XDOBS Renewable cooling

800-658-8745 - joe@xdobs.com

Air conditioning with 95% less power

Cool off grid locations

Keep cooling even during power outages

XDOBS Introduction

- XDOBS founded in 2003 by Silicon Valley Entrepreneur.
- Privately funded by founders
- Energy, Water, Greenhouse emissions research.
- Strong embedded systems and software optimization background.
- Joe Ellsworth –
  - CTO 25 years in software and embedded systems.
  - HP trained manager,
  - Lead VC funded startup in silicon valley.
  - Long term renewable energy research.
  - Managed up to 80 people.

Products & Technologies

- Water from Air without electricity (night radiant)
- Air conditioning with dramatically less power (night radiant)
- Wind powered Freezer
- Solar Thermal powered air conditioning
- Wave powered desalination

Portions patent pending

Renewable cooling Introduction

- **Provides 80+% overall reduction in HVAC Electricity consumption.**
- **Provides 90+% reduction of electricity consumption during peak demand hours.**

- Provides ROI over 10 times better than Photo voltaic solar panels at 2007 prices.
- Can delay or remove need for major grid upgrades especially in areas with peak demand failures.
- Eliminate need for rolling blackouts caused by excess power demands in the summer.
- Reduce standby generating requirements by up to 50%.
- Dramatically reduce indirect greenhouse emissions for equipped buildings.

Air conditioning Problem background

- HVAC style air conditioning is single largest consumer of power for most structures during summer months.
- Typical renewable technologies such as PV are incredibly expensive when used for chilling due to large power demands.
- Air conditioning electricity demand is leading cause of summer blackouts.
- Air conditioning electricity requires larger grid infrastructure require dramatically larger generation facilities.
- HVAC is single largest growth sector for electricity demand especially in large states.

Air Conditioning Environmental Impact

We reduce indirect HVAC emissions for on grid buildings by over 80% even more in some regions.

- Average HVAC is 2.5 to 4 ton of Air conditioning per 1,000 square foot.
- 1 Ton = 1KW at EER 10. (DOE)
- 1KWH = 1.2 pounds of carbon emissions average (DOE) (California estimates 0.867 due to large hydro electric contribution)
- Average home uses 3 to 5 ton HVAC = 3.6 pounds of carbon per hour HVAC system is active.
- 150,000 square foot building indirectly emits 540 pounds of carbon per hour when HVAC is active.
  (150,000 / 1000) * 3 = 450 ton @ EER 10 * 1.2 pounds per KWH.

XDOBS renewable cooling technology can move USA much closer to compliance with Kyoto protocols.

Purpose of this presentation

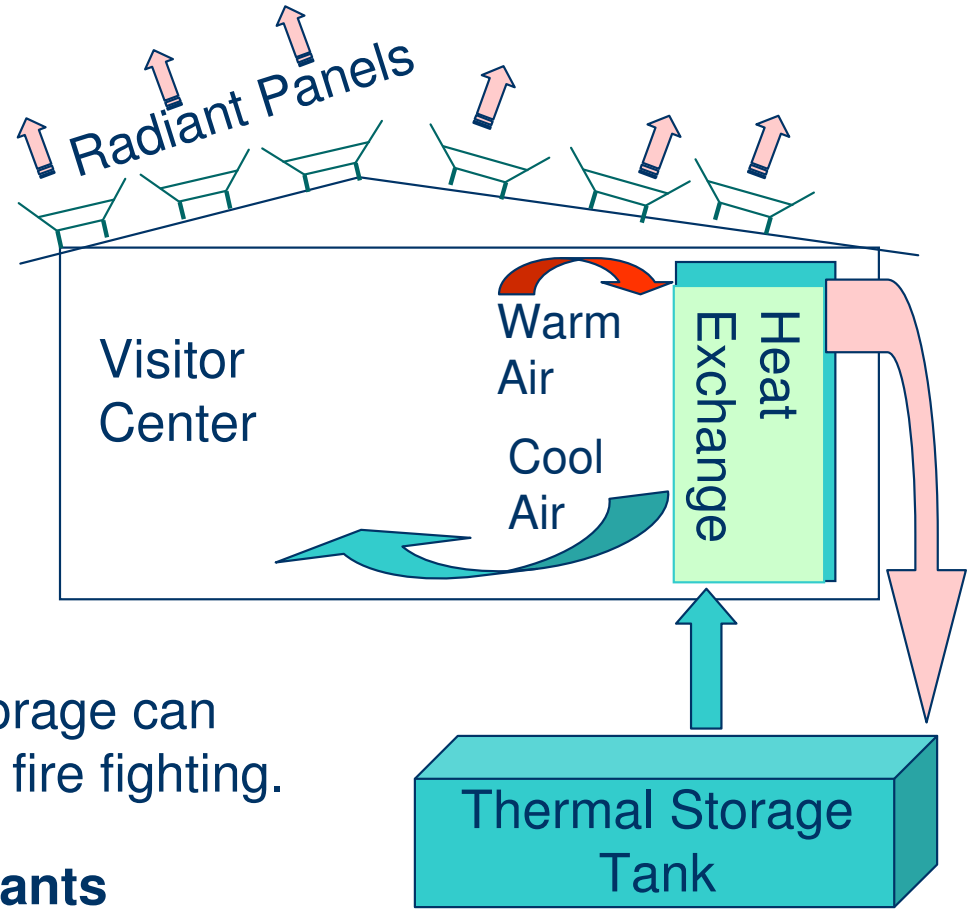
- Introduce a ideal way to cool off grid and expensive power building.
- Offer Early access to test technology on low risk test program.
- We need test partners
  - Who have invested renewable solutions in the past
  - Who manage buildings that are off grid or have expensive peak demand power and need cooling.
  - Who may have larger needs pending successful test outcome.
  - Who would help publicize the results of the tests.
- Some of the state park buildings such as Goblin valley visitor center represent ideal test locations with strong benefits to the people working and visiting those sites.

Why Government and large business should care:

Allow expensive grid upgrades to be deferred for years or decades

- Most feasible renewable strategy for cooling off grid buildings.
- Most deployable for large scale scalable renewable cooling.
- Much cheaper than PV when cooling is needed.
- Ideal for areas with high peak demand electricity prices
- Essential in areas where loss of electricity for HVAC can cause loss of human life such as health care and nursing facility in hurricane zones.
- Reduces carbon emissions by over 10X per $ invested as compared to PV.
- Static operating cost for those on fixed incomes.
- Incidental benefits:
  - Dramatically reduces roof wear due to solar exposure
  - Dramatically reduces heat gain through roof
  - Dramatically reduces attic temperatures.

System Overview
How it works



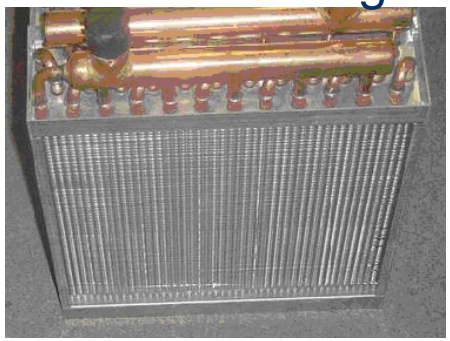
Thermal storage can be used for fire fighting.

No Refrigerants Needed

Radiant Panel

d Shield

Heat exchanger



Thermal Chimney

Major System components
XDOBS Renewable cooling

- **Radiant Panels** – Shed heat to night sky or day sky when shaded 100 to 400 watts per sq meter. Chills thermal storage fluid. Reach 10F to 20F below nighttime ambient.
- **Thermal storage fluid** – Absorbs heat from building during day and carries that heat to panels at night to be shed**.** Normally chilled to 8F below 2 hour low nighttime average.
- **Wind Shield** – Prevents convective warming of panel surface which allows extra chilling. Creates horizontal stagnant insulating area which increases efficiency and minimizes thermal gain from surface dew.
- **Thermal Storage** – A tank's) of fluid which contain the chilled fluid until needed for cooling purposes. Normally insulated and buried to retain cold. Average is 3,000 gallons per 1,000 square foot per day of storage.
- **Micro controller, Valves, Blower –** Controls circulation of fluid to maximize chilling to panels and circulation of fluid to heat exchangers to maintain desired room temperatures.
- **Heat Exchanger** – Transfers cold from the thermal storage fluid to indoor air. Several different types but cheapest is basically a set of 280,000 BTU radiators.
- **Indoor panels** (optional) - A different kind of heat exchanger. Great for new construction.
- **Thermal Chimney** (optional) – A different kind of heat exchanger looks like a chimney uses diffusion type cold air release at floor runs completely silent uses convention to drive air flow and eliminates need for most HVAC ducts. Ideal for retrofit installs.
- **Wind Assist** (optional) – Directs wind away from panels while using wind energy to provide up to 70F of additional chilling. Ideal in areas with 5 ours per day of 8 MPH winds.
- **Geo-exchange pump** (optional) – areas Uses electricity to boost chilling from radiant panels.

Radiant cooling background

Easy to understand hard to optimize.

- NASA uses it to cool space craft.
- Used to cool large telescopes world wide.
- Used to chill large scale cryogenics.
- Several DOE funded studies on various aspects.
- Successful tests in Pacific islands and Egypt.
- Radiant panels shed heat to night sky.
- Optimized to minimize heat gain from convection.
- Stored cold used to cool air during the day.
- Special design maximizes cold production
- Optional wind assist increases available chilling.
- Optional geo-exchange heat pump allows 72F comfort level in worst case conditions Las Vegas during late July.

Primary Renewable cooling be uses

- Off grid guard shacks.
- Locations with expensive power such as Diesel or propane generators.
- Areas with high peak demand power costs.
- Locations with High human cost if cooling is lost during power outages such as nursing homes and hospitals.
- Buildings that must stay operational during power outages such as police and fire stations.
- Businesses in areas where peak demand is causing high risk of grid failure.
- Areas where large scale grid upgrades are needed to meet increasing demands.

Cost for USA test

1,000 square foot would cost $14,000 which is less than 1/10th Of what it would cost to provide refrigerated Air conditioning using Photo voltaic solar panels.

- $14 per square foot installed.
  - Includes panels, thermal storage, internal air exchange, installation.
  - Considering test sites from 350 to 3500 square foot.
- Thermal storage tanks require excavation. Can be insulated and left above ground but requires additional cost housing.
- Budget 7% per year for maintenance. 1 year maintenance included.
- Designed for 15 year life but should last longer.
- Easy to maintain and moving components such as pumps can be replaced with standard modules.

Summary

1. **Choose a Test Site**
2. **Agree on goals**
3. **Arrange for funds**
4. **Set target for installation date**
5. **Arrange for installation**

- Good solution for cooling off grid locations.
- Possible application in broader range of conditions.
- Works where swamp coolers fail.
- Can substantially reduce amount of PV power needed for a given building.
- Ideal in locations where loss of power could affect critical operation due to building heat.
- Subsidized access test solutions in exchange for early adoption.

Renewable cooling compared to photo voltaic (PV) solar panels

More deployable, Higher ROI, capable as mass installation

- $ for $ the renewable cooling system can reduce power consumption by much more than Photo voltaic are capable on generating.
- Foot for foot renewable cooling will reduce power consumption by more than commercial grade Photo voltaic generate and do so at a lower cost.
- Renewable cooling has the ability to reduce power consumption for HVAC by 95% during peak demand and over 80% overall. For a large building like a 150,000 sq foot warehouse store this is the equivalent of reducing peak demand by 450 ton or over 400KW. Renewable cooling reduces this demand to under 20KW which dramatically reduces the Solar array or grid power needed.
- A 100 watt solar panel costs about $1000 installed (2006-2007) the same size of renewable cooling panel cost about $140 installed which can drop to under $100 for new construction in large volume.