

Emerging Technologies in Mechanical Systems – Next Generation of Housing

Maurice Falvey B.E. Mech MIEI

Maurice@nilan.ie

Mobile: 087 9798361

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Case Study P.H. in Co.Kerry



“It’s All about indoor climate”

PHi Certified

Specific Demands with Reference to the Treated Floor Area				
Treated Floor Area:		167.0	m ²	
	Applied:	Annual method	PH Certificate:	Fulfilled?
Specific Space Heating Demand:	14	kWh/(m ² a)	15 kWh/(m ² a)	Yes
Heating Load:	8	W/m ²	10 W/m ²	
Pressurization Test Result:	0.6	h ⁻¹	0.6 h ⁻¹	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	89	kWh/(m ² a)	120 kWh/(m ² a)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	52	kWh/(m ² a)		
Specific Primary Energy Reduction through Solar Electricity:		kWh/(m ² a)		
Frequency of Overheating:	0	%		
Specific Useful Cooling Energy Demand:		kWh/(m ² a)		
Cooling Load:	5	W/m ²		

Results

Energy Rating: **A2**
 [kWh/m²/yr]
 Energy Value: **38.73**
 [kgCO₂ /m²/yr]
 CO₂ Emissions Indicator: **8.35**



Building Details

Timber Frame construction

Style: Tradition design on rural exposed site in Co. Kerry.

- TFA 167m²
- Ground Floor = 0.061w/m²K
- Walls = 0.113 w/m²K
- Roof = 0.073 w/m²K
- Windows = Pazen 0.8w/m²K
- Air Tightness Test = 0.56ACH N50 (Q50 0.0215 ACH for DEAP)
- Thermal bridge free design.



Space Heating & Hot Water

- Nilan Compact P and backup 2KW geothermal module
- Connection to room zoned under-floor system.
- Ducting via Nilan NILAir ducting delivering supplying air at floor level.
- “No STOVE” installed
- 4.28m² of Solar Thermal Flat Panels with 300Ltr pre-heat cylinder

NILAir Ducting



Construction Detail



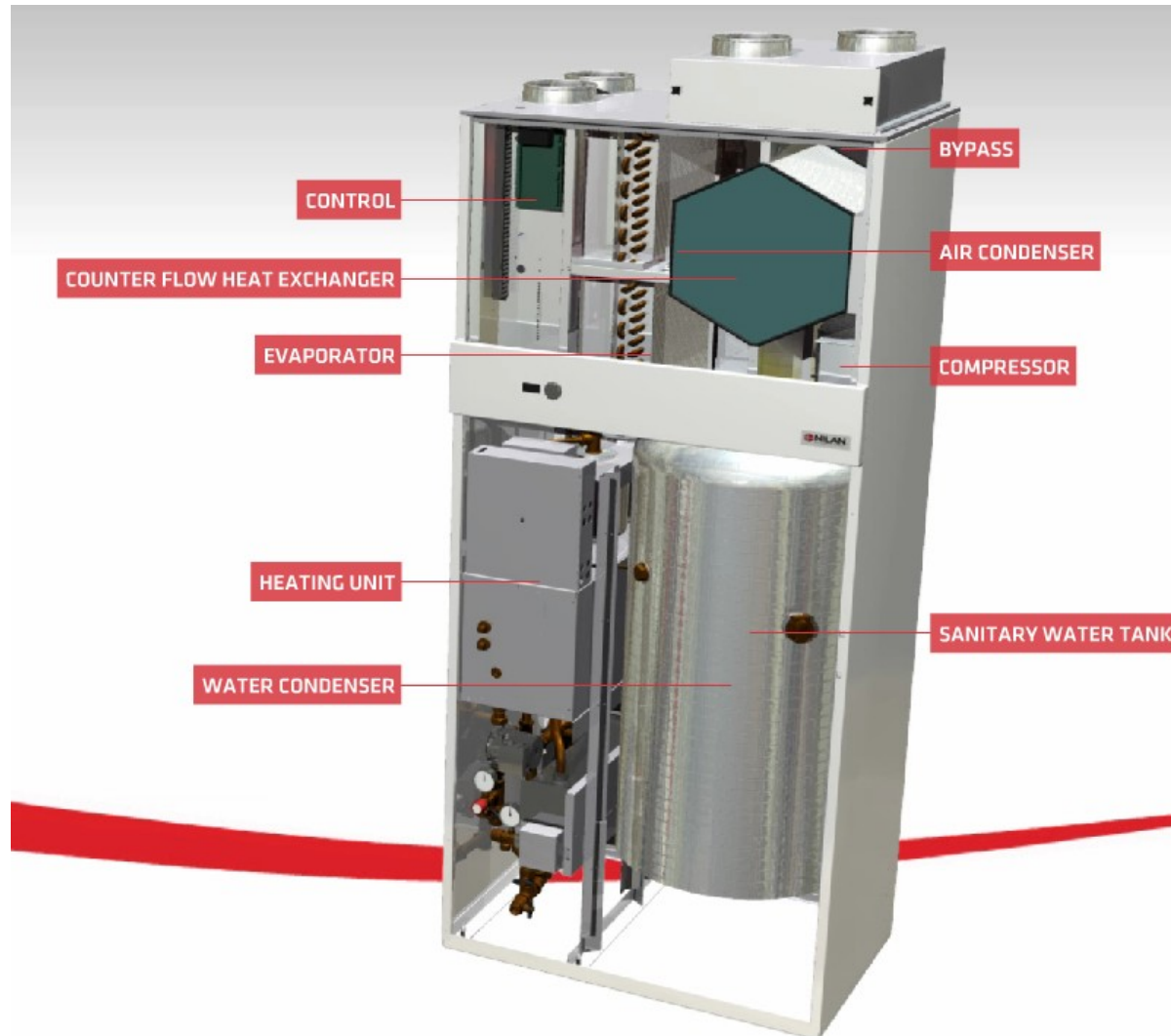
Compact P & Ducting Installation



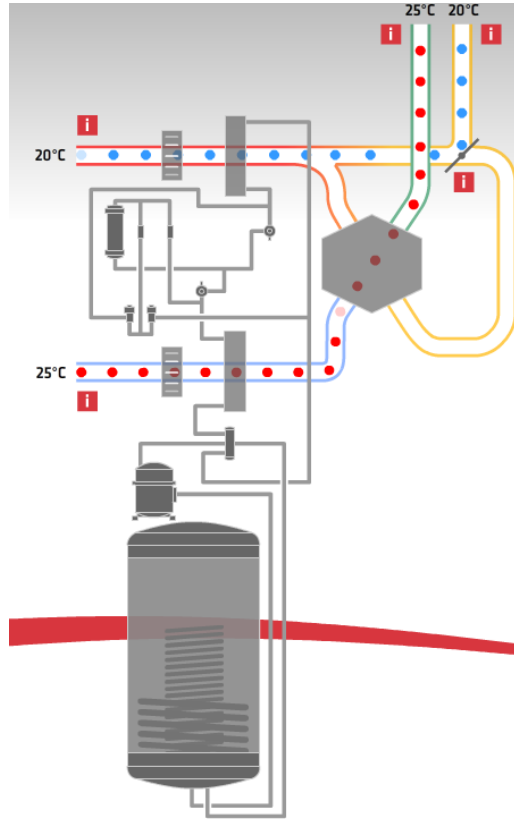
Nilan Compact P



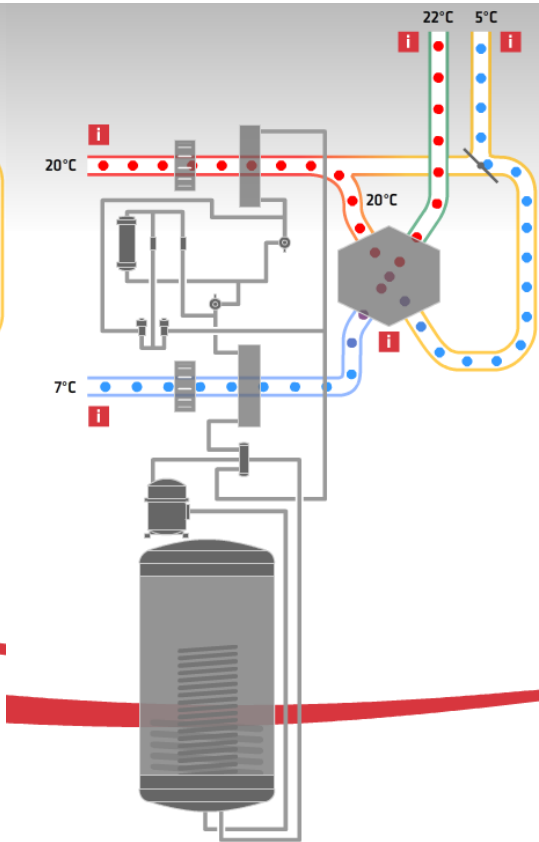
How does Nilan Compact P work!



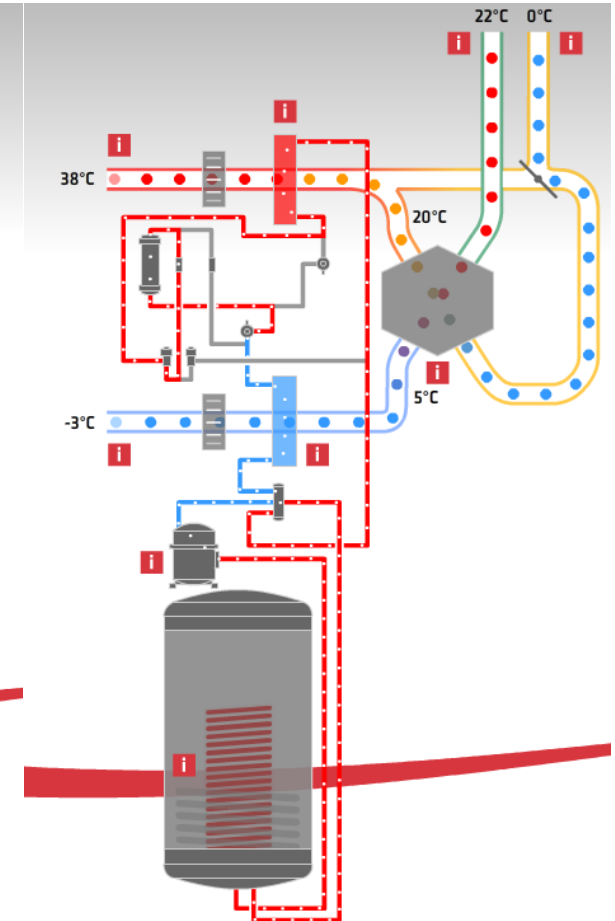
Operation of Nilan Compact P



By-Pass mode
Ventilation only

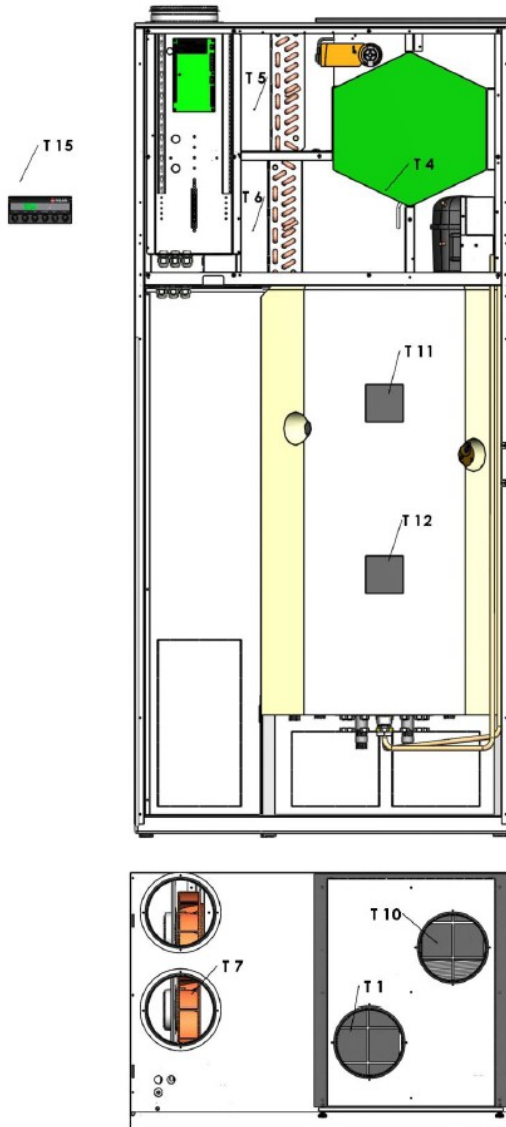


Passive Heat
Recovery mode



Passive Heat Recovery
Active A/A space heating
DHW production modes

Compact P Temp Sensors



CTS602 control panel



Located in Living Area (T15)

Explanation temperature sensors:

- T1: Fresh air.
 - T4: In the counter flow heat exchanger.
 - T5: Condenser.
 - T6: Evaporator.
 - T7: Inlet air after the electrical heating surface. (T2 is change to T7, by mounting Heating surface)
 - T10: Exhaust.
 - T11: Top of the hot water tank.
 - T12: bottom of the hot water tank.
 - T15: CTS602 panel.
- temperatures are shown in the "Show data" menu".

E5: Heating element 1,5kW

EN14511 Performance Data A/A Heat pump

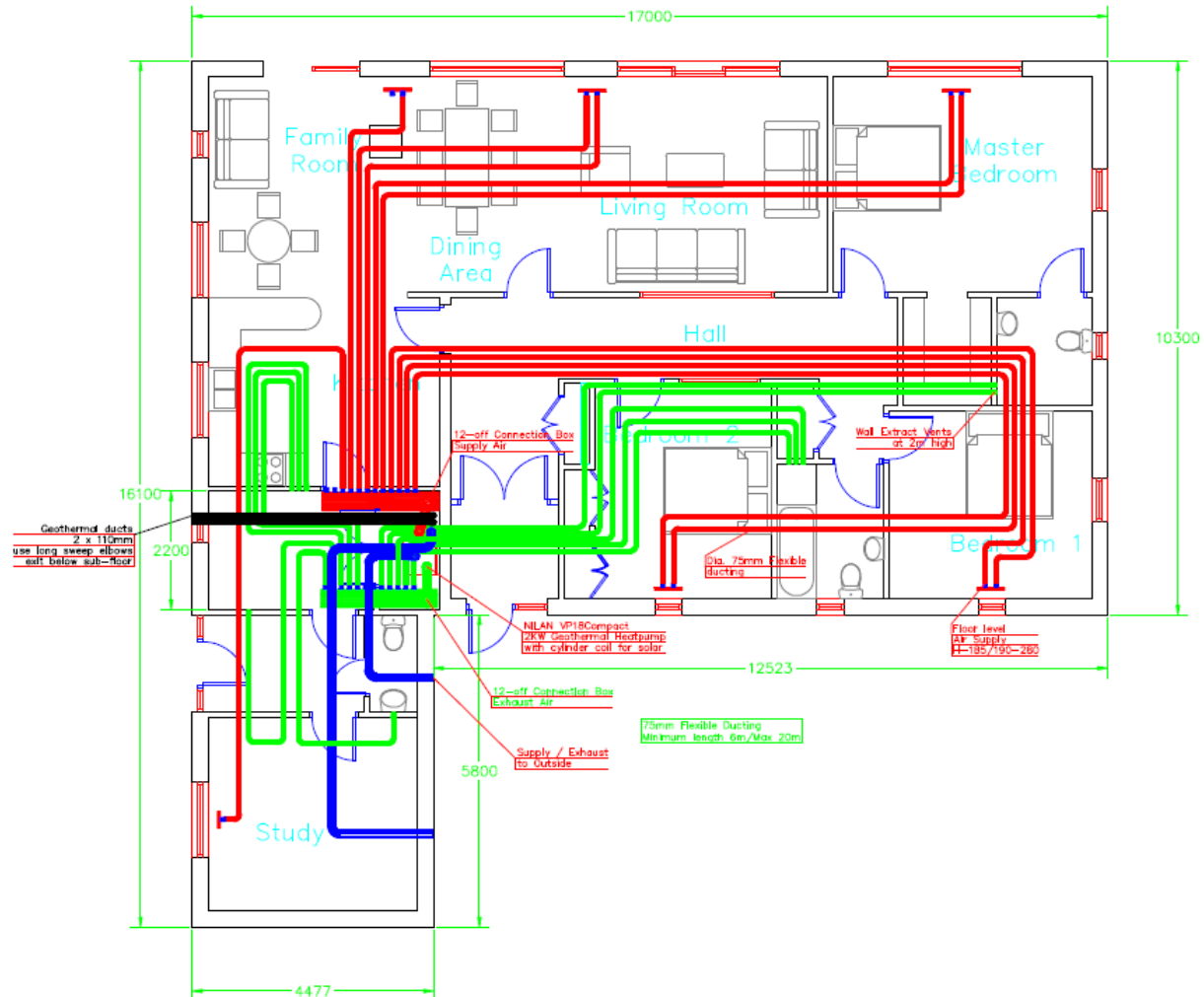
Summary Results from HP-10890/1 for A/A Space Heating

Measurements	Units	MP1	MP2	MP3	MP4	MP5	MP6	MP7	MP8	MP9
Outdoor Air	Deg C	7.1	6.9	6.9	2.1	2.0	2.0	-7.0	-7.7	-7.4
Supply Air with compressor OFF.	20.6	20.6	20.9	20.7	20.7	20.7	20.7	20.7	20.7	20.9
Supply Air with compressor ON	Deg C	42.6	35.5	32.6	39.0	32.6	30.0	33.6	26.0	23.8
Supply Air inlet volume flowrate	m3/hr	98	182	222	100	179	221	98	183	210
COP_Ph+Pext	A/A	2.76	3.58	3.81	2.5	3.19	3.41	2.44	2.65	2.83

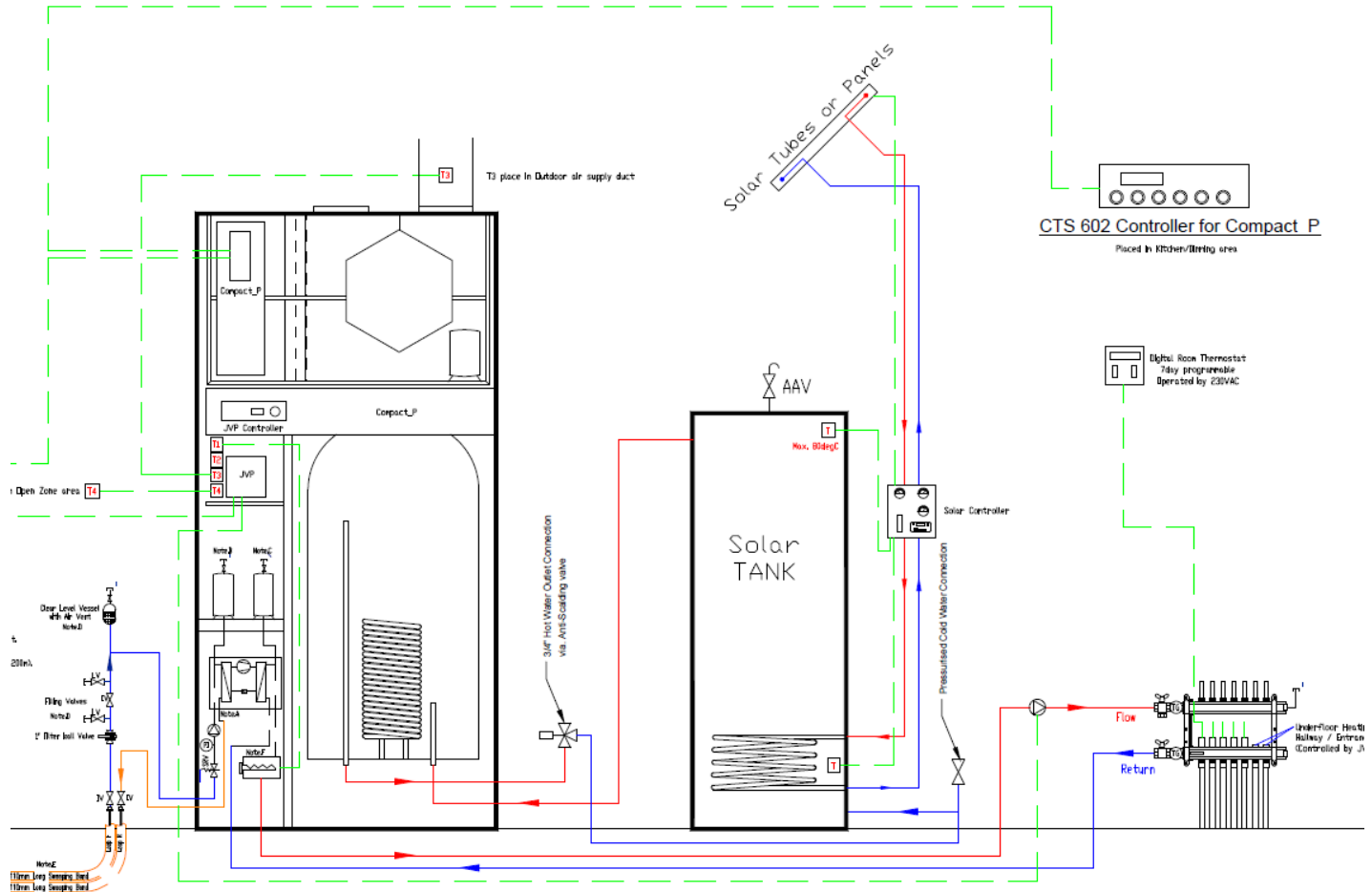
Efficiency for Main Water heating system %, based on three flowrates

Measurements	Units	1	2	3
Air flowrate	m3/hr	100	200	280
Ref Hot water Temp.	DegC	53.4	52.9	53.9
COP_DHW	A/W	2.14	2.25	2.30
Efficiency of main water heating	%	214	225	230

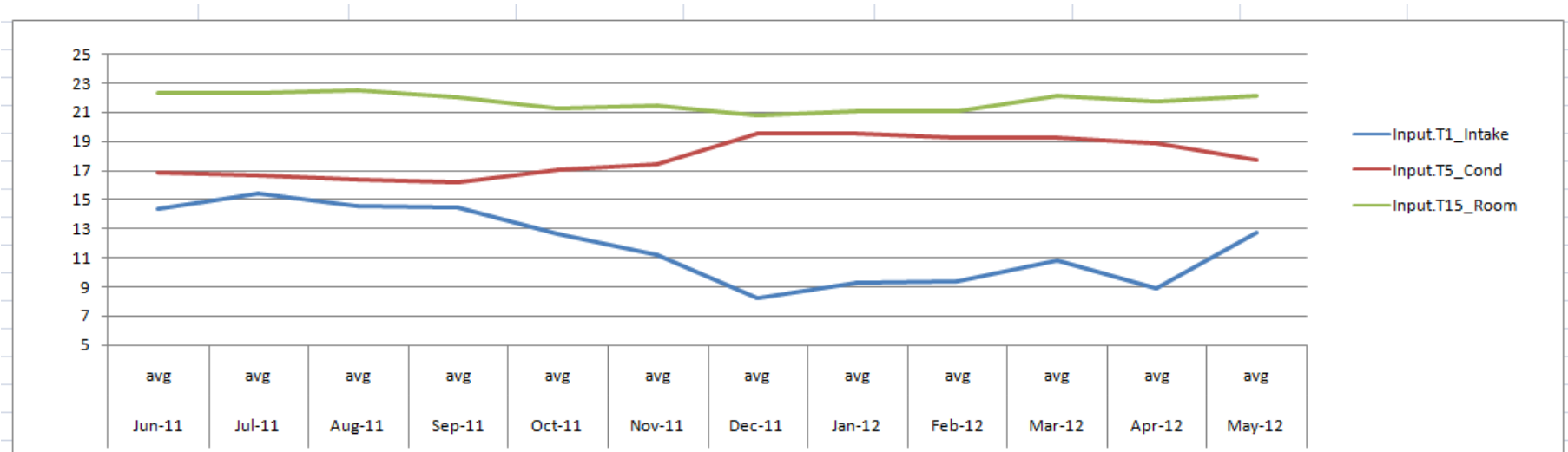
System Layout diagram



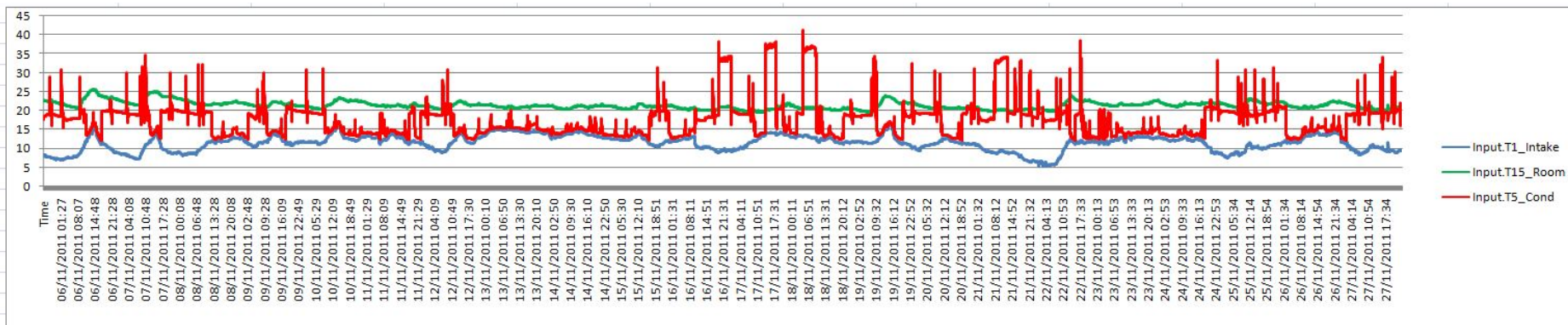
System Schematic



Indoor T15/OutdoorT1/HeatingT5

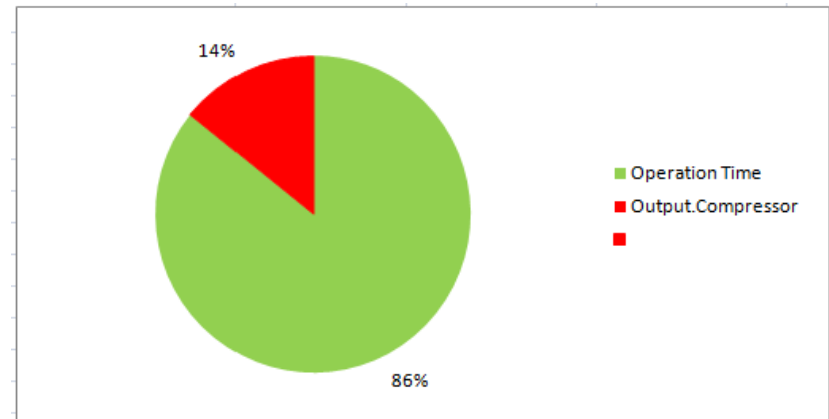
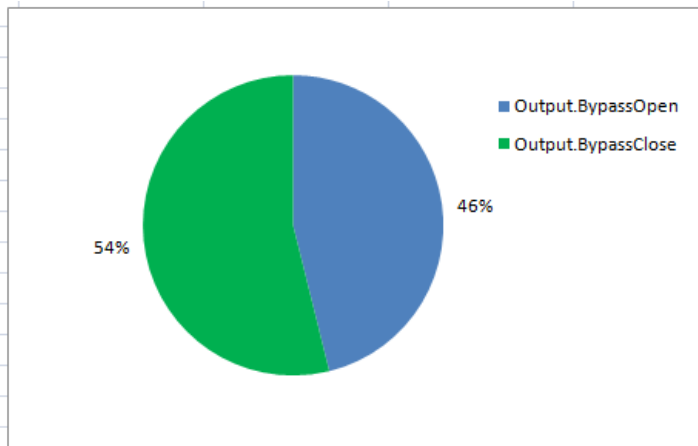
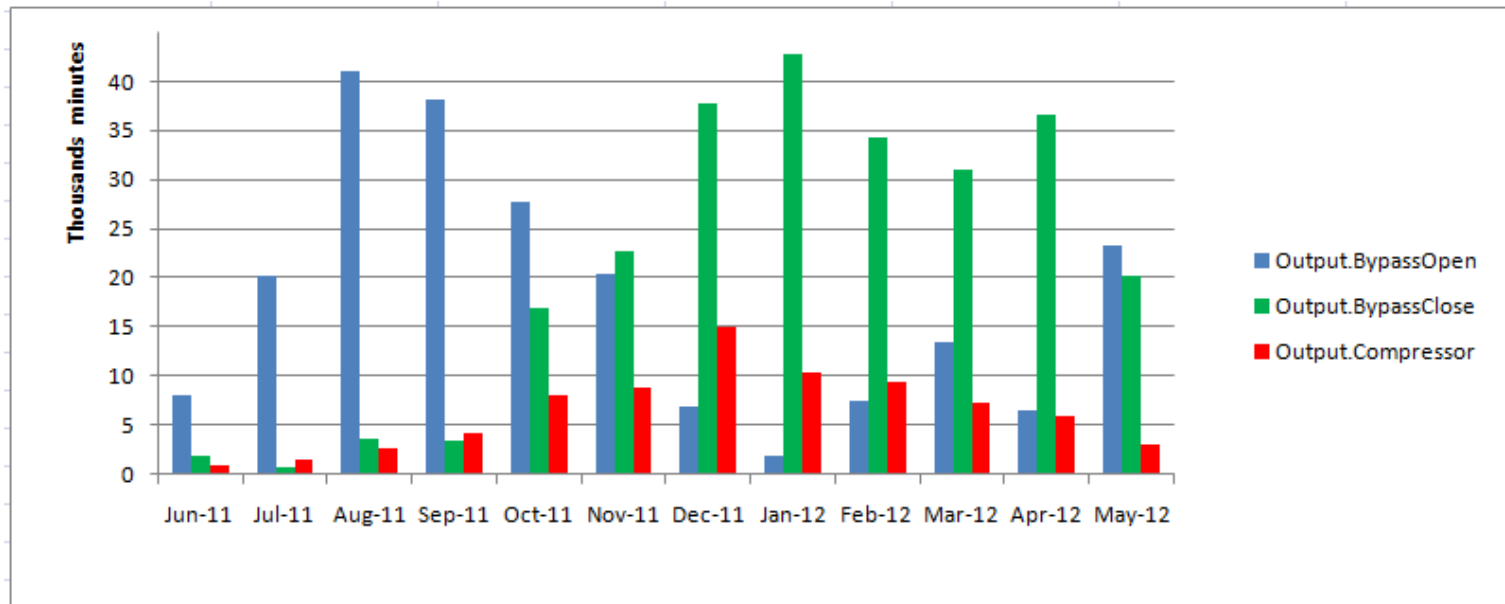


Jun 2011 to May 2012

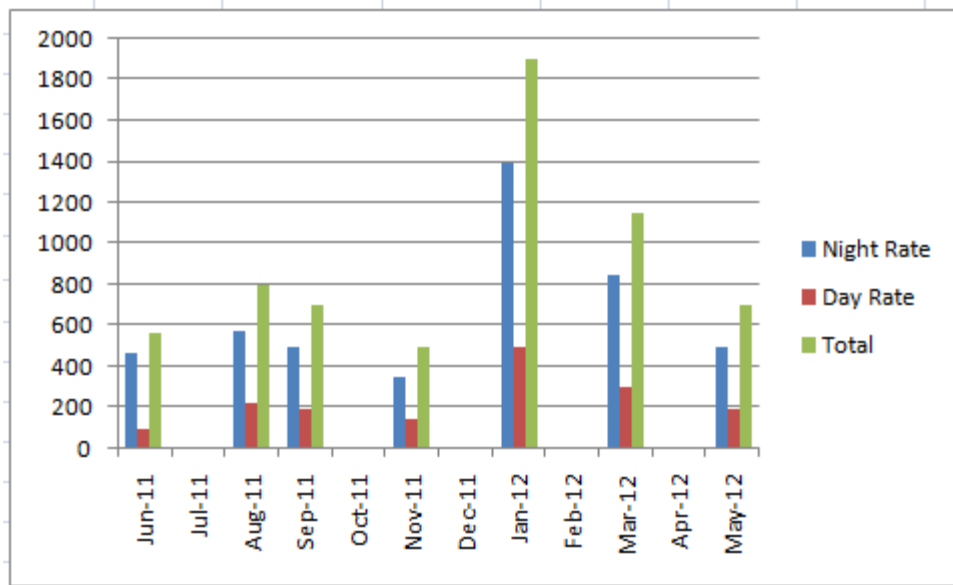


Month of Nov 2011

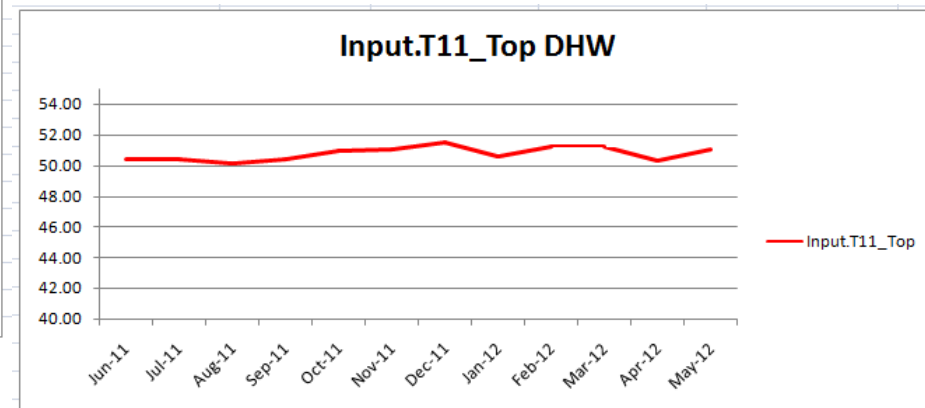
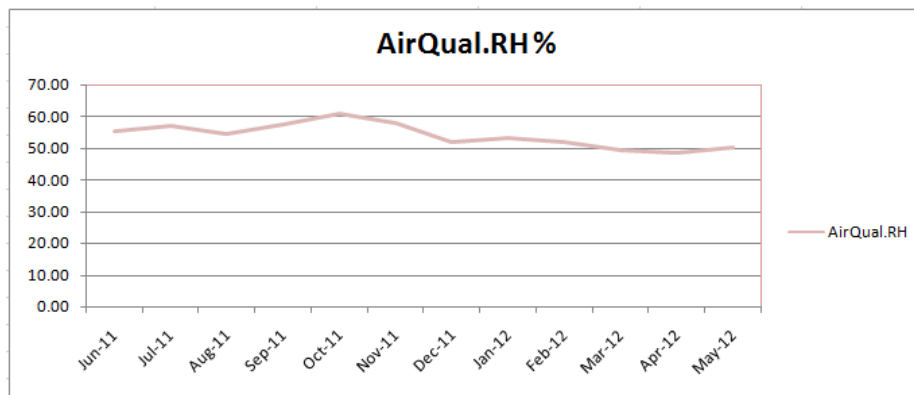
By-Pass Valve Open/Closed/Heat Pump Op



Electricity Usage, Air Quality RH% & DHW Temp



House Holder ESB costs
Day rate 1881 KWh/y
Night Rate 4435 KWh/y



Operational Costs

Components	Time	Input Power	Energy	KWh/y	Electricity Cost ESB Dual Tariff inc VAT13.5%		
					Day 0.196€/KWh	Night 0.115€/KWh	Avg Day/Night rate
Compact P Heat Pump	1285 hr	0.3 KW	385.48		€75.55	€44.33	€59.94
Compact_P Fans	7783.6 hr	0.0004 KWh/m3	448.34		€87.87	€51.56	€69.72
Geothermal Module JVP2						Compact P	€129.66
Underfloor @35degC	781 hr	0.49 KW	382.69		€75.01	€44.01	€59.51
Brine Pump	792 hr	0.035 KW	27.72		€5.43	€3.19	€4.31
Heating Circulating Pump	2303 hr	0.035 KW	80.61		€15.80	€9.27	€12.53
		Compact P + JVP2	1324.84	KWh/y		JVP2	€76.35
						Compact P + JVP2	€206.01
Solar Thermal		SPF data					
Wikosun Flat panes	4.12 m2	499x2 KWh/y	998.00	KWh/y			
Solar Hot circulating pump	2143 hr	0.035 KW	75.01	KWh/y	€14.70		€14.70
						Solar	€14.70
						SUM costs of Mech	€220.71 year
House holder ESB costs							
Day units	1881	KWh/y			€368.68		
Night units	4435	KWh/y				€510.03	
					(without charge)	ESB bill	€878.70 year

No back up immersion was used and note; where is no stove installed

Performance Actual v's PHPP

Components	COP	Output Energy	KWh/y	Solar Thermal	Total Energy Output.	14% contrib to Space Heating	m2 TFA		
Compact P Heat Pump	3.52	1356.89				Output Energy			
Compact_P Fans		448.34				KWh/y	KWh/m2/y		
	Compact P	1805.23	KWh/y	1073.01	2878.21 KWh/y	2475.26	14.82	Hot Water (DHW)	
Geothermal Module JVP2									
Underfloor @35degC	3.2	1224.61							
Brine Pump		27.72							
Heating Circulating Pump		80.61							
	JVP2	1332.94	KWh/y		1332.94 KW/y	1735.89	10.39	Space Heating	
					Total Energy Output	4211.15	25.22	Mech System	
		PE For Mech System (less Solar cont. inc pump)				8354.18	50.03	PE Mech less HouseHold	
				Factor 2.6PHPP					
Primary Energy (Usage)	Day	1881	KWh/y	2.6	4890.6				
	Night	4435	KWh/y	2.6	11531	16422	98.33	Primary Energy	
A/A heat pump output	(2deg in Feb)	1350	watt				8.08	w/m2	
PHPP calculated (Usage)						KWh/y			
DHW Demand						3472	20.79	DHW Demand	
Space Heating Demand						2328	13.94	Space Heating Demand	
Primary Energy						14863	89.00	Primary Energy Demand	
Specific PE Demand Mech.						8650.6	51.8	PE Mech System	
Heat Load					Watt	1336	8	Peak Power Load	