EmiratesGBC Technical Workshops

EmiratesGBC X Terrafic Energy

Natural Cooling Technology Using Direct and Indirect Evaporative Cooling

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COOLING THE PLANET:
REVOLUTIONIZING ENERGY-EFFICIENT CLIMATE CONTROL WITH IDEC SYSTEMS

TERRAFIC ENERGY 2023
THE TIME TO CHANGE IS NOW!

The secret of getting ahead is getting started.

- MARK TWAIN
ABOUT US

TERRAFIC ENERGY IS A DUBAI BASED SUSTAINABLE ENGINEERING AND CONSULTING ORGANIZATION, FOCUSING ON TWO HIGH IMPACT SECTORS IN THE UAE – ENERGY AND WATER AND ITS SUSTAINABLE GENERATION AND CONSUMPTION.
Evaporative cooling systems

Electricity generation with solar PV

Transparent heat-blocking coating for glass

Heat reflective paint for roofs & facade

Terrafic Energy solutions!
TACKLING THE EVER INCREASING COOLING DEMAND

Global electricity demand growth by use 2018–2050

Source: International Energy Agency
Rise in temperature

Rise in CO2 Emissions

Source: NASA
Rising global temperatures, accelerated urbanization, and the growing middle class in various regions are all contributing to an insatiable thirst for cooling.
AIR CONDITIONERS & FANS ACCOUNT FOR 20% OF THE ELECTRICITY CONSUMED IN BUILDINGS WORLDWIDE

Source: International Energy Agency
ACCORDING TO UNEP, CLIMATE-FRIENDLY COOLING SOLUTIONS COULD AVOID AS MUCH AS 460 BILLION TONNES OF GREENHOUSE GAS EMISSIONS.

Source: UNEP
According to recent research conducted by the NREL and Xerox PARC, 1,950 million tons of carbon dioxide emissions are released each year from the energy used to power air conditioning.

- 531M tons from cooling air
- 599M tons from removing humidity
- 820M tons from refrigerant leaks, manufacturing and transport

Source: NREL
A transition to climate-friendly and energy-efficient cooling, however, would avoid greenhouse gas emissions and allow an increase in cooling access that would contribute substantially to the Sustainable Development Goals (SDGs).
PRIORITIZING ENERGY EFFICIENCY

To confront this impending challenge, a crucial priority is to prioritize energy efficiency in cooling technologies. This entails embracing a multifaceted approach:

1. **Energy-Efficient Systems:** Systems that are designed to deliver the same level of cooling comfort while consuming significantly less energy.

2. **Improved Building Insulation:** Better insulation can prevent cool air from escaping buildings, reducing the workload on cooling systems and further decreasing energy consumption.

3. **Smart Cooling Solutions:** Implementing smart cooling solutions can optimize the operation of cooling systems, ensuring they run at peak efficiency and only when necessary.
TAPPING INTO THE POWER OF EVAPORATIVE COOLING
USING WATER AS A REFRIGERANT
IntrCooll principle
1 m³ water results in 695 kW cooling power
Direct adiabatic cooling
Hx Diagram
Direct adiabatic (conventional)

Direct adiabatic
1 = Direct adiabatic cooling process
2 = Indoor heating to room temp. setpoint
Indirect/direct adiabatic cooling
Indirect/direct adiabatic cooling

<table>
<thead>
<tr>
<th>Location</th>
<th>Outdoor Temperature</th>
<th>Humidity (%)</th>
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<tbody>
<tr>
<td>Dubai</td>
<td>46 °C, 29.4 °C</td>
<td>29</td>
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<tr>
<td>Riyadh</td>
<td>46 °C, 24.0 °C</td>
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<th>Supply Temperature</th>
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<td>31.9 °C</td>
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<tr>
<td>Riyadh</td>
<td>32.0 °C</td>
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<table>
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<tr>
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<th>Temperature Supply</th>
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</thead>
<tbody>
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<td>Dubai</td>
<td>26.3 °C</td>
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<tr>
<td>Riyadh</td>
<td>20.6 °C</td>
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Indirect/direct adiabatic cooling

Two-stage adiabatic cooling

Stage 1: Air-water Heat exchanger
Stage 2: Oxyvap® evaporative media

Work air

Outdoor air filters

Supply fan

Supply air

Process fan
Indirect/direct adiabatic cooling

Two-stage adiabatic cooling

Water: 40 °C

Outdoor: DB 46 °C / WB 19 °C

Stage 1: Indirect pre-cooled air: 27 °C

Water tank: 15 °C

Work air (water heat rejections section)

Stap 2: Indirect/direct cooled air 14 °C
Mollier diagram

Outdoor temperature: 46 °C

Temperature before Oxyvap®: 27 °C

Temperature supply air: 14 °C

Exhaust air: 35 °C

21.5 °C

Temperature supply air: 14 °C

Mollier-h-x-Diagram for air humid - Pressure 1.013 bar (0.000 m / 10.000 °C / 80.000 % rH)
Indirect/direct adiabatic cooling

Two stage cooling process

\[ T_{DB} \; [\degree C] \quad T_{WB} \; [\degree C] \quad RH[\%] \]

\[ 40 \quad 20,8 \quad 175 \]

Work air (water heat rejections section)

Supply Air

17,5\degree C
Free Cooling

Free cooling and ventilation with outdoor air

Outdoor Temperature < 18°C

Supply Air < 18°C

Outdoor Temperature < 18°C
Supply and outdoor temperatures example
Conventional air conditioning vs. dual-stage adiabatic cooling

Conventional air conditioning:
- Power plant: 780 L/h
- Fans: 78 kW
- Cooling: 695 kW
- Compressor: 250 kW
- Power plant: 2500 L/h

Dual-stage adiabatic cooling:
- Power plant: 30 L/h
- Fans: 3 kW
- Cooling: 695 kW
- Evaporation: 1000 L/h
- Desalination: 4 kW
Why IntrCooll?
What are we good at?

- Cooling
- Ventilation
- Compensate negative pressure
- Heating
- Filtration
- Sustainability

Thinking along and tailored advice!
A satisfied employee!

- Healthy working environment
- Comfortable working environment
- A cool environment does not drain your energy
- Improved concentration
A satisfied employer!

- Productivity boost
- Reduced leave of absence
- Attract employees
- Low energy consumption
- Small carbon footprint
- A happy employee!
- Positive image of the Company
In which we distinguish ourselves

Benefits IntrCooll compared to direct adiabatic cooling systems

-7°C
TEMPERATURE

-30%
WATER CONSUMPTION

-30%
CO₂ EMISSION

-50/70%
MOISTURE INCREASE

+50%
COMFORT
In which we distinguish ourselves

Benefits IntrCooll compared to air conditioning

-90% ENERGY CONSUMPTION

+10% PRODUCTIVITY

-90% CO₂ EMMISSION

-14% SICKNESS

-90% PEAK FLOW
IntrCooll Plus
Ventilation, Free Cooling & Indirect/Direct adiabatic cooling

- Wet-bulb efficiency up to 114%
- Maximum airflow: 14000 m³/h @ 160 Pa (incl. F7 filters)
- Power consumption max: 4210 watt*
- Sound pressure level @4 meter:66 dB(A)
- Cooling capacity up to 130 kW
- E.E.R. **: Middle East up to 40 - Europe up to 30
- Wet-weight (excl. accessories): ± 550 kg
- Dimensions:
  l= 1961 mm x w= 1961 mm x h= 1460 mm

* Maximum at 160 Pa External Static Pressure (ESP) & F7 filters
** Energy Efficiency Ratio
Large Space Cooling
Workspot Cooling
Displacement Cooling
References

- e Xtra – Saudi Arabia
- Wildkamp – Netherlands
- Tasjeel – UAE
- Khansaheb – UAE
- JUMBO – Netherlands
- Motor Oost – Netherlands
THANK YOU

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