

Från SOL-el till Innovationsagenda

Energicafé 10 april 2019

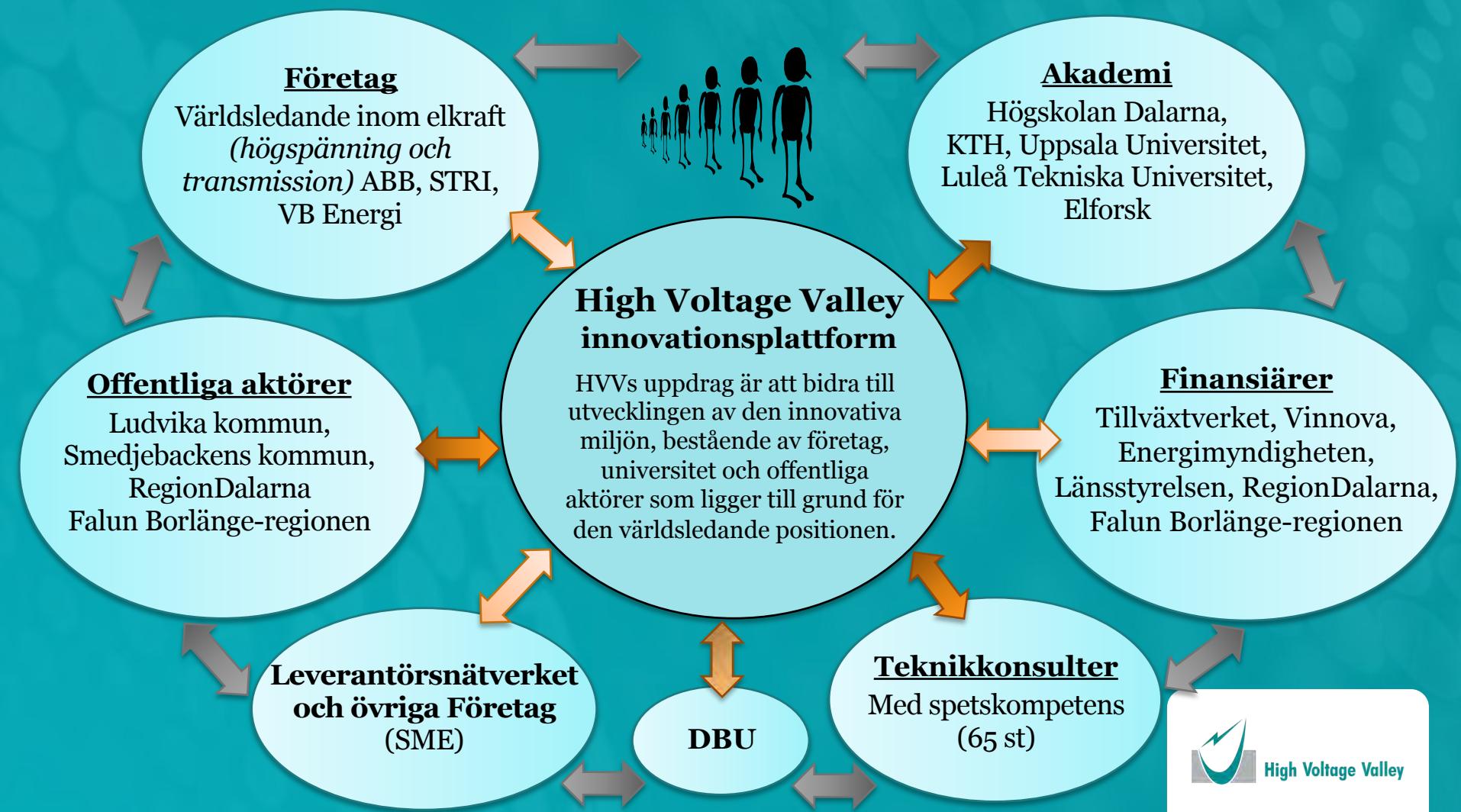


Möjliggöraren som bygger framtidens
energi effektiva samhälle

Kathrine Abrahamsen High Voltage Valley
Jan Hedberg Ludvika Hem



High Voltage Valley



High Voltage Valley 2019

Leverantörsnätverket



High Voltage Valley Walk



- **Forskning och utveckling**
- **Powerful Innovation Day**
- **HVV Walk**
- **Kommunikation**
- **Nätverk**
- **Smart Specialisation**

Capacity building, Africa



SolEL



Landmärke



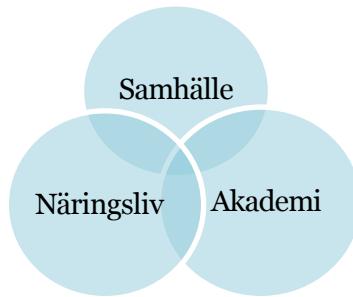
E-Mobility



Ödrif



Samarkands ägare och medlemmar



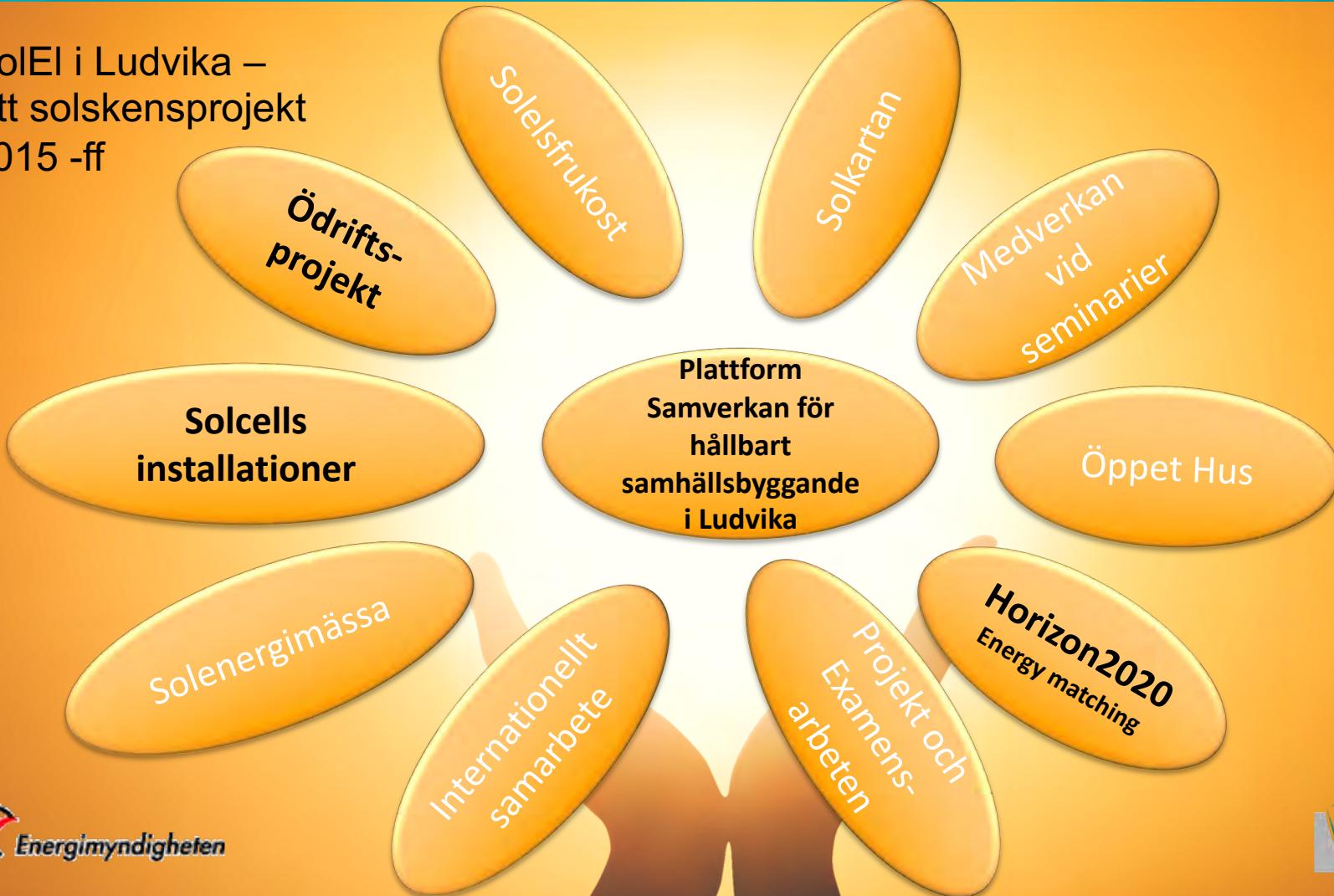
Samarkand 2015
Möjliggöraren för utveckling av morgondagens attraktiva

Solel i Ludvika –



- Från SOL-El till Innovationsagenda
- Hur en tydlig politisk satsning på solel blev en plattform för innovation.

SolEI i Ludvika – Ett solskensprojekt 2015 -ff



Solel i Ludvika



LUDVIKA
KOMMUN

VB ENERGI



alt POWER®



HÖGSKOLAN
DALRNA



ABB

Energimyndigheten



Installationer genomförda och planerade

Sporthallen april 2018

Brandkåren april 2018

Solviksskolan februari 2019

Kyrkskolan- påbörjat

Ängsgården 2019

Gonäs förskola 2019

LSS boende i Marnäs, 2019

Tjädern, 2019

fortsättning följer

Ludvika församling –församlingsgården, Okt 2018

ABB 2019

Smedjebacken och Fagersta

Flera följer efter

Planeras En gemensam webbsida för att följa alla installationer och hur mycket de producerar

Energilager

Energimässor

E-mobility nätverk

Examensarbeten – studentjobb



Elinstallatörsutbildning

Energy Matching

Energicafé

Energifrukost

En ny marknad



High Voltage Valley



*Sol Vind och Vatten – för ett lokalt fossilfritt
energisystem i Västerbergslagen*



Fossilfri ödrift



High Voltage Valley

[https://www.svtplay.se/video/21083156/nedslackt-
land/nedslackt-land-sasong-1-borjan-pa-krisen?start=auto](https://www.svtplay.se/video/21083156/nedslackt-land/nedslackt-land-sasong-1-borjan-pa-krisen?start=auto)

Samhällsviktiga funktioner i centrala Ludvika

- Stadshuset och Valla IT-center
- Räddningstjänsten
- Kyrkskolan som samlingsplats
- Tillgång till mat och bränsle



Genom innovativt samarbete kan UPOS utvecklas till:

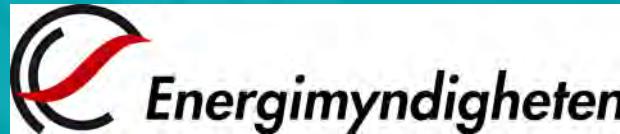
- ✓ Säker, fossilfri elförsörjning i en kris
- ✓ Smart utnyttjande av solenergi
- ✓ Ett landmärke i Ludvika
- ✓ Kanske ett konstverk??

Lokal tankesmedja



Vilka fler är med på tåget?

- AB Samarkand2015 med dess ägare och medlemmar



Riskanalys för Ludvika kommun (UPOS)

- Scenario:

Strömvabrott i mellersta Sverige under 3 veckor vintertid.

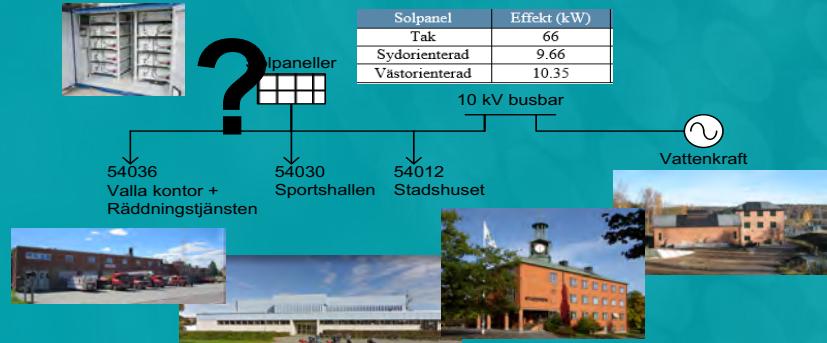
? Konsekvenser för liv och miljö

➤ Rekommendationer, Ödrift mm

Vi tänker i system

❖ Vi tänker i system

- Teknisk lösning
- Kompetens
- Resurser
- Hållbarhet
- Samhällsnytta



❖ Vi tänker fossilfritt

❖ Vi tänker lokalt

- Kompetens
- Resurser

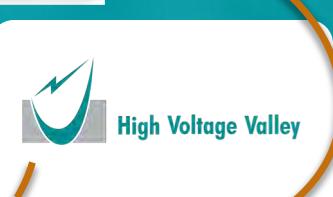
Lokala resurser



Hyttbacken vattenkraftverk
Solenergi

Innovatörer i samspel:

- Ludvika kommun och Ludvika kommunfastigheter
- High Voltage Valley
- VB Elnät och VB Kraft
- ABB, leverantörer
- Högskolan Dalarna
- m.fl



Ödrift / Lokalt elnät



- Vattenkraft 3 500 kW
 - Solenergi 218 kW
 - Elnätet förberett
- + Energilager (batterier)

Energilagrets funktion i en krissituation

- ¥ Stort strömbrott i Mellansverige: **SVART NÄT**
 1. Koppla in energilaget till:
 - Valla IT-center
 - Räddningstjänsten
 2. Starta upp vattenkraftverket
 3. Koppla in övriga kritiska fastigheter i centrum

Energilagrets funktion under normal drift

- Stabilitet till nätet när andelen solenergi ökar
 - Stöd till laddstation för elbilar
 - Testbädd för nya lösningar
-
- Ödrift, energilager ska vara klart februari 2020



ENERGY MATCHING

LudvikaHem AB, Sweden



Jan Hedberg
Energicafé 10 april 2019



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°768766.

*Countries involved (Green)
& demo sites flagged*



*Learn more about
our project*

www.energymatching.eu

Project Coordinator

Eurac

Institute for Renewable Energy
Via A. Volta 13/A
39100 Bolzano

David Moser

david.moser@eurac.edu

Laura Maturi

laura.maturi@eurac.edu

Project Partners

**eurac
research**

www.eurac.edu

tecnalia Inspiring Business

www.tecnalia.com



**DALARNA
UNIVERSITY**

www.du.se

ferroamp

www.ferroamp.com

NIBE

www.nibe.com

TULIPPS Solar System Solutions

www.tulipps.com



www.onxsolar.com

Plastica

www.plastica.nl

EUROFINESTRA INNOVARE, NATURALMENTE

www.eurofinestra.it

pellinindustrie

www.pellinindustrie.net

SolarWall by Commercial

www.solarwall.com

habitat 76

www.habitat76.fr

**R2M
SOLUTION**

www.r2msolution.com

WIP

www.wip-munich.de

CASASPA

www.casaspa.it

LudvikaHem

www.ludvikahem.se

**BOUYGUES
CONSTRUCTION**

www.bouygues-construction.com

The sole responsibility for the content of this publication lies with the authors.
It does not necessarily reflect the opinion of the European Commission. The
European Commission is not responsible for any use that may be made of
the information contained therein.



**ADAPTIVE AND
ADAPTABLE ENVELOPE
SOLUTIONS FOR
ENERGY HARVESTING
TO OPTIMIZE EU
BUILDING AND DISTRICT
LOAD**



This project has received funding from the
European Union's Horizon 2020 research
and innovation programme under grant
agreement N° 768766

The project

EnergMatching recognizes the potential of cost-effective adaptive and adaptable building skin solutions as part of an optimised building energy system for maximizing the RES harvesting in the EU built environment.

EnergyMatching aims to:

1. Define adaptive and **adaptable envelope solutions for energy harvesting** at building level
2. Integrate energy harvesting solutions into the **building and district energy** concept
3. **Geo-cluster solutions and replicate** their potential

Exploitable results

The network of EnergyMatching results is based in three pillars:

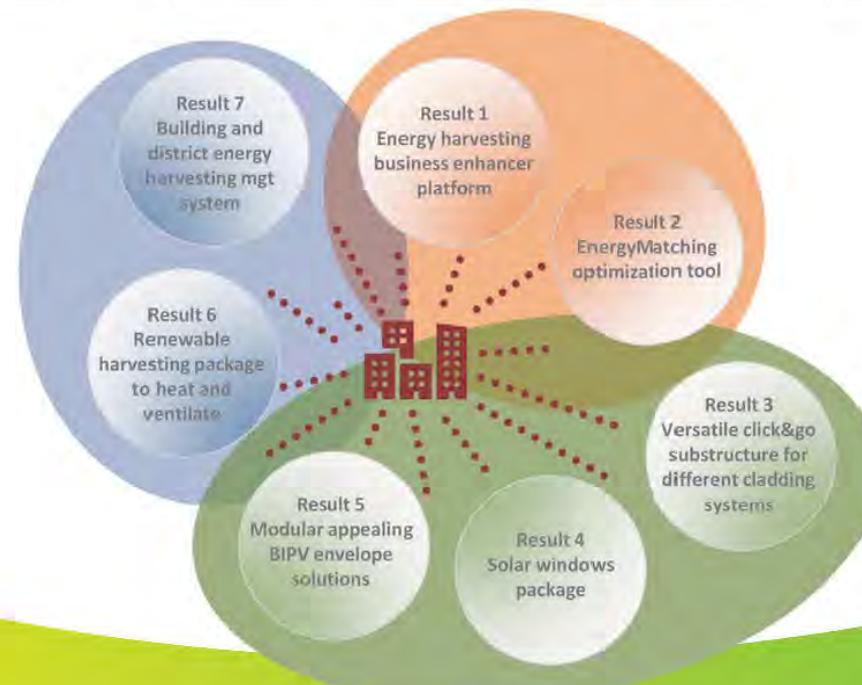
- Methodological framework and business vision
- Adaptable and adaptive skin technologies
- Building and district energy LAN

Expected impact:

The results of the project will be tested in **3 demo sites [France, Italy and Sweden]** and will lead to the following measurable impacts:

- Reduced cost of manufacturing, installation and operation of energy harvesting technologies at building and district scale

- Demonstrated replicability that will result in the acceleration of the integration of RES into EU diversified residential buildings and districts
- Cost-effective solutions supported by advanced economic and business models for investors
- Maximisation of RES generation, demand coverage and optimal integration of RES with the energy grids
- Market penetration of effective, modular, robust and easy to integrate energy harvesting solutions
- Revitalization of the EU construction / energy harvesting sectors and reduction of GHG emissions
- Improved IEQ with optimal control and natural sources exploitation



Location

- Ludvika (middle of Sweden)
- Demo case, Sunnansjö



Three apartment blocks in Ludvika

General Information	
Year of construction	1970(A&B),1973(C)
Floors	3
Apartments	53 (A+B+C) Mostly 1-2 bedrooms
Housing form	Rental property Rent includes heating and DHW but not household electricity
Facade surface gross area	2146 m ²
Roof surface gross area	1750 m ²
Gross floor area	4488 m ²
Energy consumption	165 kWh/m ² year

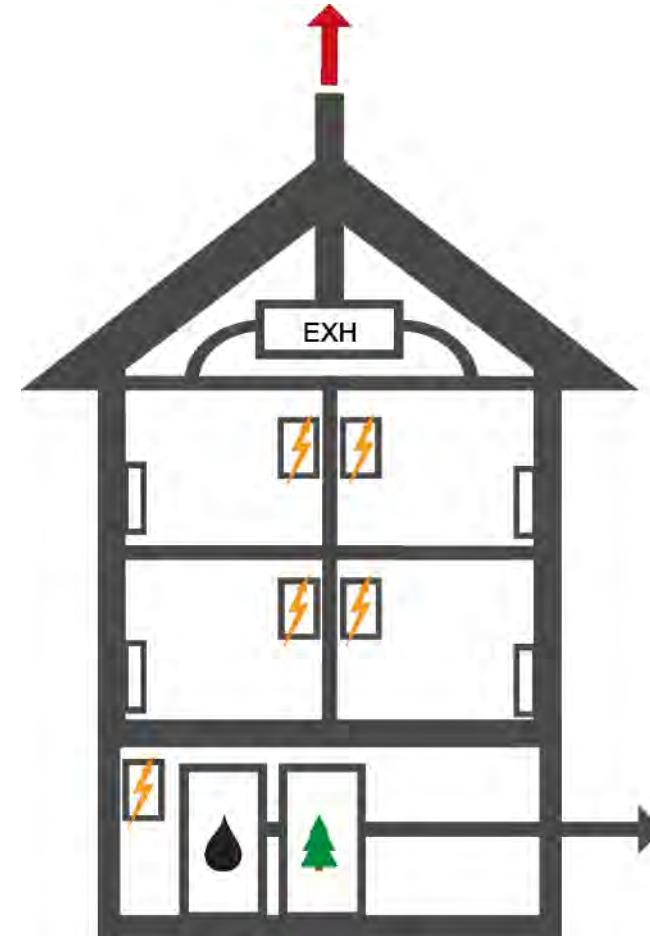


The apartment blocks today

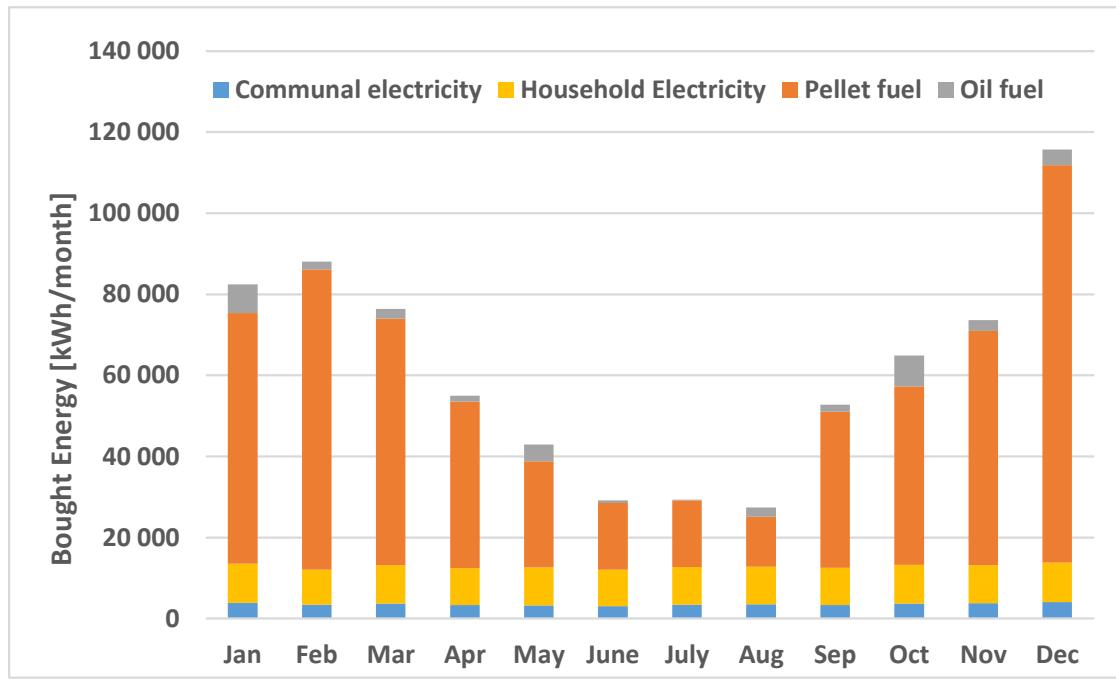
Current yearly energy consumption

Heating (paid by LudvikaHem)	560 MWh biofuel and 40 MWh oil
Electricity for apartments (paid directly by tenants to utility)	100 MWh
Electricity for systems (paid by LudvikaHem)	43 MWh
Total electricity	143 MWh
Total energy consumption	743 MWh

- HVAC
 - H. Radiators with original "1-pipe system", biofuel boiler using wood pellets and oil boiler.
- Mechanical exhaust air without heat recovery
- NO AC



Bought energy (2015)



- Measurements for all three buildings combined
- Bought energy (fuel not heat supplied)
- No heat measurements at all

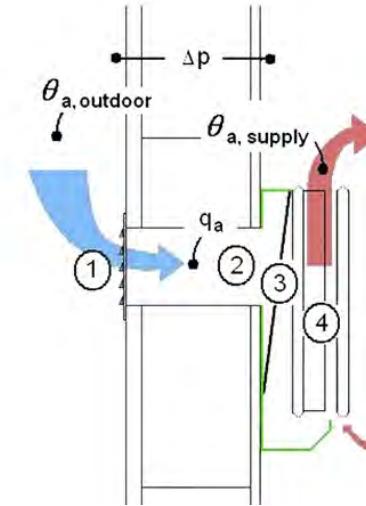
EnergyMatching renovation

- Roof BIPV
- HVAC system – exhaust air heat pumps in each building + DHW stores
 - Upgrade of control system
 - Construction permit required for the conversion of the heating systems
- DC-grid between buildings
 - “grey” area in Swedish law – Ferroamp interpret law as allowing DC-grid between buildings on same property (the case here)
 - *Already done without problems in another demo in Sweden*

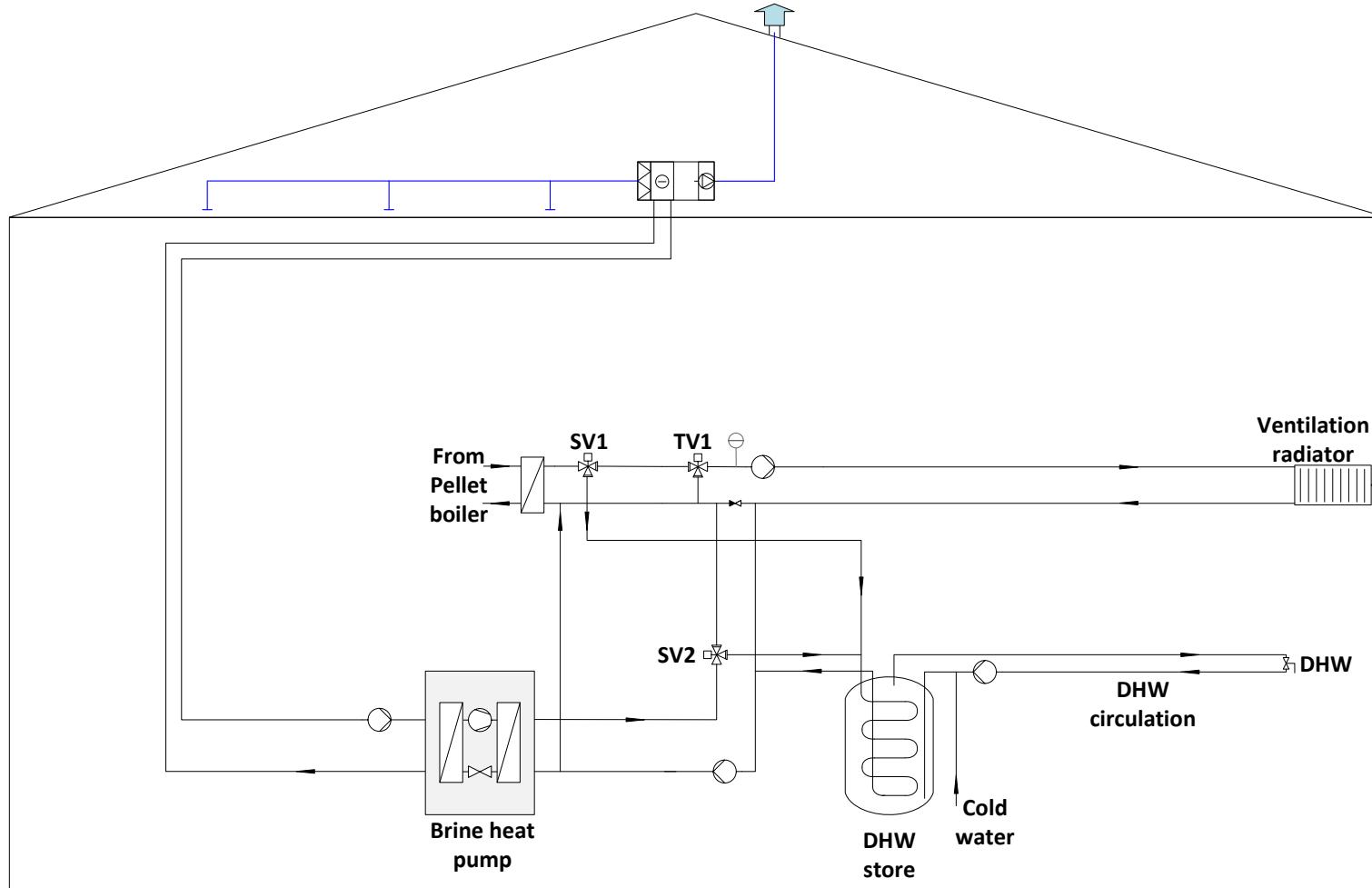


Other renovation measures at same time

- Conversion of the heat distribution system from one-pipe to two-pipe system
- Replacing radiators with preheating of outdoor air (ventilation radiators)
- Increase the insulation in the attic
- Replacement of all windows (triple glazed instead of double glazed)
- Probable replacement of poorly insulated wall sections (including windows) in stairwells and living rooms of some flats
 - Easiest to replace whole wall section as window frame is structural element
 - Building permit for change of the facade



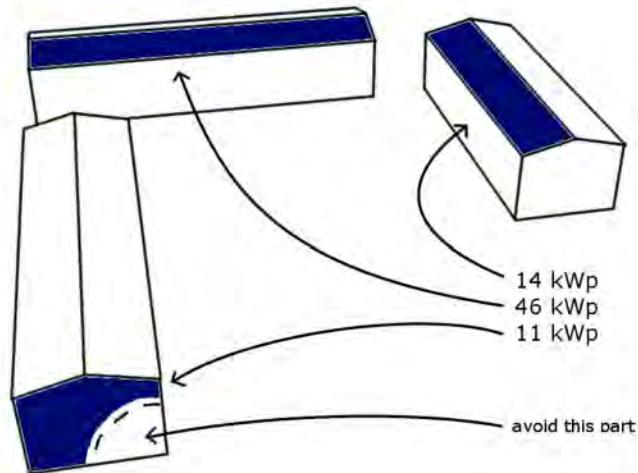
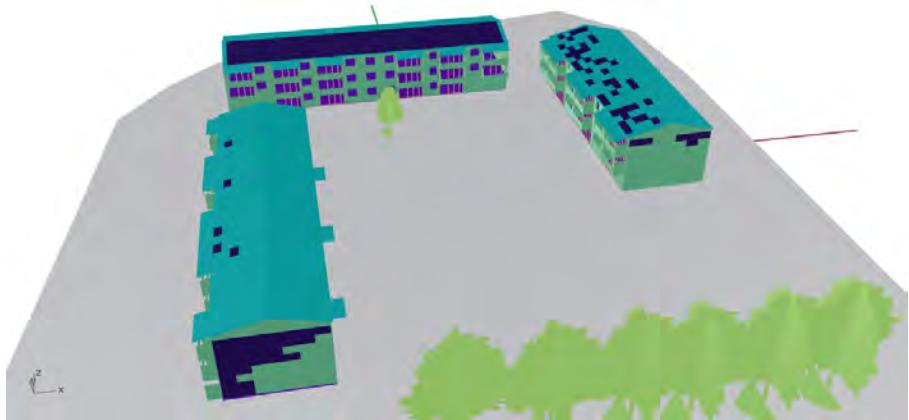
Proposed HVAC system



Swedish Demo Case, Sunnansjö Ludvika

- Nibe Heatpump 1355-45kW
- Solar Energy 60kW (PV, roof and facade)
 - Heatpump 1,5-20kW (input power)
 - Heat Boiler 0-12kW (input power)
 - Building electricity 0-28kW
- Ferroamp system
- New chipboiler 250kW
- Change heat distribution system (2-pipe system)
- Internal water storage 3,5m³

Layout of the PV system



In this document the capacity suggested by the tool is shown, the tool puts the modules in a meaningful way only if there is a shadowing object nearby, otherwise the modules are scattered in a completely random way. For this reason the result of the optimization should be interpreted.

It follows the result of the optimization “as it is”:

The interpretation is as follows:

The software suggests a large capacity on the south sloping part of the roof, and two smaller installation on the south façade and the west slope of the roof. In the two roofs it does not show any preference for the pattern of installation, in fact the modules are randomly scattered, the tool however shows that the east sloping part of the roof should be avoided.

On the facades the tool avoids the lower parts of the facades and especially the lower part of the East building and the bottom-right corner of the West building.

Synthetic wrap up

installed capacity [kWp]	70,34639
installed area[m ²]	404,2896
capacity of electric storage [Wh]	401
system cost [€]	95671,09
expected NPV [€]	40,71445
expected payback time	15 years 0 months 0 days
expected self-consumed-LCOE [€/kWh]	0,173118
self-consumption [%]	0,809887
self-production [%]	0,220885
annual cumulative production[kWh]	57523,25
annual cumulative balance production/consumption	0,272436
specific emissions of the whole produced electricity [kg CO2-eq/MWh]	246,71
specific emission of self-consumed electricity only [kg CO2-eq/MWh]	288,68
value of the fitness function	115588,7

Task 4.1 SE demo – Duration curves

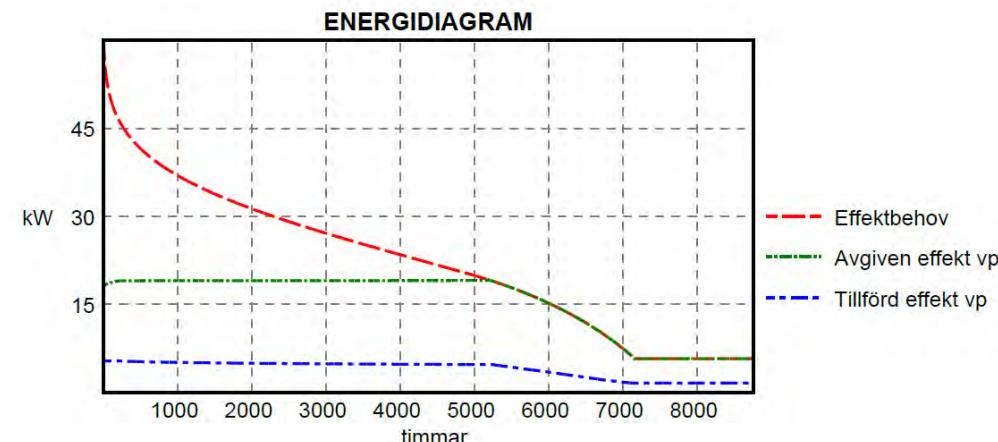
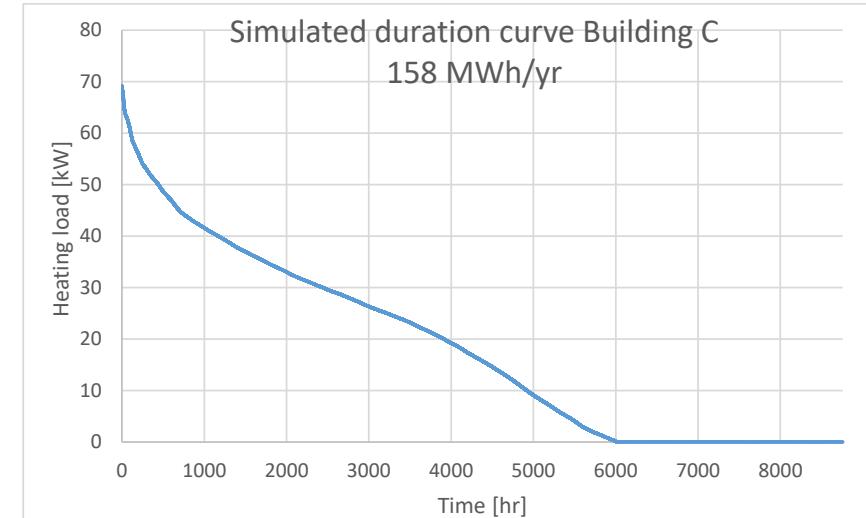
Only building C with TRNSYS, Borlänge weather, 69 kW peak space heating load

Building C is 40% of total Atemp

Total 172 kW peak space heat load

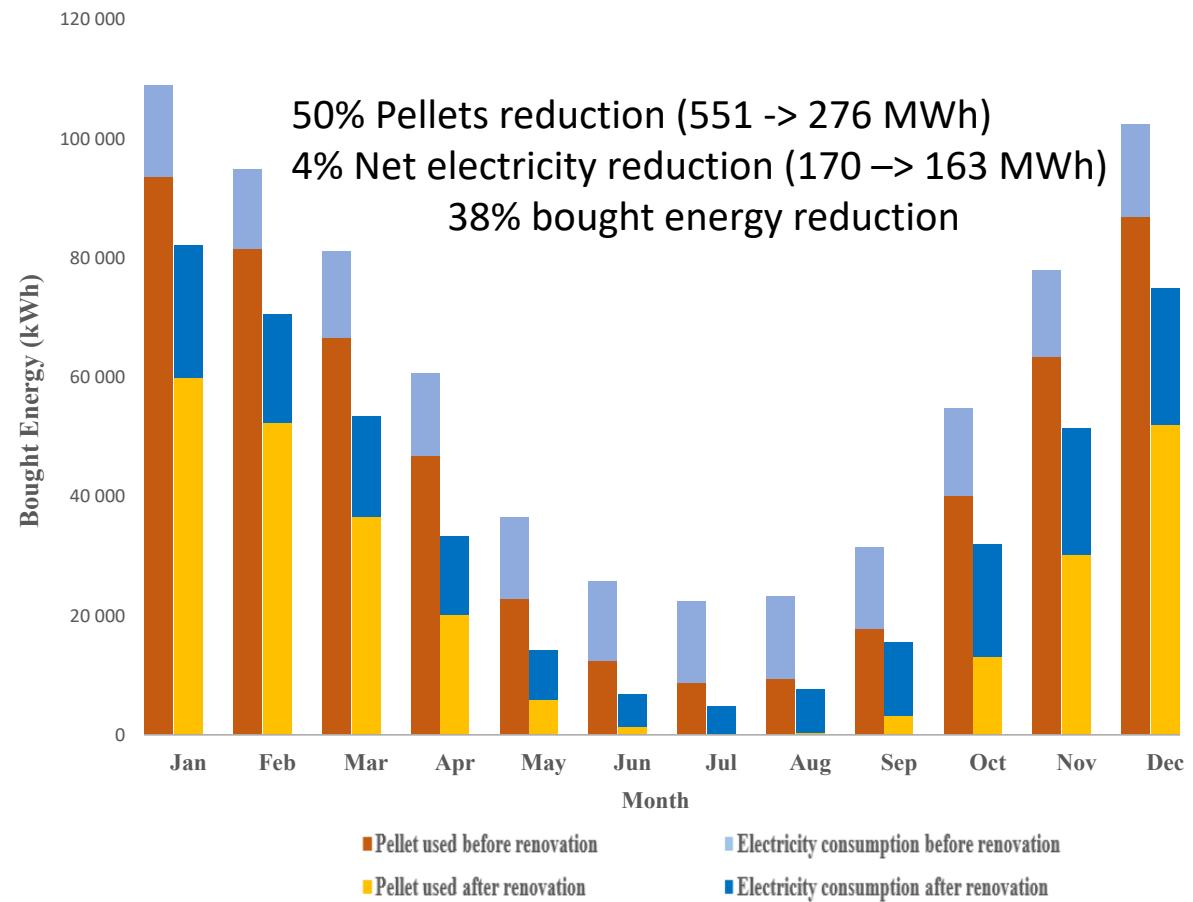
AirSite simulation building C, 58 kW peak load (incl. DHW), 151 MWh space heat, 50 MWh DHW

70% energy supply, 31% peak load



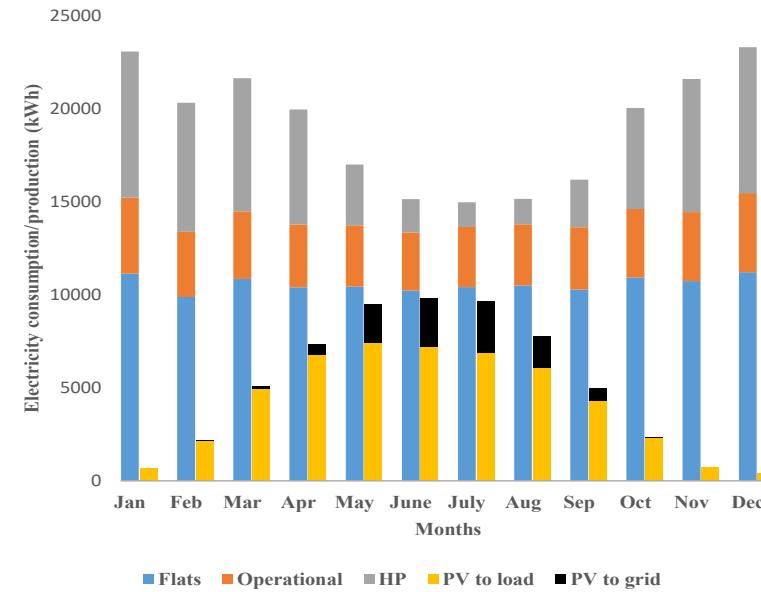
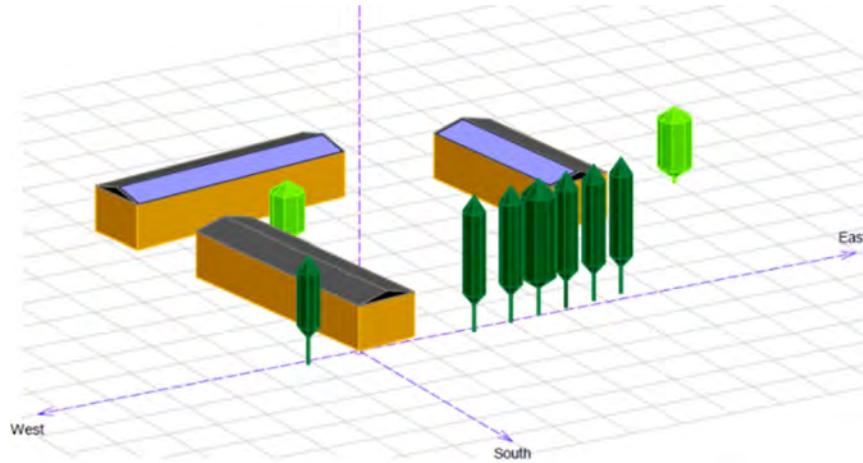
Task 4.1 SE demo – energy savings

- Includes flat as well as heat pump and operational electricity
- PV electricity used on site taken away



Task 4.1 Swedish demo – first results

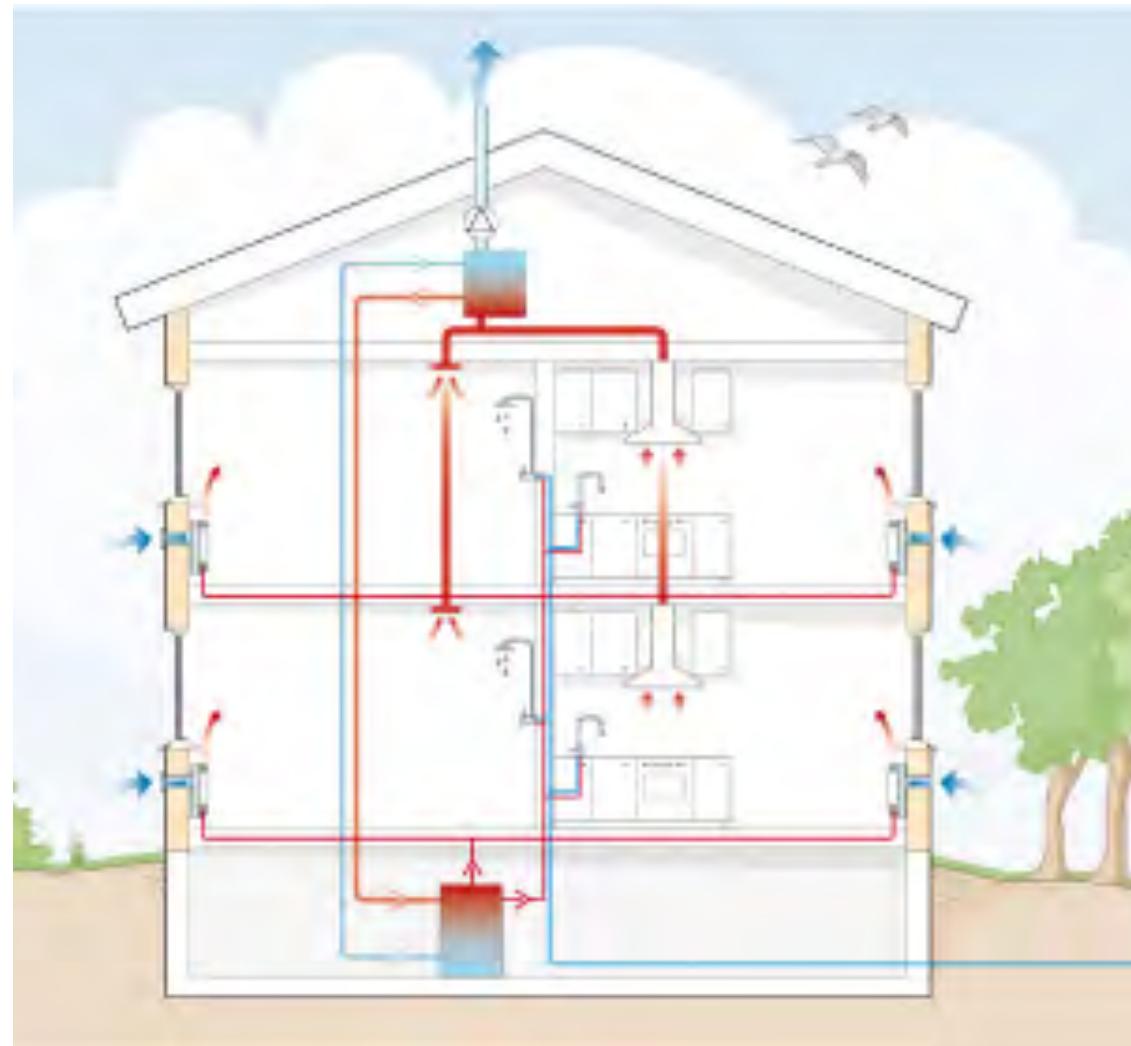
- PV modules assumed to be on roofs of buildings A & B
 - 74 kWp (453 m²)
- Includes flat as well as heat pump and operational electricity



Task 4.1 Swedish demo – next steps

- Model the exact heat pump and ventilation units
 - Couple building and HVAC models
 - Add the PV system as designed by WP2 tool
 - Size the hot water stores for extra PV storage
-
- Later on, the model will be used for developing the control of the system

Ventilation system



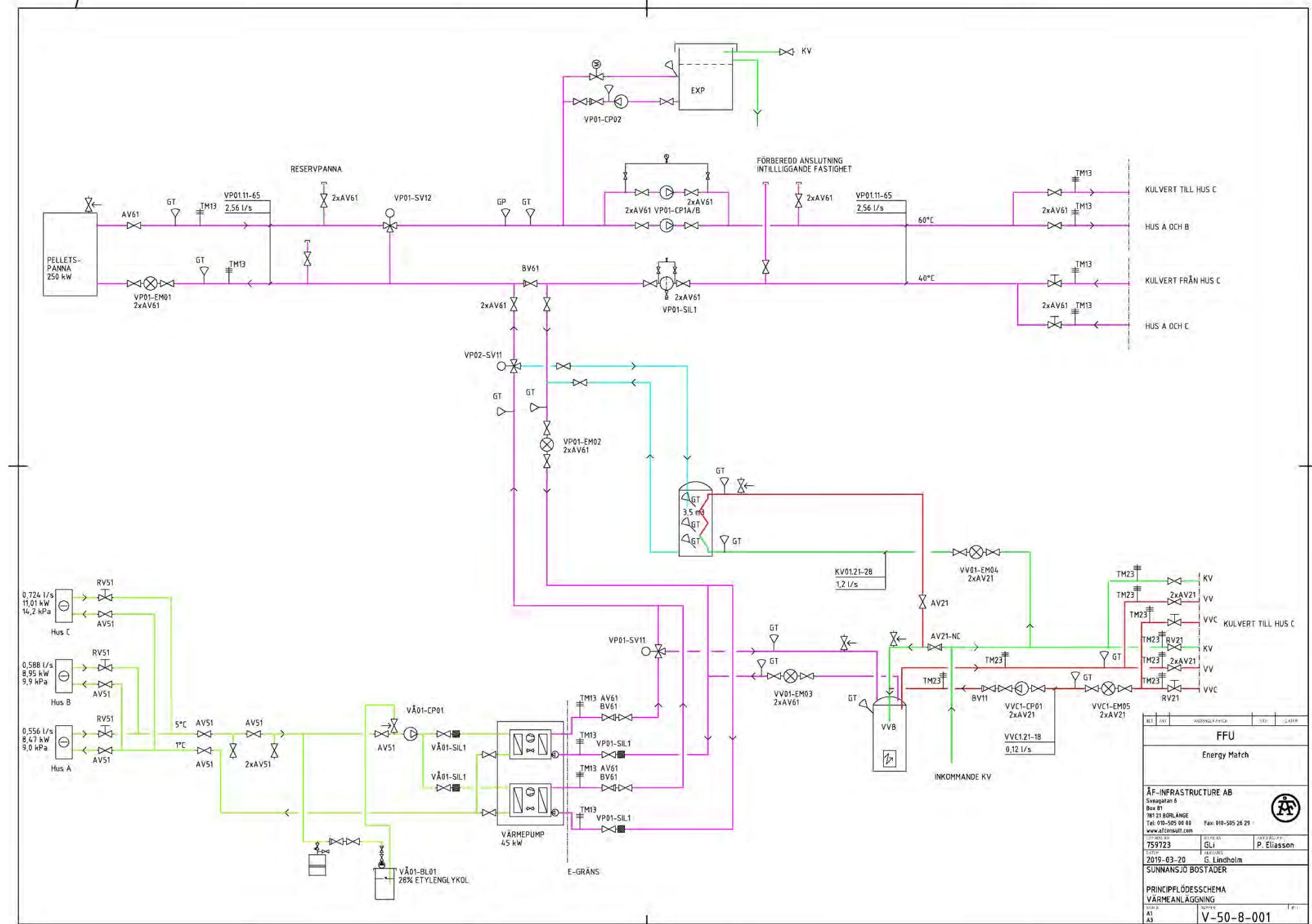
20 °C

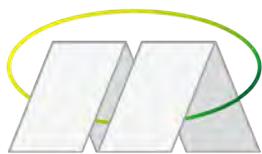


Fresh air radiator /Tillluftsrafator

AIR med en Purmo radiator förvarmer uteluften till rumstemperatur och släpper in den i rummet som en luftridå framför fönstret, vilket gör att lufthastigheten i vistelsezonen blir låg och inget kallras uppkommer.







ENERGY MATCHING



EnergyMatching technologies to be implemented	1. Résidence Emile Hauduc France (1969)	2. Comune di Campi Besenzio Italy (1984)	3. Ludvika Sweden (1973)
	Lot size 1643 m ²	2.800 m ²	4.488 m ²
	Façade area 2.146 m ²	1.100 m ²	2146 m ²
	Roof area 528 m ²	360m ²	1750 m ²
	Estimated Energy Consumption 265 kWh/m ² /year	145~175 kWh/m ² /year	170 kWh/m ² /year
	R3 Versatile click&go substructure for different cladding systems	✓	✓
	R4 Solar windows package	✓	✓
	R5 Modular appealing BIPV envelope solutions	✓	✓
R6 Renewable harvesting package to heat and ventilate	✓	✓	✓
R7 Building and district energy harvesting mgt system	✓	✓	✓

* (R) Expected results of the EnergyMatching project



ENERGY **MATCHING**

Thank you!



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°768766.