Technical Environmental Solutions/ Submission no.9/
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Task no.1

Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absolute humidity, the wet-bulb temperature and the mass of water vapor in the air in Classroom A (Aula A) of Piacenza campus in the moment that you are solving this exercise (provide the inputs that you utilized)
https://www.meteo-oggi.it/

Relative humidity = 80%
Atmospheric pressure: 30 Hg = 101.59 kpa
Temperature = 6 c

Absolute humidity:

$$\omega = \frac{0.622 \times p_v}{p - p_v}$$

we should find pv from the steam table, saturation pressure of water at 6c is 0.935 kpa

$$\phi = \frac{p_v}{p_g}$$
$$p_v = \phi \times p_g = 0.8 \times 0.935 = 0.748\ kpa$$
$$p_a = p - p_v = 101.59 - 0.748 = 100.842\ kpa$$

$$\omega = \frac{0.622\ p_v}{p - p_v} = \frac{0.622 \times 0.748}{100.842} = \frac{0.4652}{100.842} = 0.00461$$

Wet bulb temperature:

Using the psychometric chart, the wet bulb temperature is = 4 c

The mass of water vapor in class A (5x5x3)m

$$m_a = \frac{p_a v_a}{R_a \times T} = \frac{100.842\ x5x5x3}{0.28x\ (273+6)} = \frac{7563.15}{80.073} = 94.45\ kg$$

$$m_v = \frac{p_v v_a}{R_v T} = \frac{0.748\ x75}{0.4615\ x\ (273+6)} = \frac{56.1}{128.758} = 0.0396\ kg$$

Task no.1

Determine the sensible and latent load corresponding to internal gains, the ventilation, and the infiltration in a house with a good construction quality and with the same geometry as that of the example which is located in Brindisi, Italy

Sensible load

$$q_{ig,s} = 136 + 2.2A_{cf} + 22N_{oc}$$

$$q_{ig,l} = 20 + 0.22A_{cf} + 12N_{oc}$$

where

$q_{ig,s}$ = sensible cooling load from internal gains, W
$q_{ig,l}$ = latent cooling load from internal gains, W
A_{cf} = conditioned floor area of building, m^2
N_{oc} = number of occupants (unknown, estimate as N_{br} + 1)

$A_{fc} = 200$
$A_{fc} = 2$

$q_{igs} = 136 + 2.2(200) + 22(2) = 620\ w$

$q_{igL} = 20 + 0.22(200) + 12(2) = 88\ w$

Infiltration

$$Q_i = A_L \text{IDF}$$

where

A_L = building effective leakage area (including flue) at reference pressure difference = 4 Pa, assuming discharge coefficient $C_D = 1$, cm^2

IDF = infiltration driving force, $L/(s \cdot cm^2)$

$A_{ul} = 1.4 \dfrac{cm^2}{m^2}$

Exposed surface = wall area x roof area

$A_{es} = 200 + 144 = 344\ m^2$

$A_l = A_{es} \times A_{ul} = 344 \times 1.4 = 481.6\ m^2$

$IDF_{heating} = \dfrac{(l_o + H\ (\Delta \mathrm{t})[\mathrm{l}_1 + \mathrm{l}_2}{1000}$

$IDF_{heating} = \frac{0.077+0.069}{2}$ = *0.073 L/scm^2*

$IDF_{cooling} = \frac{0.035+0.040}{2}$ = 0.0375 L/scm^2

$V_l = A_l \times IDF_{heating}$
$= 481.6 \times 0.073$
$= 35.156 \quad \dfrac{L}{s}$

$V_{ic} = A_L \times IDF_{cooling}$

$= 481.6 \times 0.0375$
$= 18.06 \quad \dfrac{L}{s}$

Ventilation

$$Q_v = 0.05 A_{cf} + 3.5 (N_{br} + 1)$$

where

Q_v = required ventilation flow rate, L/s
A_{cf} = building conditioned floor area, m^2
N_{br} = number of bedrooms (not less than 1)

$Q_v = 0.05(200) + 3.5\ (1 + 1) = 17 \dfrac{l}{s}$
$V_{int}, ventilation.heating\ = V_{ih} + Q_V = 35.156 + 17$
$V_{int}, ventilation.cooling = V_{ic} + Q_V = 18.06 + 17$
$Q_{int}, ventilation.cooling\ .latent = Csensible\ x\ v\Delta T\ cooling$