Modelling the NVHR in IES

Author: Fiona Dickinson
Revision: 2.2
Date: April 2015

Introduction

This document is to allow IES users to model Breathing Buildings' NVHR ventilation system.

The main advantage of the NVHR system over other hybrid ventilation systems is that in the winter, we do not bring in air via opening windows, as this requires a large amount of preheating energy. Instead we operate in 'mixing mode' where we bring in air at high level and mix it with warm room air to create a tempered air stream which is comfortable for occupants.

To accurately model conventional natural ventilation systems, preheating at the low level openings would have to be incorporated. However as IES and building regulations do not take account of thermal comfort in relation to draughts; therefore any energy input to mitigate cold draughts does not need to be included. So the NVHR system will look the same as any other natural ventilation system in terms of heating energy consumption, because the need for preheating is disregarded by IES which just takes into account the bulk air temperature.

Downloads

The easiest way to model the e-stack ventilation strategy accurately is to download the relevant files from our website. One file is required to model the Breathing Buildings NVHR system;

1. The profiles database from the .cab file which can be downloaded here:
   http://breathingbuildings.com/products/modelling-e-stacks -in-ies
   All profiles are for full occupation 9am-4pm, this should be amended if necessary.

Summary of the Strategy

External Temperature	Internal Temperature	Strategy
< 16 degC	-	Winter Mixing Mode Minimum ventilation on CO_2
> 16 degC	<24 degC	Upwards Displacement Mode No Fans
> 16 degC	>24 degC	Upwards Displacement Mode Fan Assistance
>25degC	-	Nightcooling operates that night

Geometry

The NVHR unit is typically installed adjacent to an external weather louvre. For the purposes of modelling in IES, it is appropriate to simply draw this weather louvre as a door and to accurately reflect the aerodynamic free area of the louvre, these should achieve an equivalent orifice of approximately 37% to be assigned in MacroFlo. Typically the louvre shall be 900mm(W) by 300mm (H). Typically two NVHR units are provided in a room, but this will vary and advice is available from Breathing Buildings for project specific requirements.

Air Exchanges

The NVHR system is not a heat exchanger, and therefore cannot be modelled as a mechanical system with heat recovery. The system saves energy by bringing air into the space and mixing it with room air to reduce cold draughts, by using low powered fans. The casual gains produced inside the space by the occupants lighting and equipment, keep it warm on all but the coldest days (<5-10degC). These low powered fans can also be used to boost ventilation flow rates when the space is experiencing particularly high temperatures during the day or needs additional boost ventilation for nightcool.

Three auxiliary ventilation rates are required to effectively simulate the operation of the NVHR unit;

1. **Winter** - In winter the system aims to control CO_2 to meet a daily average of 1000ppm. This means providing a constant 80l/s of fresh air per NVHR throughout the occupied hours. This should be assigned as an Auxiliary Ventilation and should use the variation profile *"e-stack Winter Mode (Y)".*
2. **Summer Boost -** Summer boost mode occurs when the space temperature exceeds 24°C during occupied hours. A rate of 150l/s should be assigned per NVHR unit in the space as an Auxiliary Ventilation and should use the variation profile *"NVHR Summer Boost (Y)".*
3. **Nightcool Boost -** Nightcool boost mode occurs during the summer months when the temperature in the space overnight is still above target temperature at 9pm. A rate of 200l/s should be assigned per NVHR unit in the space as an Auxiliary Ventilation and should use the variation profile *"NVHR Nightcool Boost (Y)".*

MacroFlo

This mode relies on natural buoyancy and wind to drive air through the space and the fans are not required. In this mode, the unit consumes minimal power. It is important that all the windows and other openings are positioned correctly in the space as this will affect the natural ventilation flow. Two profiles should be created separately for the low level openings and the NVHR. The low level openings should only open for daytime operation and therefore should be assigned the Degree of Opening Profile *"Low Level Openings"*. The NVHR unit will open for both daytime and nightcool operation and therefore should be assigned the Degree of Opening Profile *"NVHR Louvres (Y)"*.