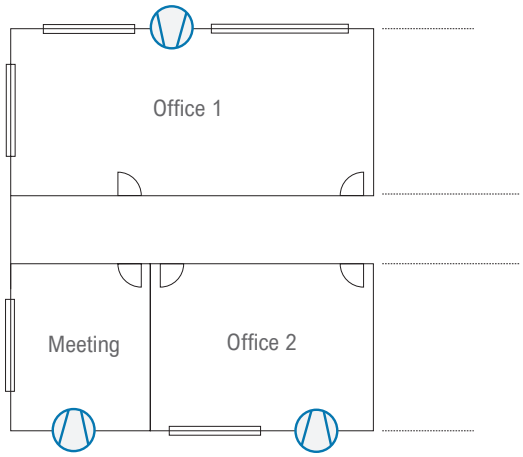
Smart IAQ Management

Enhancing Energy Efficiency in Partially Occupied Office Buildings

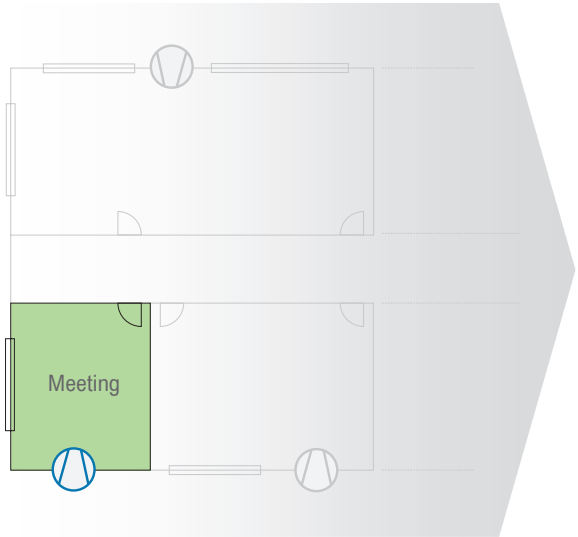
What is building energy efficiency?

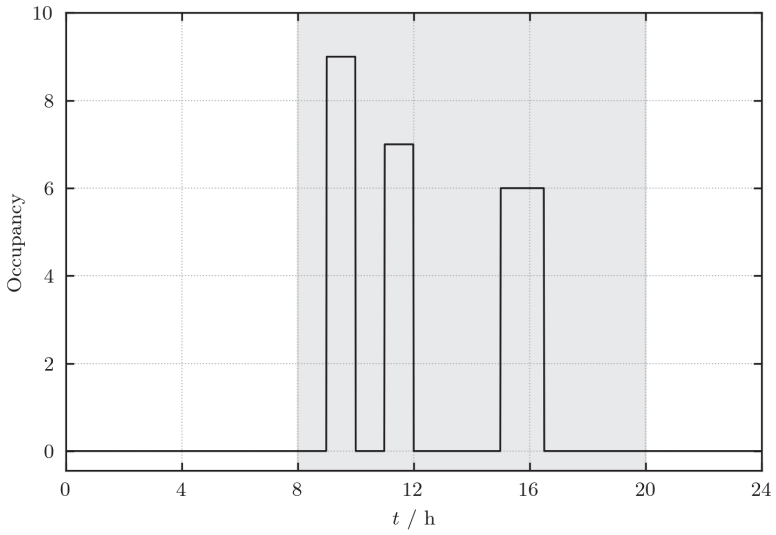
$$\text{Efficiency} = \frac{\text{Benefit}}{\text{Effort}} = \frac{\text{Indoor environmental quality (IEQ)}}{\text{Energy demand}}$$

Model



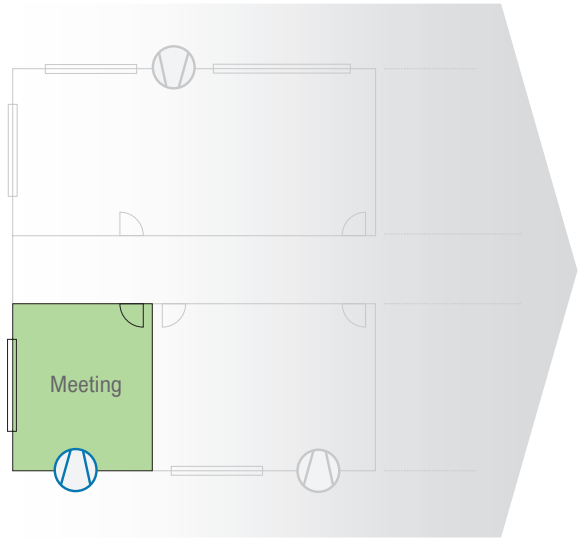
Model
Meeting room

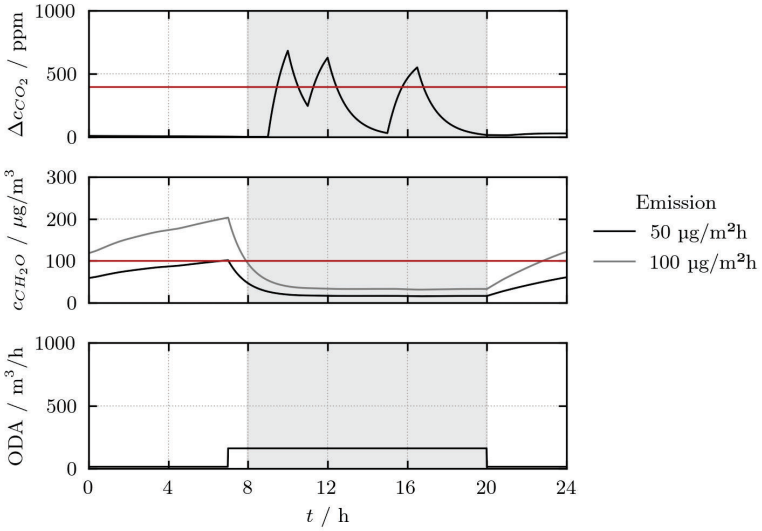




Ventilation control

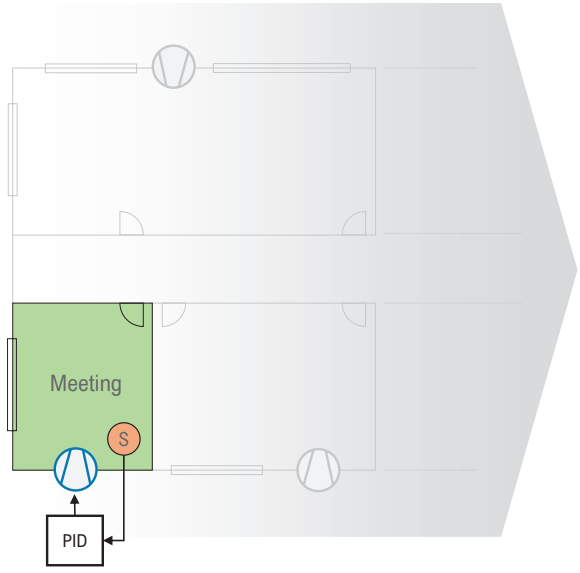
Constant (Air change rate: 1 h^{-1})

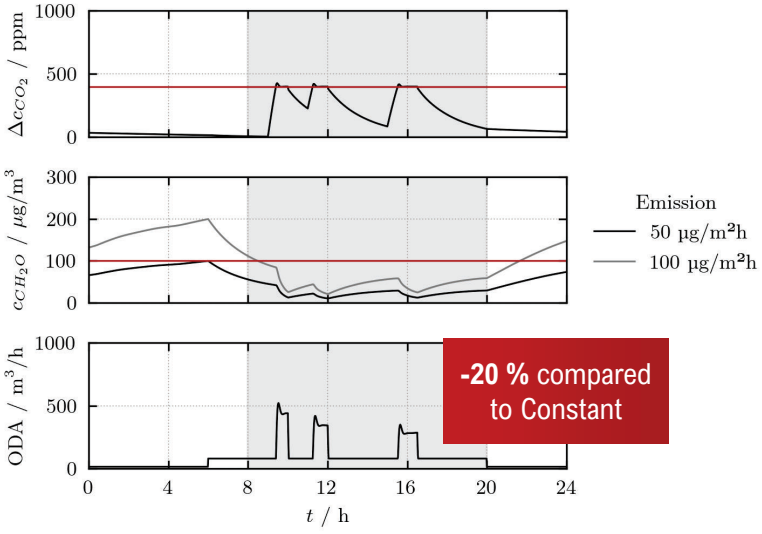




Ventilation control

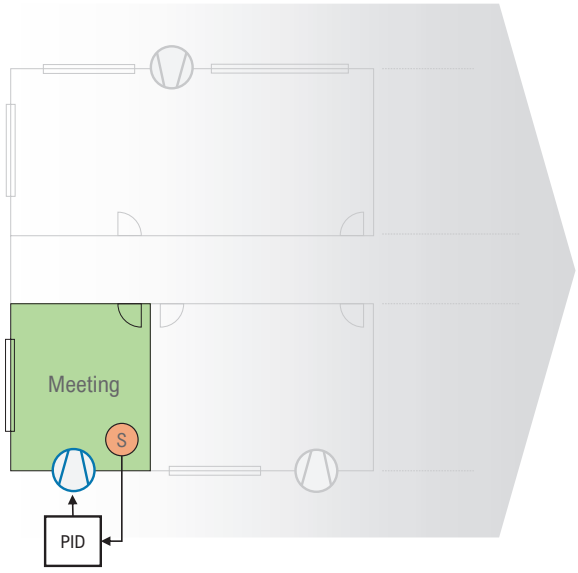
Demand based (CO_2) + Air change rate (base): 0.5 h^{-1}

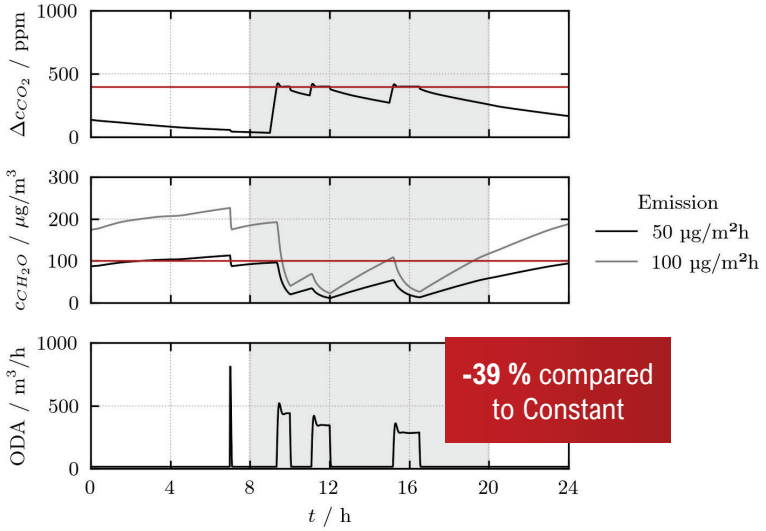




Ventilation control

Demand based (CO_2 and CH_2O)





Normative ventilation requirements

EN 16798-1

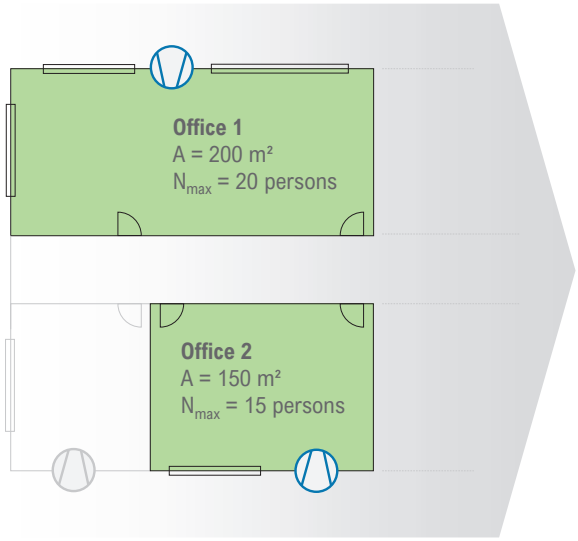
Category	Predicted percentage dissatisfied	Ventilation rate per non-adapted person l/s per person
I	15	10
II	**20**	**7**
III	30	4
IV	40	2,5

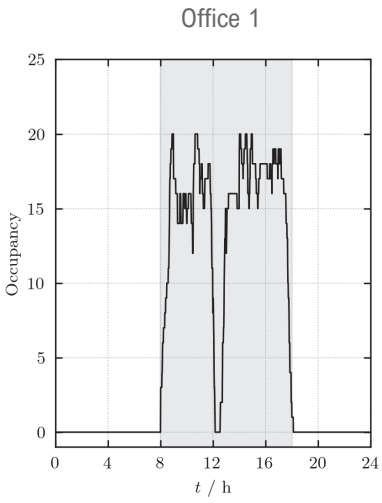
Energy performance of buildings - Ventilation for buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics

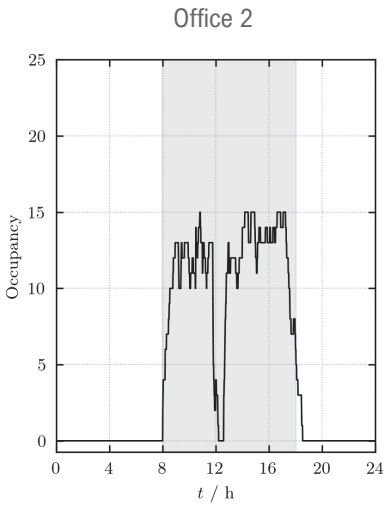
Category	Very low polluting building l/s·m²	Low polluting building l/s·m²	Non low-polluting building l/s·m²
I	0,5	1,0	2,0
II	**0,35**	**0,7**	**1,4**
III	0,2	0,4	0,8
IV	0,15	0,3	0,6

Simulative game

Ventilation optimization in Office 1 and Office 2

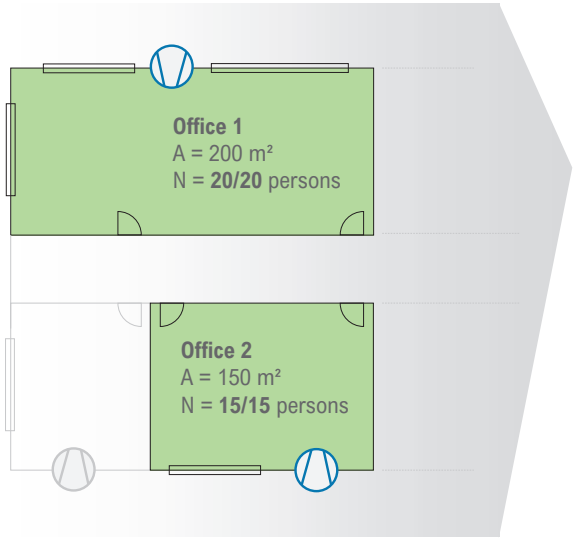






Simulative game

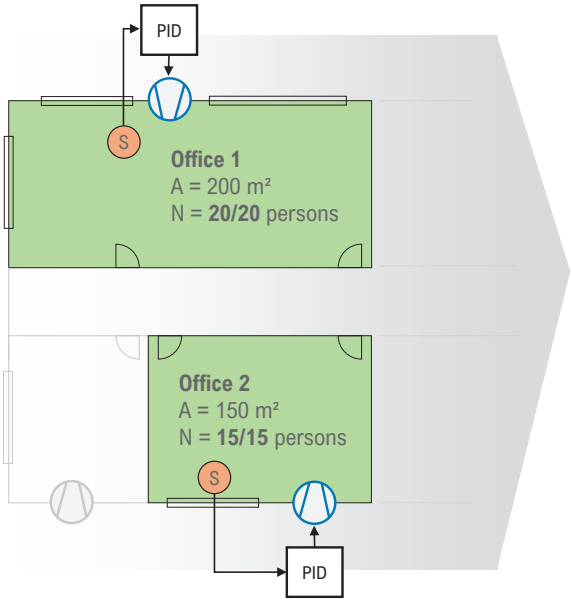
Constant ventilation



Occupancy	Control strategy	Daily ODA Requirement [m³]	Energy Savings [%]
20 / 15	CV	21.848	-

Simulative game

Demand based ventilation (CO_2) + Air change rate (base)



Occupancy	Control strategy	Daily ODA Requirement [m³]	Energy Savings [%]
20 / 15	CV	21.848	-
20 / 15	DCV	16.155	-26 %

Sources: WavebreakMediaMicro – stock.adobe.com

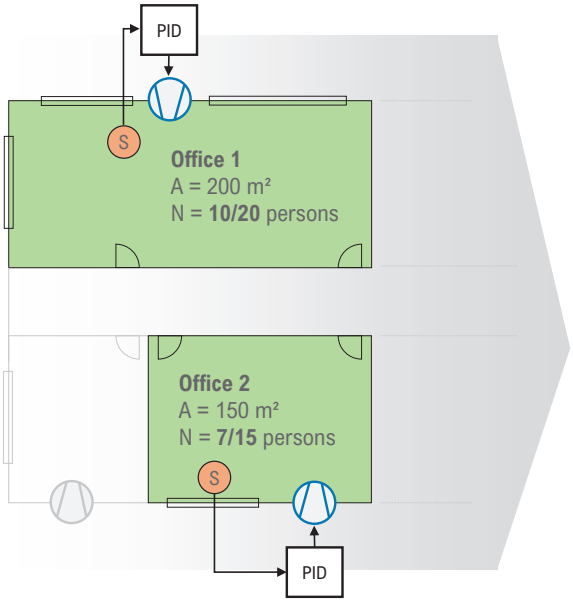
"New Normal" office occupancy

Monday …

… and Friday

Simulative game

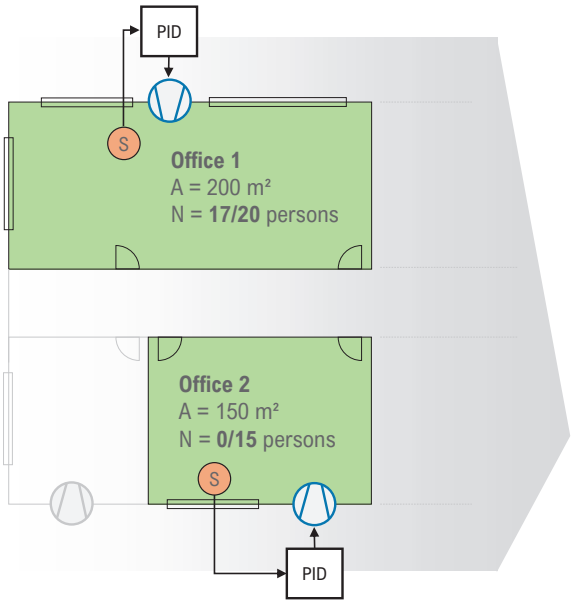
Demand based ventilation (CO_2) + Air change rate (base)



Occupancy	Control strategy	Daily ODA Requirement [m³]	Energy Savings [%]
20 / 15	CV	21.848	-
20 / 15	DCV	16.155	-26 %
10 / 7	DCV	12.596	-42 %

Simulative game

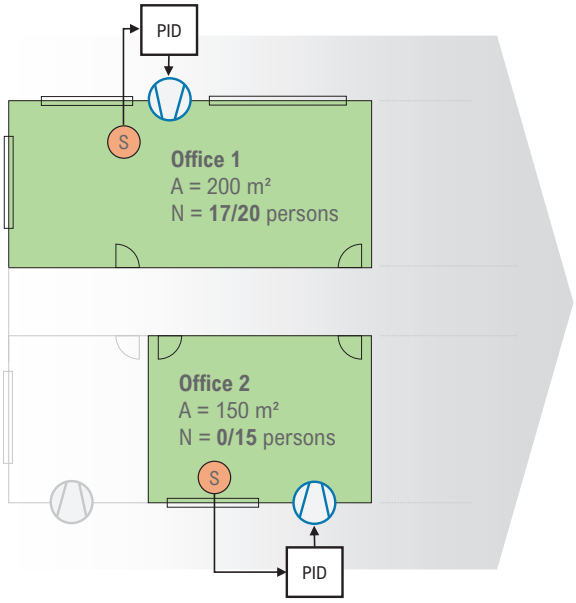
Demand based ventilation (CO_2) + Air change rate (base)

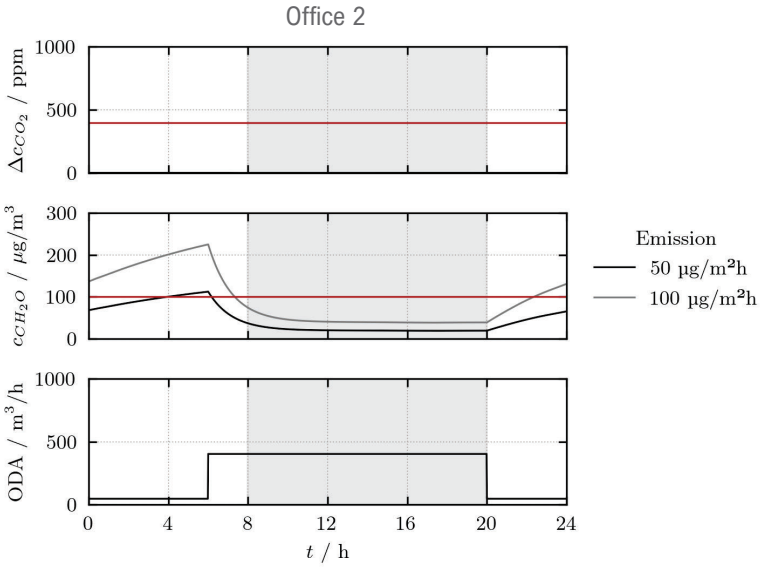


Occupancy	Control strategy	Daily ODA Requirement [m³]	Energy Savings [%]
20 / 15	CV	21.848	-
20 / 15	DCV	16.155	-26 %
10 / 7	DCV	12.596	-42 %
17 / 0	DCV	13.932	-36 %

Simulative game

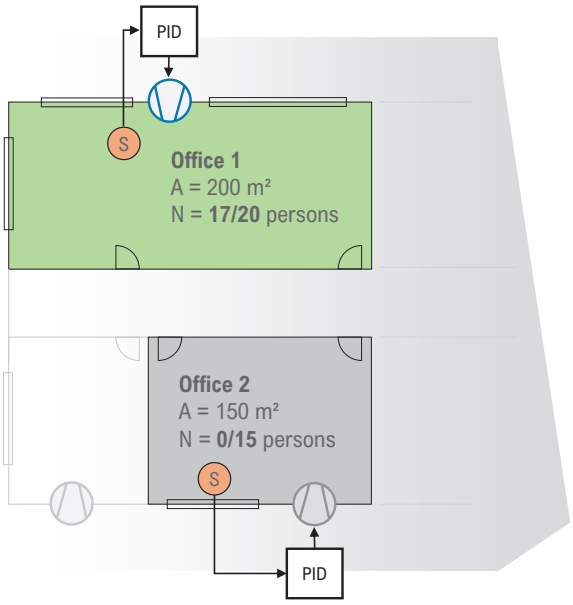
Demand based ventilation (CO_2) + Air change rate (base)





Simulative game

Demand based ventilation (CO_2) + Air change rate (base)



Occupancy	Control strategy	Daily ODA Requirement [m³]	Energy Savings [%]
20 / 15	CV	21.848	-
20 / 15	DCV	16.155	-26 %
10 / 7	DCV	12.596	-42 %
17 / 0	DCV	13.932	-36 %
17 / 0	DCV (Office 2 not ventilated)	9.616	-56 %

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