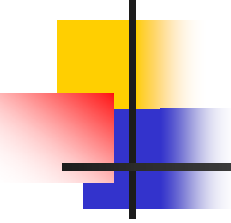




HVAC - Energy - Environment

Sumaya HMX Systems Ltd.,
Bangalore 560058

April 2005

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-
- We as facility / utility managers are quite often left with the unenviable task of optimizing seemingly conflicting objectives...
 - Indoor comfort vs. energy bills
 - Factory environment vs. lower budget for capital equipment
 - Green initiatives vs. functional requirement of the unit

.....the natural question may be what is the relevance of this title???

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...a quick review

- Since late eighties, we have been hearing phrases like:
 - ODP – Ozone depletion potential
 - GHG – Green House gases
 - GWP – Global warming potential
 - Now the actively used phrase ' carbon emission'
- We have also been hearing about Montreal / Kyoto protocol

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....review continued

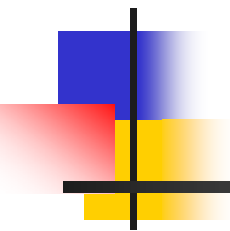
- Agreed that several industries are responsible and contribute to the various problems listed
 - Automobiles....petroleum...CO₂ emission
 - Halons...ODP
 - Coal industry - GWP

- In this document we shall restrict it to HVAC industry

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Objective

- The objective of this document is to share a few thoughts on...
 - Connect between HVAC – Environment – Energy
 - Indian perspective
 - Energy and Environment friendly technologies
 - HMX Ambiator
- Each is addressed in the following sections

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Is there a 'connect' between
HVAC – Environment - Energy

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HVAC.. Environment.. Energy

- We do not have to go very far to link HVAC and Energy
 - Organizations spend between 40 to 70% of the total building energy costs in HVAC
- As regards environment, there is both direct and indirect impact
 - Direct – in terms of CFC, ODP
 - Indirect – total energy, GWP of power generation, Carbon emissions etc.,



Some references...

- Space conditioning (heating, cooling, and ventilation) is the most significant energy use in the commercial sector, representing the best opportunity for reducing carbon emissions in the future.
- More efficient lighting and office equipment also contribute to carbon reductions (along with some modifications in the use of computer and telecommunications equipment).
- Total energy use per square foot of commercial floor space in 2010 is projected across the cases to drop by 26%

Energy Information Admin...DOE, USA

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HVAC.. Environment ..Energy

- How can we go about this??
 - To have a meaningful discussion, we need to go back to the core issue that HVAC industry caters to.... 'thermal comfort'



ASHRAE 55 or ISO 7730.....

- While designing Air conditioning system we refer to ASHRAE 55 standard.
- Maintain operative temperature between:
 - 20.0 to 23.5⁰ C in winter
 - 22.5 to 26.0⁰ C in summer
- Maintaining Rh between 30 to 60%



Standards...

- These standards are based on static model
 - “One size fits all” approach
- *Thermally bored* syndrome
- These do not take cognizance of ‘thermal adaptation’ by the occupants.
 - Adaptation due to various factors
 - Profile
 - Occupational
 - Personal
 - Other reasons
- Currently there is a lot of deliberation on need to address a dynamic model for thermal comfort

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Standards..

- There have been studies addressing thermal adaptiveness (Humphreys 1976, Busch 1992, Richard de Dear et., al 1992/1998, Baker and Standeven 1994 and so on...)
 - Winter preferences for different countries
 - Japan 14 deg. C
 - Norway 17 deg. C
 - Sweden 21 deg. C

- We do not have Indian standards for thermal comfort

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HVAC... Environment... Energy

- We can address the connect between the three by integrating:
 - Climatology
 - Ambient weather
 - Energy
 - Choice of technology
 - Indoor Environment
 - Thermal comfort

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Indian perspective

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Indian perspective

- Within the Indian sub continent, we experience 6 different ambient weather conditions
 - Hot & dry
 - Warm & humid
 - Moderate
 - Cold and cloudy
 - Cold and sunny
 - Composite

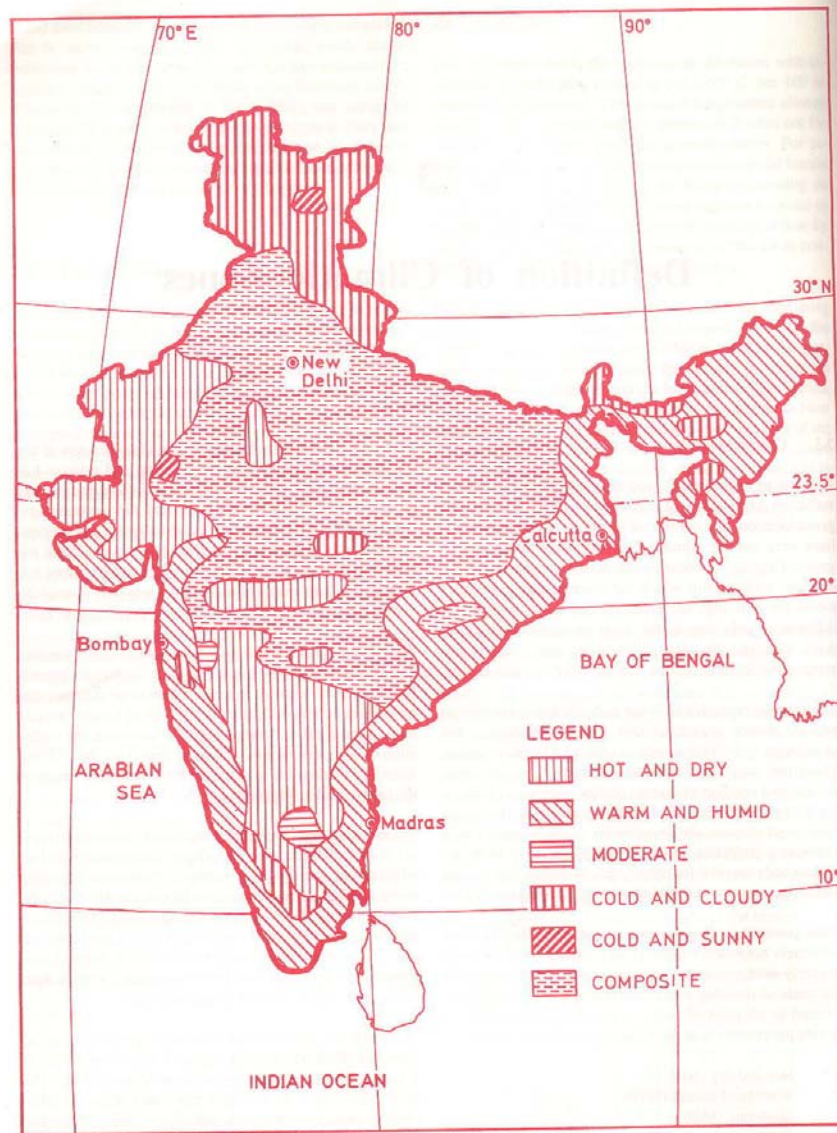


Figure 4: Climatic zones of India

perspective



Indian perspective

- We are witnessing significant progress by way of...
 - Different types of Chillers, each getting more energy efficient, advanced refrigerants
 - Different technologies (Working without HFC's)
 - Vapour compression using hydro carbons, ammonia, carbon-di-oxide
 - Vapour absorption / adsorption
 - Dessicant cooling
 - And many more....

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Indian perspective

Apart from those listed above, a range of Energy efficient and Eco friendly technologies come in very relevant for the different climate regions shown in earlier slide

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Energy and Environment friendly technologies...

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Energy and Eco. Friendly technologies

- Free Cooling
- Night Ventilation
- Earth Cooling (ground cooling)
- Evaporative Cooling
 - Direct Evaporative cooling
 - Indirect Evaporative cooling
 - Two stage evaporative cooling

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Energy and Eco. Friendly technologies

- Free Cooling

- Uses the principle of 'reverse chimney' effect
- This solution is typically integrated into a building at conceptual stage.
 - Provide for towers – *ala* watch towers
 - Have ambient air collected at the top of towers
 - Saturate this stream of air
 - Move this air stream to cool the designated areas

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Energy and Eco. Friendly technologies

■ Night Ventilation

- Night air is always cooler.
 - Bangalore in this season is about 14 to 17 deg. C
- Use this cool air to cool the thermal mass of the building.
- This will translate to about 7 to 10% energy saving advantage

■ Earth Cooling

- Earth temperature is cooler than ambient environment
- A tunnel (pipe) is laid few metres beneath ground
- Ambient air flowing through this gets cooled naturally

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Energy and Eco. Friendly technologies

- Evaporative Cooling / Conditioning
 - India is one of the largest markets in the world for these technologies
 - We have products at different levels of sophistication and different levels of technical performance being offered in the market

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HMX Ambiator...

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Introduction...

- Ambiator is an innovative product offering to Indian Market, that has been successfully commercialized
- It is an energy efficient and eco friendly product:
 - Effects energy savings upto **60 %** as compared to conventional air conditioners
 - Is an eco –friendly product, as it does not use any CFC or GHG (green house gases)

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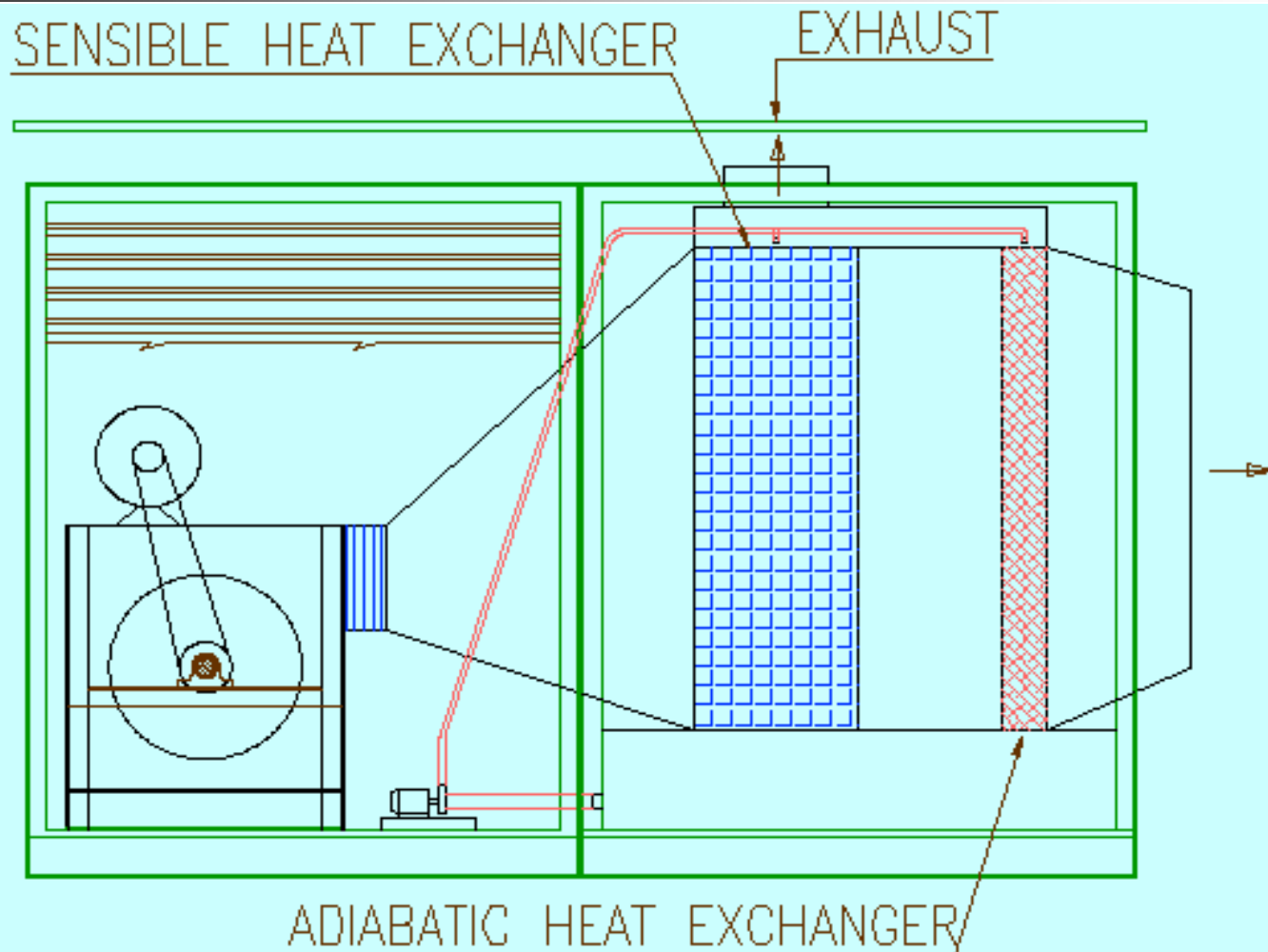
A few international references...

- Internationally, systems working on similar principles are called IDEC systems or Two stage evaporative cooling systems.
 - These systems are identified as Zero ODP (ozone depletion potential) and Zero (Global warming potential) systems.
- Research references are available from:
 - DOE - Department of Energy, USA
 - CEC – California Energy commission
 - LBL -Lawrence Berkeley laboratory

Principle of working of Ambiators...

- Ambient air is drawn across filters (5/10/20 microns depending upon requirement) and passed through two heat exchangers:
 - **Sensible Heat Exchanger:** Air is cooled sensibly without adding any water. This works on the principle of indirect evaporative cooling of air.
 - **Adiabatic Heat Exchanger:** Air from HE 1, is passed through an adiabatic heat exchanger for evaporative cooling of air. In this heat exchanger, sensible heat is converted into latent heat.

Schematic Diagram



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What is new in Ambiators ?

- Ambiators represent a new technology
 - These incorporate a Wet plate, Cross flow heat exchanger, where based on Indirect Evaporative Cooling, sensible cooling is achieved.
 - This forms the **core technology** of Ambiator.

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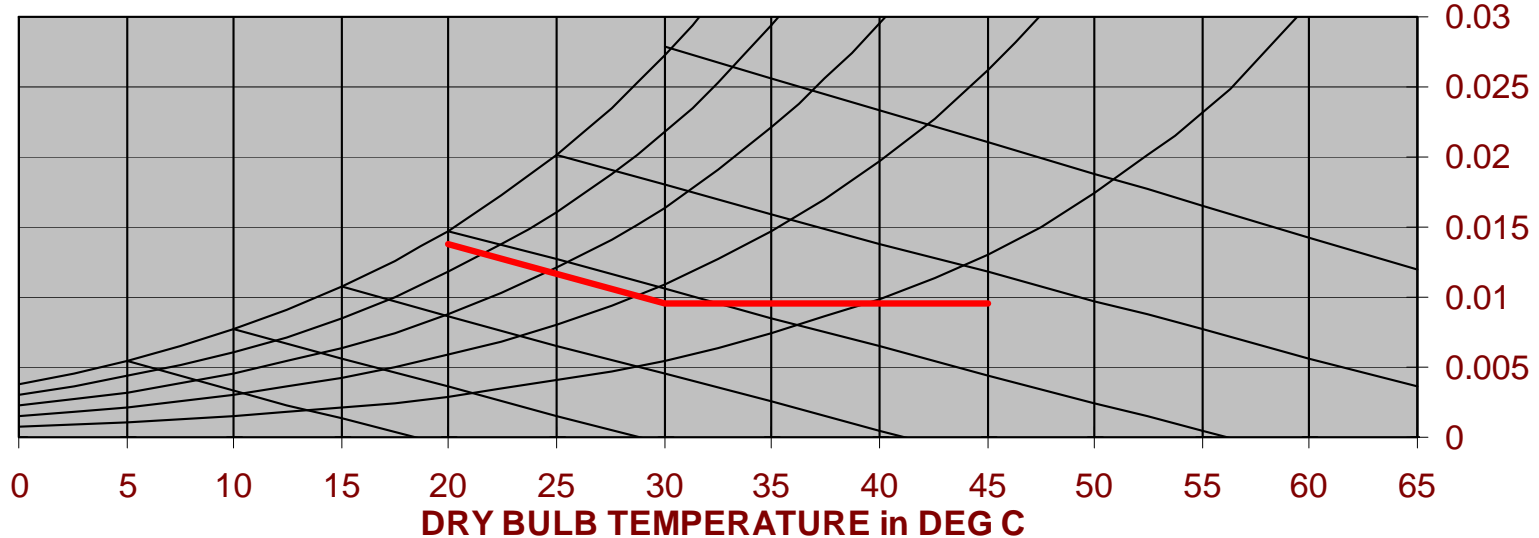
Key features of Ambiators...

- Ambiators are:
 - Energy Efficient (EER of over 25)
 - Eco friendly (No CFC is used)
- Ambiators come with an integrated control panel with options such as:
 - Variable speed drives
 - PLC/Micro controller based control systems
 - Remote management
 - Integration with existing control systems / BMS / Energy Management

Psychrometric chart ...

PSYCHROMETRIC CHART
based on barometric pressure of 1013mbar

**MOISTURE
KG/KG**



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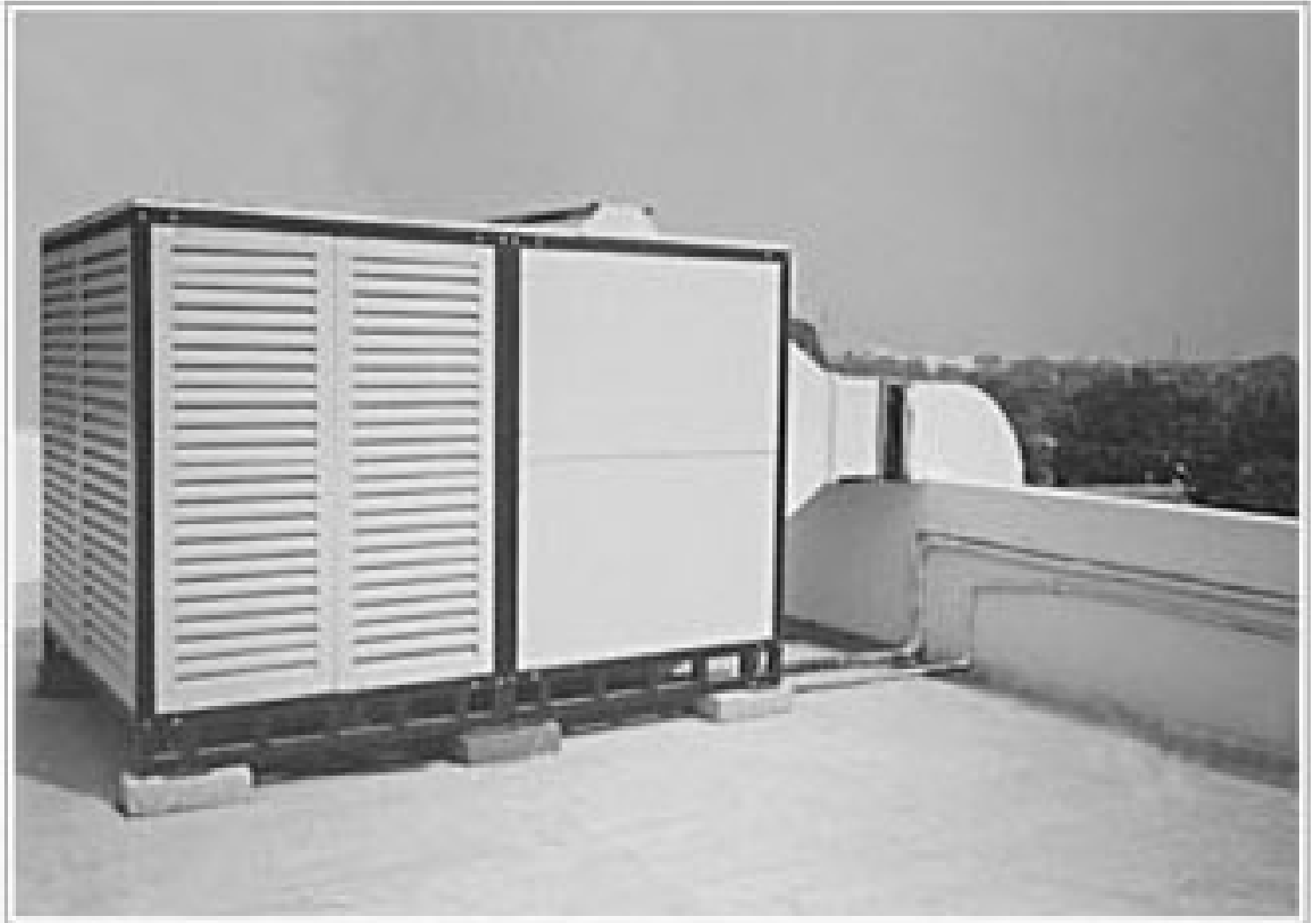
Applications...

- HMX Ambiator can be used as an Energy efficient alternative to air conditioners
- It presents an innovative and unique technological solution for
 - Comfort conditioning
 - Industrial ventilation and cooling
 - Pre cooling for Compressors / Gas turbines
 - Hybrid air conditioners
 - 100% fresh air applications.

Case studies....

- **Wipro**
 - Comfort conditioning
- **MICO**
 - Control room conditioning
 - Industrial Ventilation and cooling
 - Comfort conditioning
- **Exide**
 - Rectifier room / charger room conditioning
- **Saint Gobain**
 - Spot Cooling
- **ABB**
 - Industrial Ventilation & Comfort conditioning
- **Jindal Aluminium**
 - Process Cooling
 - Compressors pre cooling
- **Sun Pharma**
- **Glenmark Pharma**
- **Taj West End**

One of the Installations



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Product endorsement...

- TERI (Tata Energy Research Institute) has conducted a detailed research and brought out its report vide document DCS 001 (in collaboration with GTZ and EMC)
 - TERI, confirms the Energy savings potential of HMX Ambiator.
- PCRA – papers have been presented during various workshops/seminars at PCRA.



TATA ENERGY RESEARCH INSTITUTE



GERMAN TECHNICAL CO-OPERATION



ENERGY MANAGEMENT CENTRE

DEMONSTRATION CASE STUDY**DCS 001****ENERGY SAVING PRODUCT****AMBIATOR FOR COMFORT AIR CONDITIONING****PRODUCT**

AMBIATOR* is a low cost and low energy intensive alternative to conventional air conditioning. It works on the principle of two-stage evaporative cooling:

Stage 1:

Sensible Heat Exchanger: The air from the atmosphere is sucked in through 20 micron (as per the standard norms) dust filters and is forced across a heat recuperator consisting of a cross flow, wet plate plastic heat exchanger, which has an efficiency of about 60%. The air that flows through the heat exchanger is never in direct contact with water (which is passing on the other side of the heat exchanger). The wet side of the heat exchanger is covered with a hydrophilic material, which maintains a thin film of water, which evaporates when the sensible heat is transferred to the wet side. A portion of the cooled air picks up the evaporating water and exhausts out. About 15-20% of the air is used up this way. The air that comes out of this heat exchanger will be significantly colder than the ambient.

Stage 2:

Adiabatic Heat Exchanger: The air that is coming from the heat recuperator is then passed through an evaporative cooling module, which consists of a cellulose media made up of a speciality material called "Celdek", which is constantly kept wet with a water drip. Part of the sensible heat in the air is converted into latent heat and the air is finally delivered in to the conditioned space at significantly lower temperature than the intake.

Instrumentation. For evaluation of its performance, elaborate instrumentation arrangements were made to record / monitor various parameters. An energy meter and an hour meter were connected across the mains of blower and water pumps to find out the number of operating hours of the machine and the corresponding energy consumption. A "tinytag" logger was installed in the conditioned space to record temperature (dbt) and relative humidity (%) every one hour.

AMBIATOR BASED AIR CONDITIONING SYSTEM - Salient Features	
Advantages	Limitations
Lower capital cost	Lowest cooling temperature 24°C.
Very low power consumption	Relative Humidity 60-70 percent as against 40-60 percent achievable with a conventional system
100% fresh air on continuous basis against 10 percent, superior clean indoor air quality	Ambiator is somewhat bulky and has to be mounted in open space

COMPARISON OF CONVENTIONAL A/C SYSTEM WITH AMBIATOR	
Conventional air conditioning	Ambiator-based air conditioning
Can provide 20-24°C temp. & 30-60% rH	Can provide less than 26°C dbt for 96% time in a year & rH in the range of 60-70%
Power requirement ~ - 1.2 kW/TR	Power requirement only 0.5-0.6 kW/TR; demand savings also possible
Typically 10% fresh air	100% fresh cool air
Sick building syndrome envisaged	No problems of Sick building syndrome
Poor indoor air quality	Excellent indoor air quality
CFCs causing ozone depletion	Eco-friendly. No CFCs involved

APPLICATION AREAS

Comfort Cooling in offices, hospitals, factories, cinema halls, floriculture, control rooms, DG sheds, compressor rooms, hotels, restaurants, show rooms, department stores and anywhere where there is need for clean fresh cool air.

* Ambiator is the product of Sumaya HMX Systems Ltd., 18, 3rd B Cross, Domlur II Stage, Bangalore 560 071 Tel: 080-527 1614 Fax: 526 3996 Further enquiries may be addressed to them.

**changes address**

A-422, Peenya Industrial Estate, 1st Stage,
Bangalore - 560 058 Phone : 91-80-372 2325, 372 1065
Telefax : 91-80-372 2326

<http://www.hmx.biz>
E-mail : ambiator@hmx.biz



a few of the links...

- www.greendesign.net
- www.epbl.lbl.gov
- www.socalgas.com
- www.energy.ca.gov
- www.oikos.com
- www.eande.lbl.gov
- www.p2library.nfesc.navy.mil
- www.epa.gov
- www.dtic.mil
- www.eren.doe.gov
- www.fsec.ucf.edu



how to reach us...

Sumaya HMX Systems Ltd.,
A-422, 1st Cross, 1st Stage
Peenya Industrial Estate,
Bangalore 560 058.

Ph.: 91 80 2372 1065 / 2372 2325

Fax: 91 80 2372 2326

E-mail : ambiator@hmx.biz

Website : www.hmx.biz

**air side
engineering**
... **Cut Energy Bills by 60%**

HMX ambiator

**Energy efficient alternative
to Air conditioners**

**An innovative and unique
technological solution for**

Comfort Conditioning

Industrial Ventilation and Cooling

Pre cooling for DG sets, Compressors,
Gas turbines

Hybrid Air conditioners.

100% fresh air applications

Retrofits to existing AHU's and Chillers.



**Product
endorsed by**

**TERI
GTZ (of Germany)
EMC (Govt of India)**

SELECT CUSTOMER LIST

Wipro
MICO
Zuari Cement
Saint Gobain
HAL
Sun TV
NIIT
ThinkGen

HMX ambiator

HMX Ambiators offer an Energy efficient alternative to conditioning Air to a comfortable, sensible and healthy levels with minimum power requirement and without using Energy intensive compressors. Thus the product is both Eco friendly and Energy efficient.

Principle of Operation

HMX Ambiator cools air in two stages **Indirect & Direct evaporative cooling respectively**. Internationally, systems working on same principle are called IDEC systems or two stage evaporative cooling systems.

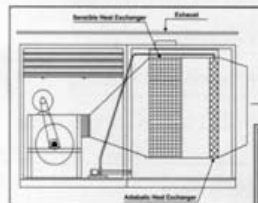
Ambient air is drawn across filters (filtration up to 5/10/20 microns depending upon requirement) and passed through two heat exchangers.

Stage 1 - Sensible Heat Exchanger

In this heat exchanger, air is cooled sensibly without adding any water. This works on the principle of indirect evaporative cooling of air. This heat exchanger forms the **core technology** of HMX ambiator.

Stage 2 - Adiabatic Heat exchanger

Air from Stage 1 passes through 'Celdek', an adiabatic heat exchanger for evaporative cooling of air. In this heat exchanger, sensible heat is converted into latent heat.



The blowers are designed with sufficient static pressure to enable distribution across a hall / office / factory.

Ambiator - Product Details

- ◆ **The Ambiators are available in various capacities**
 - Small up to 2000 CFM
 - Medium 2000 to 10,000 CFM
 - Large systems 10,000 to 50,000 CFM
- ◆ **The Ambiators come with an integrated control panel with several options such as**
 - Variable speed drives.
 - PLC / Micro controller based control systems.
 - Remote management
 - Integration with existing control systems / BMS / Energy management systems.

Project & Engineering

- We do turnkey 'Engineering solutions', including the engineering, installation and commissioning.
- The Ambiators can be integrated with other Air handling systems to optimize on power consumption.

Marketing & Service

- All India network.
- Attractive ESCO alternatives available where by you pay out of your savings.
- We guarantee uptime of machines.
- Service & AMC offered.
- We have a 64 kbps line, 24/7 hours presence. CRM option available.

HMX

HMX is a technology driven company offering innovative Energy Efficient products HMX Ambiators and, services ESCO solutions in the field of Energy Conservation, Industrial applications and HVAC.

Sumaya HMX Systems Ltd.

A-422, Peenya Industrial Estate, 1st Stage, Bangalore 560 058
Phone: 91-80-372 1065, 372 2325 Telefax: 91-80-372 2326
e-mail: ambiator@hmx.biz Visit us : www.hmx.biz

Chennai Office :
22, 4th Lane, 1st Cross, Adayar, Chennai - 600 020. Ph : 91-44-491 4560, 491 1460

