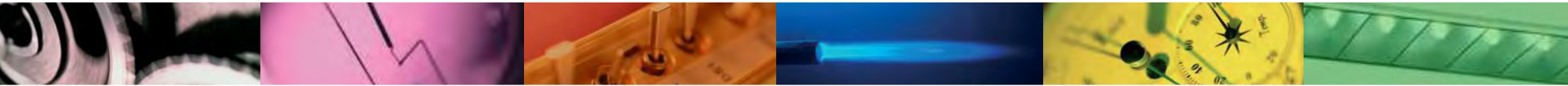


ventilation in *Passivhaus* schools



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Gitschotellei 138

2600 Berchem

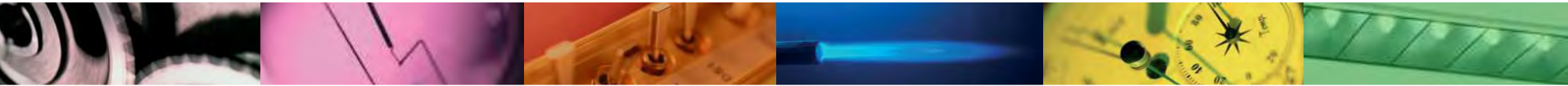
www.passiefhuisplatform.be

info@passiefhuisplatform.be

building structure and envelope

heating

electrical consumption



ventilation

cooling

Passivhaus concept

importance of indoor air quality
centralized/decentralized units

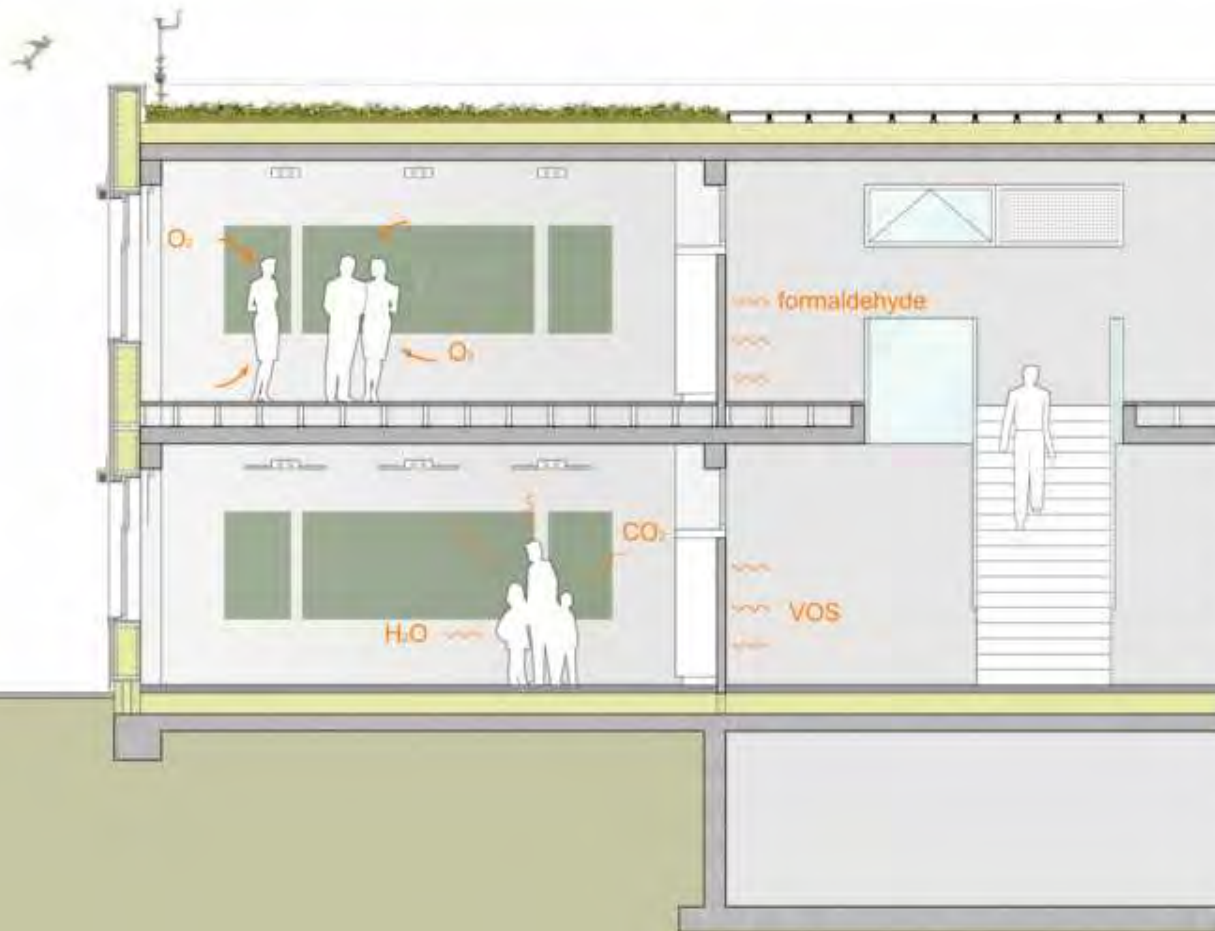


ventilation

importance of indoor air quality



indoor air quality (IAQ)



- need for external air \approx activity and weight of people
- indoor pollutants evacuation: CO₂, VOS, odours, ...
- children are extremely sensitive to results of poor air quality
- growth processes are vulnerable to disruption
- higher breathing volume compared to adults
- less able to get rid of most environmental toxins accumulated in the body
- good indoor air quality supports children's learning abilities, academic performance and attendance

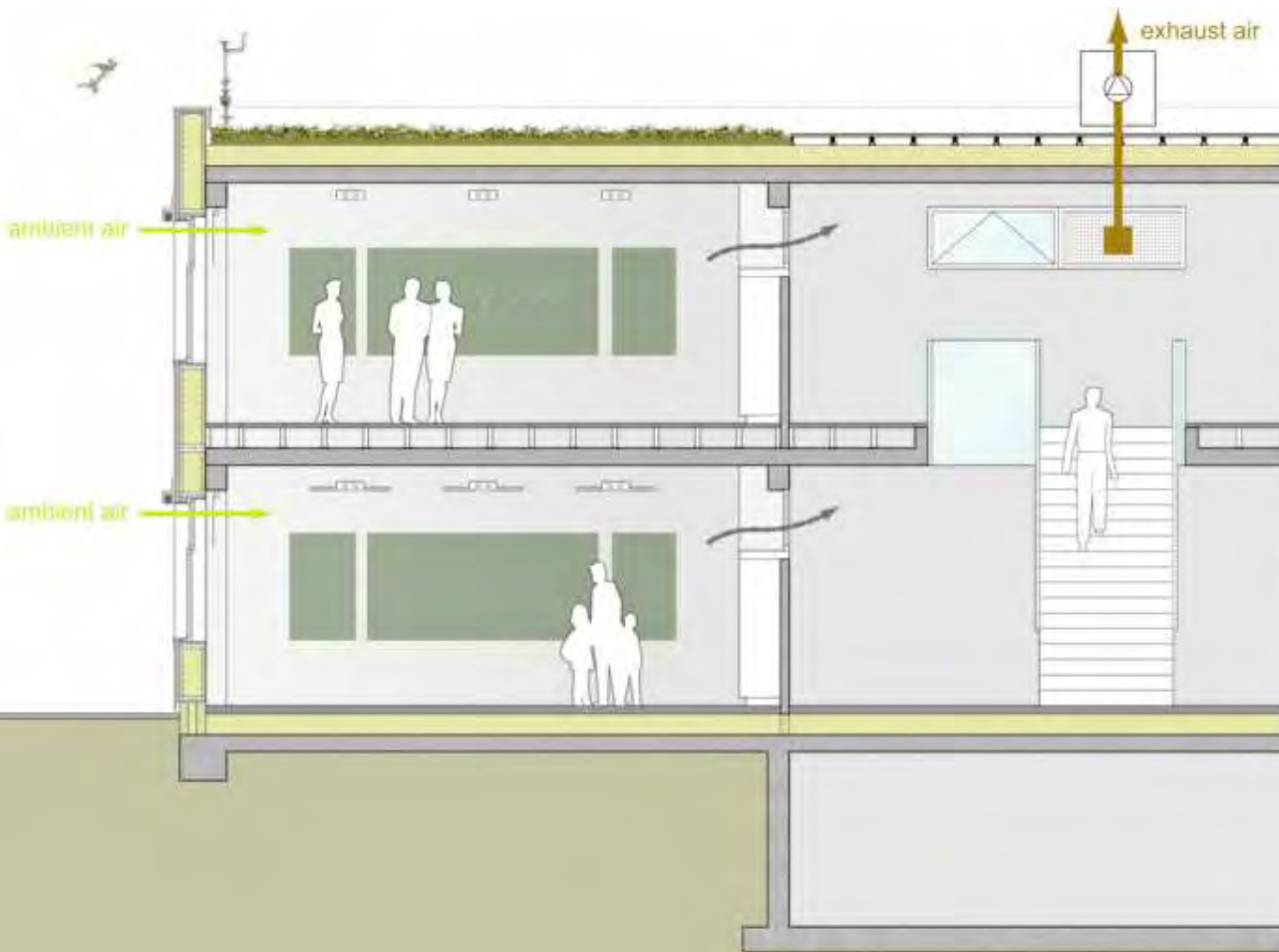


ventilation

importance of indoor air quality



conventional new buildings: window ventilation



comfort issues

- thermal comfort: draught issues
- acoustical comfort: external noise pollution

indoor air quality

- insufficient air supply in winter
- direct air without filtering

energy consumption

- no heat recovery
- high ventilation heat losses
- electrical consumption of exhaust fan(s)

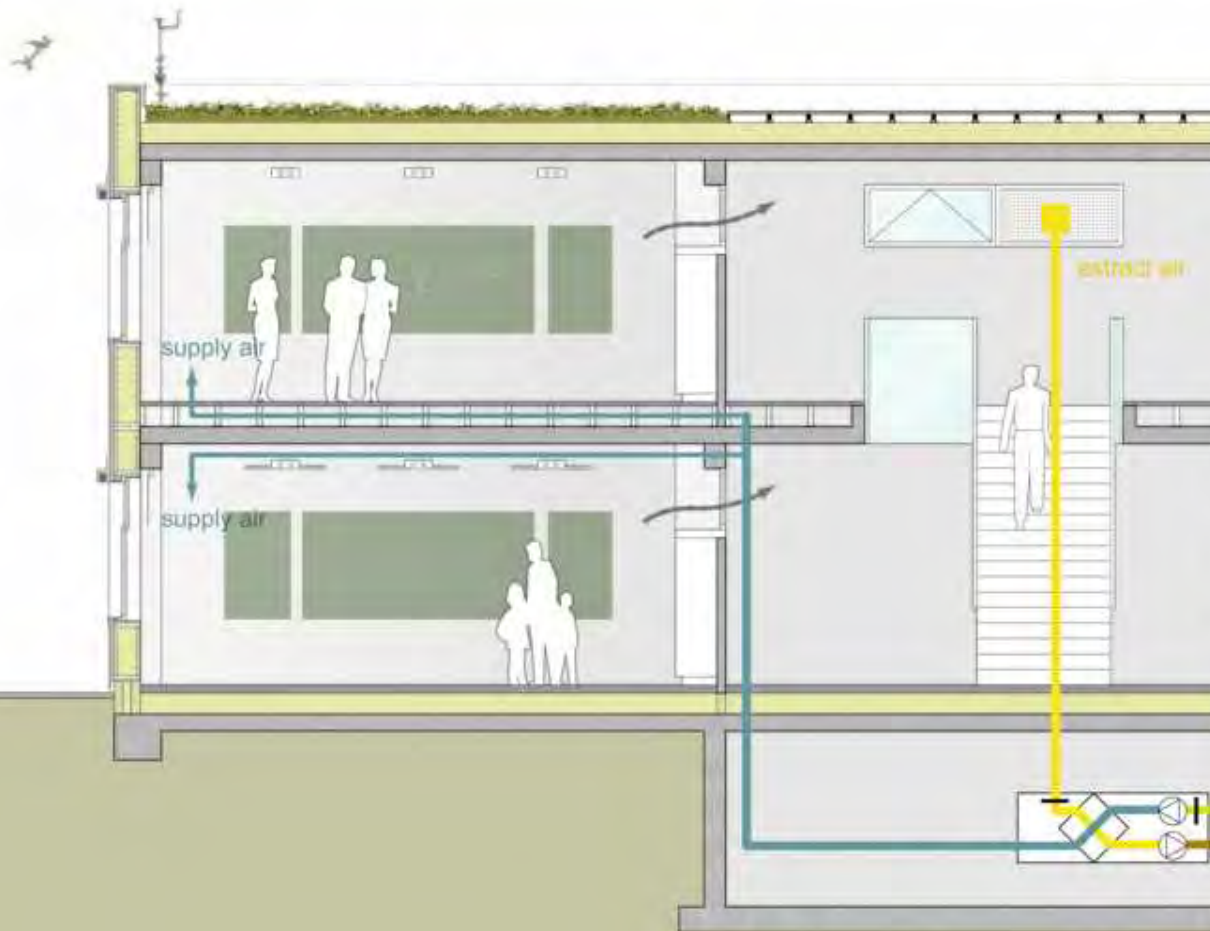


ventilation

importance of indoor air quality



Passivhaus buildings: mechanical ventilation with heat recovery



comfort advantages

- thermal comfort: supply air temperature after heat exchanger $\geq 16,5^{\circ}\text{C}$
- improved acoustical comfort
- measures against fan noise propagation & sound propagation between rooms !

indoor air quality

- required air changes in all weather conditions
- occupancy based controlled ventilation
- air filters present

energy consumption

- recovery of heat/cold/humidity
- low ventilation heat losses
- electrical consumption of fans !
EC-engines
insulated, low air resistance ductwork

ambient air

exhaust air



Oude school, vieze lucht

De luchtkwaliteit is vooral in oude scholen vaak ondermaats. De passiefschool scoort dan weer prima.

GENT | De luchtkwaliteit in klaslokalen is zestig procent van de tijd ondermaats. Dat heeft Agoria, de federatie van de technologische industrie gemeld. Onder de hoede van Arnold Janssens, hoofddocent bouwfysica van de Universiteit Gent, werden tien lagere en secundaire scholen onderzocht, zowel oudere als recentere (na 2000), evenals een passiefschool in Beernem. Een week lang werd om de vijf minuten het CO₂-gehalte gemeten. Dat is op zich niet schadelijk maar het geldt als een goede graadmeter voor de perceptie van slechte lucht. Veel CO₂ wijst op te weinig ventilatie en betekent ook dat er

andere vervuillende stoffen te weinig afgevoerd worden. Vooral de oudere scholen scoorden slecht. In de nieuwere gebouwen was de lucht slechts in 40 procent van de tijd belabberd. Het best scoorde de passiefschool. Die is extreem goed geïsoleerd en heeft een volledige mechanisch ventilatiesysteem. De lucht was er 99,9 procent van de tijd prima. Het ging wel om een school met dunbevolkte klassen. Voor Janssens bevestigt dit onderzoek dat de luchtkwaliteit in veel van onze scholen laat te wensen over. Dat heeft kwalijke gevolgen op de frisheid, de concentratie en het welbevinden van leerlingen en leerkrachten.

Kan daar iets aan gedaan worden? 'Investeren in een ventilatiesysteem hoeft niet zo duur te zijn', zegt Arnold Janssens, 'als ze nieuwe ramen laten plaatsen met dubbele beglazing, dan kost het niet veel extra om er ventilatieroosters aan toe te voegen.' En waarom niet gewoon de ramen af en toe opengooien? 'Dat is piekventilatie en die haalt de CO₂ meteen naar beneden. Maar zodra ze weer dichtgaan, neemt de koolstofdioxide weer snel toe.' Vorig jaar lanceerde de Vlaamse overheid de campagne Lekker Fris. Daarin gaf ze scholen advies. Er staan enkele kleinere tips tussen, zoals: plaats de printer en de kopieermachine buiten de klas. Of: gebruik geen veger maar wis het bord met water. (ty)

Biz. 10 > reportage.

source: De Standaard, 6 maart 2009

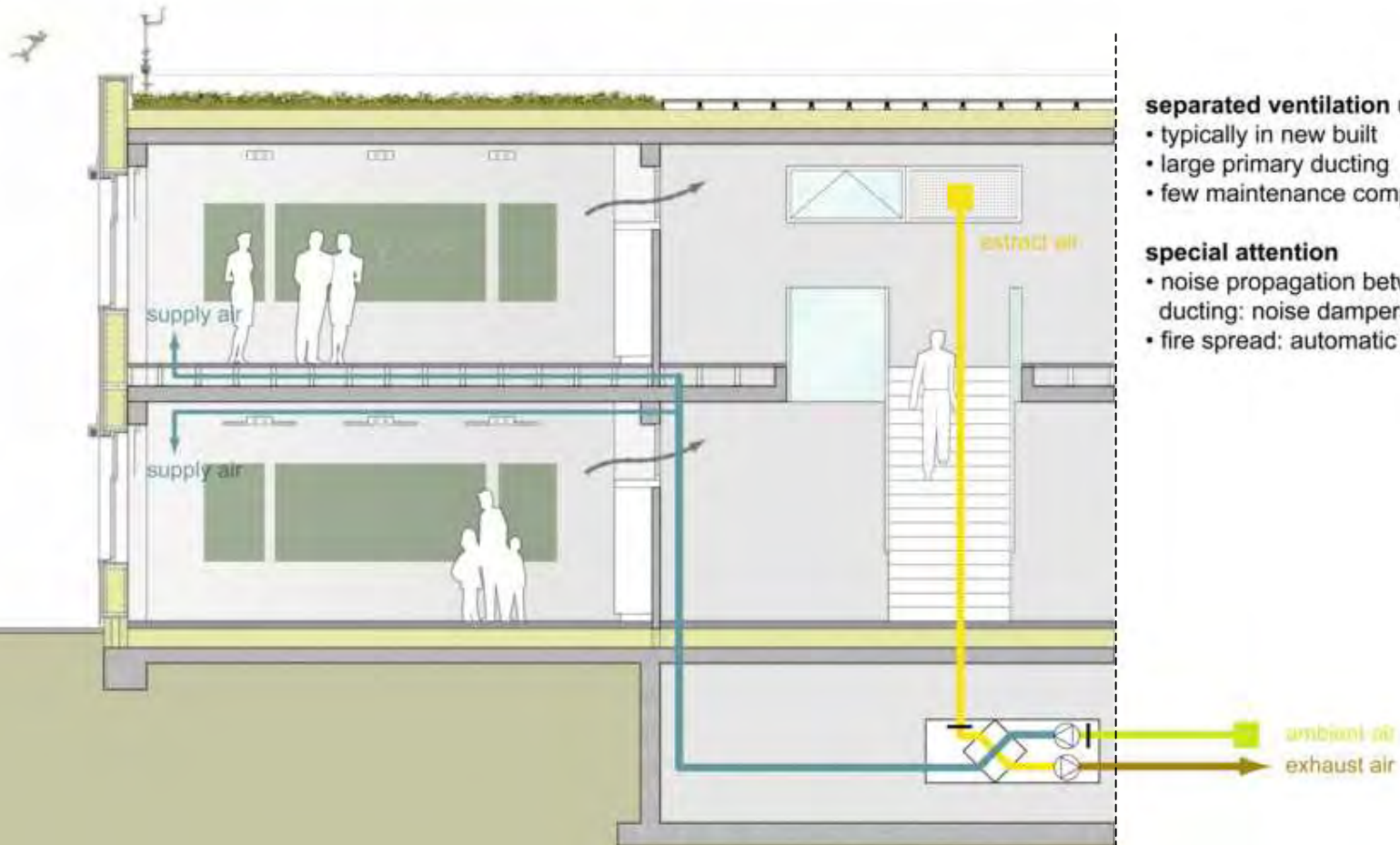


ventilation

centralized/decentralized units



centralized heat recovery unit



separated ventilation unit and plant room

- typically in new built
- large primary ducting
- few maintenance components

special attention

- noise propagation between rooms through ducting: noise dampers
- fire spread: automatic closing valves

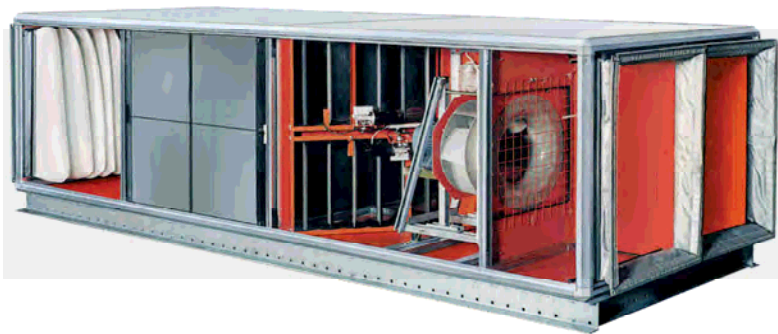
ambient air

extract air

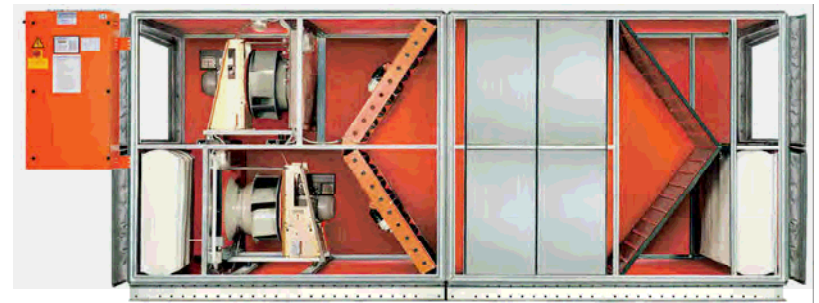
ventilation
centralized/decentralized units



centralized heat recovery unit



centralized unit - horizontal configuration



centralized unit - vertical configuration

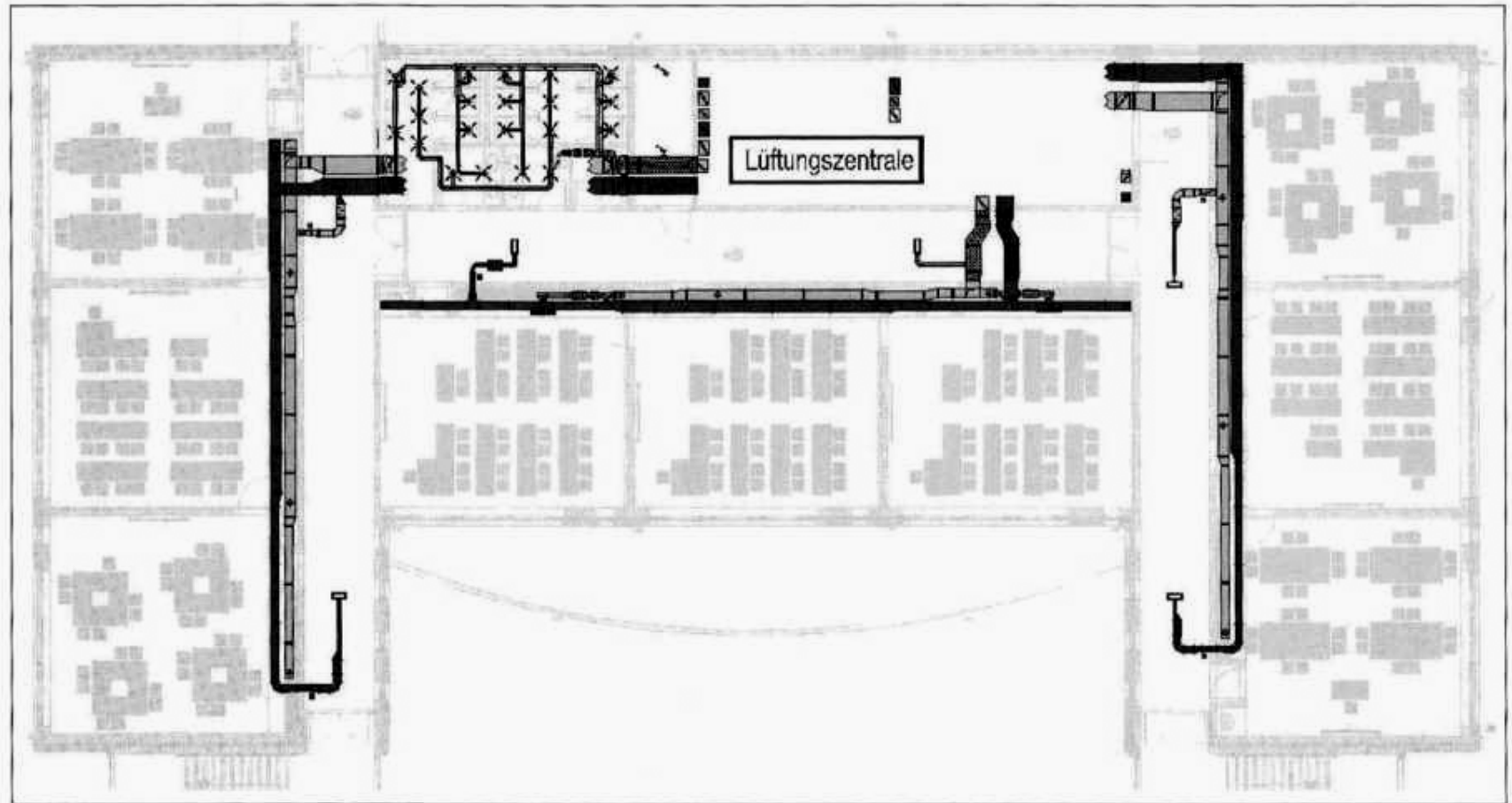


ventilation

centralized/decentralized units



centralized heat recovery unit

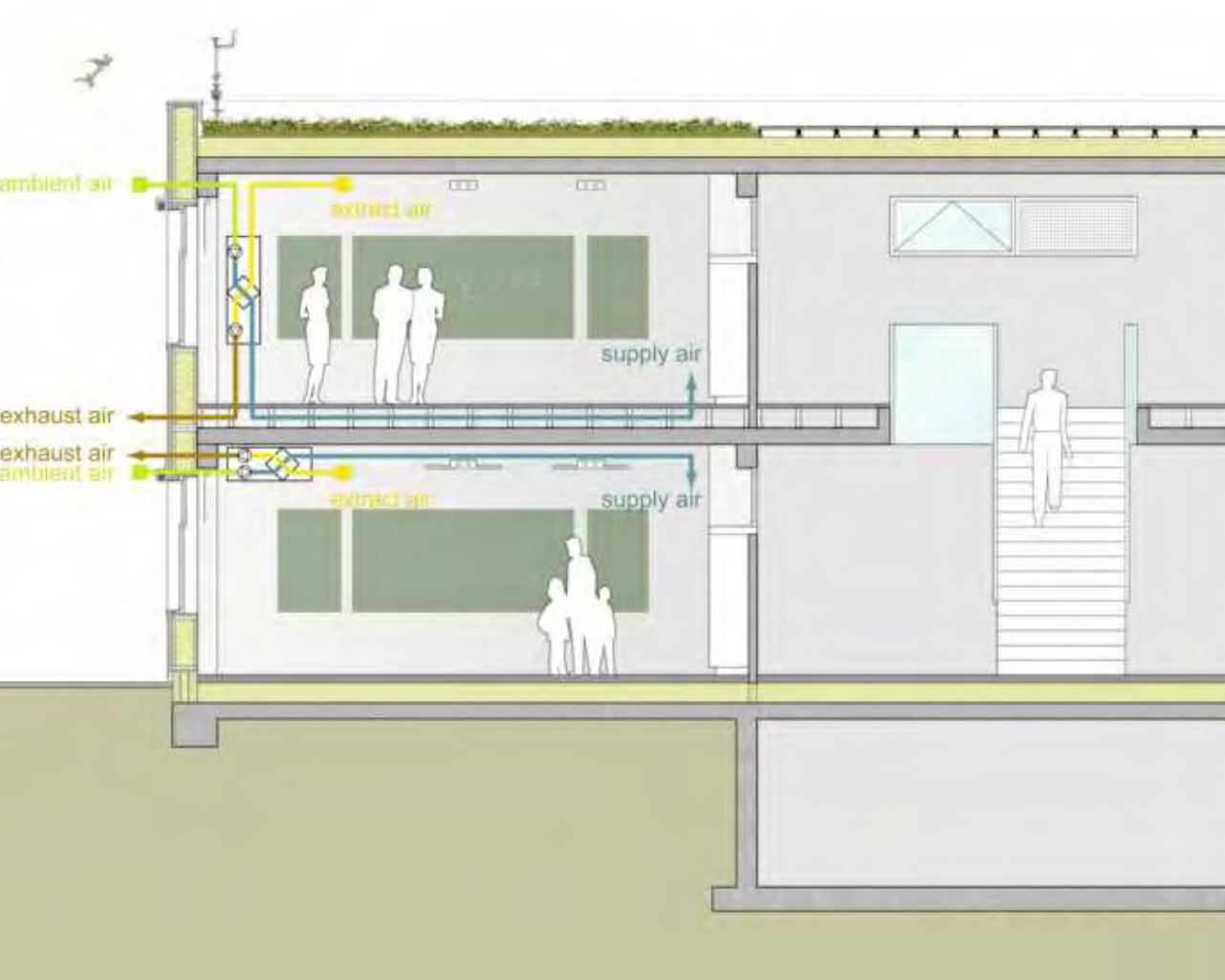


ventilation

centralized/decentralized units



decentralized heat recovery units



ventilation unit per room

- typically in renovation
- wall - suspended ceiling
- smaller ducting

special attention

- ventilator noise per room
- more maintenance components



ventilation centralized/decentralized units



decentralized heat recovery units



decentralized unit in wall configuration



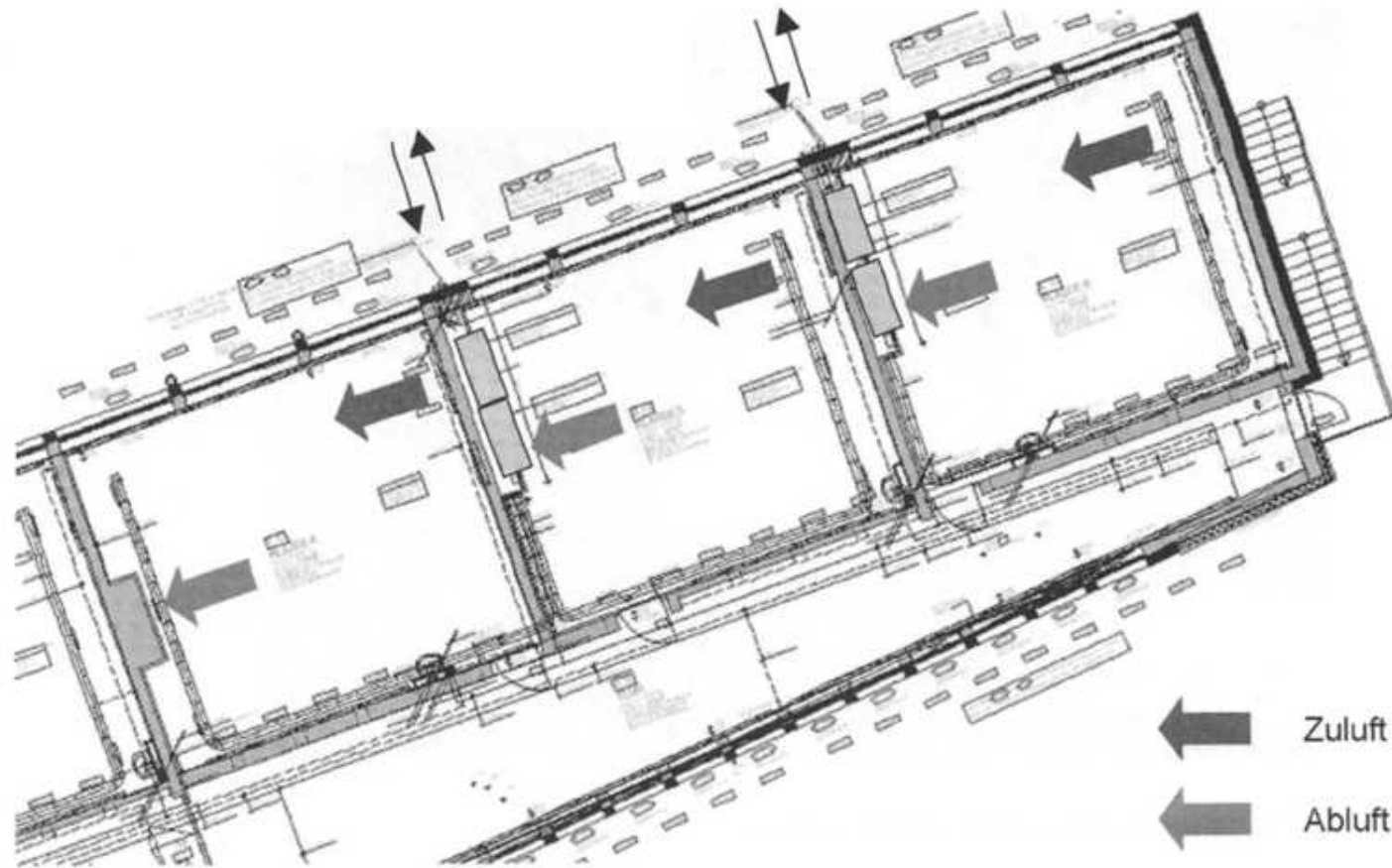
decentralized unit in suspended ceiling



ventilation centralized/decentralized units



decentralized heat recovery units

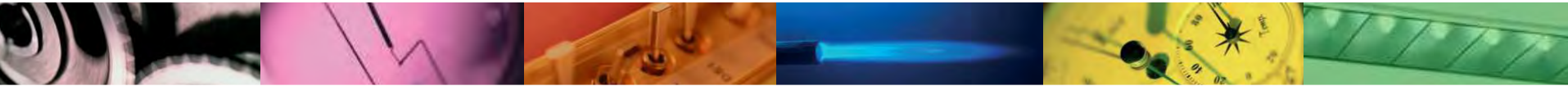


intermittent heating
all-air heating system
air + radiators heating

building structure and envelope

heating

electrical consumption



Passivhaus concept

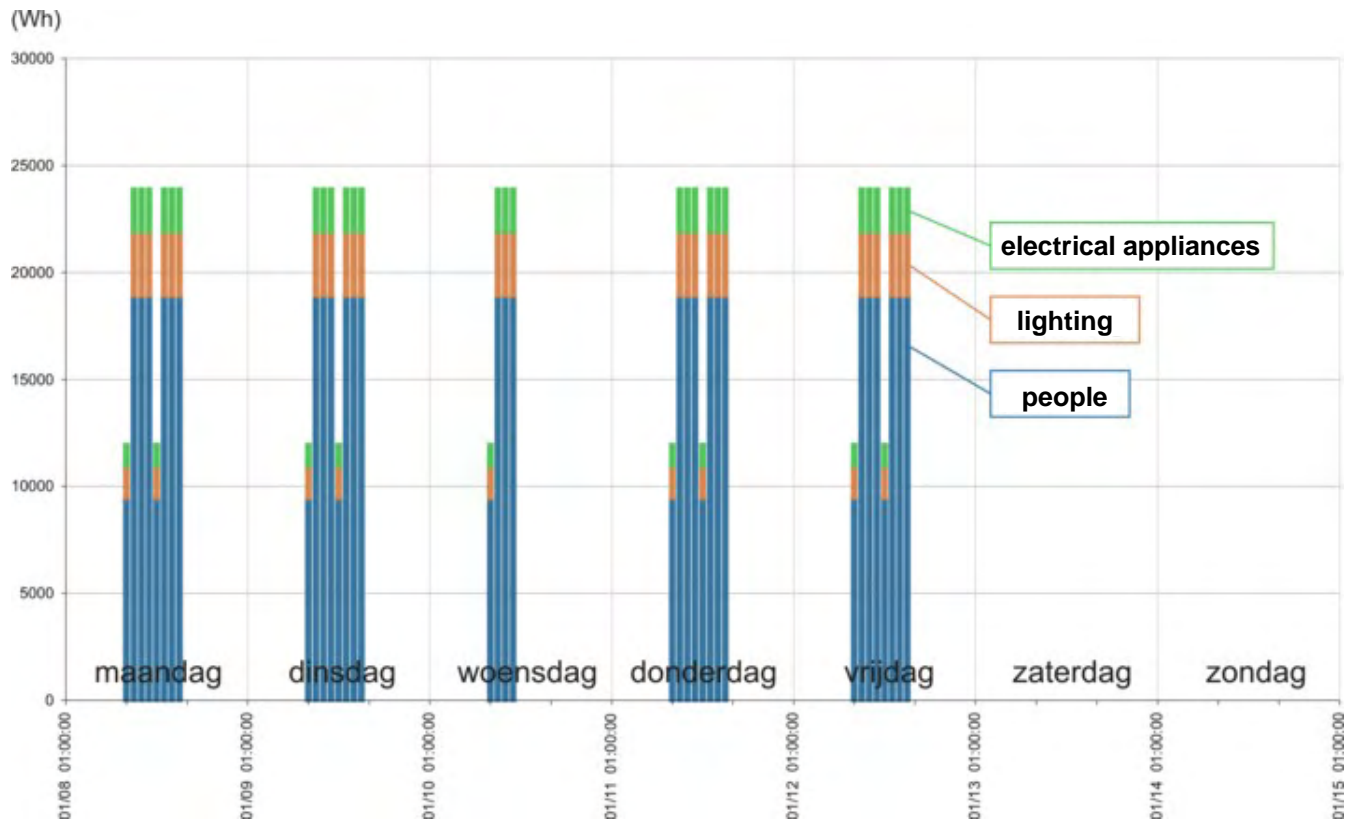
ventilation

cooling



heating in *Passivhaus* schools

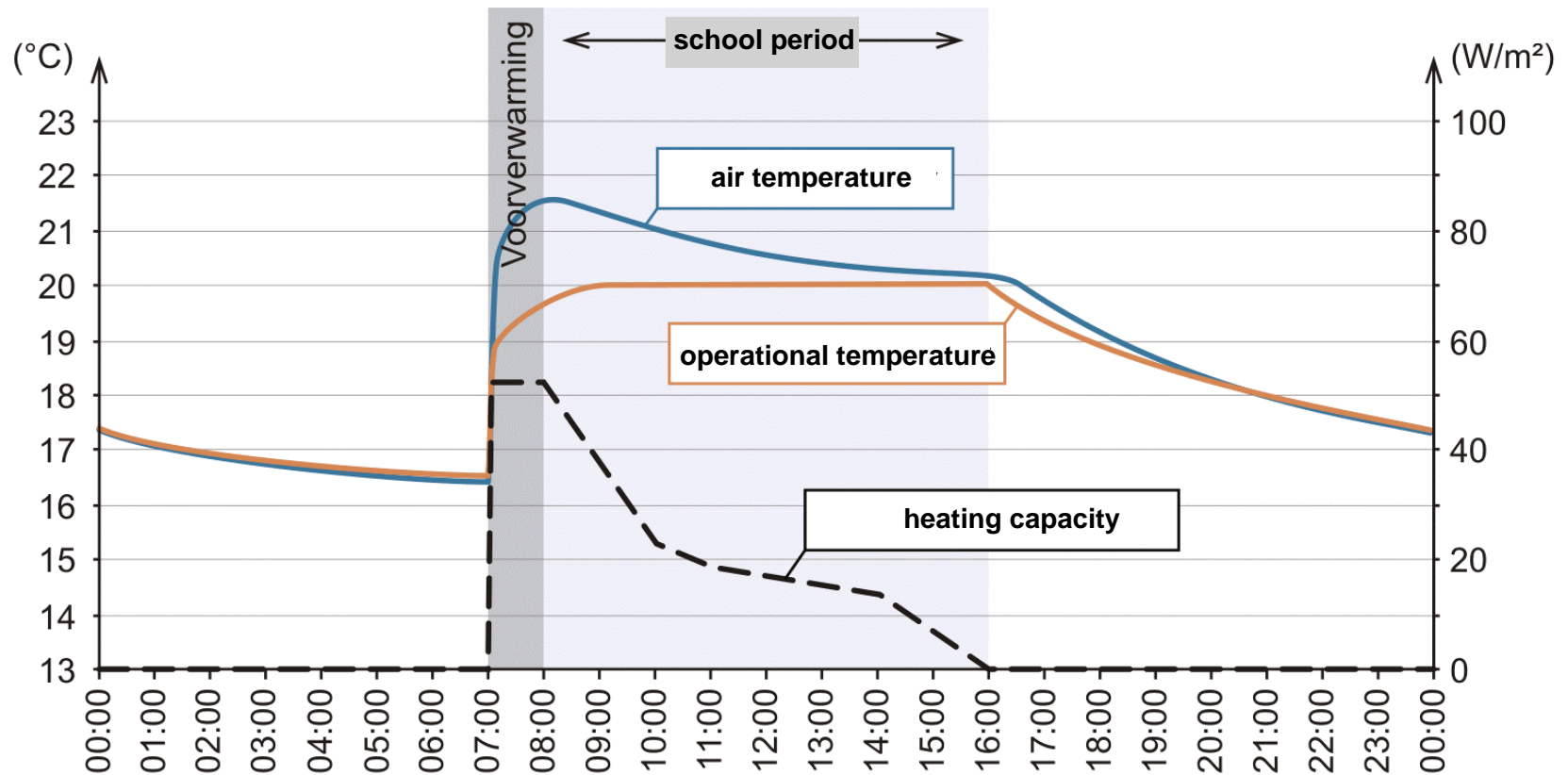
- use pattern short in schools (less than 60 hours per week): **intermittent heating regime**





heating in *Passivhaus* schools

- use pattern short in schools (less than 60 hours per week): **intermittent heating regime**
- dynamic calculations required for designing maximum heat capacity
- eg. preheating phase after a winter night

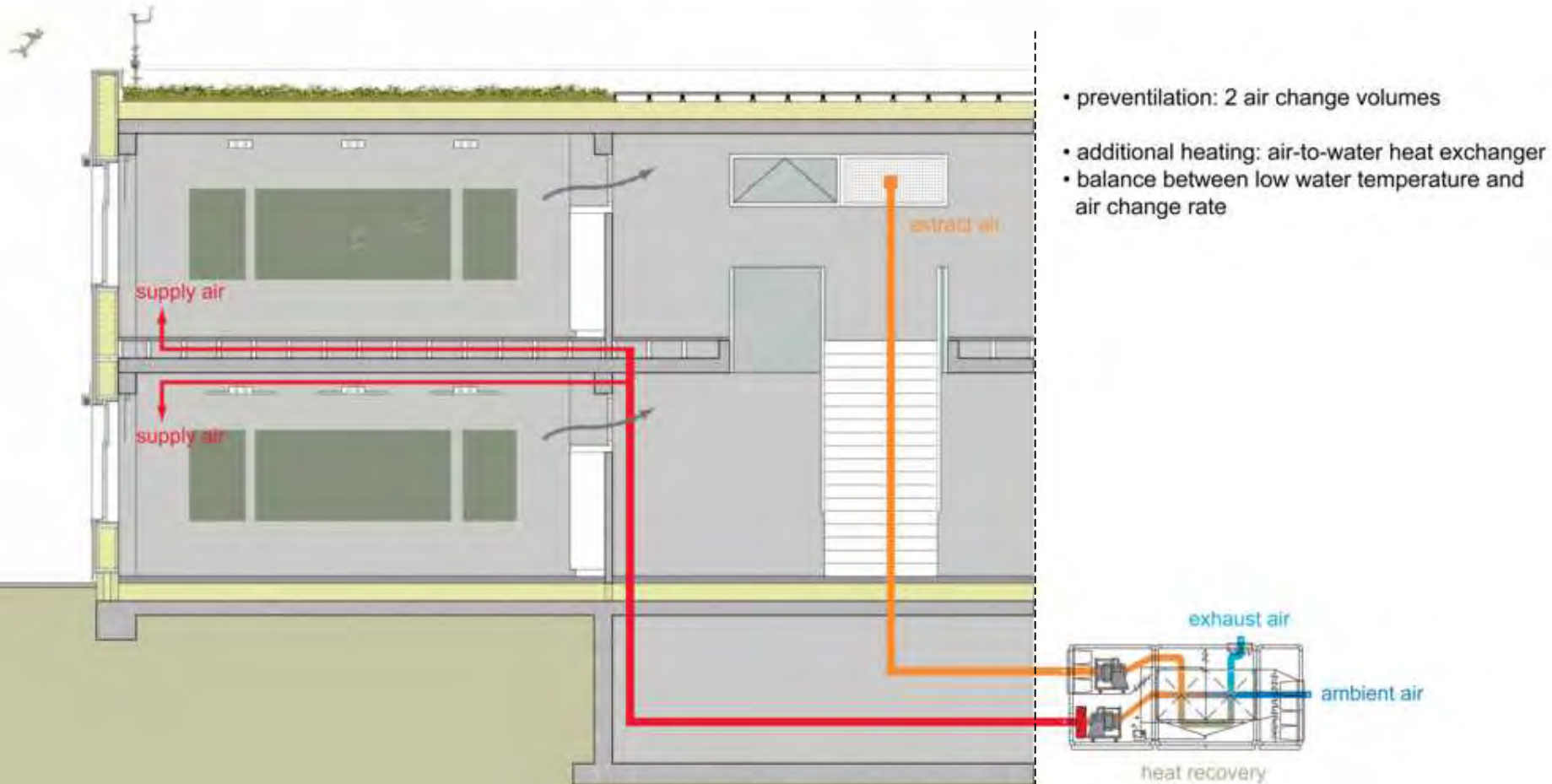




heating all-air heating



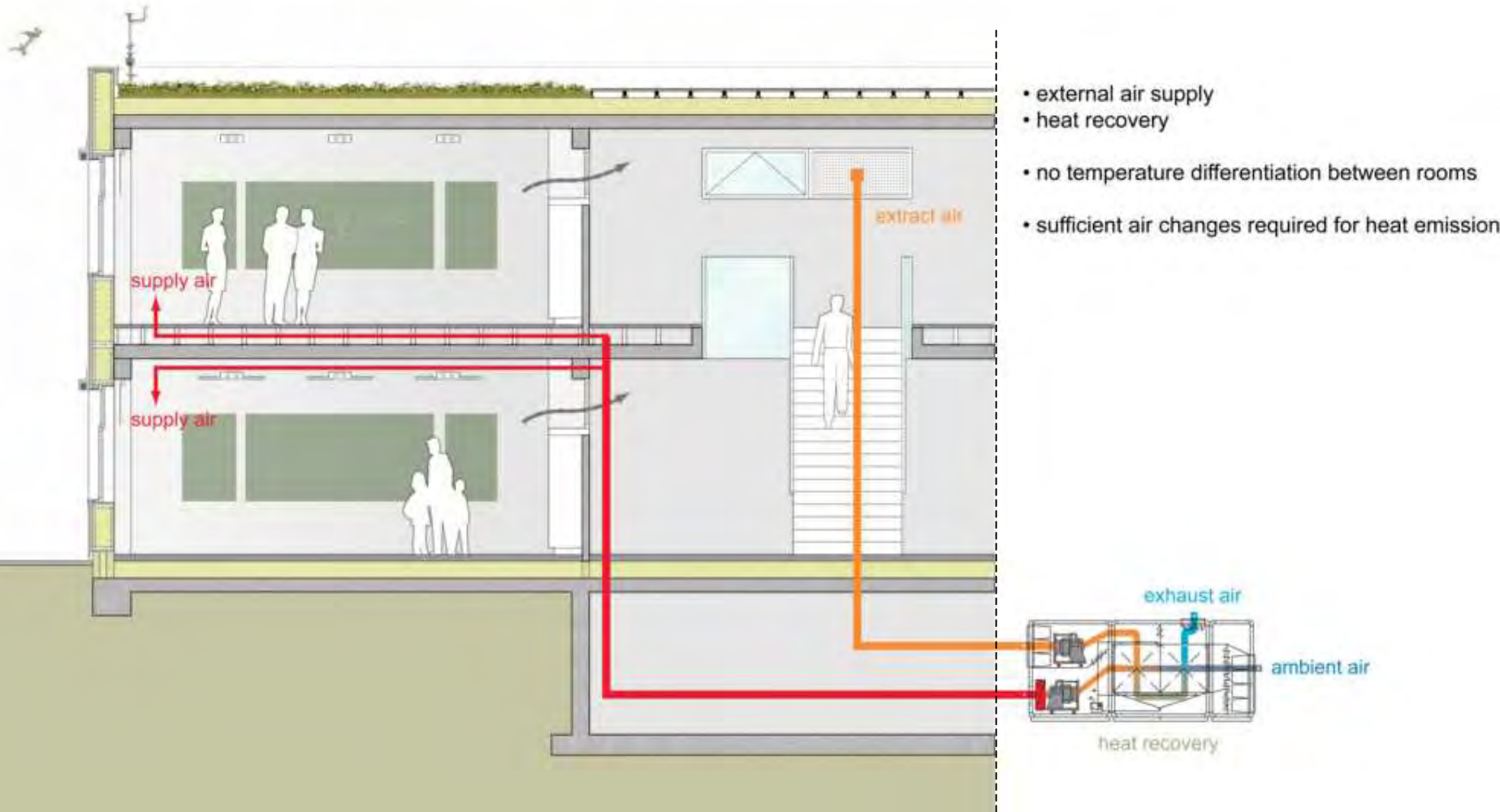
preventionilation - preheating



heating all-air heating



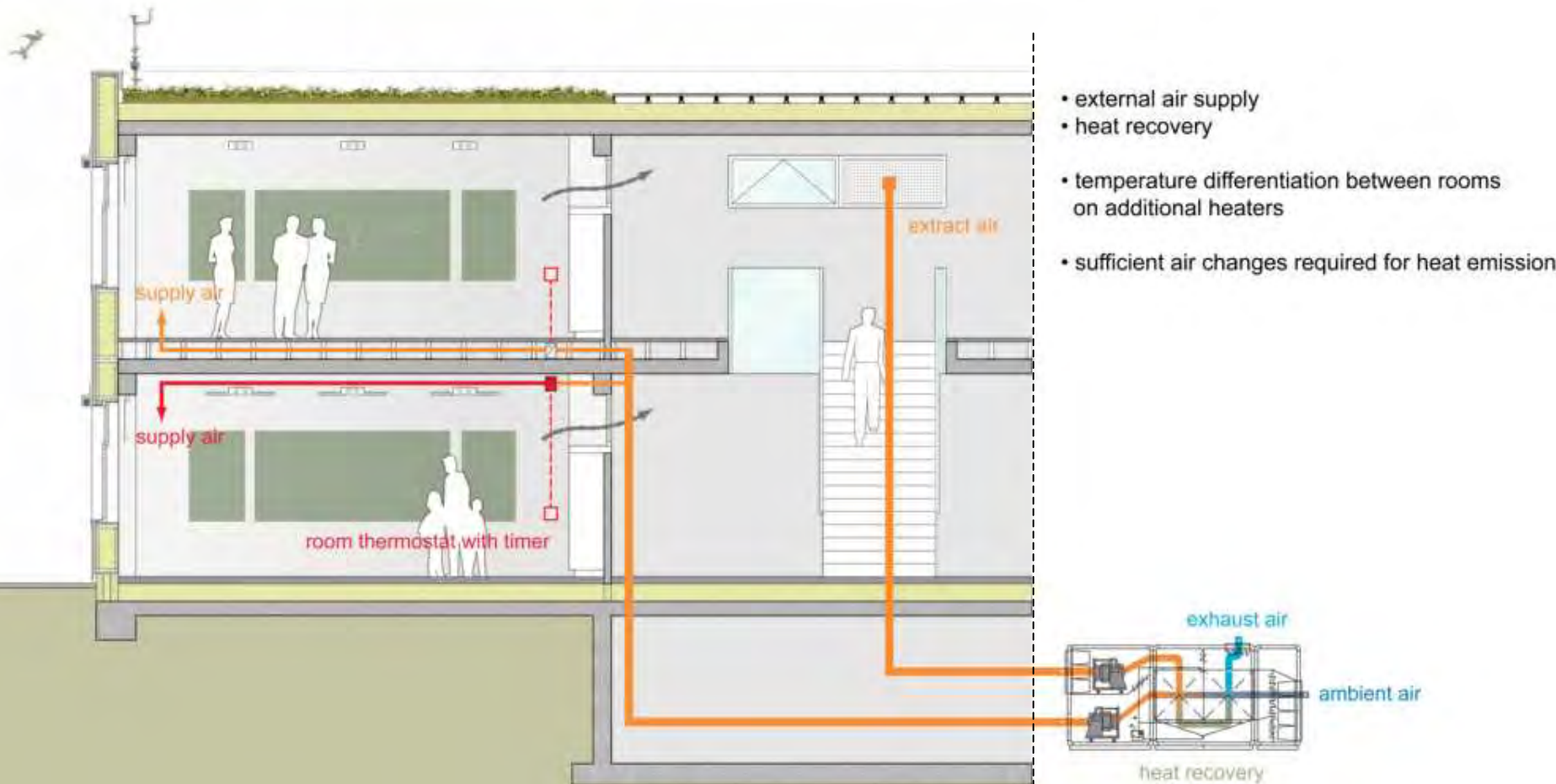
school period



heating all-air heating



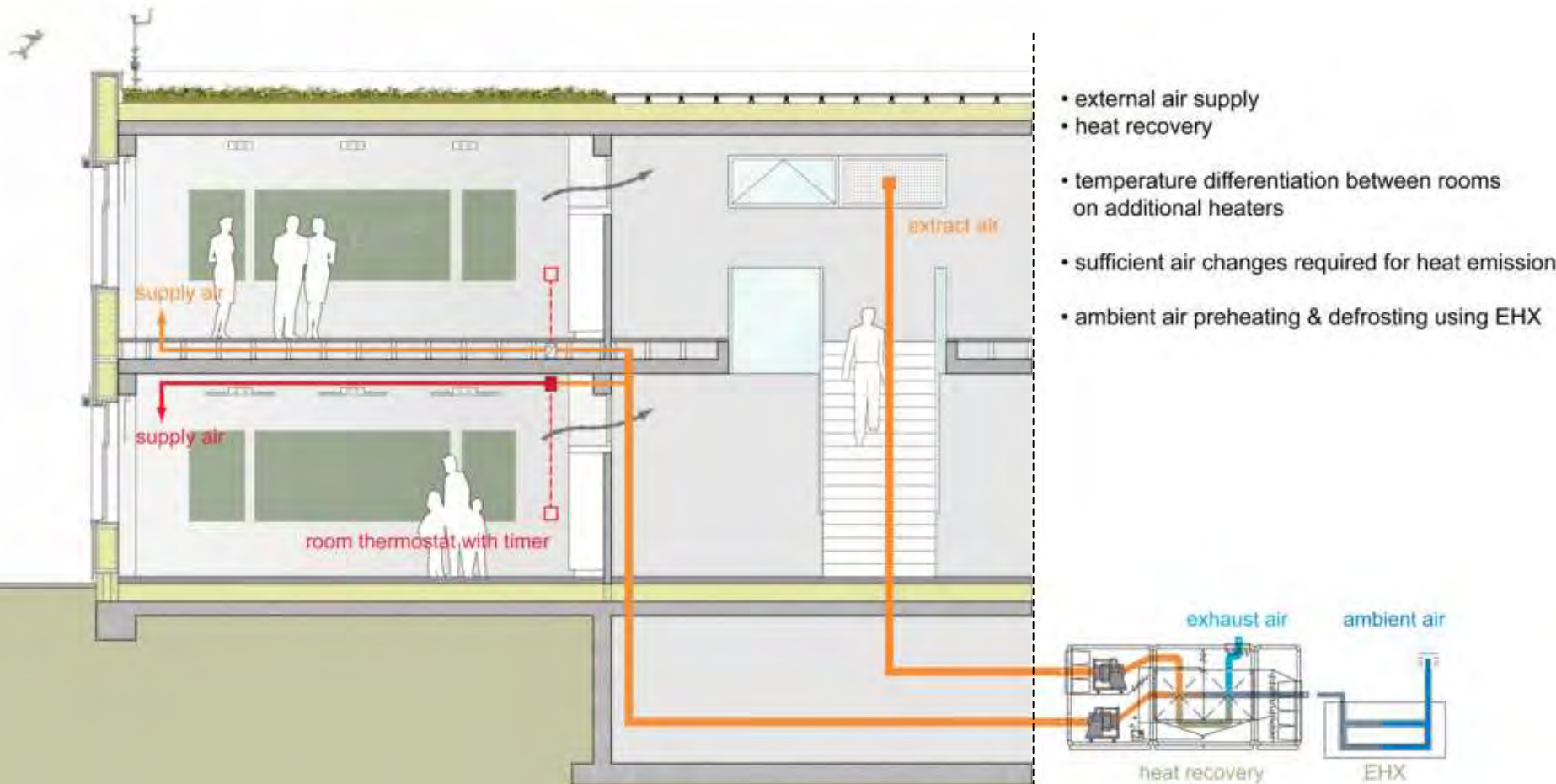
school period



heating all-air heating



school period



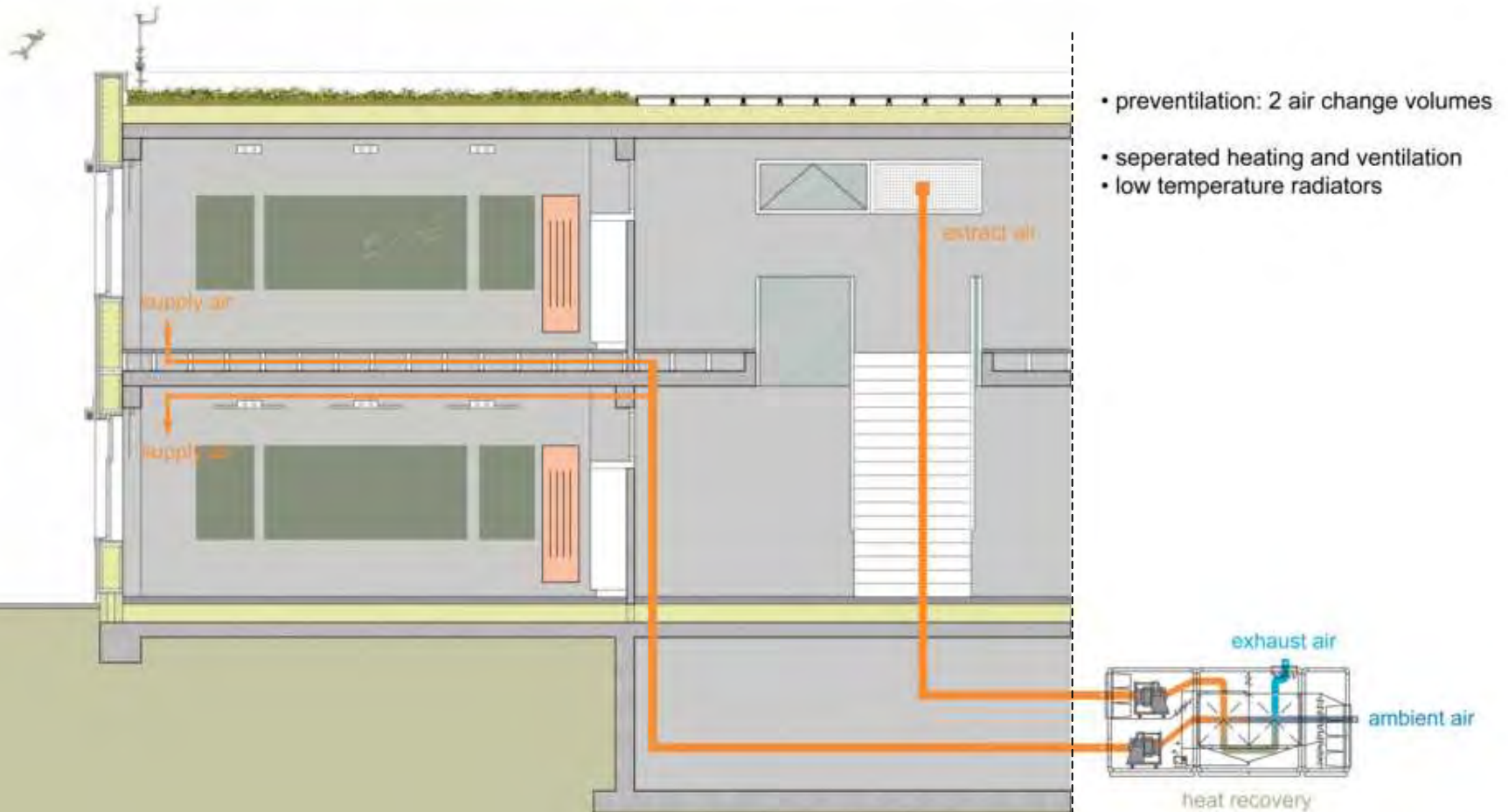


heating

air + radiators heating



preventionilation - preheating

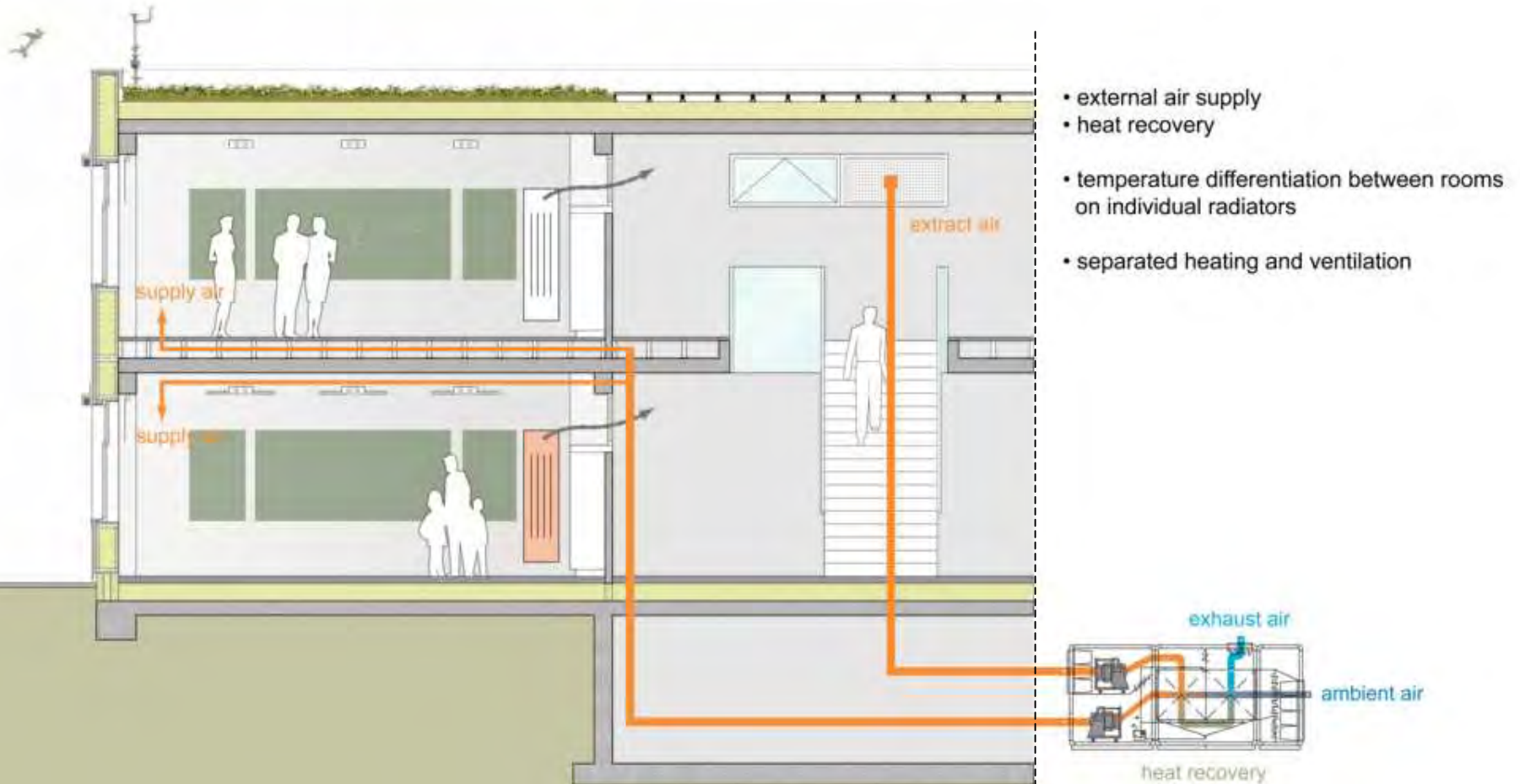


heating

air + radiators heating



school period

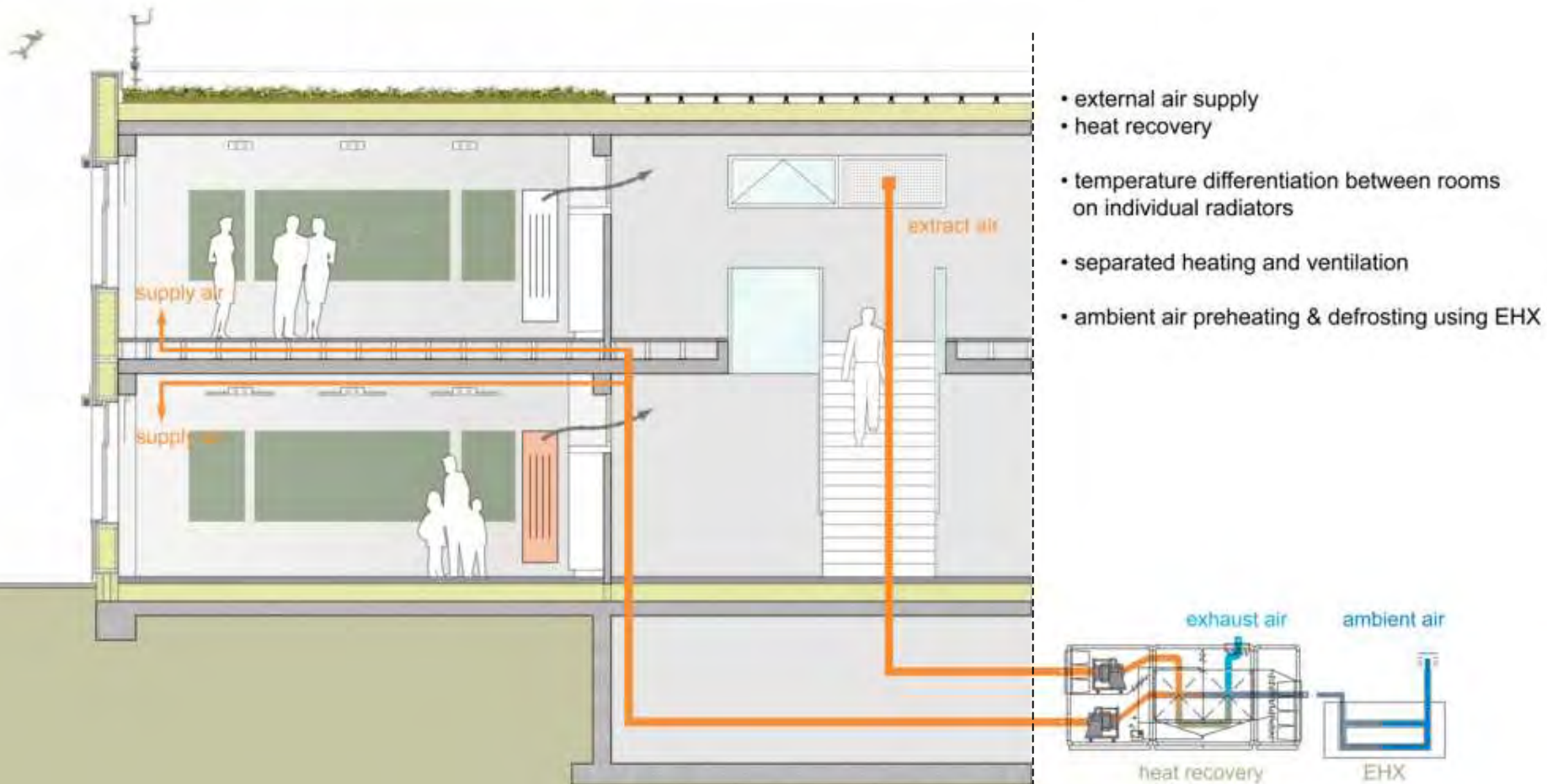


heating

air + radiators heating

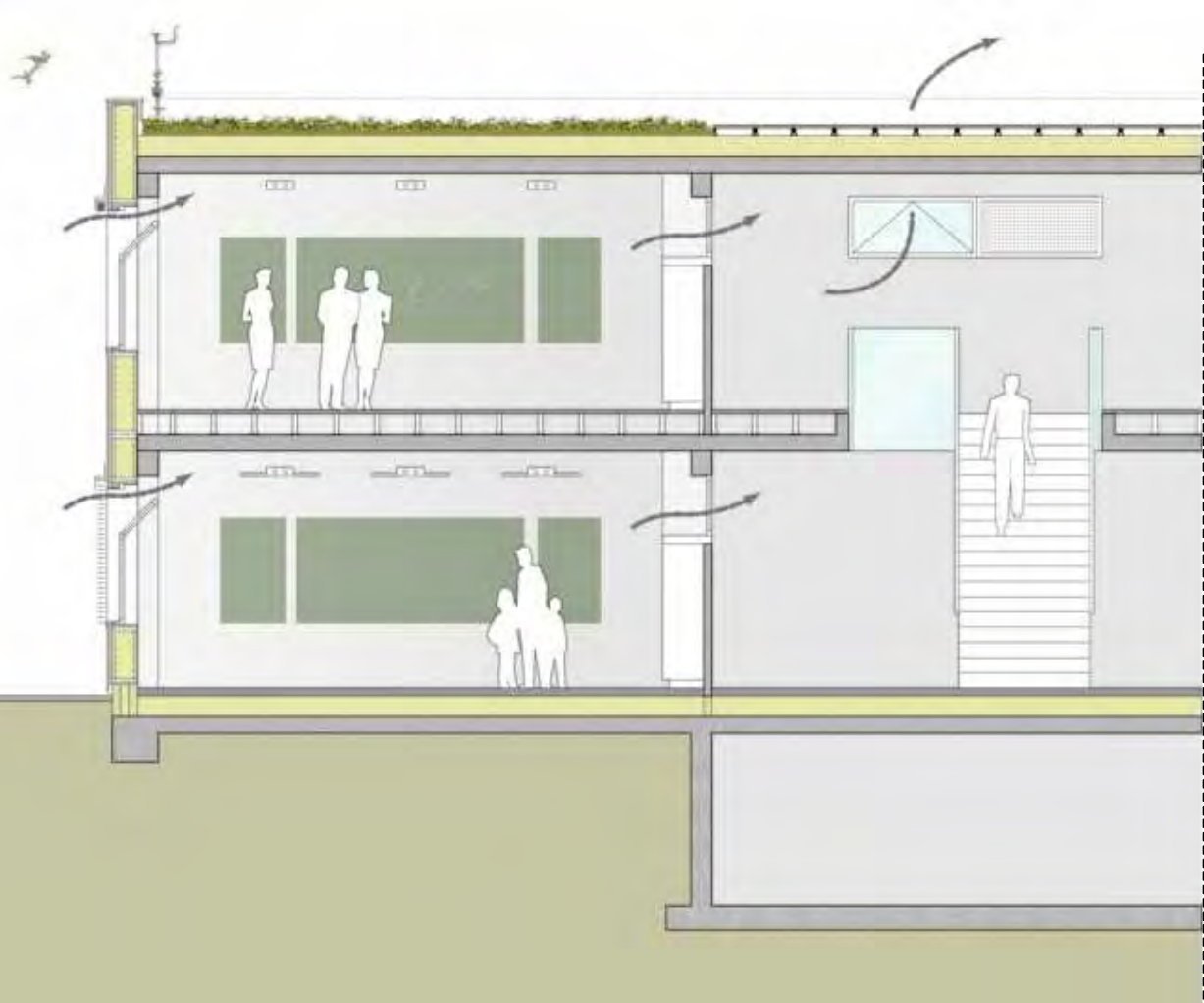


school period

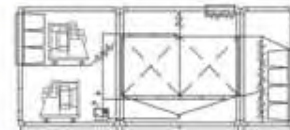




clean ambient air, no noise pollution

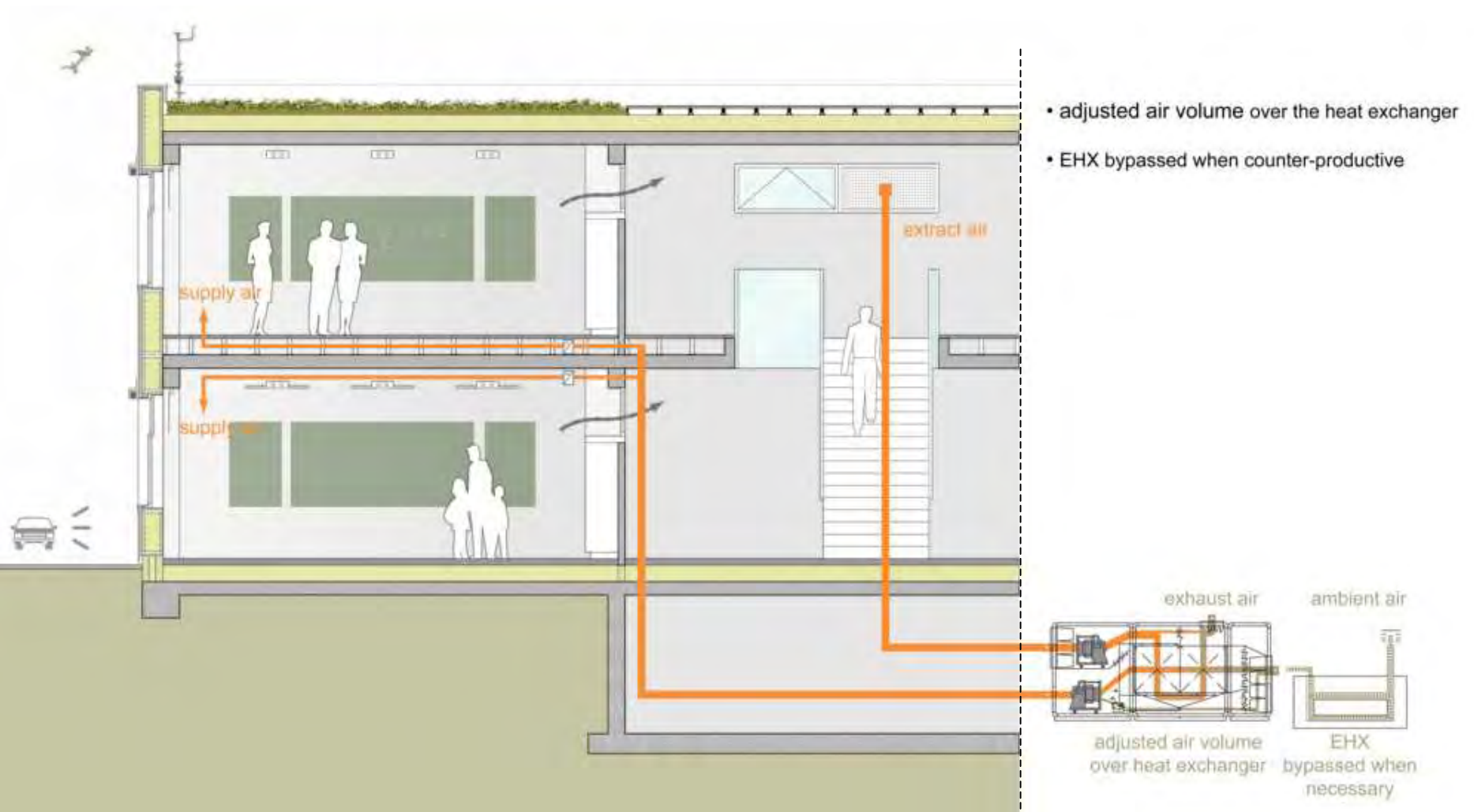


- draught-free window ventilation
- automatic switch to mechanical ventilation if room temperature drops





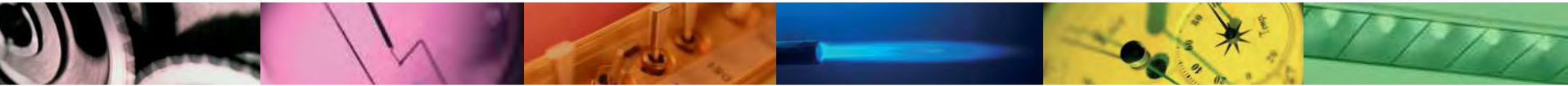
poor ambient air, noise pollution



building structure and envelope

heating

electrical consumption



Passivhaus concept

ventilation

cooling

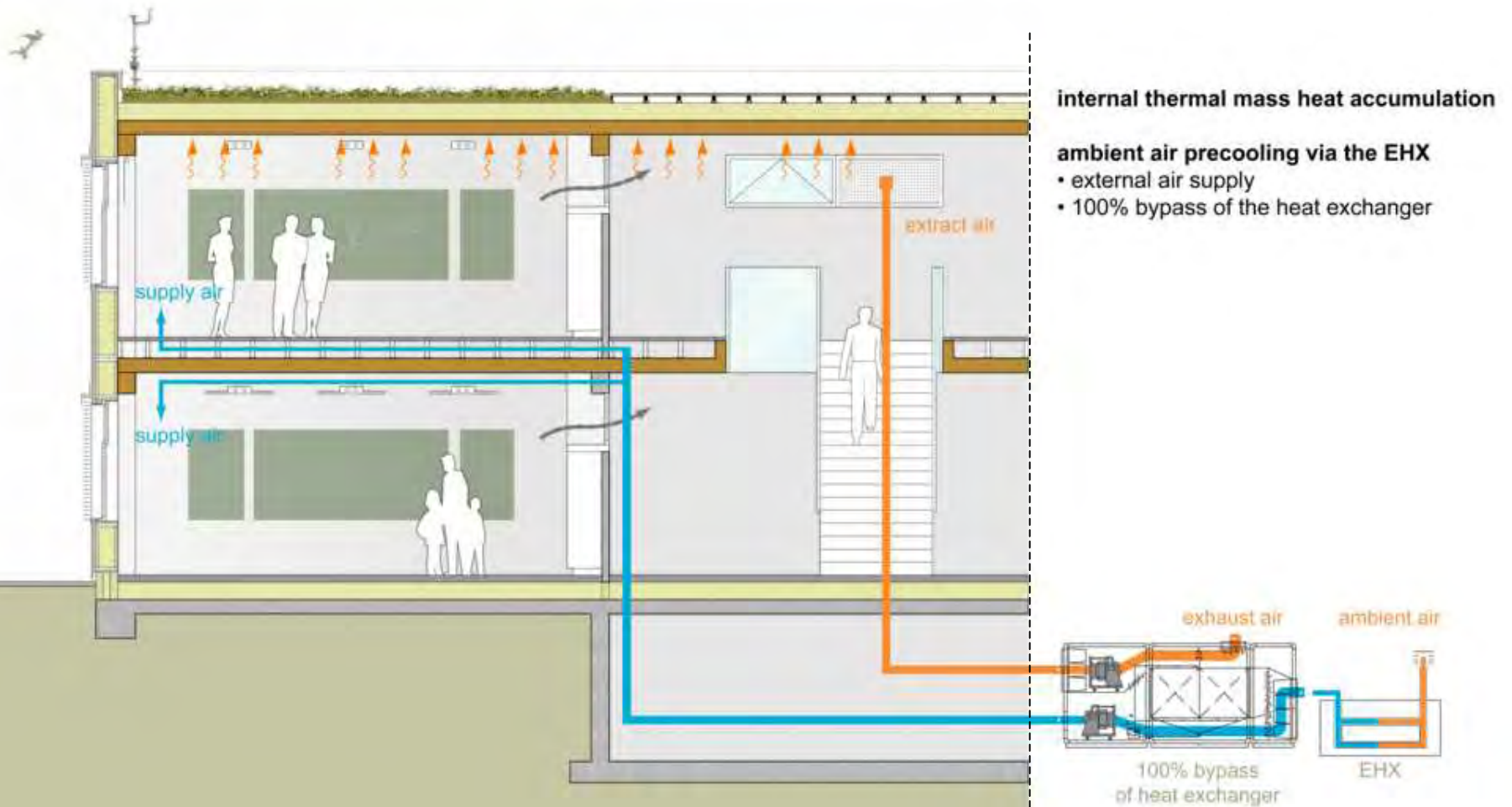
summer day
summer night
impact of passive cooling strategies



cooling
summer day



earth heat exchanger

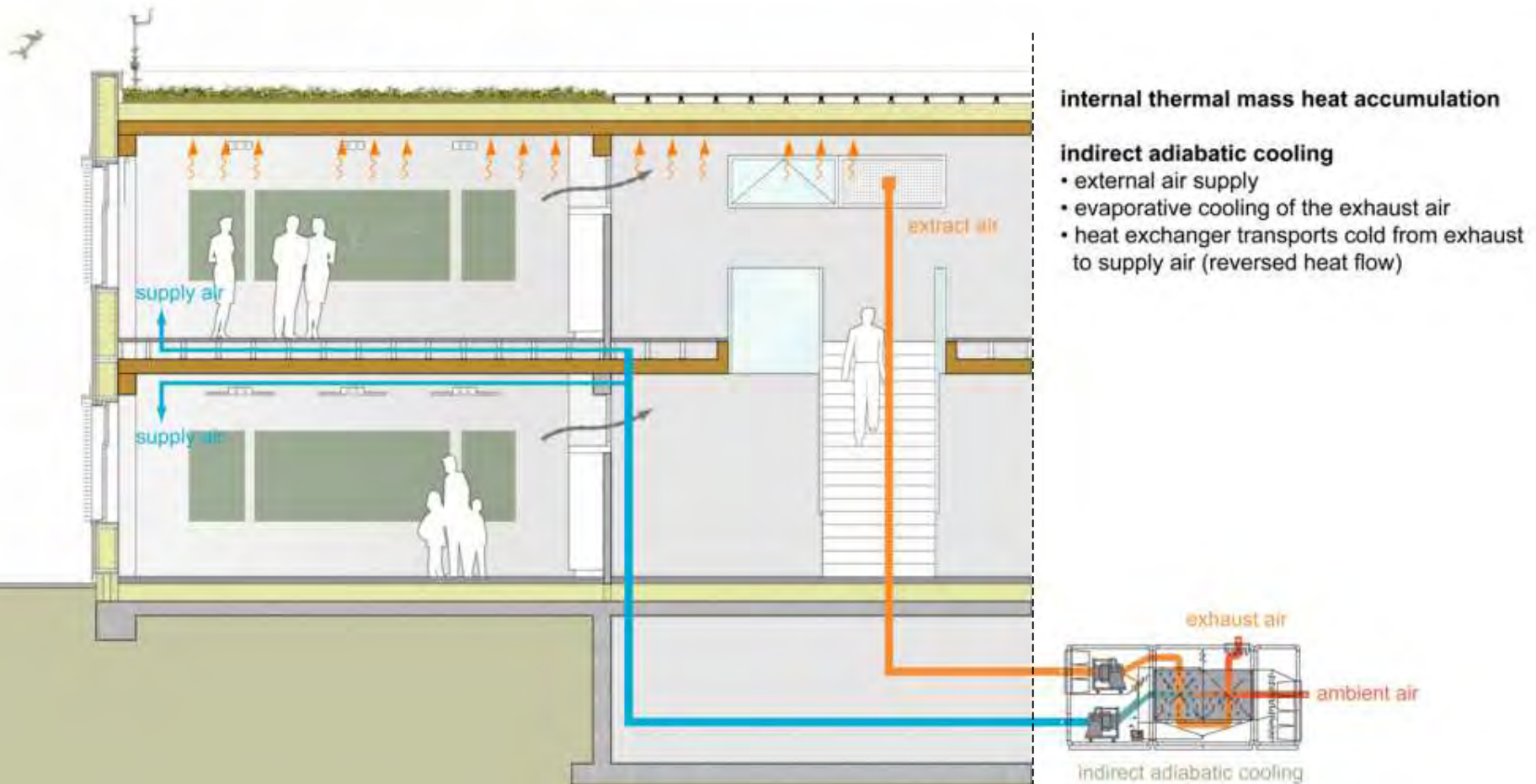




cooling
summer day



indirect adiabatic cooling





cooling
summer day



indirect adiabatic cooling

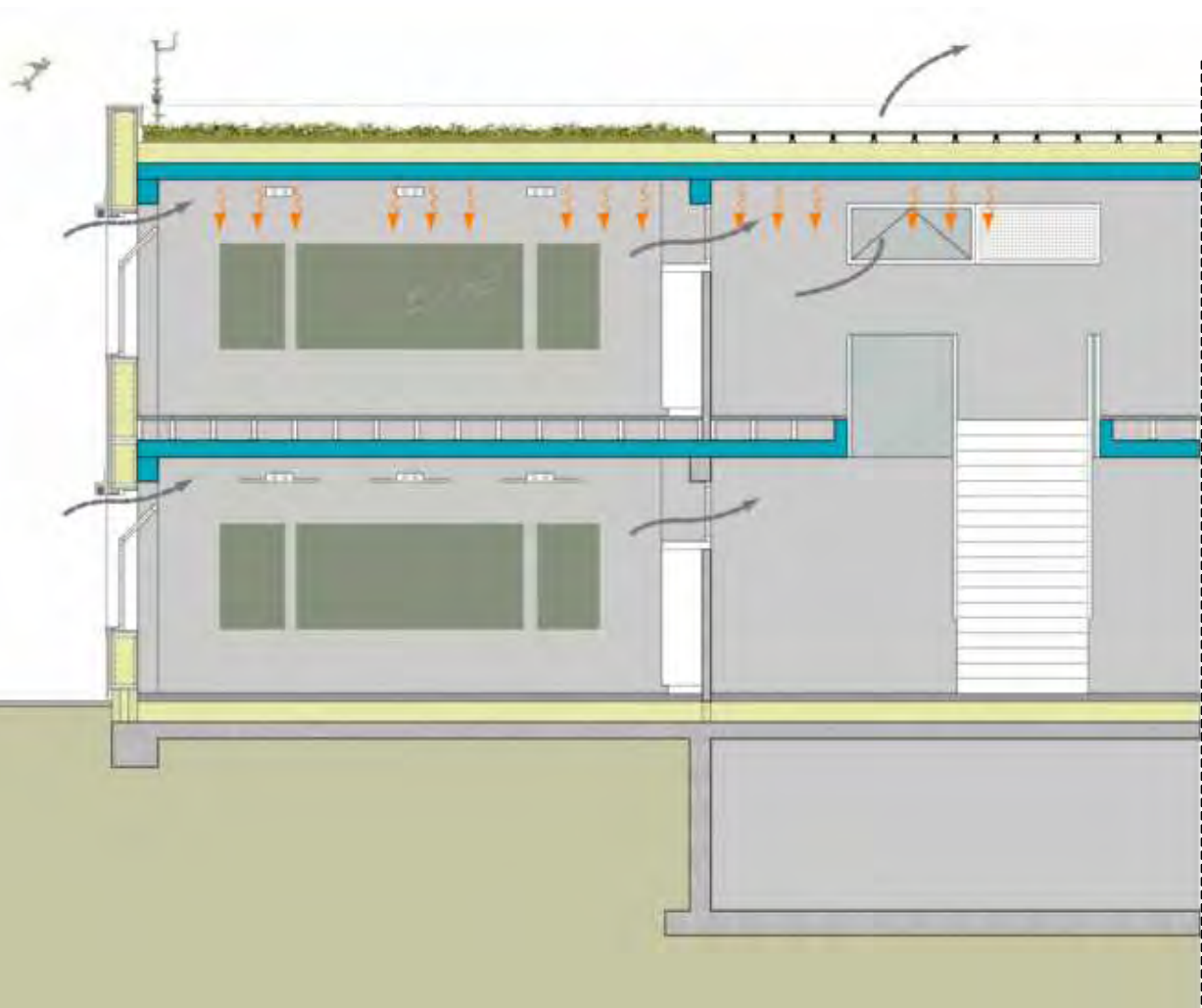




cooling summer night

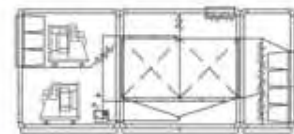


free night cooling



interior thermal mass heat discharge

- high rate natural ventilation
- all passive, free cooling
- automated burglary safe ventilation openings





cooling

impact of passive cooling strategies



reference versus sunshading + high interior thermal mass with free night cooling

