

EvapCal

EvapCal is a design analysis tool for evaluating performance of direct, indirect, and two-stage (indirect-direct) evaporative coolers. It is designed to help decision makers in taking informed decisions related to system sizing, water requirement, required air changes and resulting supply air condition with respect to thermal comfort of occupants.

The tool utilises hourly weather files for analysis and offers three main utility tabs, namely:

1. Evaporative Cooler Design

This tab displays calculated design parameters based on user input data of weather, building heat load and design of evaporative cooler. Hourly heat maps are generated for resultant indoor air in 2D and 3D format to visually present performance of the system.

The screenshot displays the EvapCal software interface. At the top, there are three tabs: "Evaporative Cooler System Design", "Evaporative Cooler Design Chart", and "Evaporative Cooler Design Report". Below the tabs are three buttons: "Select Indian City", "Browse Existing EPW Weather File", and "Open Saved Project (.evp file)". A checkbox for "SI Unit System" is also present.

The input fields are organized as follows:

- City: IND_AHMADABAD
- Project Name: MNIT
- Project Reference No: 01
- Revision No: R01
- Designed By: Ms. Khyati
- Submitted By: EvapCal
- Building Geometry: Area (sqft): 100000, Height (ft): 12
- Outdoor Design Conditions: 1% DBT (°C): 41.2, WBT (°C): 22.88
- Maximum Allowable Indoor Conditions: DBT (°C): 28, RH %: 70
- Heat Load (Btu/hr): Sensible: 1500000, Total: 2500000
- Type of Evaporative Cooling: Direct, Indirect, 2 Stage
- Saturation efficiency %: Direct: [], Indirect: 80
- Temperature Rise through Duct-work (°C): 0.5

A "Calculate" button is located at the bottom right of the input section.

RESULTS :

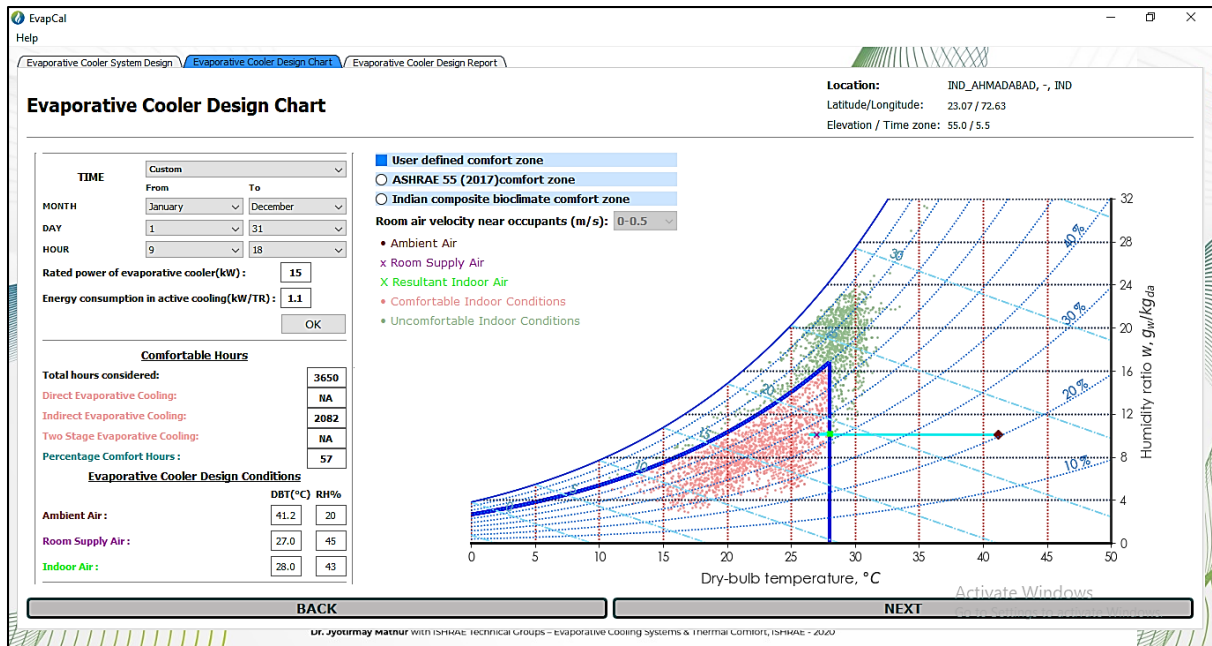
Required Air Flow Rate (CFM):	812194
Supply Air Temperature (°C):	27.0
Supply Air Humidity RH%:	45
Air Change Per Hour (rounded-off to the nearest integer):	41
Peak Water Requirement without bleed-off loss (LPH):	8927

Below the results, there are eight buttons for generating heatmaps: "Ambient DBT on 2D Heatmap", "Ambient WBT on 2D Heatmap", "Indoor DBT on 2D Heatmap", "Indoor RH on 2D Heatmap", "Ambient DBT on 3D Heatmap", "Ambient WBT on 3D Heatmap", "Indoor DBT on 3D Heatmap", and "Indoor RH on 3D Heatmap".

At the bottom, there is a "NEXT" button and a footer: "Dr. Jyotirmay Matnur with ISHRAE Technical Groups - Evaporative Cooling Systems & Thermal Comfort, ISHRAE - 2020".

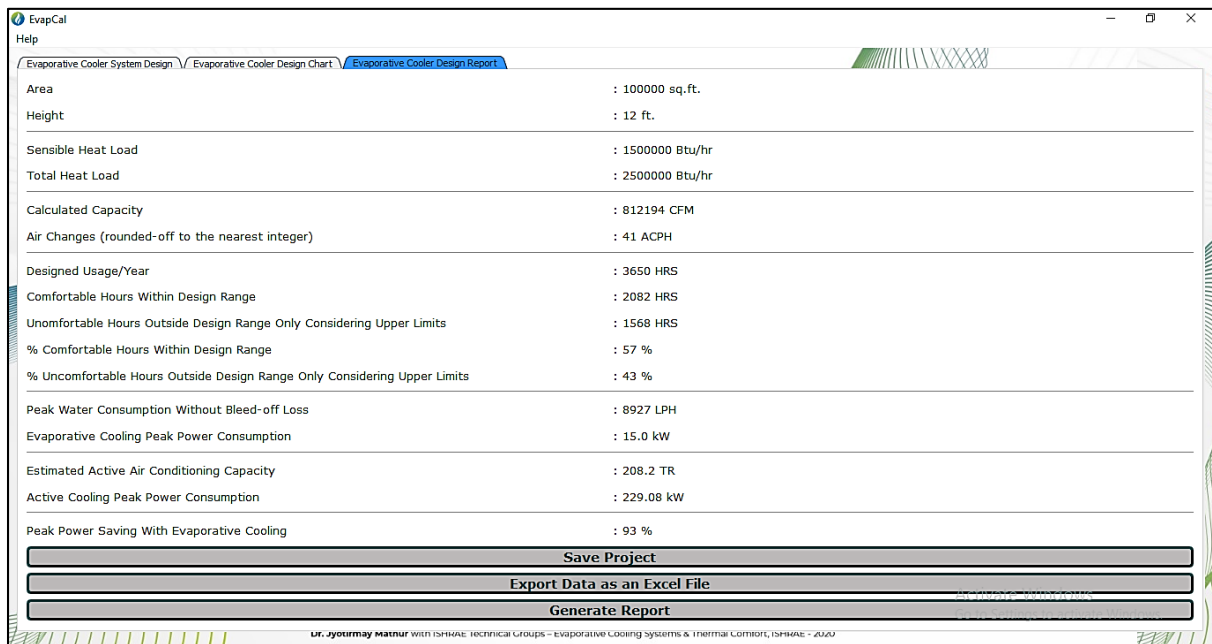
2. Evaporative Cooler Design Chart

It displays psychrometric chart based on the calculated design parameters for the application-based operational schedule in terms of months/days/hours to calculate achievable thermal comfort hours. Comparative thermal comfort analysis is facilitated among user defined comfort zone, ASHRAE-55 2017 comfort zone and India composite bioclimatic comfort zone.



3. Evaporative Cooler Design Report

Info-graphic reports can be generated in PDF and EXCEL formats to refer to the project data whenever required in the future. Projects can be saved in “.evp” format that can be imported in the tool for further revision in the design data.



The “EvapCal” tool is developed by Ms. Khyati Paghdar and Mr. Raj Gupta (as a part of their M.Tech. Theses in two successive years at Centre for Energy and Environment, MNIT Jaipur) in association with ISHRAE (Indian Society of Heating, Ventilation and Air-conditioning Engineers). The project was mentored by industry experts: Mr. Nishant Gupta (Managing Director, Degree Day Pvt. Ltd., Indore, India), Mr. Vaibhav Gupta (Director, Humidin Casilica,

Delhi, India) and Technical Groups of ISHRAE - Evaporative Cooling and Thermal Comfort in association with Prof. Jyotirmay Mathur of MNIT Jaipur.

EvapCal software and user manual may be downloaded from:

<https://ishrae.in/home/DownloadEvapCal>