



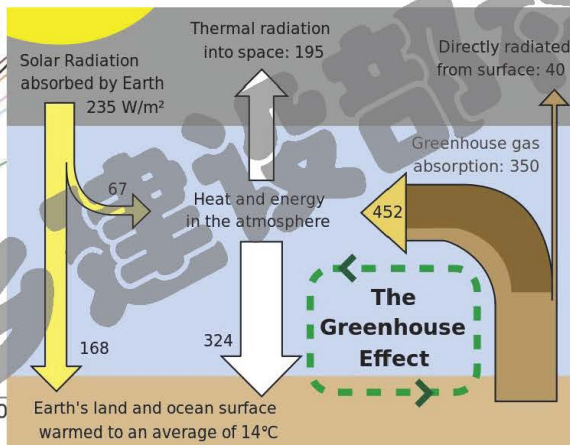
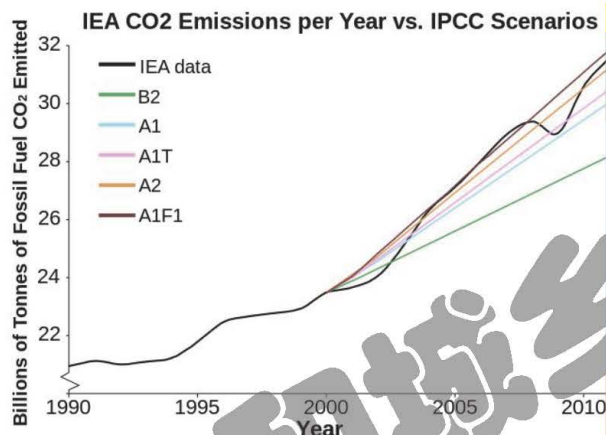
Blauberg Ventilatoren GmbH

PASSIVE HOUSE VENTILATION

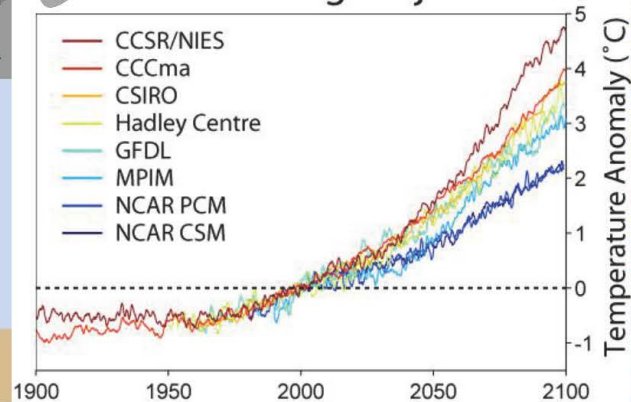
Maksym Kolenyk
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maksym.kolesnyk@blaubergventilatoren.de

Problem



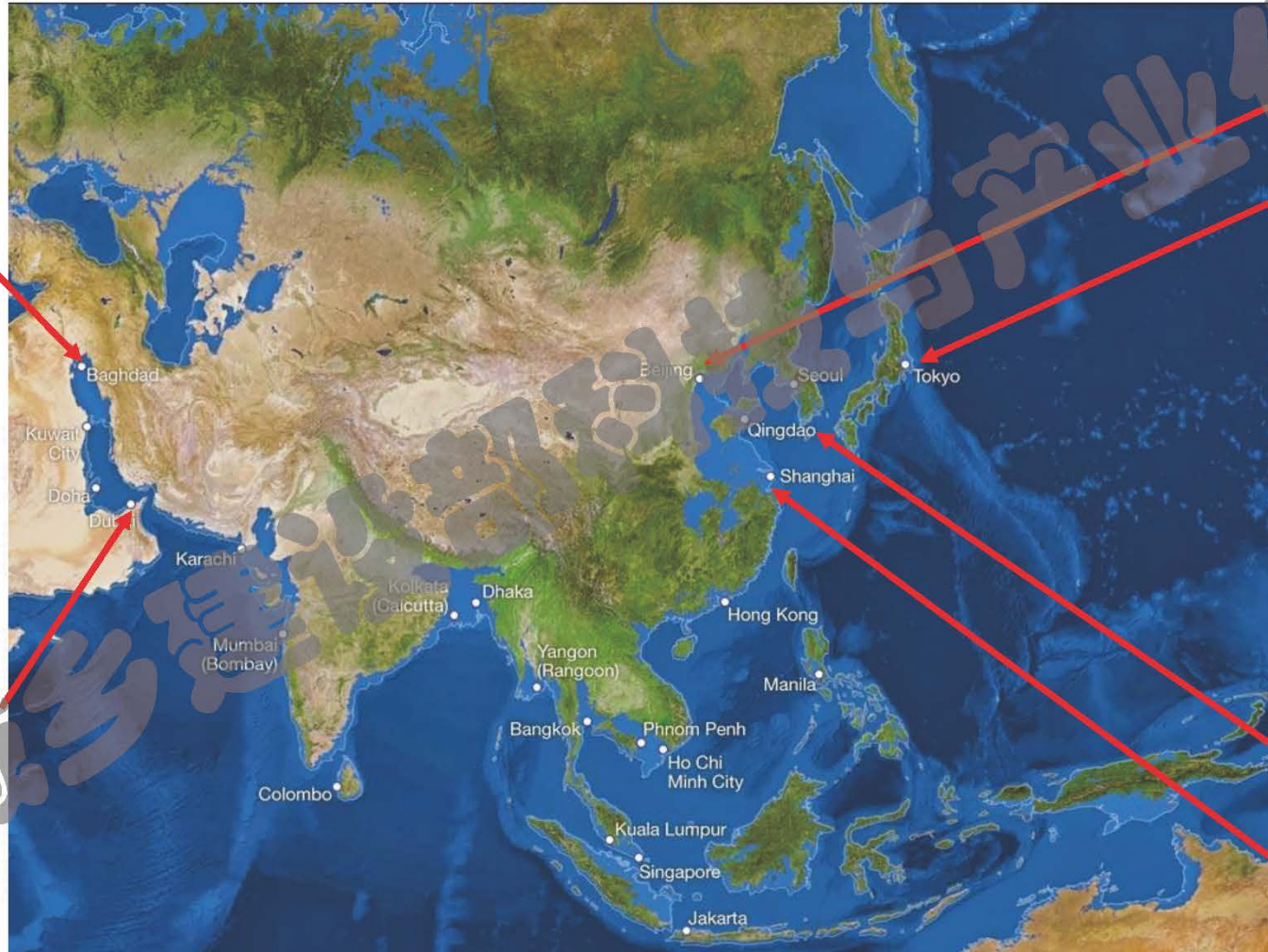
Global Warming Projections



The result by 2100 year:

Baghdad is flooded

Dubai is under the water



Beijing is a coastal city

Tokyo is under the water

Qingdao is flooded

Shanghai is under the water

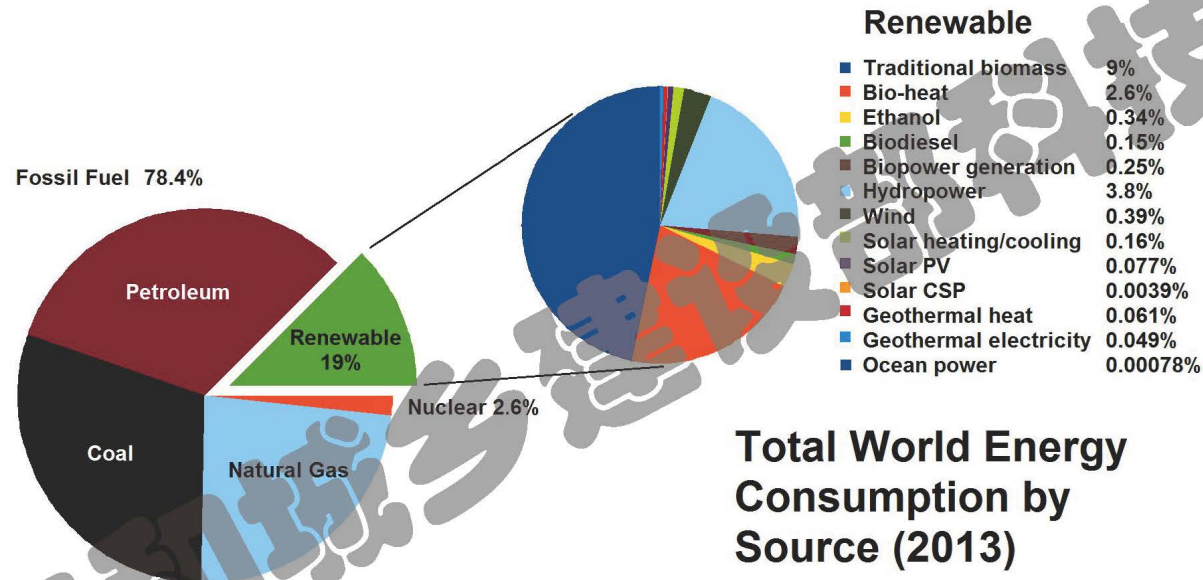
Finding the problem roots

Where the CO2 comes from?

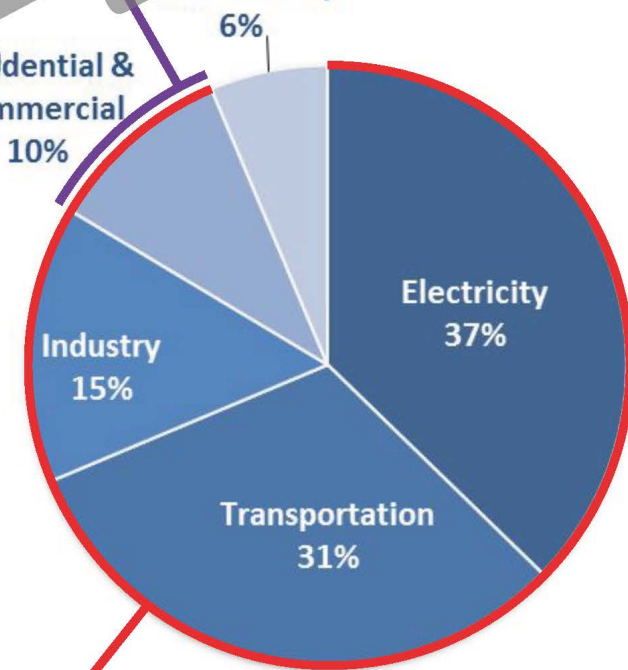
CO2 comes from energy consumption!

Residential and Commercial

Other (Non-Fossil Fuel Combustion)

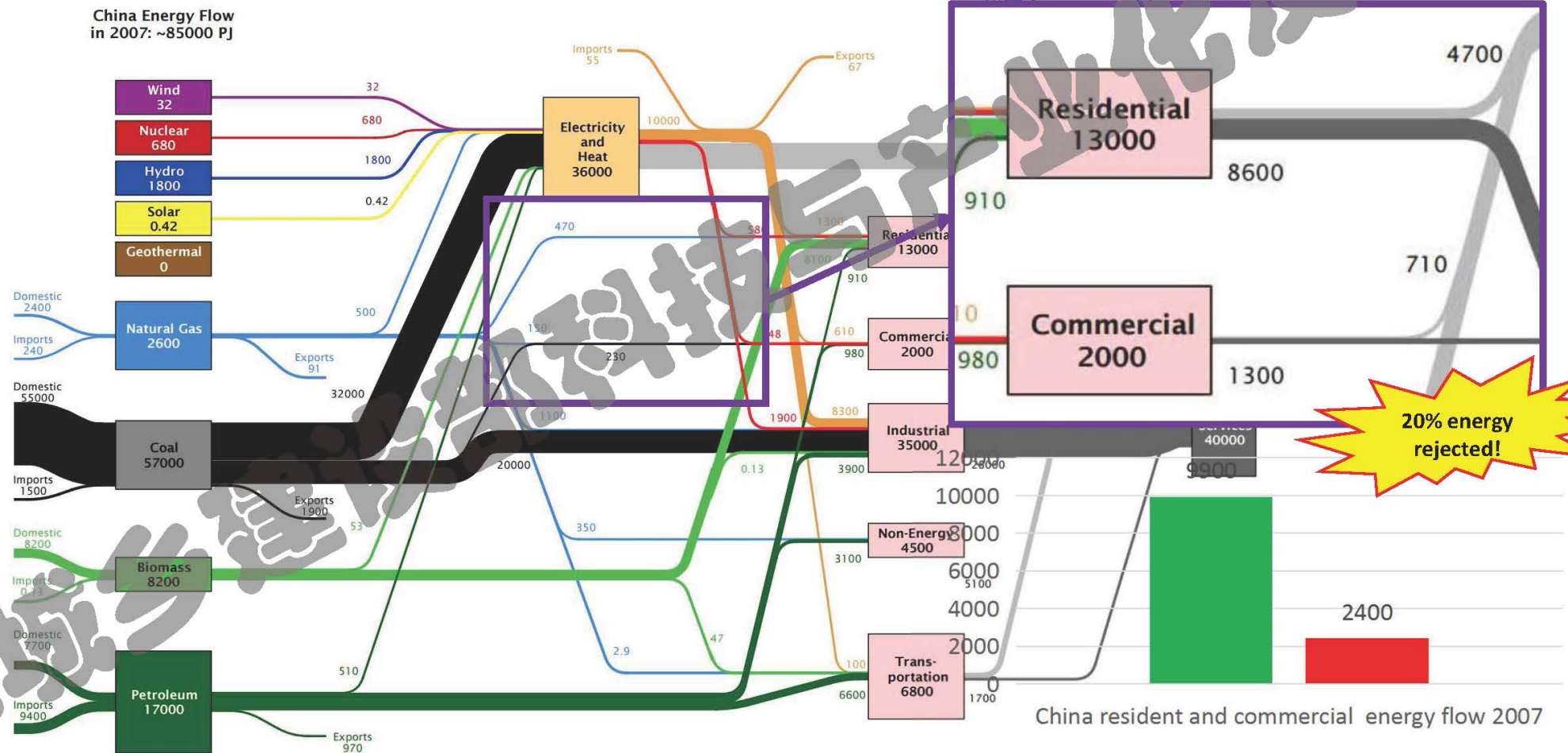


Residential & Commercial



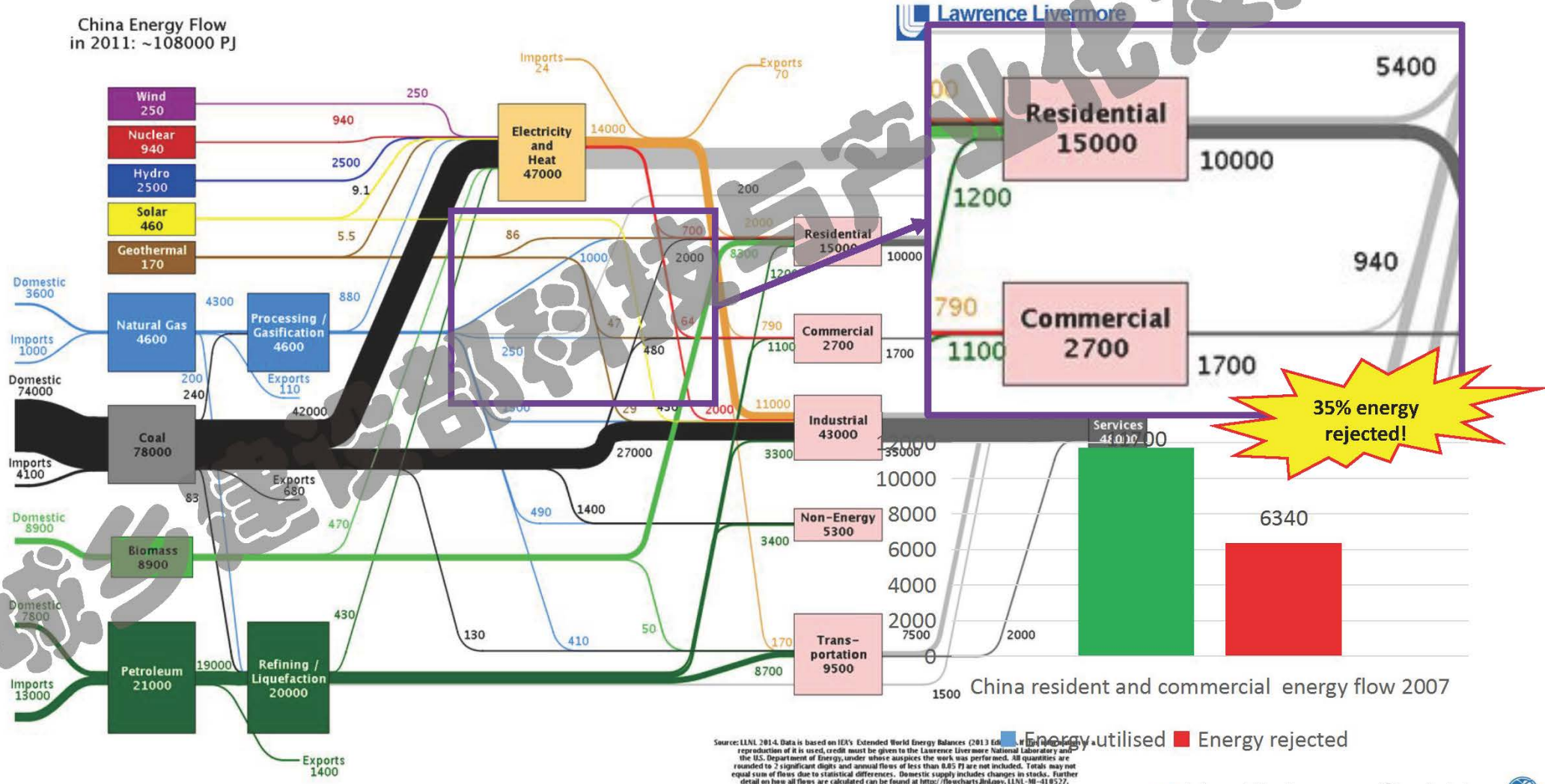
Energy production

China Energy Flowchart 2007

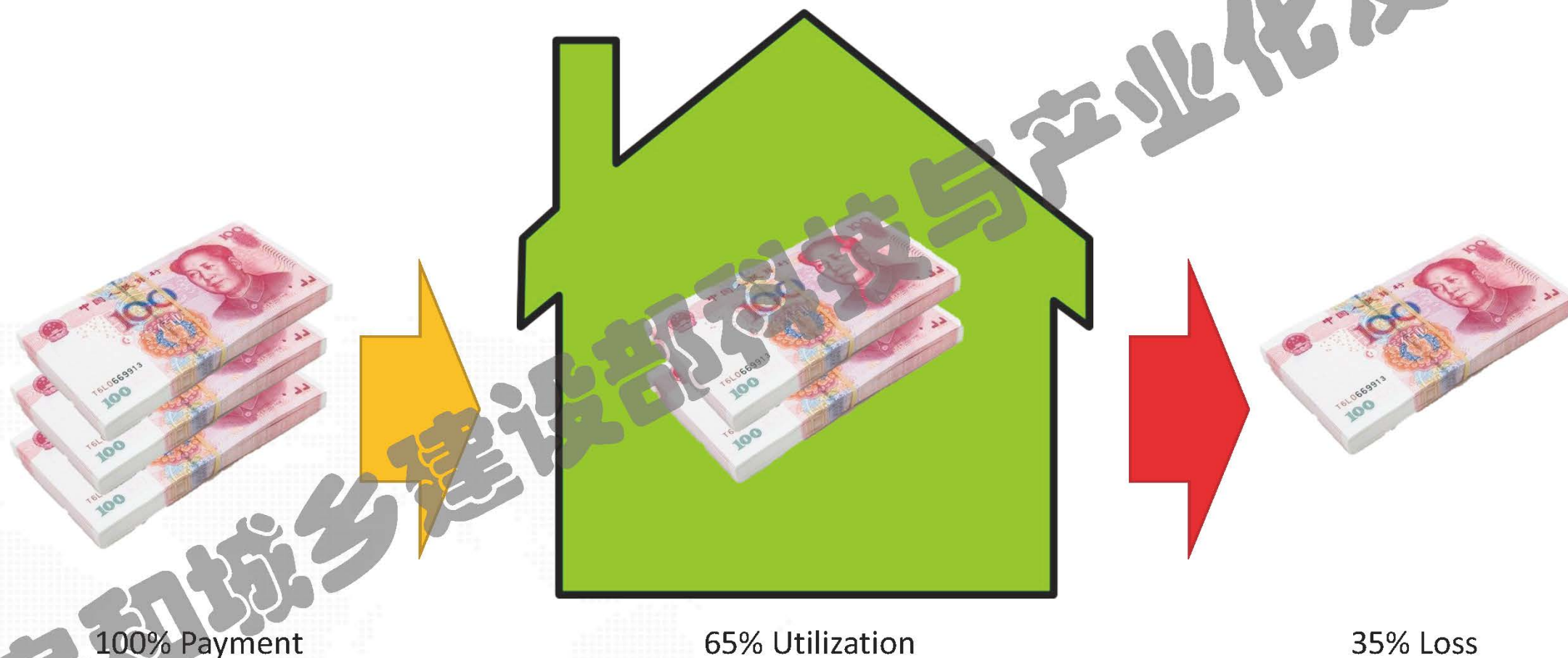


Source: LLNL 2011. Data is based on IEA's Extended World Energy Balance. If the reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at <http://flowcharts.llnl.gov>. LLNL-TB-473098.

China Energy Flowchart 2011



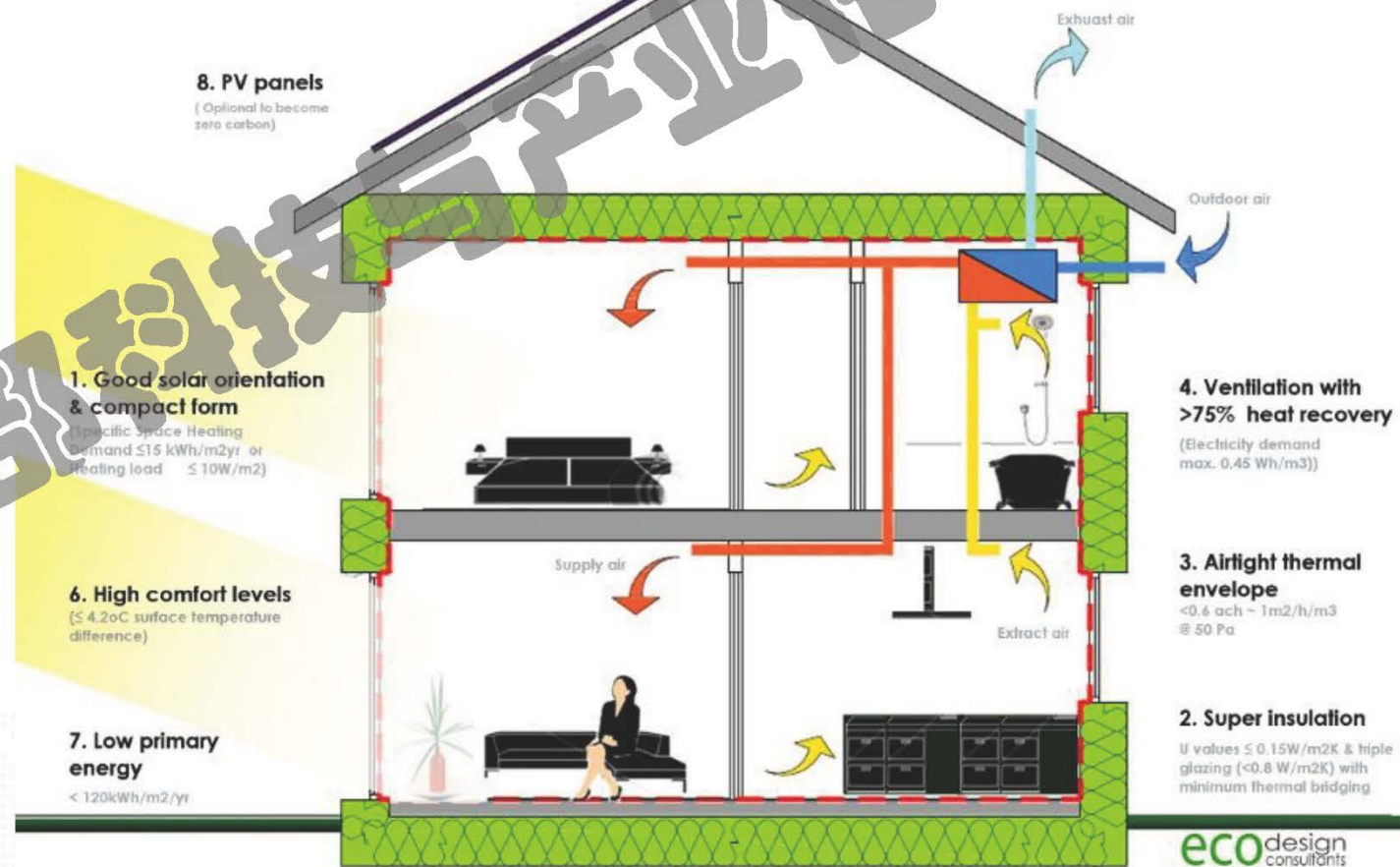
Wat does it mean to house owner?



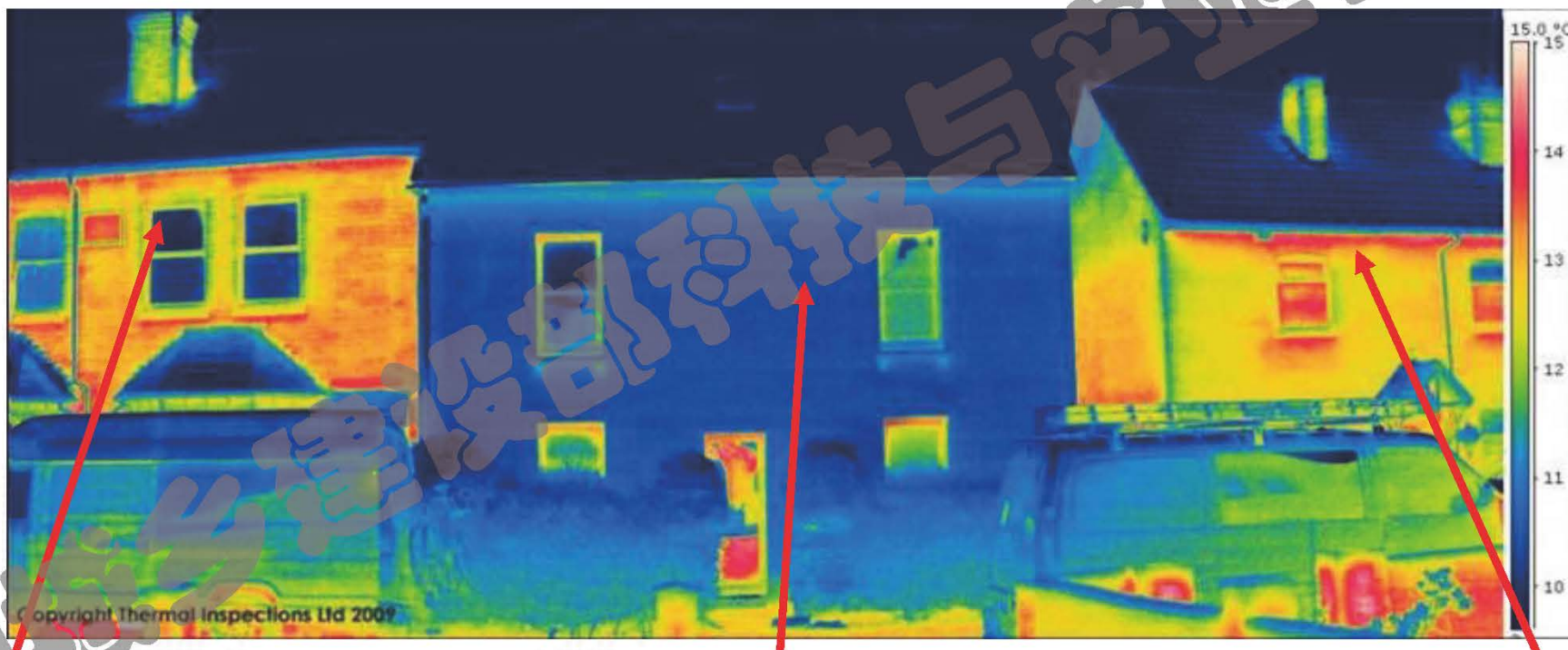
What is PASSIVE HOUSE?

- Good solar orientation & compact form (specific space heating < 15kWh/m²y)
- Super insulation (U value < 0.15W/m²K)
- Airtight thermal envelope (< 0,6 ach)
- Ventilation with heat recovery >75%
- High comfort level (< 4,2°C surface temperature difference)
- Low primary energy (< 120kWh/m²/y)

PassivHaus Principles



How passive house is different?

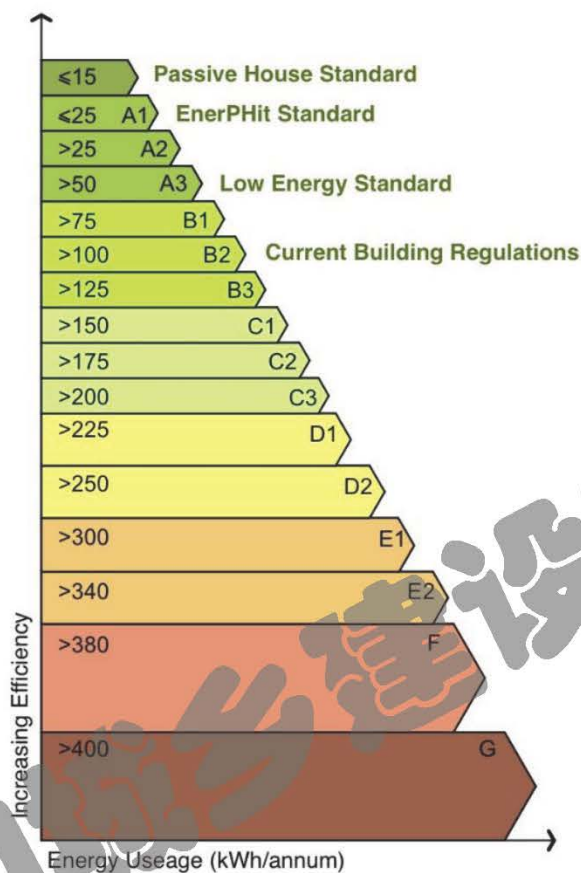


Regular building code

Passive house technology

Regular building code

Passive House vs. other standards



Energy Performance Ratings of Buildings

Note: The Passive House Standard has greater efficiency than A1. We are Certified to design to this rigorous standard

Passive House consume 6.66 times less power then current building code, up to 3.33 times less power in comparison to other eco building codes.

How passive house looks like?

Examples of Solar Panels on a Passivhaus in Wales, UK.



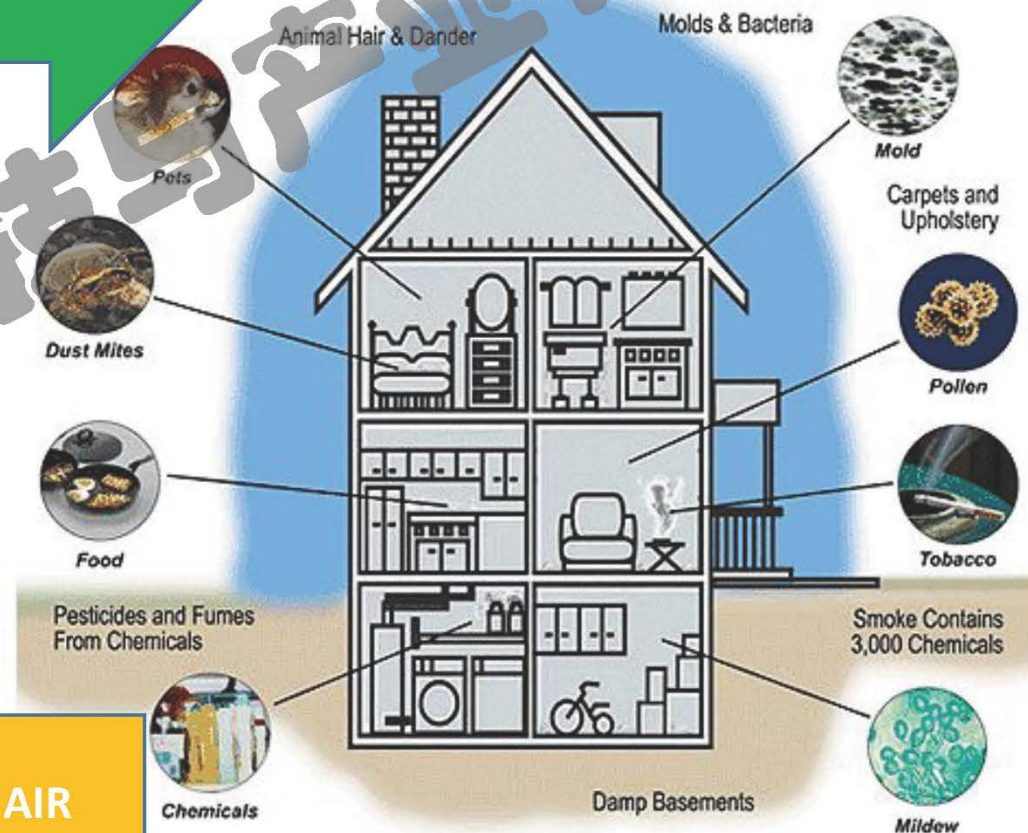
Example of a Pre-fabricated Passivhaus in Germany

Fresh air supply in the world

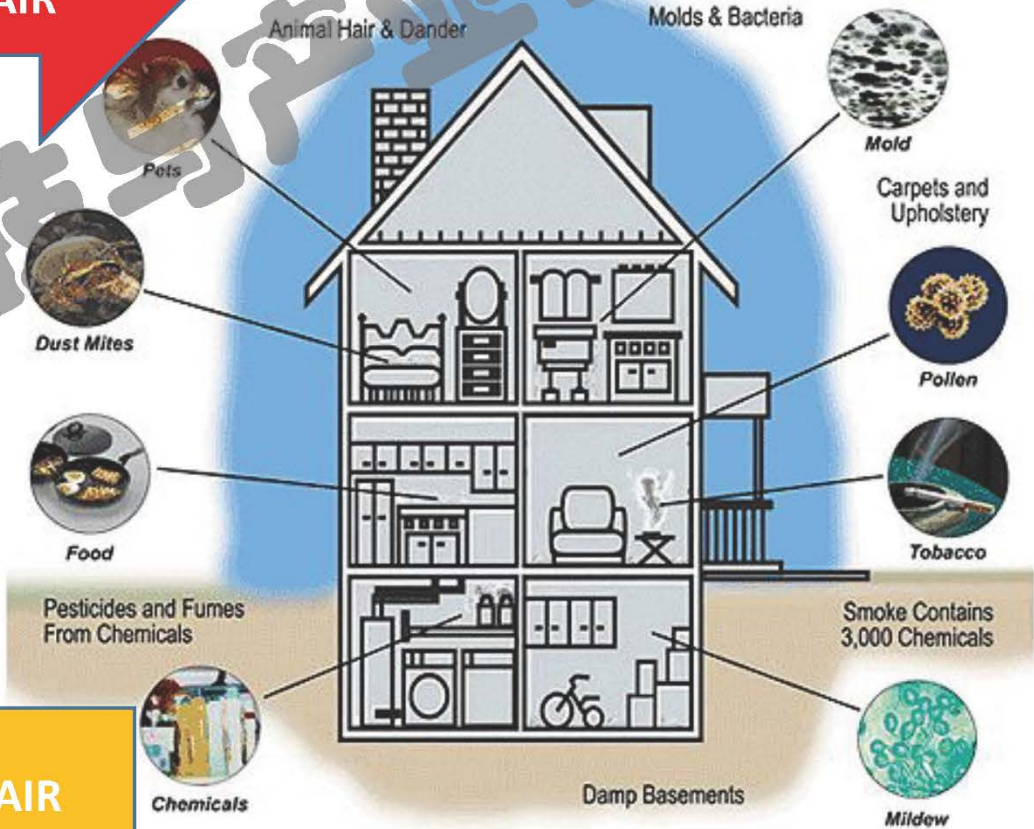


FRESH AIR

POLUTED AIR



Fresh air supply in China



Ventilation solutions for Passive House



Not suitable for
passive house

Mechanical exhaust ventilation,
natural supply ventilation

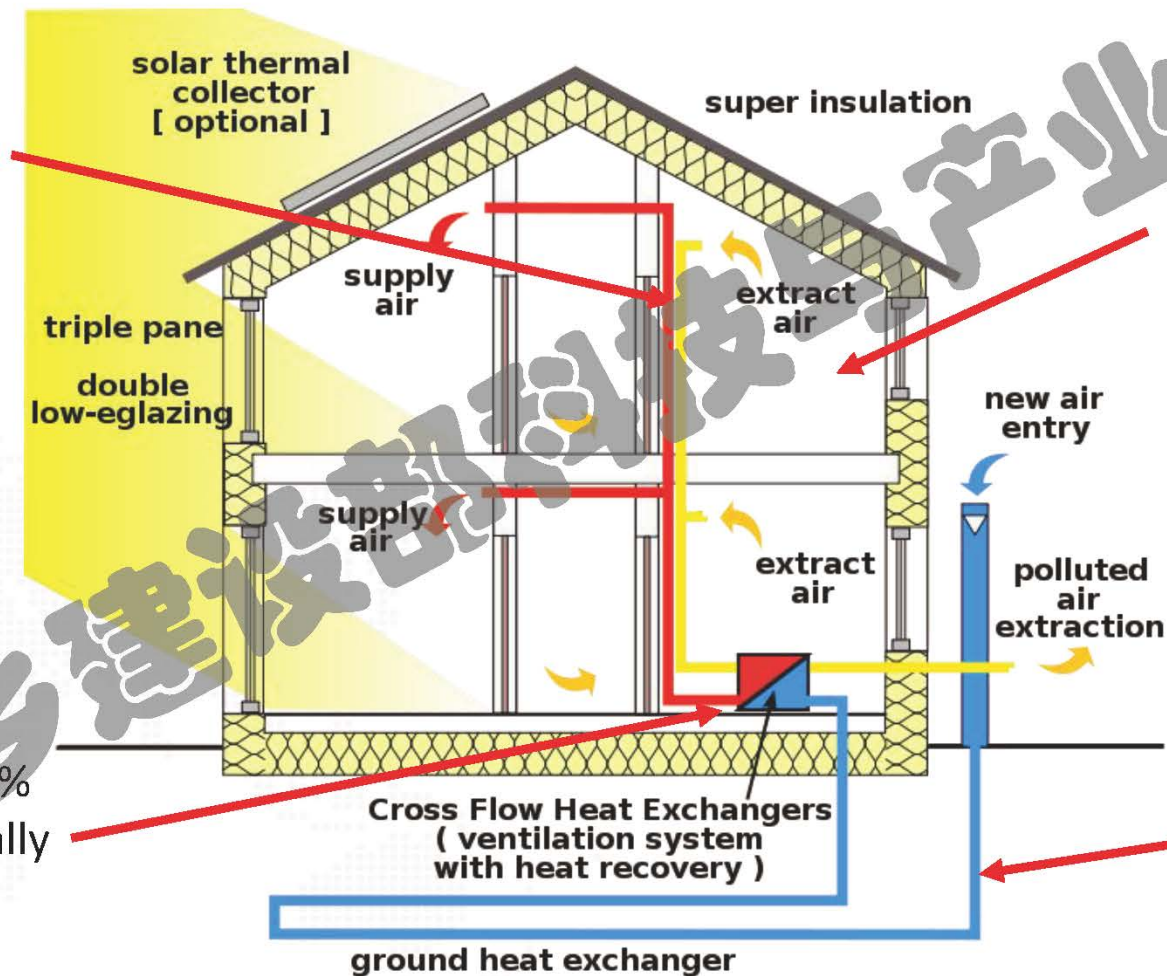


Two way balanced solution, with
heat exchanging and filters

Ventilation in Passive House

All ventilation ducts are insulated and sealed against leakage.

Heat recovery rate of over 75% and high-efficiency electronically commutated motors (ECM),

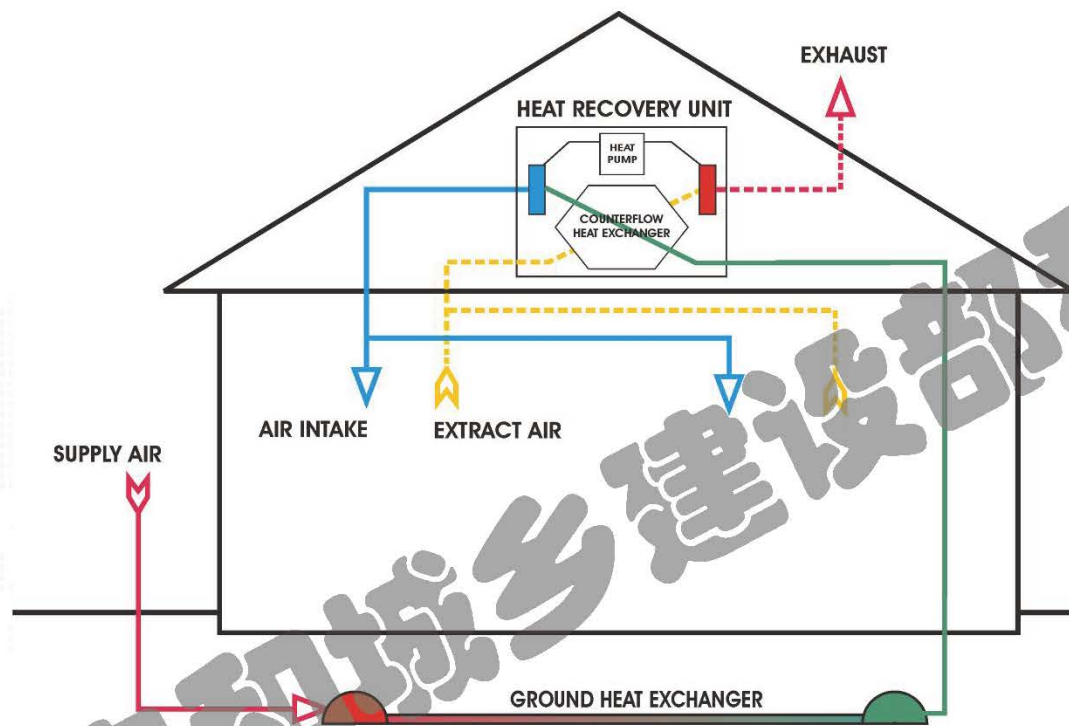


Air change rate can be optimized and carefully controlled at about 0.4 air changes per hour

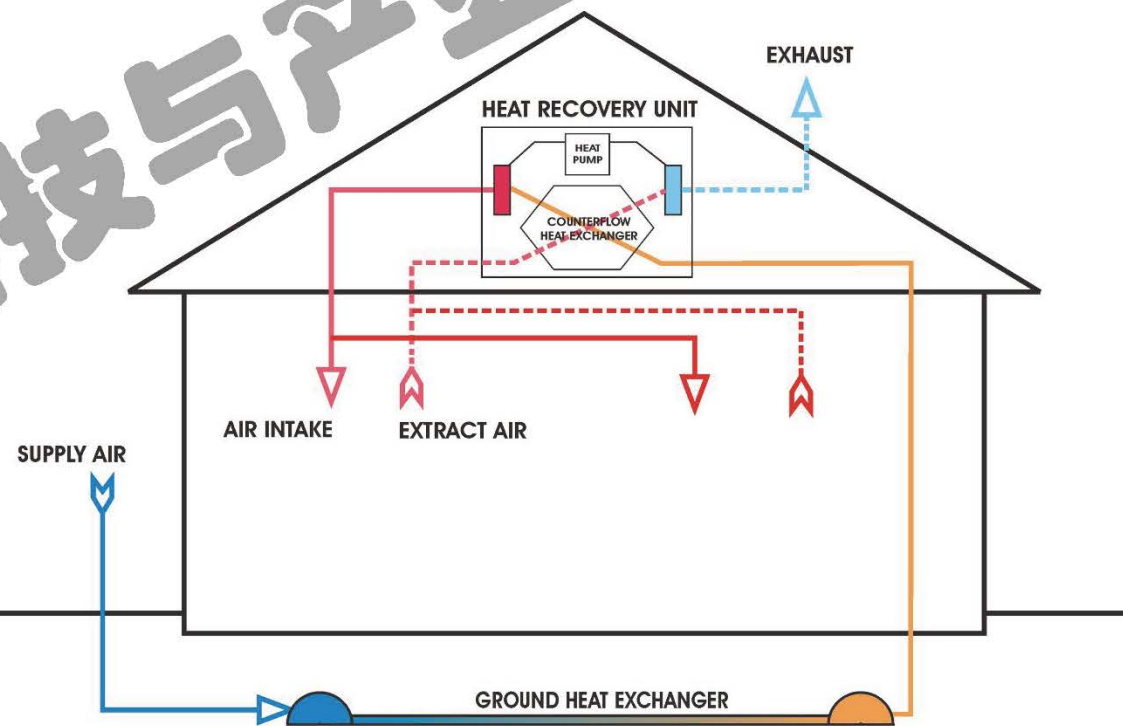
Earth warming tubes (typically ≈ 200 mm diameter, ≈ 40 m long at a depth of ≈ 1.5 m).

How a Heat recovery Ventilator Works

To preserve cooling energy in summer



To preserve heating energy in winter



Ventilation units suitable for Passive House



Window and Window Vent



Exhaust Fans



Inline Fan



AHU – HRU - ERU



Passive house AHU requirements

Criteria	Restriction
Passive House – comfort criterion	Minimum supply air temperature 16.5°C
Efficiency criterion(Heat)	The effective dry heat recovery must be higher than 75% with balanced mass flows at external temperature of between –15 and +10°C and dry extract air.
Electrical efficiency criterion	At the designed mass flow rate the total electrical power consumption of the ventilation device may not exceed 0,45W per m ³ /h of transported supply air flow.
Balancing and controllability	Outdoor air and exhaust air mass flow must be balanceable for the rated air flow rate, with controllability of at least 3 levels (basic ventilation(70-80%), standard ventilation(100%), increased ventilation(130%)).
Sound absorption	Noise level in installation room <35dB(A), in living areas < 25db(A), in functional areas < 30dB(A)
Room air hygiene	Outdoor air filter at least F7, extract air filter at least G4
Frost protection	Frost protection for heat exchanger without supply air interruption, frost protection for an air heater in case of failure of an air heater in case of failure of the extract air fan or frost protection heater coil.

Indoor air quality - IAQ

The following persons:

- The y temp
- The l
- The y is the

- The c
- The c
- The l



Increasing the level of airtightness will certainly lead to energy savings, but it will also lead to unhealthy indoor air quality.

A ventilation unit with heat recovery is absolutely essential for meeting the requirements for a healthy indoor climate while allowing for significant energy savings;



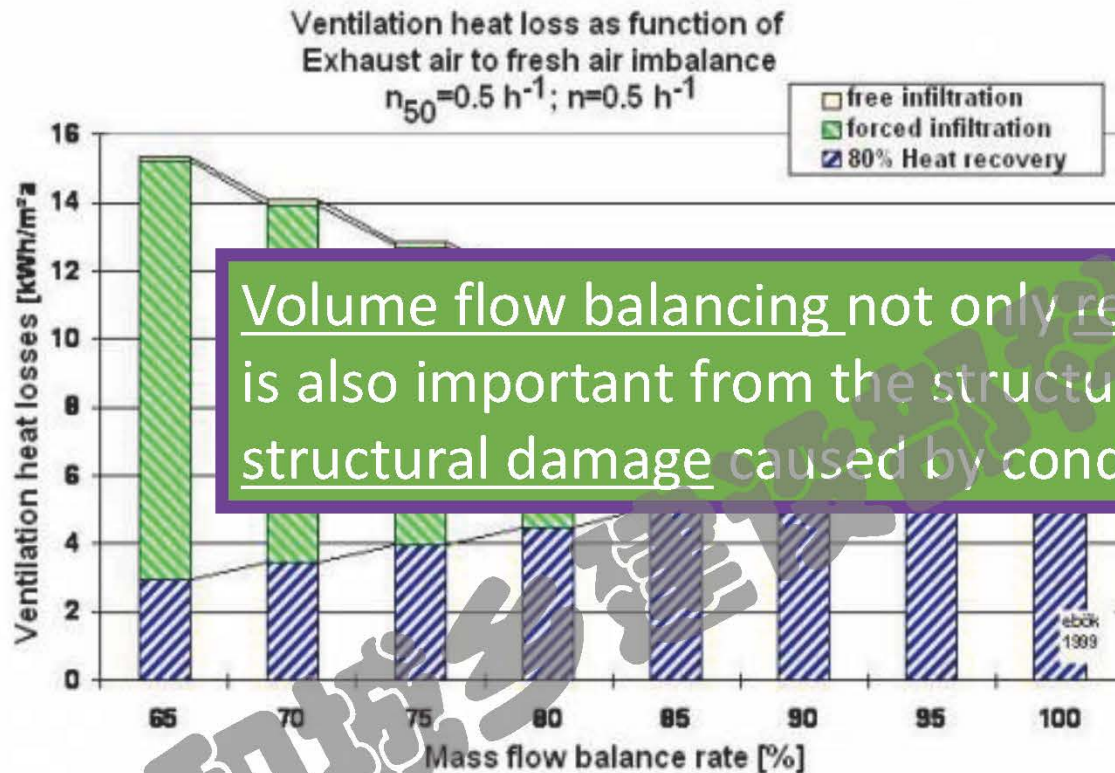
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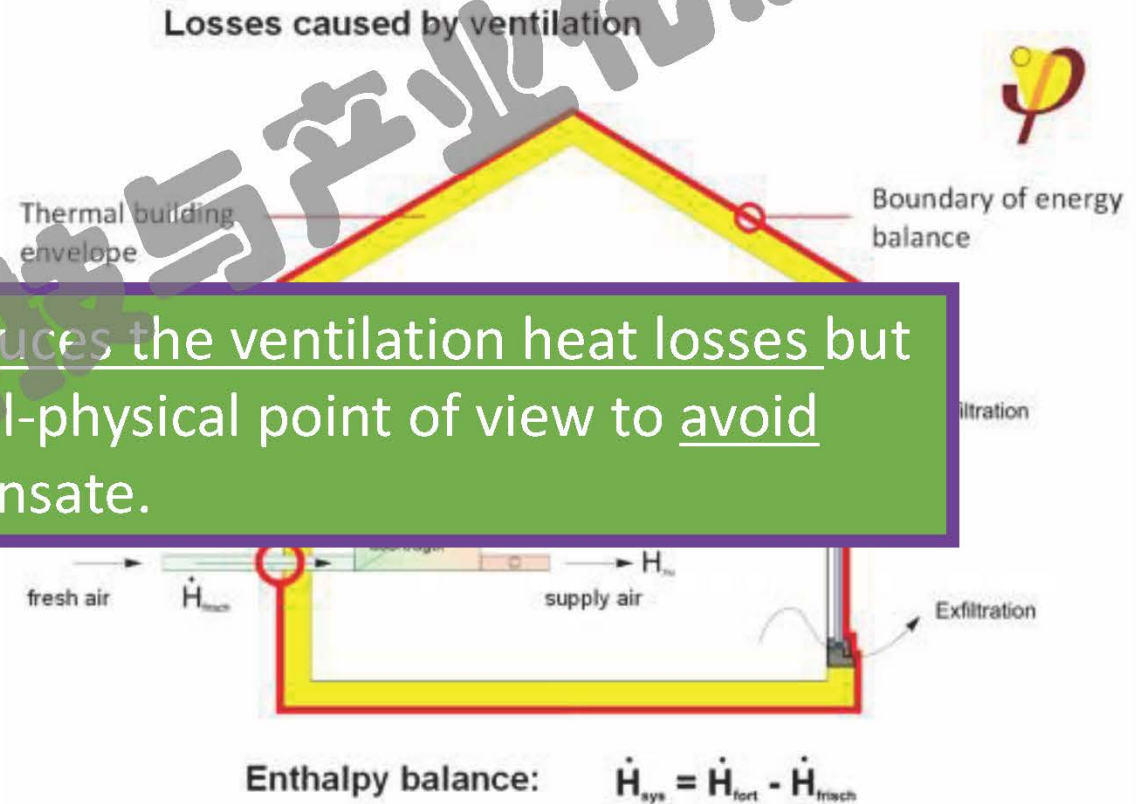


Volume flow balancing

Assuming a building airtightness of $n_{50} = 0.5 \text{ h}^{-1}$ and a ventilation air exchange of $n = 0.5 \text{ h}^{-1}$. Nominal heat recovery rate is 80 %.



Volume flow balancing not only reduces the ventilation heat losses but is also important from the structural-physical point of view to avoid structural damage caused by condensate.



Increasing imbalance causes increasing losses due to forced Infiltration. 10% imbalance leads to increase in ventilation heat losses of $0.5 \text{ kWh}/(\text{m}^2\text{a})$ (+5%). An imbalance of 20% causes heat losses of $1.5 \text{ kWh}/(\text{m}^2\text{a})$ (+19%).

Airflow rate

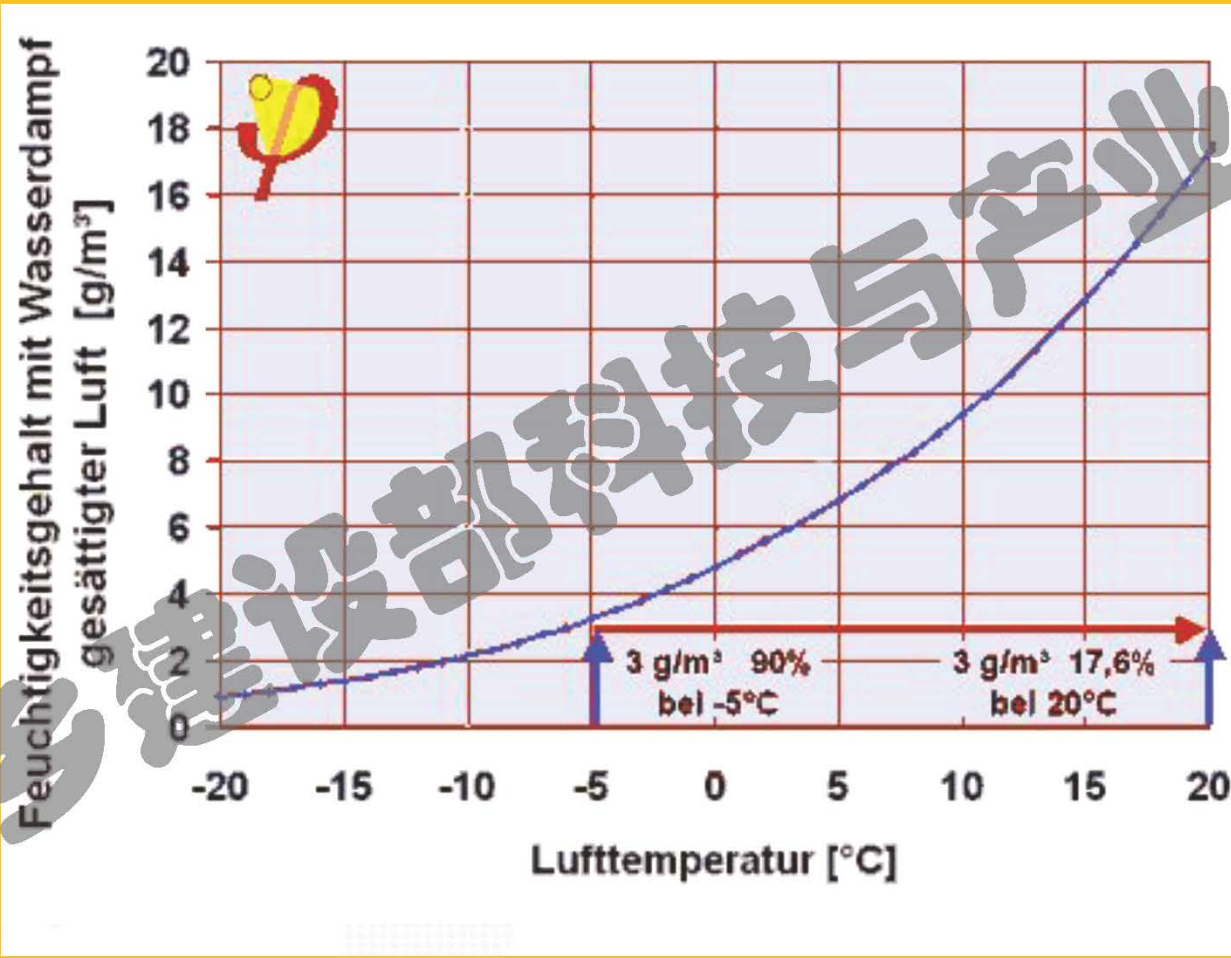
Air volumes and air humidity

The level of relative humidity is influenced by the following parameters:

- the intensity of the incoming air
- the amount of fresh air

The water vapor from incoming air makes no difference whether the air is humidified or dehumidified, as the mass of the water vapor remains the same.

This diluting effect is even more pronounced for water vapor (for example, at -5°C).



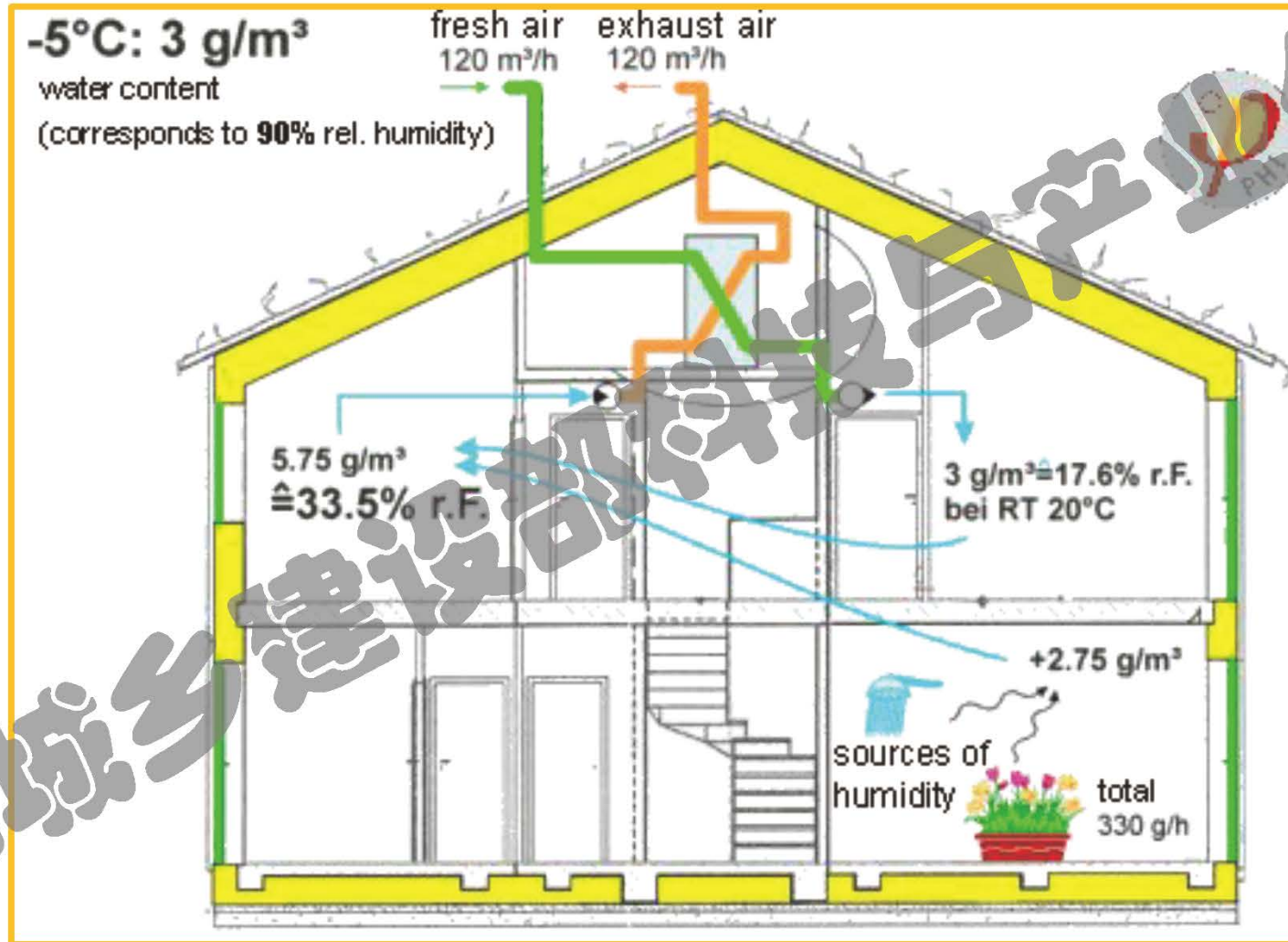
of the following

ternal air. It makes no difference (as long as no heat recovery system) –

small amount of water vapor (for example, at -5°C).

Airflow rate 0,37ACH

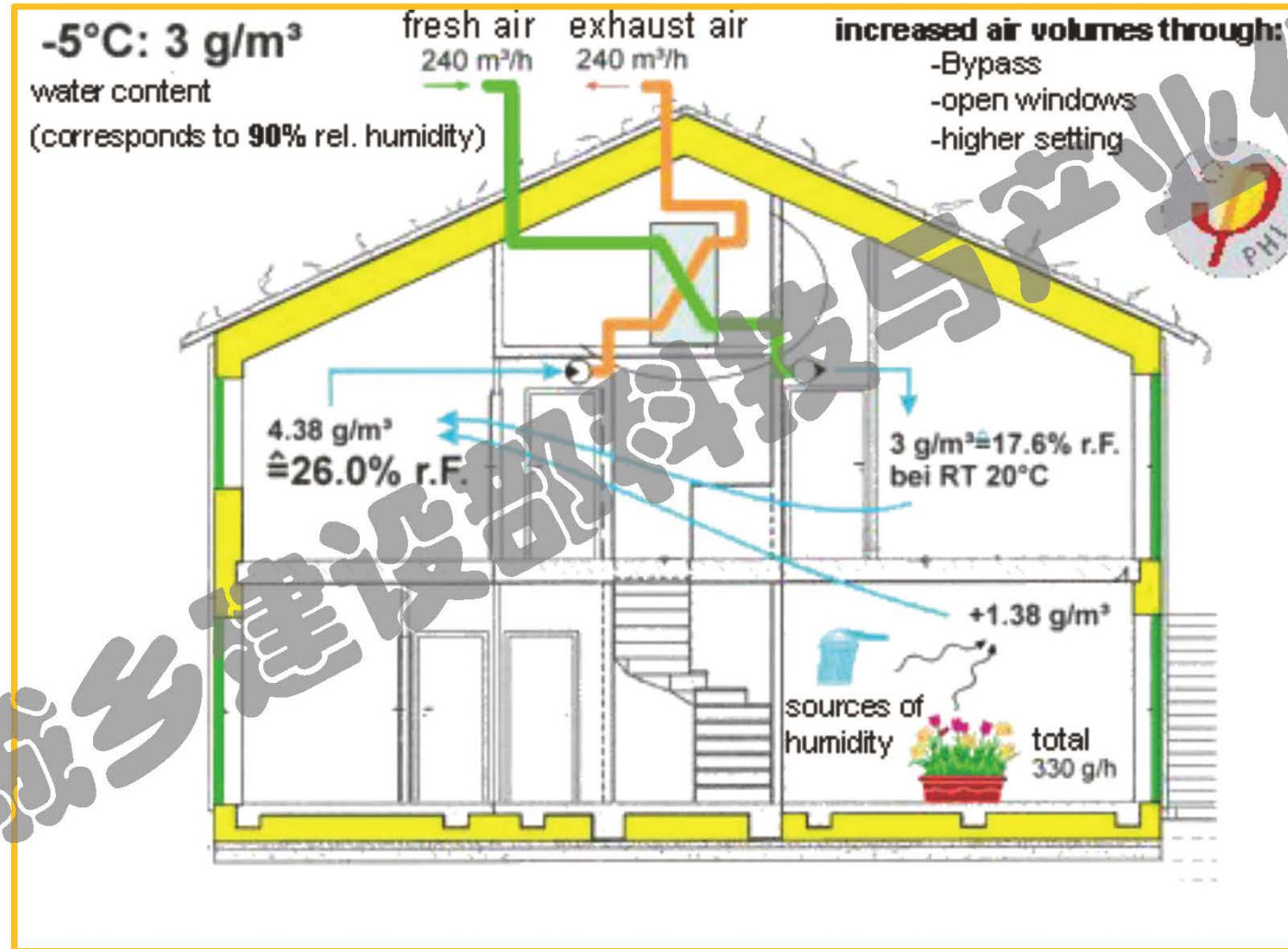
If this co
humidity
sources i
househo
m³/h in t
humidity
(Air quar
air chang



relative
from internal
ources in the
lation (120
door air
s acceptable.

Airflow rate 0,75ACH

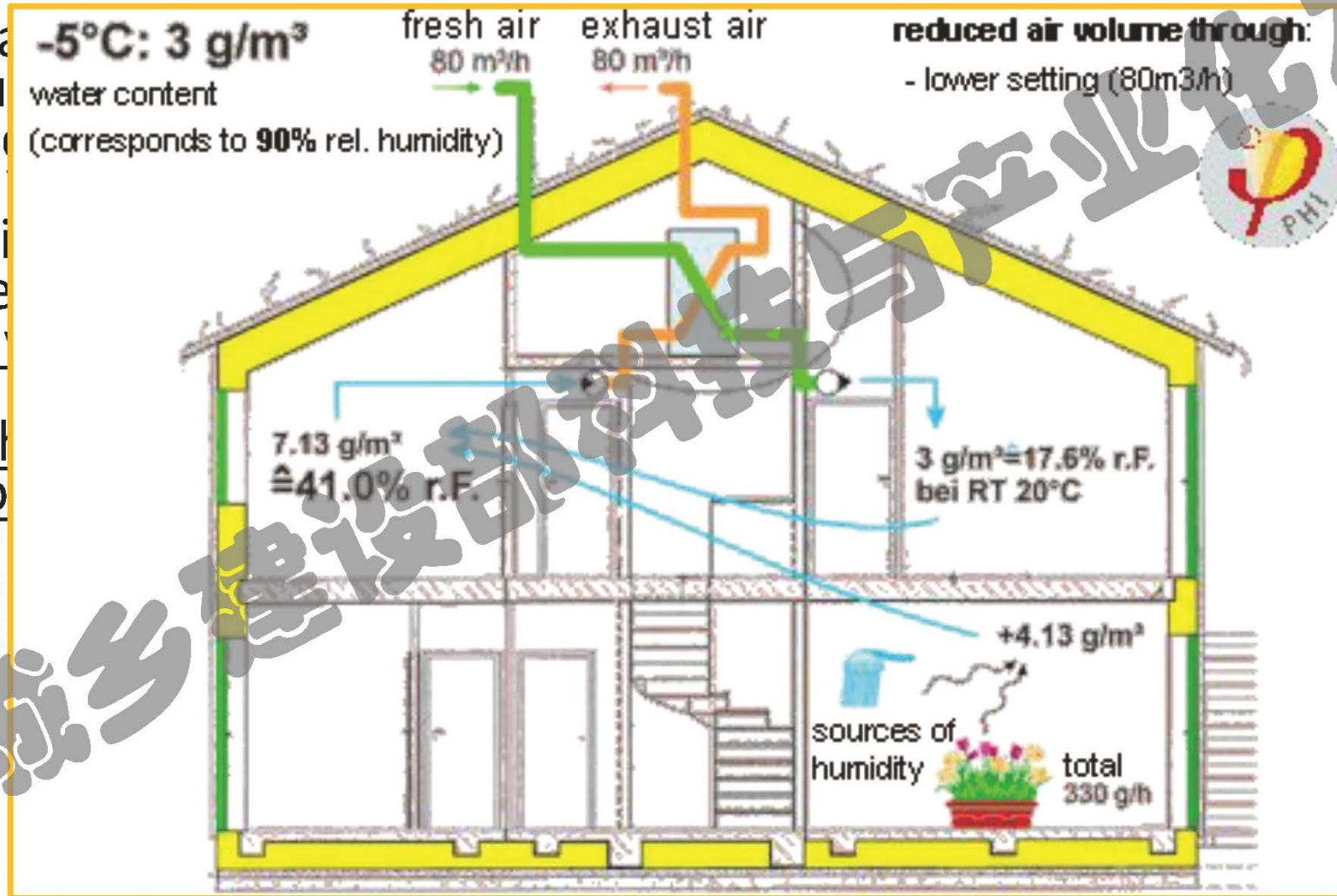
With “inc
house is c
generally
person ar
balance (a



ased into the
t **27%**. This is
60 m³/h per
the moisture

Airflow rate 0,25ACH

If the occupancy is solved: reduced humidity becomes a problem. In example, winter period – when the quality – the air changes in the building is inadequate. If there are no



fresh air is easily diluted. The cold air or air

use, but as it is still 1 unless

Reference airflow rate

Ventilation system air changes between 0.3 and 0.4 are “reference values”. For Passive Houses we generally recommend that air volumes should be based on these lower values, so that with good air quality, the indoor air humidity also remains within the comfortable range.

To keep correct indoor air humidities:

- Adjust air volumes to lower levels
- Add sources of moisture in the living areas (e.g. plants)

Ducts in suspended ceilings

Duct structure

- “**branching**”
conducted
sections for
contain the
As the main
diameter
and the a
- “**star-sha**
distributed
lined. As
can be re



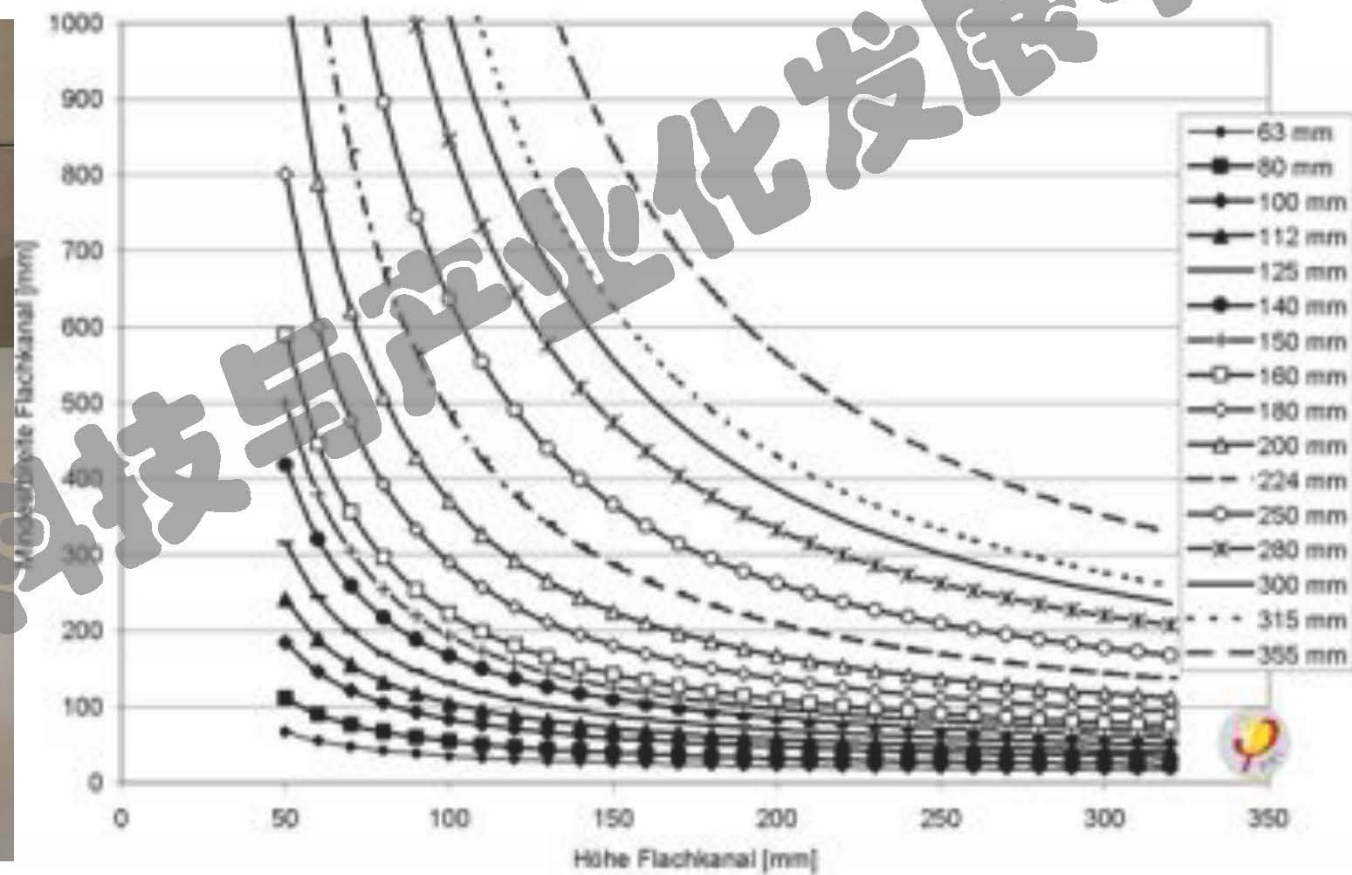
ation unit is
er. Duct
nel. These
en the rooms.
usually has a
partment

a central
s suitably
the diameter

Duct shapes



than round ducts having the same λ
have larger dimensions for the same air flow rates.



Silencers

As a rule, it is the silencer and not the ventilation duct that is decisive for the installation height. It is possible to reduce the height of the silencer by selecting a rectangular design instead of a round silencer.



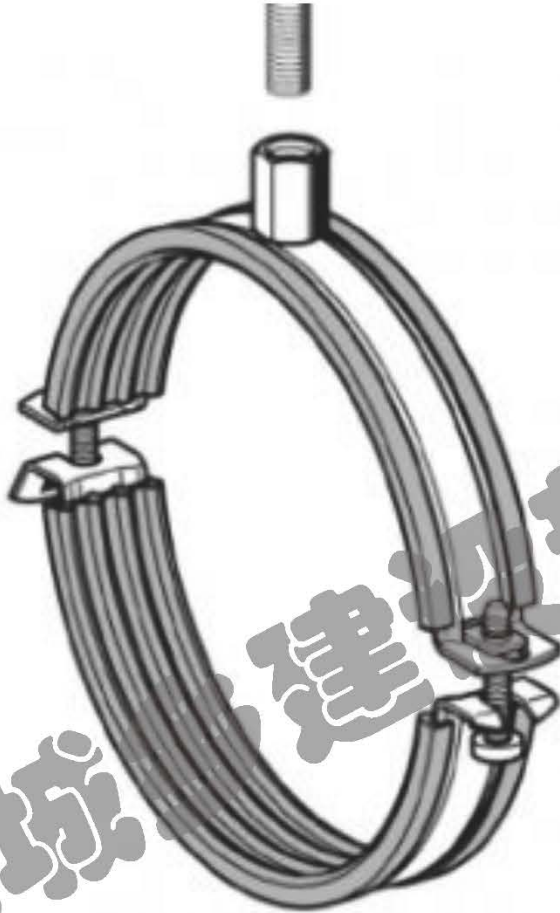
Duct intersections

Duct intersections cannot always be avoided, especially in old buildings. Due to these, installation heights are usually increased, but by means of special fittings for intersections, lowering of the suspended ceiling due to intersections can be prevented. If the width of the fitting is increased correspondingly, the additional pressure drop remains within limits.



Duct attachment

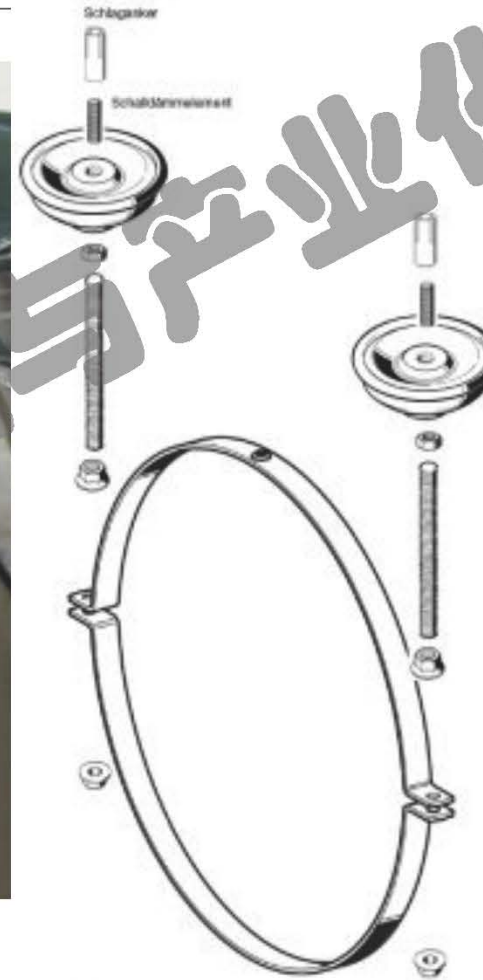
The duct attachment is a suspended ceiling. The distance of the duct from the unfinished ceiling is 10 to 25 mm. With the conventional construction, the threaded rods remain, which are fixed to the ceiling. The brackets are fixed to the rods at a distance from the duct in order to accommodate the minimum distance.



of the minimum

and ducts positioned ceiling

this can be rods per minimum gained in



BLAUBERG KOMFORT EC SB 350

Flow
rate
54...279
m³/h

Efficiency
79...83%

Electric
eff. 0,27
W/m³/h



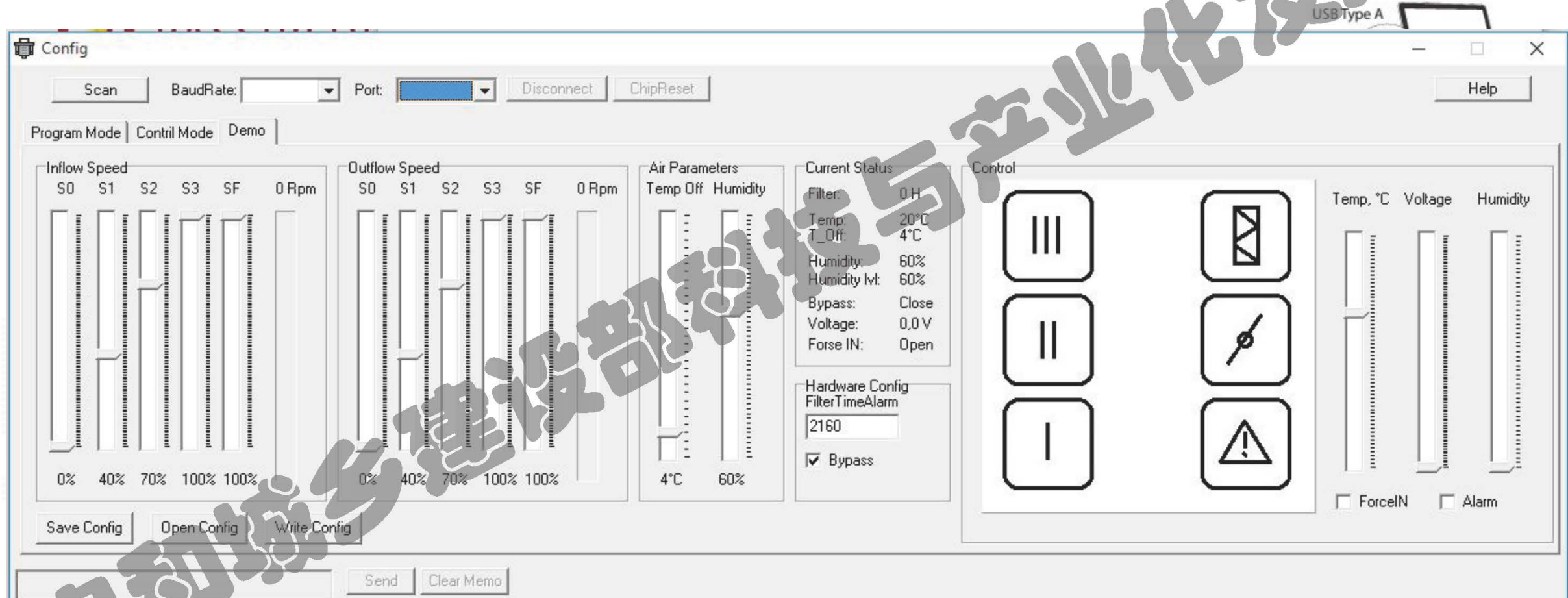
MOTOR
EC



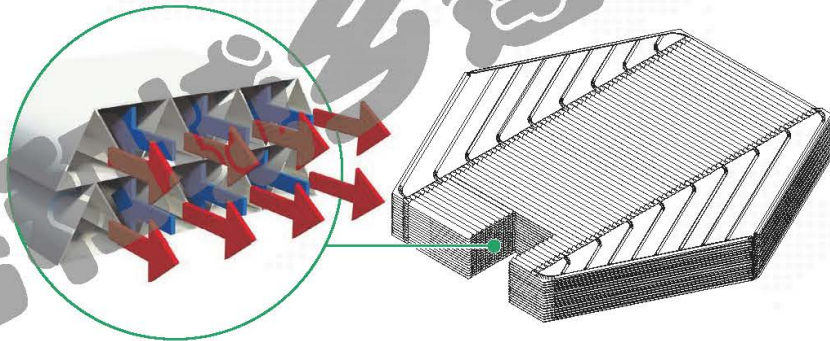
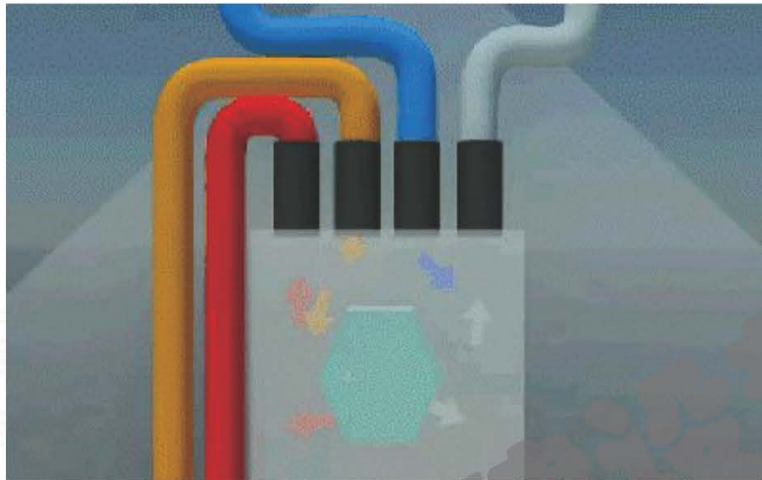
Blauberg Ventilatoren GmbH, Komfort EC SB350 S11	Blauberg Ventilatoren GmbH, Komfort EC SB350 S11	Blauberg Ventilatoren GmbH, Komfort EC SB350 S11
Flow rate for all room air flow rate for all	Germany Blauberg Ventilatoren GmbH, Komfort EC SB350 S11 Blauberg Ventilatoren GmbH, Komfort EC SB350 S11	heat exchanger is simple. The filter can be replaced by equipped (as default) with following filter qualities:
ventilation (= 70-80 %), air readability of the set	test facility using balanced mass flow on the outdoor measurement should be taken from the documents relating to	in of icing over of the heat exchanger and freezing up of ratures (-15 °C). The regular functioning of the device
before does not comply small switch to separate	$\frac{P_{\text{ex}}}{P_{\text{ex}} - P_{\text{ext}}} + \frac{P_{\text{ex}}}{P_{\text{ex}} - P_{\text{ext}}}$	ing loads caused by the forced infiltration would become frost protection circuit should ensure prevention of frost
that was set before the	boundary can be calculated using η_{heat} based on the infiltration (rate). The rates of heat recovery are usually	by of failure of the pre-heating coils and extract air fans
I should be restricted to vel and sound pressure installation room can be	%, at 154 m³/h)	cluding that for regulation, but without that for the frost external pressure of 100 Pa (50 Pa for each of the
below 25 dB(A) in living en determined at an air	ft/m³	test should be carried out in accordance with the DIBt The leakage air flows must not be greater than 3 % of exhaust device.
use Institute Page 2/3	Passive House Institute Page 1/3	Passive House Institute Page 3/3



Volume flow balancing in SB 350



Counter flow heat exchanger



国家空调设备质量监督检验中心 检 验 报 告

报告编号: 2015HR51

共 5 页第 2 页

样品编号		2015HR51	
检 验 结 果			
序号	检 验 项 目		检验结果
1	风量 (m³/h)	新风	416
		排风	415
2	出口全压 (Pa)	新风	49
		排风	47
3	输入功率 (W)		479
4	有效换气率 (%)		98
5	制热工况温度交换效率 (%)		80
6	噪声 [dB(A)]		46.9
备注	1、检测高速档; 2、噪声的检验结果为机组安装在半消声室内的测试值。		

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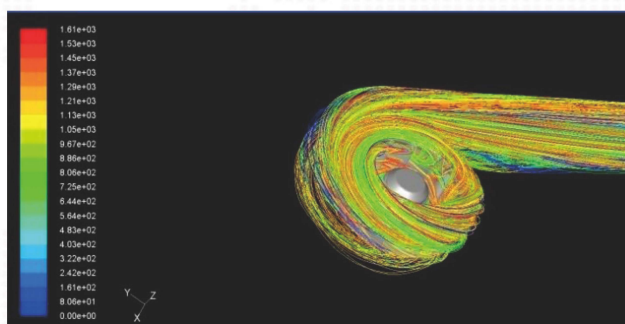
Komfort EC SB 350

80%

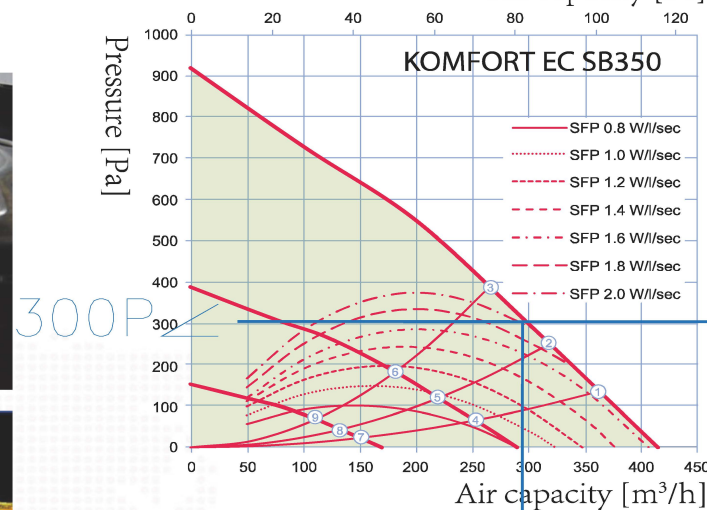


EC Centrifugal fan

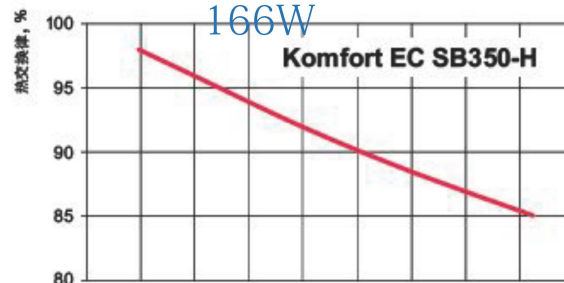
EBM EC with Radical impeller



EC SB350 air flow static pressure

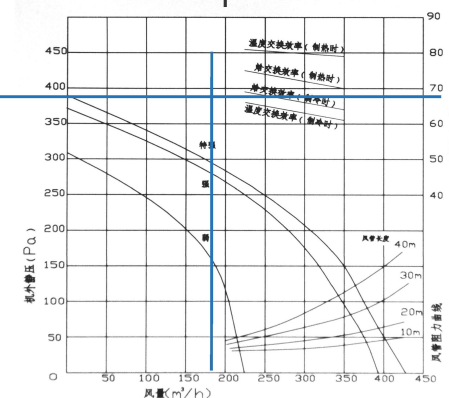


Air volume : 300 (M)³ / 166W



Heat exchange rate datasheets

FY-E35PMA Air flow static pressure



Air volume : 170 (M)³ / 229W



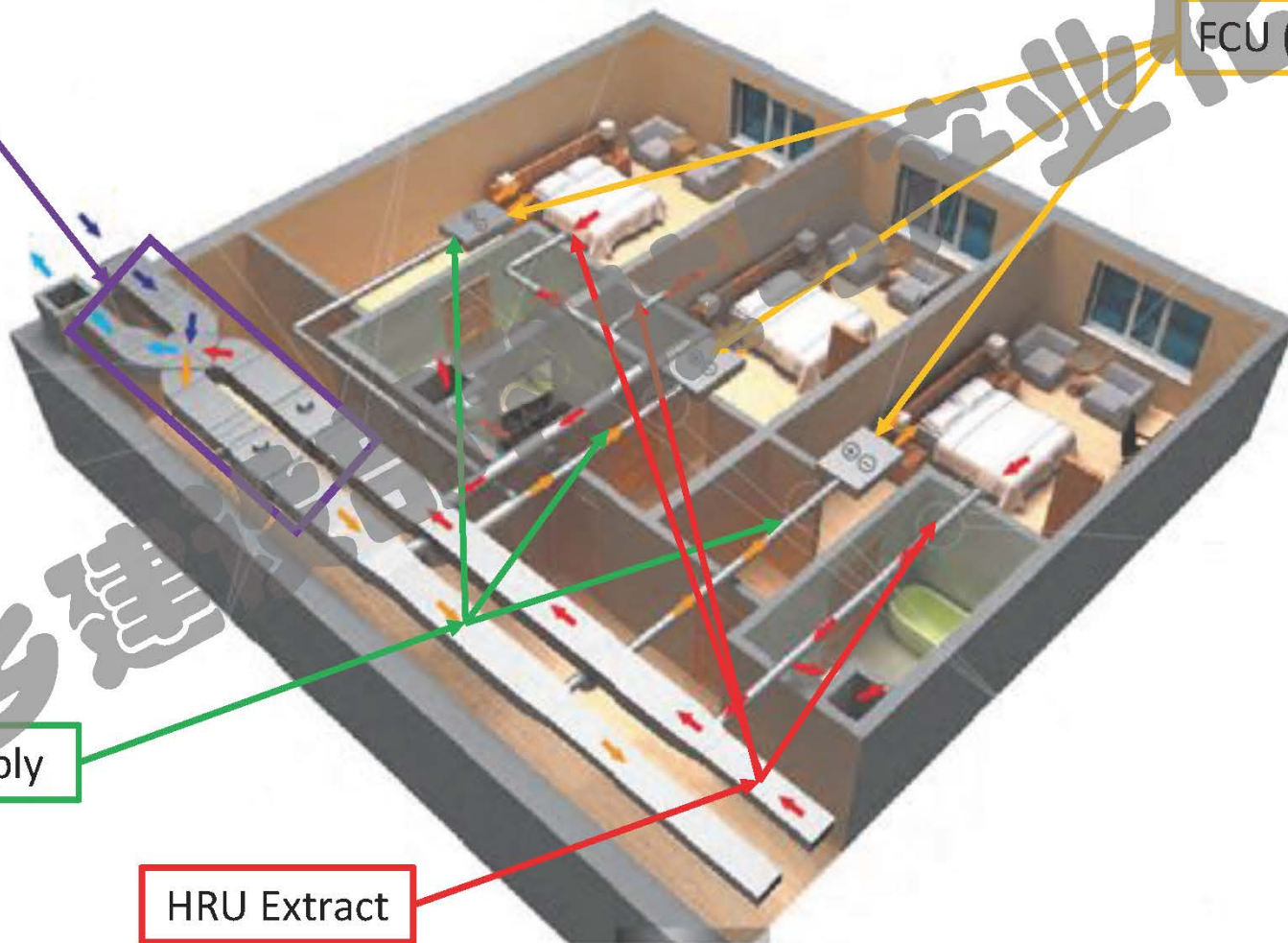
Combining AC and HRU

HRU (Heat recovery unit)

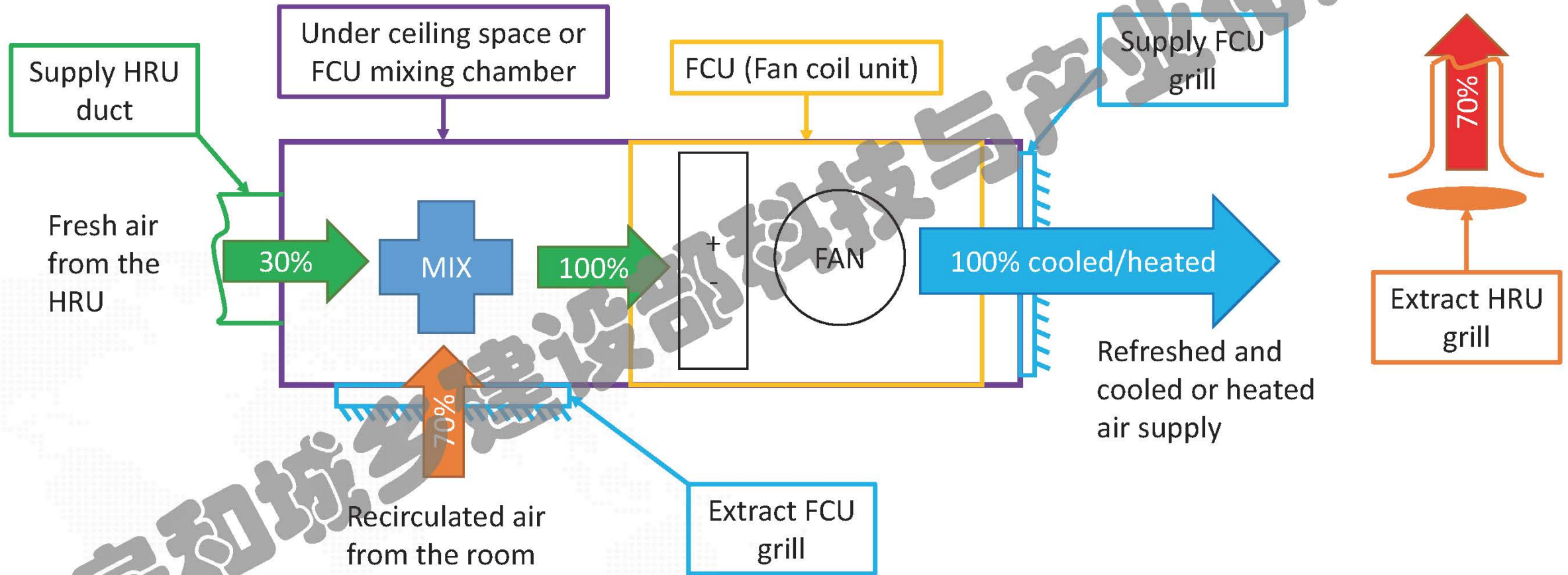
FCU (Fan coil unit)

HRU Supply

HRU Extract



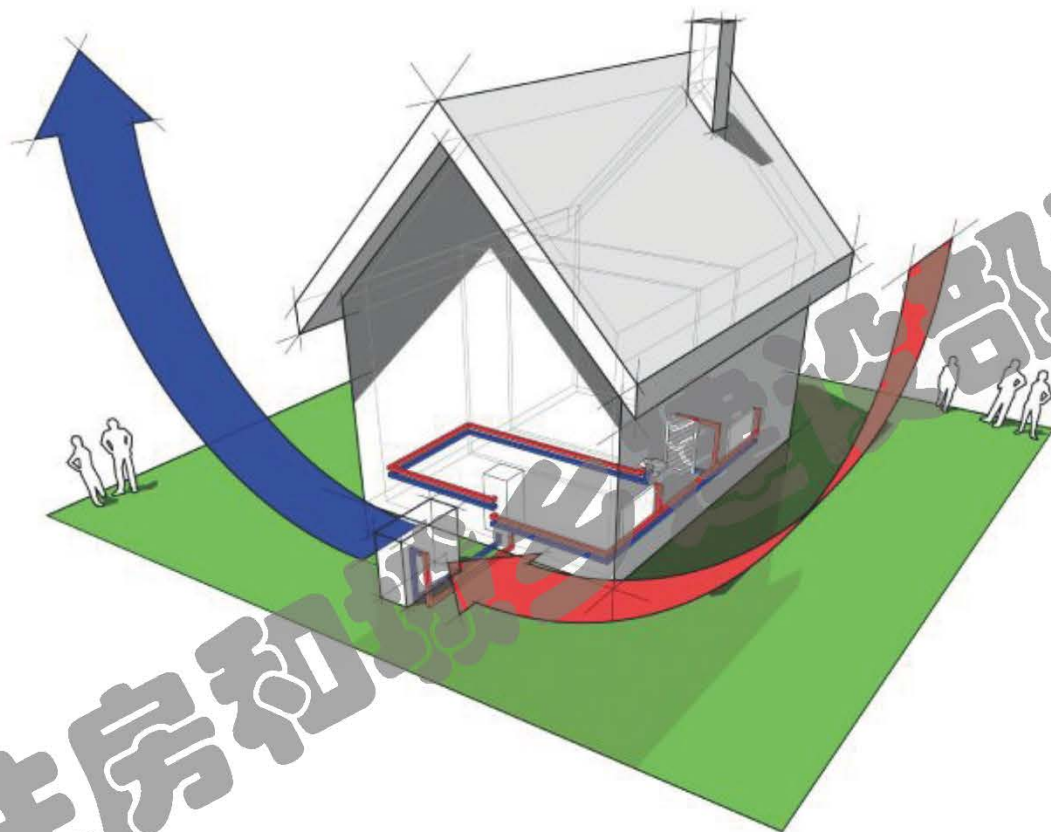
System examination



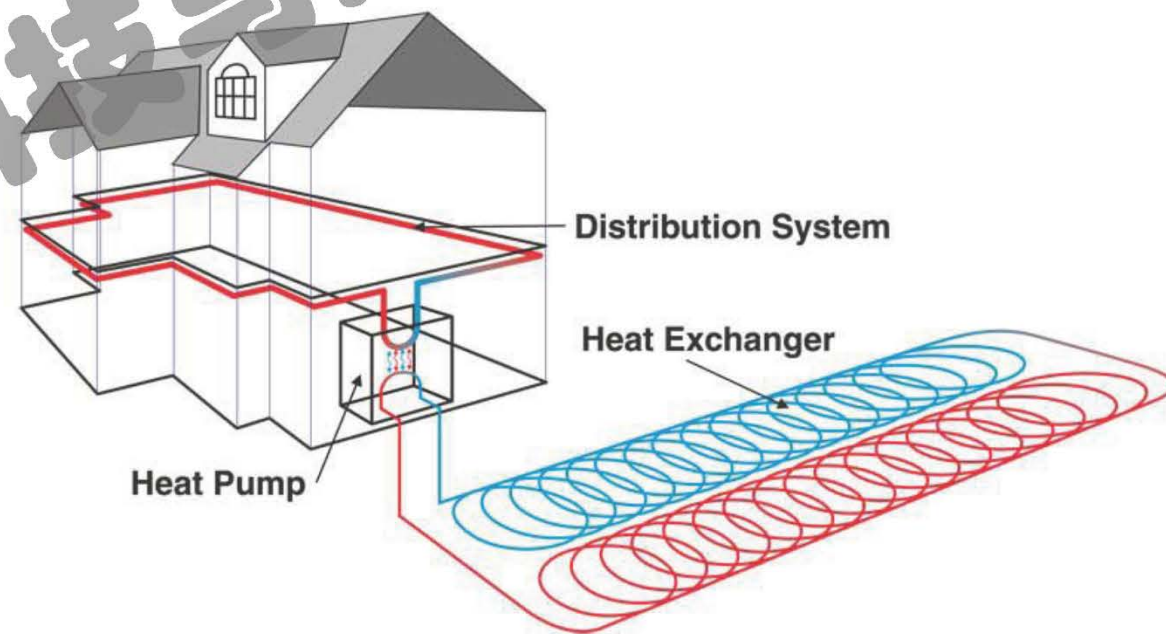
Running the FCU

To run FCU you can use air or ground source heat pumps

air source heat pump



ground source heat pump



THANK YOU

May the fresh air be with you.

Some information in this PPT was provided by the Passipedia is offered by [Passive House Institute](#)