XDOBS Renewable cooling FAQ

How does the technology work (overview)

Air conditioning is all about moving heat from inside a building and disposing of that heat someplace else. This is normally done using refrigerants and a compressor. We do the same thing but invented a specialized plastic panel which radiates heat way. It could be said that it radiates it away towards space. We are able to radiate up to 150 watts per square meter and up to 400 watts per square meter in special circumstances. It is the same process used to cool large telescopes and spacecraft.

Most of the heat load occurs during the day while our process works mostly at night. To accommodate the difference we store the cold in form of chilled water which is used the next day to absorb the heat from the building. The heat transfer into the cold water from the building can occur in multiple ways but we invented a specialized thermal chimney which provides the best benefits of diffusion based cooling at a much lower retrofit cost. In new construction this approach can reduce duct sizing by over 80% which allows thinner crawl spaces which can reduce building construction costs by enough to pay for our system.

Each night the heat absorbed during the day is radiated away and the process starts over.

We still have to circulate air and water but our total energy cost can be less than 10% that which is used by conventional HVAC systems. In extremely hot areas with warmer nights we can still use the process but have to augment it with a high efficiency geo-exchange pump and in these cases the higher water output temperatures allow us to shed over 400 watts per square meter and we can still save over 80% of the energy.

The Florida government published a white paper which indicates every KWh we can save reduces green gas house carbon emissions by 2 pounds and other pollutants by 1/3 of a pound. We did a study for California that showed a 10% adoption would reduce carbon emissions by 4 billion pounds a per year. In California's case it would also eliminate the need for rolling blackouts caused by excessive power demands from air conditioners.

Are you considering other methods

We started with a solar thermal design for cooling and moved toward this system because it was less complex to get into large scale manufacturing. We are working on a wind boost option on the design board which turns wind energy directly into mechanical energy we can use to chill the fluid even further beyond what the radiant panels are capable of. It turns what is normally a liability, Wind into a positive Asset.

We have published several low energy distillation techniques for large scale desalination have a wave powered desalination and wave powered hydrogen conceptual design completed and waiting for resources.

Our main problem is not finding the next opportunity but filtering the many present to fit our resources while maximizing our returns. Even with GE level resources it would take decades to take all the technologies we have in various design stages to full market and we do not have GE level resources.

Where are you n the process of implementing is commercially

Early production, We can produce the product as they are ordered by customers but we have not set up a large scale production line and probably will not do so until funded by large customer orders. We have managed to reduce our per panel production time by 80% but it still requires multiple man hours.

We know how to automate several of these steps with approaches even better than what we are currently using. These include advanced twin wall thermal forming, vertical blow molding, roto molding and custom extrusion which when combined will cut our investment to less than ½ man hour per panel. Each of these steps require significant money. We decided to adopt each stage as customer orders or external financing allow.

Every successful product continues to evolve and improve as customers request refinements which is also true for this product. We have lots of ideas on how to refine and improve it but it is a perfectly good and usable in it's current form.

What kind of data have you accumulated

We have installed panels that are extensively instrumented with some of the best sensors we could buy. These sensors are hooked to wireless transceivers that allow us to get readings from the panels continually. So far those readings show that on fairly windy days the panels will average chilling 8.8 to 9.9F below ambient and that on less windy days they average 10F to 12F chilling with bursts to 15F.

On June-18th the panels in Heber city, UT where capable of chilling the thermal storage fluid down to the mid 20's. On June-22 when daytime temperatures reached 96.5F the panels where able to chill to 36F the next night which is much colder than we actually need.

This summer we are installing test structures which demonstrate the systems ability to keep a structure at the comfort level throughout days with temperatures in the 90's.

We are also offering special discounts to companies who wish to host test sites of their own as part of an evaluation process to use the product across a much larger group of buildings. Our hope is to develop good data from a larger range of climates using this partially subsidized group of test partners.

Has it been independently tested

We focus more on cooperative testing. We stay heavily involved in each test cycle and help the test partners set up the instrumentation and help analyze the data and then co-publish the results.

We are working with LSU to test the A2WH aspect of the system in Port sulfur LA. This is an interesting application where the produced water is used to flush the salt out of citrus tree root zones. If it is successful it could double the economic productivity of the entire region. It will take 2 to 3 years to obtain definitive results but the initial data looks promising.

We are currently in the process of selecting test partners for the next set renewable cooling of tests. This is cooperative testing where we supply most of the electronics and monitoring while the partner validates the results for their application. This group of partners will be those who have a larger problem and those who could buy at hundreds of buildings worth of product provided the test proves successful.

It looks like the early adopters will be cell companies, radio broadcasters, hospitals and nursing facilities who have a very high cost to keep air conditioning active during power outages. For a cell company if we can reduce the cooling load by 90% it can allow them to keep a facility on the air for 2 to 3 times longer with the same set of batteries. In many instances the savings in batteries will pay for the system. It can help eliminate the need for a local generator the system is paid for right up front. For hospitals it can save lives since most hospitals do not have large fuel supplies to run the HVAC system the renewable cooling can keep the facility livable indefinitely which dramatically extends their fuel supply. Now we need really good proof point data for each of these applications which are where the test partners are very helpful.

What price point do you expect to start out at in terms of cents / KWh

The price point depends on the size of installation and the total up front commitment. I recently did a estimate for Wal-Mart that showed a $2 million USD installation cost for a 150,000 square foot store. This included retrofit of existing HVAC, thermal storage tanks etc.

An average store of this size will use between 200 ton and 450 ton of air conditioning which can consume 450Kw per hour active. If you assume that the store needs to run the HVAC to 10 hours during the peak summer they will consume 4,500KWh per day. The system should have a 20 year life so a store with an 8 month cooling season we end up saving 21.6 million KWh. If we divide the 2 million investment by the KWh saved we have a cost per KWH of $0.0926 per KWh.

Another way of looking at this is that it currently costs about $10,000 per KW of photo voltaic solar panels installed. To deliver 450KW to drive the HVAC system during daylight hours + 200K more so save some up for evening hours you need 650K of

capacity which works out to an investment of 6.5 million, over 3 times the cost of the renewable cooling system.

How much might this price change in the next 5 years.

This is all driven by how much capital you invest in the production line and how large of increments you can buy raw materials such as plastic in. If we reach sufficiently high volumes the cost could drop by 80% which we will pass back to the customers.

If we hit these economies of scale the cost for the large Wal-Mart store drops from an initial investment of $2 million USD down to $400,000 USD while our cost per lifetime KWh drops from 9.26 cents to $0.0185 cents. During the same lifetime we can expect to see the cost for grid KWh to rise which makes this even more extraordinary.

In the long term this becomes a competitive advantage that allows those who invest and obtain a static operating cost to substantially out compete those who are still paying the rapidly increasing grid prices.

How does your technology compare to others like it out there.

To the best of our knowledge there are no commercial companies with products in production that utilize similar approaches. There are a number of DIY approaches including roofing ponds but none of these appear viable for large scale deployment. For that reason our competitors are other technologies that can be used to solve the same problem.

The closest competitor would be absorption chillers powered by solar tracking parabolic troughs which heat a fluid to 300F or higher to drive the absorption chiller. We have partners in Europe who developed their own version of these and our own EEDRT system is similar. These are very good for very hot high sun environments like Egypt where the nighttime temperatures may stay above 90F. The problem is with complexity and cost. The tracking troughs must be very precise and they must be aimed very precise which imposes stringent manufacturing and materials requirements which results in high costs. Then you have to aim the system which requires motors, linkages, sensors etc all of which add to cost. The materials have withstand at least 400F and the high temp fluid must be delivered to the chiller which requires high temp high efficiency insulation. In addition there is need to maintain all those troughs and moving parts. Our system is much more simple, Contains almost no moving parts can use much less expensive material, It can be manufactured cheaper and doesn't require any refrigerants.

The next main competitor would be PV photo voltaic panels which are being used to supply power for a high efficiency HVAC system. This approach is also OK but our energy density is higher while our costs can be less than 1/3 that of the installed PV systems which could drop to less than $1/10^{th}$ as scale ramps up.

A number of radiant technologies have been tested some of which where funded by the USA department of energy. We studied what they did and what problems they identified. We focused mostly only these identified problems during our early design process and the result is a very robust system.

- Almost every test we looked at installed panels on a sloped roof which caused 90% of their cooling energy to be invested in chilling air close to their surface which ran right off the panels to the ground below. You may not avoid sloped roof installation but we developed a design which allows us to eliminate a majority of the thermal losses associated with this problem.
- Other groups tested with secondary glazing to improve performance but they encountered condensation on the glazing which destroyed their efficiency we developed a stagnant insulating layer to give us much of the same benefits without secondary glazing.
- Some groups encountered issues with wind re-warming the plastic surface so we developed two strategies for the wind one which funnels the winds away from the surface and a second which uses the winds energy to provide extra chilling.
- The last group encountered problems with dew condensing on the exterior panel stealing cold so we developed strategies for preserving horizontal stagnant insulating layer so new humid air never makes it to the panel surface.
- Many groups used the obvious metal radiant surfaces which is a easy choice since metal roofing is readily available and metal radiates well but it is also highly conductive which means that it is highly susceptible conductive and convective loss of the cold to the air around it. The metal also chills the outer surface much more aggressively than the cold is transferred through. This when combined with the issues above caused significantly lower efficiency. Our approach completely avoids a majority of this problem.

You can not say we borrowed their design but we definitely borrowed their design weaknesses to make our design more robust.

What are it's strengths?

- Carbon reductions without sacrificing comfort.
- Low enough power demands to operate easily when off grid or during power outages.
- Viable ROI especially with large scale deployment.
- Relatively simple to install and easy to maintain with very few moving parts. Easy to repair.
- Fixed operating costs that could be essential for the elderly who are living on fixed incomes.
- Next logical step after new windows and upgraded insulation.
- Massively scalable. This is one of few technologies that can be deployed in sufficient scale to actually reduce USA carbon emissions.
- It depends on materials already being produced in very large scale with no single point supply issues. We do not have the problem faced by PV (Photo voltaic) solar

cell companies of needed highly refined silicon or super high tech, high precision manufacturing lines.

- Retain comfortable cooling in critical facilities during power outages. This could be especially critical hospitals and nursing facilities in the hurricane zone
- Can reverse urban heat island effects which traditional HVAC only aggravates.
- Targets one of the largest causes of electricity shortages and the fastest growing sector for electricity consumption.
- Reduces load on the grid when the grid is under highest demand so it can eliminate rolling blackouts or at least reduce the impact of the blackouts when they occur.

What are it's weaknesses?

We always try to turn weakness in to new market opportunities or new products. For example we originally invented the radiant panels to use for harvesting Air to water but they can only work in this mode where humidity is relatively high. We turned that around to use the same basic technology to produce the renewable cooling market which applies in a larger portion of the country and at least in the USA is a much larger market.

- People have to be re-educated to think about 10 year power costs before they can compare the system fairly. The average American tends to compare our cost to what they can buy at the local home improvement store without factoring in the energy costs over time. For our product to be successful we have to shift the viewpoint to think of cooling as a long term capital investment. The replacement window companies have been successful at motivating this shift and have laid the ground work for us. Ultimately I think these companies may be the most logical dealers and installers for our product so it may turn into a benefit.
- Can only cool with the radiant panels to a certain level and if that is not far enough we have to add a geo-exchange pump. This raises costs in ultra hot areas such as Phoenix and Las Vegas.
- The panel efficiency goes down as the dust thickness goes up so they have to be periodically cleaned. Most often with a leaf blower but may require a damp cloth.
- Some people don't like the idea of having panels on their roofs. I don't think asphalt shingles or gravel are inherently more attractive so this is more a mind set issue than a reality. We will have to focus developing version of the product that more readily merges with architectural styles. We will also need a version that can link each panel together to provide uniform outer surface. I also think that as people start experiencing the effects of global warming they may care more about flooding coast lines than panels but until then there is a perception issue to overcome.
- It uses radically different strategies for energy savings than are known in the market today and as a result are not yet qualified for some of the tax incentives offered by the state and federal governments.

How might someone invest in your company?

Contact me at 800-658-8745. We have not been actively seeking venture capital. We are interested in qualified individuals or organizations that are passionate about global warming, the environment and humanitarian issues. The national market could be worth

hundreds of billion of $ which should make it interesting to investors but it takes time and a long term commitment which is motivated equally by an interesting solving the problem.

As I mentioned above what we really need right now we are aggressively seeking test partners who if their test proves successful could make a decision to deploy on a larger scale. That is limited by those who have buildings that need cooling are either off grid, where peak demand power is abnormally expensive or where they have a requirement to keep cooling active during power outages.

I personally would really like to move forward with implementing the full scale vertical blow molding which would dramatically increase our production rates. To really pursue the blow molding we need at least 5 million in the bank beyond our sales and marketing budgets. The fastest way to get that money would be external financing but we will get there eventually with incremental growth it will just take longer.

What are your long term financial goals?

This is a market worth over 100 billion USD but even more important is it's ability to reduce carbon emissions by billions of pounds per year when widely deployed. We recognize that to bring the largest possible benefit to America it will need the resources of a Fortune 50 company such as GE and as such we will not shy away from acquisition or exclusive licensing by the right partner who is strongly committed.

With that said we are building the business from the perspective managing and growing it indefinitely while accepting limited amounts of money from the outside.