $ as coastal desalination with only 800mm of rain.

Each panel takes up a bit extra space for the wind guards which also act as funnels for rain capture This means each panel captures about 1.2 times the water implied by it's rated space which brings the rainfall capture up to an average of 86.2 million liters per day. When combined with the 42.75 million liters from the air to water production it reaches 128.9 liters per day or 103% that produced by the coastal desalination plant at the same cost. An area with 1600mm of rain will nearly double the production of the coastal desalination plant.

Recharge ground water tables

Using the rain water can be difficult due to the rate in some climates because the rainfall tends to occur during 2 or 3 months. In most parts of Australia they are faced with serious ground water depletion issues. In the USA demonstration projects have shown that it is cost effective to treat water and re-inject it into the deplete aquifers which represent incredible storage capacity.

The ideal solution would use the same set of panels to deliver the captures rain water from the panels into an alternate pipeline which leads to an area with access to the city aquifer. An alternate pipeline is not mandatory but is recommended because the water delivered by rain is not quite as clean as the water produced by condensation.

The rainfall is relatively clean since it fell on the plastic panel surfaces but for safety the water from rainfall would be treated with a vortex separator to remove dust and blown dirt and then sterilized large scale ozone prior to being injected into the local aquifer.

If the panels can be installed with a minimum of 500 foot of drop between them and the injection wells then sufficient power can be generated from the falling water to operate the ozone system with sufficient pressure left over to operate the injection process without need for electricity driven pump.

In effect this strategy eliminates the water lost due to shallow evaprotranspiration and ensures that water is delivered directly in it’s most pure form to the ground water table where it can be withdrawn for future use.

A2WH Land usage compared to biomass

The desalination plant will be consuming a large portion of the green energy available in the country . A portion of the green energy the Sydney plant will be using is Biomass which claims to be net zero carbon producer but in reality it is net zero only if no fertilizer, fuel or pumped water are used in the original plant production , harvesting or delivery.

In reality the biomass has to be delivered by truck or train and by the time all indirect energy costs are factored in biomass electricity while renewable still represents a net positive carbon contribution.

A2WH is more Eco friendly than Biomass

Desalination plant will consume 262.8 Gig watt hours per year.

The land consumed to grow enough plants to produce 30 megawatts of power totals 262.8 GWh (Giga watt hours) per year (used by the desalination plant will use up considerably more land than A2WH.

According to EIA report Biomass represents 48% of all renewable electricity at this rate biomass would supply 126 GWh per year. The EIA report on Biomass shows that 50,000 acres will produce 200,000 ton of biomass for a production rate of 4 ton per acre. A different section of the same report shows averages from 2.6 to 6.7 Ton per acre.

The EIA report shows energy contents averaging up to 8,629 BTU per dry pound which at an optimistic 50% generating and delivery efficiency converts to 0.0025289 GWh per Ton. At this rate it requires at least 103,918 dry ton of biomass to generate the 262.8 GWh of power. At 4 acre per ton production it will require 25,979 acres of intensive cultivation to grow enough biomass to deliver the power for the 125 million liters per day.

In reality most biomass plants deliver fewer BTU per pound and most farmers are reporting averages between 2 and 2.5 ton per acre. Using the more conservative numbers it could easily require 55,000 acres to produce the biomass needed to generate 262GWh per year.

A2WH has less risk of surface water contamination

This biomass requires all kinds of water, fertilizer, run off, harvesting and delivery all of which entail environmental costs. A university of Illinois report recommends 40 to 70 pounds of nitrogen added per acre of Switch grass per year. Switch grass is one of the most productive yielding biomass plants and is one of very few to reach 4 ton per acre production rates. At 40 pounds per acre 25,979 acres would require 1.04 million pounds of nitrogen per year. According to the USA department of agriculture a substantial fraction between 10% and 60% of this nitrogen ultimately winds up contaminating local surface water.

There are also a fairly large array of fungicides and herbicides used to maintain switch grass fields in optimal production.

A2WH is made out of HDPE plastic which is one of the most recyclable products on the market. The entire A2WH system can be easily recycled and there is a strong demand for the HDPE, steel, aluminum and copper which are the main components so in effect even when removed it can be completely recycled with no negative environmental impact.

The A2WH system when used for rain capture directly takes the water falling on the surface of the panels and funnels it into the rain storage and delivery tanks. This dramatically reduces surface run off from the area which eliminates erosion and delivery of silt into the local water shed. Much of the rain water is injected into the local aquifer which allows the system benefit of the stored water without picking up as many minerals and almost eliminating losses due to evaporation or contamination during runoff aggregation.

The area around the panels is treated by adding a layer of weed resistant plastic topped with 2" to 6" of gravel or rot resistant bark. This completely eliminates water based erosion for the area and the related surface paths. It effectively freezes the top soil under the panels in its current state. This can dramatically reduce the delivery of silt into the local river system although even 5 billion AUD covers such a small amount of land that it will not have a noticeable impact on the water entering local reservoirs.

A2WH + rain capture can use 1/3 the land when compared Biomass

In contrast even without considering our rain capture the A2WH system could deliver the same amount of water with 25,241 acres without the agriculture water, chemicals and harvesting and with dramatically lower delivery costs. If rain capture at 750mm per year is included the A2WH system would require less than 9,000 acres for the same water delivery. The A2WH system yields a net carbon reduction while even the best Biomass chain yields a net positive carbon contribution.

He who acts first wins

We are receiving inquires from all areas of Australia and have not started serious marketing. It is inevitable that our A2WH system will become a major candidate as an alternative to the nuclear and fossil fuel powered coastal desalination plants. The only question remains of who in Australia will be instrumental in making it happen. We are offering incredible deals for the group who funds a demo system in the range of 10,000 to 100,000 square foot and they will naturally receive the resulting business.

We recommend 100,000 square foot (2+ acres) as the minimum demonstration because feedback from municipal buyers in the USA indicated it was the smallest scale they would consider a viable demonstration. In some regions this number could be higher.

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