SPF Solartechnik Prüfung Forschung

Institut für Solartechnik
OST – Ostschweizer Fachhochschule
Oberseestrasse 10, CH-8640 Rapperswil
Tel. +41 55 222 48 21, Fax +41 55 222 48 44
www.solarenergy.ch

TRNSYS-Type 820
CO2 room concentration
V0.1

Martin Neugebauer, 23.03.2022

1 Introduction

TBD

2 Parameters, Inputs and Outputs

2.1 Parameters

Nr.	***short***	***explanation***	***unit***	***range***
1	V_{room}	Volume of room	m^3	[0;+inf]
2	C_{v}	Outside CO2 concentration	ppm	[0;10^6]
3	C_{ini}	Initial CO2 concentration inside room	ppm	[0;10^6]

2.2 Inputs

Nr.	***short***	***explanation***	***unit***	***range***
1	$\mathrm{met}_{\mathrm{tot}}$	Total met inside room (sum of individual)	-	[0;+inf]
2	Q_{inf}	Infiltration rate	m^3/h	[0;+inf]
3	Q_{vent}	Ventilation rate	m^3/h	[0;+inf]

2.3 Outputs

Nr.	***short***	***explanation***	***unit***	***range***
1	C	CO2 concentration inside room	ppm	[0;10^6]
2	$\dot{m}_{\mathrm{gen}}$	CO2 generation rate inside room	kg/h	[0;+inf]

3 Calculation

The proportionality factor G between 1 met and the rate of CO_2 production is:

$$G = 0.25\,\frac{\mathrm{l}}{\mathrm{min}} \cdot \rho_{\mathrm{CO2}} = 0.015\,\frac{\mathrm{m}^3}{\mathrm{h}} \cdot 1.87\,\frac{\mathrm{kg}}{\mathrm{m}^3} = 28050\,\frac{\mathrm{mg}}{\mathrm{h}}$$

Like this the CO_2 generation rate in a room can be calculated as:

$$\dot{m}_{\mathrm{gen}} = G \cdot \mathrm{met}_{\mathrm{tot}}$$

Per timestep Δt this generation together with the air exchange through infiltration and ventilation leads to the following change in concentration:

$$\Delta C = 0.51\,\frac{\mathrm{ppm}}{\mathrm{mg/m^3}} \cdot \frac{\dot{m}_{\mathrm{gen}} \cdot \Delta t}{V_{\mathrm{room}}} + (C_{\mathrm{v}} - C) \cdot \frac{(Q_{\mathrm{inf}} + Q_{\mathrm{vent}}) \cdot \Delta t}{V_{\mathrm{room}}}$$

This means that having started from C_0 before the timestep the concentration after the timestep is:

$$C = C_0 + \Delta C$$