Examples of Heat Pumps in DEAP

Q1 2016

Contents:

1 Introduction

This document outlines a number of worked examples to demonstrate how the Heat Pump Tool (Version 1, Q1 2016) is used for entry of heat pumps in the Dwelling Energy Assessment Procedure (DEAP) for space and water heating.

The document must be read in conjunction with the following:

- DEAP Heat Pump Methodology Guidance
- Heat Pump Tool for DEAP
- DEAP Manual and Survey Guide
- Designer/Installer Sign Off sheet

The first two examples work through in detail how to enter heat pumps that are compliant and not compliant with the Ecodesign/ Energy Labelling directives.

The examples look at how data is sourced, how it is entered into the Heap Pump Tool and finally how the results are entered into the DEAP software.

The other examples demonstrate use of additional inputs, focusing on different scenarios from the first two examples such as different types of heat pump, the use of backup heaters, group heating schemes etc.

It should be noted that the following entries within the DEAP software are as per the existing methodology and therefore are not covered in these examples:

- Heating and Hot Water Controls
- Primary Circuit Losses
- Electricity from central heating pumps and fans
- Entries for all other heating system types
- All other aspects of DEAP not specific to heat pumps (e.g. building elements, lighting etc.)

2 Example 1: Air to water heat pump not compliant with Ecodesign/ Energy Labelling Directives. Listed on HARP.

2.1 Heat pump parameters

The first example is based on the following:

- Heat Pump installed in a dwelling prior to the 26th September 2015.

Under the Ecodesign and Energy Label directives there is no mandatory requirement for the heat pump to comply with the directives. However the Assessor should check with the heat pump manufacturer/ supplier that the heat pump is not compliant, as the heat pump model may be available on the market post 26th September 2015 and therefore would need to be compliant with the directives. The Assessor has obtained contact details of the system designer or installer from the client.

In this case the Assessor has received a copy of the designer/ installer sign off sheet from the installer confirming that the heat pump is not compliant with the Ecodesign / Energy Labelling directives and has been tested to EN 14511. The installer also confirmed that the heat pump is available on the HARP Database.

Model of the installed heat pump(s)	Model 123	Ensure this is exact product model, including model name, number and qualifier where present.
Type of Heat Pump	Air to Water ☑	
	Brine to Water ☐	
	Water to Water ☐	
	Exhaust Air to Water ☐	
	Air to Air ☐	
	Brine to Air ☐	
	Water to Air ☐	
Is the Heat Pump compliant with Ecodesign Directive	No	Select Yes or No
Is the Heat Pump compliant with Labelling Directive	No	Select Yes or No
Space Heating Test Standard	I.S. EN 14511	Select Standard, I.S. EN 14825 or I.S. EN 14511
Water Heating Test Standard	I.S. EN 14511	Select Standard, I.S. EN 16147 or I.S. EN 14511 or I.S. EN 255-3
Is the heat pump listed on HARP	Yes	lect Yes or No

Figure 1: Heat Pump Selection from Designer/Installer Sign off Sheet

2.2 Design details

The installer also confirmed the following as part of the sign off sheet:

4. Heat Emitter Design		
Is there one or more radiators present	No	Select Yes or No
Is there one or more fan coil units present	No	Select Yes or No
Is there underfloor heating present	Yes	Select Yes or No
Is there warm air supply from the heat pump	No	Select Yes or No
Has a load / weather compensation been installed?	Yes	Select Yes or No
Provide details of zone, temperature and time control installed?	2 space heating & 1 water zones with time and temperature control on each.	Input number of heating zones, thermostats, etc
Temperature (°C) of the water leaving the heat pump when supplying space heating based on full heating system design conditions and at the design external temperature?	35.00	Input temperature in degrees celcius

Figure 2: Heat Emitter Design from Sign off Sheet

5. Hot Water System		
Maximum flow temperature (°C) of the heat pump while providing hot water (by heat pump only) based on certified data	55.00	Input temperature in degrees celcius, please provide supporting documentation.
Type of DHW Store	Separate Hot Water Storage	Input the type of store present, no store, integral store or separate store
Is there an integral immersion or electric element present capable of providing hot water	Yes	Select Yes or No

Figure 3: Hot Water System from Sign off Sheet

For existing dwellings it may not always be possible to get a Designer/ Installer Sign off Sheet. In those circumstances the Assessor should verify as much information as possible on site and follow the guidance set out in the DEAP Heat Pump Methodology guidance document.

2.3 Source of test data

For heat pumps that are not compliant with the Ecodesign/ Energy Labelling Directive, the Seasonal Performance Factor (SPF) can be sourced using the approach used in DEAP previously:

- HARP Database
- Certified or CE marked data from accredited laboratory with test certificates to IS EN 14511-2, IS EN 255-2 or EN 15879.
- Use of DEAP Table 4a defaults for heat pump efficiencies.

In this case the heat pump is listed on the HARP database as confirmed by the designer/ installer:

Type:	Air to water		
Seasonal Performance Factor (SPF):	426%		
Rated capacity (kW)	6.85	**EN test method used:**	EN14511-2:2000(electric)
Tested by Body:		**Certificate No :**	

Figure 4: HARP Database entry

2.4 Entry in Heat Pump tool

1. General Information

Using the heat pump tool, the Assessor completes the administration data including name of client, address of installation, MPRN, BER and Eircode numbers. As always, ensure that the test/HARP data matches the actual name of the heat pump in the dwelling being assessed.

2. Assessor Details

The Assessor completes own name and assessor number.

DEAP Heat Pump Tool

Version 1

Publication Date: Q1 2016

Colour Key: User Input, only editable cells; Constant; Calculated Value; User does not need to edit,

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Description:	Value:	Unit:	Guidance Notes:
1. General information			
Name of owner/ client:	A Another		
Address of installation:	Main St, Dublin		
MPRN Number:	1234567890		
Eircode:	DUB 10W1		
BER Number:	8000012345		
2. Assessor Details			
Assessor Name:	J Bloggs		
Assessor Number:	123456		

Figure 5: Heat Pump Tool General Information

3. Building Data

The Assessor takes the Total heat loss (W/K) from the Building Elements - Heat loss results tab in the DEAP assessment and enters it in the tool.

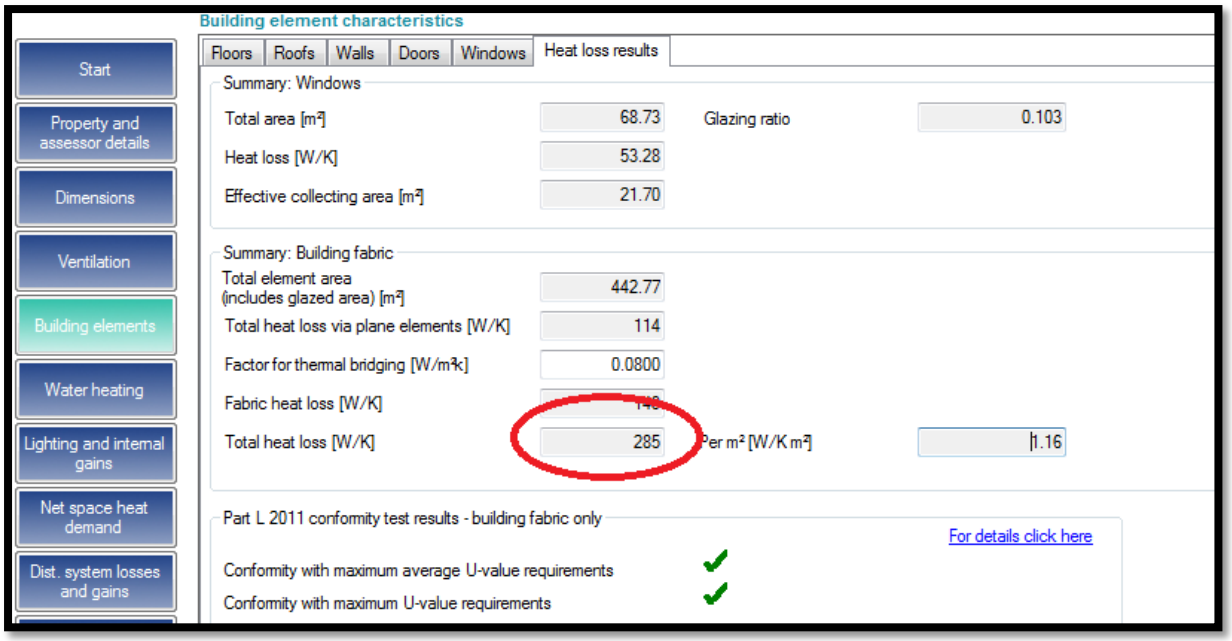


Figure 6: DEAP Software – Building Elements

The "Heat Loss Watts" figure in the heat pump calculator is the calculated heat loss from the dwelling. Where a designer/ installer is advising that the Design Flow Temperature is below the defaults built into the heat pump calculator, the BER Assessor must obtain and retain documentary evidence from the designer/installer to support the reduced flow temperature. The Assessor should use the heat loss figure in the heat pump calculator to compare to the documentary evidence provided by the designer/installer. Refer to the Heat Pump Methodology for guidance on the documentary evidence required to support a reduced design flow temperature.

In this example, the heat pump is serving a single dwelling; therefore "No" is selected for "Is the Heat Pump part of a Group Heating Scheme". Because it is not a group heating scheme, the fields for proportion of group heating provided by heat pump, floor area of dwelling and total floor area served by the heat pump are blacked out and do not need to be completed:

3. Building Data			
Total heat loss (W/K) taken from DEAP	285	W/K	Source from the Building Elements - Heat Loss Results Tab in DEAP
Heat Loss Watts	6175.95	Watts	Required Heating Capacity at design conditions.
Is the Heat Pump part of a Group Heating Scheme	No		
Proportion of group heating provided by the heat pump	0%	%	
Floor Area of Dwelling	0	m^2	Source from DEAP
If Heat Pump serves a Group Heat Scheme, the total Floor Area served by Heat Pump is:	0	m^2	

Figure 7: Heat Pump Tool – Building Data

4. Heat Pump Data

The Assessor enters the Manufacturer and Model of the heat pump taken directly from Section 3 of the Designer Installer Sign Off Sheet, the type of heat pump taken directly from Section 3 of the Design Installer Sign Off Sheet, and specifies that the heat pump is supplying Space Heating and Domestic Hot Water taken directly from Section 2 of the Designer Installer Sign Off Sheet and the

standards the heat pump has been tested to, taken directly from Section 3 of the Design Installer Sign Off Sheet.

In this case the heat pump is tested to I.S.EN 14511; therefore the temperature control (also called capacity control), operation limit temperature and water operating limit temperature are blacked out as they are not required by the heat pump calculator.

4. Heat pump Data			
Manufacturer of the installed heat pump(s)	Heat Pump Manu		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Model of the installed heat pump(s)	Model 123		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Type of heat pump	Air to Water		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Temperature Control	Variable Outlet		Source from Ecodesign Data
Does the installation provide:	Space heating and Domestic Hot Water		Source from Designer/ Installer sign off sheet or site evidence without Ecodesign
Space Heating Test Standard	I.S. EN 14511		Source from Ecodesign Data or HARP Database
Water Heating Test Standard	I.S. EN 14511		Source from Ecodesign Data or HARP Database
Operation Limit Temperature (TOL)	-8.00	°C	Source from Ecodesign Data
Heating water operating limit temperature (WTOL)	65.00	°C	Source from Ecodesign Data

Figure 8: Heat Pump Tool – Heat pump Data

5. Heating

In this case the heat pump is tested to I.S.EN 14511, therefore the "Annual Space heating requirement", "Is there a fixed secondary heater present", "Is there a CHP present", "Fraction of main space and water heating from CHP" and "Annual space heating provided by heat pump" fields are blacked out as they are not required by the heat pump calculator.

The "Design outdoor temperature" is a constant.

5. Heating			
Annual space heating requirement taken from DEAP	28745	kWh	Source from the Distribution system loss and gains tab in DEAP
Is there a fixed secondary heater present?	No		Details on CHP and secondary heating must match the DEAP energy requirements entries.
Is there a CHP present?	No		Details on CHP and secondary heating must match the DEAP energy requirements entries.
Fraction of main space and water heating from CHP	0.1		Details on CHP and secondary heating must match the DEAP energy requirements entries.
Annual space heating provided by Heat Pump	28745	kWh	
Design Outdoor Temperature	-3	°C	Based on CIBSE Guide A Section 2
Indoor Design Temperature (Mean Internal Temperature)	18.67	°C	Source from Net Space Heat Demand "Required mean internal temperature during heating hours degC"

Figure 9: Heat Pump Tool – Heating

The Indoor Design Temperature is taken from "Net Space Heat Demand – Required mean internal temperature during heating hours" in DEAP:

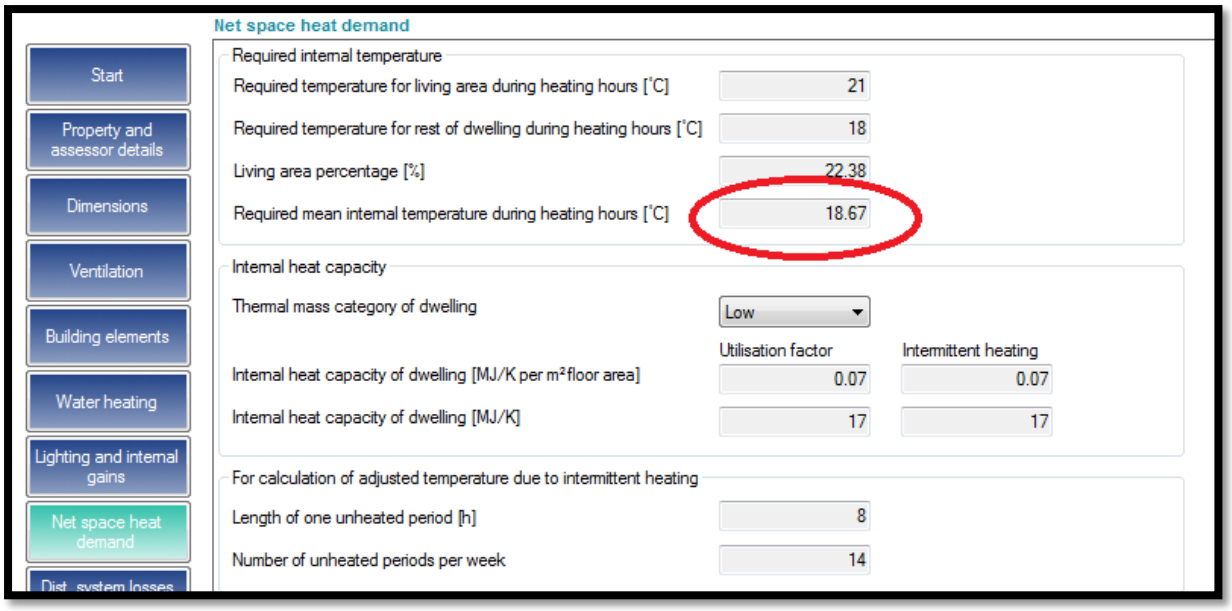


Figure 10: DEAP Software – Net space heat demand

The Assessor selects the type of heat emitters present in the dwelling; this is taken from Section 4 of the Designer Installer Sheet and confirmed by the assessor on site. Based on the heat emitters present, the software calculates a "default supply temperature". The Assessor can enter a design flow temperature below the default, taken from Section 4 of the Design Installer Sign Off Sheet but must have adequate documentary evidence to support the reduced temperature as outlined above. Please refer to DEAP Heat Pump Methodology for guidance on the evidence required.

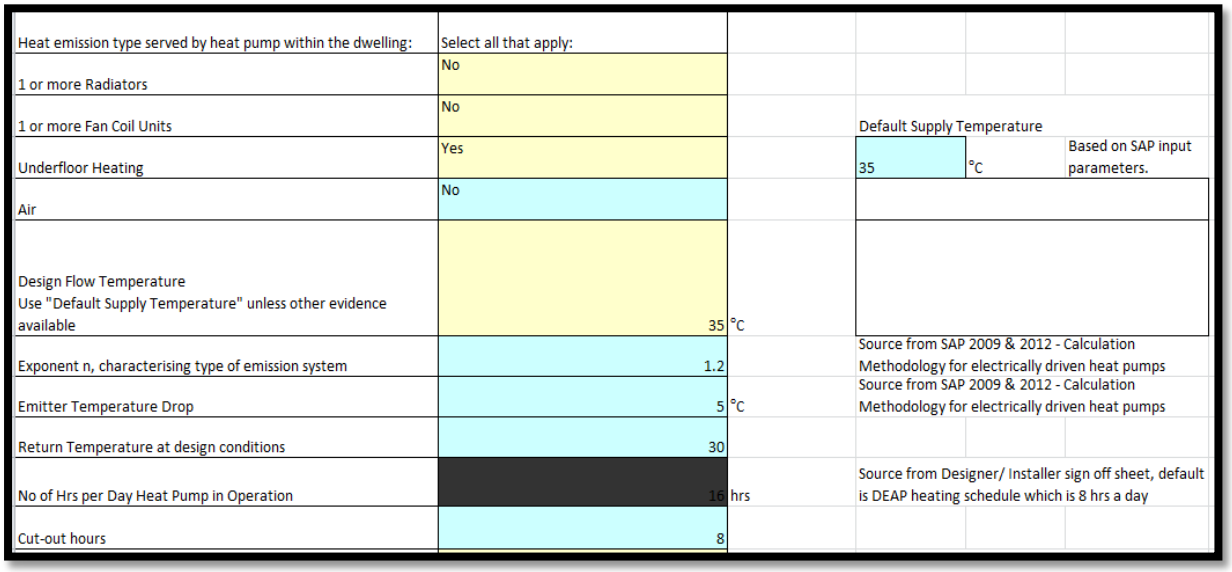


Figure 11: Heat Pump Tool – Heat Emitters

Note the "No of hours per day heat pump is in operation" and back up heater data is blacked out as it is not used in the calculator for EN 14511 based calculations.

6. Domestic Hot Water

The Assessor takes the "Output from the Main water heater" from the Water Heating Tab in DEAP and enters it in the Heat Pump calculator.

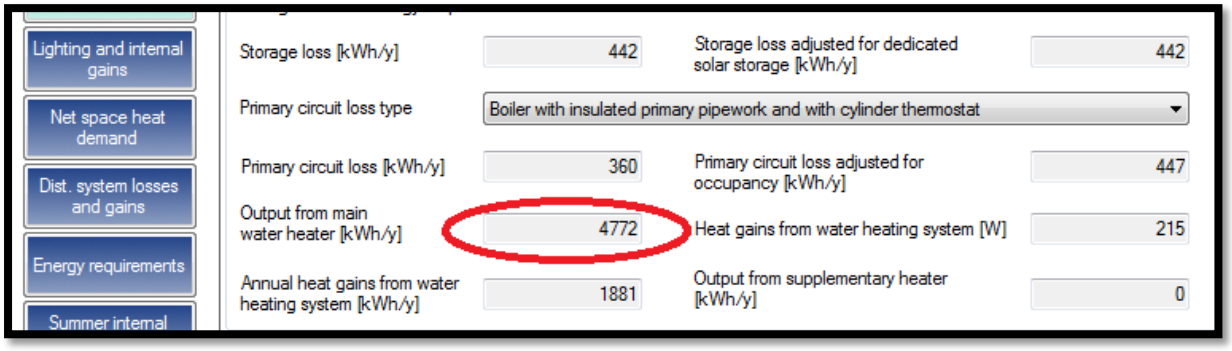
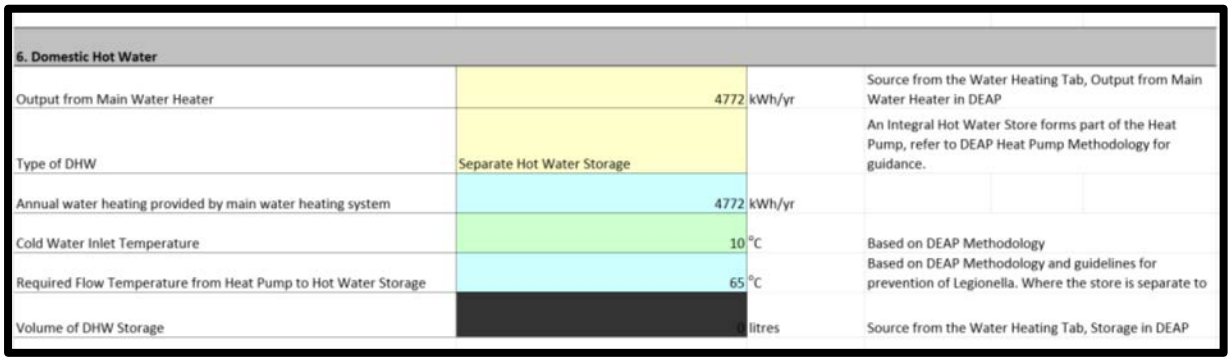


Figure 12: DEAP Software – Water Heating

The Assessor also selects the "Type of DHW" based on the installed system's hot water storage and section 5 of the Designer Installer Sign Off Sheet. The "Volume of DHW Storage" is blacked out as it is not used in the calculator for EN 14511 based calculations.



6. Domestic Hot Water			
Output from Main Water Heater	4772	kWh/yr	Source from the Water Heating Tab, Output from Main Water Heater in DEAP
Type of DHW	Separate Hot Water Storage		An Integral Hot Water Store forms part of the Heat Pump, refer to DEAP Heat Pump Methodology for guidance.
Annual water heating provided by main water heating system	4772	kWh/yr	
Cold Water Inlet Temperature	10	°C	Based on DEAP Methodology
Required Flow Temperature from Heat Pump to Hot Water Storage	65	°C	Based on DEAP Methodology and guidelines for prevention of Legionella. Where the store is separate to
Volume of DHW Storage		litres	Source from the Water Heating Tab, Storage in DEAP

Figure 13: Heat Pump Tool – Domestic Hot Water

7. Product Performance Data

As the Space Heating and Water Heating test standards are EN 14511, the data associated with EN 14825, EN 16147 and EN 255-3 are blacked out.

Based on the data available, the Assessor enters the SPF in compliance with DEAP Methodology, as taken from HARP in this instance.

The installer has also confirmed the presence of load and weather compensation from Section 4 of the Designer Installer Sign Off Sheet and an integral immersion from Section 5 the Designer Installer Sign Off Sheet. Finally the maximum flow temperature of the heat pump is 55°C as detailed in Figure 3 and taken from Section 5 of the Designer Installer Sign Off Sheet. As the maximum flow temperature is 55°C, "No" is selected for can the heat pump reach a flow temperature of >=65°C.

Test Conditions EN 14511-2			
Is the Heat Pump Listed on HARP	Yes		
Enter SPF based on DEAP Methodology/ HARP	4.26	kW/kW	compliance with DEAP methodology or from DEAP table 4a defaults
Is there load or weather compensation present?	Yes		Source from Designer/ Installer sign off sheet or site evidence
Does the heat pump have an Integral Immersion	Yes		Source from Designer/ Installer sign off sheet or site evidence
Does heat pump reach a flow temperature of >=65oC	No		dataplates or accredited test data for the heat pump in question.

Figure 14: Heat Pump Tool – Test Conditions

8. Results

The Heat Pump Calculator then calculates the efficiency of the Main Heating and Main Hot Water systems and the efficiency adjustment factors for entry in the assessment in the DEAP software.

The tool also calculates the "Additional Renewable Contribution from the Heat Pump". This is renewable energy that is supplied by the heat pump but not accounted for in the DEAP software. The Heat Pump Calculator combines the efficiency of the Heat Pump and backup heater, in this case electric immersion giving a combined efficiency of 162% that is entered into the DEAP tool. Therefore DEAP would not consider the water heater (including heat pump and immersion) to be renewable. The heat pump calculator determines the renewable proportion attributable to the heat pump itself and this is added to the DEAP assessment.

8. Results			
Results			
Efficiency of Main Heating System	426%	%	Enter this in DEAP: energy requirements: space heating
Efficiency Adjustment Factor - Main Heating	1.00		Enter this in DEAP: energy requirements: space heating
Efficiency of Main Hot Water System	162%	%	Enter this in DEAP: energy requirements: water heating
Efficiency Adjustment Factor - Main Hot Water	1.00		Enter this in DEAP: energy requirements: water heating
Additional Renewable Contribution from Heat Pump	985.77	kWh/year	Enter this in DEAP: energy requirements: fuel data: Renewable Energy: Energy Saved or Produced: Renewable Thermal: Part L Total contribution (kWh/yr). Note: this is only applied to Part L renewable contribution in new dwelling assessments.

Figure 15: Heat Pump Tool - Results

2.5 Entry in DEAP

The "Efficiency of the Main Heating System" and "Efficiency Adjustment Factor – Main Heating" are entered under the Energy Requirements – Space heating tab in DEAP.

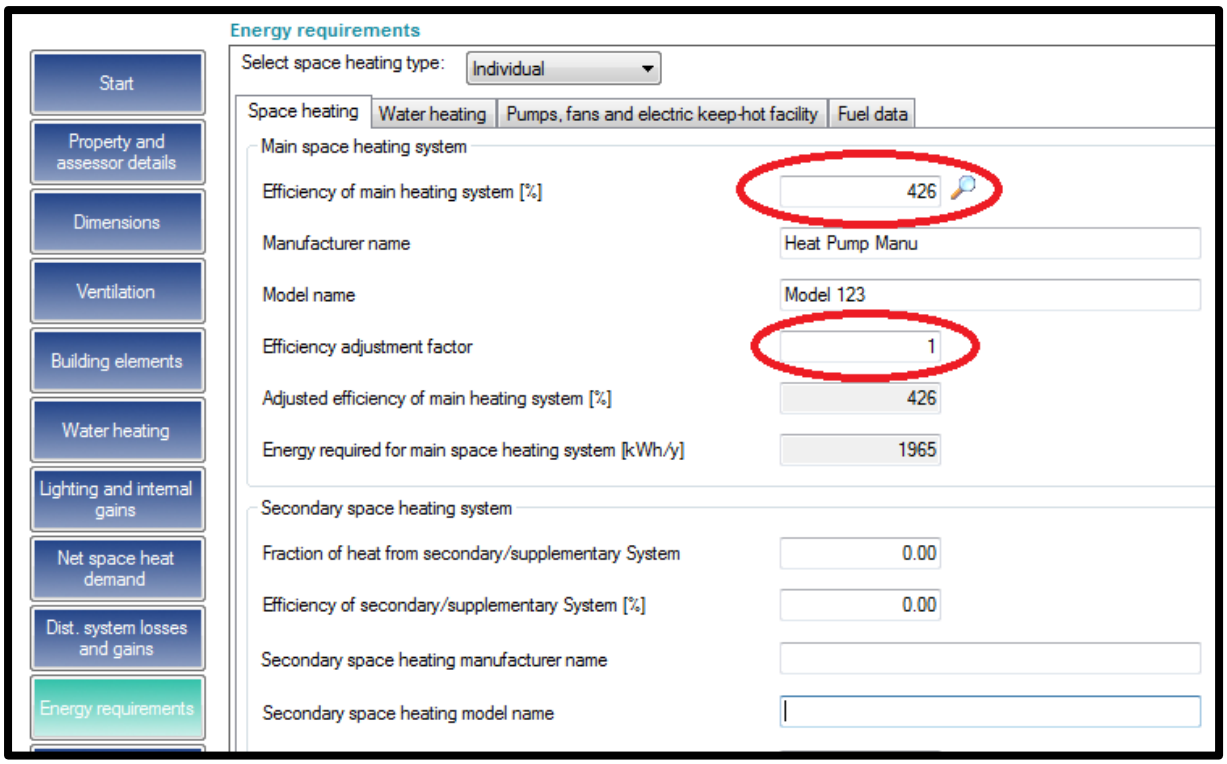


Figure 16: DEAP Software – Energy Requirements – Space heating

The "Efficiency of the Main Water Heating System" and "Efficiency Adjustment Factor – Main Hot Water" are entered under the Energy Requirements – Water heating tab in DEAP.

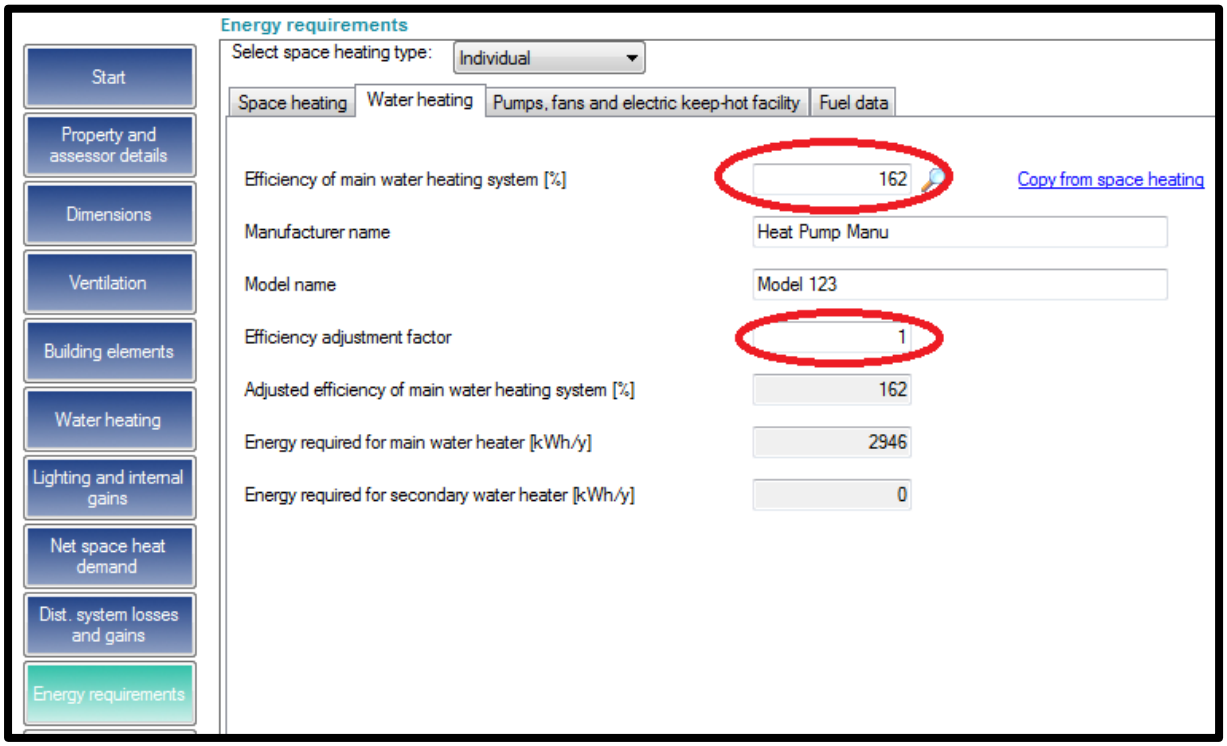


Figure 17: DEAP Software – Energy Requirements – Water heating

The “Additional Renewable Contribution” is entered under the Energy Requirements – Fuel Data – Renewable Energy in DEAP under the Part L total contribution **only**. The type of renewable energy is Renewable Thermal.

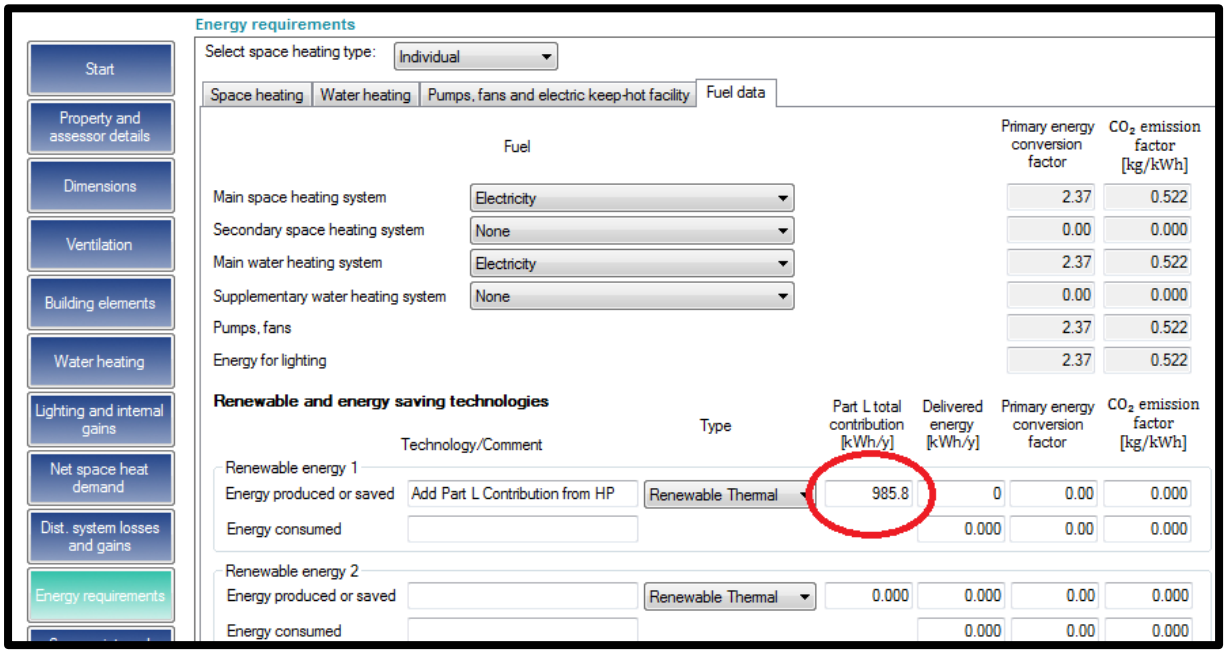


Figure 18: DEAP Software – Energy Requirements – Fuel Data

3 Example 2: Air to water heat pump compliant with Ecodesign/ Energy Labelling Directive

3.1 Heat pump parameters

The second example is based on the following:

- Heat Pump installed in a dwelling after the 26th September 2015 and compliant with the Ecodesign/ Energy Labelling Directives. Provides space and water heating.

The Ecodesign directive requires that technical data is made publicly available declaring the test data for the heat pump to EN 14825 and EN 16147.

The Assessor received the following details in the Designer/ Installer Sign off sheet.

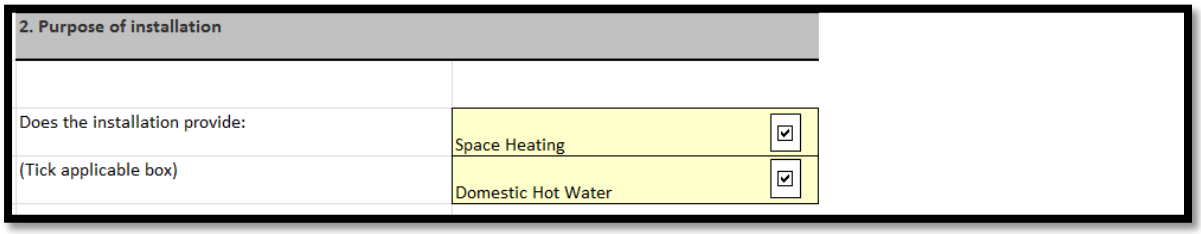


Figure 19: Purpose of Installation from Sign off Sheet

3. Heat pump selection		
Manufacturer of the installed heat pump(s)	Heat Pump Manufacturer	Ensure this is exact product manufacturer name.
Model of the installed heat pump(s)	Heat Pump 123	Ensure this is exact product model, including model name, number and qualifier where present.
Type of Heat Pump	Air to Water ☑	
	Brine to Water ☐	
	Water to Water ☐	
	Exhaust Air to Water ☐	
	Air to Air ☐	
	Brine to Air ☐	
	Water to Air ☐	
Date of Installation	01/12/2015	Insert date heat pump was installed
Is the Heat Pump compliant with Ecodesign Directive	Yes	Select Yes or No
Is the Heat Pump compliant with Labelling Directive	Yes	Select Yes or No
Space Heating Test Standard	I.S. EN 14825	Select Standard, I.S. EN 14825 or I.S. EN 14511
Water Heating Test Standard	I.S. EN 16147	Select Standard, I.S. EN 16147 or I.S. EN 14511 or I.S. EN 255-3
Is the heat pump listed on HARP	No	Select Yes or No
No of Hours per Day Heat Pump has been designed to run	16	Select 8,16 or 24 which most represent the design

Figure 20 Heat Pump Selection from Sign off Sheet

3.2 Design details

The designer/ installer also confirmed the following as part of the sign off sheet; this was verified by the Assessor on site.

Firstly the assessor noted that the designer/ installer had advised that the heat pump was designed to meet the full space heating and hot water demand (Section 3 of the Designer Installer Sign Off Sheet). The assessor confirmed this on site as no backup heaters were installed. Note: The Backup heaters identified in Section 3 of the Designer Installer Sign Off Sheet are heaters other than the heat pump itself, for example boilers. Backup water heaters which are part of the heat pump, i.e. integral immersions are identified in Section 5 of the Designer Installer Sign Off Sheet.

Does the heat pump provide a full or partial space heating service?	Full	Select Full, Partial or None
If partial, is there a back up space heater present to supplement the Heat Pump?	No	Select Yes or No
Outline type of backup space heater and associated fuel		Enter Type and Fuel of Heater
Does the heat pump provide full or partial hot water heating?	Full	Select Full, Partial or None
If partial, is there a back up water heater present to supplement the Heat Pump?	No	Select Yes or No
Outline type of backup water heater and associated fuel		Enter Type and Fuel of Heater

Figure 21: Heat Pump Selection from Sign off Sheet

The dwelling is served by a combination of radiators and underfloor heating (taken from Section 4 of the Designer Installer Sign Off Sheet), with the design supply temperature being 45°C with the following controls.

4. Heat Emitter Design

Is there one or more radiators present	Yes	Select Yes or No
Is there one or more fan coil units present	No	Select Yes or No
Is there underfloor heating present	Yes	Select Yes or No
Is there warm air supply from the heat pump	No	Select Yes or No
Has a load / weather compensation been installed?	Yes	Select Yes or No
Provide details of zone, temperature and time control installed?	2 space heating & 1 water zones with time and temperature control on each.	Input number of heating zones, thermostats, etc
Temperature (°C) of the water leaving the heat pump when supplying space heating based on full heating system design conditions and at the design external temperature?	45.00	Input temperature in degrees celcius

Figure 22: Heat Emitter Design from Sign off Sheet

The heat pump was tested at a reference temperature of 55°C for water heating and had a separate hot water store (taken from Section 5 of the Designer Installer Sign Off Sheet).

5. Hot Water System

Maximum flow temperature (°C) of the heat pump while providing hot water (by heat pump only) based on certified data	55.00	Input temperature in degrees celcius, please provide supporting documentation.
Type of DHW Store	Separate Hot Water Storage	Input the type of store present, no store, integral store or separate store
Is there an integral immersion or electric element present capable of providing hot water	Yes	Select Yes or No

Figure 23: Hot Water System from Sign off Sheet

3.3 Source of test data

For heat pumps compliant with the Ecodesign directive, technical documentation outlining the declared test data must be made available to the public to comply with the directive.

Additional test data may be sourced that is in compliance with EN 14825 and EN 16147 from manufacturer's literature referencing the relevant regulations/ directives, CE marked data or accredited test data as detailed in the heat pump guidance document. The following data is an excerpt from a publicly available technical data declaration in compliance with the Ecodesign directive referencing EN 14825 test data.

Air-to-water heat pump:	yes
Water-to-water heat pump:	no
Brine-to-water heat pump:	no
Low-temperature heat pump:	no
Equipped with a supplementary heater:	yes
Heat pump combination heater:	no
Parameters shall be declared for	medium-temperature application.
Parameters shall be declared for	average climate conditions.

Item	Symbol	Value	Unit
Rated heat output (*)	Prated	13.5	kW
Declared capacity for heating for part load at indoor temperature 20 °C and outdoor temperature Tj			
Tj = - 7 °C	Pdh	11.9	kW
Degradation co-efficient (**)	Cdh	0.99	-
Tj = + 2 °C	Pdh	7.2	kW
Degradation co-efficient (**)	Cdh	0.98	-
Tj = + 7 °C	Pdh	5.9	kW
Degradation co-efficient (**)	Cdh	0.98	-
Tj = +12 °C	Pdh	7.4	kW
Degradation co-efficient (**)	Cdh	0.98	-
Tj = bivalent temperature	Pdh	11.9	kW
Tj = operation limit temperature	Pdh	9.3	kW
Tj = – 15 °C (if TOL < – 20 °C)	Pdh	-	kW
Bivalent temperature	Tbiv	-7	°C

Item	Symbol	Value	Unit
Seasonal space heating energy efficiency	ηs	125	%
Declared coefficient of performance or primary energy ratio for part load at indoor temperature 20 °C and outdoor temperature Tj			
Tj = - 7 °C	COPd	1.83	-
Tj = + 2 °C	COPd	3.18	-
Tj = + 7 °C	COPd	4.27	-
Tj = +12 °C	COPd	6.32	-
Tj = bivalent temperature	COPd	1.83	-
Tj = operation limit temperature	COPd	1.70	-
Tj = – 15 °C (if TOL < – 20 °C)	COPd	-	-
Operation limit temperature	TOL	–15	°C
Heating water operating limit temperature	WTOL	60	°C

Other items						
Capacity control	variable			Rated air flow rate, outdoors	-	8400	m^3/h
Sound power level, indoors/outdoors	L_{WA}	45/78	dBA				
Annual energy consumption	Q_{HE}	8541	kWh				

For heat pump combination heater:							
Declared load profile	L			Water heating energy efficiency	ηwh	99	%
Daily electricity consumption	Qelec	5.000	kW/h				
Annual electricity consumption	AEC	1109	kW/h				

Figure 24: Example of Technical Data in compliance with Ecodesign Directive

3.4 Entry in Heat Pump Tool

1. General Information

Using the heat pump tool, the Assessor completes the administration data including name of client, address of installation, MPRN, BER and Eircode numbers, as detailed in Example 1.

2. Assessor Details

The Assessor completes own name and Assessor number, as detailed in Example 1.

3. Building Data

The Assessor takes the Total heat loss (W/K) from the Building Elements - Heat loss results tab in the DEAP assessment and enters it in the heat pump calculator. Refer to Figure 6 showing how this data is sourced. In this example the Total Heat Loss is 321 W/K.

In this case the heat pump is serving a single dwelling; therefore "No" is selected for "Is the Heat Pump part of a Group Heating Scheme".

3. Building Data			
Total heat loss (W/K) taken from DEAP	321	w/k	Source from the Building Elements - Heat Loss Results Tab in DEAP
Heat Loss Watts	6875.82	Watts	Based on W/K by the Temperature Difference
Is the Heat Pump part of a Group Heating Scheme	No		
Proportion of group heating provided by the heat pump	50%	%	
Floor Area of Dwelling	50	m^2	Source from DEAP
If Heat Pump serves a Group Heat Scheme, the total Floor Area served by Heat Pump is:	100	m^2	

Figure 25: Heat Pump Tool – Building Data

4. Heat Pump Data

The Assessor enters the Manufacturer and Model of the heat pump, the type of heat pump, specifies that the heat pump is supplying Space Heating and Domestic Hot Water along with the standards the heat pump has been tested to, all taken from Section 2 and 3 of the Designer Installer Sign Off Sheet.

The temperature control (also called capacity control), operation limit temperature and water operating limit temperature are taken directly from the test data, refer to Figure 24.

4. Heat pump Data			
Manufacturer of the installed heat pump(s)	Heat Pump Manufacturer		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Model of the installed heat pump(s)	Heat Pump 123		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Type of heat pump	Air to Water		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Variable Outlet		Source from Ecodesign Data
Does the installation provide:	Space heating and Domestic Hot Water		Source from Designer/ Installer sign off sheet or site evidence without Ecodesign
Space Heating Test Standard	I.S. EN 14825		Source from Ecodesign Data or HARP Database
Water Heating Test Standard	I.S. EN 16147		Source from Ecodesign Data or HARP Database
Operation Limit Temperature (TOL)	-15.00	°C	Source from Ecodesign Data
Heating water operating limit temperature (WTOL)	60.00	°C	Source from Ecodesign Data
5. Heating			

Figure 26: Heat Pump Tool – Heat Pump Data

5. Heating

The Annual Space heating requirement is taken from DEAP.

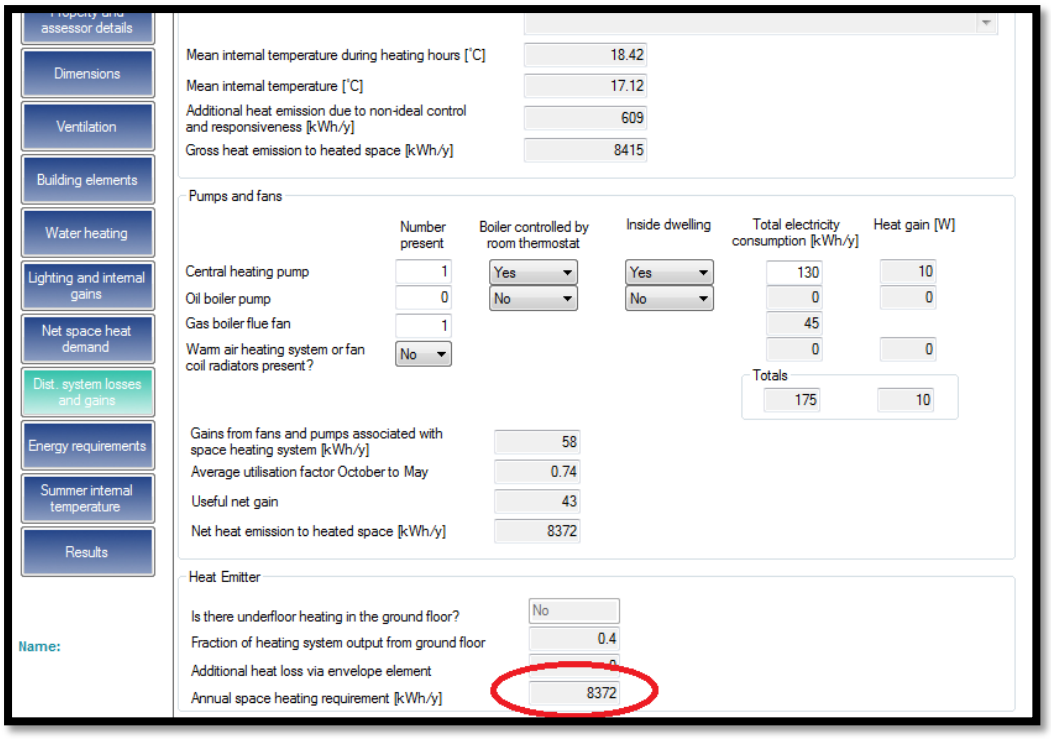


Figure 27: DEAP Software – Dist. System losses and gains

For this dwelling there is no secondary heater or CHP present. The presence of a secondary heater/ CHP is determined based on the DEAP methodology as normal.

The Indoor Design Temperature is taken from DEAP, as per Figure 10. In this case the Indoor Design Temperature is 18.42°C.

5. Heating			
Annual space heating requirement taken from DEAP	8372	kWh	Source from the Distribution system loss and gains tab in DEAP
Is there a fixed secondary heater present?	No		Details on CHP and secondary heating must match the DEAP energy requirements entries.
Is there a CHP present?	No		Details on CHP and secondary heating must match the DEAP energy requirements entries.
Fraction of main space and water heating from CHP	0.1		Details on CHP and secondary heating must match the DEAP energy requirements entries.
Annual space heating provided by Heat Pump	8372	kWh	
Design Outdoor Temperature	-3	°C	Based on CIBSE Guide A Section 2
Indoor Design Temperature (Mean Internal Temperature)	18.42	°C	Source from Net Space Heat Demand "Required mean internal temperature during heating hours
Heat emission type served by heat pump within the dwelling:			

Figure 28: Heat Pump Calculator – Heating 1

The Assessor selects the type of heat emitters present within the dwelling. Based on Section 4 of the sign off sheet, 1 or more radiators and Underfloor Heating is present and are also identified by the Assessor during DEAP survey. Refer to Figure 22 for an example.

Note: As with all DEAP inputs, the actual data observed on site takes precedence. Therefore if the Assessor observes data on site that contradicts the Designer/ Installer sign off sheet, the Assessor must base the BER on what was observed on site.

The software calculates a default supply temperature of 55°C as there are radiators present. The designer/ installer sign off sheet states that Design Flow Temperature is 45°C. When the Assessor enters this in the tool, a warning appears stating "As Design Flow Temperature is less than Default, please ensure that documentary evidence is available to support it". The heat pump guidance document details the evidence required.

The designer/ installer in Section 3 of the sign off sheet has confirmed the system operates 16 hours per day. This is the number of hours the heat pump can be activated by thermostatic/ load control devices to maintain internal temperature and is entered in the tool as follows:

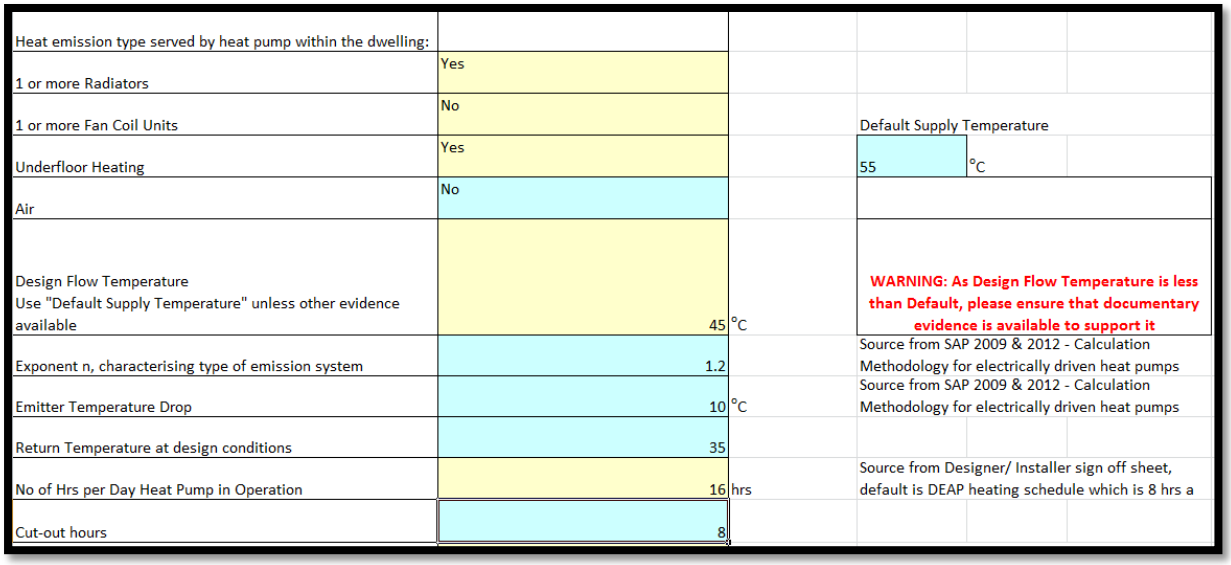


Figure 29: Heat Pump Calculator – Heating 2

Note: if the design flow temperature is greater than the Water Operating Limit Temperature (WTOL= 60°C in this case), an error message will be displayed and the Heat Pump tool will not produce a result:

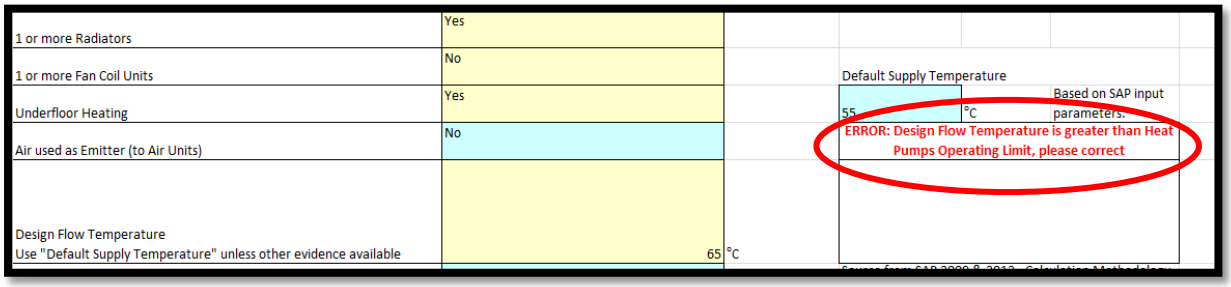
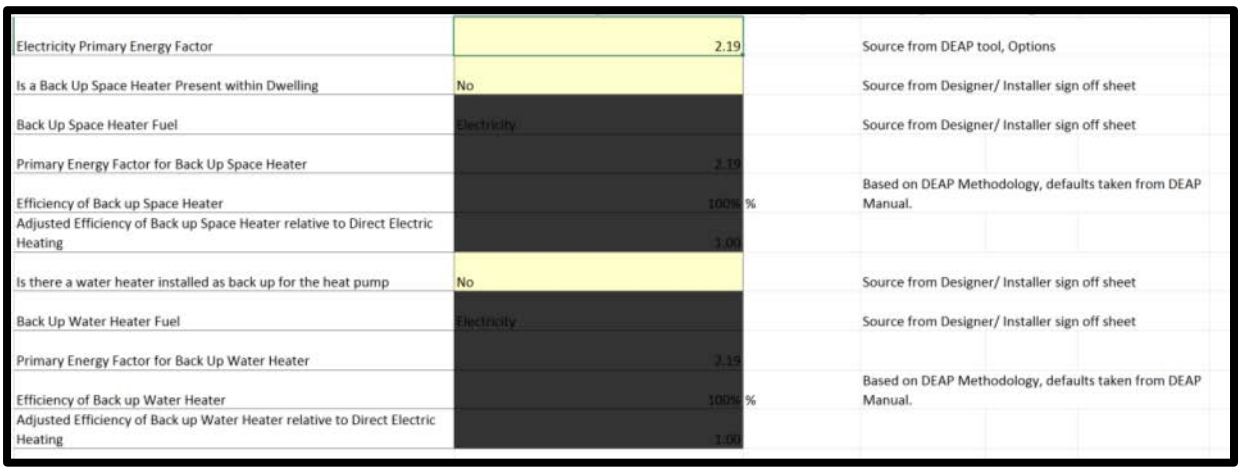


Figure 30: Heat Pump Calculator – Heating 3

The designer/ installer has also confirmed that no backup heater is installed in Section 3 of the Designer Installer Sign Off Sheet: refer to Figure 21. The Assessor selects "No" for the backup heaters. This blacks out the fuel and efficiency for backup heaters. If the heat pump does not meet the demand of the space heating or hot water, direct electrical heating is assumed as the backup.



Electricity Primary Energy Factor	2.19	Source from DEAP tool, Options
Is a Back Up Space Heater Present within Dwelling	No	Source from Designer/ Installer sign off sheet
Back Up Space Heater Fuel	Electricity	Source from Designer/ Installer sign off sheet
Primary Energy Factor for Back Up Space Heater	2.19	
Efficiency of Back up Space Heater	100% %	Based on DEAP Methodology, defaults taken from DEAP Manual.
Adjusted Efficiency of Back up Space Heater relative to Direct Electric Heating	1.00	
Is there a water heater installed as back up for the heat pump	No	Source from Designer/ Installer sign off sheet
Back Up Water Heater Fuel	Electricity	Source from Designer/ Installer sign off sheet
Primary Energy Factor for Back Up Water Heater	2.19	
Efficiency of Back up Water Heater	100% %	Based on DEAP Methodology, defaults taken from DEAP Manual.
Adjusted Efficiency of Back up Water Heater relative to Direct Electric Heating	1.00	

Figure 31: Heat Pump Calculator – Heating 4

6. Domestic Hot Water

Similar to Figure 12, the Assessor takes the "Output from the Main water heater" from the Water Heating Tab in DEAP and enters it in the Heat Pump calculator. In this case the Output from the Main Water Heater is 4772 kWh/yr.

The Assessor also selects the Type of DHW and details of the volume of storage taken from DEAP.

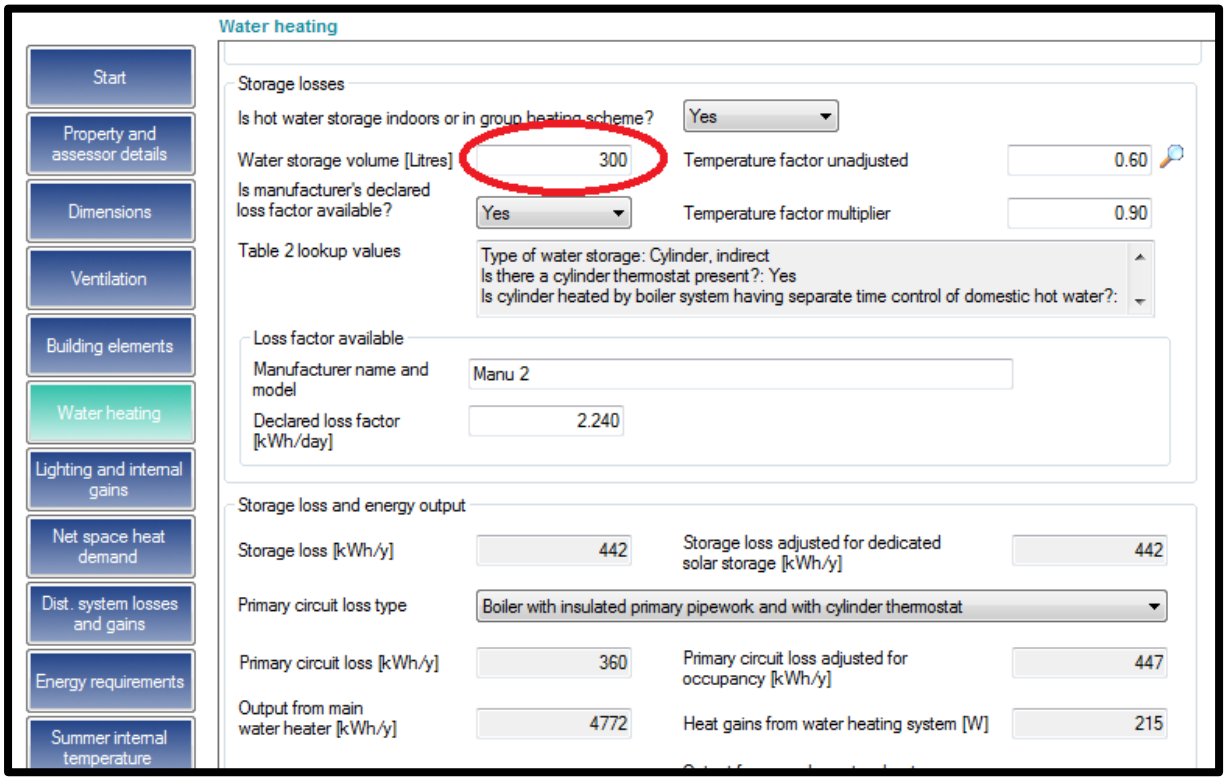


Figure 32: DEAP Software – Water heating

6. Domestic Hot Water			
Output from Main Water Heater	4772	kWh/yr	Source from the Water Heating Tab, Output from Main Water Heater in DEAP
Type of DHW	Separate Hot Water Storage		An Integral Hot Water Store forms part of the Heat Pump, refer to DEAP Heat Pump Methodology for guidance.
Annual water heating provided by main water heating system	4772	kWh/yr	
Cold Water Inlet Temperature	10	°C	Based on DEAP Methodology
Required Flow Temperature from Heat Pump to Hot Water Storage	65	°C	Based on DEAP Methodology and guidelines for prevention of Legionella. Where the store is separate to
Volume of DHW Storage	300	litres	Source from the Water Heating Tab, Storage in DEAP

Figure 33: Heat Pump Calculator – Domestic Hot Water

7. Product Performance Data

As the Space Heating test standard is EN 14825 and Water Heating Test Standard is EN 16147, the entries associated with EN 14511 and EN 255-3 are blacked out in the calculator.

The test data associated with EN 14825 are taken directly from the publicly available technical data declarations in compliance with the Ecodesign directive or directly from manufacturer's literature referencing the relevant directives/ regulations and EN 14825 accredited/CE marked test data. Refer to Figure 24 for an example of data following the Ecodesign directive.

In this case only the mandatory test data High Temperature (55°C) was available; therefore "No" was selected for Low, Medium and Very High test points.

Note: The Ecodesign Directive requires that parameters must be provided for "Medium Temperature Applications" which is defined in the Ecodesign Directive as an indoor heat exchanger outlet temperature of 55°C and therefore relates to High Temperature test points in EN 14825.

7. Product Performance Data			
Test Conditions EN 14825:2013	High Temperature Data is mandatory requirement under Ecodesign Directive (Note its referred to as Medium Temperature Application in Ecodesign directive)		Source from Ecodesign Data or accredited tests to EN14825
Additional Test Points available at:	Low Temperature	No	Source from Ecodesign Data or accredited tests to EN14825
	Medium Temperature	No	Source from Ecodesign Data or accredited tests to EN14825
	Very High Temperature	No	Source from Ecodesign Data or accredited tests to EN14825
Maximum Test Temperature allowed for in EN14825 testing		55	

Figure 34: Heat Pump Tool – Product Performance Data EN 14825 -1

Note the Design Flow Temperature entered in the calculator must be less that the Maximum Test Temperature. Referring to Figure 34, the Maximum Test Temperature is 55°C, therefore if the design flow temperature is greater than 55°C an error will be displayed in the calculator and no result will be produced.

By selecting "No" for the other test points (Low, Medium, Very High), the input data associated with them is blacked out. The entries below are taken directly from Figure 24.

	Test Conditions EN 14825:2013	A (88%)	B (54%)	C (35%)	D (15%)	E* (100%)
Low Temperature Application (35°C)	Source	A-7	A2	A7	A12	A-15
	Sink	W34	W30	W27	W24	W35
EN 14825:2013 - Table 12 (ASHP) or Table 24 (GSHP)	Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
	Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
Mid Temperature Application (45°C)	Source	A-7	A2	A7	A12	A-15
	Sink	W43	W37	W33	W28	W45
EN 14825:2013 - Table 6 (AAHP), Table 9 (GAHP), Table 15 (ASHP) or Table 27 (GSHP)	Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
	Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
High Temperature Application (55°C)	Source	A-7	A2	A7	A12	A-15
	Sink	W52	W42	W36	W30	W55
EN 14825:2013 - Table 18 (ASHP) or Table 30 (GSHP)	Heating Capacity (kW)	11.90	7.20	5.90	7.40	9.30
	Coefficient of Performance (kW/kW)	1.83	3.18	4.27	6.32	1.70
Very High Temperature Application (65°C)	Source	A-7	A2	A7	A12	A-15

Figure 35: Heat Pump Tool – Product Performance Data EN 14825 -2

The source and sink temperatures displayed are based on the type of heat pump and the temperature control (also called capacity control). The same methodology would be used for Brine to Water, Water to Water and Exhaust Air to Water heat pumps with the source data adjusting accordingly.

Similarly the test data associated with EN 16147 is taken directly from the publicly available technical data declared in compliance with the Ecodesign directive or directly from EN 16147 accredited/CE marked test data. In this case the assessor has sourced data from Ecodesign technical data sheet in compliance with the directive. Referring to Figure 24, the water heating energy efficiency and Declared Load Profile were obtained directly from the Ecodesign technical data sheet.

The assessor has also received data from the manufacturer stating that the capacity of the heat pump is 5kW, the reference hot water temperature is 55°C and the Standby Heat Loss is 0.6 kWh/day. Note that the "standby heat loss" and "volume of DHW accounted for in test" shown below are the figures in the EN16147 data.

Test Conditions EN 16147			
Source of data	Water heating energy efficiency, ηwh		Source from Ecodesign Data or accredited tests to EN 16147
Water heating energy efficiency, ηwh	99	%	Source from Ecodesign Data or accredited tests to EN 16147
Equivalent Coefficient of Performance	2.475	kW/kW	
Reference Hot Water Temperature	55	°C	Source from Ecodesign Data or accredited tests to EN 16147, set at 40°C if unknown.
Required Source Temperature	7	°C	Based on Table 5 of EN 16147
Capacity of Heat Pump	5	kW	Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Declared Load Profile	L		Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Standby Heat Loss	0.6	kWh/day	Source from Ecodesign Data or accredited tests to EN 16147, set as 0 if unknown
Volume of DHW accounted for in test	150	litre	Source from Ecodesign Data or accredited tests to EN 16147

Figure 36: Heat Pump Tool – Product Performance Data EN 16147

Note: As per the Ecodesign Directive guidance, the Declared Load Profile must comply with the volume used in the test. If the volume used in the test does not meet the requirements set out in the Ecodesign Directive a warning will be displayed requesting that the assessor contact the manufacturer and seek alternate test data.

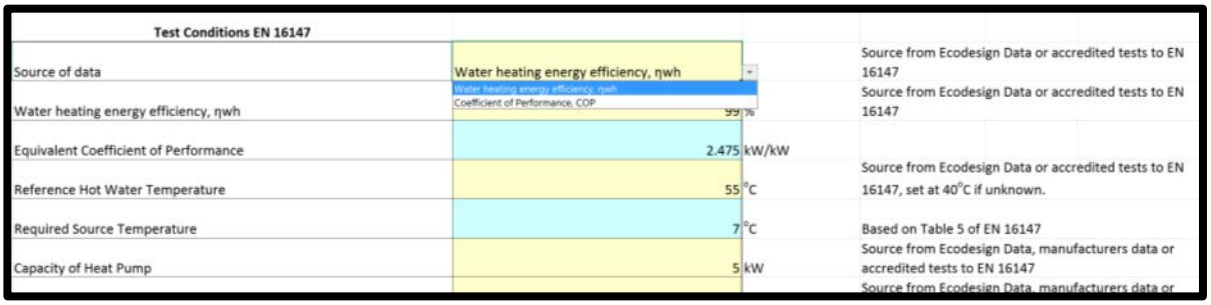
Similarly, the declared load profile and volume used in testing must be appropriate for the installation within the dwelling. If the installed storage does not meet the requirements in Ecodesign a warning will be displayed advising the assessor to advise the client/ designer and installer that the installation may not perform to the calculated efficiency.

Test Conditions EN 16147			
Source of data	Water heating energy efficiency, ηwh		Source from Ecodesign Data or accredited tests to EN 16147
Water heating energy efficiency, ηwh	99	%	Source from Ecodesign Data or accredited tests to EN 16147
Equivalent Coefficient of Performance	2.475	kW/kW	
Reference Hot Water Temperature	55	°C	Source from Ecodesign Data or accredited tests to EN 16147, set at 40°C if unknown.
Required Source Temperature	7	°C	Based on Table 5 of EN 16147
Capacity of Heat Pump	5	kW	Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Declared Load Profile	4XL		Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Standby Heat Loss	0.6	kWh/day	Source from Ecodesign Data or accredited tests to EN 16147, set as 0 if unknown
Volume of DHW accounted for in test	700	litre	Source from Ecodesign Data or accredited tests to EN 16147

WARNING: The test data is not appropriate for the installation within the dwelling, the assessor must contact the client/ designer and installer, advising that the installed hot water cylinder is not appropriate for the Ecodesign Directive efficiency data and therefore the heat pump will not perform to the same efficiency.

Figure 37: Heat Pump Tool – Product Performance Data EN 16147

Test data may also be taken directly from accredited EN 16147 test certificates. In these cases the efficiency quoted will be the COP, therefore the tool gives an option for COP or Water Heating Energy Efficiency, refer to Figure 38: Heat Pump Tool – Source of Data.



Test Conditions EN 16147			
Source of data	Water heating energy efficiency, ηwh		Source from Ecodesign Data or accredited tests to EN 16147
Water heating energy efficiency, ηwh	Coefficient of Performance, COP	%	Source from Ecodesign Data or accredited tests to EN 16147
Equivalent Coefficient of Performance	2.475	kW/kW	
Reference Hot Water Temperature	55	°C	Source from Ecodesign Data or accredited tests to EN 16147, set at 40°C if unknown.
Required Source Temperature	7	°C	Based on Table 5 of EN 16147
Capacity of Heat Pump	5	kW	Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147

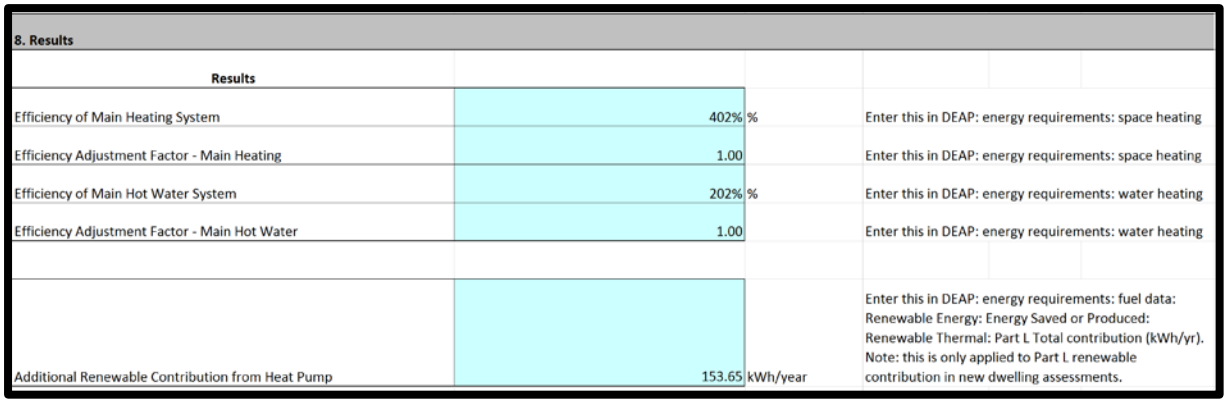
Figure 38: Heat Pump Tool – Source of Data

The same methodology would be used for Brine to Water, Water to Water and Exhaust Air to Water heat pumps with the source data adjusting accordingly.

8. Results

The Heat Pump Calculator then calculates the efficiency of the Main Heating and Main Hot Water systems and the efficiency adjustment factors for use in DEAP.

The tool also calculates the "Additional Renewable Contribution from the Heat Pump". This is renewable energy that is supplied by the heat pump but not accounted for in the DEAP tool. The Heat Pump Calculator combines the efficiency of the Heat Pump and backup heaters. In this case electric element is used to supplement the hot water giving a combined efficiency of 202% to be entered into the DEAP software. Therefore DEAP would not consider the water heater to be renewable. The heat pump calculator determines the renewable proportion attributable to the heat pump itself and this is added to the DEAP assessment.



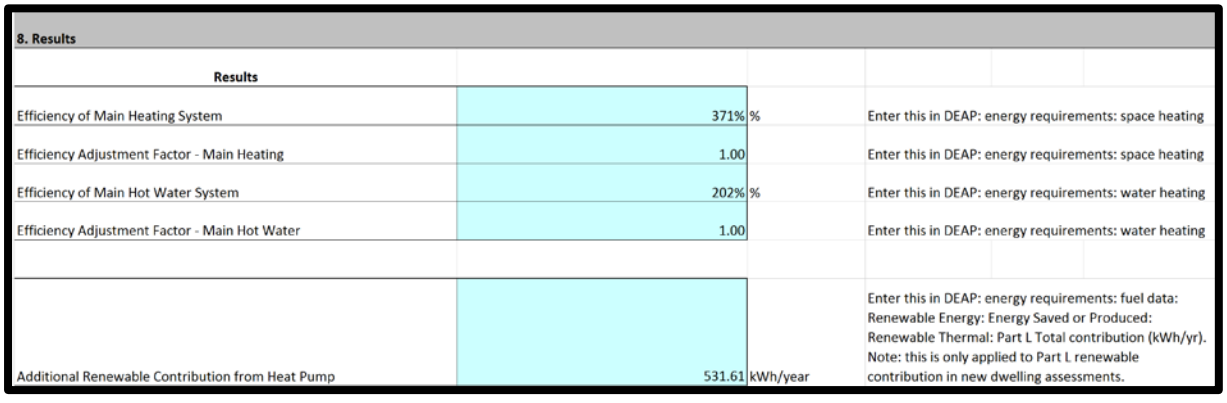
8. Results

Results			
Efficiency of Main Heating System	402%	%	Enter this in DEAP: energy requirements: space heating
Efficiency Adjustment Factor - Main Heating	1.00		Enter this in DEAP: energy requirements: space heating
Efficiency of Main Hot Water System	202%	%	Enter this in DEAP: energy requirements: water heating
Efficiency Adjustment Factor - Main Hot Water	1.00		Enter this in DEAP: energy requirements: water heating
Additional Renewable Contribution from Heat Pump	153.65	kWh/year	Enter this in DEAP: energy requirements: fuel data: Renewable Energy: Energy Saved or Produced: Renewable Thermal: Part L Total contribution (kWh/yr). Note: this is only applied to Part L renewable contribution in new dwelling assessments.

Figure 39: Heat Pump Tool – Results

Note: As only one set of test data is available (at 55°C) the tool bases the Efficiency on a flow temperature of 55°C irrespective of the actual flow temperature. Where more than one set of data is available, the tool will then adjust the efficiency based on the flow temperature using interpolation between the two sets of test points. **All sets of available valid test data must be used.**

The run hours can also impact on the results. For example if the heat pump was installed to operate 8 hours a day to meet internal environmental conditions, i.e. a timer on the heat pump only allows the heat pump to operate 3 hours in the morning and 5 hours in the evening. The ability of the heat pump to meet demand will be reduced resulting in the following results in this instance:



8. Results

Results			
Efficiency of Main Heating System	371%	%	Enter this in DEAP: energy requirements: space heating
Efficiency Adjustment Factor - Main Heating	1.00		Enter this in DEAP: energy requirements: space heating
Efficiency of Main Hot Water System	202%	%	Enter this in DEAP: energy requirements: water heating
Efficiency Adjustment Factor - Main Hot Water	1.00		Enter this in DEAP: energy requirements: water heating
Additional Renewable Contribution from Heat Pump	531.61	kWh/year	Enter this in DEAP: energy requirements: fuel data: Renewable Energy: Energy Saved or Produced: Renewable Thermal: Part L Total contribution (kWh/yr). Note: this is only applied to Part L renewable contribution in new dwelling assessments.

Figure 40: Heat Pump Tool – Results 2

3.5 Entry in DEAP

The Efficiency of the Main Heating System and Efficiency Adjustment Factor – Main Heating are entered under the Energy Requirements – Space heating tab in DEAP. Refer to Figure 16 for similar input.

The Efficiency of the Water Heating System and Efficiency Adjustment Factor – Main Hot Water are entered under the Energy Requirements – Water heating tab in DEAP. Refer to Figure 17 for similar input.

The Additional Renewable Contribution is entered under the Energy Requirements – Fuel Data – Renewable Energy in DEAP under the Part L total contribution only. The type of renewable energy is Renewable Thermal. Refer to Figure 18 for similar input.

4 Example 3: Air to air heat pump compliant with Ecodesign/ Energy Labelling Directive

4.1 Heat pump parameters

The calculator caters for a number of heat pump types heating air rather than water: Air to Air, Brine to Air and Water to Air.

This example looks at how an Air to Air heat pump would be entered into the calculator and DEAP. Taking the details from Example 2, the air to water heat pump is replaced with an air to air heat pump. A similar methodology would be used for Brine to Air or Water to Air.

As an air to air heat pump, it is providing space heating only.

The designer/ installer sign off sheet has been updated as follows:

Does the installation provide:	Space Heating ☑	
(Tick applicable box)	Domestic Hot Water ☐	
3. Heat pump selection		
Manufacturer of the installed heat pump(s)	Heat Pump Manufacturer	Ensure this is exact product manufacturer name.
Model of the installed heat pump(s)	Heat Pump 123	Ensure this is exact product model, including model name, number and qualifier where present.
Type of Heat Pump	Air to Water ☐	
	Brine to Water ☐	
	Water to Water ☐	
	Exhaust Air to Water ☐	
	Air to Air ☑	
	Brine to Air ☐	
	Water to Air ☐	
Date of Installation	01/12/2015	Insert date heat pump was installed
Is the Heat Pump compliant with Ecodesign Directive	Yes	Select Yes or No
Is the Heat Pump compliant with Labelling Directive	Yes	ect Yes or No
Space Heating Test Standard	I.S. EN 14825	Select Standard, I.S. EN 14825 or I.S. EN 14511

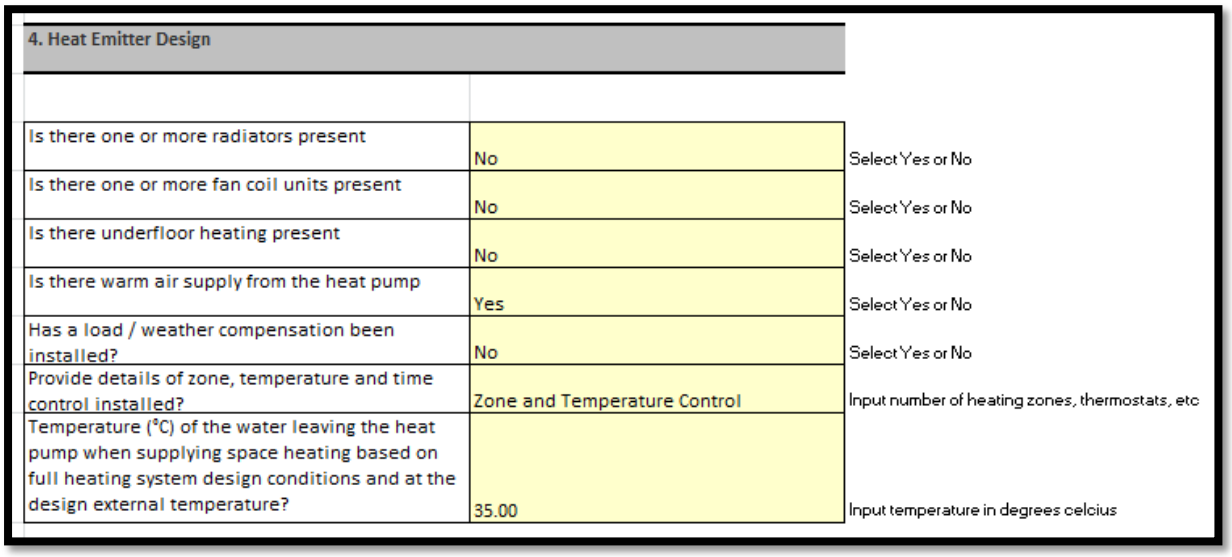
Figure 41: Heat Pump Selection from Sign off sheet

4.2 Design details

The designer/ installer also confirmed the following as part of the sign off sheet; this was verified by the Assessor on site:

Firstly that the heat pump was designed to meet the full space heating demand with no backup heaters installed (as per Section 3 of the Designer Installer Sign off sheet). Water heating is supplied by an alternate system rather than heat pump.

The dwelling is served by warm air supply; therefore the default supply temperature is 35°C:



4. Heat Emitter Design		
Is there one or more radiators present	No	Select Yes or No
Is there one or more fan coil units present	No	Select Yes or No
Is there underfloor heating present	No	Select Yes or No
Is there warm air supply from the heat pump	Yes	Select Yes or No
Has a load / weather compensation been installed?	No	Select Yes or No
Provide details of zone, temperature and time control installed?	Zone and Temperature Control	Input number of heating zones, thermostats, etc
Temperature (°C) of the water leaving the heat pump when supplying space heating based on full heating system design conditions and at the design external temperature?	35.00	Input temperature in degrees celcius

Figure 42: Heat Emitter Design from Sign off Sheet

4.3 Source of test data

Similar to Example 2, for heat pumps compliant with the Ecodesign directive, technical documentation outlining the test data declaration must be made available to the public to comply with the directive. Assessors can also source data from manufacturer publications referencing the relevant directives/ standards.

4.4 Entry in Heat Pump Tool

1. General Information

As per Examples 1 and 2 for details of the client and dwelling.

2. Assessor Details

As per Examples 1 and 2 for details of the BER Assessor.

3. Building Data

As per Examples 1 and 2 for details of the dwelling heat loss and group/individual heating.

4. Heat Pump Data

The Assessor enters the Manufacturer and Model of the heat pump, the type of heat pump, in this case Air to Air heat pump. As the heat pump is only supplying “Space Heating”, the Water Heating Test Standard in blacked out.

4. Heat pump Data			
Manufacturer of the installed heat pump(s)			Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Model of the installed heat pump(s)			Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Type of heat pump	Air to Air		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Temperature Control	Variable Outlet		Source from Ecodesign Data
Does the installation provide:	Space heating		Source from Designer/ Installer sign off sheet or site evidence without Ecodesign
Space Heating Test Standard	I.S. EN 14825		Source from Ecodesign Data or HARP Database
Water Heating Test Standard	I.S. EN 16147		Source from Ecodesign Data or HARP Database
Operation Limit Temperature (TOL)	-15.00	°C	Source from Ecodesign Data

Figure 43 Heat Pump Tool – Heat Pump Data

5. Heating

The annual heating requirement and internal temperature is as per Example 2. Refer to Figure 27 and Figure 28 respectively.

As the heat pump is an Air to Air heat pump, air is automatically selected as a heat emitter.

Heat emission type served by heat pump within the dwelling:	Select all that apply:				
1 or more Radiators	No				
1 or more Fan Coil Units	No		Default Supply Temperature		
Underfloor Heating	No		35	°C	Based on SAP input parameters.
Air used as Emitter (to Air Units)	Yes				
Design Flow Temperature Use "Default Supply Temperature" unless other evidence available	35	°C			
Exponent n, characterising type of emission system	1		Source from SAP 2009 & 2012 - Calculation Methodology for electrically driven heat pumps		
Emitter Temperature Drop	5	°C	Source from SAP 2009 & 2012 - Calculation Methodology for electrically driven heat pumps		
Return Temperature at design conditions	30				
No of Hrs per Day Heat Pump in Operation	16	hrs	Source from Designer/ Installer sign off sheet, default is DEAP heating schedule which is 8 hrs a day		
Cut-out hours	8				

Figure 44: Heat Pump Tool – Heating

As per Example 2, no backup heater has been installed.

6. Domestic Hot Water

As “Space Heating” was selected for “Does the installation provide:”, all editable fields in the Domestic Hot Water section are blacked out.

7. Product Performance Data

As the Space Heating test standards are EN 14825, the data associated with EN 16147, EN 14511 and EN 255-3 are blacked out.

The test data associated with EN 14825 is taken directly from the publicly available technical data declaration in compliance with the Ecodesign directive or directly from manufacturer literature referencing directives/ regulations (or accredited/CE marked test data).

For “to Air” heat pumps there is only one set of test conditions under EN 14825, therefore “No” is selected for Low, Medium and Very High.

7. Product Performance Data			
Test Conditions EN 14825:2013	High Temperature Data is mandatory requirement under Ecodesign Directive (Note its referred to as Medium Temperature Application in Ecodesign directive)	For Heating by Air, select No for Low, Medium and Very High Temperature Test Points	Source from Ecodesign Data or accredited tests to EN14825
Additional Test Points available at:	Low Temperature	No	Source from Ecodesign Data or accredited tests to EN14825
	Medium Temperature	No	Source from Ecodesign Data or accredited tests to EN14825
	Very High Temperature	No	Source from Ecodesign Data or accredited tests to EN14825
	Maximum Test Temperature allowed for in EN14825 testing	55	

Figure 45: Heat Pump Tool – Product Performance Data EN 14825 -1

Note as “to Air” has been selected the sink temperature is A20 based on the requirements set out in EN 14825 standard.

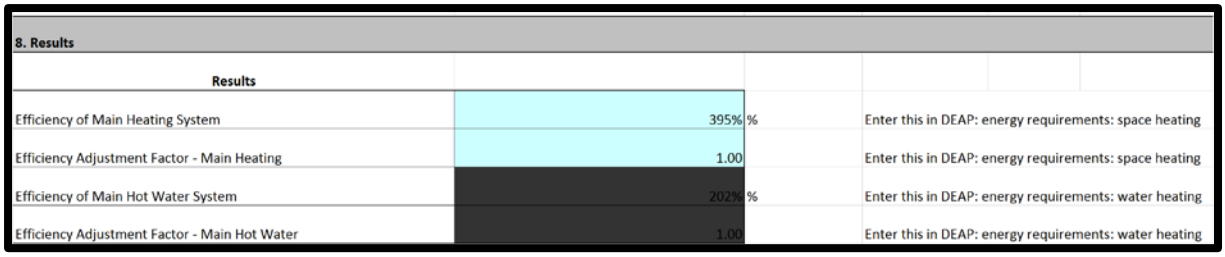
	Test Conditions EN 14825:2013	A (88%)	B (54%)	C (35%)	D (15%)	E* (100%)
Low Temperature Application (35°C)	Source	A-7	A2	A7	A12	A-15
	Sink	A20	A20	A20	A20	A20
EN 14825:2013 - Table 12 (ASHP) or Table 24 (GSHP)	Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
	Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
Mid Temperature Application (45°C)	Source	A-7	A2	A7	A12	A-15
	Sink	A20	A20	A20	A20	A20
EN 14825:2013 -Table 15 (ASHP) or Table 27 (GSHP)	Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
	Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
High Temperature Application (55°C)	Source	A-7	A2	A7	A12	A-15
	Sink	A20	A20	A20	A20	A20
EN 14825:2013 - Table 6 (AAHP), Table 9 (GAHP), Table 18 (ASHP) or Table 30 (GSHP)	Heating Capacity (kW)	11.90	7.20	5.90	4.50	9.30
	Coefficient of Performance (kW/kW)	1.89	3.18	4.27	6.32	1.70
Very High Temperature Application (65°C)	Source	A-7	A2	A7	A12	A-15

Figure 46: Heat Pump Tool – Product Performance Data EN 14825 -2

8. Results

The Heat Pump Calculator then calculates the efficiency of the Main Heating and the efficiency adjustment factors.

In this case there is no “Additional Renewable Contribution from the Heat Pump”. There is no backup heating required. DEAP correctly reflects the renewable contribution from the heat pump.



8. Results			
Results			
Efficiency of Main Heating System	395%	%	Enter this in DEAP: energy requirements: space heating
Efficiency Adjustment Factor - Main Heating	1.00		Enter this in DEAP: energy requirements: space heating
Efficiency of Main Hot Water System	202%	%	Enter this in DEAP: energy requirements: water heating
Efficiency Adjustment Factor - Main Hot Water	1.00		Enter this in DEAP: energy requirements: water heating

Figure 47: Heat Pump Tool – Results

4.5 Entry in DEAP

The Efficiency of the Main Heating System and Efficiency Adjustment Factor – Main Heating are entered under the Energy Requirements – Space heating tab in DEAP. Refer to Figure 16 for similar input.

5 Example 4: Exhaust Air to water heat pump compliant with Ecodesign/ Energy Labelling Directive

5.1 Entry in Heat Pump Tool

This example is based on the dwelling in Example 2 served by an Exhaust Air to Water heat pump in lieu of an Air to Water heat pump.

As the Exhaust Air to Water Heat Pump is similar to other "to Water" heat pumps, the methodology is as per Example 2 with the following changes.

The type of heat pump is selected as "Exhaust Air to Water"

Type of heat pump	Exhaust Air to Water		Source from Ecodesign Data or HARP Database or in compliance with DEAP methodology
Temperature Control	Variable Outlet		Source from Ecodesign Data
Does the installation provide:	Space heating and Domestic Hot Water		Source from Designer/ Installer sign off sheet or site evidence without Ecodesign
Space Heating Test Standard	I.S. EN 14825		Source from Ecodesign Data or HARP Database
Water Heating Test Standard	I.S. EN 16147		Source from Ecodesign Data or HARP Database
Operation Limit Temperature (TOL)	-15.00	°C	Source from Ecodesign Data
Heating water operating limit temperature (WTOL)	60.00	°C	Source from Ecodesign Data

Figure 48 Heat Pump Tool – Heat Pump Data

Under EN 14825, Exhaust Air to Water heat pumps part load tests are performed with outdoor heat exchanger conditions and therefore are as per an Air to Water Heat Pump for identification of test data. For this heat pump only high temperature application data is available:

	Test Conditions EN 14825:2013	A (88%)	B (54%)	C (35%)	D (15%)	E* (100%)
Low Temperature Application (35°C)	Source	A-7	A2	A7	A12	A-15
	Sink	W34	W30	W27	W24	W35
EN 14825:2013 - Table 12 (ASHP) or Table 24 (GSHP)	Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
	Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
Mid Temperature Application (45°C)	Source	A-7	A2	A7	A12	A-15
	Sink	W43	W37	W33	W28	W45
EN 14825:2013 - Table 6 (AAHP), Table 9 (GAHP), Table 15 (ASHP) or Table 27 (GSHP)	Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
	Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
High Temperature Application (55°C)	Source	A-7	A2	A7	A12	A-15
	Sink	W52	W42	W36	W30	W55
EN 14825:2013 - Table 18 (ASHP) or Table 30 (GSHP)	Heating Capacity (kW)	11.90	7.20	5.90	7.40	9.30
	Coefficient of Performance (kW/kW)	1.83	3.18	4.27	6.32	1.70
Very High Temperature Application (65°C)	Source	A-7	A2	A7	A12	A-15

Figure 49: Heat Pump Tool – Performance Data EN 14825

Under EN 16147, Exhaust Air to Water heat pumps are tested to a source temperature of 20°C which differs from an Air to Water Heat Pump.

Test Conditions EN 16147			
Source of data	Water heating energy efficiency, ηwh		Source from Ecodesign Data or accredited tests to EN 16147
Water heating energy efficiency, ηwh	99	%	Source from Ecodesign Data or accredited tests to EN 16147
Equivalent Coefficient of Performance	2.475	kW/kW	
Reference Hot Water Temperature	55	°C	Source from Ecodesign Data or accredited tests to EN 16147, set at 40°C if unknown.
Required Source Temperature	20	°C	Based on Table 5 of EN 16147
Capacity of Heat Pump	5	kW	Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Declared Load Profile	L		Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Standby Heat Loss	0.6	kWh/day	Source from Ecodesign Data or accredited tests to EN 16147, set as 0 if unknown
Volume of DHW accounted for in test	150	litre	Source from Ecodesign Data or accredited tests to EN 16147

Figure 50: Heat Pump Tool – Performance Data EN 16147

The Heat Pump tool calculates the Efficiency of the Main Heating System and Main Hot Water System, as well as the efficiency adjustment factors for entry in the DEAP software.

Note a guidance note appears in the Renewable Contribution for Part L compliance for Exhaust Air heat pumps: As per the DEAP methodology, the renewable contribution should be based on outside source temperatures. See the heat pump guidance document for further details.

8. Results			
Results			
Efficiency of Main Heating System	642%	%	Enter this in DEAP: energy requirements: space heating
Efficiency Adjustment Factor - Main Heating	1.00		Enter this in DEAP: energy requirements: space heating
Efficiency of Main Hot Water System	202%	%	Enter this in DEAP: energy requirements: water heating
Efficiency Adjustment Factor - Main Hot Water	1.00		Enter this in DEAP: energy requirements: water heating
Additional Renewable Contribution from Heat Pump	Please refer to guidance on how to deal with renewable contribution from Exhaust Air Heat Pumps	kWh/year	Enter this in DEAP: energy requirements: fuel data: Renewable Energy: Energy Saved or Produced: Renewable Thermal: Part L Total contribution (kWh/yr). Note: this is only applied to Part L renewable contribution in new dwelling assessments.

Figure 51: Heat Pump Tool – Results

Therefore where an Assessor is looking to carry out Part L renewable contribution compliance check the Assessor must select Air to Water Heat Pump and adjust the test data and source temperatures to outside air.

5.2 Entry in DEAP

The Efficiency of the Main Heating System and Efficiency Adjustment Factor – Main Heating are entered under the Energy Requirements – Space heating tab in DEAP, refer to Figure 16for similar input.

The Efficiency of the Water Heating System and Efficiency Adjustment Factor – Water Heating are entered under the Energy Requirements – Space heating tab in DEAP, refer to Figure 17 for similar input.

6 Example 5: Air to water heat pump compliant with Ecodesign/ Energy Labelling Directive with backup heater.

6.1 Design Details

This fifth example takes the second example and includes a backup heater for each of space and water heating.

As per the Heat Pump Methodology guidance document, any system that is acting as a backup to the heat pump is considered part of the Main Heating system and is therefore not considered a secondary heater. The backup would heat multiple rooms (like the heat pump) rather than be a single room heater (such as a typical secondary heater in DEAP).

In this case, the designer/ installer has confirmed that a backup heater is present in Section 3 of the Designer Installer Sign Off Sheet: a solid fuel stove with back boiler supplying space and water heating.

Does the heat pump provide a full or partial space heating service?	Partial	Select Full, Partial or None
If partial, is there a back up space heater present to supplement the Heat Pump?	Yes	Select Yes or No
Outline type of backup space heater and associated fuel	Solid Fuel Stove with Back Boiler	Enter Type and Fuel of Heater
Does the heat pump provide full or partial hot water heating?	Partial	Select Full, Partial or None
If partial, is there a back up water heater present to supplement the Heat Pump?	Yes	Select Yes or No
Outline type of backup water heater and associated fuel	Solid Fuel Stove with Back Boiler	Enter Type and Fuel of Heater

Figure 52: Backup heater from Signoff sheet.

There is no accredited test data available for the efficiency of the stove, therefore following the DEAP methodology, default efficiency is taken from Table 4a of the DEAP Manual of 65%.

Note: The solid fuel stove with back boiler is considered as part of the main heating system, i.e. it's a backup to the heat pump. Following Section 9.2.4 of the DEAP Manual, the combination of the boiler and room heater are part of the main heating system and therefore the room heater is not entered separately as a secondary room heater. If the installation was a gas fired room heater with back boiler, following Section 9.2.4 of the DEAP Manual, the room heater could be a secondary heater following the DEAP Appendix A requirements while the back boiler is part of the main heating system and therefore a backup to the heat pump in this instance.

6.2 Entry in Heat Pump Tool

The data entered in the Heat Pump Tool is as per the Example 2 with additional input for the backup heater.

The Assessor selects the fuel and enters the efficiency of the backup heater. Note the adjusted efficiency of backup heater shows the efficiency of the backup heater in comparison to a direct

electric heater so it can be combined with the electrical heat pump as a single heating system in DEAP.

Electricity Primary Energy Factor	2.19		Source from DEAP tool, Options
Is a Back Up Space Heater Present within Dwelling	Yes		Source from Designer/ Installer sign off sheet
Back Up Space Heater Fuel	Solid multi-fuel		Source from Designer/ Installer sign off sheet
Primary Energy Factor for Back Up Space Heater	1.1		
Efficiency of Back up Space Heater	65%	%	Based on DEAP Methodology, defaults taken from DEAP Manual.
Adjusted Efficiency of Back up Space Heater relative to Direct Electric Heating	1.29		
Is there a water heater installed as back up for the heat pump	Yes		Source from Designer/ Installer sign off sheet
Back Up Water Heater Fuel	Solid multi-fuel		Source from Designer/ Installer sign off sheet
Primary Energy Factor for Back Up Water Heater	1.1		
Efficiency of Back up Water Heater	65%	%	Based on DEAP Methodology, defaults taken from DEAP Manual.
Adjusted Efficiency of Back up Water Heater relative to Direct Electric Heating	1.29		

Figure 53: Heat Pump Tool – Backup heater

The Heat Pump Calculator then calculates the efficiency of the Main Heating and Main Hot Water systems and the efficiency adjustment factors taking account of the Backup heater.

The tool also calculates the "Additional Renewable Contribution from the Heat Pump". This is renewable energy that is supplied by the heat pump but not accounted for in the DEAP tool. The Heat Pump Calculator combines the efficiency of the Heat Pump and backup heaters. In this case stove back boiler is used to supplement the hot water giving a combined efficiency of 220% that is entered into the DEAP tool. Therefore DEAP would not consider the water heater to be renewable. The heat pump calculator determines the renewable proportion attributable to the heat pump itself and this is added to the DEAP assessment.

8. Results			
Results			
Efficiency of Main Heating System	402%	%	Enter this in DEAP: energy requirements: space heating
Efficiency Adjustment Factor - Main Heating	1.00		Enter this in DEAP: energy requirements: space heating
Efficiency of Main Hot Water System	220%	%	Enter this in DEAP: energy requirements: water heating
Efficiency Adjustment Factor - Main Hot Water	1.00		Enter this in DEAP: energy requirements: water heating
Additional Renewable Contribution from Heat Pump	153.65	kWh/year	Enter this in DEAP: energy requirements: fuel data: Renewable Energy: Energy Saved or Produced: Renewable Thermal: Part L Total contribution (kWh/yr). Note: this is only applied to Part L renewable contribution in new dwelling assessments.

Figure 54: Heat Pump Tool – Results

6.3 Entry in DEAP

The Efficiency of the Main Heating System and Efficiency Adjustment Factor – Main Heating are entered under the Energy Requirements – Space heating tab in DEAP. Refer to Figure 16 for similar input.

The Efficiency of the Water Heating System and Efficiency Adjustment Factor – Main Hot Water are entered under the Energy Requirements – Water heating tab in DEAP. Refer to Figure 17 for similar input.

The Additional Renewable Contribution is entered under the Energy Requirements – Fuel Data – Renewable Energy in DEAP under the Part L total contribution only. The type of renewable energy is Renewable Thermal. Refer to Figure 18 for similar input.

7 Example 6: Brine to water heat pump compliant with Ecodesign/ Energy Labelling Directive with group heating scheme

7.1 Design Details

This example looks at the use of a Brine to Water Heat pump serving a Group Heating Scheme.

The dwelling is as per Example 2, but the heat pump is serving 6no. houses.

As the heat pump is in compliance with the Ecodesign/ Energy Labelling directives, the methodology is as per Example 2. For heat pump installations serving group heating schemes, the Assessor must allow for the total heating demand of the group heating scheme as follows:

The Assessor must determine the following:

- Area of the dwelling being assessed
- The total area of dwellings being served by the group heating scheme
- The number of heat pumps serving the group heating scheme

7.2 Source of test data

For heat pumps in compliance with the Ecodesign/ Energy Labelling directives, the methodology is as per Example 2. However an allowance needs to be made if there are a number of heat pumps serving the group heating scheme. Note: This example is based on all heat pumps being of the same model/ type.

For example, if the following test data is available for a heat pump:

Type of heat source/sink:		Brine-to-water						
Low-temperature heat pump:		No						
Equipped with supplementary heater:		Yes						
Heat pump combination heater:		Yes						
Climate condition:		Average						
Temperature application:		Medium temperature (55 °C)						
Applied standards: EN14825 and EN16147								
Rated heat output	Prated	10,0	kW		**Seasonal space heating energy efficiency**	η_s	147	%
Declared capacity for part load at outdoor temperature Tj					*Declared coefficient of performance for part load at outdoor temperature Tj*			
Tj = -7 °C	Pdh	7,9	kW		Tj = -7 °C	COPd	3,40	kW
Tj = +2 °C	Pdh	8,7	kW		Tj = +2 °C	COPd	3,91	kW
Tj = +7 °C	Pdh	9,2	kW		Tj = +7 °C	COPd	4,25	kW
Tj = +12 °C	Pdh	9,6	kW		Tj = +12 °C	COPd	4,58	kW
Tj = biv	Pdh	8,2	kW		Tj = biv	COPd	3,52	kW
Tj = TOL	Pdh	7,6	kW		Tj = TOL	COPd	3,19	kW
Tj = -15 °C (if TOL < -20 °C)	Pdh		kW		Tj = -15 °C (if TOL < -20 °C)	COPd		kW
Bivalent temperature	T_{biv}	-5,2	°C		Operation limit temperature	TOL	-10	°C
Cycling interval capacity for heating	Pcych		kW		Cycling interval efficiency	COPcyc		-
Degradation co-efficient	Cdh	1,00	-		Heating water operating limit	WTOL	65	°C
Power consumption in modes other than active mode					*Supplementary heater*			
Off mode	P_{OFF}	0,002	kW		Rated heat output	Psup	2,4	kW
Thermostat-off mode	P_{TO}	0,01	kW					
Standby mode	P_{SB}	0,007	kW		Type of energy input	Electric		
Crankcase heater mode	P_{CK}	0,014	kW					
Other items								
Capacity control	fixed				Rated air flow rate, outdoors			m^3/h
Sound power level, indoors/outdoors	L_{WA}	45/-	dB		Rated water flow rate, indoor heat exchanger		0,82	m^3/h
Annual energy consumption	Q_{HE}	5345	kWh		Rated brine or water flow rate, outdoor heat exchanger		1,56	m^3/h
For heat pump combination heater:								
Declared load profile	**XL**				**Water heating energy efficiency**	η_{wh}	96	%
Daily electricity consumption	Q_{elec}	7,95	kWh		Daily fuel consumption	Q_{fuel}		kWh
Annual electricity consumption	AEC	1745	kWh		Annual fuel consumption	AFC		GJ

Figure 55: Brine to Water Test Data

The number of heat pumps in the group heating scheme in this example is 3no.

When entering the data into the Heat Pump Tool the following are noted for Figure 56:

1) The heat pump is fixed capacity control as selected under Section 4 of the Heat Pump Tool. The tool automatically fixes the sink temperature at 55^{o}C for all test points.
2) The five test points are quoted in the declared test data at the outdoor temperature of Tj, as referenced in the tool as the test conditions. The source temperature for the Brine to Water heat pump is Brine at a temperature of 0^{o}C in compliance with EN 14825.
3) The Heating Capacity entered in the tool must accommodate the actual capacity of the installation, therefore it is entered in the tool as follows: i.e. 3no x Heating Capacity at each test point:

Test Conditions EN 14825:2013	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Source	B0	B0	B0	B0	B0
Sink	W35	W35	W35	W35	W35
Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
Source	B0	B0	B0	B0	B0
Sink	W45	W45	W45	W45	W45
Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00
Source	B0	B0	B0	B0	B0
Sink	W55	W55	W55	W55	W55
Heating Capacity (kW)	23.70	26.10	27.60	28.80	22.80
Coefficient of Performance (kW/kW)	3.40	3.91	4.25	4.58	3.19
Source	B0	B0	B0	B0	B0
Sink	W65	W65	W65	W65	W65
Heating Capacity (kW)	0.00	0.00	0.00	0.00	0.00
Coefficient of Performance (kW/kW)	0.00	0.00	0.00	0.00	0.00

Figure 56: Heat Pump Tool – Performance Data EN 14825

Similarly the capacity associated with the EN 16147 also needs to account for the 3no heat pumps. The capacity of the heat pump was 5kW, this has been increased to 15kW. The storage, standby losses and Declared Load Profile are all taken directly from the Ecodesign Data/ test certificates and NOT adjusted. It should be noted that given the number of configurations that can occur with Group Heating schemes, the tool does not include a check of the test data against the installed storage data but a "Note" appears asking the assessor to check that the test data is appropriate for the installation.

Test Conditions EN 16147			
Source of data	Water heating energy efficiency, ηwh		Source from Ecodesign Data or accredited tests to EN 16147
Water heating energy efficiency, ηwh	96	%	Source from Ecodesign Data or accredited tests to EN 16147
Equivalent Coefficient of Performance	2.4	kW/kW	
Reference Hot Water Temperature	55	°C	Source from Ecodesign Data or accredited tests to EN 16147, set at 40°C if unknown.
Required Source Temperature	0	°C	Based on Table 5 of EN 16147
Capacity of Heat Pump	15	kW	Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Declared Load Profile	XL		Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147
Standby Heat Loss	0.6	kWh/day	Source from Ecodesign Data or accredited tests to EN 16147, set as 0 if unknown
Volume of DHW accounted for in test	150	litre	Source from Ecodesign Data or accredited tests to EN 16147
			NOTE: Assessor must verify that the installed storage volume is greater than used in test results

Figure 57 Heat Pump Tool – Performance Data EN 16147

7.3 Entry in Heat Pump Tool

When entering in the Heat Pump Tool, the Assessor must allow for the total demand on the heat pump(s) from the group heating scheme.

The Assessor selects "Yes" for the "Is the Heat Pump part of a Group Heating Scheme". They then enter the proportion of group heating provided by the heat pump, the floor area of the dwelling being assessed and the total floor area being served by the group heating scheme.

In this example the heat pump is providing 100% of the group heating scheme main heating, the floor area of the dwelling is 100m^2 and the group heating scheme is serving 6no dwellings of the same type with total floor area 600m^2.

3. Building Data			
Total heat loss (W/K) taken from DEAP	321	W/K	Source from the Building Elements - Heat Loss Results Tab in DEAP
Heat Loss Watts	41254.92	Watts	Required Heating Capacity at design conditions.
Is the Heat Pump part of a Group Heating Scheme	Yes		
Proportion of group heating provided by the heat pump	100%	%	
Floor Area of Dwelling	100	m^2	Source from DEAP
If Heat Pump serves a Group Heat Scheme, the total Floor Area served by Heat Pump is:	600	m^2	

Figure 58: Heat Pump Tool – Building Data

The remainder of the data input into the tool is as per Example 2. The heat pump tool calculates the Main Heating Efficiency, the Water Heating Efficiency and associated efficiency adjustment factors:

8. Results			
Results			
Efficiency of Main Heating System	383%	%	Enter this in DEAP: energy requirements: space heating
Efficiency Adjustment Factor - Main Heating	1.00		Enter this in DEAP: energy requirements: space heating
Efficiency of Main Hot Water System	195%	%	Enter this in DEAP: energy requirements: water heating
Efficiency Adjustment Factor - Main Hot Water	1.00		Enter this in DEAP: energy requirements: water heating
Additional Renewable Contribution from Heat Pump	415.23	kWh/year	Enter this in DEAP: energy requirements: fuel data: Renewable Energy: Energy Saved or Produced: Renewable Thermal: Part L Total contribution (kWh/yr). Note: this is only applied to Part L renewable contribution in new dwelling assessments.

Figure 59 Heat Pump Tool - Results

7.4 Entry in DEAP

When entering into DEAP, the methodology is as outlined in DEAP Manual Section C3 is followed.

The percentage of heat for space heating and that for water heating is determined based on the space and water heat delivered to the dwelling. Taking the heating demand and water demand from Example 2 of 8372 kWh/yr and 4772 kWh/yr respectively, and the heat pump is providing 100% of the load, the percentages are as follows 64% for space heating and 36% for hot water. Note the figures 8372 kWh and 4772 kWh are as per the DEAP delivered energy in the "Results" tab in the group heating assessment.

Taking the results from Heat Pump Calculator the efficiencies are entered into DEAP as follows:

The efficiency entered into DEAP is the Efficiency (from Heat Pump Tool) x Efficiency Adjustment Factor (from Heat Pump Tool).

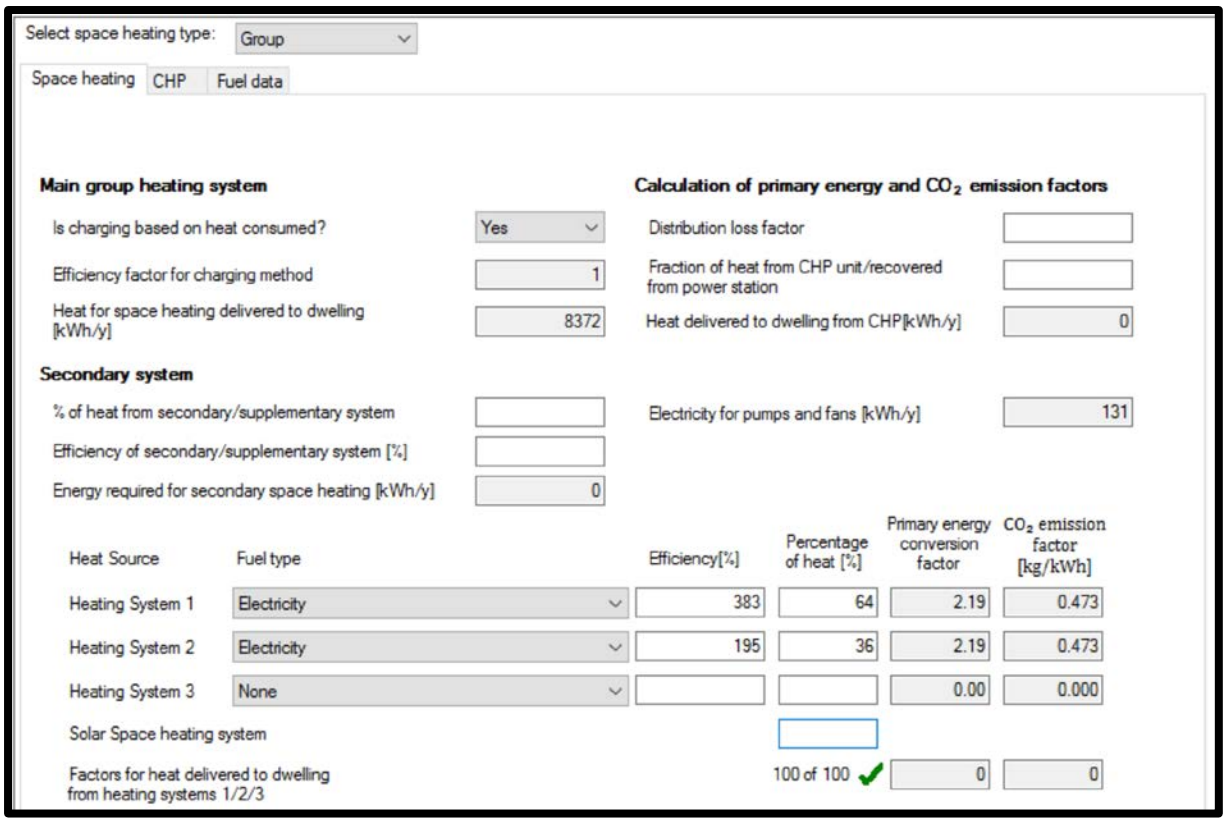


Figure 60 DEAP Tool Energy Requirements 1