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Training for Renovated Energy Efficient Social housing

Intelligent Energy -Europe programme, contract n° EIE/05/110/SI2.420021

Intelligent Energy Europe

Section 1 Techniques
1.3 Ventilation

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DHV

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DHV

Introduction

- **Need of ventilation and principles**
- **Different ventilation systems**
- **Airflow rates, indoor air quality**
- **Links between heating, ventilating and cooling**
- **Technologies available on the market**

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Contents

- **Introduction**
- **Summary slides**
- **Presentation**

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Main issues

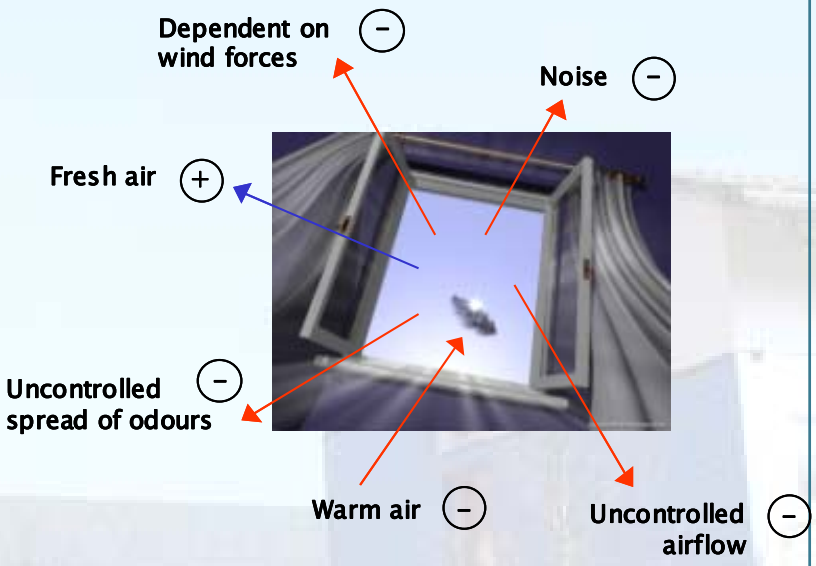
Often poor ventilation in existing building

Renovation required

Energy saving required

More ventilation can result in:

- + Better indoor air quality
- - More energy use
- - Discomfort by draught



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Improve ventilation in existing building

- Natural ventilation
- Mechanical ventilation
- Balanced ventilation with heat recovery

Natural ventilation

- Self regulation vent

Mechanical ventilation

- Apply heat recovery, central or decentral

Controlled ventilation

- Natural or mechanical

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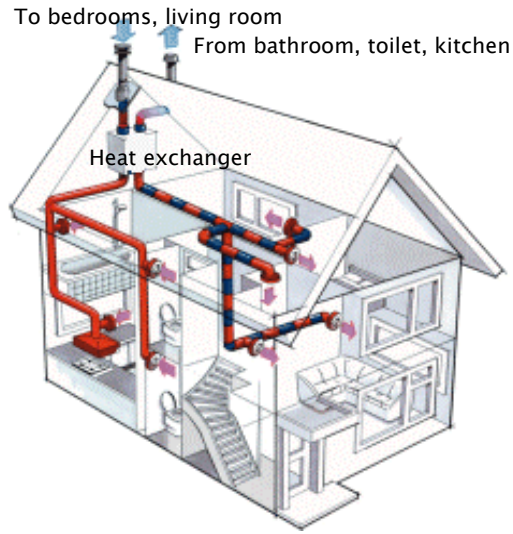
Examples



HRV ventilation concept

Applying systems with:

- Heat recovery → to save energy
- Control of airflow → to save energy and avoid draught
- T, RH or CO2 controlled ventilation → to save energy with remaining good indoor air quality

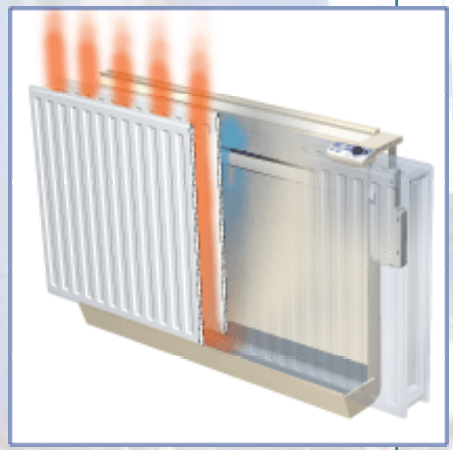

Self-regulating vent

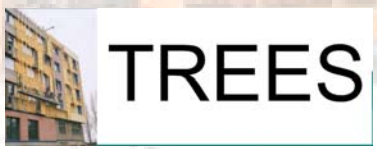
Inlet control: constant flow

+


Switches in rooms


CO_2 sensor


Heat recovery, ventilation combined in radiator




Program system

Why ventilation in buildings

- **Fresh air for people**
- **Indoor air quality control**
- **Humidity control**
- **Temperature control**

Required

- During day and nighttime
- During winter, spring, summer, autumn

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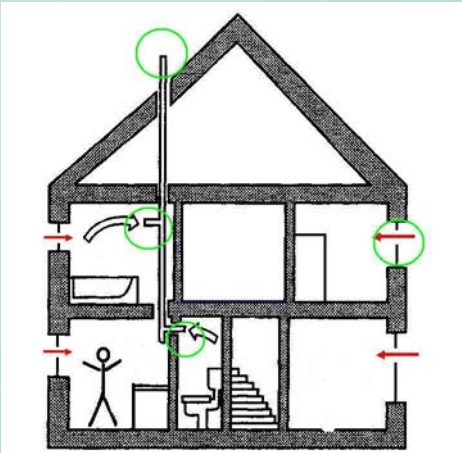
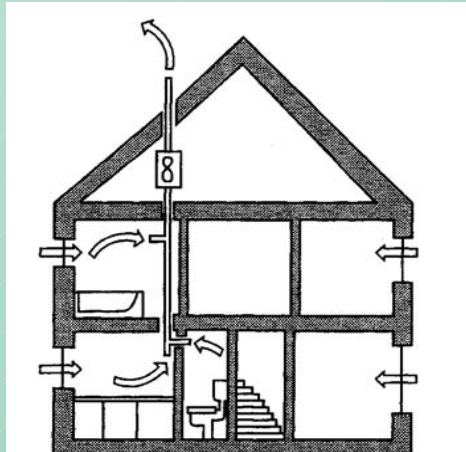
Ventilation systems

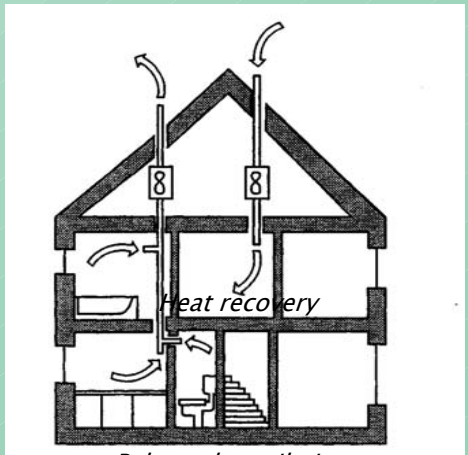
- **Natural supply, natural exhaust**
- **Natural supply, mechanical exhaust**
- **Mechanical supply, mechanical exhaust**



Natural ventilation



Exhaust ventilation



Balanced ventilation

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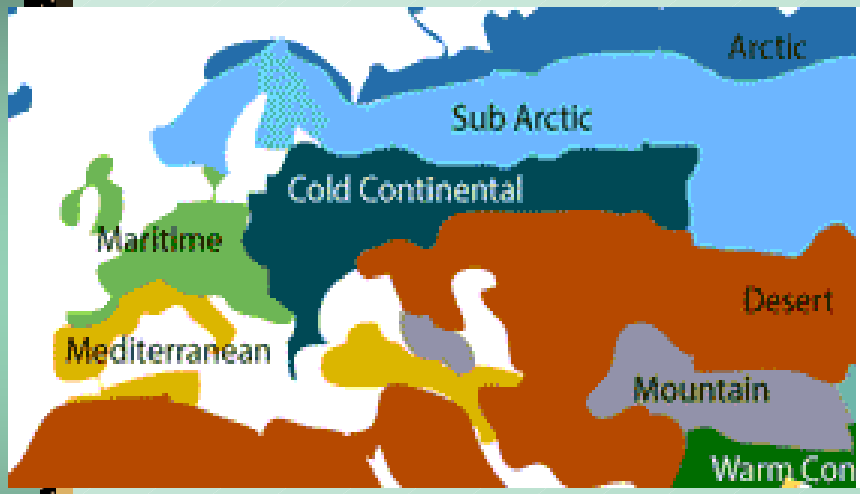
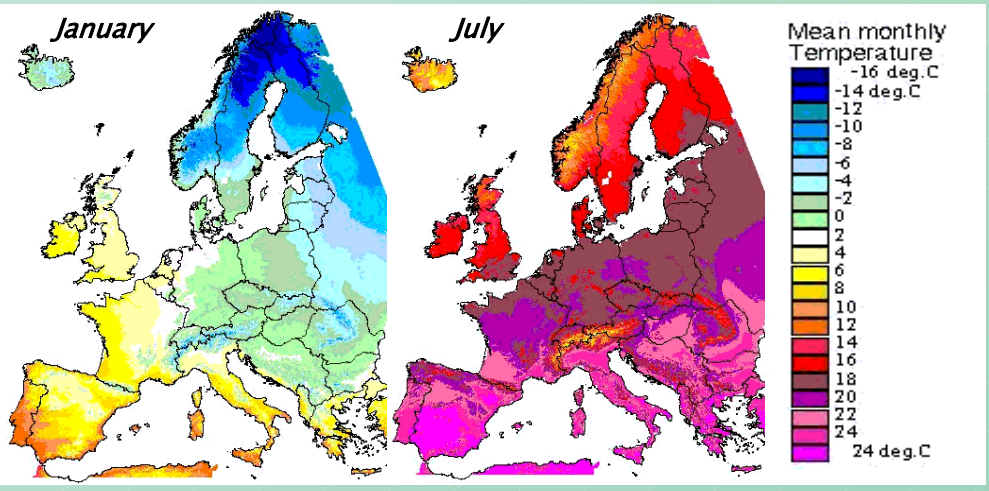
European climate zones





Climates of Europe

Measures depend on the climatic zone at the specific building site.

Measures related to Mediterranean, Maritime and Sub Arctic climates → covering most part of Europe.

Mean monthly temperatures (ºC)

	January	**July**
Mediterranean:	-2 to 12	14 to 26
Maritime:	-10 to 8	6 to 24
Sub Arctic:	-16 to –2	6 to 16

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Natural ventilation

Natural ventilation

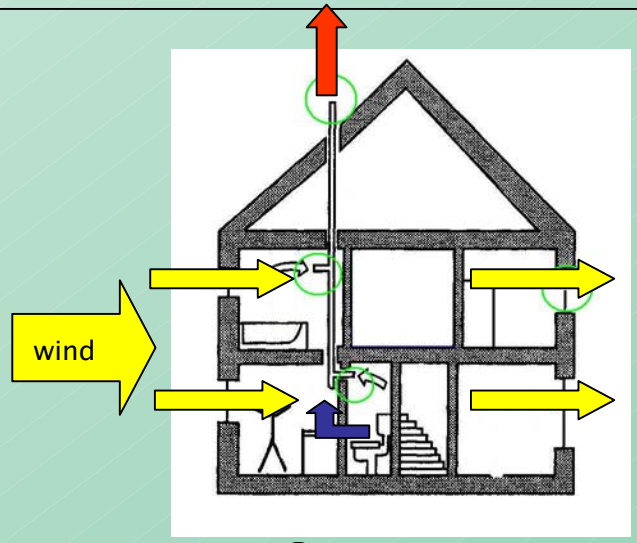
- infiltration
- air through opened windows, doors and vents.

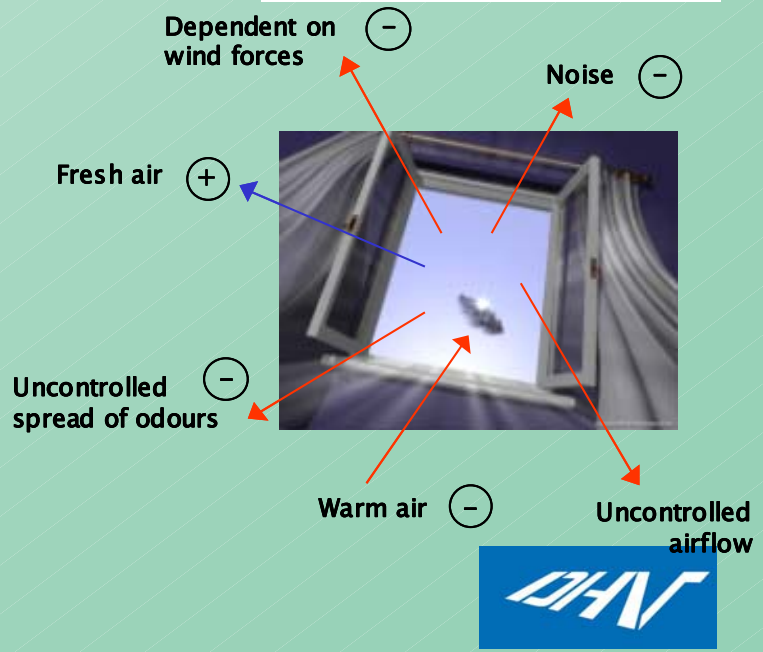
Advantages

- Silent, except for fierce wind
- No electrical energy needed
- Simple system and maintenance
- Low investment costs.

Disadvantages

- Dependent on wind forces
- Risk of burglary through open windows
- Low energy efficiency, no heat-recovery
- Risk of draft
- Risk of unwanted spread of damps/odours
- Risk of noise from outside.
- Exhaust air ducts demand extra space.
- Not suitable for high buildings.





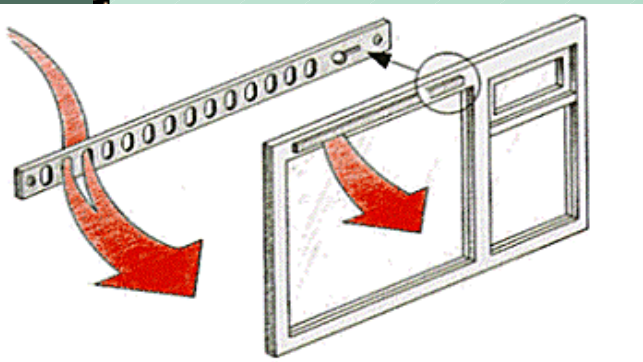
Natural ventilation supply control

Possible improvements

- Prevention of burglary: using ventilation vents (fig. 1)
- Noise control: using noise reducing vents (fig. 2a/b)
- Quantity control: using constant-flow vents with self-regulating system (fig.3)
- Draft prevention:
    1) ventilation with self-regulating vents;
    2) valve at inner side of vent to direct air stream from outside to ceiling;
    3) minimal height above ground 1,80 m.

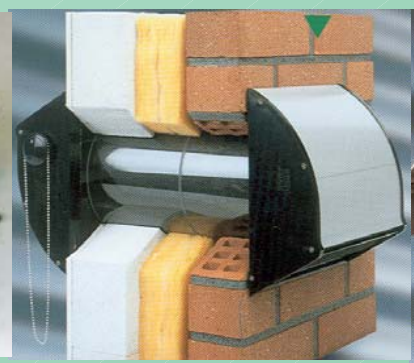
Application

- Natural ventilation is generally not used anymore due to disadvantages.

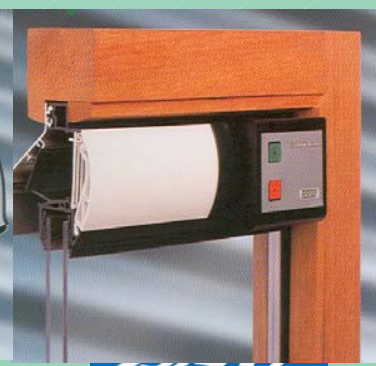


(1) Ventilation vent

(2a) Noise-reducing vent in window



(2b) Noise-reducing vent in exterior wall



(3) Self regulating vent

Natural supply, mechanical exhaust(1)

Mechanical exhaust ventilation

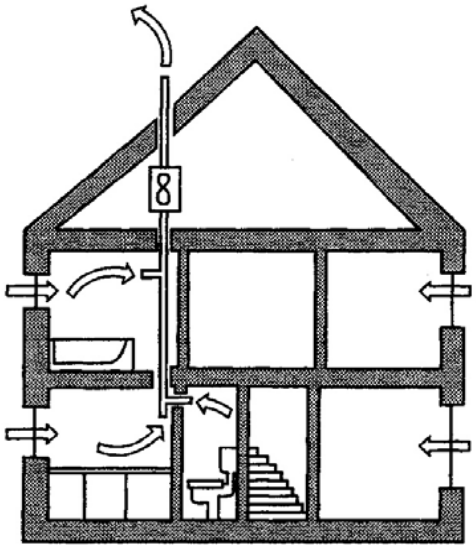
- a fan exhausts indoor air
- natural air supply by windows and/or vents.

Advantages

- Quantity of ventilation can be controlled.
- Exhaust moisture/odors out of sanitary rooms
- Less ducts compared to balanced ventilation.
- Simple system and widely known.
- Possibility of Individual control per room.

Disadvantages

- Risk of draft close to windows.
- Noise from fan in apartment buildings.
- Building envelope must be made airtight.
- Extra space needed for exhaust air ducts.



Exhaust ventilation

Natural supply, mechanical exhaust(2)

Application

Mechanical exhaust with natural air supply commonly applied

Possible improvements

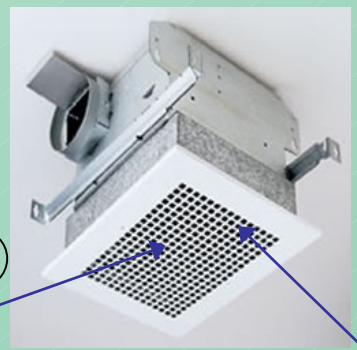
- Demand regulated system to program ventilation and save energy.
- Draft can be limited by self regulating vents.
- Spring fixation and covering of fan to reduce noise nuisance.

Traditional grille

Inlet control by user (+/−)

Self-regulating vent

Inlet control: constant flow (+)



No spread of odours (+)

Exhaust fan

Exhaust control (+)

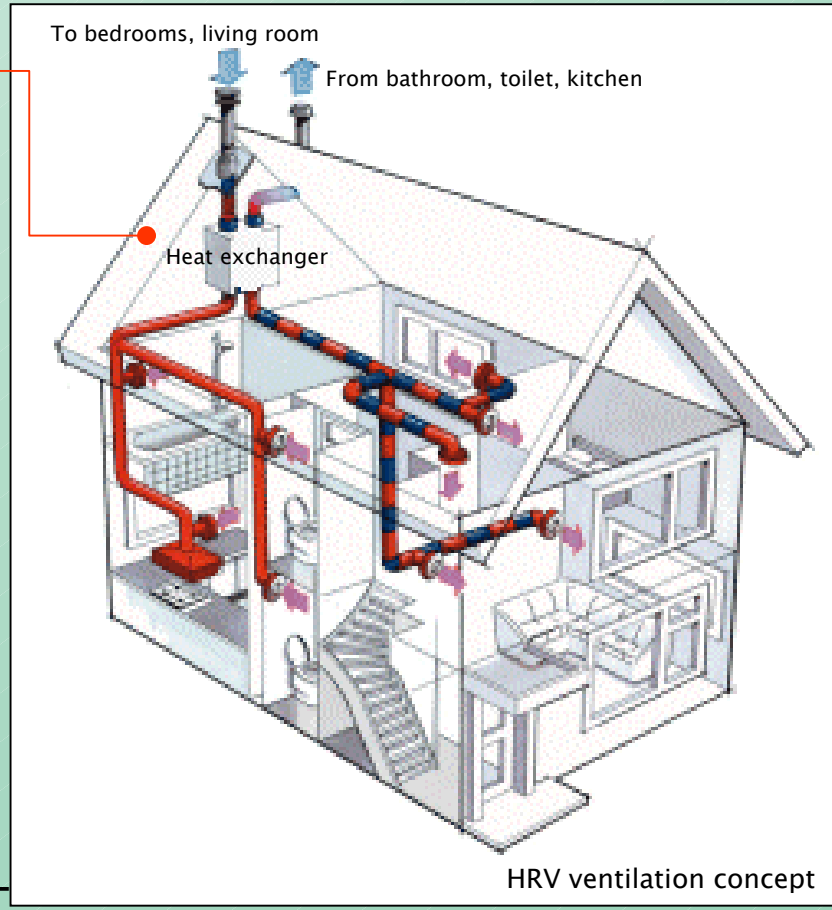
Mechanical supply and exhaust

Exhaust & supply

- Stale air exhausted from bathrooms, laundry and kitchen
- Fresh air supplied to bedrooms, living room and other living areas.
- Ducts: important for ducts to be as short, smooth, and airtight as possible.

Advantage

- Adequate ventilation is possible with HRV.
- A tight home with an HRV usually uses less energy
- Air supply is controlled and not from basements or crawlspaces (as exhaust-only systems).



HRV ventilation concept

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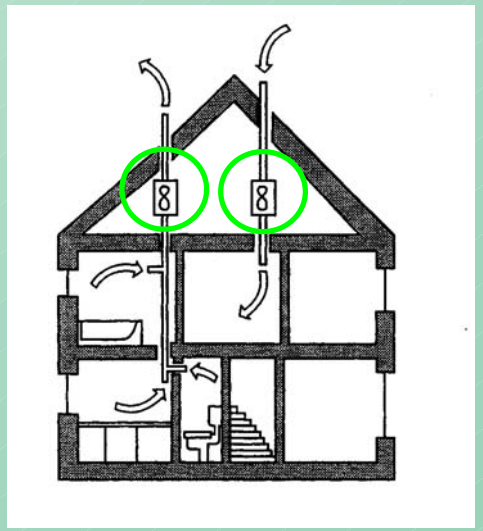
Balanced ventilation improvements

Disadvantages

- Possible noise pollution from fans and air movement in ducts.
- System needs proper, sensitive adjustment
- Exhaust air ducts lot of extra space
- Adequate and frequent maintenance required
- Airtight building envelope required



Application

Balanced ventilation commonly applied in housing

Possible improvements

- Extra inlet grilles will reduce air speed and draught.
- Extra air tightness of the building prevents suction out of crawl space.
- Instructions for use and maintenance keeps installation work properly.

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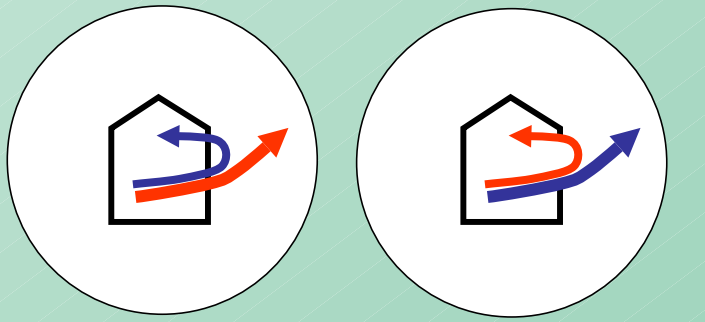
Heat recovery from ventilation air

Heat-recovery fan

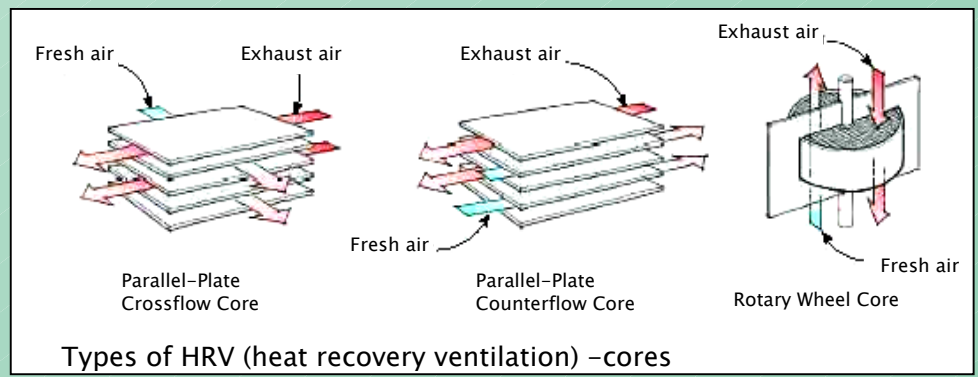
Mediterranean zone.

Heat-recovery fan exhausts stale air from house
+
brings in the same amount of fresh air



Two airstreams pass each other in heat-exchange core, allowing much of heat energy in the stale air to be transferred to the fresh incoming air, without any mixing

During warm periods, heat transfer other way around



Types of HRV (heat recovery ventilation) -cores

Ventilation rates

Ventilation standards

Numerous standards and guidelines, national and international

Given in:

- Outdoor air supply requirements (volume per time per person)
- Supply requirements per square meter ($m^3/h.m^2$)
- Outdoor air exchange-rate (h^{-1})
- Exhaust air requirements per room (m^3/h)

International standards for ventilation are

- American guideline: ASHRAE standard 62-1989
- European guideline: CEN1752

Building codes are often very minimal

Ventilation rates

Indicators of indoor air quality

- Max CO_2 concentration in room space (1000 or 1200 ppm)
- Humidity, max humidity level, to avoid mould growth
- Smoking, 50 – 120 m^3/h of fresh air required

Required air exchange-rates (Dutch Building Code)

Room	Exchange rate
Living room	Supply: 0,7 dm^3/s (2,5 m^3/h) per m^2, with a minimum of 7 dm^3/s (25 m^3/h)
Bedroom	Supply: 0,7 dm^3/s (2,5 m^3/h) per m^2 floor area, with a minimum of 7 dm^3/s (25 m^3/h)
Kitchen	Extract: 21 dm^3/s (75 m^3/h)
Bathroom	Extract: 14 dm^3/s (50 m^3/h)
Toilet	Extract: 7 dm^3/s (25 m^3/h)

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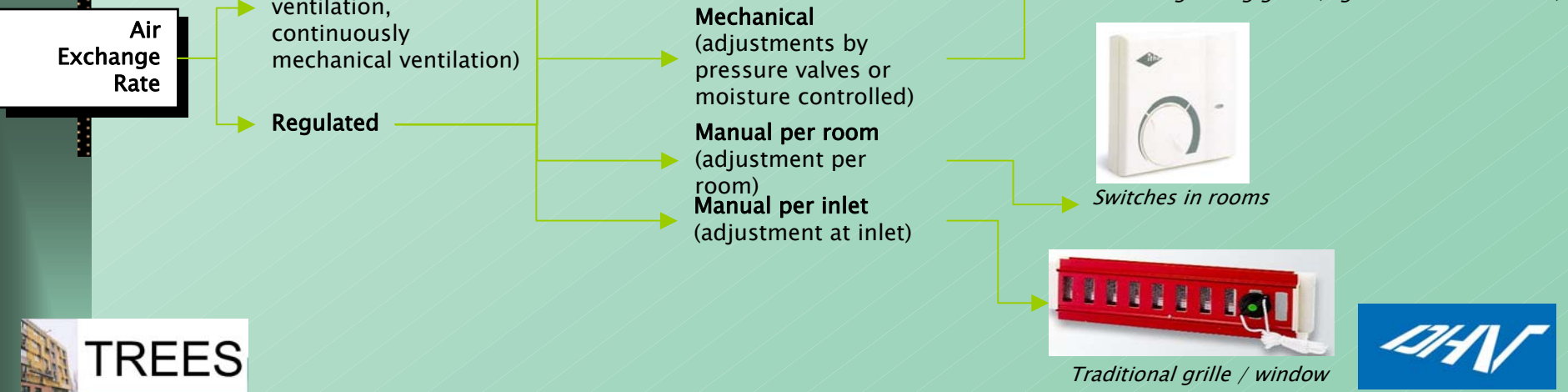
Ventilation controls

Ventilation quantity traditionally unregulated

Improve indoor air quality + save energy → ventilation to be optimised using automatic systems:

- Sensor that measures air quality
- Programs that regulate the fans
- Self-regulating grilles



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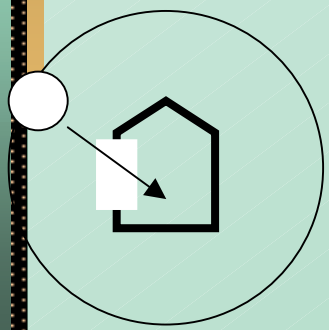
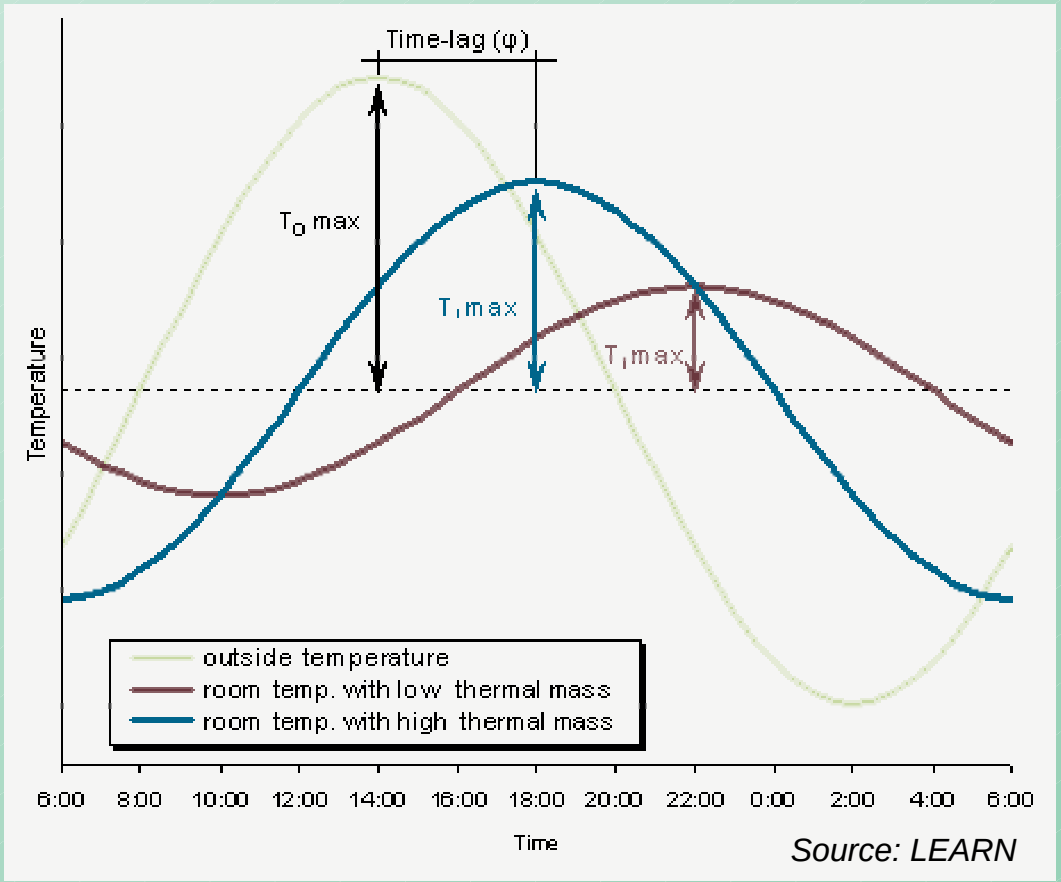
Thermal mass, and summer night ventilation

Thermal mass helps avoid the daytime heat and keep the night-time coolness inside the building for a longer period.





Source: LEARN

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Ventilation systems on the market

- **Decentralized preheating of natural supply air**
- **Decentralized heat recovery**
- **Ground heat exchanger**