venticool webinar
“Ventilative cooling and summer comfort: Freevent project in France”

Peter Wouters
April 25 2018

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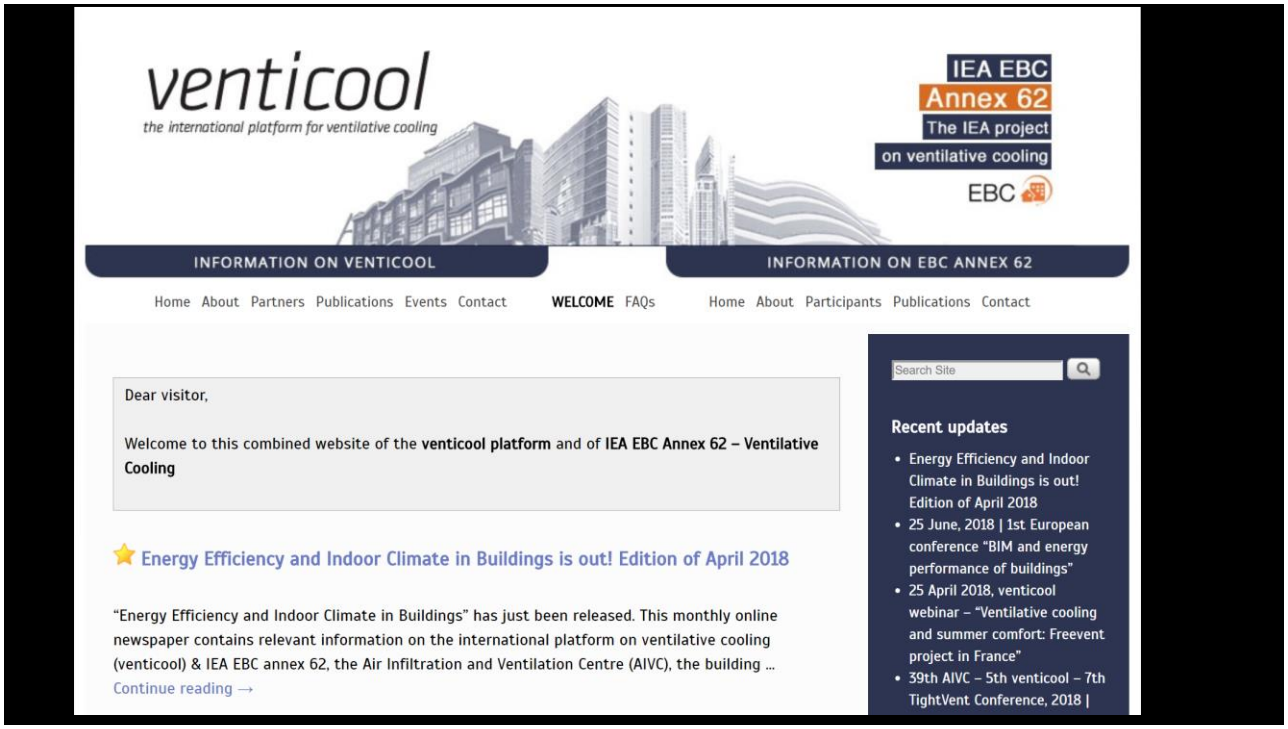
the international platform for ventilative cooling



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IEA EBC Annex 62 The IEA project on ventilative cooling

EBC

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← 39th AIVC – 5th venticool – 7th TightVent Conference, 2018 | Abstract submission is now closed

25 June, 2018 | 1st European conference "BIM and energy performance of buildings" →

25 April 2018, venticool webinar – "Ventilative cooling and summer comfort: Freevent project in France"

Wednesday 25 April 2018, 10:30 AM–12:30 PM (Brussels time, CET)

Ventilative cooling reduces overheating, improves summer comfort and decreases cooling loads. It is therefore one of the most efficient ways to improve summer comfort. Conditions on site, thermal inertia, solar shading and various constraints lead to the choice of the system and its design. Performance is linked to good sizing, design, correct usage of thermal destocking, and last but not least correct fit in and correct take over, checking airflows as well as controls of the system.

Search Site

Recent updates

- Energy Efficiency and Indoor Climate in Buildings is out! Edition of April 2018
- 25 June, 2018 | 1st European conference "BIM and energy performance of buildings"
- 25 April 2018, venticool webinar – "Ventilative cooling and summer comfort: Freevent project in France"

More focusing on market implementation

AIVC

TightVent Europe

BUILDING AND DUCTWORK AIRTIGHTNESS PLATFORM

More focusing on knowledge generation aspects

More focusing on market implementation

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Towards better quality and compliance

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venticool Newsletter


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Newsletter

Foreword

No 11 • DECEMBER 2017

We are happy to introduce to you the 11th newsletter of the venticool platform of December 2017!

Our first two articles, provide feedback on the ventilative cooling workshop in Brussels followed by the final IEA-EBC Annex 62 expert meeting in Gent in October, 2017. Further on, Professor Maria Kolokotroni presents the summing-up of the ventilative cooling track at the 38th AIVC-6th TightVent-4th venticool joint conference held in Nottingham, UK on 13-14 September, 2017. Christoffer Plesner from Velux, follows up on his last article on new work items recently approved by CEN and ISO with regard to ventilative cooling.

As usual, this edition provides detailed information on upcoming events in the field of ventilative cooling. A major venticool event is the upcoming 39th AIVC-7th TightVent & 5th venticool joint conference: "Smart ventilation for buildings" in Juan-les-Pins, France on 18-19 September 2018, with a specific track largely devoted to ventilative cooling. We hope to see you there.

For more frequent updates, please visit our website, follow us on twitter and Linked In and subscribe to our monthly newspaper "Energy Efficiency and Indoor Climate in Buildings" to find out more about our activities. We wish you a pleasant reading.

The venticool team

@venticool

IEA EBC Annex 62- Ventilative Cooling- 8th Expert Meeting, Gent, Belgium, October 24-25, 2017

Per Heiselberg, Aalborg University

16 delegates from 10 countries attended the 8th expert meeting. The host was KU Leuven, Faculty of Engineering Technology, Technology Campus Ghent, Associate Professor Hilde Breesch.

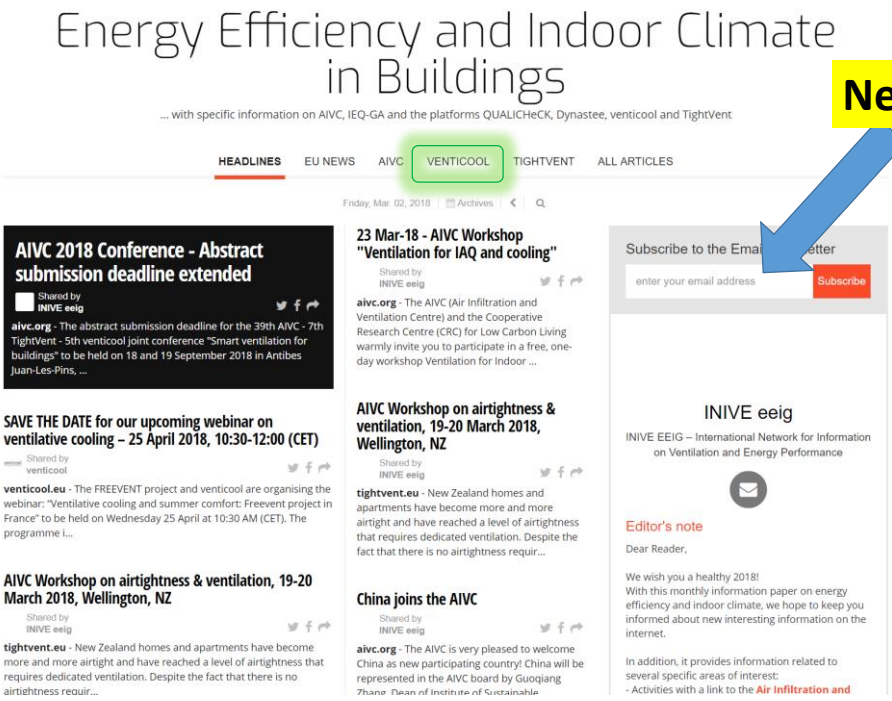
This was the final project meeting and the main focus was to complete the final reports of the project. They include a Guide Book for ventilative cooling design, a Source Book for ventilative cooling technology and a book of Case Studies with 15 well-documented examples of application of ventilative cooling solutions and their performance. These publications will be available in the beginning of 2018 from the IEA and venticool websites.

The meeting also included a discussion of recommendations for standards, legislation and compliance tool to improve the application of ventilative cooling in new and existing buildings in the future. These recommendations are based on a thorough analysis of international standards in the field and of the present legislation as well as the compliance tools used in 8 European countries. The full background report as well as a short summary with recommendations will also be available in the beginning of 2018.

In this issue

Happy participants after completion of the last meeting of Annex 62 meeting at KU Leuven, Gent, Belgium

http://subscriptions.inive.org/



News.inive.org

INIVE

Smart ventilation for buildings

Topical sessions at 2018 conference …

1. IAQ metrics
2. Smart ventilation control
3. Sensors for smart ventilation
4. Rationale behind ventilation requirements and regulations
5. Utilization of heat recovery
6. Integrating uncertainties due to wind and stack effect in declared airtightness results
7. Ductwork airtightness
8. Residential cooker hoods
9. French initiatives for indoor air quality
10. Demand controlled ventilation in French buildings – 35 years of wide scale experience
11. Commissioning of ventilation systems – Improving quality of installed ventilation systems
12. Measurement Accuracy of air flow and pressure difference
13. Air cleaning as supplement for ventilation
14. New annex on resilient cooling
15. BIM and Construction 4.0 opportunities in relation to ventilation and airtightness

EBC

Energy in Buildings and Communities Programme

www.iea-ebc.org

Invitation to IEA EBC Annex Definition Workshop on

Resilient Cooling for Residential and Small Office Buildings

The workshop will be held on Friday, 27th April 2018, 10:00 to 17:00 at Vienna International Airport, Office Park 1.

Agenda of today…

- **Assessment of thermal and comfort performance**
  - Andres Litvak, Apebat - France
- **On site measurements and feedback**
  - Anne Marie Bernard - Allie'Air, France
- **Guidelines to achieve an effective ventilative cooling**
  - Nicolas Piot, EGE - France

Ventilative Cooling and Summer Comfort: The FREEVENT project

Contents

Programme (Brussels time)

10:30	**INTRODUCTION:** Peter Wouters, INIVE, Belgium	11:20	**Questions and answers**
10:40	**ASSESSMENT OF THERMAL AND COMFORT PERFORMANCE** Andres Litvak, Apebat, France	11:30	**GUIDELINES TO ACHIEVE AN EFFECTIVE VENTILATIVE COOLING** Nicolas Piot, EGE, France
10:55	**Questions and answers**	11:45	**Questions and answers**
11:05	**ON SITE MEASUREMENTS AND FEEDBACK** Anne Marie Bernard, Allie'Air, France	12:00	**End of the webinar**

Ventilative Cooling major issues

- Heat wave periods are more and more frequent. The associated increase of mortality is a real issue in terms of public health
- Non air-conditionned new or refurbished buildings show summer overheating issues (loads containment)
- Energy Transition, bioclimatic architecture and passive house buildings : how to guaranty summer comfort without air-conditionning

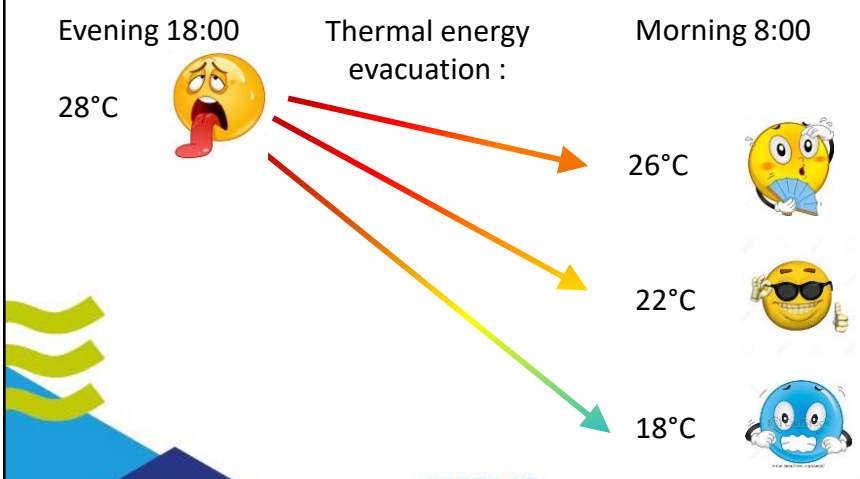
FREEVENT Guide : published and online

Downloadable on Construction21.fr :
https://www.construction21.org/france/community/pg/groups/19939/

since April 2018

Ventilative Cooling Performance

- Thermal Energy Evacuation



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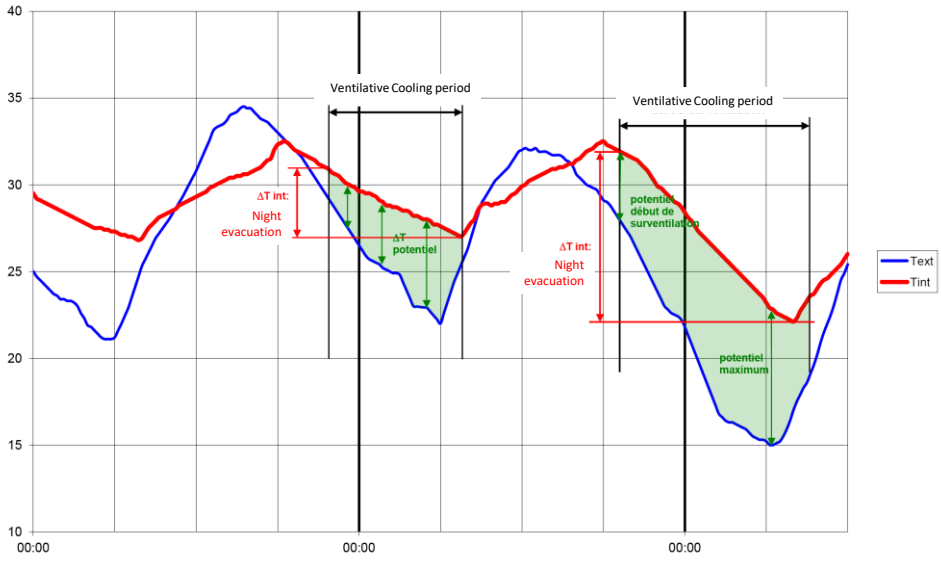
Thermal Potential and Evacuation



Energy Performance

- EER : Energy Efficiency Ratio

EER = kWh cooling / kWh electric

- Natural Ventilation

kWh élec ~ 0

EER = ∞

- Mechanical Ventilation

EER usually between 4 and 10

The EER optimization depends on evacuation potential. A performant EER doesn't mean necessarily an efficient ventilative cooling.

OPTIMIZATION OF THERMAL PERFORMANCE AND COMFORT

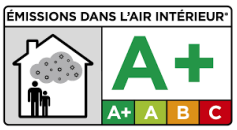
- To characterize the ventilative cooling performance : evacuation and EER
- Accounting for all the comfort issues related to ventilatve cooling :
  - Temperature (over-heating, too cold in the morning)
  - Acoustics (inside, outside)
  - Air velocity
- Bioclimatic Architecture and Ventilative cooling

Thermal Comfort

- Definition of discomfort threshold
  - According to activity, clothing, adaptative comfort. Generally between 27 and 28°C.
  - Acceptable number of hours beyond the discomfort threshold
  - Caution for discomfort in the morning
  - Caution for residual air velocities, if ventilation occurs during building occupancy hours

Acoustics Comfort

- Premises occupied during ventilative cooling period:
  - Natural ventilation: noise exposure zone, as regarding to doorway openings
  - Mechanical ventilation: equipment noise, air velocity
- Unoccupied premises during ventilative cooling period:
  - Mechanical ventilation: equipment noise towards neighbours
- In all cases: install interphone systems if transfer grille are necessary to mantain adecuate airflow pathways through the whole premises



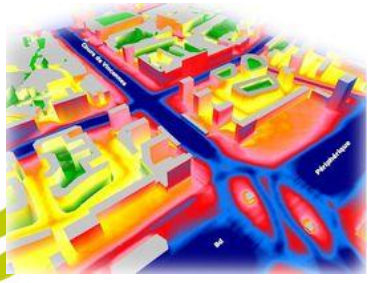
Indoor Air Quality

- Ventilative Cooling impacts IAQ, through increased air change rates
  - Positive impact in the majority of cases in non polluted environments (increased dilution of indoor pollutants)
  - Caution for preventing outdoor pollutants penetration from outside (industrial zone, road traffic routier, airport, etc…). The necessity of filtration enforces mechanical ventilation equipments and has an impact on EER.

Available Public Ressources

- Noise exposure

Maps provided by local authoritues

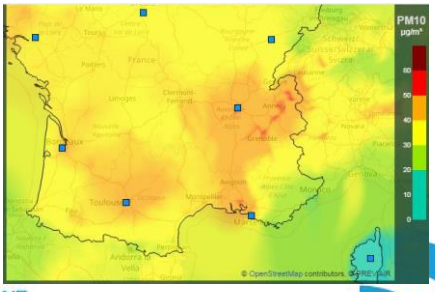


- Air Quality

In France, maps provided by Prevair.org

- **PM_{10}**
- **$PM_{2.5}$**
- **NO_2**
- **O_3**

Example of 24/02/2018



Bioclimatic Architecture

- The challenge of ventilative cooling :
  - Unload in a brief summer sparsely cold night all the accumulated heat during a hot long day, then preserve coolness as long as possible.
- Action-levers:
  - Solar shadings
  - Thermal inertia and insulation,
  - Height of premises (stack effect) and warm air stratification
  - Limitation of internal loads

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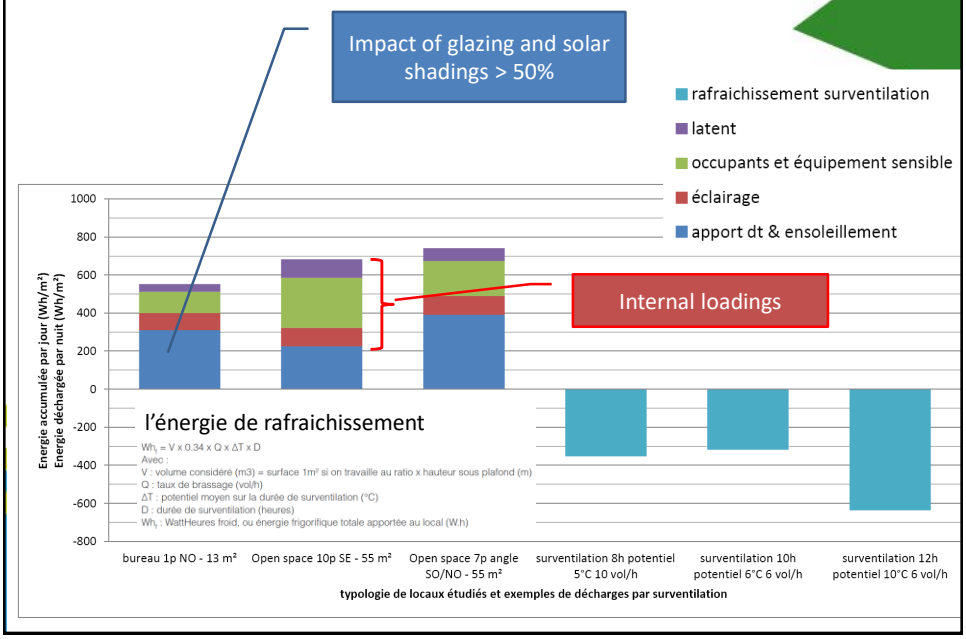
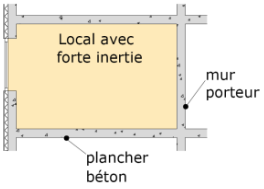
Energy Approach



Thermal Inertia / Insulation

- Thermal shift and damping

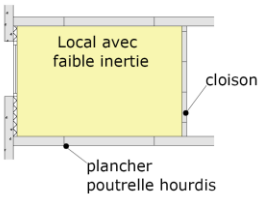
Heavy walls
(internal insulation)



Inside Peak Temperature
at 22:00 = 29 °C
Damping = 4 °C
Shift = 6h
T° at 2:00 am = 25°C

Outside Peak
Temperature =
33 °C at 16:00

Light walls
(internal insulation)



Inside Peak Temperature
at 18:00 = 32 °C
Damping = 1°C
Shift = 2h
T° at 2:00 am = 23°C

<u>In all cases</u> : external envelop with high inertia

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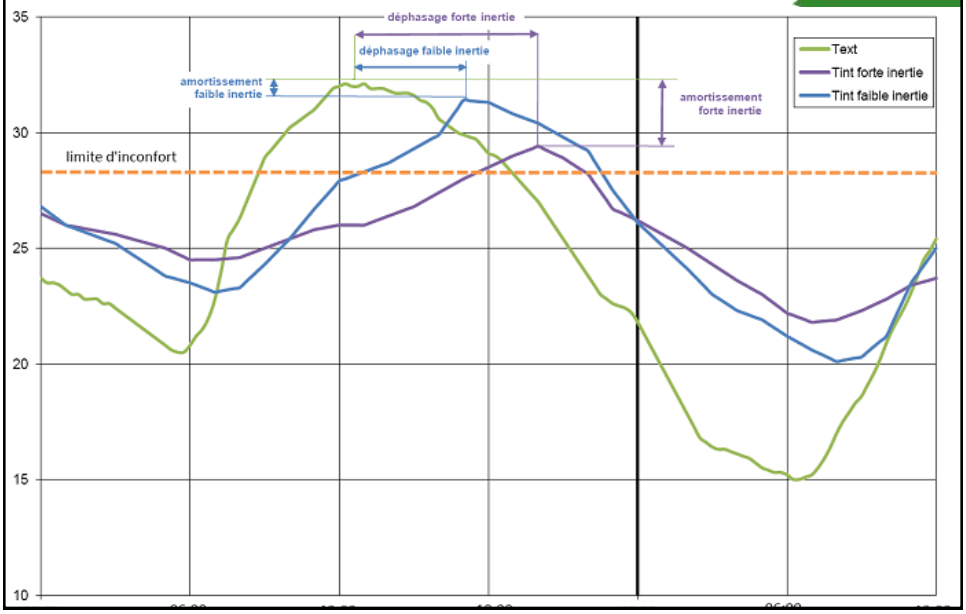
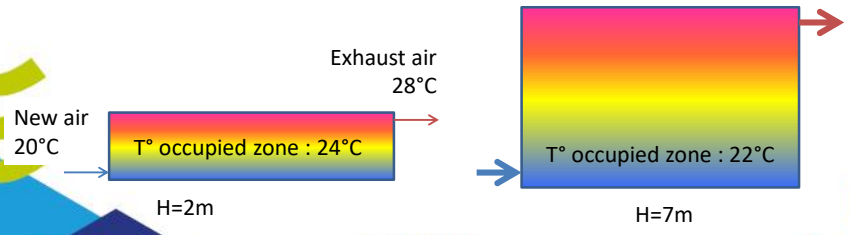
3. Building Analysis

Thermal Inertia



Stack Effect Height

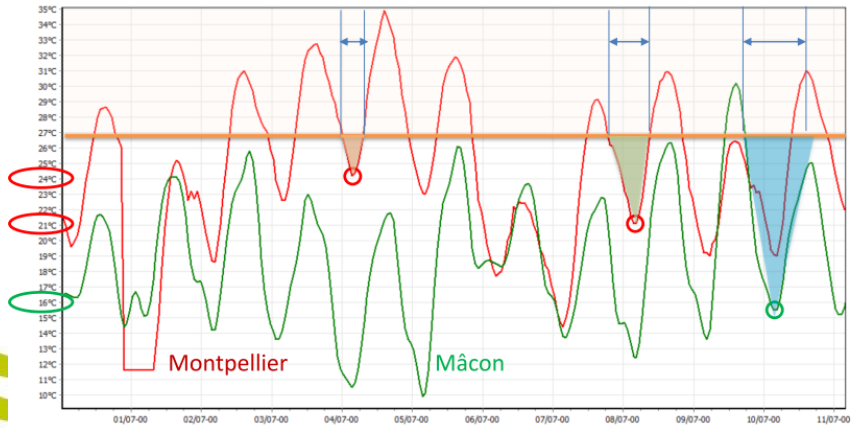
- Tall height promotes:
  - Stack effect for natural ventilation
  - Warm air stratification, then comfort in occupied zones in all cases



Ventilative Cooling Air Flowrates

- The air flowrate depends mainly on the cooling potential of the site.
- Modelling on identical buildings in Mâcon and Montpellier show better results of 1 ACH in Mâcon, and 4 ACH in Montpellier.
- Usually, one should **aim at 2 to 6 ACH**

Comparison of outside T°



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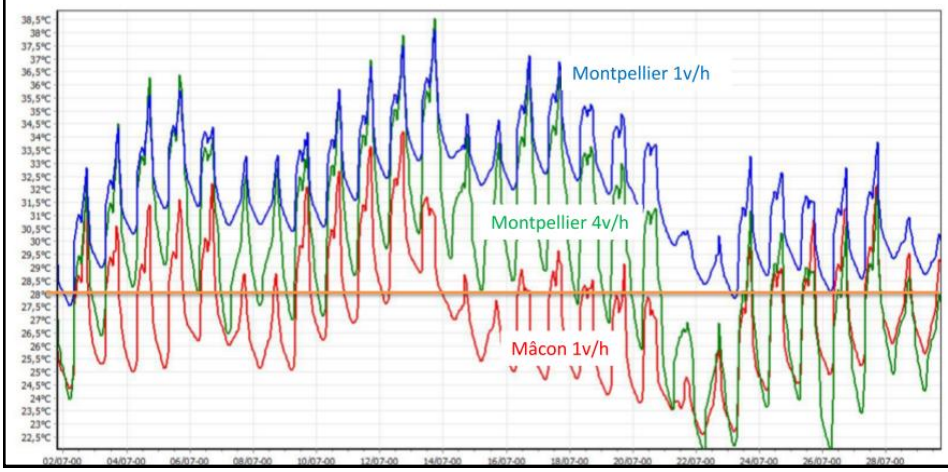
ORDERS OF MAGNITUDE

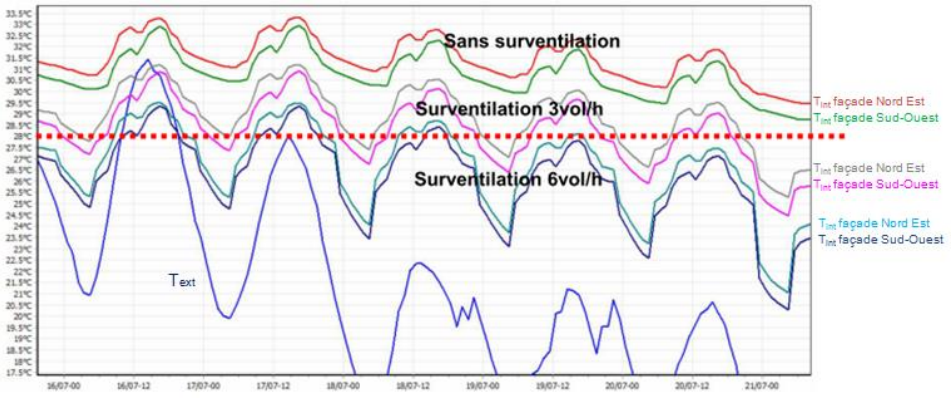
Ventilation air flowrates

Comparison of 2 sites :
better results in Mâcon (1 vol/h) than in Montpellier (4 vol/h) !



Ventilation air flowrates

Assessing ACH in an office building in Toulouse Détermination du taux de brassage sur un bâtiment tertiaire à Toulouse



Regular Hygienic Ventilation (**0,3 à 0,5 vol/h**) : **722 h** average discomfort hour/year
Ventilative Cooling **3 vol/h** : **266 h** average discomfort hour/year
Ventilative Cooling **6 vol/h** : **83 h** average discomfort hour/year

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KEY POINTS FOR SUCCESS

- Upstream bioclimatic design :
  - Ventilative cooling will not compensate a poor design of internal and external loadings.
- Adapted dimensionning that accounts for all comfort criterias
- Involvement of owners / maintener and occupants in the first years for fine-tuning operation.

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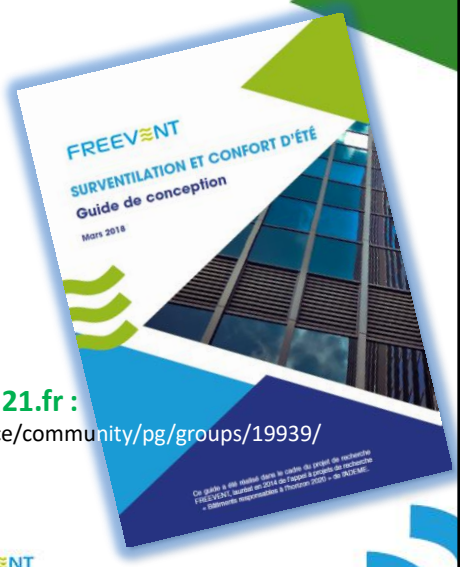
Questions ?



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Ventilative cooling and summer comfort: Freevent project in France

ALLIE'AIR
Etudes et Diagnostics Aérauliques & Acoustiques

EGE INGÉNIERIE

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aldes

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venticool
the international platform for ventilative cooling

Ventilative Cooling and summer comfort FREEVENT project in France

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ON SITE MEASUREMENTS AND FEEDBACK

Measurement results and feedback on 6 buildings monitored (houses, office buildings, dojo, day nursery)

Anne-Marie-BERNARD,

annemarie.bernard@allieair.fr

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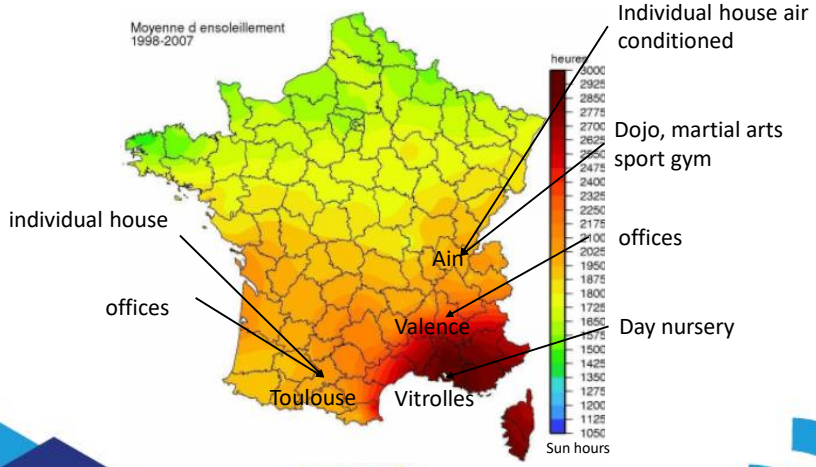
ON SITE MEASUREMENTS AND FEEDBACK



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Office building near Toulouse

- Recent building 2009
- Supply & exhaust ventilation during occupation (daytime)
- Motorised Airing at night:
  - Automatic control
  - Manual override
  - Monitoring

- System optimisation required 2 years and strong involvement from occupants
- Opening 15cm/window and bars to protect entering

Office building near Toulouse

- Temperatures probes (indoor and outdoor)
- Wind and rain probes to authorize or not ventilative cooling
- Initial study : decrease of temperature expected at night 2°C

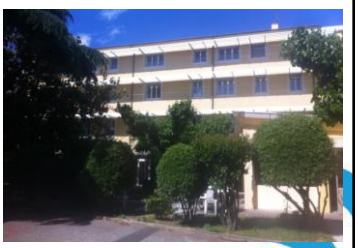
	Temperature decrease @night with/without ventilative cool.	Potential decrease	Average ratio
Ground floor	-1,8°C / -0,5°C	3°C	60 %
First floor	-2,5°C / -1,5°C	4°C	62 %

Office building near Toulouse

- Conclusions :
  - Control of ventilative cooling MUST be checked in real conditions when taking over the building
  - Temperature decrease estimated obtained
  - Potential of decrease not achieved (possible to increase with assistance)
  - Occupants satisfied (pool) though

Office building in Valence

- Building retrofitted 2005
- Ventilative cooling :
  - Mechanical exhaust in corridors
  - Time control
  - occupants open window when leaving offices
- Some occupants complain of air too cool in the morning
- Exhaust reduced due to neighbour complaints (noise) (speed 3/5)



Office building in Valence

- 4 offices monitored on 3 floors
- 1 only open windows regularly

Probe	S2	S11	S15	S10
Opening of window at night	75%	8%	16%	0%

- Temperature decrease good and close to potential only in this office
- Low temperatures in the morning

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Office building in Valence

- Conclusions :
  - Savings reduced by windows closed at night (exhaust fan doesnt worth absorbed power)
    - EER from 0 à 4 sur les 4 bureaux mesurés
    - EER from 7 to 10 when windows are opened
  - Temperature control is needed
    - Avoid low temperature in the morning,
    - Reduce fan absorbed power for nothing
  - occupants awareness is essential (and to consider their complaints)
  - Decrease of temperature correct although fan speed is limited for noise

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Day nursery in Vitrolles

- Collective day nursery 2012
- Supply & exhaust Ventilation stopped at night
- Ventilative cooling :
  - Motorized openings low and high (ground floor building)
  - Time and temperature control
- occupants complain of overheating and the city hall has installed air conditioning after our monitoring

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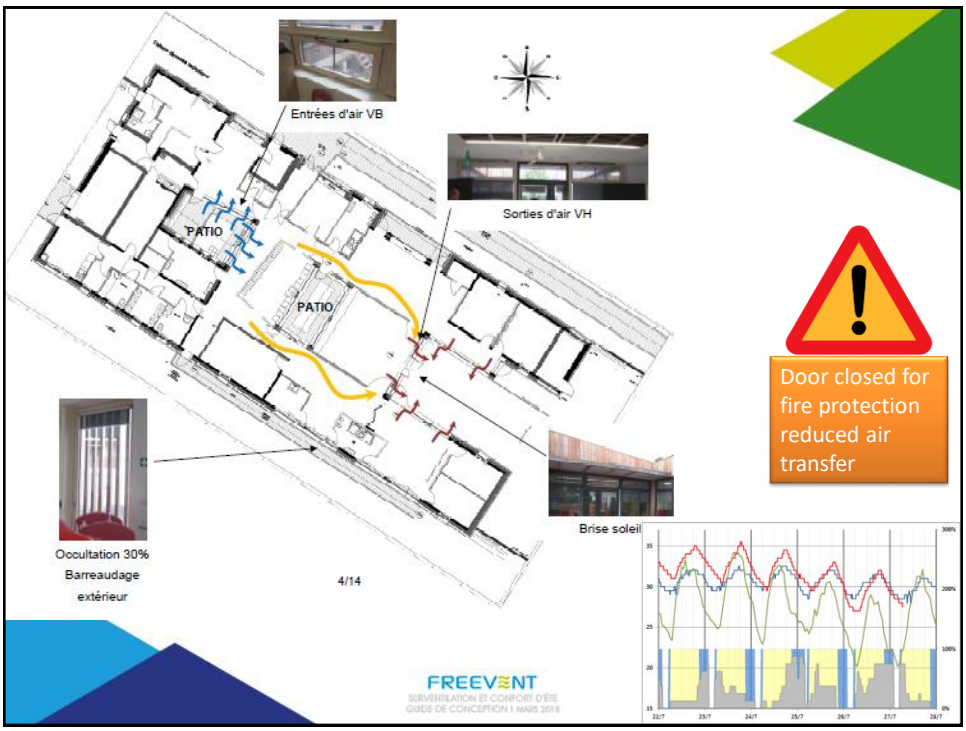

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Day nursery in Vitrolles

- Night temperature decrease < day increase
- Building height 2.5m => stack effect too low
- Natural ventilation airflow 1200 m3/h for DT=5°C => not sufficient (1 ach of overall building, 2 ach of transfer zone)
- High inertia doesn't allow to decrease at least what was stocked at day

Day nursery in Vitrolles

- Leaving exhaust from mechanical ventilation would have helped (with EC motors)

System	Cooling energy (kWh)	Fan power (kWh)	EER	DT outdoor-indoor in the morning (°C)
Airing	40	0	N/A	7.2
Exhaust at ventilation flow	44	9.75	4.5	5.2
Exhaust ventilative cooling	60	14.3	4.2	2.8
Exhaust ventilative cooling with EC motors	60	7.8	7.7	2.8

Dojo – Martial art Sport gym (Ain)

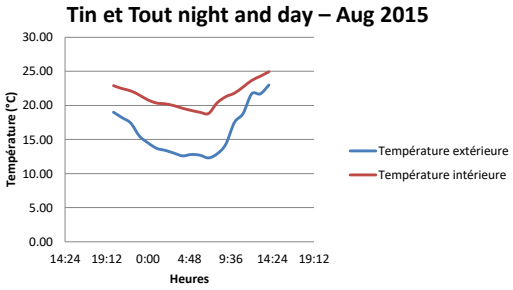
- recent Building 2014
- 3 sport rooms, ceiling height 6m
- Ventilative cooling possible on AHU but installation not sized for this purpose (ducts, dampers…)
- High overheating day-time
- Used only in the evening in summer (18h-22h)

Dojo – Martial art Sport gym (Ain)

- Summer 2015
  - Replacement of self regulating dampers by standard dampers
  - Replacement of horizontal diffusers (ATD) by vertical supply
  - Measured airflow 3400 m3/h in occupation (1000 when not occupied), max possible airflow measured 3900 m3/h (estimated 4500 m3/h on AHU curve)
  - AHU control with night cooling 22h-7h
  - Night cooling didn't start some nights

Dojo – Martial art Sport gym (Ain)

- Comfort improved in the morning with ventilative cooling
  - 5% PPD in the morning with 50% the evening before
  - Temperature decrease at night 35% of potential,
- Fast day increase at day (low inertia and high airflow

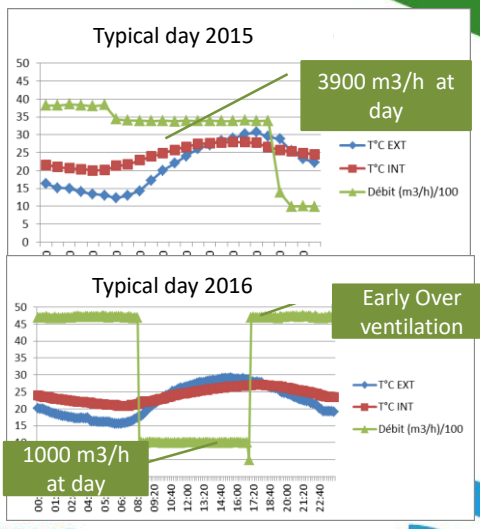


Dojo – Martial art Sport gym (Ain)

- Summer 2016
  - CO2 DCV (reduce day temperature increase)
  - Duct improvement to reduce pressure drop
  - Filters change
  - Airflow increased to 4500 m3/h at max
  - Analysis and correction of control defaults

Dojo – Martial art Sport gym (Ain)

- Early over ventilation at 17h if indoor vs outdoor temperature allow it, occupation at 18h
- Savings 2°C during day vs 2015
- Slower day increase
- Savings in absorbed power (summer & winter / CO^2)
- Temperature decrease 86% of potential in 2016 (vs 35% in 2015)



Dojo – Martial art Sport gym (Ain)

- EER decreased in 2016 vs 2015
  - Ventilative cooling starting at 17h due to occupancy at 18h (low difference of temperature in-out = poor EER)
  - Airflow increased
  - EER and temperature decrease are often varying inversely

	EER min	EER max	EER moyen
2015	0,64	3,42	2,56
2016	0.20	2.31	1.1

Dojo – Martial art Sport gym (Ain)

- Conclusions
  - Night ventilation was improved optimising control and adapting it to specific use of this building
  - Over ventilation MUST be planned when sizing the installation
  - Needs to take over and check control in real conditions to optimise comfort & energy
  - Energy savings due to fan absorbed power with CO^2 DCV

Individual house near Toulouse

- 2015
- Balanced Ventilation
- Bypass of HRU and increase of airflow for night ventilation

Airflow m3/h	supply	Exhaust
Holidays	84	87
Airflow1	105	100
Ventilative cooling	212	189

Individual house near Toulouse

- Good EER but insufficient airflow to achieve comfort
- Higher airflow particularly in bedrooms would be needed

Airflow ach	around 1
Night temperature decrease °C	-2.3°C
Decrease / potential	~50%
Night ventilation time h	10
EER	12.5

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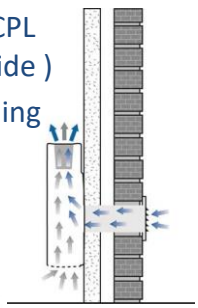
GUIDE DE CONCEPTION I MARS 2018

Individual A/C house (Ain)

- Individual house 1990, retrofitted (insulation, shutters …) in 2012
- Air Conditioned house (heat pump)
- Supply unit in main bedroom (12 m²) :
  - 25 – 225 m3/h controlled by CPL (time control, occupant override)
  - Allow to shut off air conditioning at night
  - Reduce energy consumption



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Individual A/C house (Ain)

- Monitoring, 3 periods
  - Heat wave with mechanical night ventilation
  - Standard summer mechanical night ventilation
  - Standard summer, airing (CPL breakdown)

	Average airflow (m3/h)	Average Abs. Power during occ (W)	Average EER during occ	Energy saving (kWh)	A/C use at day time (h)
Heat wave mec. Vent (7 days)	111.9	19.9	1.3	0	9.6
Mec . Ventilation (49 days)	65.0	11.9	13.2	82	3.6
Airing (22 days)	20.9	0.0	nc.	19	3.0
Total (85 days)	54.6	8.8	7.9	100	4.2

– occupant increased airflow during heat wave more than needed (air speed)

Individual A/C house (Ain)

- Conclusions :
- Night ventilation reduced the A/C used at night and generally in the morning.
- Occupant override has not been the best energy choice :
  - Too high airflow during heat wave (speed need)
  - Starts too early when temperature decrease late at night

ADEME

Agence de l'Environnement et de la Maîtrise de l'Energie

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QUESTIONS ?

Contents

Programme (Brussels time)

10:30	**INTRODUCTION:** Peter Wouters, INIVE, Belgium	11:20	**Questions and answers**
10:40	**ASSESSMENT OF THERMAL AND COMFORT PERFORMANCE** Andres Litvak, Apebat, France	11:30	**GUIDELINES TO ACHIEVE AN EFFECTIVE VENTILATIVE COOLING** Nicolas Piot, EGE, France
10:55	**Questions and answers**	11:45	**Questions and answers**
11:05	**ON SITE MEASUREMENTS AND FEEDBACK** Anne Marie Bernard, Allie'Air, France	12:00	**End of the webinar**

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venticool
the international platform for ventilative cooling

FREEVENT Guide is online (in french)

Downloadable on Construction21.fr :

https://www.construction21.org/france/community/pg/groups/19939/

Guidelines to achieve an effective ventilative cooling (FREEVENT Guide)

- Definitions :
  - Mecanichal / natural / hybrid ventilative cooling
  - Thermal Potential, Energy Evacuation
- The expected requirements
- Site analysis
- Building analysis
- Choice of ventilative cooling system
- Examples and figures (orders of magnitude)

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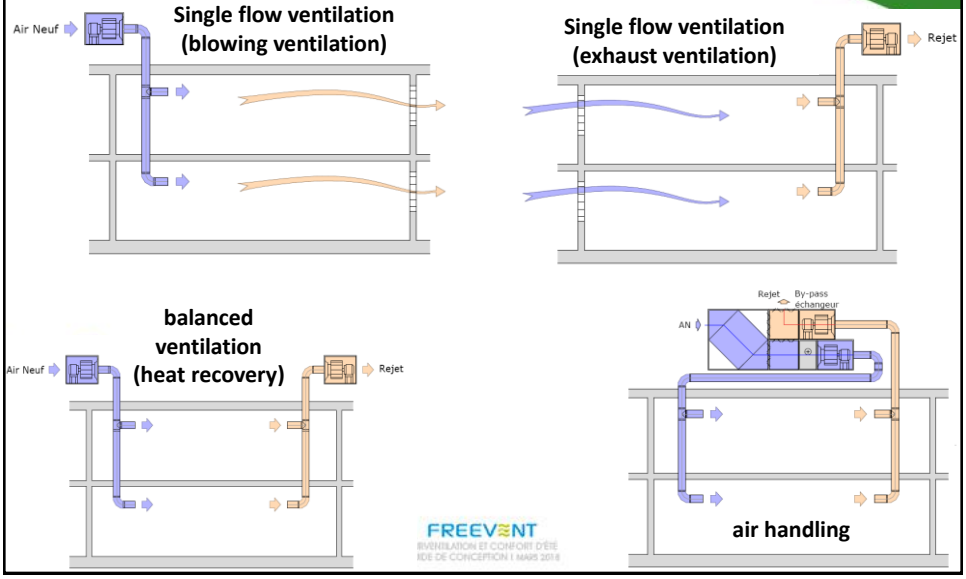
CONCEPTS AND DEFINITIONS

Mechanical ventilative cooling



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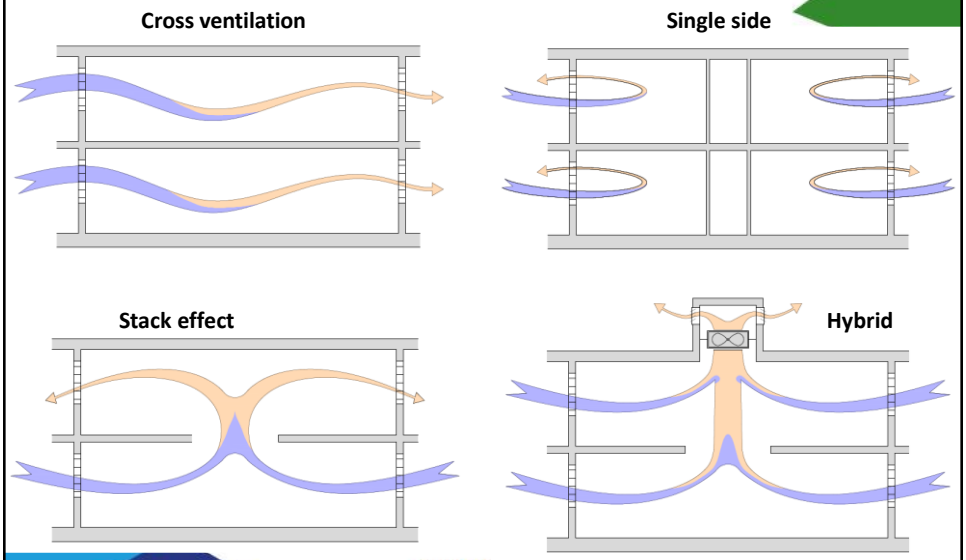
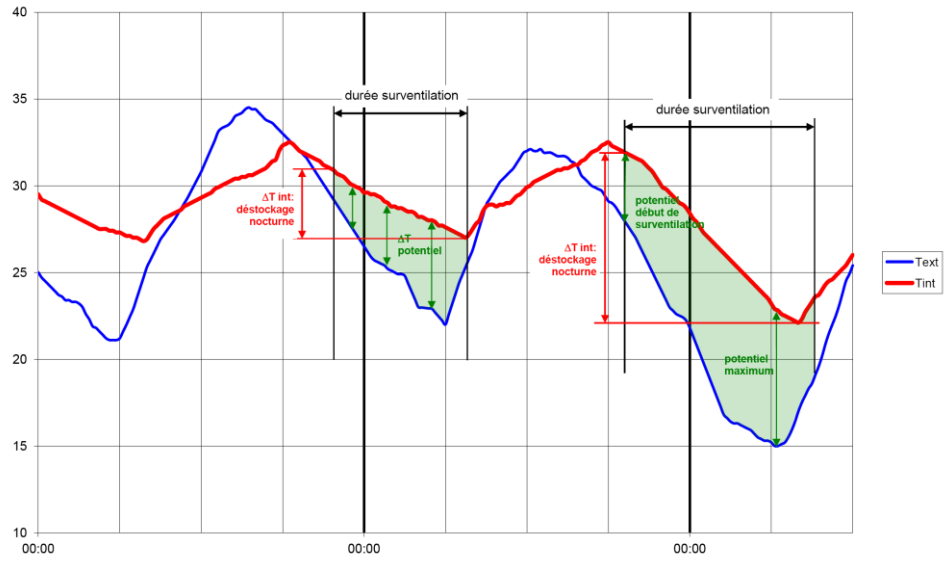
Natural and hybrid, mixed ventilative cooling

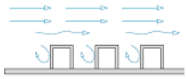


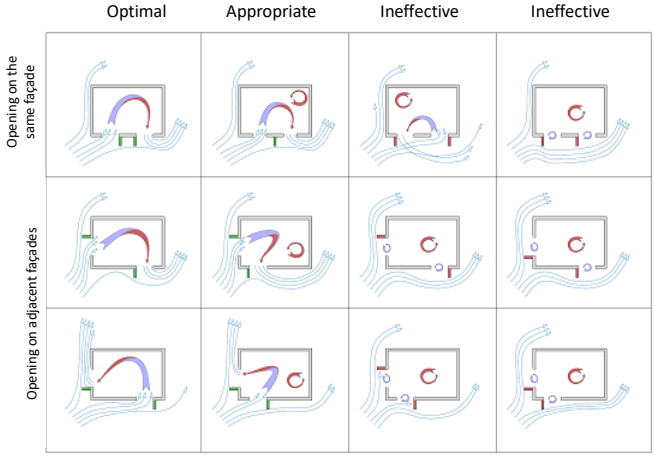
Thermal Potential and Energy Evacuation



2. Site Analysis

Wind exposure





Read specialized guides and handbooks (AIVC)

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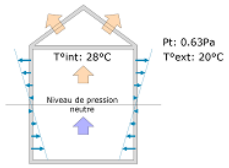
Evaluation of the natural ventilative cooling driving force

Stack Effect alone

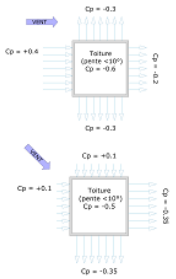
$Pt = 0.044\ H\ (Te - Ti)$

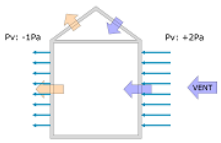


$$Q = C.S\sqrt{2\,g.h.\frac{Ti - Te}{Ti}}$$

Wind Speed

$Pv = \rho\ C_p\ v^2 / 2$

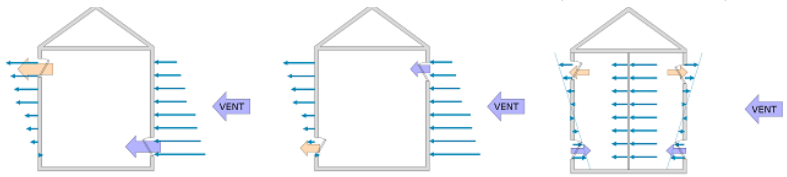




Wind+stack effect combined
Ideally oriented openings

Wind+stack effect combined
Poorly oriented openings

Wind+stack effect combined
monofaçade openings
(wind effect cancelled)



For natural ventilation, driving forces create few pascal pressure available

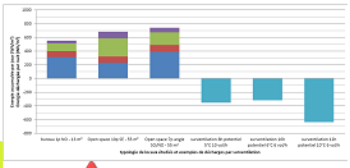
3. Building caracteristics analysis

Dynamic Thermal Simulation

PROGRAMME	SITE	BATIMENT
Objective : maximum allowed number of hours of discomfort or air-conditionning energy consumption reduction - Classification of premises - Occupancy scenario - Internal loads	- Thermal potential - Distance obstacles providing natural shading	- External loads (solar shadings optimized design) - Internal loads - Ventilation, infiltrations - Thermal inertia : internal thermal insulation / external thermal insulation

Dynamic Thermal Simulation

Calculate the Air Change Rate necessary to achieve the programme requirement



Approche simplifiée insuffisante pour du dimensionnement.

SYSTEMS COMPARISON

- Natural ventilative cooling
  - No electrical consumption
  - Energy evacuation uncertain, mainly if the potential is low, energy balance.
  - More design parameters to deal with (site, building)
- mechanical ventilative cooling
  - Better controled evacuation
  - Auxiliary equipment consumption, EER
  - Acoustic awereness
  - Balancing,
  - Ducts sizing

The FREEVENT Guide documents for each of them :

- Pro arguments for each system
- Constraints to be checked
- Alertness Critical points to be studied

Coefficient of Performance :
Use of EER for controls settings

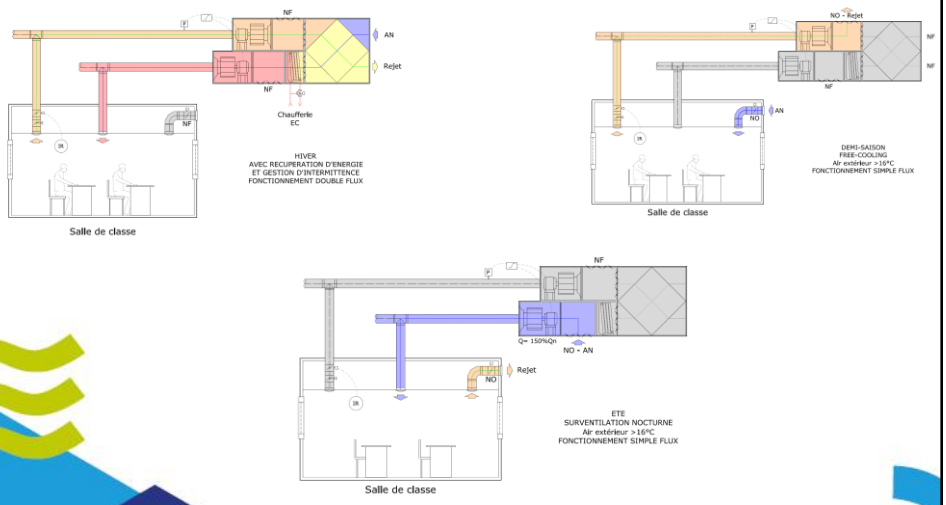
EER = kWh thermal energy evacuated / kWh fan

kWh thermal evacuation = 1,22 x Q (L/s) x (T_{ext} - T_{int}), over the duration of ventilative cooling
kWh fan = SFP x Q (Specific Fan Power x Flow Rate)
EER = 1,22 x ΔT / SFP

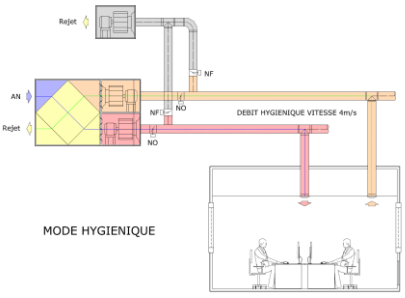
Example : determination of a control rule for ventilative cooling activation :
SFP = 0.9 W / (L/s), let's set EER > 4,
One should get ΔT > 3°C between inside and outside before activating ventilative cooling

DESIGN EXAMPLES

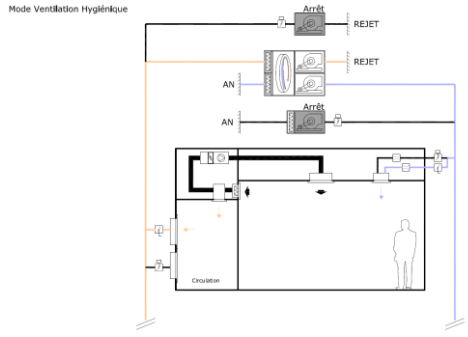
School / Educationnal Building

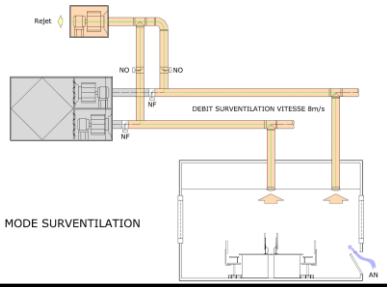


Office buildings with balanced heat recovery ventilation

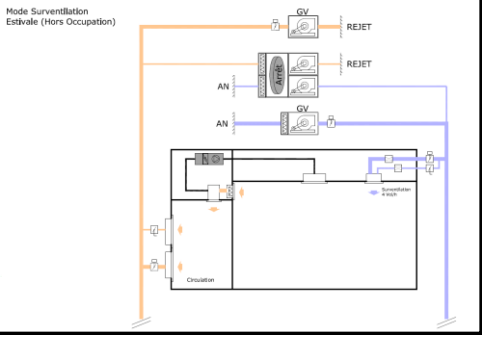


MODE HYGIENIQUE

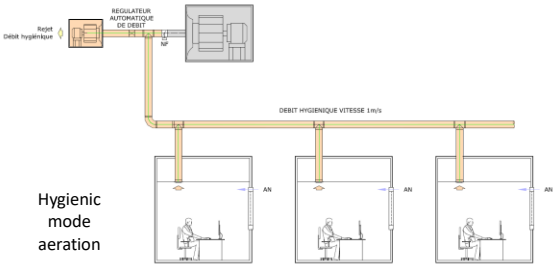




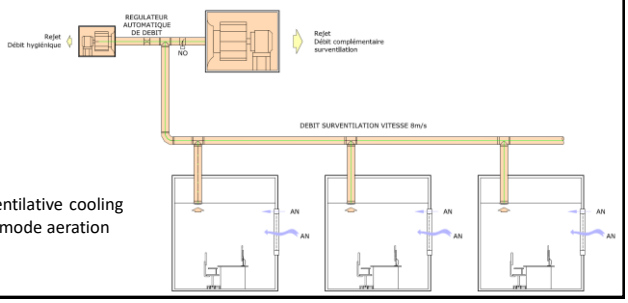
MODE SURVENTILATION



Office buildings with single flow ventilation

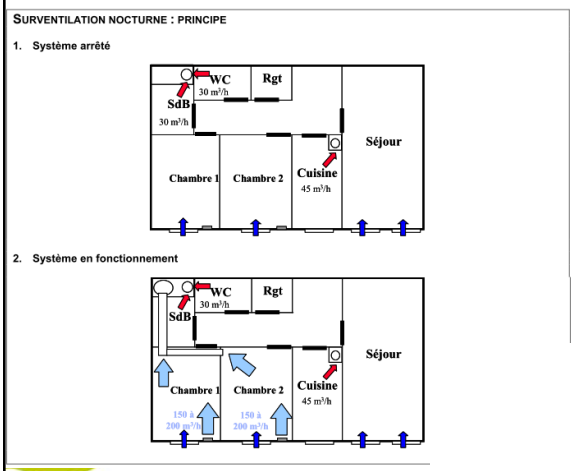


Hygienic mode aeration

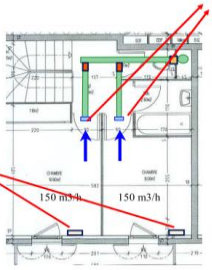


ventilative cooling mode aeration

Residential buildings with balanced heat recovery ventilation



Vanne de compensation



Grille d'extraction type AAD 100
Dim : 250x100

FEEDBACK FROM MONITORING

Buildings with good results for ventilative cooling show :

- Good upstream programme design
- commissionning with extended monitoring
- raising of the user's awareness with operating principles.

Avoid occupants discomfort :

- Acoustics
- Residual air velocity if ventilation occures during building occupancy hours
- Cold sensation in the morning if ventilative cooling is not set off
- Unwanted moisture generation in air-conditioned buildings (enthalpy control to be planned)

FEEDBACK FROM MONITORING

Commissionning, in particular for controls

• Checkin of planned operation for every mode, in particular in the absence of supervision (Building Management System)
• Calibration of threshold limits, position and calibration of temperature probes
• Multizone regulation in order to avoid discomfort

Further maintenance

- Operating manual for users and the owner
- Limitation of motorized equipments and associated regulation
- Facilitated access for equipements

FEEDBACK FROM MONITORING

Provide air transfer and effective transfer of premises

• Management by occupants of manually operated openings (windows and doors)
• Air transfer grilles and acoustics isolation of premises

Caution for undersizing

• Lack of stack effect and drivng forces for natural ventilation
• Excessive pressure losses in mechanical ventilation
• Undersized ground-coupled heat exchanger, to be designed for summer ventilative cooling air-flow rates.

Degradation of buildings thermal performances

- Infiltration occurances in air inlet or exhaust when ventilative cooling is off
- Creation of thermal bridges

PERSPECTIVES…

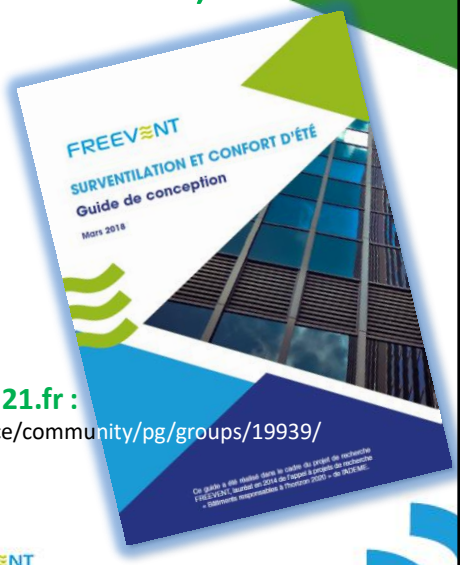
Development of devices specifically dedicated to ventilative cooling

Development of integrated standard control modules dedicated to ventilative cooling

Main difficulty : to design a double air flow-rate without adding multiples motorized damper, with all the associated regulation equipments. Limit of use of self-regulating dampers.

Guide FREEVENT (in French)

Questions ?



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https://www.construction21.org/france/community/pg/groups/19939/