



# Modern and energy-saving concept in a small residential buildings

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## Topics

The big challenge - Near-zero energy building

Experience from Sweden - different types of ventilation.....

## Lecturer

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Sweden already has the most  
stringent energy requirements in  
Europe

Calls thus to more solid basis for  
near-zero energy building to  
2016





# Modern and energy-saving concept in a small residential buildings

## The big challenge – EU 2020 and 2050

### Europe 2020 initiative

- A strategy for **competitive, sustainable** and **secure energy**<sup>1</sup>

### Energy Roadmap 2050

- **Moving** to a **reasonable** low-carbon economy in 2050, while at the same time ensuring **security of energy supply** and **competitiveness**<sup>2</sup>

### The Swedish Government

- For buildings is a goal of total energy use per unit of area in residential and commercial buildings **should be reduced by 20 percent by 2020** and **by 50 percent in 2050** compared to 1995.<sup>3</sup>

1) Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

2) **Energy Roadmap 2050**, EUROPEAN COMMISSION, Brussels, 15.12.2011, COM(2011) 885 final

3) The Swedish Government Communication (Regeringens skrivelse) 2011/12:131, Vägen till nära-nollenergibygnader

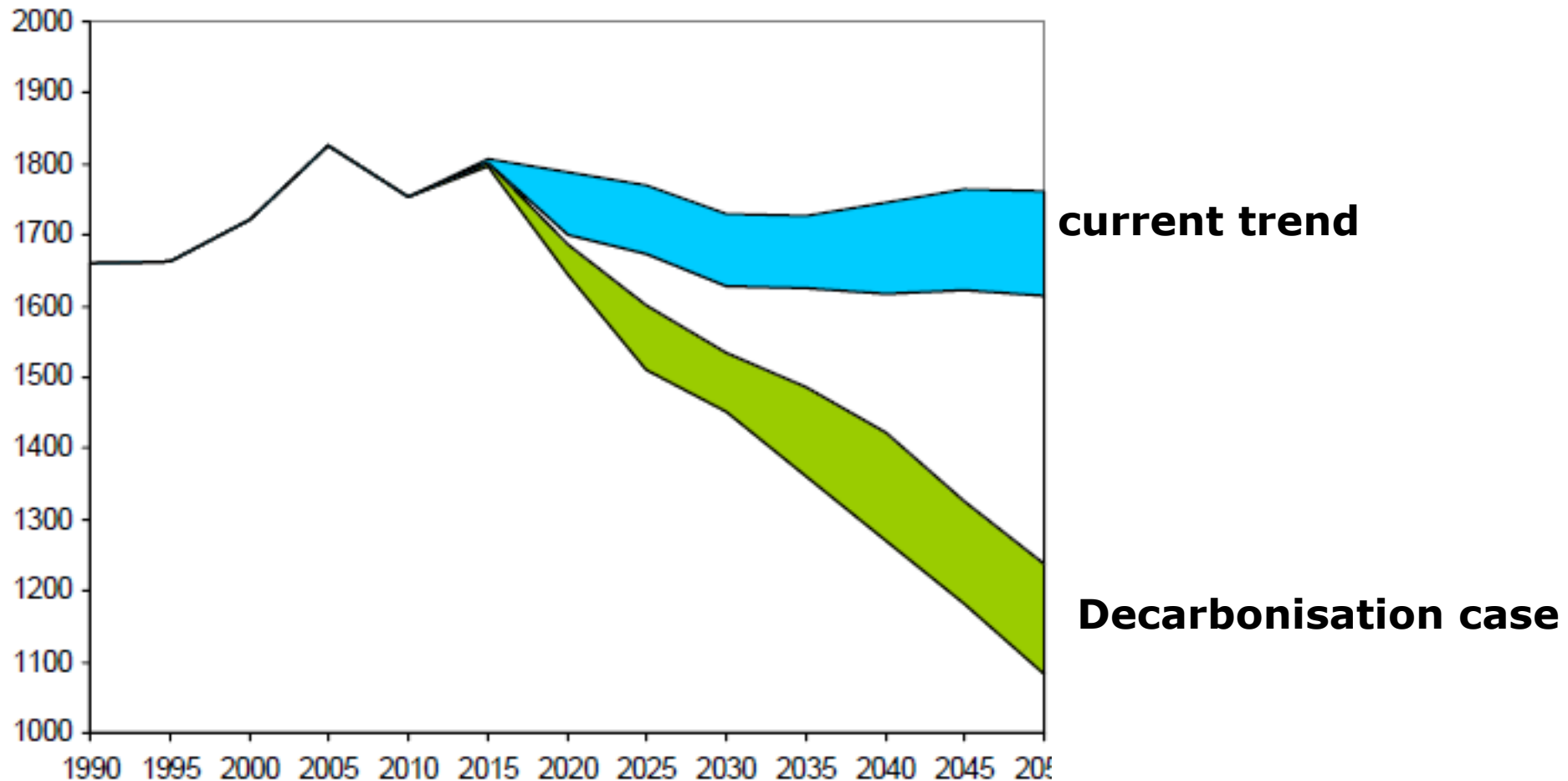


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# Modern and energy-saving concept in a small residential buildings

## The big challenge – EU 2020 and 2050

### Gross energy consumption - range in **current trend** (REF/CPI) and **decarbonisation case** (in Mtoe)





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## The big challenge – EPBD2 and Sweden

- 2010 (EU)
  - **The EU adopted** the Energy Performance of Buildings **Directive 2010/31/EU** (also called **EPBD2**)<sup>1,2</sup> which is the **main legislative instrument to reduce the energy consumption of buildings.**
  - EPBD2 requires that the property owner **reported** the amount of **renewable energy**, this is **not official requirements today.** <sup>2</sup>
- 2012 (Sweden)
  - Sweden already has the **most stringent energy requirements in Europe**, the Housing Minister Stefan Attefall <sup>1</sup>
    - **2009**, Energy use in residential and commercial buildings amounted **to 216 kWh / m<sup>2</sup>**
    - **2020**, requirements is **142 kWh/m<sup>2</sup>**
    - **2050**, requirements is **89 kWh/m<sup>2</sup>**
    - **2013** the requirements is in Southern (90 kWh/m<sup>2</sup>) and Northern (130 kWh/m<sup>2</sup>) **today**, it is technically possible to build more energy efficient today (**40-70 kWh/m<sup>2</sup>**)

1) Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

2) Energimyndigheten workshop om Måtkriterier i lågenergibygnader 29 January 2013

3) Vi har de hårdaste energikraven i Europa, VVS-Forum (1/2012), 2012-01-13

### 2013 (Sweden)

- Swedish Government **calls** thus a **more solid basis** for Sweden to adopt even more stringent tightening of building regulations and **specify a specific level** of what a "*near-zero energy building*" **is**.<sup>1</sup> Swedish Parliament has allocated a total of ~ **12,85 Euro** (SEK 120) million for investment in the **evaluation of nearly zero-energy** buildings in the period 2014-2016.<sup>1</sup>

### Project plan<sup>2</sup>

- The aim is to **collect measurement data**, both **short** and **medium term**.
- 2015, a **solid information** and **assumptions** for decisions to **specify a specific level** of what a "near-zero energy building" **is**.

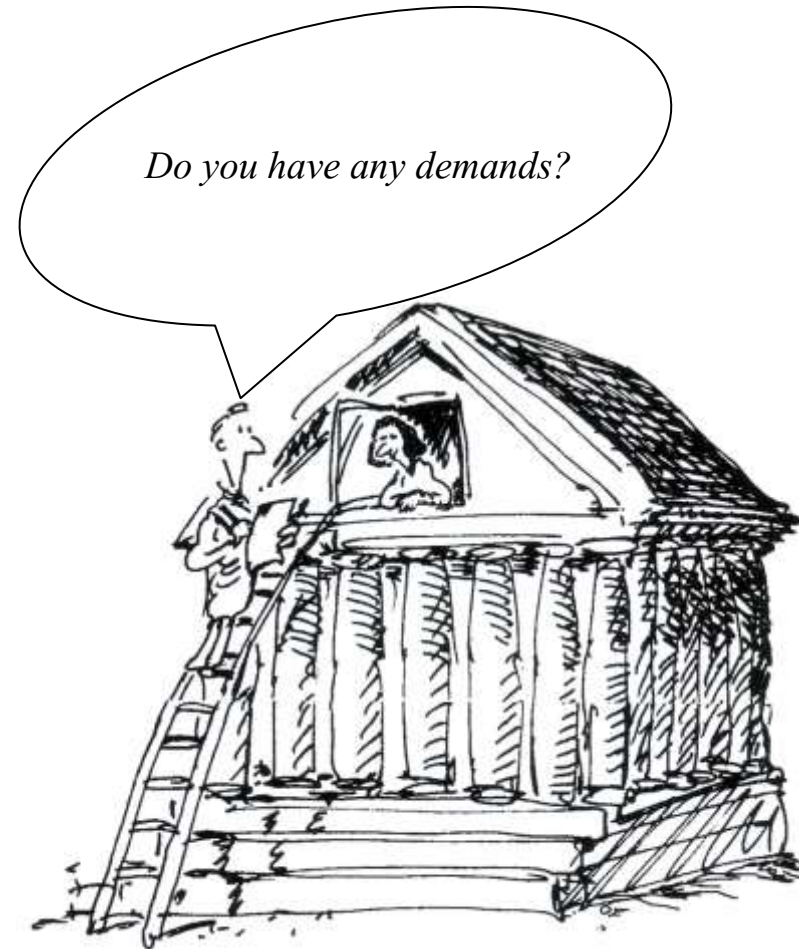
### The Boundary conditions and mistakes<sup>3</sup>

- **Identify** and **avoid** the mistakes made during previous energy efficiency.<sup>3</sup>
- Important to **learn from past** mistakes, the authorities need to cooperate

1) Energimyndigheten workshop om Måtkriterier i lågenergibygnader 29 january 2013, page 4

2) Vägen till nära-nollenergibygnader" Skr. 2011/12:131, page 7,8,10

3) Uppdrag 13: Nationell strategi för lågenergibygnader, ER 2010:39, ISSN 1403-1892, page 24-25

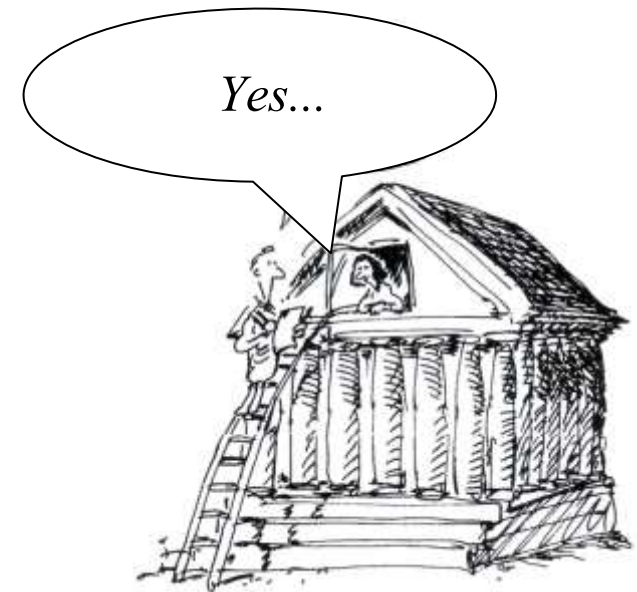




# Modern and energy-saving concept in a small residential buildings

## Air handling system, Design methodology and selection criteria

- What type of **authority** are the?
- What type of **agreement** between then *Building proprietor* and *Contractor* is there?
- What type of **document** is the?
- What **areas** need *ventilation*?
  
- What type of **system** should be used, *extract* or *balanced*?
  - What *type* of *air distribution system* should be used?
  - Are there any *alternative systems* to consider?
- **Where** should the fan and plant be *installed*?
  - Fan units *up* or *down* in the building?
- What type of **control system** should be used?
- Have I considered what will happen in the event of a **fire** in the *building*?
- Have I considered the **noise** from *fans, ducts* and *units* etc?







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# Modern and energy-saving concept in a small residential buildings

## The Swedish building sector – Ventilation demand can be found in BBR 2013

### Authority

- Plan och bygglagen (PBL)
- Plan och byggförordningen (PBF)
- Lagen om offentlig upphandling (LOU)
- Boverkets byggregler (BBR)

### Building Regulations (BBR)



### Chapter 6: Hygiene, health and environment

### Agreement between then Building proprietor and Contractor

- AB/ABT, two different type of contract
- AF (Administrative Direction)
- AMA (Technical directions)
- Drawing etc.

### Swedish guidelines

- BH90
- Standards





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## Building Regulations, BBR2013 – 6:21 General (air)

Buildings and their installations shall be designed to **ensure** they can provide the conditions for good air quality in rooms where people are present other than occasionally.

The requirements for indoor air quality shall be determined on the basis of the room's intended use. The air must not contain pollutants in a concentration resulting in negative health effects or unpleasant odours.

### Question:

What is “...good air quality in rooms where people are present...”?





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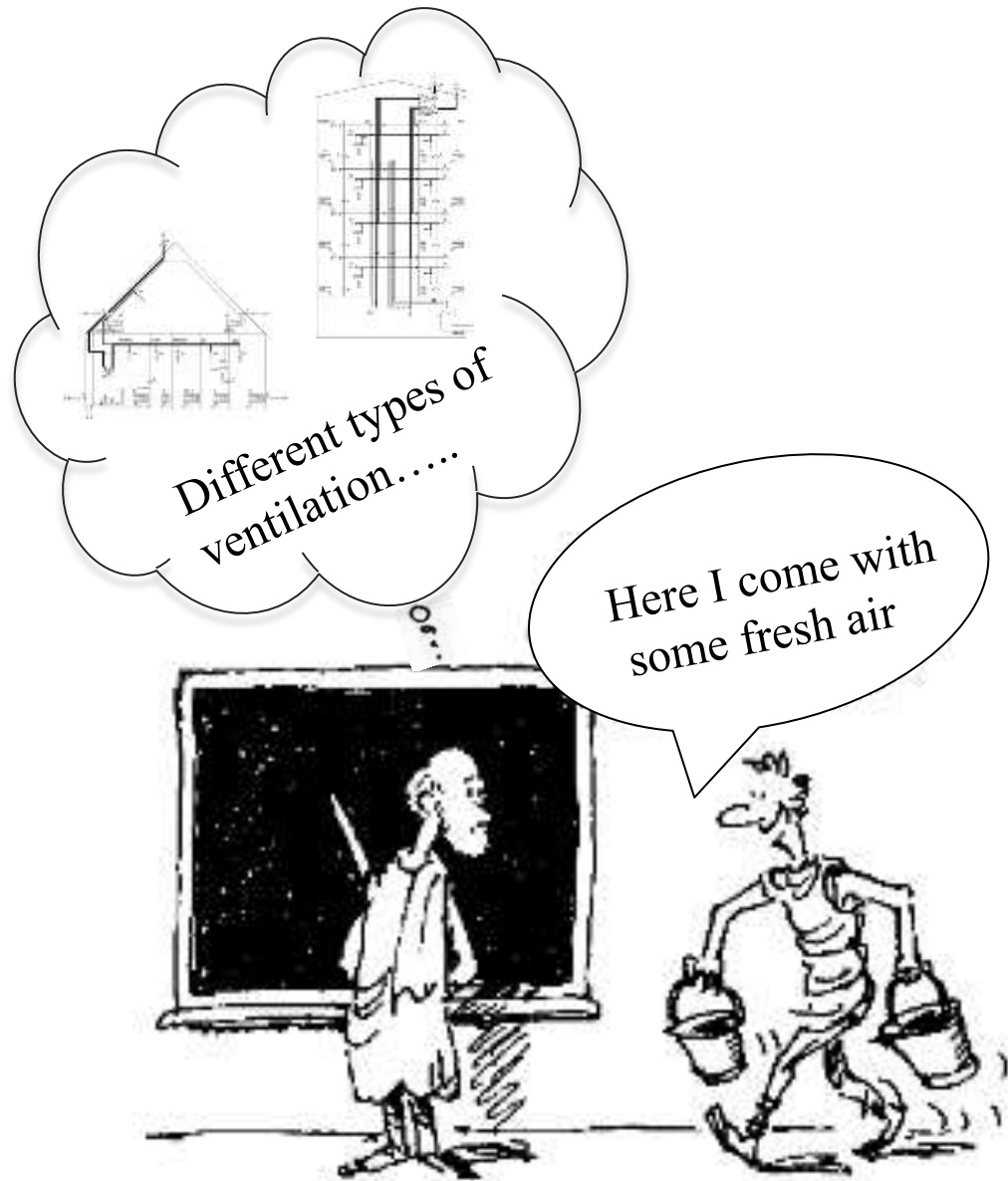
## Modern and energy-saving concept in a small residential buildings Building Regulations, BBR2013 – 6:21 General (air)

Ventilation systems shall be designed for a **minimum** outdoor air flow corresponding to 0.35 l/s per m<sup>2</sup> floor area. When in use, rooms shall be able to have a **continuous air exchange**.

In residential buildings where the ventilation can be controlled separately for each dwelling, the ventilation system is allowed to be designed with presence and demand control systems. However, the flow of outdoor air must not be lower than 0.10 l/s per m<sup>2</sup> of floor area when the dwelling is unoccupied and 0.35 l/s per m<sup>2</sup> of floor area when the dwelling is occupied.

**Reflection:** *Swedish Government removed minimum airflows for different room types in the beginning of this century.*





### Mechanical ventilation:

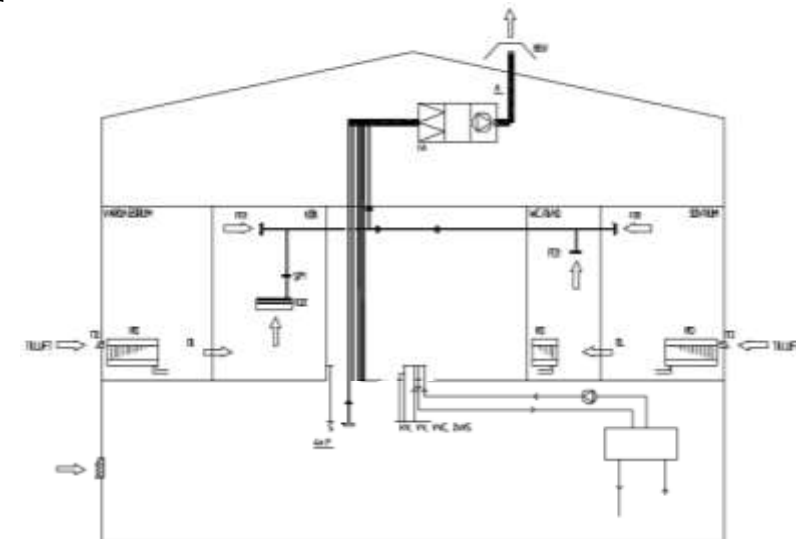
- Indoor air is with drawn and replaced by fresh air continuously from clean external source

### Mechanical or "forced" ventilation:

- is used to control indoor air quality

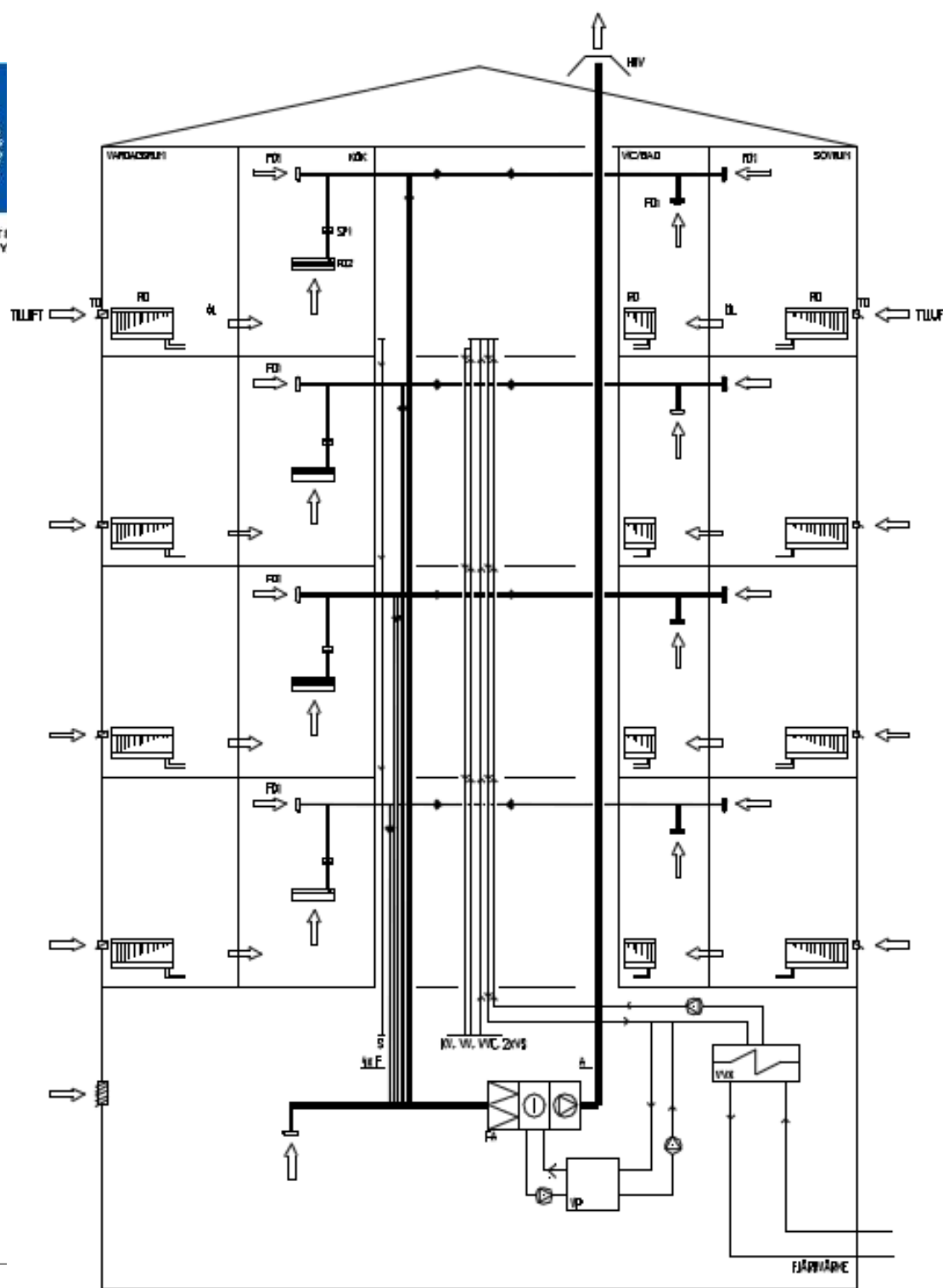
### Volume vs. Pressure ventilation:

- *Volume*: Volume is constant and pressure will vary.
  - fixed air flow
- *Pressure*: Pressure is constant and volume will vary.
  - pressure-controlled air flow



# Residential building – type 1

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## Air flow:

- *Extract air* system with a air handling unit in the basement / garage
- *Supply air* through the façade

## Energy recovery:

- Heat pump, model liquid/water

## Noise:

- *Supply air device* in the façade gives higher noise from the outside.

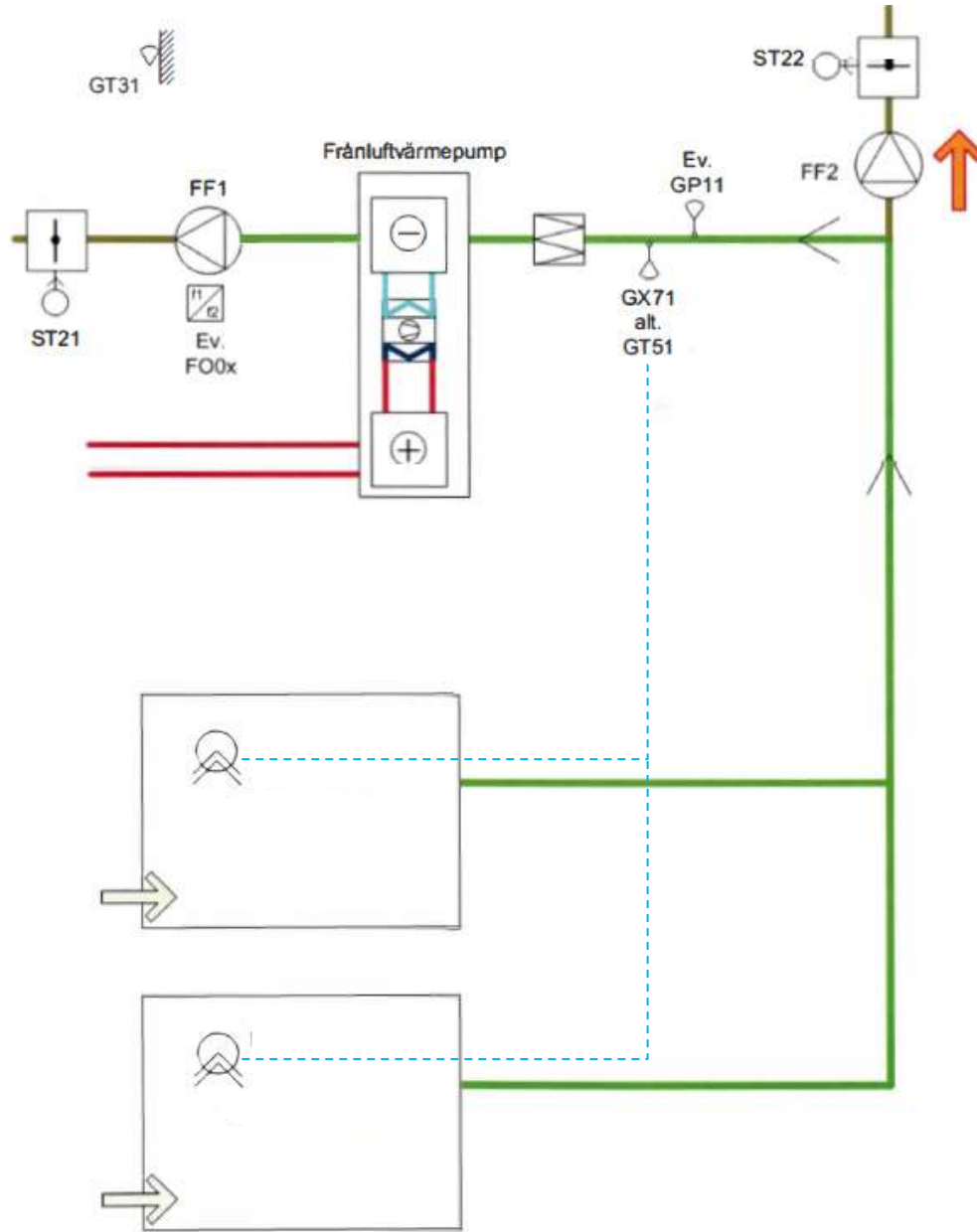
## Feature summary:

A simple ventilation system with energy recovery and maintenance purposes easier than a *Supply air and Extract air* system with Energy recovery.

When using supply air *device* in the facade, avoid busy roads or other nearby noise sources.

# Residential building – type 1

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## Fire-protection

- Systems serving multiple fire cells
- Active systems - separate exhaust fan in operation

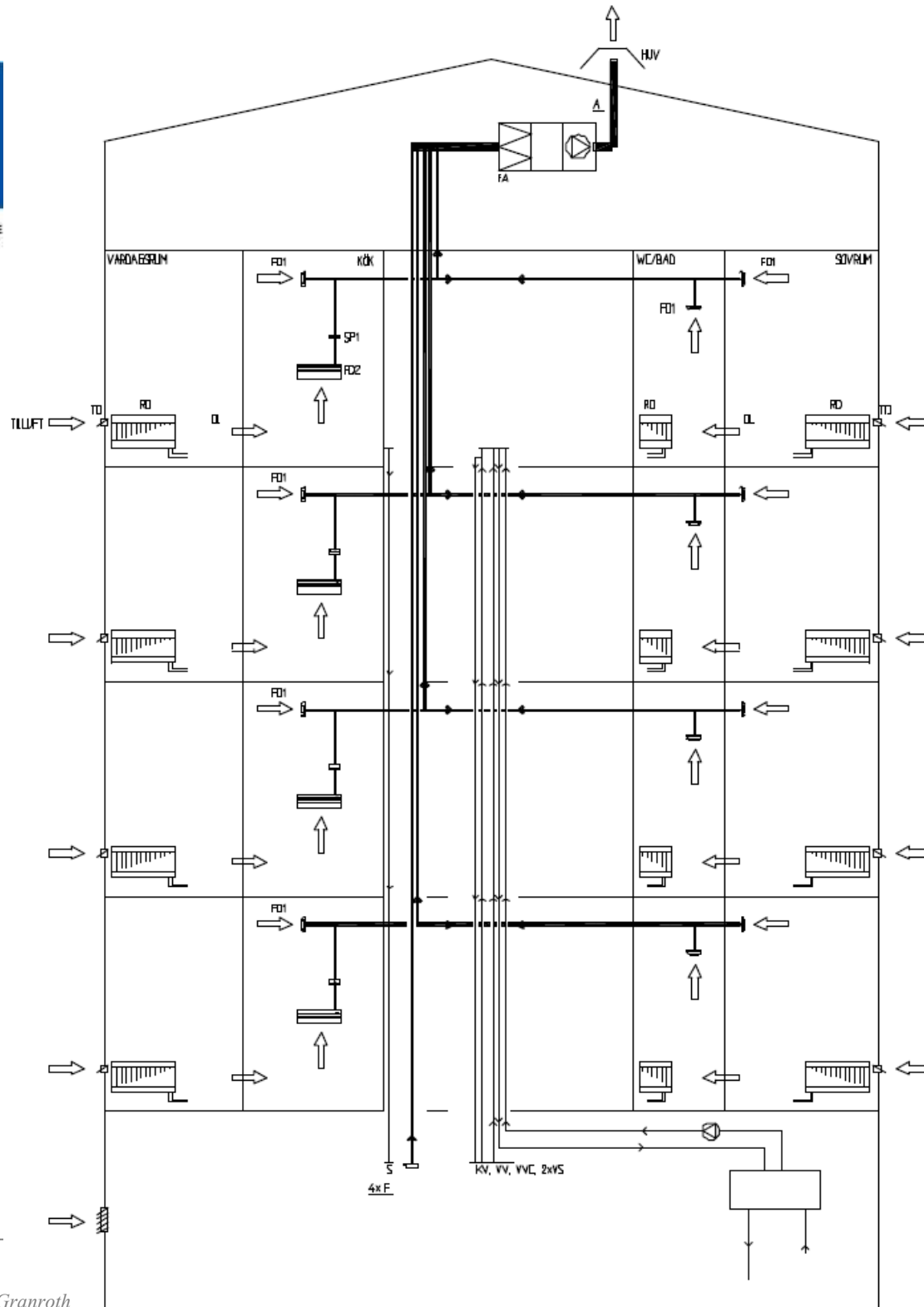
Protection method for fire gas is to use special temperature durability exhaust fan.

The system solution is used when regular exhaust fan fails arising mixture temperature for 1 hour.



# Residential building – type 2

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## Air flow:

- *Extract air* system with a air handling unit in the in the attic
- *Supply air* through the façade

## Noise:

- *Supply air device* in the façade gives higher noise from the outside.

## Feature summary:

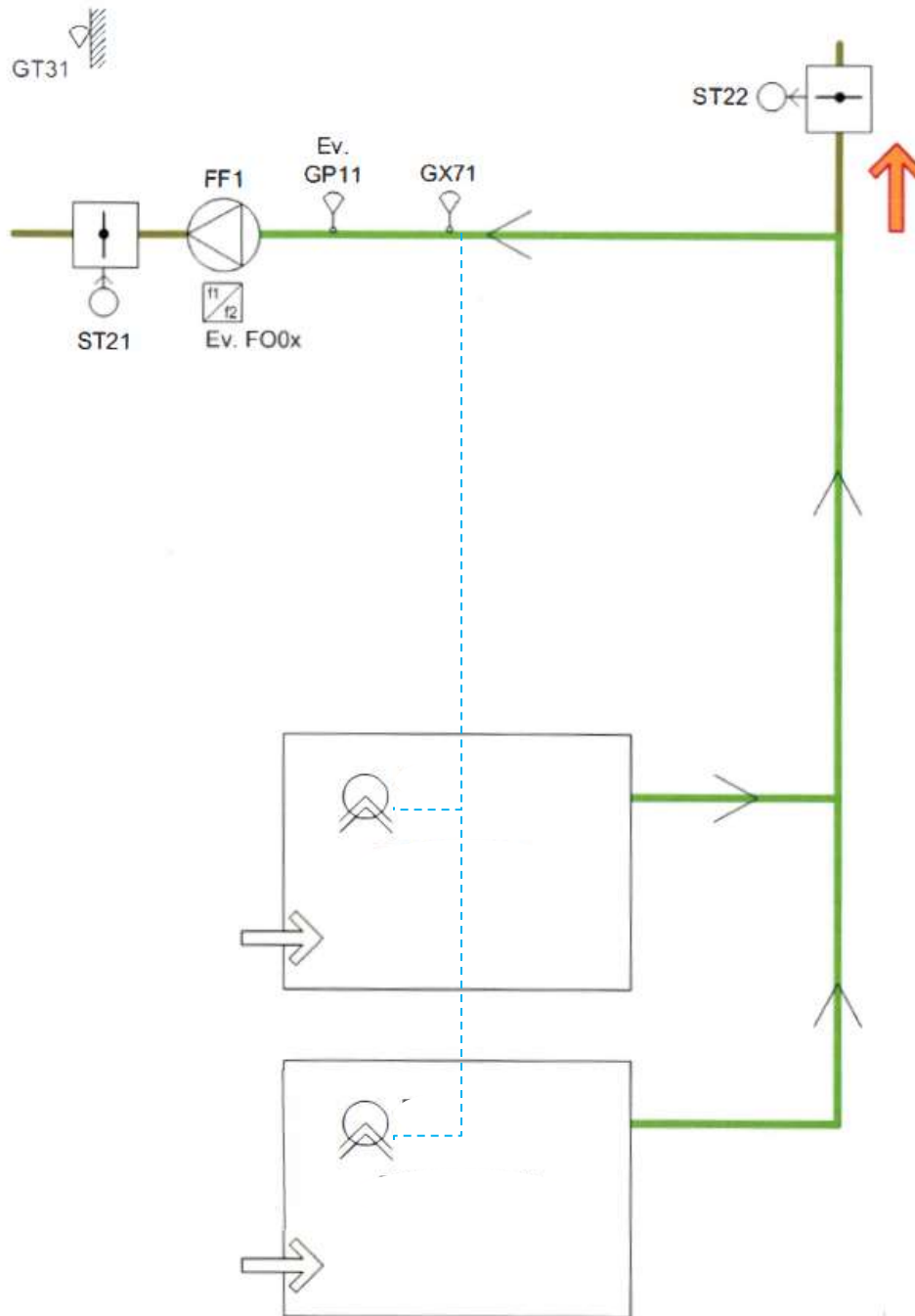
The simplest ventilation systems of all and maintenance purposes easier than a *Supply air and Extract air system* or *Extract air system* with energy recovery.

The downside is that it may require a larger radiator surface areas where you bring the outdoor air behind them, the possible risk of draught in the winter and places greater demands on U-values for the façade.

When using supply air *device* in the facade, avoid busy roads or other nearby noise sources.

# Residential building – type 2

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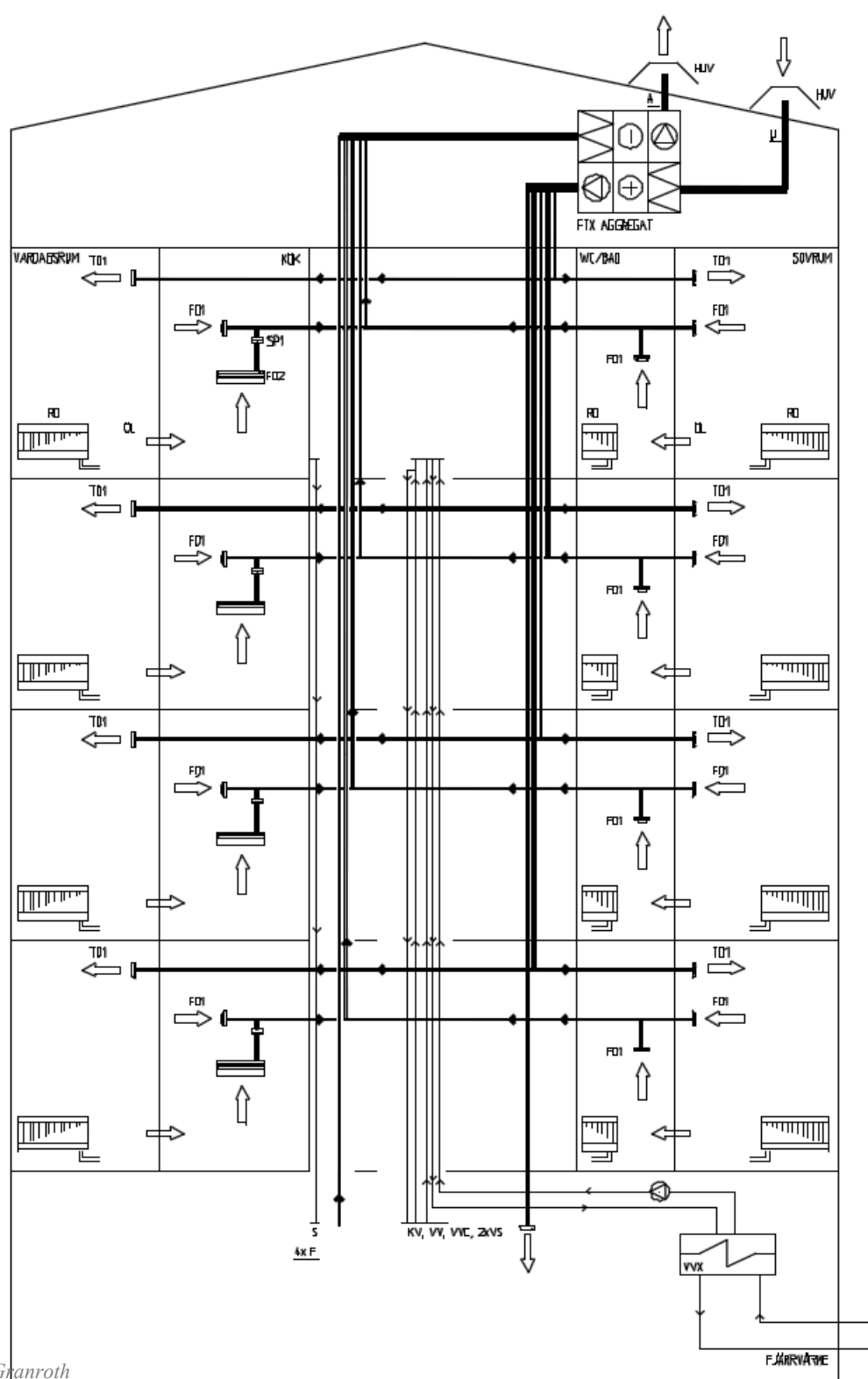


## Fire-protection

- Systems serving multiple fire cells
- Passive systems - primary pressure relief of the duct system.

Protection method for smoke spread is that the duct system pressure relief through the pressure relief damper ST22 in combination with stopped fan.

# Residential building – type 3



### Ventilation:

- Supply and Extract air system with energy recovery in the attic

### Energy recovery:

- Heat exchanger in the air handling unit

### Noise:

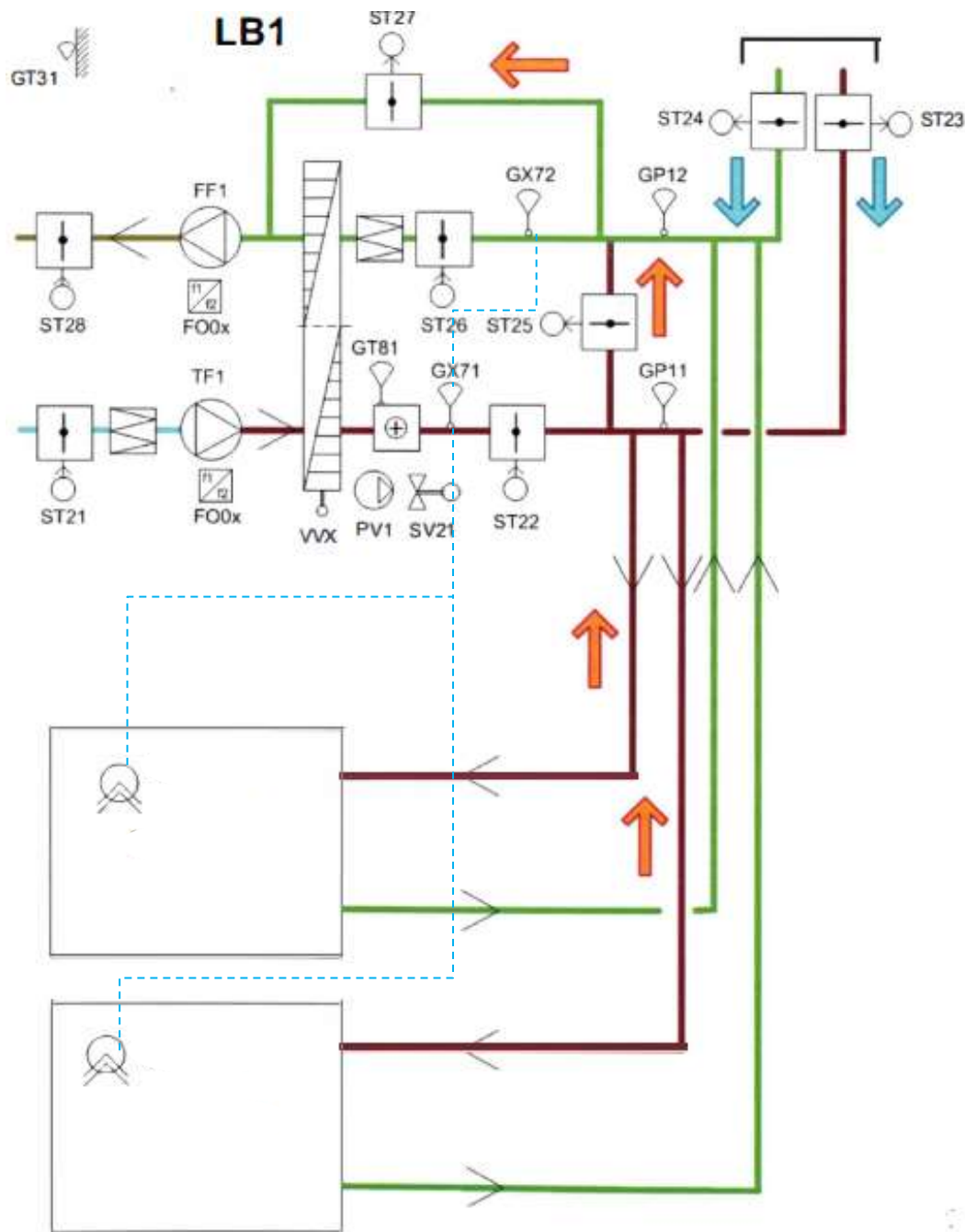
- Less noise than *Supply air device* in the façade.

### Feature summary:

A more complicated ventilation system than the *Extract air system with energy recovery*, but is a superior choice for busy roads or other nearby noise sources.

If you connect the extractor hood in the kitchen, to exhaust air. Then you should be selected cross heat exchanger, if one chooses rotary heat exchanger there is a high risk of transmission of cooking odors to the supply air.

# Flerbostadshus – Hus 3, luft



## Fire-protection

- Systems serving multiple fire cells
- Active systems - converted to exhaust with standard exhaust fan in operation with relieving the supply and exhaust air systems

Protection method for fire gas is converted to utilize the system with regular exhaust fan in operation in combination with the relief of common supply and exhaust duct.

The system solution is used when regular exhaust fan fails arising mixture temperature for 1 hour.

# Modern and energy-saving concept in a small residential buildings

## Single-family house

### Feature summary:

#### Ventilation:

*Extract air system with heat pump*

#### Heat:

Hydronic heating system with radiators

#### Source of heat:

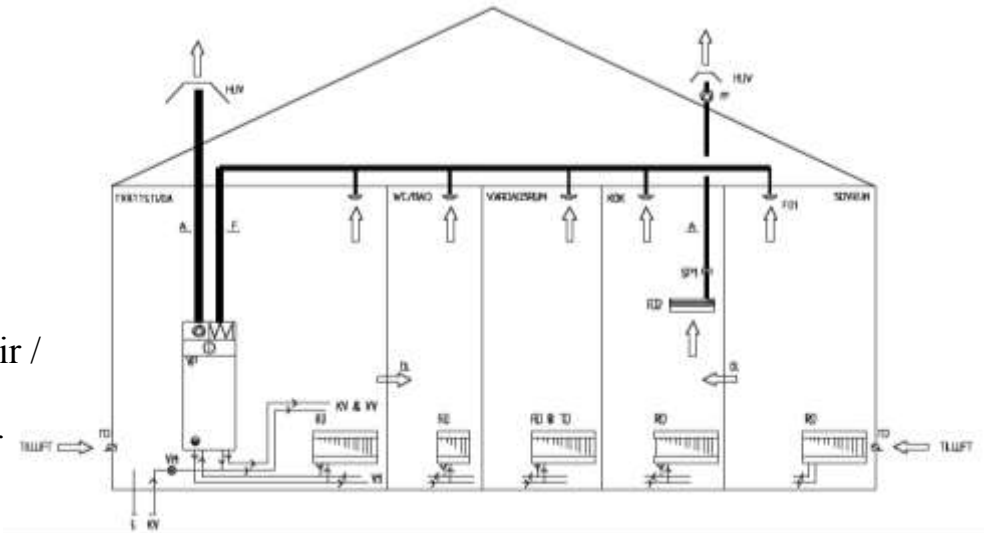
Heat pump with the additional heat source

#### Energy recovery:

Through exhaust air the heat pump model air / water

#### Noise:

*Supply air device in the façade gives higher noise*



Overview - 1 and 2

### Feature summary:

#### Ventilation:

*Extract air system with heat pump*

#### Heat:

Hydronic heating system with radiators

#### Source of heat:

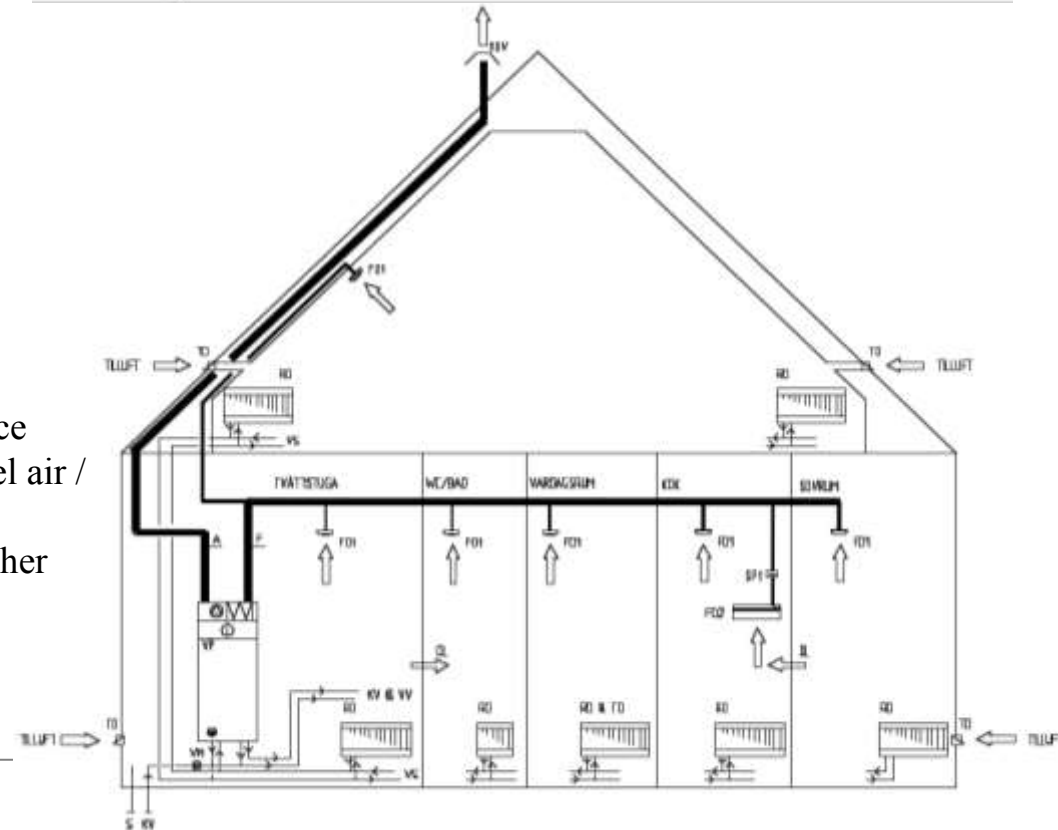
Heat pump with the additional heat source

#### Energy recovery:

Through exhaust air the heat pump model air / water

#### Noise :

*Supply air device in the façade gives higher noise*



# Modern and energy-saving concept in a small residential buildings

## Single-family house

### Feature summary:

#### Ventilation:

*Extract air system with heat pump*

#### Heat:

Electric radiators with central building control system.

#### Source of heat:

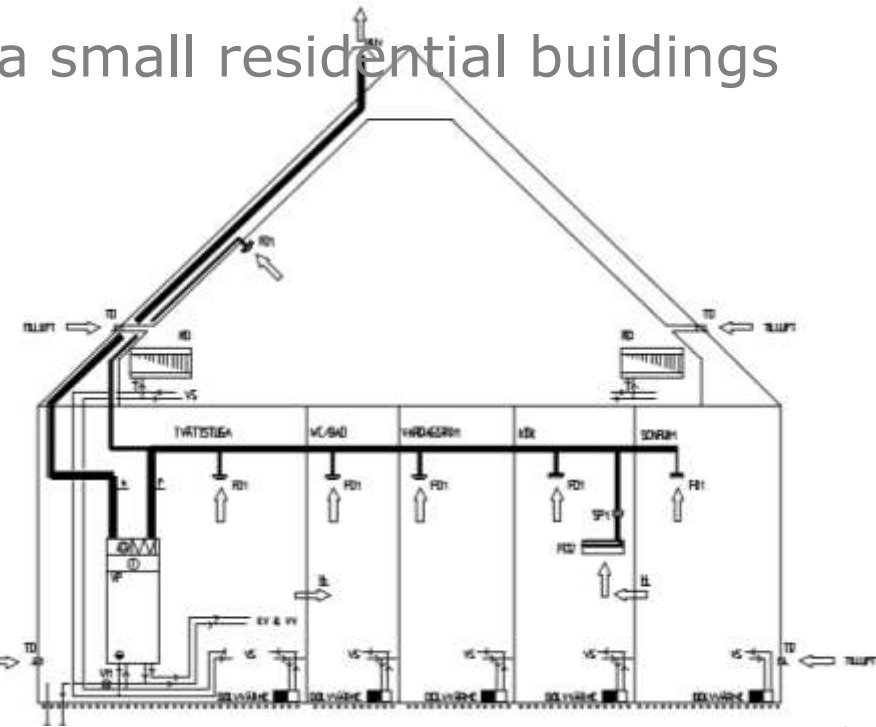
Electricity and heating of domestic water use to an exhaust air heat pump.

#### Energy recovery:

Through exhaust air the heat pump model air / water.

#### Noise:

*Supply air device in the façade gives higher noise*



Overview - 2 and 4

### Feature summary:

#### Ventilation:

*Supply and Extract air system with heat pump*

#### Heat:

Hydronic heating system with radiators

#### Source of heat:

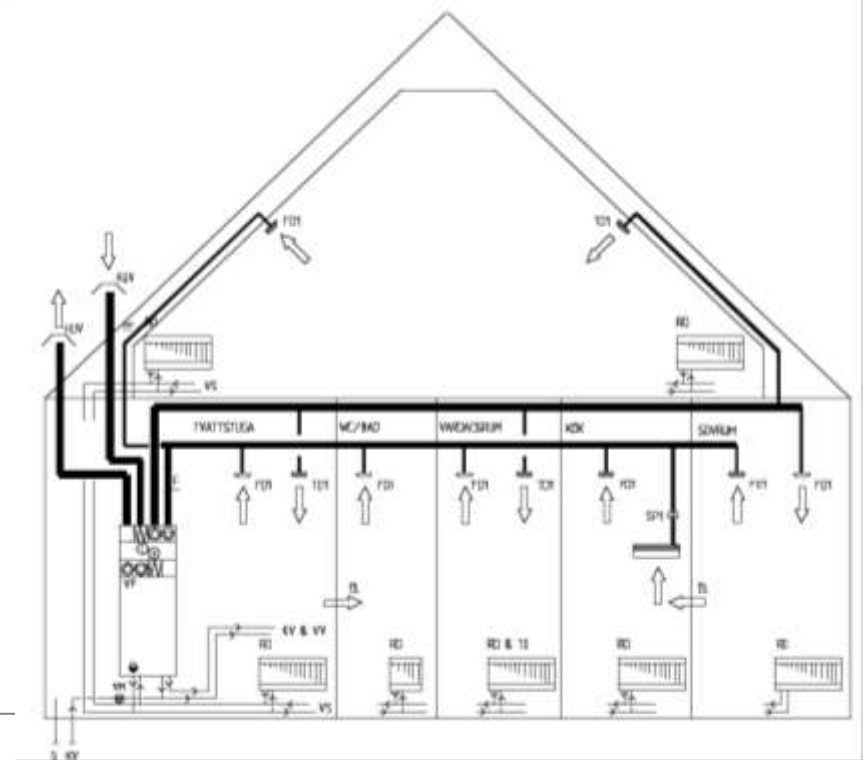
Heat pump with the additional heat source

#### Energy recovery:

Through heat pump model air/water

#### Noise:

Less noise then *Supply air device* in the façade.







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# Modern and energy-saving concept in a small residential buildings Single-family house

## Feature summary:

**Ventilation:**

*Supply and Extract air system with heat pump*

**Heat:**

Hydronic heating system with radiators and floor heating

**Source of heat:**

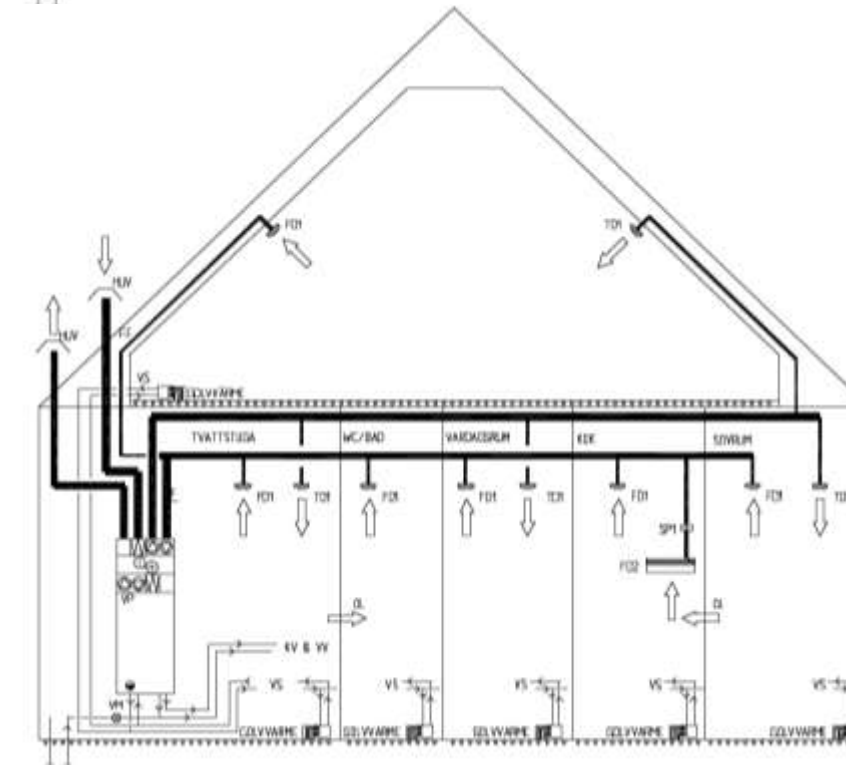
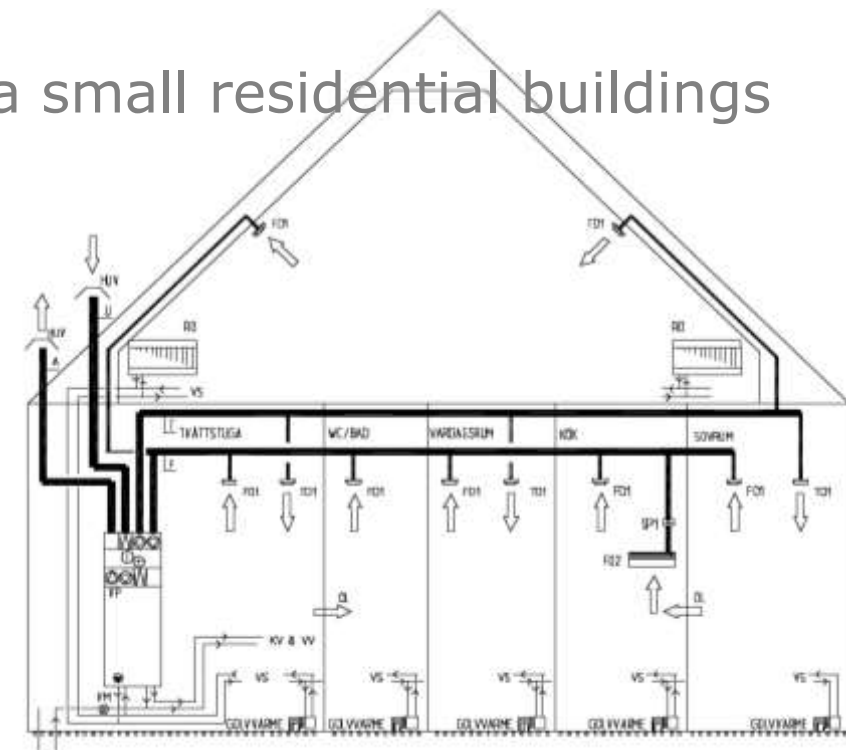
Heat pump with the additional heat source

**Energy recovery:**

Through heat pump model air/water

**Noise:**

Less noise than *Supply air device* in the façade.



Overview - 5 and 6

## Feature summary:

**Ventilation:**

*Supply and Extract air system with heat pump*

**Heat:**

Hydronic heating system with floor heating

**Source of heat:**

Heat pump with the additional heat source

**Energy recovery:**

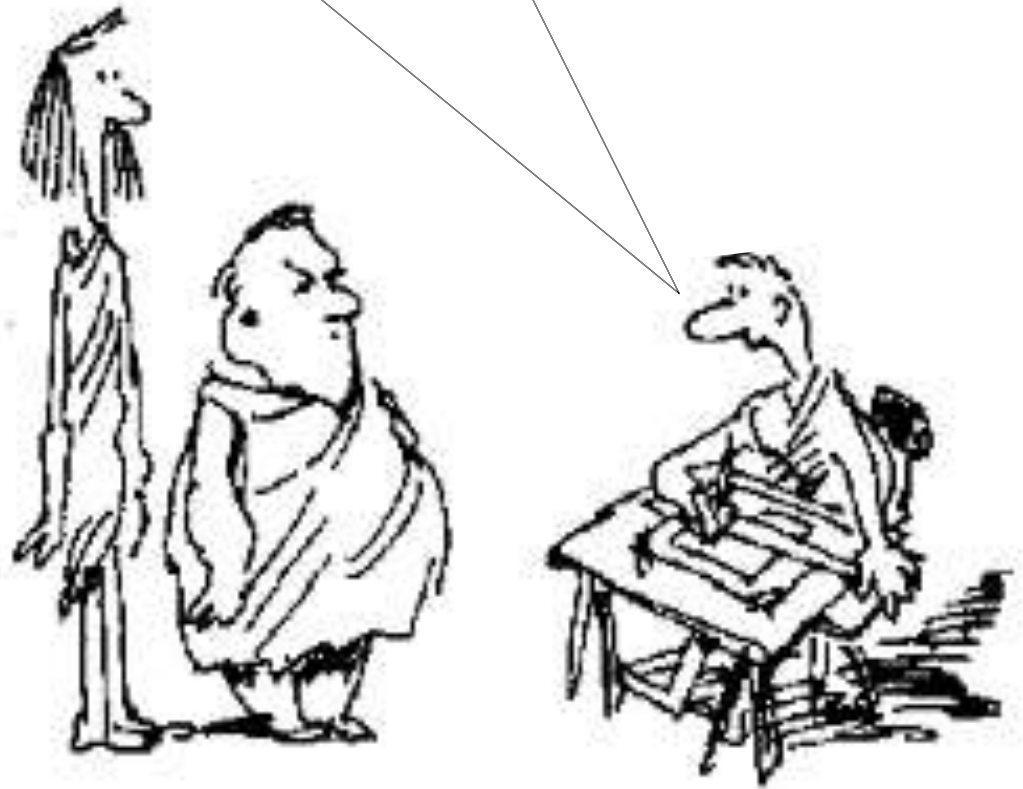
Through heat pump model air/water

**Noise:**

Less noise than *Supply air device* in the façade.



Understanding,  
not just facts and figures.



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