



Presentation:

Can a single 2kW Mini-split heat and cool a 100m² passive house?

Stefan Pallantzas

Civil Engineer NTUA, CPHD, Certifier



The 204House,
in Lafayette,
Louisiana

“During full summer heat, the house will lean heavily on its energy recovery ventilator to reduce humidity and air temperature, but it also is equipped with a 1-ton ductless mini-split air conditioner with a single vent.”

Source : <http://www.greenbuildingadvisor.com>



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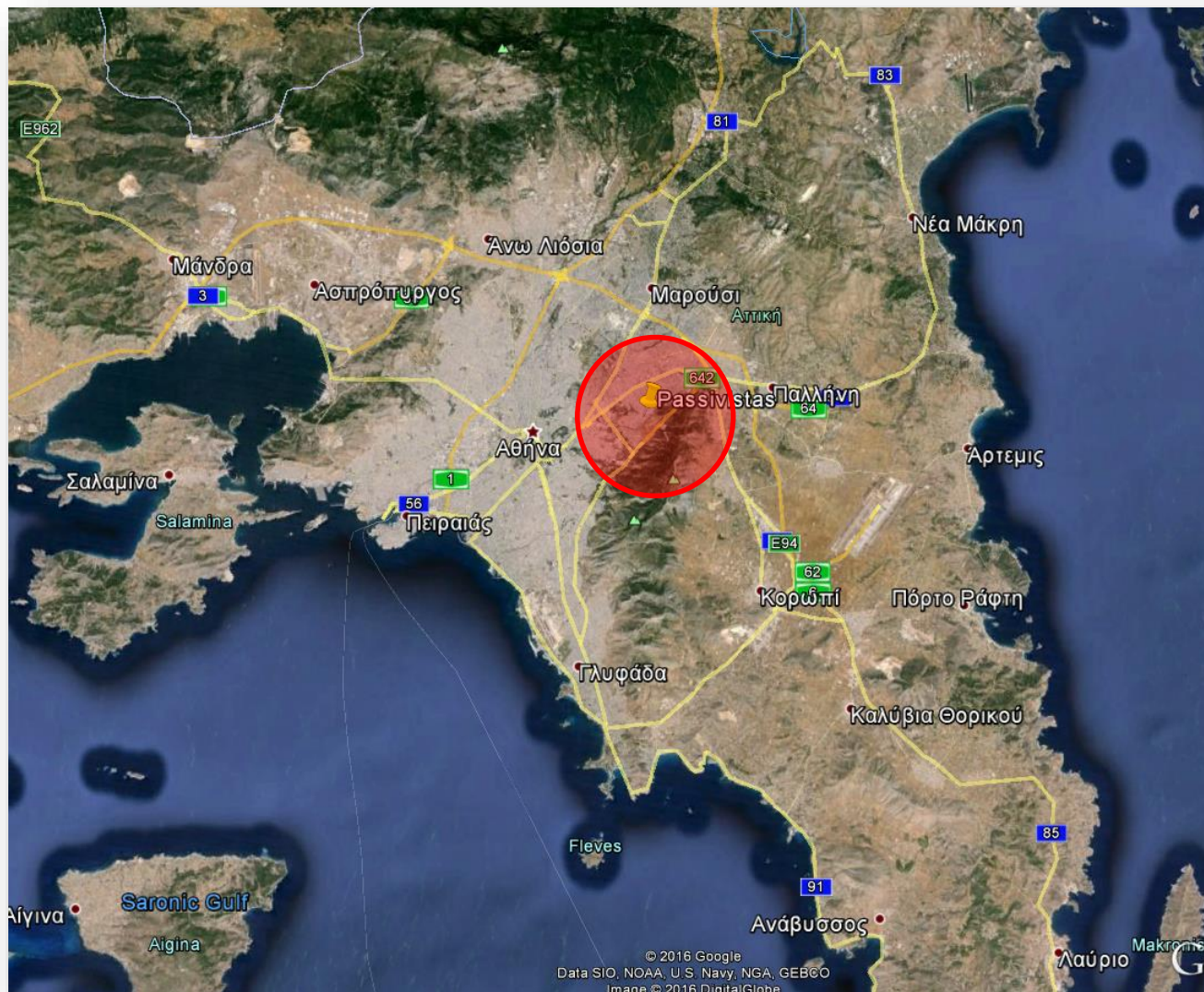
Project location
Papagou – Athens
GREECE



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Retrofit**

Passive House Institute

| classic | plus | premium |





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Project location
Papagou – Athens
GREECE



Burgas, Bulgaria, June2018

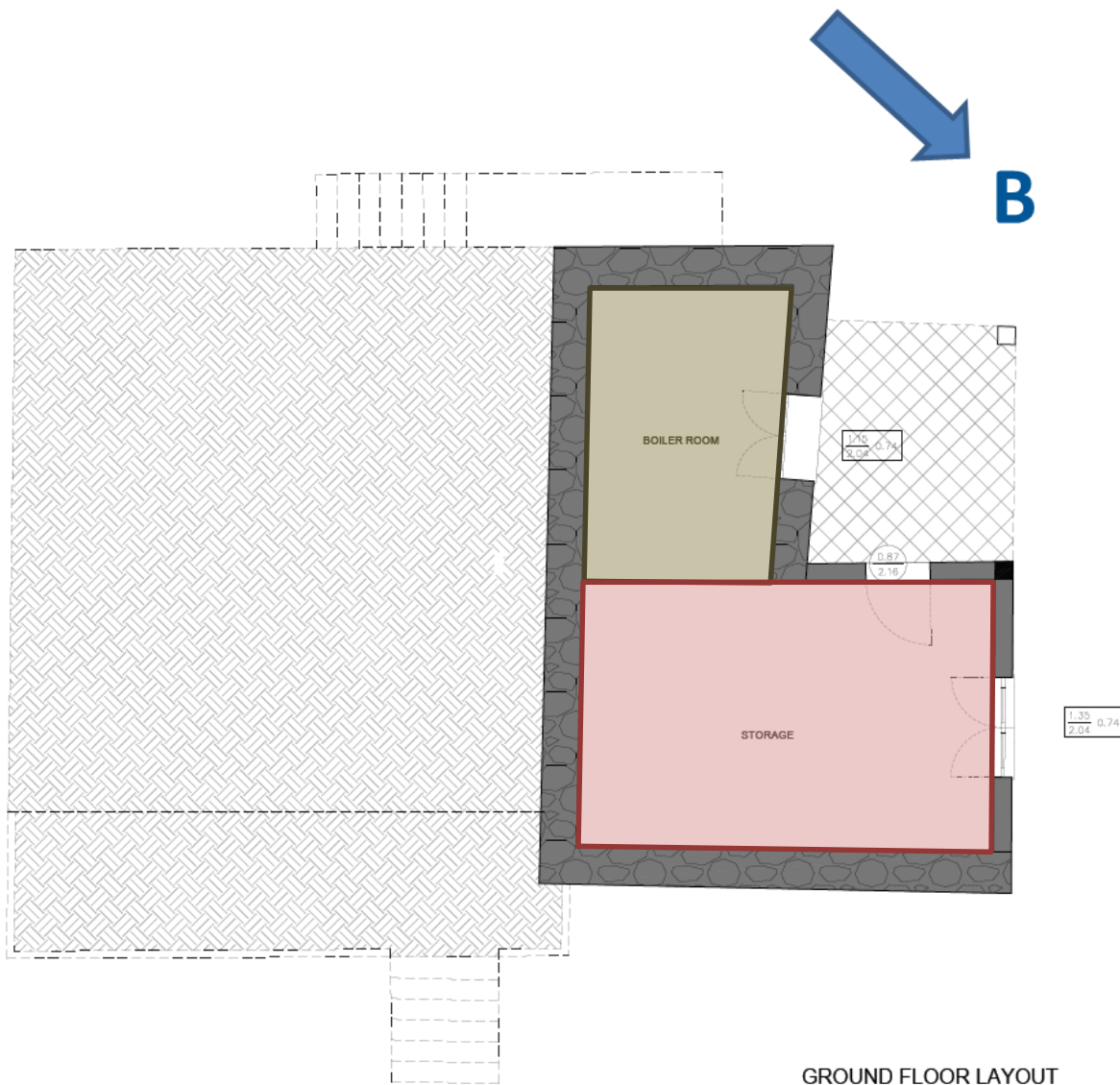
Author : Stefan Pallantzas

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Project description

TFA:

1ST FLOOR = 85 T.M.
GROUND FLOOR = 30 T.M.



Certificate

Certified retrofit
Savvatis Plus
(Climate zone: Warm)



Passivistas:TheHouseProject
Anastaseos 112 str, GR-15669 Papagou Athens,
Greece



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Client	Stefan Pallantz	Arakatsios 112 GR-15669 Papagou, Athin, Greece
Architect	Alkara Rodi	Aggeliki Stathopoulou Chrysanthemou 18 GR-15504 Ochia Nera 15504 Ochia, Greece
Building Services	Irak Igounemidis	Michael Agiou 44 GR-45133 Kalamata, Greece
Energy Consultant	Stefan Pallantz	Arakatsios 112 GR-15669 Papagou, Athin, Greece

Buildings retrofitted to the EnerPHit Standard offer excellent thermal comfort and very good air quality all year round. Due to their high energy efficiency, energy costs as well as greenhouse gas emissions are extremely low.

The design of the above-mentioned building meets the criteria defined by the Passive House Institute for modernization to the 'EnerPHit Plus' standard:

Building quality	This building	Criteria	Alternative criteria
Heating	Heating demand kWh/(m²a)	12	15
Cooling	Cooling + dehumidification demand kWh/(m²a)	11	15
Cooling	Cooling load W/m²	10	11
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	1,0
Non-renewable primary energy (PE)	PE demand kWh/(m²a)	85	60
Renewable primary energy (PER)	PER demand kWh/(m²a)	48	45
Generation	Generation of renewable energy kWh/(m²a)	68	63

The associated certification booklet contains more characteristic values for this building.

Darmstadt, 05. April 2017
Certifier: Georgia Kadeva, Passive House Institute

www.passivhouse.com 13070-13071_PHI_EP_20160205_STH_00006



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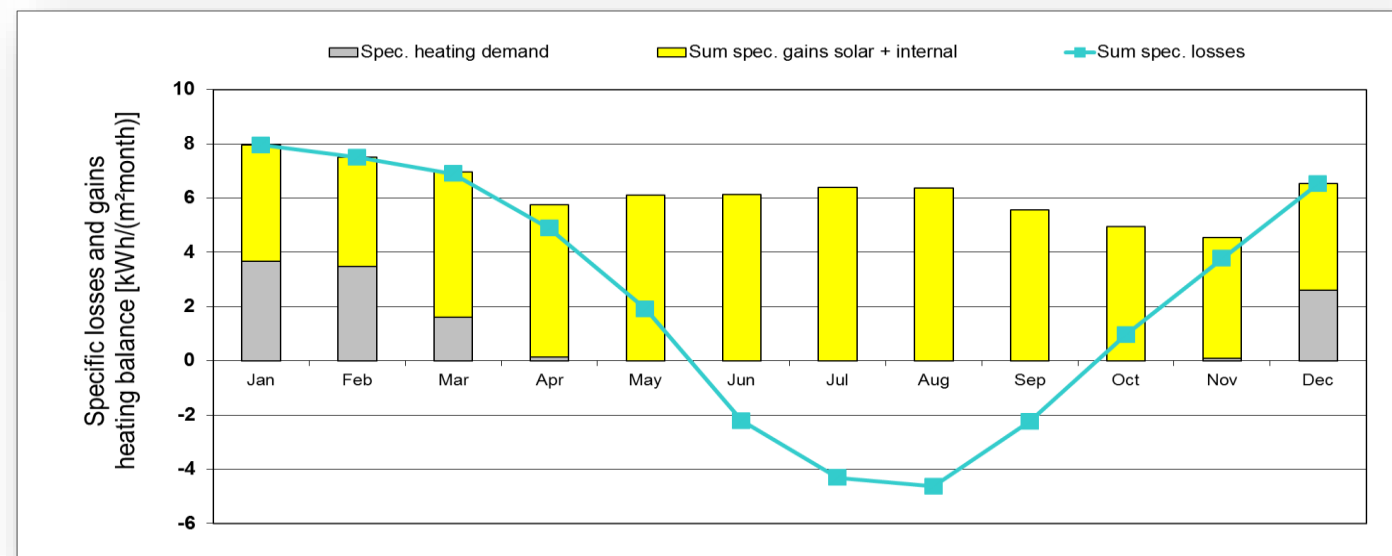
Specific building characteristics with reference to the treated floor area

	Treated floor area m²		Criteria	Alternative criteria	Fulfilled?²
Space heating	Heating demand kWh/(m²a)	12	15	-	yes
	Heating load W/m²	11	-	-	
Space cooling	Cooling & dehum. demand kWh/(m²a)	12	16	16	yes
	Cooling load W/m²	10	-	11	
	Frequency of overheating (> 25 °C) %	-	-	-	-
	Frequency excessively high humidity (> 12 g/kg) %	0	10	-	yes
Airtightness	Pressurization test result n ₅₀ 1/h	0,6	1,0	-	yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	85	-	-	-
Primary Energy	PER demand kWh/(m²a)	48	45	48	yes
Renewable (PER)	Generation of renewable energy kWh/(m²a)	68	60	63	

² Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

EnerPHit Plus? **yes**





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The proposed
solutions for
heating-cooling



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The after-heater



Month	TOTAL PHPP	MEASURED	HEATING PHPP	HEATING MEASURED
JAN 2016	689,78	619,35	419,00	367,45
FEB 2016	641,25	388,55	398,00	206,57
MAR 2016	397,78	339,80	183,00	141,35
APR2016	218,01	151,35	15,00	5,00

Total Winter Cost =	366,93 €	Per Day =	2,02 €
Total Heating Cost =	161,07 €	Per Day =	0,89 €



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**The proposed
solutions for
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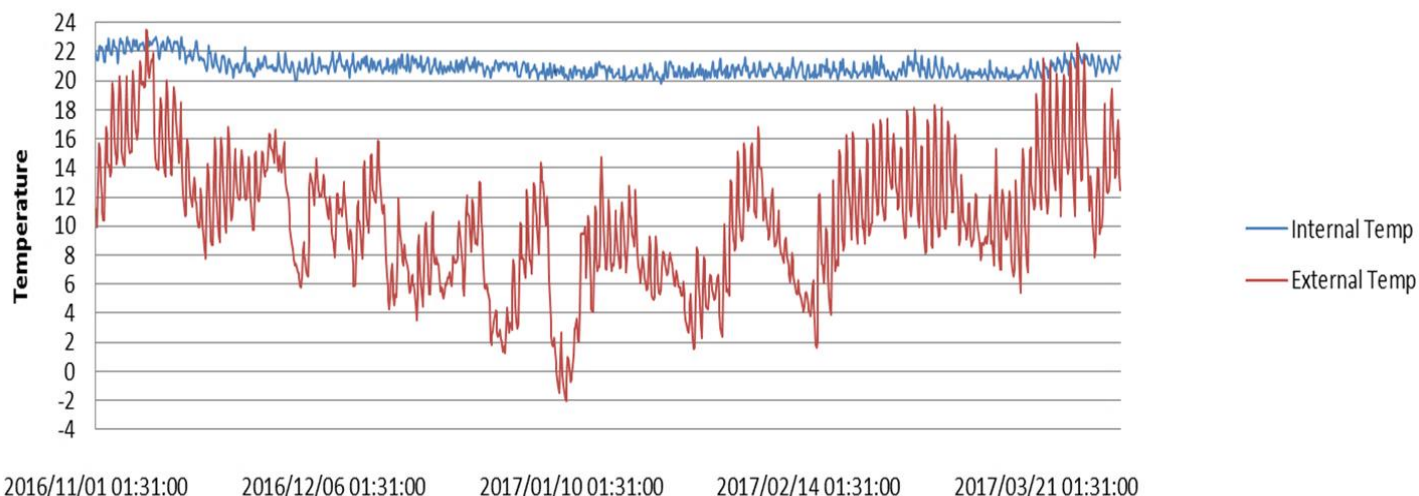
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The Mini split

Winter 2016/2017

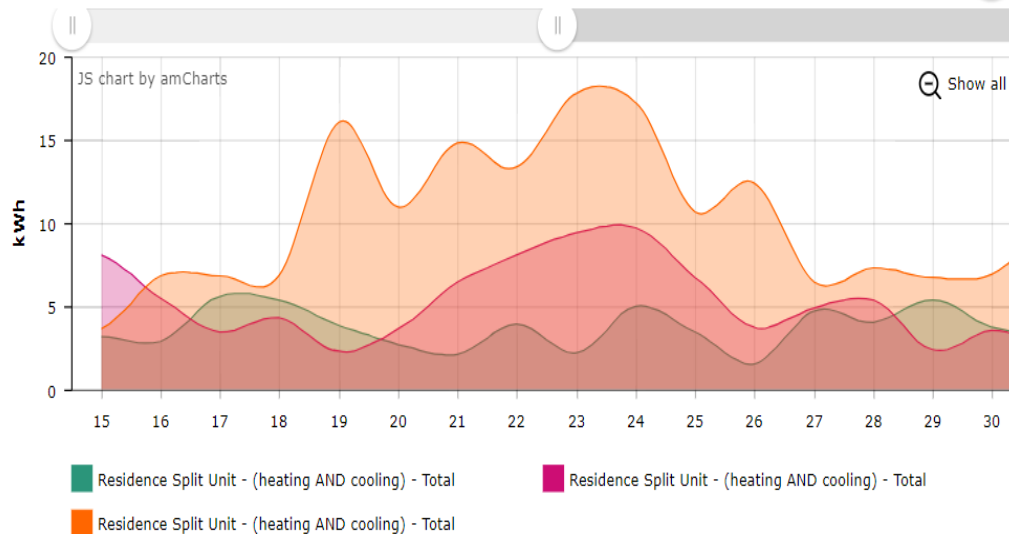


Month	TOTAL PHPP	MEASURED	HEATING PHPP	HEATING MEASURED
JAN 2017	413,40	448,24	163,84	217,08
FEB 2017	371,31	336,24	154,35	117,53
MAR 2017	291,18	265,89	88,62	53,69
APR 2017	219,41	171,38	23,22	5,09

Total Winter Cost =	307,78 €	Per Day =	1,69 €
Total Heating Cost =	91,06 €	Per Day =	0,50 €

Comparing 2016, 2017, 2018

Energy



Total of the month:

Residence Split Unit - (heating AND cooling) - Energy

129.15 kWh 2018

Residence Split Unit - (heating AND cooling) - Energy

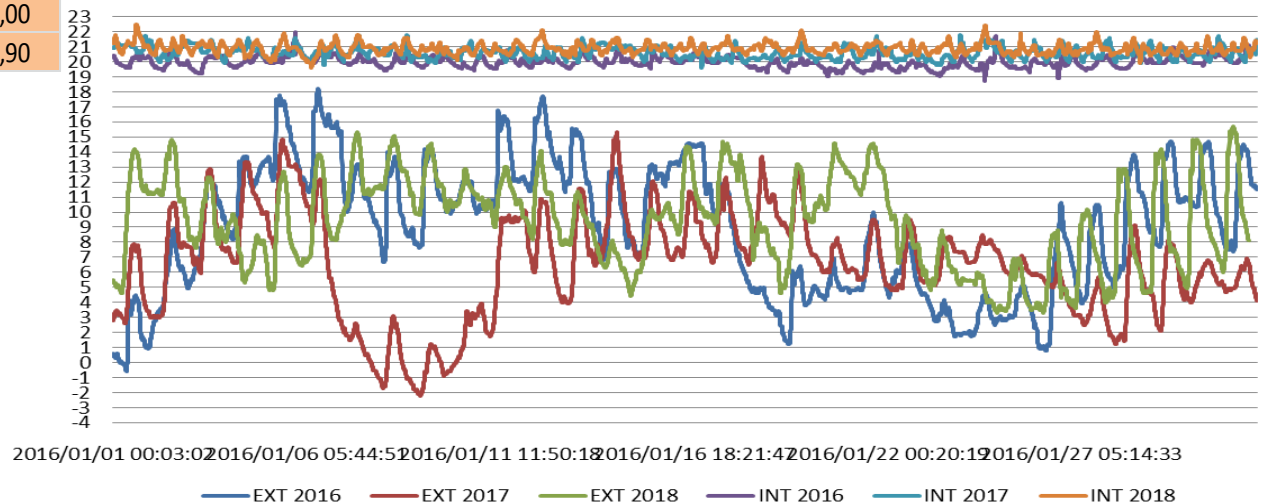
168.92 kWh 2017

Residence Split Unit - (heating AND cooling) - Energy

174.46 kWh 2016

	JAN 2016	JAN 2017	JAN 2018
EXT. TEMP PHPP	8,53	8,53	8,53
EXT. TEMP MEASURED	8,90	6,56	9,37
INT TEMP PHPP	20,00	20,00	20,00
INT TEMP MEASURED	20,00	20,58	20,90

Temperatures 2016,2017,2018



TEMPERATURE - OUTDOOR NORTHWEST SIDE



TEMPERATURE - INDOOR LIVINGROOM



TEMPERATURE - INDOOR BEDROOM FROM 18.6.16





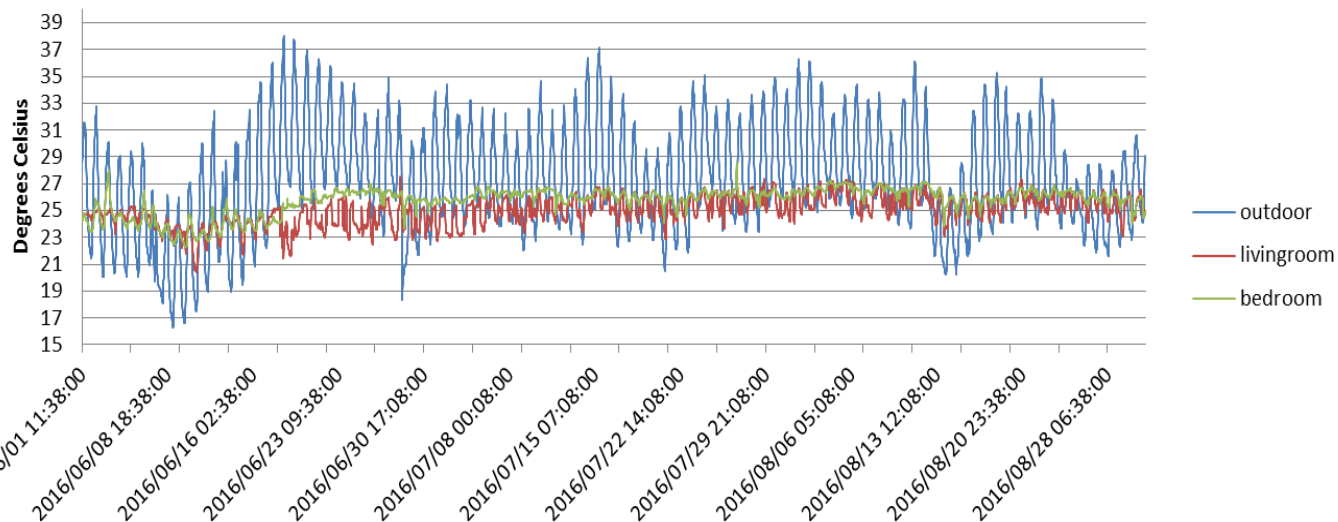
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Summer 2016



Energy

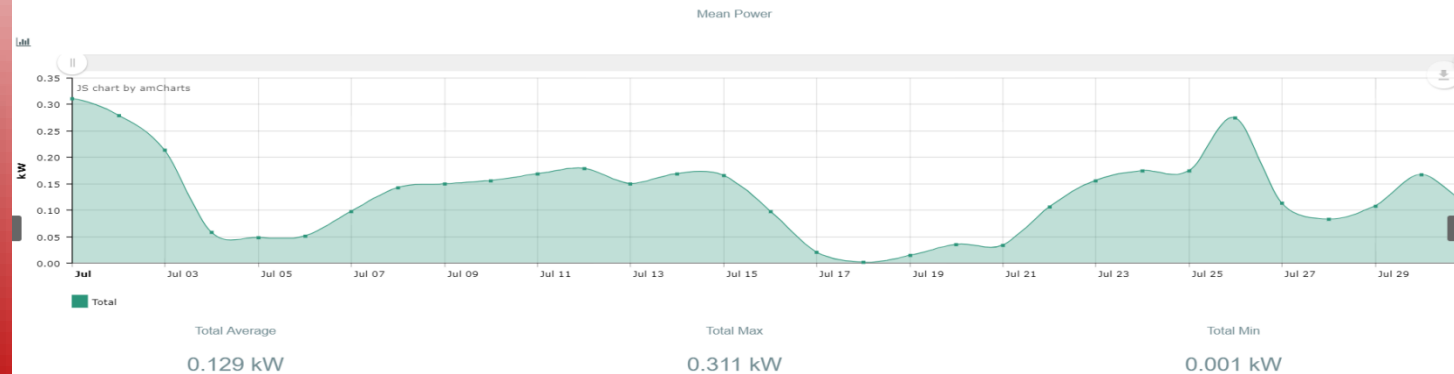
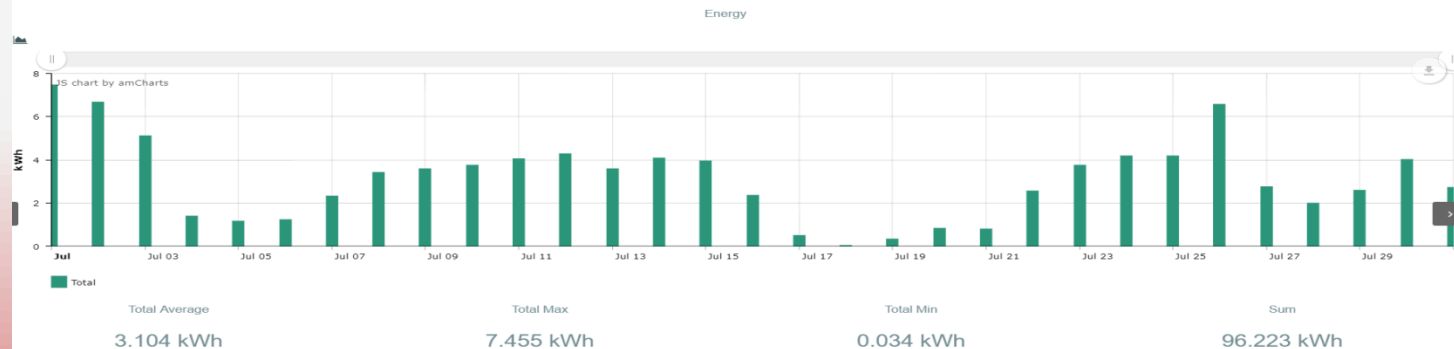
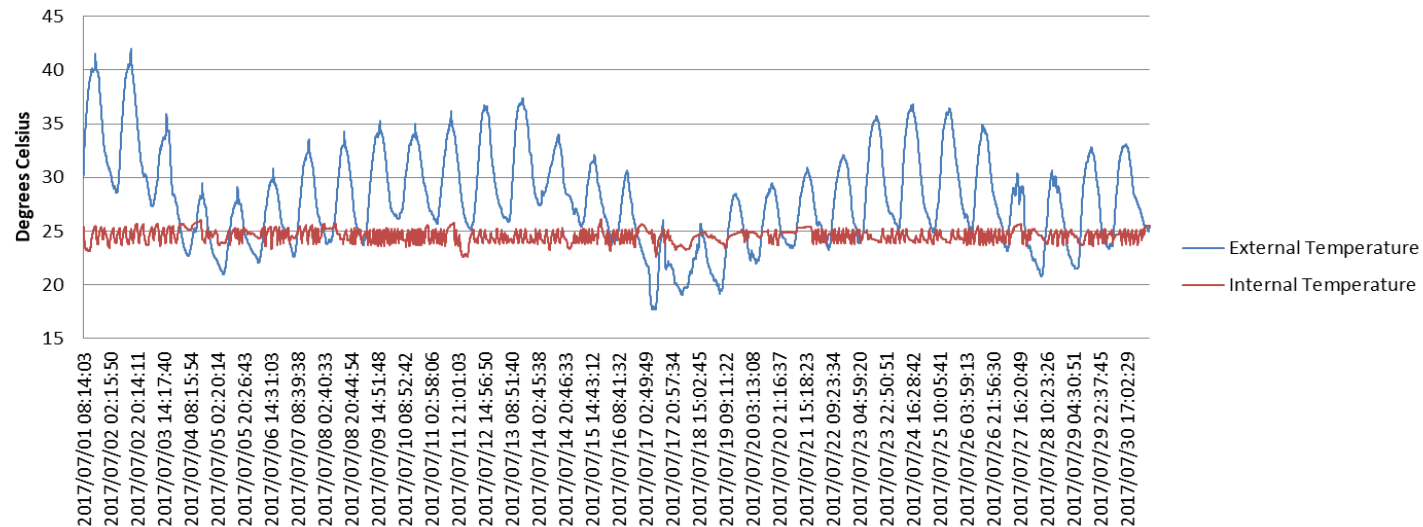


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July 2017





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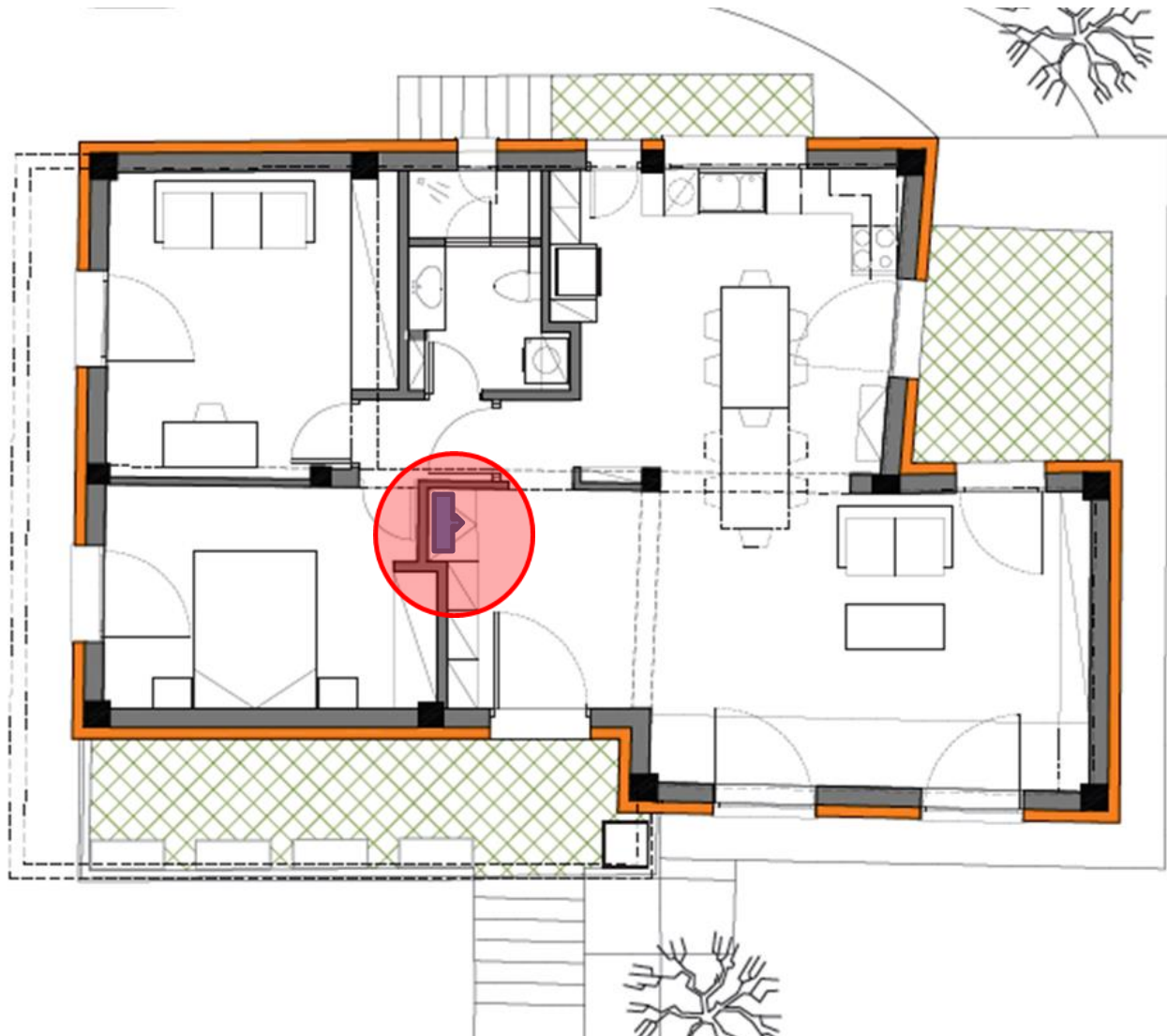
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Mini-split???

Heat pump???



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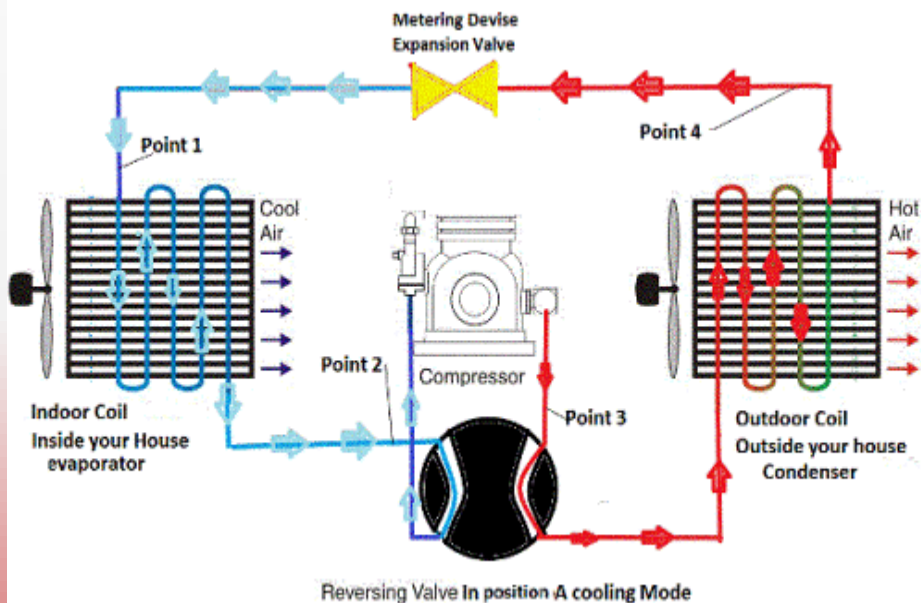


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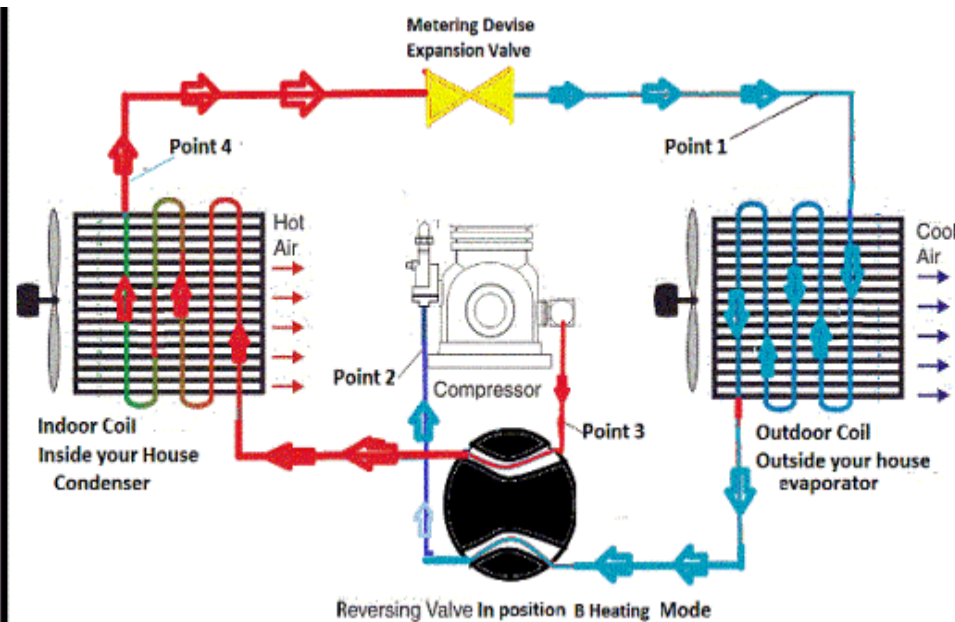


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Reversing Valve In position A cooling Mode



Reversing Valve In position B Heating Mode



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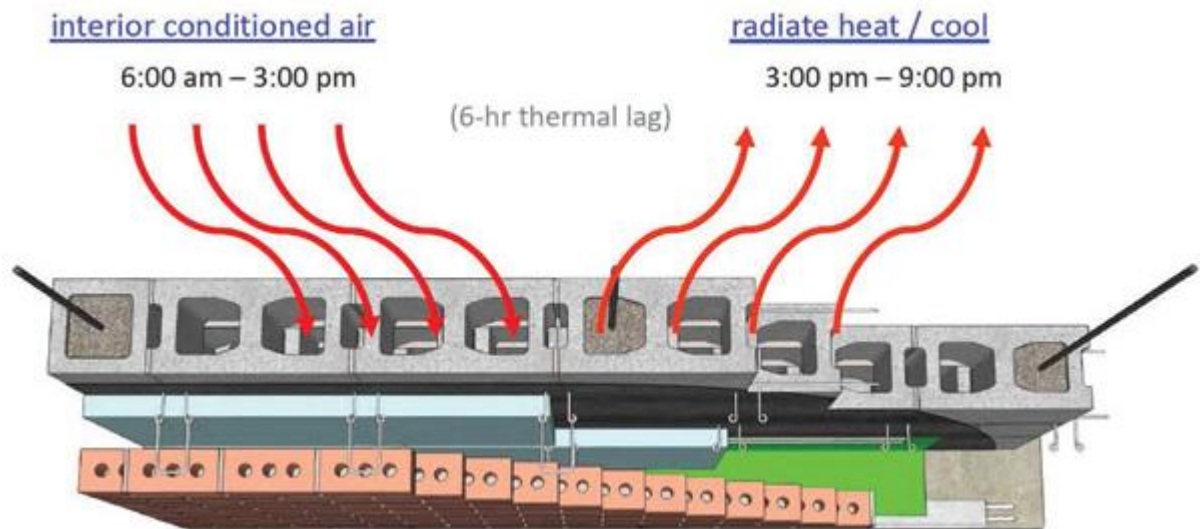
Heat Pump performance : the mild MED climate is the advantage



Air Source Heat Pump Type	Full heat output at or above this temperature	Heat output down to 60% of maximum at
Conventional	8.3 °C (47 °F)	0 °C (32 °F)
Low Temp Optimized	5 °C (41 °F)	-8.3 °C (17 °F)



Heat Pump performance : the influence of the thermal mass





Heat Pump performance : the use of eco/silent mode

Example Indoor Unit



INDOOR UNIT

19dB



WHISPER

30dB



OUTDOOR UNIT

46dB



ALARM CLOCK

80dB

20dB



RUSTLING LEAVES

44dB



BIRD CHIRP

60dB



CONVERSATION

KINGERSONS



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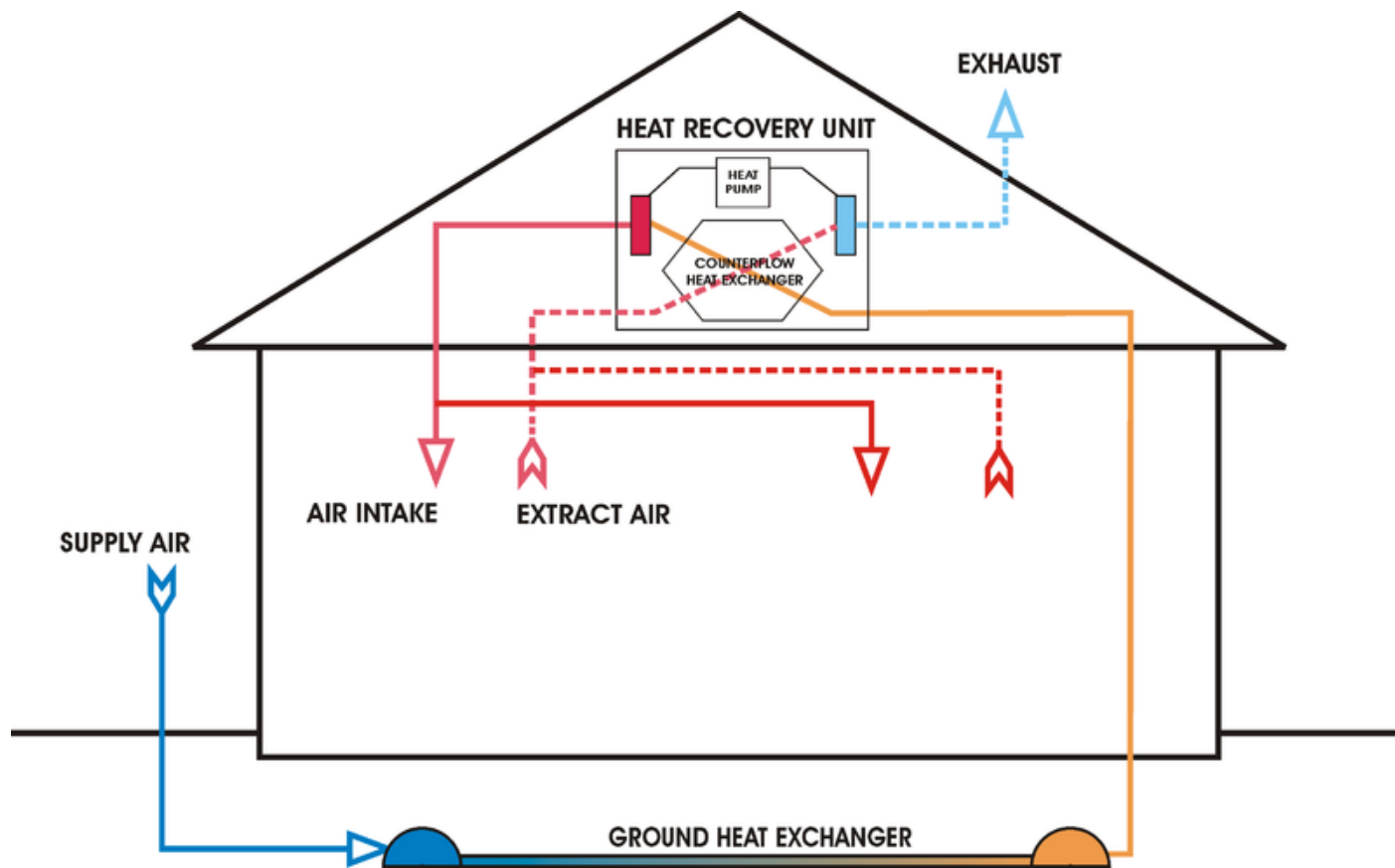


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Heat Pump performance : the passive house concept





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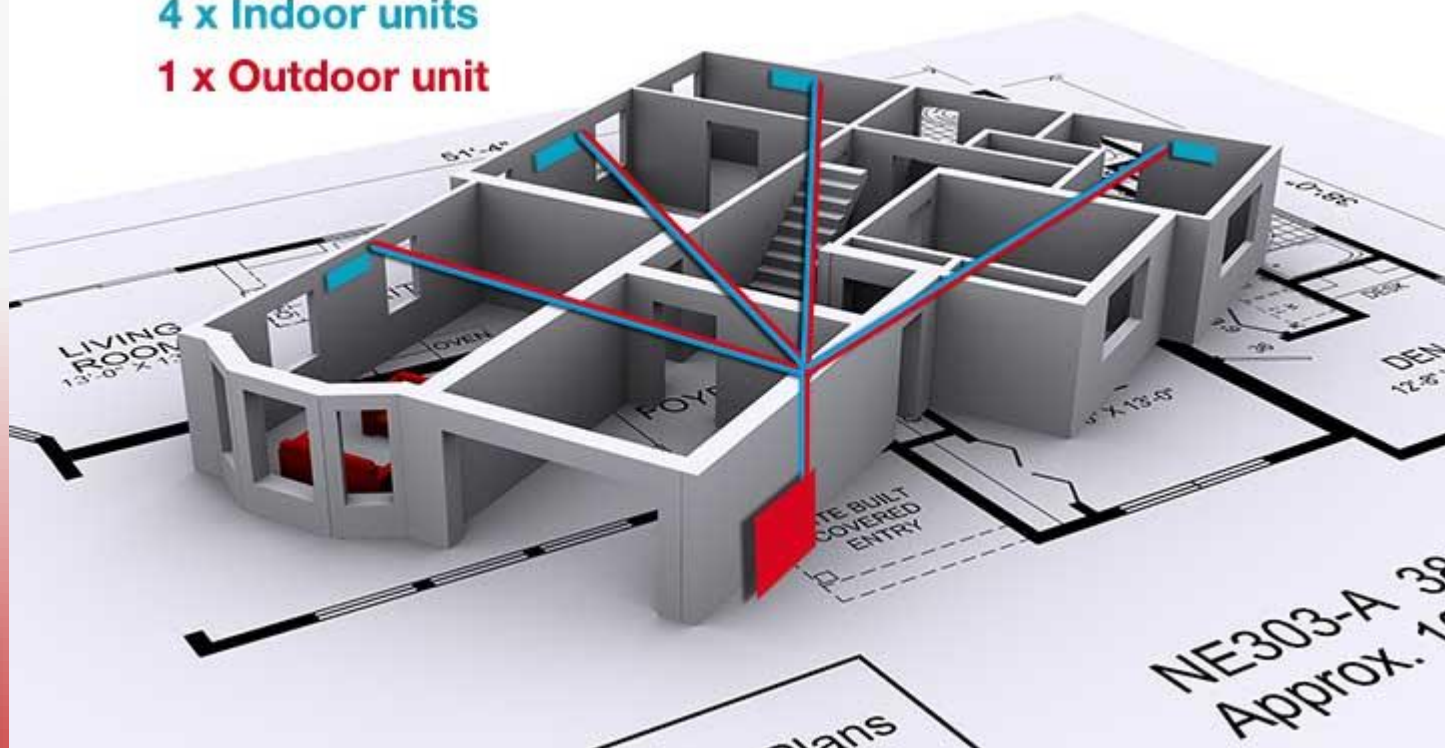
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Heat Pump performance : the easy distribution

4 x Indoor units
1 x Outdoor unit



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Conclusions

- **2KW Minisplits can cover heating/cooling demand in small residences up to 100m2.**
- **Keep always the house between the thermal comfort margins. Use simple automatization.**
- **Try to reach the best performance of the heat pump using the advantages of the passive house concept.**
- **Keep it simple, stupid!**



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Heat Pump performance : What about bigger houses?



Burgas, Bulgaria, June2018

Author : Stefan Pallantzas

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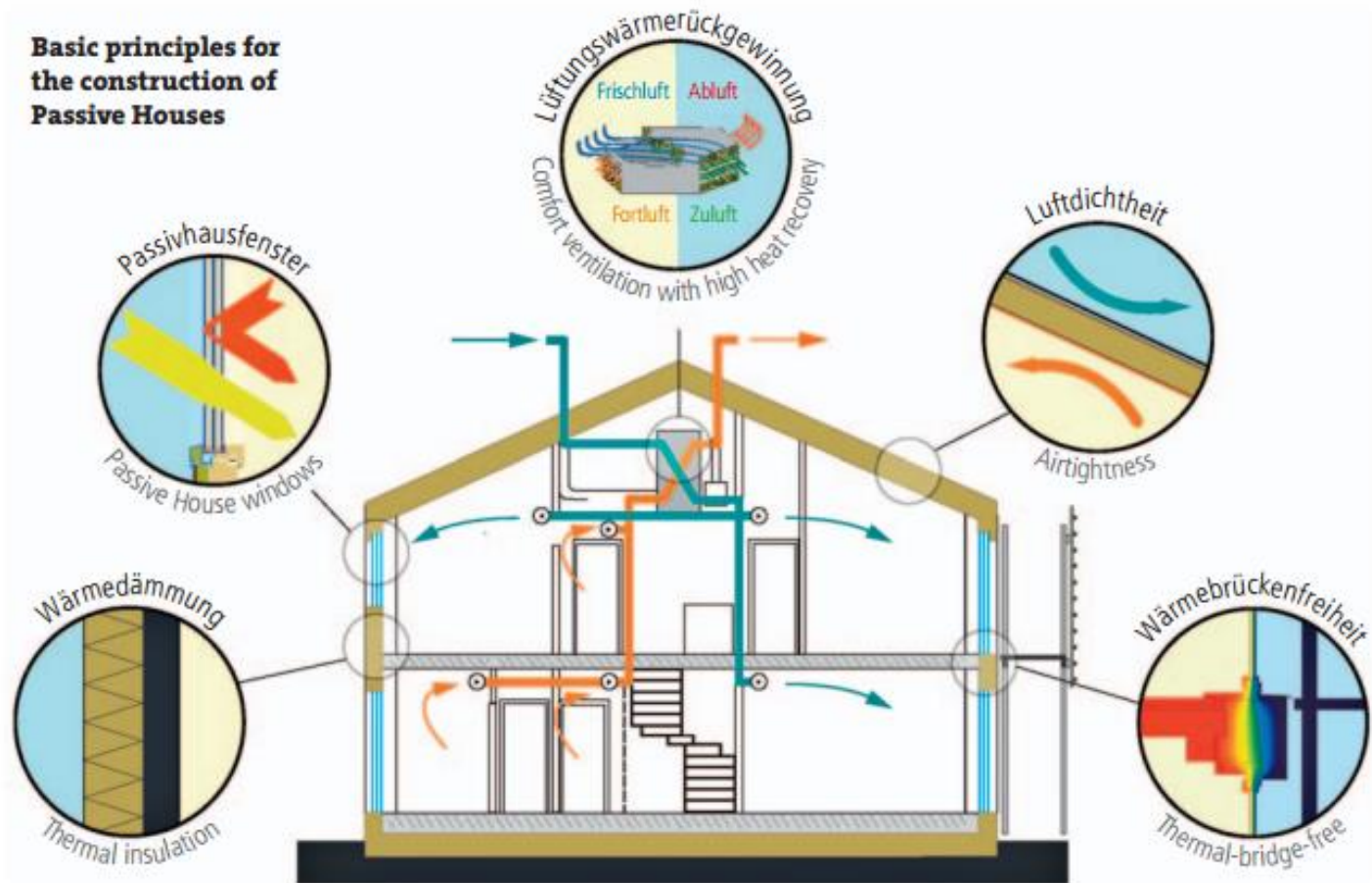


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Basic principles for the construction of Passive Houses



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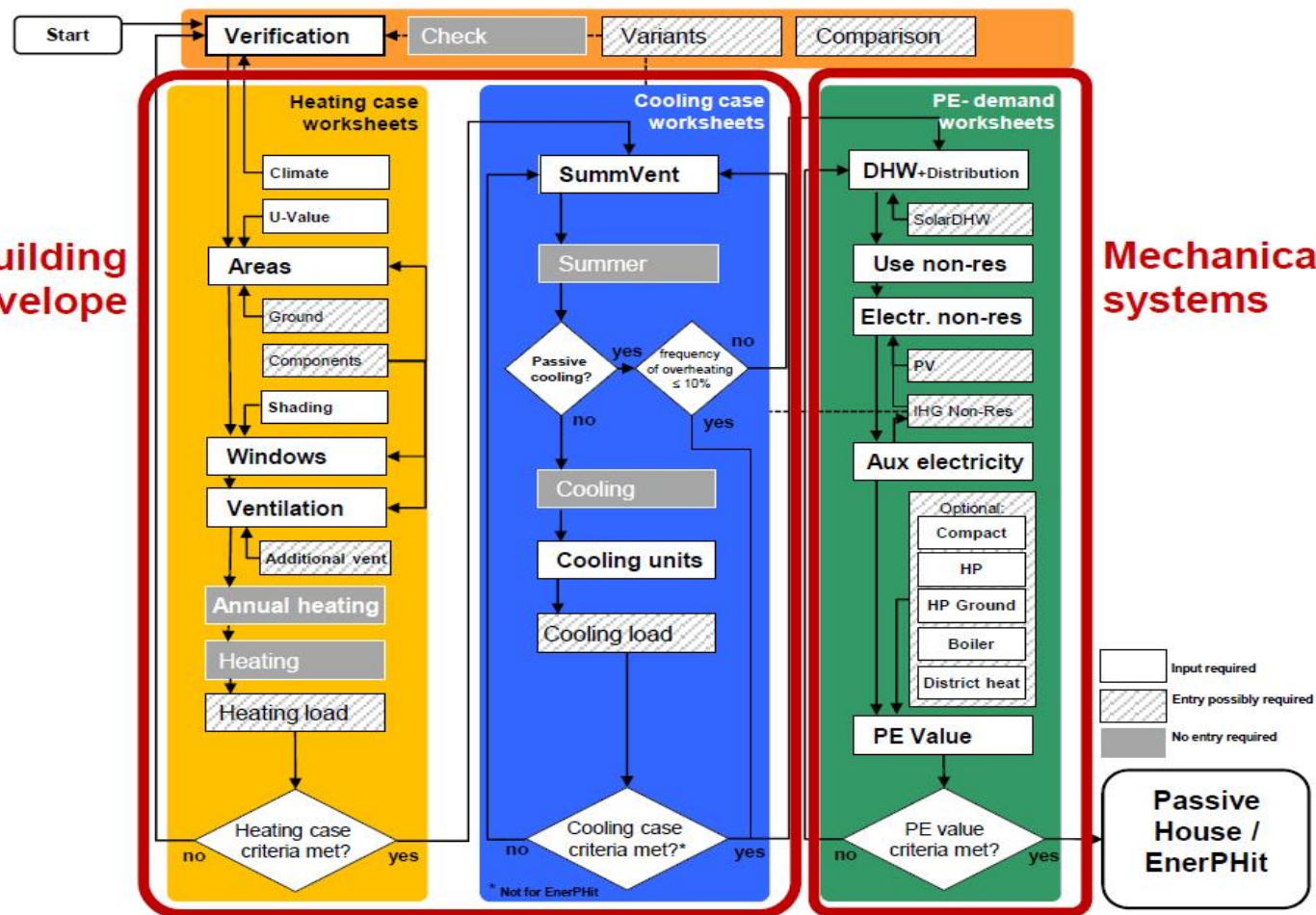


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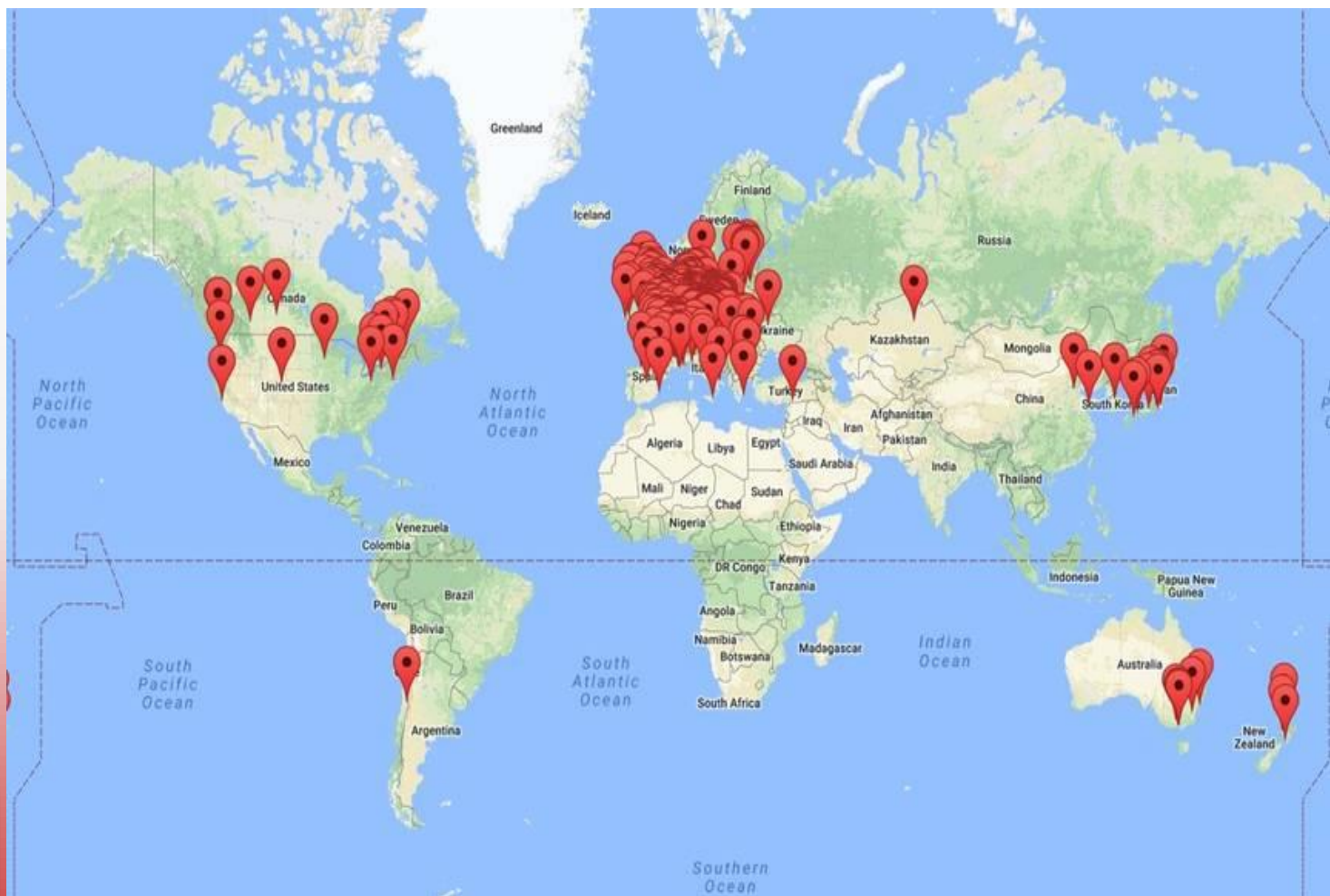
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**Building
envelope**



**Mechanical
systems**





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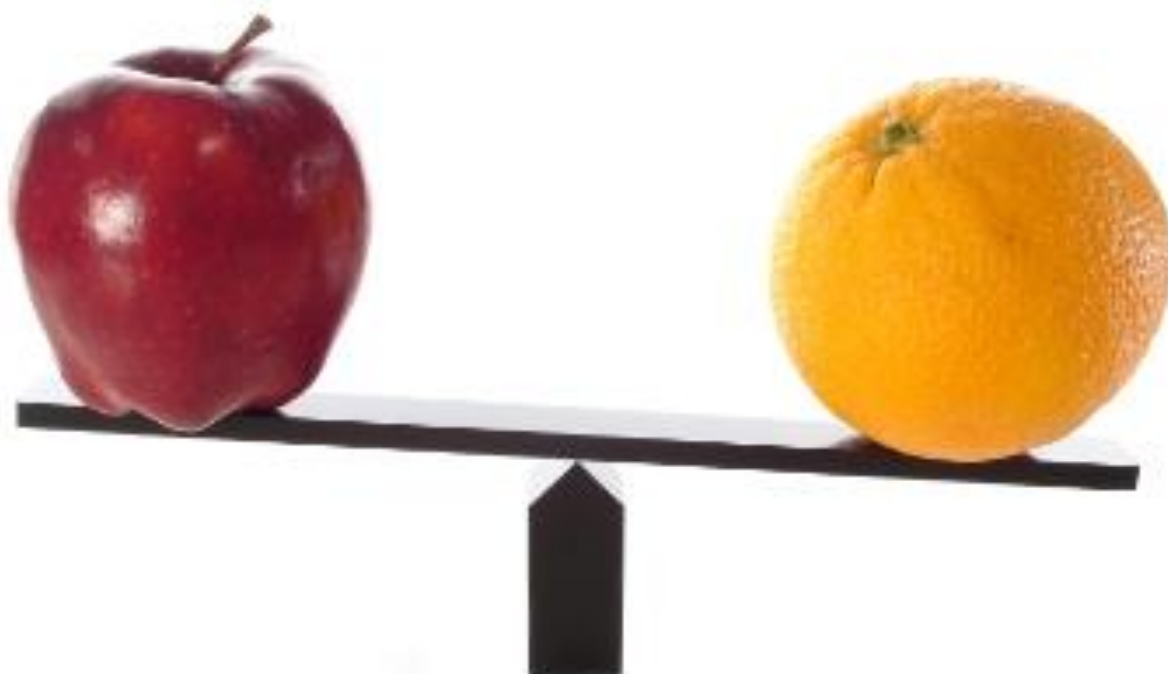
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Passive house : the difference



Passive house : the red pill



This is your last chance. After this, there is no turning back. You take the blue pill—the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill—you stay in Wonderland, and I show you how deep the rabbit hole goes. Remember: all I'm offering is the truth, nothing more.



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Passive House
Live in comfort!
Save Energy!
Save the planet!

Thank You!



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