



## Introduction

The ordinary manual contains a description of individual tools in VIP-Energy. It is about how data is entered, an overview description of calculation functions and how results can be retrieved.

This tutorial is a complement with descriptions of how the tools can be used in different situations.

Other complements are 3 calculation examples available to download from [www.vipenergy.net](http://www.vipenergy.net).

## From drawing to calculation

VIP-Area is a complement program to VIP-Energy. VIP-Area is accessed from the VIP-energy main menu. You can start multiple instances of VIP-Area regardless of VIP-Energy license restrictions.

In VIP-Area you can compile the dimensions of the building. The program has a general overlay function so that one building part can be replaced by another in a command on a line.

The VIP-Area results are imported directly into VIP-Energy.

In construction projects, different construction and installation solutions may be investigated and therefore work with several different project files in parallel. When architectural execution as window areas changes, it is useful that the data can be updated by modifying an instance of VIP-Area and then using a command to update the data in each of the project files. In a project with more zones, the zones are updated in connection with each calculation and therefore you do not have to do this manually for each zone.

It is useful to first add total façade partitions with the most common outer wall type...

Annotation in VIP-Area	Description in VIP-Energy	Building part type	Orientation	Width	Height	Number	Area
		Wall type 1	SOUTH	17.8	22.2	1	

and then replace parts of the outer wall type with windows.

Annotation in VIP-Area	Description in VIP-Energy	Building part type	Orientation	Width	Height	Number	Area	
		Window type 1	SOUTH	1.4	1.4	23		
		Wall type 1	Window type 1	SOUTH	1.40	1.40	23.00	45.08
		Wall type 1	Window type 1	SOUTH	1.90	1.40	8.00	21.28
		Wall type 1	Window type 2	SOUTH	1.90	1.40	8.00	21.28
		Wall type 1	WD type 2	SOUTH	1.00	2.10	8.00	16.80
		Wall type 1	Entrance	SOUTH	1.40	2.10	1.00	2.94
		Wall type 1	Window type 1	WEST	1.40	1.40	24.00	47.04
		Wall type 1	Window type 2	WEST	1.40	1.40	8.00	15.68
		Wall type 1	WD type 2	WEST	1.00	2.10	8.00	16.80
		Wall type 1	Window type 1	EAST	1.40	1.40	17.00	33.32
		Wall type 1	Window type 2	EAST	1.40	1.40	15.00	29.40
		Wall type 1	WD type 2	EAST	1.00	2.10	16.00	33.60

If there are several wall types, one wall type can be replaced with another.



## 2- and 3-dimensional building parts

For example, in outer corners and window splays, the corresponding enveloping area is normally reported under 1D parts that are also included in the 2D part. The area that is then added to the 2D part should be removed from the 1D area. In Sweden it is normally the internal area that is used as a enclosing area, but in other countries the external area may be normal.

All measurements in [m]

Facades | Windows Doors | Parts towards ground | Roof/Floor parts | Inner parts | 2D parts | 3D parts | Floor area | Fresh air vents | Building parts properties

Annotation in VIP-Area	Subtract from Description in VIP-Energy	Building part type	Add to Description in VIP-Energy	Building part type	Orientation	Width	Length	Number	Area
	Wall type 1	Wall type 1	Window splay	Window splay	SOUTH	0.2	181.6	1	
	Wall type 1	Wall type 1	Window splay	Window splay	SOUTH	0.20	181.60	1.00	36.32
	Wall type 1	Wall type 1	Window splay	Window splay	SOUTH	0.20	52.80	1.00	10.56
	Wall type 1	Wall type 1	Window splay	Window splay	SOUTH	0.20	49.60	1.00	9.92
	Wall type 1	Wall type 1	Window splay	Window splay	SOUTH	0.20	7.00	1.00	1.40
	Wall type 1	Wall type 1	Window splay	Window splay	WEST	0.20	134.40	1.00	26.88
	Wall type 1	Wall type 1	Window splay	Window splay	WEST	0.20	44.80	1.00	8.96
	Wall type 1	Wall type 1	Window splay	Window splay	WEST	0.20	49.60	1.00	9.92
	Wall type 1	Wall type 1	Window splay	Window splay	EAST	0.20	95.20	1.00	19.04
	Wall type 1	Wall type 1	Window splay	Window splay	EAST	0.20	84.00	1.00	16.80
	Wall type 1	Wall type 1	Window splay	Window splay	EAST	0.20	99.20	1.00	19.84
	Wall type 1	Wall type 1	Window splay	Window splay	NORTH	0.20	240.00	1.00	48.00

Buttons: Add, Insert, Remove

For 2-dimensional building parts, specify width and length. The program excludes the resulting area from the building part type specified under "Subtract from".

In other cases such as edges on slab on grade, the corresponding area is not included under 1D parts, nor should that area be added to the enclosure area. This sets the width of the 2D part to zero and does not mark any building part type under "Subtract from".

The width and area indicated under multidimensional building parts has only an effect on the envelope area and U-value of the building. The energy calculation is not affected.

Under the Totals tab, the program compiles, among other things, data regarding properties for windows and doors. For example, windows can be used as a quantity for calculating thermal bridges in window splays under 2D building parts.

VIP-Energy export | Sum Windows Doors

Windows Doors Description	Facade type	Window type	Orientation	Number	Perimeter	Area
Wall type 1	Wall type 1	Window type 1	SOUTH	31.0	181.6	66.4
Wall type 1	Wall type 1	Window type 2	SOUTH	8.0	52.8	21.3
Wall type 1	Wall type 1	WD type 2	SOUTH	8.0	49.6	16.8
Wall type 1	Wall type 1	Entrence	SOUTH	1.0	7.0	2.9
Wall type 1	Wall type 1	Window type 1	WEST	24.0	134.4	47.0
Wall type 1	Wall type 1	Window type 2	WEST	8.0	44.8	15.7
Wall type 1	Wall type 1	WD type 2	WEST	8.0	49.6	16.8
Wall type 1	Wall type 1	Window type 1	EAST	17.0	95.2	33.3
Wall type 1	Wall type 1	Window type 2	EAST	15.0	84.0	29.4
Wall type 1	Wall type 1	WD type 2	EAST	16.0	99.2	33.6
Wall type 1	Wall type 1	Window type 1	NORTH	40.0	240.0	89.6
Wall type 1	Wall type 1	WD type 1	NORTH	8.0	49.6	16.8

Sorting:  Description,  Facade type,  Window type,  Orientation

You can choose how the summary should be divided. In some cases, there may be different types of spals for different walls and windows.

For 3-dimensional building parts, the number of building parts and the area for each building part are indicated.



VIP-Area assumes that a building part has one orientation. Outer corners have two orientations however, but this is solved by distributing the length of the 2-dimensional building part on two rows with different orientations.

The input window for "Description in VIP-Energy" is used only exceptionally when clarifying the accounting or grouping input data.

When VIP-Area is used to describe the building, the "Building" input window in VIP-Energy is not used to change quantities. In that window, only input is used for the turning of the building, the number of apartments and the type of soil, data that is not retrieved from the VIP-Area.

Since all data concerning building parts are overwritten in VIP-Energy when imported from VIP-Area, the tab "Building part properties" is available in VIP-Area where you can link building part properties to description, building part type and orientation. If these properties are made to the VIP-Energy Building Dialogue, the changes will be retained when you exit the dialog, but data will be restored from VIP-Area the next time you enter the dialog.

The option "Reference building part" in the 2D calculation is not used when data is entered via VIP-Area. In general, there is no longer any reason to use the function with reference building part. This feature remains mainly in order to update older files.

## Calculation of multidimensional building parts

Multidimensional building parts are sometimes called thermal bridges, but it can often also be details that provide an extra insulation capacity.

There is some literature information that thermal bridges could be estimated as a percentage mark-up based on  $U\text{-value} \times \text{Area}$  for one-dimensional building parts. We advise against that approximation and an important reason is that there is no logical relationship between change of thermal conductance in one-dimensional and multidimensional building parts.

For example, the replacement of insulation materials in walls, ceilings and floors does not change the flow of heat through balcony fixings.

The presence of thermal bridges differs between different types of construction technology. With light stud walls, there is more room for insulation than with concrete frame. The  $U$ -value of the light wall is therefore often relatively low compared to heavier structures. But instead, studs and apartment-separating walls can be significant thermal bridges that are not associated with concrete structures where the insulation goes unbroken past such connections.

We therefore recommend that each type of thermal bridge be calculated based on the chosen design type. The list shows examples of details that should be checked.

- Outer corner
- Window splays
- Plinths, floor angles
- Roof angles
- Balcony fixings
- Floor edges and apartment-separating walls



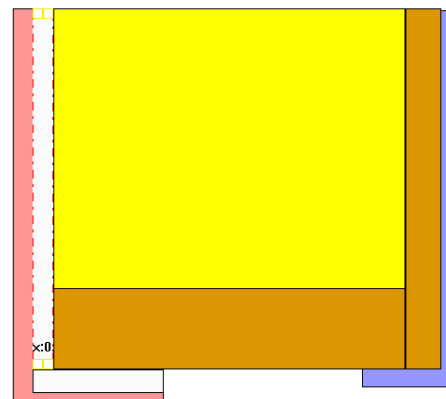
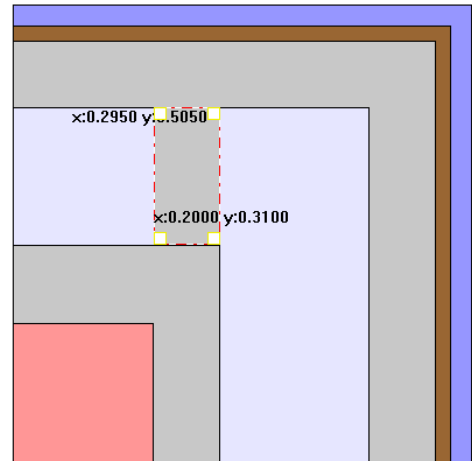
## 2D building parts calculation

Symmetrical corners are best built up with a number of squares that lay on each other. Outdoor air is placed at the top of the list and indoor air at the bottom and in between the materials from outside to inside.

The figure on the right shows the outer corner of a climate shell structure with the outside and inside of Leca with intermediate insulation. Smaller pieces of Leca connecting the inner and outer Leca layer have been solved with a block laid on over the insulation.

It can generally be useful to lay a larger area of a commonly used material and then cover it with smaller areas of other materials. In the case of the outer corner, one option would have been to put on two separate parts of insulation as it is Leca at the bottom from the bottom left corner up to visible Leca at the top right.

The figure on the right shows a window splay in a wooden stud construction. The essential thing is to get with the right thickness and the materials that can cause extra heat flow. In this case, the wooden stud leads heat around the window frame. When calculating splays, a gap is left between indoor air and outdoor air where the window frame is.



## 3D building parts calculation

Balcony slabs casted to the floor with intermittent concrete blocks are typical examples of thermal bridges that are calculated in three-dimensional. The example that comes with VIP-Energy at the installation represents a normal design without additional measures to reduce the thermal bridge. The size of the intermittent concrete and the amount of reinforcement depends on the size of the balcony, etc. and should be checked against the designer in each case.

With stricter requirements for both energy and internal surface temperatures, special prefabricated fixing elements are increasingly used for balconies containing thermal bridge brakes. The supplier reports a psi value W/mK that can be used. In those cases, it may be easier to create a two-dimensional model with the right psi value by fitting insulation between a balcony plate and floor.

## Underfloor heating

Underfloor heating is simulated with the function of built-in heat layers. The function affects energy use by adding heat via a heat storing building part. The negative effects of this are more noticeable the more the building's power needs vary. In case of increased heating demand, an additional amount of energy is added to the construction before heat begins to be delivered to the building. In case of reduced heat demand, stored energy is emitted which results in an overtemperature that provides additional energy use.

For heat layers in floors to outside or ground, the transmission increases by giving a higher temperature to part of the climate shell than the room air. Energy consumption with underfloor



heating can be sensitive to how the construction is built up. The heat resistance between heat layer and room air is sensitive as a greater resistance results in a higher temperature in the heat layer that affects both stored heat and transmission. Wooden floorings are usually laid on a layer of foam that has a low thermal conductivity. Thick wooden floors usually lead to a noticeably increased consumption. It may be important to include all the details.

You can choose how the heating power is to be distributed among different parts of the underfloor heating and normally distribute it in relation to the area of the building part. This results in even warm floor surfaces. Where part of the building is heated with radiators, the distribution of power requirements between underfloor heating and radiators shall be calculated. In this calculation, transmission from the floor to outside should not be included but only that emitted heat from the floor surface.

As an alternative to controlling the underfloor heating power based on the heat requirement of the zone, the power can be controlled against constant surface temperature. The function is intended for simulation of comfort underfloor heating that is disconnected from the room's power requirements but depending on the room temperature. It is advisable to combine the function with the fact that the bathrooms are divided into separate zones with transfer air from the rest of the home to the bathroom.

When calculating with multiple zones, the program does not support underfloor heating in the zone separation building part. If the zone is supplemented with the same building part with the INNER orientation, the effect of heat storage and transmission to the outside of the building is added, but the transmission to the outside is not added to the other zone, but goes away as a regulation loss.

## Impact from surrounding environments

Enclosing building parts around a zone can be oriented towards other environments with INNER, TEMP and other zones. The TEMP function should only be used for adjacent zones with constant temperature. A case in point is cold storage rooms. In cases with adjacent zones with similar temperatures, INNER is used. In cases where there is uncertainty how the climate will be in the adjacent zone, it is safest to calculate with several zones.

## Multi-zone calculation

### Zoning

For buildings with only heating and with homogeneous climate requirements, it is not normally necessary to divide into several zones. For buildings with comfort cooling, the load from solar radiation moves around the building and some parts may have cooling needs while others have heating needs. In this case, it is advisable to divide the building into at least 4 zones, one per façade. In wider buildings with a core that does not have direct contact with facades, a separate zone for the core may be appropriate.

In general, rooms with special requirements or loads should be divided into separate zones. A case in point is server rooms in office buildings.

In many cases, it may also be advisable to put unheated spaces as crawl spaces in separate zones. This is especially true if the crawl space is indoor air vented or participates in the energy system in some other way.



## Supply centres

Centers are used to allocate a limited power capacity to different zones. An unlimited number of centers can be added, but normally only make sense with a common one for all zones.

In connection with heat supply and cooling supply, it is only a question of using central supply if the power is limited. This can occur, for example, in follow-up calculations when heating or refrigeration is insufficiently dimensioned.

For calculation with a heat pump center that supplies several zones, the function facilitates handling. The program distributes the available power to the zones in relation to power requirements.

## Ventilation

Features for time-controlled and temperature-controlled ventilation include a package of tools for simulation airflows and recovery.

There is no categorization of the type of system such as exhaust air or balanced ventilation, but the function is a consequence of how you choose to insert the input.

## Supply air temperatures

You set temperature requirements for supply air only if there are requirements in reality. In offices and homes, it is common to limit the temperature downwards for comfort reasons. If the building is cooled with maximum supply air temperature regardless of room temperature, the maximum permissible supply air temperature function is used. If the cooling power is controlled by the room temperature, the requirement of the highest room temperature is set in the operating case catalogue.

If you choose a simpler control and do not link recovery to heating needs in rooms, a higher value of the minimum supply air temperature means that the recycling is used to a greater extent. A sharp increase in supply air temperature leading to overtemperature in the room may result in increased consumption. You can use VIP-Energy to optimize these types of settings of control functions.

## Recovery

### Heat exchange

Energy efficiency refers to the proportion of thermal energy in the extract air that is recovered. There are different efficiencies from manufacturers that are not always well defined or easy to understand.

The efficiency measured according to the EN308 standard is well defined and that is the value to be chosen. It is the thermal efficiency with balanced airflows and without elements of condensation and latent recycling. In these contexts, heat of evaporation is called latent energy. When condensing moisture in heat exchangers, heat is released which dampens the temperature decrease in the exhaust air and raises the temperature in the supply air.

If the temperature in the exhaust air is lowered to below freezing point, the condensation water can freeze and stop the air flow. This is especially true in plate heat exchangers and the problem is not as large in rotating exchangers or heat storage package exchangers. Only the moisture added to the room air can condense in heat exchangers.



The exchanger must then be defrosted and this can be carried out more or less efficiently. In VIP-Energy, defrosting is simulated automatically if calculation is made according to EN308. Otherwise, defrosting can be simulated manually by lowering the efficiency. The lowering can start at a few degrees below zero and be lowered more with a falling temperature. Lowering by 5-10 % at -20 °C should be sufficient.

## Return air

When a ventilation unit supplies a single premise or an individual activity, return air is sometimes used. The reason is usually that the supply air is used to cool, to heat, to humidify or dry, but that there is no need to supply the same amount of outdoor air as the need for air conditioning.

In some cases, in addition to the return air function with mixing dampers, there is a heat exchanger that recovers the heat from the part of the extract air flow that is not returned as supply air. Bathhouses are a case in point of operation where this type of installation is common. In some cases, there is also a heat pump last in the exhaust air flow.

Combinations of return air and exchange can in most cases be simulated according to the real function by combining the tools available under control functions for ventilation and with heat pumps.

## Airflows between different zones

### Transfer air

Transfer air from one zone to another is dissolved with a combination of tools.

The zone calculation dialog window specifies the zones from which air should be retrieved.

In control cases for time-controlled ventilation, the ventilation unit is set to retrieve "outdoor air" or "extract air" from other zones and these units will then receive the mix of air defined in the zone calculation dialog. The term "Outdoor air" may seem irrelevant when the air is drawn from other zones, but it is a way of defining the unit connection to which the air mix is connected.

There is no internal connection of the size of the airflow in the calculation function between units in the different zones. It is not necessary for the calculation, but the only essential is the temperature and moisture content of the air reaching the unit in the receiving zone. However, for simulation of a real case, the exhaust air flow in one or more zones shall correspond to the supply air flow in another zone. It is the same real fan that occurs as the exhaust fan in the unit in the emitting zone and as a supply air fan in the unit in the receiving zone. In order to avoid double counting electricity consumption, efficiency and pressure increase are only given in the zone where it is the supply air fan. If the electricity consumption is put in the exhaust fan, the electrical energy to the fan and the temperature increase will not benefit the receiving zone.

### Common ventilation unit for several zones

In some cases, the same ventilation unit serves several zones with different climatic conditions. The mix of air from different zones assembled in the zone calculation dialog window is connected to the extract air side of the unit.

In control cases for time-controlled ventilation, specify whether a unit should collect extract air from the mix defined in the zone calculation or whether the extract air should be taken from its own zone.



## Examples and advice on the application of calculation 18(18) in VIP-Energy

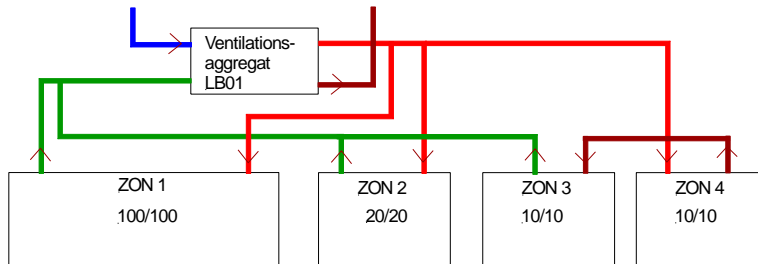
8(18)  
2020-08-02

The total capacity of the central ventilation unit is divided into the zones it serves.





Exemplet nedan visar 4 zoner som på olika sätt kopplats till ventilationsaggregatet LB01.



Connections between zones

Airmix between zones

Zone A "Indoor"	Share air from zone B to A [%]	Zone B "Outdoor"
ZONE 1	15	ZONE 2
ZONE 1	77	ZONE 1
ZONE 2	8	ZONE 3
ZONE 2	8	ZONE 3
ZONE 4	77	ZONE 1
ZONE 4	15	ZONE 2
ZONE 4	8	ZONE 3
ZONE 3	100	ZONE 4

The percentages in the table refer only to the temperature and moisture content of the air and do not relate to the size of the airflow. Air flows are inserted into input dialogues for time-controlled ventilation in each zone.

The airflow in LB01 is 130 l/s. Of this, ZONE 1 contributes 100 l/s ,77%, ZONE 2 by 20 l/s 15%, and ZONE 3 by 10 l/s, 8%. ZONE 4 does not contribute to the extract air flow to the unit, but takes in supply air.

In the case that the air mix is to be connected to the extract air in a unit, the remaining air properties are taken from the own zone. If the air mix is added directly into a zone such as "Outdoor air", the remaining temperature and humidity content are taken from the outdoor air.



Control cases time depending ventilation

Lowest supply air temperature  
 Activate  
Supply air temperature Op.point 1: 18 Op.point 2: 18  
Outdoor temperature °C Op.point 1: -20 Op.point 2: 20

Highest supply air temperature  
 Activate  
Supply air temperature °C Op.point 1: 0 Op.point 2: 0  
Outdoor temperature °C Op.point 1: 0 Op.point 2: 0

Heat exchanger  
 Activate  
 Fixed efficiency  
 Efficiency acc to EN308  
Air flow: 100 l/s  
Efficiency: 75 %  
Out door temperature Op.point 1: 0 Op.point 2: 0

Exchanger type  
 Counter current plate exch.  
 Single cross current plate exch.  
 Double cross current exch.  
 Rotating exch.  
 Run-around coil exch.  
 Heat storage package exch.

Defrost method  
 On demand  
 Limited exhaust air temperature  
 Preheating of out door air  
 Time controlled  
 No defrost  
Time margin: 50 %  
Number of sections: 1

Control case  
Ctrl Unit 1

Recovery at heat demand in room  
 Recovery at cooling demand in room  
 Recovery at cooling demand in supply air  
 Outdoor air from other zones  
 Extract air from other zones  
 Connected to water heating system  
 Connected to exhaust air heat pump

Heat pump  
Katalog

Recovery refer to heat exchange and air recirculation  
Lowest outdoor temperature at operation point 1  
Heat exchange and recirculation is normally controlled by heating- and cooling demand.  
Fixed efficiency is independent of heating and cooling but depending on outdoor temperature.

Air recirculation  
 Activate  
 Fixed recirculation %  
Recirculation % Op.point 1: 0 Op.point 2: 0  
Outdoor temperature °C Op.point 1: 0 Op.point 2: 0

Flow adjustment  
 Activate  
Flow % of schedule Op.point 1: 0 Op.point 2: 0  
Outdoor temperature °C Op.point 1: 0 Op.point 2: 0  
 Constant fan pressure  
 Constant flow resist

Info

Extract air ducts  
Length: 30 m  
Heat conductance: 0.4 W/mK

Supply air ducts  
Length: 30 m  
Heat conductance: 0.4 W/mK

OK Cancel

Input for ZONE 1, ZONE 2 and ZONE 4. In the dialogue "Control case time-controlled ventilation" is checked "Extract air from other zones" and the efficiency is marked for heat exchange.



Control cases time depending ventilation

Lowest supply air temperature  
 Activate Op.point 1 18 Op.point 2 18  
Supply air temperature °C  
Outdoor temperature °C -20 20

Highest supply air temperature  
 Activate Op.point 1 0 Op.point 2 0  
Supply air temperature °C  
Outdoor temperature °C 0 0

Heat exchanger  
 Activate  
 Fixed efficiency  
 Efficiency acc to EN308  
Air flow 10 l/s.m<sup>2</sup>  
Efficiency 75 0  
Out door temperature 0 0

Exchanger type  
 Counter current plate exch.  
 Single cross current plate exch.  
 Double cross current exch.  
 Rotating exch.  
 Run-around coil exch.  
 Heat storage package exch.

Defrost method  
 On demand Time margin 10 %  
 Limited exhaust air temperature 0 °C  
 Preheating of out door air 0 °C  
 Time controlled 0 °C 50 %  
 No defrost Number of sections 1

Control case  
FX  
VADRING  
FX

Recovery at heat demand in room   
Recovery at cooling demand in room   
Recovery at cooling demand in supply air   
 Outdoor air from other zones  
 Extract air from other zones  
 Connected to water heating system  
 Connected to exhaust air heat pump

Heat pump  
Katalog

Recovery refer to heat exchange and air recirculation  
Lowest outdoor temperature at operation point 1  
Heat exchange and recirculation is normally controlled by heating- and cooling demand.  
Fixed efficiency is independent of heating and cooling but depending on outdoor temperature.

Air recirculation  
 Activate  
 Fixed recirculation % Op.point 1 0 Op.point 2 0  
Recirculation %  
Outdoor temperature °C 0 0

Flow adjustment  
 Activate Op.point 1 0 Op.point 2 0  
Flow % of schedule  
Outdoor temperature °C 0 0  
 Constant fan pressure  
 Constant flow resist

Info

Extract air ducts  
Length 0 m  
Heat conductance 0 W/mK

Supply air ducts  
Length 0 m  
Heat conductance 0 W/mK

OK Cancel

Input for ZONE 3 that is not involved and share supply air from LB01 but takes Outdoor air from ZONE 4 as supply air.



Time scheduled ventilation system

Ventilation unit	Supply air fan		Extract air fan		Control case	Time schedule
	Pressure. Pa	Efficiency %	Pressure. Pa	Efficiency %		
Unit 1	500	60	400	60	Ctrl Unit 1	LB Kontor
Unit 1	500.0	60.0	400.0	60.0	Ctrl Unit 1	LB Kontor

Monday's Tuesday's Wednesday's Thursday's Friday's Saturday's Sunday's

Supply air I/s	Extract air I/s	From week	To week	Start hour	End hour
100.0	100.0	1	53	0	24

Flow units:  
 ACH  
 l/s  
 m³/h  
 l/s.m²  
 m³/hm²

Copied from:  
Mondays  
Tuesdays Mondays  
Wednesdays Mondays  
Thursdays Mondays  
Fridays Mondays  
Saturdays Mondays  
Sundays Mondays

Hour: 0 to 24  
Week: 1 to 53

OK Cancel

For ZONE 1, the airflow is specified to 100 l/s



Time scheduled ventilation system

Ventilation unit	Supply air fan		Extract air fan		Control case	Time schedule
	Pressure. Pa	Efficiency %	Pressure. Pa	Efficiency %		
Unit 1	500	60	400	60	Ctrl Unit 1	Office
Unit 1	500.0	60.0	400.0	60.0	Ctrl Unit 1	Office

Monday's | Tuesday's | Wednesday's | Thursday's | Friday's | Saturday's | Sunday's

Supply air l/s	Extract air l/s	From week	To week	Start hour	End hour
20.00	20.00	1	53	0	24

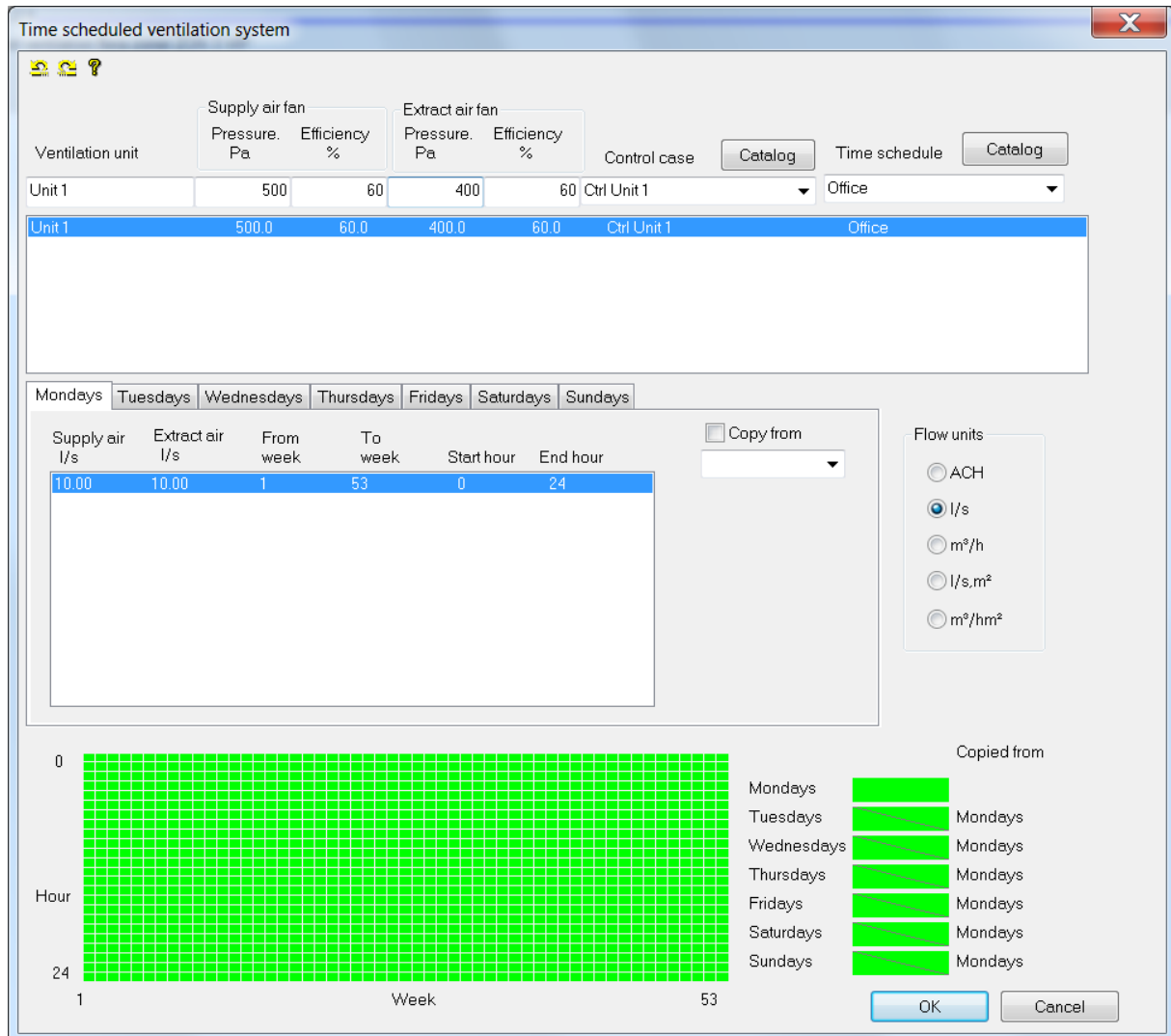
Flow units:  
 ACH  
 l/s  
 m³/h  
 l/s.m²  
 m³/hm²

Copied from:  
Monday's [Green] Monday's  
Tuesday's [Green] Monday's  
Wednesday's [Green] Monday's  
Thursday's [Green] Monday's  
Friday's [Green] Monday's  
Saturday's [Green] Monday's  
Sunday's [Green] Monday's

Hour: 0 to 24  
Week: 1 to 53

OK Cancel

For zone 2, 20 l/s is specified



For ZONE 3 and ZONE 4 10 I/s.

In ZONE 4, it is necessary to indicate both supply air flow and extract air flow on the same unit in order for the program to calculate heat exchange.

For ZONE 3 that only fetches air from another zone without heat exchange supply air and exhaust air as an alternative is shared on different units. It will be the same result with a unit without recycling as a separate supply air fan and exhaust fan.

### Combination of units

In cases where the same ventilation unit has significantly different functions different times or outdoor temperatures that are not covered by available tools, this can be simulated by creating multiple units.

Units can be controlled by time schedule or controlled against outdoor temperature with the airflow control function in the control case dialog.

### Temperature controlled ventilation

The function is used when the air flow to the outdoor air and exhaust air is varied due to varying cooling needs.



The dialogue is the entrance to two separate functions and it is likely passive forced that is the most useful. With it you can let the ventilation start if the room temperature is above a level while the outdoor temperature is low enough to cool. The setpoint temperature for starting the function can be varied in time in operation case dialog.

In combination with heat storing buildings that are normally only ventilated during the day, the function can significantly reduce cooling requirements.

It is less common for outdoor air flow to be varied in connection with increased cooling requirements even if it occurs.

If you want to block temperature-controlled ventilation at certain hours, you can insert a time-controlled flow with 100% return air without temperature requirements or pressure in fans. The time-controlled flow has then prevented the force of temperature-controlled flow.

In many cases, only the return air flow and not the outdoor air flow is increased when needed to cool. In this case, only electricity consumption to fans is affected. The ventilation then basically functions as a fan convector with cooling.

## Heating system

### System temperatures

The supply temperature and return temperature data are only active in combination with heat pumps and solar collectors. There is no connection between the supply temperature and the temperature in the underfloor heating layer. It is up to the user to customize the input.

For calculation with underfloor heating, the supply temperature can usually be kept lower than when heating with radiator systems and this is positive in combination with heat pumps and solar collectors.

Normal temperature difference between supply temperature and return and in heat pumps is 7-10 °C. In the underfloor heating system, this difference is reduced to 3-5 °C with a separate shunt and circulation pump with higher flow rate than that which can be taken through the heat pump.

The return temperature that goes to the heat pump is the same as the return from the underfloor heating and the supply from the heat pump is thus 7-10 °C higher.

Therefore, even if the underfloor heating operates at 35/30 °C, the heat pump will operate at 40/30 °C.

### Regulation losses

Regulation of heat in the real building is never entirely accurate. This is especially true for water-borne heat. The power capacity of the heating system must respond to the need that arises when there is no other heat supplement such as solar radiation. But in energy-efficient buildings, solar heat, operation energy and person heat are at times responsible for a significant proportion of heating demand. Heat release from pipes may also result in some unwanted temperature increase in addition to the requirement. For an even temperature and good energy economy, it is important that the heat from the heating system is regulated down when the room temperature rises. Self-acting thermostatic valves on radiators need a few degrees raise to close completely. Often there must also



be some glitches before they start to close because the temperature near the radiator may be a little higher than in the room in general.

To cover this type of incompleteness in the calculation, it is usually sufficient to raise the minimum room temperature by 2 °C. This is done in the dialogue for heat supply.

Electric radiators have a more precise control, but without power control to the radiators depending on outdoor temperature there is a risk of excessive overconsumption by airing heat away.

Underfloor heating systems are usually regulated electronically with temperature sensors in each room that close valves at a small temperature rise, but even that type of regulation has a temperature gap between closing and opening which justifies an increase in the minimum temperature of 1 °C. In the simulation of underfloor heating with its heat inertia, there are regulation losses that the program takes care of. In case of increased power demand, the materials in the floor must first be heated before heat is released to the room. When the heating demand decreases, the floor sometimes emits more heat than necessary, resulting in overtemperatures and additional energy consumption. Large heat capacity in the floor structure and high power per floor area increase the regulation losses.

## Hot tap water

As with heating systems, cold water temperatures and hot tap water temperatures only have an impact in combination with heat pumps and solar collectors. In single-family houses this is not a major problem when you have more control over how heat pumps work. If the condenser power of the heat pump is sufficient, the compressor normally produces all hot tap water.

In apartment buildings, however, attention should be paid to how the system is structured. There is a risk that additional heat from electric cartridge heater or district heating will always replenish heat if the heat pump is unable to raise the temperature sufficiently on outgoing hot tap water. The result is that part of the consumption and all heat loss from pipes is supplied with primary heat. To guard, the hot tap water temperature can be set a few degrees higher than the maximum temperature of the heat pump until you are sure that the real system has an optimal function.

Losses from pipelines depend on the length and insulation of the piping. Normally, the outer diameter of the insulation is approximately twice the pipe diameter and heat flow 0,3-0,4 W/mK.

## Activity

Dimensioning calculations for comparison with norm requirements depend on the impact of the activities carried out in the building. Work is underway to standardize values for different activities within a project called Sveby and is now also listed Swedish National Board of Housing, Building and Planning publication BEN. Information is available at [www.sveby.org](http://www.sveby.org).

Values is worked through for homes, offices and education premises. The office publication also contains some values for other types of activities.

The values discussed in Sveby are activity energy, hot tap water and temperature setpoints. Moisture supplements from activity have not been treated but we hope it can be addressed. Moisture supplements also called latent energy affect energy recovery in exhaust heat pumps. When simulating room climate, moisture supplementation and relative humidity affect the calculation of PPD index. Normally the moisture content in homes is about 2 g/kg higher than the outdoor air and





normally the air renewal is  $0.35 \text{ l/s m}^2$  or  $0.42 \text{ g air/s m}^2$ . In addition to ventilation, airing equivalent to  $0.025 \text{ l/s m}^2$  or  $0.03 \text{ g/s m}^2$  can be expected. Normally moisture supplements,  $2\text{g/kg}$ , can be translated with air renewal  $0.45 \text{ g/s m}^2$  into input  $0.9 \text{ mg/s m}^2$ . In offices it can be assumed that the moisture supplement is approximately  $0.4 \text{ mg/s m}^2$  as in this case only moisture from persons and the thermal personal load is  $1 \text{ W/m}^2$ .

## Comfort cooling

The program has three options for cooling supply. Computationally, passive cooling and district cooling are equivalent. The only difference arises from the presentation of energy costs and comparison with energy requirements where passive cooling is not taken into account.

Passive cooling can be used for simulation of free energy source as energy well.

It is also convenient to use passive cooling as a replacement for airing, and sunscreen to limit overtemperatures. It is reasonable to assume, for example, that measures are being taken in homes to limit room temperature when it reaches a certain level. Surveys show that most people find it uncomfortable with room temperatures above  $27 \text{ }^\circ\text{C}$ . If the temperature is not limited in the calculation, there is a risk that heat storage in materials will be overestimated and that too low energy requirements will be calculated.

Chillers generally have a simpler function compared to heat pumps and inputs are therefore also greatly simplified in VIP-Energy. As a rule, the cooling water temperature is kept constant and the coefficient of performance therefore varies mainly against the outdoor temperature. The value of the coefficient of performance for cooling is 1.0 lower than COP for heating factor. If the cooling water temperature is  $10 \text{ }^\circ\text{C}$  and the condenser temperature  $50 \text{ }^\circ\text{C}$ , the COP for heating is similar to that of a geothermal heat pump with a supply temperature of  $40 \text{ }^\circ\text{C}$  and the refrigerant temperature  $0 \text{ }^\circ\text{C}$ , approximately 4. The COP for cooling is then 3.

With falling outdoor temperature, the temperature gap between outdoor temperature and cooling water temperature decreases and the COP increases.

When the outdoor temperature is a few degrees below the cooling water temperature, in some chiller solutions you can cool the water directly against the outdoor air.

Request the COP values from the designer in each case.

## Other Standards (Only available in Swedish version)

In the dialog window for comparison against BBR-related requirements, there is a department called "Other Standard". There you can specify project requirements that, for example, connect to requirements according to the SGBC.

PPD index is calculated according to the international standard SS-EN ISO 7730:2006. The PPD calculations are based on calculations of air temperature, surface temperatures and relative humidity validated according to Ashrae 140-2007, which is the international validation standard for energy calculation programs.

Solar thermal load and solar heat factor are requirements defined by SGBC.



## Solar cells

The program has a well-developed function for calculating electricity production in solar cells. The user can add an unlimited number of solar cells with any orientation. It is even possible to mix different types of solar cells.

Efficiency and coefficients to take into account cell temperature and solar intensity are primary inputs. For many products, efficiency and temperature coefficient are presented in data sheets. The standard value is the power produced by solar cells at  $1000 \text{ W/m}^2$  solar irradiation and  $25 \text{ }^\circ\text{C}$  cell temperature.  $140 \text{ W/m}^2$  therefore corresponds to 14% efficiency.

Information for how efficiency varies with solar intensity is not as uniform as information about temperature dependence. As an additional help, the program reports graphically how the efficiency varies with temperature and solar intensity.

It is possible to provide a heat capacity to the solar cell. Without additional measures, the cell's heat capacity is negligible and there may be a potential in mounting solar cells against a heat inertia e.g. concrete wall and thus keep down the temperature during the time solar electricity is produced.

There is also a possibility to store electricity in accumulators. The capacity of a car battery with  $12 \text{ V}$   $80 \text{ Ah}$  is equivalent to  $960 \text{ Wh}$ . When charging batteries, some of the energy is lost. Normal battery efficiency is 70%. As with all other types of energy losses, the residual energy is converted into heat. The development of heat is not taken into account.

The program calculates for each hour how much of the electricity produced can be used within the building. The surplus not used instantaneously or charged in accumulators may be exported to the mains provided that the building is connected. Without connection to the electricity grid, only the energy used internally in the building is extracted. The energy used in the building is divided into heating, power supply and process energy. When comparing against BBR-related requirements, solar power used for activity energy is not included.