SUSTAINABLE ENERGY AUTHORITY OF IRELAND

DEAP Heat Pump Methodology 2020

For Heat Pump configurations not covered in DEAP 4 software

April 2021

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Report prepared for SEAI by:
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Sustainable Energy Authority of Ireland
SEAI is Ireland's national energy authority investing in, and delivering, appropriate, effective and sustainable solutions to help Ireland's transition to a clean energy future. We work with the public, businesses, communities and the Government to achieve this, through expertise, funding, educational programmes, policy advice, research and the development of new technologies.

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Contents:

1 Introduction

This document supplements Version 4.2.2 of the DEAP Manual, the DEAP software (https://deap.seai.ie/) and accompanies the Microsoft Excel Heat Pump Calculator (Published August 2020, minor updates April 2021[1]) published by SEAI. The calculator and this guidance facilitate entry of heat pump types and systems not yet catered for in the DEAP software, and follows changes proposed in the document "DEAP Heat Pump Methodology Proposed Changes" issued for public consultation by SEAI in Q2 2019. This calculator and guidance must be used when calculating efficiencies for use in residential BER assessments and/or Part L compliance calculations for the following systems incorporating heat pumps in any of the following scenarios:

- **Low Temperature Heat Pump:** These are Low Temperature "to-water" units as defined in the Ecodesign directive which cannot deliver heating water at a temperature at or above 52^{O}C[2].
- **Gas adsorption/absorption Heat Pumps (called GAHP in this document):** These heat pumps consume gas rather than electricity. The test data for these units is structured in the same way as electrical heat pumps but is based on different test standards detailed in Section 2 of this document.
- **Direct Exchange (DX) heat pumps:** These units circulate refrigerant rather than water through the ground loop. For the purposes of this calculator, they are similar to Brine /Water (B/W) units, although the source temperature is 4^{o}C rather than 0^{o}C.
- **Exhaust Air to Air heat pumps:** These are double duct systems using heat pump technology to source heat from extracted air to heat incoming fresh air. Like Exhaust Air to Water heat pumps already facilitated in the DEAP software, the renewable energy contribution is adjusted as energy recovered from the dwelling via heat recovery is not considered renewable in line with the Renewables Directive (2018/2001).
- **Multiple Heat Pump Arrangements:** The heat pump calculator facilitates multiple heat pump configurations (up to three heat pumps, with means to separate space and water heating heat pumps). The combined efficiency of the three heat pumps may be entered as group heating or individual heat pumps, or combinations thereof. The user enters proportion of space heating and water heating from each heat pump as well as heat pump type information and associated test data for each unit. This document details relevant test data / standards for these heat pump types in Section 2 and demonstrates how to account for each type in Section 3.

This calculator enables DEAP users to account for the above system types using the current version of the DEAP 4 software.

There are also some updates to the "DEAP Heat Pump - Designer/ Installer Sign Off Form" accompanying the DEAP Heat Pump Calculator 2020, referred to as Heat Pump Calculator in this guidance document, to facilitate the new heat pump types and associated standards. When carrying out heat pump analysis for DEAP using the heat pump calculator, the Assessor must upload the heat pump calculator and Designer/installer sign off excel files used for the BER assessment as evidence when completing the DEAP software online assessment.

[1] This update reduces the dwelling heat loss to be met by heat pump(s) when CHP is part of the heating system

[2] As per Ecodesign Regulation 813/2013: *'low-temperature heat pump' means a heat pump space heater that is specifically designed for low-temperature application, and that cannot deliver heating water with an outlet temperature of 52 °C at an inlet dry (wet) bulb temperature of – 7 °C (– 8 °C) in the reference design conditions for average climate;*

1.1 Using the Heat Pump Calculator with DEAP

As this calculator and guidance supplement the DEAP software, please ensure to follow the DEAP Manual, particularly "Appendix G: Heat Pumps". The text from the DEAP Manual is generally not replicated in this guidance document but is referenced where necessary. However, there are aspects of the interaction with the DEAP Manual and Software to bear in mind when using this calculator:

- A number of DEAP software entries must be completed for the dwelling in question prior to using this calculator. Namely:
  - Building and Ventilation sections. This enables DEAP to calculate fabric heat losses and therefore the space heat demand for the heat pump.
  - Space heating -> Controls and Responsiveness; as well as Pumps and Fans
  - Water heating -> Options and Storage; as well as Solar thermal (if applicable). This enables DEAP to calculate the water heat demand for the heat pump.
  - Lighting
- The "DEAP Heat Pump - Designer/ Installer Sign Off Form" must be completed by the heat pump system Designer/ Installer in advance of using the Heat Pump Calculator.
- A number of data points, such as dwelling heat demand, are then sourced from the DEAP software and manually entered into the Heat Pump Calculator. This guidance document details how to source these figures from DEAP and use them in the heat pump calculator.
- A number of data points, such as heat pump test data, are entered and used in this calculator for the aforementioned heat pump types (e.g. GAHP). Sourcing and using these test figures is similar to the process for heat pumps already catered for in DEAP (e.g. electrical A/W heat pumps with Ecodesign based data).

The heat pump calculator shades out fields not relevant to the entries made by the user.

- Results from this calculator (such as heat pump system efficiencies) are manually entered in the DEAP software assessment as described in this document. DEAP uses these calculator results to determine overall energy usage for space and water heating and Renewable Energy Part L compliance contribution checks.
- **When using the heat pump calculator, add a note to the "Assessor Comments" section in DEAP under "Edit Survey Details" referencing use of the heat pump calculator, and, where relevant, the Renewable Energy Ratio adjustment described in this document**.
- Note that like electric heat pumps, the renewable contribution from GAHP is based on the heat provided by the heat pump minus the fuel (gas in this case) supplied to the heat pump. This is the ambient (renewable) energy the heat pump sources from the environment.
- When heat pump efficiencies are manually entered in the DEAP software, DEAP calculates the associated renewable energy contribution for the purposes of Part L compliance checking (Renewable Energy Ratio, or, RER). This may need to be adjusted in certain scenarios. The extent of the adjustment is automatically calculated by the heat pump calculator and is used to adjust the overall RER as detailed in this document. Scenarios involving this adjustment are:
  - Calculated heat pump efficiency includes a combination of heat pump and backup heating
  - Reduction in renewables due to use of Exhaust Air as a heat source
  - Reduction in renewables for any heat pump with its heat source preheated by another heating system. For example, a heat pump with a boiler providing heat to its "source loop" or a heat pump with its source preheated by another heat pump).
  - Entry of heat pumps in a group heating system.
  - The adjustment is not required in cases where the Part L renewable energy ratio is not relevant in DEAP (i.e. existing dwelling BER assessments). It is only required for new-final and new-provisional assessments.
  - Where Part L RER is relevant (i.e. New final or new provisional assessment), a copy of the "DEAPentries" sheet from the completed heat pump calculator must be provided with the Part L compliance report and client must be advised in writing of the change to RER.

1.2 Overview of the Heat Pump Calculator tabs

There are a number of tabs in the Heat Pump Calculator. These are similar to the original Heat Pump Calculator published in 2016 (and subsequently integrated with the DEAP software):

- **Cov; Code; Proj tabs**: These are the cover sheet, the overview of the different tabs and the basic information about the dwelling and assessment respectively.
- **DEAPEntries tab**: This tab takes fields manually transferred from DEAP by the Assessor for use in the Heat Pump Calculator. It also presents the final results from the calculator to be transferred by the Assessor into DEAP. This user carries out RER adjustment where required on this tab.
- There are three of each of the following tabs. This allows for up to three systems to be entered and analysed in the calculator:
    - **HP_1, HP_2, HP_3 tabs**: User enters design and test data for up to three heat pumps.
    - **HeatingCalc_1 / 2 / 3**: Carries out space heating calculations based on the dwelling heat demand and the above inputs for up to three heat pumps. There are no user entries on these tabs.
    - **DHWCalc_1 / 2 / 3**: Carries out water heating calculations based on the dwelling hot water demand and the above inputs for up to three heat pumps. There are no user entries on these tabs.
    - **SpaceStandardsID_1 / 2 / 3 and WaterStandardsID_1 / 2 / 3:** used by each HP tab to check if the user has selected valid entries heat pump types and associated standards. There are no user entries on these tabs.
- **Meteorological data:** Holds weather data from ASHRAE for use in the Heat Pump Calculator.

2 Test data and heat pump types

Table 1 below shows the applicable test data for all heat pump types catered for in the DEAP methodology as well as detailing the scenarios for which this Heat Pump Calculator is used, and those for which the DEAP software is used. Additional information is provided on group heating functionality and requirements in Section 2.1 below.

Table 1 shows the following information:

- Heat pump type (e.g. Air to Water, Direct Exchange etc.)
- Specify the fuel: electricity or gas (GAHP)
- Differentiate between space and water heating for each heat pump type
- Specifies the relevant standard for each heat pump type and each heat use. For example:
    - space heating standard for a GAHP is EN12309-6[3].
    - water heating standard for an electric heat pump is EN16147[4].
    - water heating standard for a GAHP is EN13203-6[5].
- Specifies the relevant source temperatures for tests. For example:
    - test points use source temperature of 4°C for DX units and 0°C for brine source units.
- Specify relevant sink temperatures for each of fixed control and variable control units. For example:
    - in a medium temperature application, the sink temperature at all 5 test points is 45°C for a fixed control "to-water" unit
    - in a medium temperature application, the sink temperature at the test points varies: 43°C; 37°C; 33°C; 28°C; 45°C for a variable control "to-water" unit
- Outlines the heat pump types that are specifically classed as "Low Temperature". The Heat Pump Calculator must be used in this case. Notes:
    - While Low Temperature units do not provide hot water, a separate hot-water only heat pump may be specified for the same dwelling or the Low Temperature Heat Pump may "pre heat" the hot water in the Heat Pump Calculator (this is the sole exception to the rule where "Low temperature heat pumps" do not ordinarily provide hot water).
    - Ordinarily "High temperature" test data, as shown in the table, must always be provided for "to-water" units for space heating. However, in the case of low temperature units, "Low temperature" test data is mandatory and "medium temperature" test data is optional for use in the Heat Pump Calculator.
- The following must currently be assessed in the Heat Pump Calculator:
    - all "Low temperature" units;
    - GAHPs;
    - DX units;
    - Exhaust Air to Air,
    - Heat pumps in group heating systems
    - Systems with multiple heat pumps.
    - Other systems are generally assessed using DEAP as shown in the table.
- Other Notes for Table 1:
    - source/ sink temperatures and test points shown are based on the relevant standards and Ecodesign Directive requirements.
    - GAHPs use the same source and sink temperatures as corresponding electric A/W, B/W and W/W units.

[3] I.S. EN 12309-6:2014: Gas-fired sorption appliances for heating and/or cooling with a net heat input not exceeding 70 kW - part 6: calculation of seasonal performances

[4] References for electrically driven heat pumps are provided in the DEAP manual.

[5] EN 13203-6:2018: Gas-fired domestic appliances producing hot water. Assessment of energy consumption of adsorption and absorption heat pumps

2.1 Group heating and multiple heat pump scenarios

The calculation of efficiency for heat pumps in group heating systems, whether served by single or multiple heat pumps, requires use of the heat pump calculator. Individual systems served by multiple heat pumps also requires the use of the heat pump calculator. The examples later in this document illustrate the approach. A number of scenarios for space/water group heating are catered for in the Heat Pump Calculator such as:

- Single heat pump heating several dwellings;
- Single heat pump heating several dwellings with secondary heating in the dwelling (e.g. stove);
- Single heat pump with boiler and/or solar space heating supplying heat to several dwellings with/without secondary heating in the dwelling;
- Any of the above with Combined Heat and Power (CHP) meeting some of the heat demand;
- Group heat pump providing "pre-heat" to other heat pumps (group or individual), which in turn heat the dwelling;
- Group heat pump heating multiple dwellings also containing individual boilers within dwellings;
- Two or more heat pumps in the heating system within a dwelling.

					Sink temps (fixed) deg C @ part loads: 88%; 54%; 35%; 15%;				Sink temps (variable) deg C @ part loads: 88%; 54%; 35%; 15%; 100%						
Heat pump type	Electric/ GAHP?	Space heating? Water heating?	Test standard	Source temps degC	Low temp application	Medium temp	High temp	Very high temp	Low temp application	Medium temp	High temp	Very high temp	How to treat low temperature version of this heat pump	Approach where ecodesign n/a	DEAP Software or Heat Pump Calculation tool applies?
A/W	Electric	Space	EN14825:2016 Table 8, 9, 10, 11	-7; 2; 7; 12; TOL	35	45	55	65	34; 30; 27; 24; 35	43; 37; 33; 28; 45	52; 42; 36; 30; 55	61; 49; 41; 32; 65	"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2/255-3	Only use this calculation tool for: . Low Temperature units or . if EN14825/14511 used for DHW or . Multiple HPs / group system
		Water	EN16147	7	Reference hot water temperature in EN16147 test								No DHW mode for low temp option		
B/W	Electric	Space	EN14825:2016 Table 12, 13, 14, 15	0	All sink test points identical to A/W electric heat pumps								"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2/255-3	Only use this calculation tool for: . Low Temperature units or . if EN14825/14511 used for DHW or . Multiple HPs / group system Otherwise use DEAP software
		Water	EN16147	0									No DHW mode for low temp option		
W/W	Electric	Space	EN14825:2016 Table 12, 13, 14, 15	10	All sink test points identical to A/W electric heat pumps								"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2/255-3	Only use this calculation tool for: . Low Temperature units or . if EN14825/14511 used for DHW or . Multiple HPs / group system Otherwise use DEAP software
		Water	EN16147	10									No DHW mode for low temp option		
EAHP	Electric	Space	EN14825:2016 Table 8, 9, 10, 11	20	35	45	55	65	34; 30; 27; 24; 35	43; 37; 33; 28; 45	52; 42; 36; 30; 55	61; 49; 41; 32; 65	"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2/255-3	Only use this calculation tool for: . Low Temperature units or . if EN14825/14511 used for DHW or . Multiple HPs / group system
		Water	EN16147	20	Reference hot water temperature in EN16147 test								No DHW mode for low temp option		
Direct exchange (DX)	Electric	Space	EN14825 Table 12, 13, 14, 15 (4 degrees source)	4	All sink test points identical to A/W electric heat pumps								"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2/255-3/ EN15879-1	Use Heat Pump Calculation tool for all DX units
		Water	EN16147	4									No DHW mode for low temp option		
A/A	Electric	Space	EN14825:2016 Table 6	-7; 2; 7; 12; TOL	20								No additional "low temp" option.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2	Only use this calculation tool for: . Multiple HPs / group system Otherwise use DEAP software
B/A	Electric	Space	EN14825:2016 Table 7	0	20								No additional "low temp" option.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2	Only use this calculation tool for: . Multiple HPs / group system Otherwise use DEAP software
W/A	Electric	Space	EN14825:2016 Table 7	10	20								No additional "low temp" option.	DEAP Appendix G/HARP and Table 4c. EN14511/255-2	Only use this calculation tool for: . Multiple HPs / group system Otherwise use DEAP software
Double duct air conditioner / Exhaust Air to Air	Electric	Space	EN13141 (See EN14511:2018 table 3 as per DEAP Manual)	-15; -7; 2; 7; 12 (20 for EA/A)	20								No additional "low temp" option.	Ecodesign doesn't apply for space heating for these units.	Only use this calculation tool for: . Exhaust Air to Air or . If EN14825/14511 used for DHW or . Multiple HPs / group system Otherwise use DEAP Software for these units. Additional guidance DEAPG4.3
		Water	EN16147	7	Reference hot water temperature in EN16147 test										
A/W	GAHP	Space	EN12309-6:2014 Table 5, 8, 11, 14	-7; 2; 7; 12; TOL	35	45	55	65	34; 30; 27; 24; 35	43; 37; 33; 28; 45	52; 42; 36; 30; 55	61; 49; 41; 32; 65	"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	n/a	Use Heat Pump Calculation tool for all GAHP units
		Water	EN 13203-6	7	Reference hot water temperature in 13203-6 test								No DHW mode for low temp option		
B/W	GAHP	Space	EN12309-6:2014 Table 17, 20, 23, 26	0	All sink test points identical to A/W GAHP								"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	n/a	Use Heat Pump Calculation tool for all GAHP units
		Water	EN 13203-6	0									No DHW mode for low temp option		
W/W	GAHP	Space	EN12309-6:2014 Table 17, 20, 23, 26	10	All sink test points identical to A/W GAHP								"Low temp application" mandatory. "Medium temp application optional". High temp mandatory if not low temp heat pump.	n/a	Use Heat Pump Calculation tool for all GAHP units
		Water	EN 13203-6	10									No DHW mode for low temp option		

Table 1: Overview of standards, test points and heat pump types

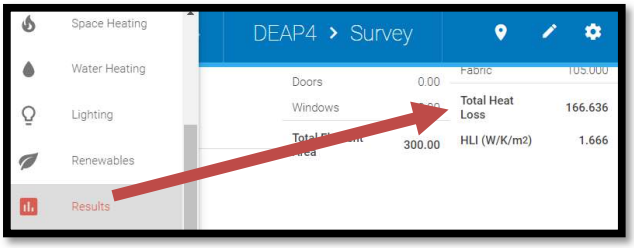
3 Examples

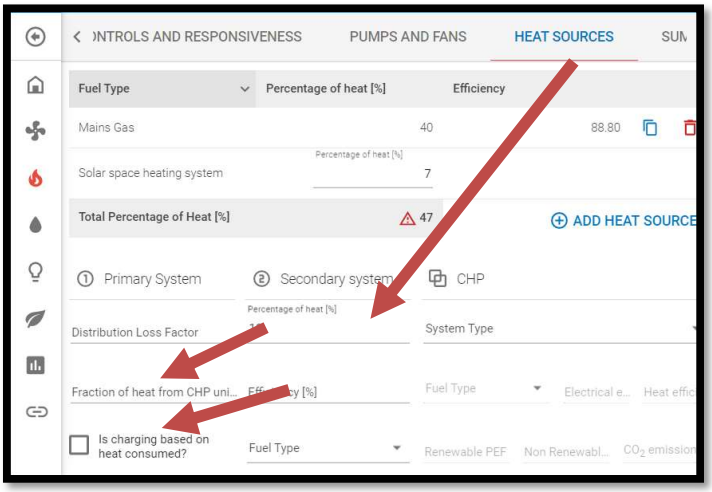
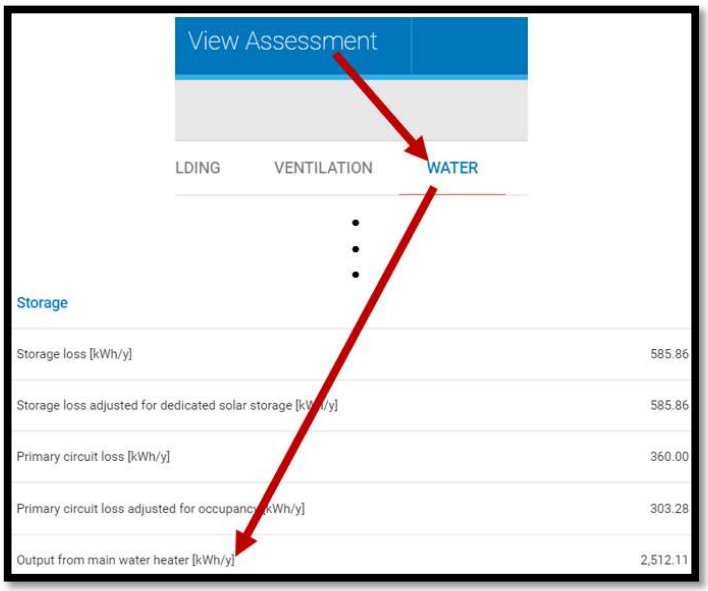
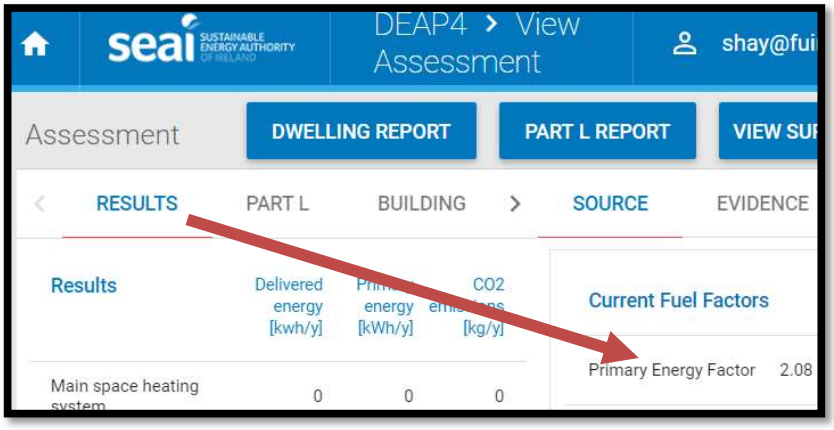
This section sets out a number of examples of the systems to be assessed using the Heat Pump Calculator and does not focus on heat pump types already catered for in the DEAP software. Generally, the standards/Ecodesign based data is of the same format/requirements as heat pumps facilitated in the original 2016 DEAP Heat Pump Methodology and now, in the DEAP software. The same Ecodesign directive and regulations apply to low temperature, DX and GAHP heat pumps, so Ecodesign test data already in use by BER Assessors since 2016 is not replicated in this document.

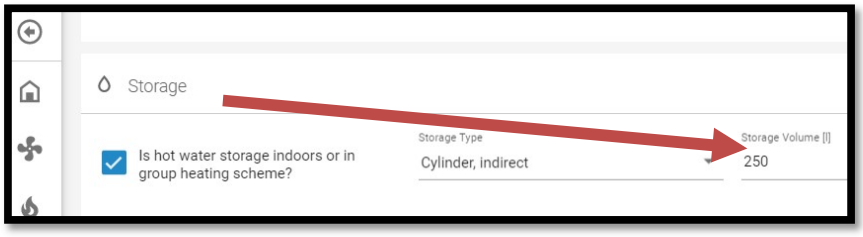
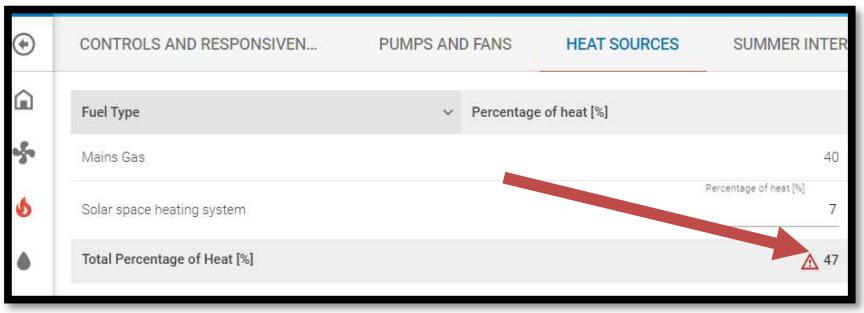
3.1 DEAPEntries tab: guidance on values sourced from the DEAP assessment

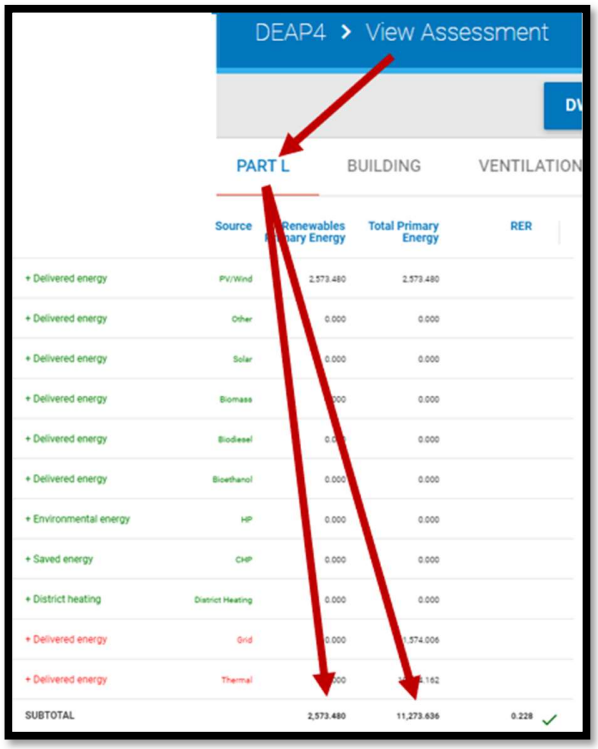
Section 1.1 details that the building, ventilation and lighting sections as well as parts of the space and water heating sections of the DEAP assessment must be completed to generate relevant inputs for the Heat Pump Calculator. The "DEAP Heat Pump - Designer/ Installer Sign Off Form" must also be completed in advance of using the Heat Pump Calculator. These are entered in the "DEAPEntries" tab (yellow cells) and are sourced as explained in this table and applies to the examples detailed later in this document.

Table 2: Sourcing data from DEAP

Description:	Unit:	Guidance Notes:
Total heat loss (W/K) taken from DEAP	W/K	Sourced from DEAP "results" tab as per the screenshot. This is the sum of heat losses from fabric + ventilation + windows: 
Annual space heat requirement (total)	kWh	Sourced from DEAP: View assessment: Gains/losses 
Floor Area of Dwelling	m²	Sourced from DEAP: Building: Floors tab. 
Living area of dwelling	m²	

Proportion of space heat from secondary system	%	Sourced from DEAP: Space heating: heat sources 
Fraction of heat from CHP		
Is charging based on heat consumed (group heating systems only)		
Output from main water heater	kWh	Sourced from DEAP: View assessment: Water 
Electricity Primary Energy Factor		Sourced from DEAP: View assessment: Results 

Volume of DHW Storage	litres	Sourced from DEAP: Water Heating: options and storage 
Type of space heating heat pump		The user can specify the heat pump type for space and water heating separately for up to three heat pumps. These will be one of "None"; "Heat Pump"; "Exhaust Air Heat Pump", based on the "DEAP Heat Pump - Designer/ Installer Sign Off Form" & Ecodesign Data sheet for the Heat Pump.
Type of water heating heat pump		
% main space / water heat provided by each heat pump based on system design	%	Sourced from design data for space and water heating for up to three heat pumps. In individual heating systems, these values must always total 100% for each of space heating and water heating where there is one or more space heating or water heating heat pump installed. In group heating systems, the sum of these values for each of space heating and water heating will depend on the presence of other heating systems in the design (e.g. group heating boilers or solar space heating). The proportions of heat from conventional boilers (and other systems such as heat pumps) should be estimated based on operational records or, in the case of a new scheme, on the basis of its design specification. The heat pump will provide 100% minus [the percentage from solar space heating + percentage from boilers] towards the space and water heat demand. In the example shown, the boiler + solar space heating provides 47%. Therefore, the proportion of group heating provided by heat pump will be 53%. The designer/installer should provide the resulting estimate of space heating and water heating from the installed heat pump(s) for use in the heat pump calculator. Where no design specification or operational records are available, the assessor should proportion the heat pump contributions based on the capacity of each heating system. 
Is heat pump source preconditioned		Sourced from system designer/ As Built schematic. Indicates if the heat pump sources its heat from another heating system/device such as another boiler or heat pump. Entered for up to three heat pumps. For example, if an Air to Water Heat Pump is preheating the source of a Water to Water heat pump, this entry is set to "no" for the air to water unit, and set to "yes" for the water to water unit.
Is the Heat Pump part of a Group Heating Scheme		Specified for up to three heat pumps. The heat pump calculator allows up to three heat pumps as well as a combination of units within the dwelling (individual) and heating multiple dwellings (group). The DEAP software "group scheme" entry is selected under Space heating: Controls and responsiveness tab as shown.

		
If "Exhaust Air Heat Pump(s)" what is the total exhaust Air Flow Rate	m³/h	Should be taken from the Technical Data sheet for the Heat Pump(s). This value is be entered for up to three heat pumps. If there is only a single exhaust air heat pump present, this value will match DEAP: Ventilation tab. 
Total renewables primary energy from DEAP software	kWh	Sourced from DEAP: View assessment: Part L 
Total primary energy from DEAP software	kWh	

3.2 DEAPEntries tab: values returned from the Heat Pump Calculator for DEAP

Once the Heat Pump Calculator entries are completed as detailed in the examples later in this document, the calculator returns a number of fields (in blue cells in the DEAPEntries tab) for entry in DEAP. Entering these fields in the DEAP software is carried as outlined in the following tables for the examples detailed later in this document. Table 3 details the approach to each result from the DEAPEntries tab.

Table 3: Returning data to DEAP.

Description:	Unit:	Guidance Notes:
Efficiency of space heating heat pump + backup	%	Enter in DEAP: Space heating: heat source as heating system efficiency. For group heating system, always enter as the first heat pump system in DEAP.
Efficiency of water heating heat pump + backup	%	Enter in DEAP: Water heating: heat source as heating system efficiency. For group heating system, always enter as the second heat pump system in DEAP.
Space heating fuel and water heating fuel		Space heating fuel: Enter in DEAP: Space heating: heat source as fuel. Gas fired heat pumps treated as natural gas / LPG boilers (with efficiency as derived by this calculation). For group heating system, enter as the first heat pump system in DEAP. Water heating fuel: Enter in DEAP: Water heating: heat source as fuel. Gas fired heat pumps treated as natural gas / LPG boilers (with efficiency as derived by this calculation). For group heating system, always enter as the second heat pump system in DEAP.
Efficiency adjustment factor for space heating and water heating		These will always be "1" when using the heat pump calculator.
Group heating % of heat from space heating	%	This value only applies to systems with a group heating heat pump. It must be entered as the **first** heat pump system percentage of heat in the DEAP Software so that the renewable contribution and adjustment thereof is calculated correctly.
Group heating % of heat from water heating	%	This value only applies to systems with a group heating heat pump. It must be entered as the **second** heat pump system percentage of heat in the DEAP Software. The DEAP software will not account for the renewable contribution and therefore the renewable contribution will need to be adjusted as per the heat pump calculator (this is shown in examples in this document).
Additional errors and warnings #1		If this error is shown, the heat pump test temperatures are lower than expected by the proportion of water heating set by the user. Either the proportion of heat from this heat pump will need to be lowered or alternative (valid) test data is required.
Additional errors and warnings #2		This warning indicates that backup heating is deemed necessary by the heat pump calculator. Alternative heat pumps (e.g. larger capacity) or reproportioning of heat may alleviate the issue and improve overall system efficiencies).
Additional errors and warnings #3		While the heat pump calculator allows the standard IS EN 14825/14511 to be used in place of IS EN 16147 for water heating, it may not be used for more than one of the three heat pump iterations facilitated in the heat pump calculator.
DEAPEntries: Renewable Energy Adjustments (fields completed AFTER results from table above complete). New dwellings only.		
Total renewables primary energy from DEAP software	kWh	Sourced from DEAP: View assessment: Part L after completion of the BER assessment Refer to Table 2.
Total Primary Energy from DEAP software	kWh	
Adjusted Renewable Energy Ratio to be attached to compliance report	kWh	Calculated by the Heat Pump Calculator. The Assessor is required to: - Add note to the "Assessor Comments" section in DEAP - notify the client in writing of this result, - attach the Heat Pump Calculator to evidence in the DEAP software AND - attach the result to the Part L compliance report.

Table 4 outlines how each system type is treated when porting results from the calculator to DEAP.

Table 4: Summary of heat pump types: approach in DEAP

Group/ individual system:	Heat pump type:	Fuel type in DEAP	Heating system selected in DEAP	Efficiencies	Renewables	Controls comment
Individual	Any electric individual heat pump including: . Exhaust air to air . DX . Electric Low temp heat pumps	Electricity	Direct acting electric boiler	As calculated by heat pump calculator. NB space and water heating efficiencies will differ so need to be entered separately. Deselect the option "heats water" when entering the space heating details of the heat pump in DEAP.	Relevant for new dwellings for all heat pump system types. When heat pump efficiencies are manually entered in the DEAP software, DEAP calculates the associated renewable energy contribution for the purposes of Part L compliance checking (Renewable Energy Ratio, or, RER). This may need to be adjusted in certain scenarios. The extent of the adjustment is automatically calculated by the heat pump calculator and is used by the Assessor to adjust the overall RER as detailed in this document.	Enter in DEAP as per the system installed in the dwelling. Efficiency adjustment factor must = 1.0 when sourcing results from the heat pump calculator.
Individual	Any GAHP individual heat pump including: . A/W . B/W . W/W . Gas low temp. heat pumps	Mains gas or LPG as supplied to the dwelling	Regular non-condensing gas boiler			Enter in DEAP as per the system installed in the dwelling. Non-condensing option with interlock gives Efficiency Adjustment Factor of 1.0 in DEAP. Efficiency adjustment factor must = 1.0 when sourcing results from the heat pump calculator.
Individual heating system with multiple heat pumps	Combination of heat pump types above	As per electric or GAHP guidance in this table above depending on whether all heat pumps are electric or GAHP.	As per electric or GAHP guidance in this table above depending on whether all heat pumps are electric or GAHP.			As per electric or GAHP guidance in this table above depending on whether all heat pumps are electric or GAHP.
Group heating: single heat pump and systems with multiple heat pumps	Single heat pump type or combination of heat pump types as above	Electricity, mains gas or LPG as above	Group heating scheme	Enter space heating efficiency, proportion and fuel as heating system #1 in group heating section of DEAP Software. Enter water heating efficiency, proportion and fuel as heating system#2 in group heating section of DEAP software. Total percentage of heat including additional boiler and solar space heating must = 100% in DEAP software.		Enter in DEAP as per the system installed in the dwelling.

3.3 Low temperature heat pumps

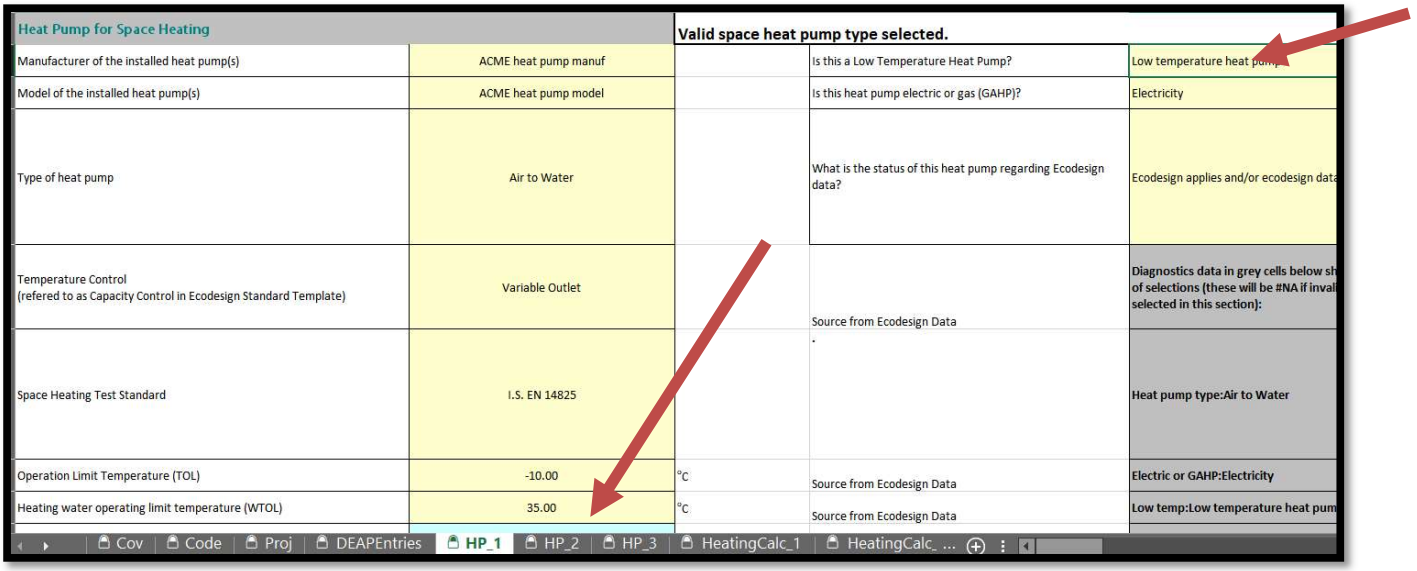
3.3.1 Low temperature heat pump for space heating only. Individual heating system.

This example is based on a single heat pump defined as a Low Temperature heat pump under the Ecodesign directive. The heat pump complies with Ecodesign/Energy Labelling directive. As it is a low temperature unit, it does not provide water heating. In this example, water heating is provided by a gas boiler, meaning that "Type of water heating heat pump" is set to "none". As there is only one heat pump, space heating entries for heat pumps #2 and 3 are not populated. Data is entered in yellow cells in the heat pump calculator. The DEAPEntries tab is populated as per guidance in Table 2 above based on information in the DEAP Software as follows:

Inputs from DEAP ↓ User to populate yellow cells below and in HP 1/2/3 tabs.			
Description:	**Value:**		
Total heat loss (W/K) taken from DEAP	178.08		
Annual space heat requirement (total)	6114.20		
Floor Area of Dwelling	100.00		
Living area of dwelling	10.00		
Percentage of space heat from secondary system	10%		
Fraction of heat from CHP	0.00		
Output from main water heater	2512.11		
For Group Heating: Is charging based on heat consumed?	No		
Electricity Primary Energy Factor	2.08		
Volume of DHW Storage	250		
Description:	**Heat pump # 1**	**Heat pump # 2**	**Heat pump # 3**
Type of space heating heat pump	Heat Pump	None	None
Type of water heating heat pump	None	None	None
% main space heat provided by each heat pump based on system design	100%	0%	0%
% main water heat provided by each heat pump based on system design	0%	0%	0%
Is heat pump source preconditioned?	No	No	No
Is the Heat Pump part of a Group Heating Scheme	No	No	No
If "Exhaust Air Heat Pump(s)" what is the total exhaust Air Flow Rate			

Cov | Code | Proj | DEAPEntries | HP_1 | HP_2 | HP_3 | H ...

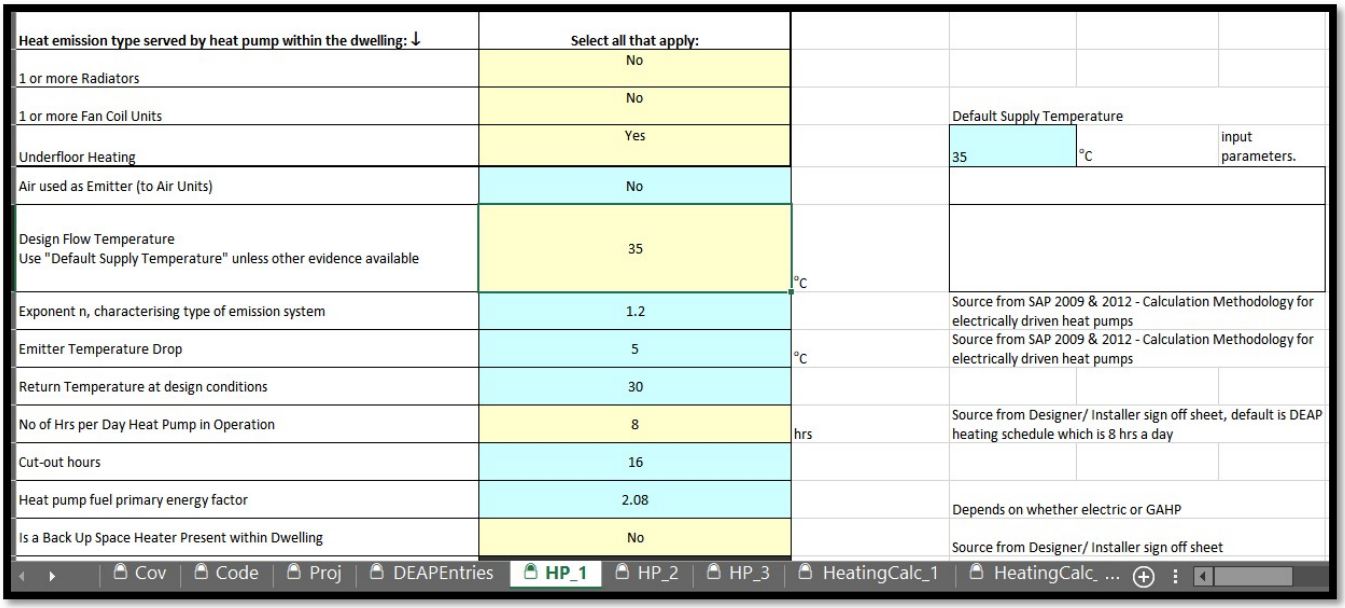
Along with the DEAPEntries being completed, the user completes a number of entries in the **HP_1 tab** of the Heat Pump Calculator based on the "DEAP Heat Pump - Designer/ Installer Sign Off Form", starting with some basic information about the heat pump. The Heat Pump Calculator flags cases where valid or invalid entries are made (e.g. the wrong standard is chosen based on heat pump type and applicability of Ecodesign). The "WTOL" entry highlighted below is sourced from test data and must be < 52^{O}C for low temperature heat pumps:



Heat Pump for Space Heating			Valid space heat pump type selected.	
Manufacturer of the installed heat pump(s)	ACME heat pump manuf		Is this a Low Temperature Heat Pump?	Low temperature heat pump
Model of the installed heat pump(s)	ACME heat pump model		Is this heat pump electric or gas (GAHP)?	Electricity
Type of heat pump	Air to Water		What is the status of this heat pump regarding Ecodesign data?	Ecodesign applies and/or ecodesign data
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Variable Outlet		Source from Ecodesign Data	Diagnostics data in grey cells below sh of selections (these will be #NA if inval selected in this section):
Space Heating Test Standard	I.S. EN 14825		-	Heat pump type:Air to Water
Operation Limit Temperature (TOL)	-10.00	°C	Source from Ecodesign Data	Electric or GAHP:Electricity
Heating water operating limit temperature (WTOL)	35.00	°C	Source from Ecodesign Data	Low temp:Low temperature heat pum

Cov | Code | Proj | DEAPEntries | HP_1 | HP_2 | HP_3 | HeatingCalc_1 | HeatingCalc_ ...

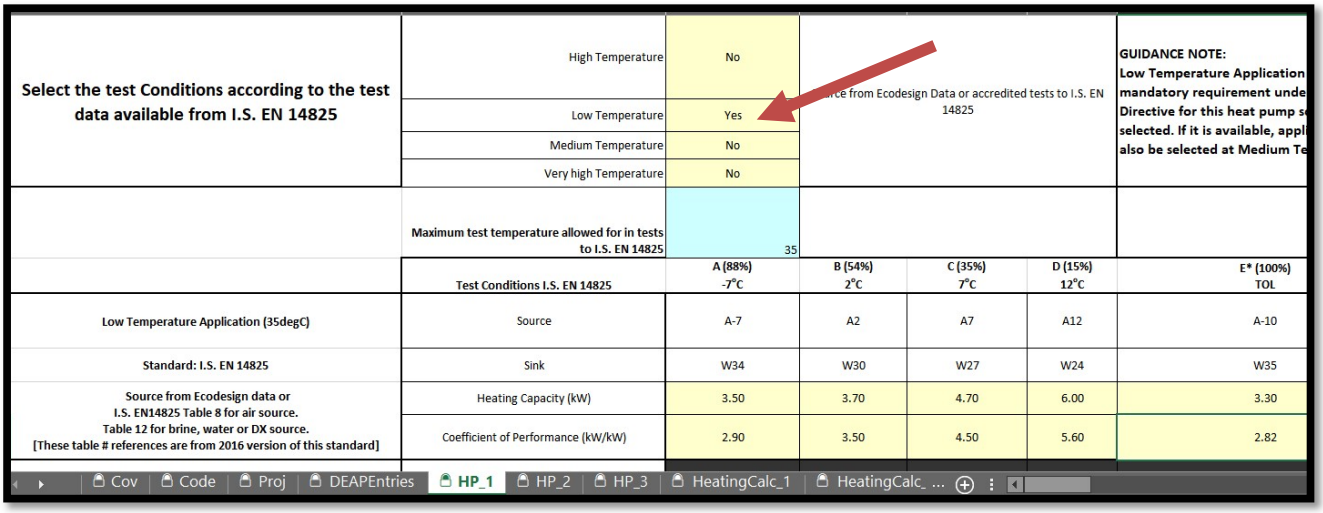
Entries related to heat emitters, backup heating, heat pump operation limit temperatures etc. all use the same approach as heat pumps assessed directly within the DEAP software following DEAP Appendix G. Note that for a Low Temperature heat pump, the unit is designed for lower emission temperatures (e.g. underfloor heating or system with radiators designed to run at a lower temperature). The entries for the example in question are as follows:



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	Yes		35	°C	input parameters.
Air used as Emitter (to Air Units)	No				
Design Flow Temperature Use "Default Supply Temperature" unless other evidence available	35	°C			
Exponent n, characterising type of emission system	1.2		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	8	hrs	Source from Designer/ Installer sign off sheet, default is DEAP heating schedule which is 8 hrs a day		
Cut-out hours	16				
Heat pump fuel primary energy factor	2.08		Depends on whether electric or GAHP		
Is a Back Up Space Heater Present within Dwelling	No		Source from Designer/ Installer sign off sheet		

Cov | Code | Proj | DEAPEntries | HP_1 | HP_2 | HP_3 | HeatingCalc_1 | HeatingCalc_ ...

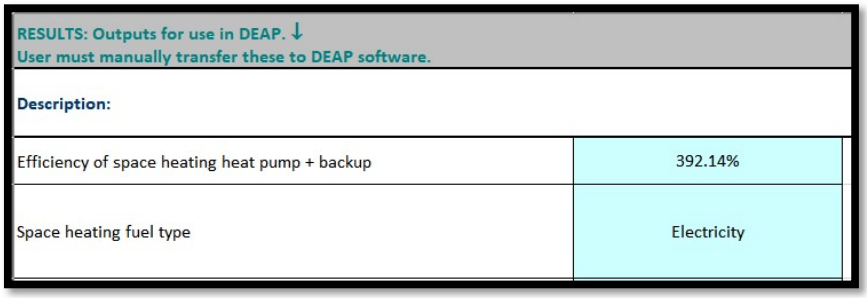
The user specifies the test data available for this unit. "High temperature" and "Very high temperature" data are not appropriate or available for "Low temperature" heat pumps. While "medium temperature" data is optional for this type of heat pump, it is not assumed to be available for this example. "Low temperature" is mandatory for "low temperature" heat pumps, so is set to "yes". The corresponding COPs and capacities are entered at each of the five test points such as in the following example:



Select the test Conditions according to the test data available from I.S. EN 14825	High Temperature	No	ce from Ecodesign Data or accredited tests to I.S. EN 14825			GUIDANCE NOTE: Low Temperature Application mandatory requirement unde Directive for this heat pump s selected. If it is available, appl also be selected at Medium Te
	Low Temperature	Yes				
	Medium Temperature	No				
	Very high Temperature	No				
	Maximum test temperature allowed for in tests to I.S. EN 14825	35				
	Test Conditions I.S. EN 14825	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Low Temperature Application (35degC)	Source	A-7	A2	A7	A12	A-10
Standard: I.S. EN 14825	Sink	W34	W30	W27	W24	W35
Source from Ecodesign data or I.S. EN14825 Table 8 for air source. Table 12 for brine, water or DX source. [These table # references are from 2016 version of this standard]	Heating Capacity (kW)	3.50	3.70	4.70	6.00	3.30
	Coefficient of Performance (kW/kW)	2.90	3.50	4.50	5.60	2.82

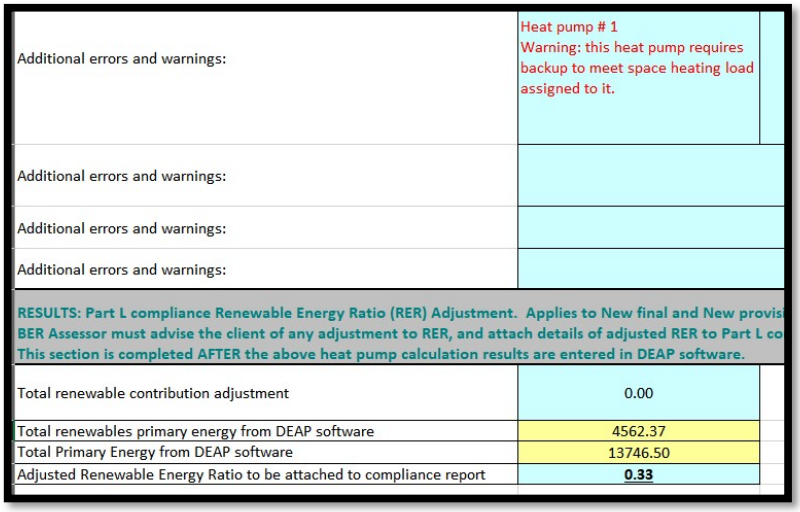
Cov | Code | Proj | DEAPEntries | HP_1 | HP_2 | HP_3 | HeatingCalc_1 | HeatingCalc_ ...

In this example, as "Type of water heating heat pump" is set to "none", then no water heating entries are required. The results for space heating are now automatically updated in the DEAPEntries tab as follows.



RESULTS: Outputs for use in DEAP. ↓ User must manually transfer these to DEAP software.	
Description:	
Efficiency of space heating heat pump + backup	392.14%
Space heating fuel type	Electricity

No adjustment is required for renewables in this case (as shown by the "0" value) automatically calculated by the heat pump calculator in the following figure. Note also that the calculator advises the user that a backup is indicated as being necessary. Alternative heat pumps (e.g. larger capacity) or reproportioning of heat may alleviate the issue and improve overall system efficiencies).

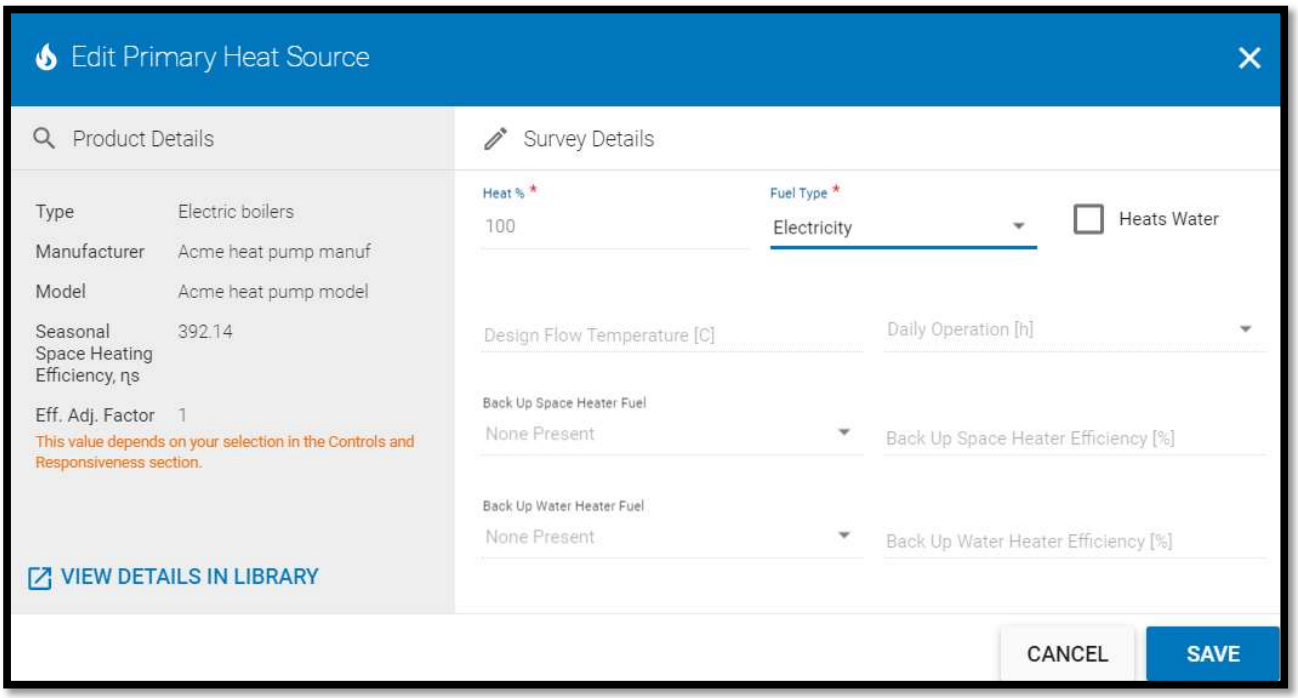


Additional errors and warnings:	Heat pump # 1 Warning: this heat pump requires backup to meet space heating load assigned to it.
Additional errors and warnings:	
Additional errors and warnings:	
Additional errors and warnings:	

RESULTS: Part L compliance Renewable Energy Ratio (RER) Adjustment. Applies to New final and New provis BER Assessor must advise the client of any adjustment to RER, and attach details of adjusted RER to Part L co This section is completed AFTER the above heat pump calculation results are entered in DEAP software.	
Total renewable contribution adjustment	0.00
Total renewables primary energy from DEAP software	4562.37
Total Primary Energy from DEAP software	13746.50
Adjusted Renewable Energy Ratio to be attached to compliance report	**0.33**

The efficiency and heating system are populated by the Assessor in DEAP as per Table 3 and Table 4 above.

Fuel type in DEAP is electricity. Heating system entered in DEAP is "Direct acting electric boiler" with efficiency as per the following diagram. Selecting this option enables DEAP to show control options suitable for a heat pump. In addition, this option enables DEAP to process the efficiency result from the heat pump calculator correctly.



3.3.2 Low temperature heat pump for space heating only with a separate water heating heat pump

In this example all information is the same as the example in 3.3.1, but the "Type of water heating heat pump" is set to "Heat Pump" in the DEAPEntries tab and a separate water heating unit is specified. Again, the Heat Pump Calculator validates the basic entries made in specification of the heat pump. HP_1 tab water heating entries are as follows in this example:

2	**Heat Pump for Water Heating**	
3	Manufacturer of the installed heat pump(s)	Acme heat pump manuf
4	Model of the installed heat pump(s)	Acme heat pump HW model
5	Type of heat pump	Air to Water
6	Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Fixed Outlet
7	Describe the water heating heat pump arrangement	Separate Heat Pump providing Space Heating and Domestic Hot Water
8	Water Heating Test Standard	I.S. EN 16147
9	Output from Main Water Heater	2512.11
0	Type of DHW	Separate Hot Water Storage
1	Cold Water Inlet Temperature	10
2	Required Flow Temperature from Heat Pump to Hot Water Storage	65
3	Volume of DHW Storage	250
4	Is there a water heater installed as back up for the heat pump	No
		Electricity

Data is sourced for the water heating unit as would be done for a unit entered directly in the DEAP software. Example as follows:

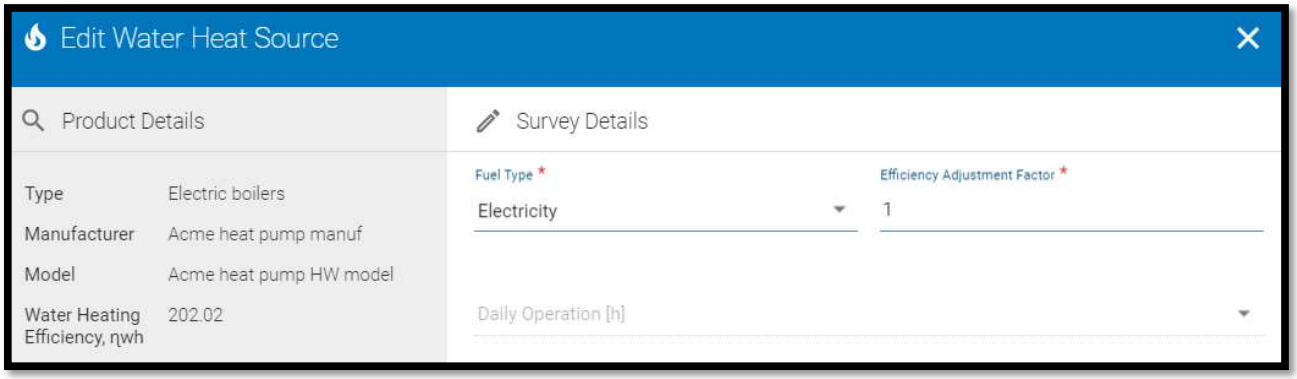
Ecodesign based water heating tests to EN16147 (or EN13203-6 for GAHP)		
Source of data	Water heating energy efficiency, ηwh	
Water heating energy efficiency, ηwh	90	%
Equivalent Coefficient of Performance	2.25	kW/kW
Reference Hot Water Temperature	54	°C
Required Source Temperature	7	°C
Capacity of Heat Pump	6	kW
Declared Load Profile	M	
Standby Heat Loss	1.2	kWh/day
Volume of DHW accounted for in test	150	litre

The results for space **and** water heating are now automatically updated in the DEAPEntries tab as follows and are populated in DEAP as per Table 3 and Table 4 above:

Description:	
Efficiency of space heating heat pump + backup	392.14%
Space heating fuel type	Electricity
Efficiency of water heating heat pump + backup	202.02%
Water heating fuel type	Electricity
Efficiency adjustment factor for space heating and water heating	1
Group heating % of heat from space heating	n/a for individual system
Group heating % of heat from water heating	n/a for individual system
Additional errors and warnings:	
Additional errors and warnings:	Heat pump # 1 Warning: this heat pump requires backup to meet space heating load assigned to it. Warning: this heat pump requires backup to meet water heating load assigned to it.

Cov | Code | Proj | DEAPEntries | HP_1 | HP_2 | HP_3

The space heating heat pump is entered in DEAP as an electric boiler as shown in Section 3.3.1. The water heating heat pump is as follows in DEAP:



3.4 DX heat pump

Direct Exchange electric heat pumps follow the same guidance and use the same test standard (IS EN 14825) as electric Brine-to-water units. The main difference is that the source temperatures for space and water heating are 4°C rather than 0°C. This difference is automatically reflected in the Heat Pump Calculator. Key data entries for the space heating aspect of the DX heat pump are as follows for this example for a new dwelling:

Heat Pump for Space Heating		Valid space heat pump type selected.		
Manufacturer of the installed heat pump(s)	ACME heat pump manuf		Is this a Low Temperature Heat Pump?	Not low temperature heat pump
Model of the installed heat pump(s)	DirectEx640		Is this heat pump electric or gas (GAHP)?	Electricity
Type of heat pump	Direct exchange (DX)		What is the status of this heat pump regarding Ecodesign data?	Ecodesign applies and/or ecodesign c
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Variable Outlet		Source from Ecodesign Data	Diagnostics data in grey cells below of selections (these will be #NA if in selected in this section):
Space Heating Test Standard	I.S. EN 14825			Heat pump type: Direct exchange (

In this DX example, an excerpt from the space heating COP and capacity ecodesign data entered in the calculator is as follows. Note the "E4" source temperature rather than the "Bo" value expected for a B/W unit.

High Temperature Application (55degC).	Source	E4	E4	
Standard: I.S. EN 14825	Sink	W52	W42	W3
Source from Ecodesign data or I.S. EN14825 Table 10 for air source. Table 14 for brine, water or DX source. [These table # references are from 2016 version of this standard]	Heating Capacity (kW)	3.10	3.10	3.1
	Coefficient of Performance (kW/kW)	2.30	2.30	2.3

When "Direct Exchange" is selected for water heating, the data entered is again similar to that selected for Brine-to-water units, but with source temperature of 4°C automatically assigned by the Heat Pump Calculator.

Ecodesign based water heating tests to EN16147 (or EN13203-6 for GAHP)		
Source of data	Water heating energy efficiency, ηwh	
Water heating energy efficiency, ηwh	125	%
Equivalent Coefficient of Performance	3.125	kW/kW
Reference Hot Water Temperature	53	°C
Required Source Temperature	4	°C

The results for space **and** water heating from the DEAPEntries tab are populated in DEAP as per Table 3 and Table 4 above in the same way as the examples under sections 3.3.1 and 3.3.2

- Main space heating is entered as a "direct acting electric boiler"
- Fuel type is electricity
- The main space heater does not heat water. This enables the user to enter a separate efficiency for the main water heating provided by the heat pump.

- Water heater is fueled by electricity from the DEAPEntries tab, and efficiency adjustment factor = 1.0.
- Any renewable adjustment is accounted for in the dwelling Renewable Energy Ratio. In this example, the heat pump calculator showed a total renewable contribution adjustment <> 0. As this is a new dwelling, the RER adjustment **must** be carried out where an adjustment value is shown in the heat pump calculator. After the heat pump space and water heating systems above are entered in DEAP, then the Renewable Energy Ratio automatically derived in DEAP in this example is as follows:

	Source	Renewables Primary Energy	Total Primary Energy	RER
+ Delivered energy	PV/Wind	0.000	0.000	
+ Delivered energy	Other	0.000	0.000	
+ Delivered energy	Solar	0.000	0.000	
+ Delivered energy	Biomass	0.000	0.000	
+ Delivered energy	Biodiesel	0.000	0.000	
+ Delivered energy	Bioethanol	0.000	0.000	
+ Environmental energy	HP	5,823.629	5,823.629	
+ Saved energy	CHP	0.000	0.000	
+ District heating	District Heating	0.000	0.000	
+ Delivered energy	Grid	0.000	6,560.712	
+ Delivered energy	Thermal	0.000	0.000	
SUBTOTAL		5,823.629	12,384.342	0.470 ✓

These are imported by the Assessor back into the DEAPEntries tab of the heat pump calculator to derive the adjusted RER, which is in turn attached to the Part L compliance report and notified to the client. The RER in DEAP was 0.47, but the adjusted value relevant for Part L compliance is 0.46.

RESULTS: Part L compliance Renewable Energy Ratio (RER) Adjustment. Applies to New final and New provisional assessments only. BER Assessor must advise the client of any adjustment to RER, and attach details of adjusted RER to Part L compliance report. This section is completed AFTER the above heat pump calculation results are entered in DEAP software.	
Total renewable contribution adjustment	-306.43
Total renewables primary energy from DEAP software	5823.63
Total Primary Energy from DEAP software	12384.34
Adjusted Renewable Energy Ratio to be attached to compliance report	**0.46**

3.5 GAHPs

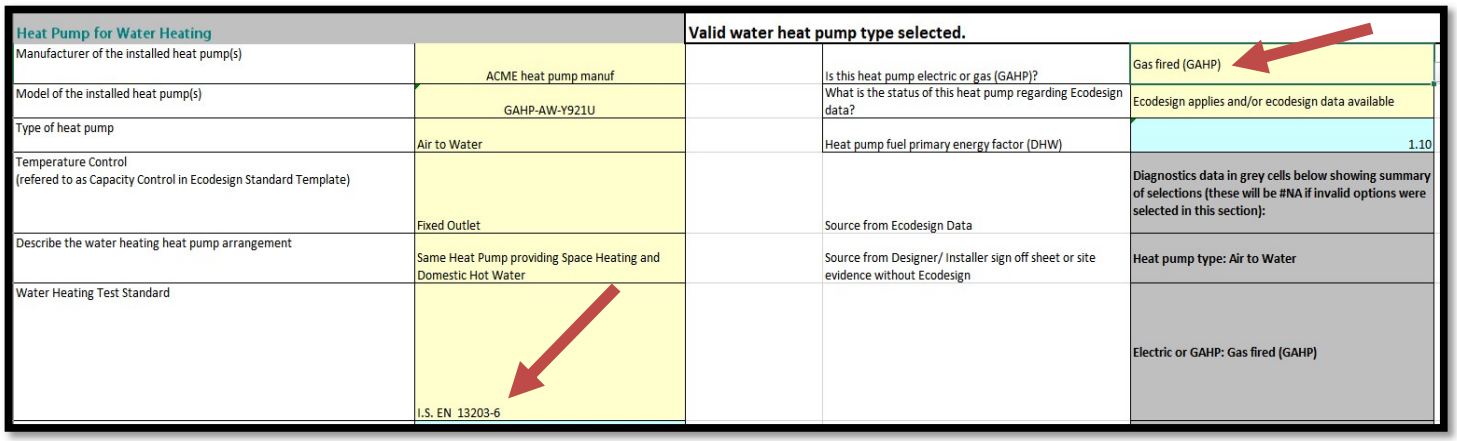
Sourcing and entering data for gas fired heat pumps (GAHPs) is similar to electrically driven Air-to-water, Brine-to-water and water-to-water heat pumps. The same mandatory ecodesign data requirements apply as electric heat pumps. The same ecodesign compliant test points and temperatures apply, but, as GAHP are not yet catered for in the DEAP software, the Heat Pump Calculator must be used. The standard for GAHPs for space heating is IS EN 12309-6 rather than IS EN 14825.

Heat Pump for Space Heating		Valid space heat pump type selected.		
Manufacturer of the installed heat pump(s)	ACME heat pump manuf		Is this a Low Temperature Heat Pump?	Not low temperature heat pump
Model of the installed heat pump(s)	GAHP-AW-Y921U		Is this heat pump electric or gas (GAHP)?	Gas fired (GAHP)
Type of heat pump	Air to Water		What is the status of this heat pump regarding Ecodesign data?	Ecodesign applies and/or ecodesign data available
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Fixed Outlet		Source from Ecodesign Data	**Diagnostics data in grey cells below showing summary of selections (these will be #NA if invalid options were selected in this section):**
Space Heating Test Standard	I.S. EN 12309-6			**Heat pump type: Air to Water**

Backup heating and test data are entered in the same manner as for an electric heat pump, noting that the Heat Pump Calculator details the relevant tables in IS EN 12309-6 as per the following excerpt. The efficiency figures for GAHP are typically lower than electric heat pumps. However, this is offset somewhat in the final BER grade as electricity has a higher primary energy factor than natural gas / LPG.

Select the test Conditions according to the test data available from I.S. EN 12309-6						
	High Temperature	Yes	Source from Ecodesign Data or accredited tests to I.S. EN 12309-6			**GUIDANCE NOTE: High Temperature Application Data is a mandatory requirement under Ecodesign Directive for this heat pump so must be selected as well as any other temperature applications for which test data is available**
	Low Temperature	Yes				
	Medium Temperature	Yes				
	Very high Temperature	No				
	Maximum test temperature allowed for in tests to I.S. EN 12309-6	55				
	Test Conditions I.S. EN 12309-6	**A (88%) -7°C**	**B (54%) 2°C**	**C (35%) 7°C**	**D (15%) 12°C**	**E* (100%) TOL**
Low Temperature Application (35degC)	Source	A-7	A2	A7	A12	A-10
Standard: I.S. EN 12309-6	Sink	W35	W35	W35	W35	W35
Source from Ecodesign data or I.S. EN12309-6 Table 5 for air source. Table 17 for Brine or Water source. [These table # references are from 2014 version of this standard]	Heating Capacity (kW)	3.50	3.70	4.70	5.10	3.30
	Coefficient of Performance (kW/kW)	1.60	1.70	1.80	1.90	1.50

When the GAHP provides hot water, the guidance and sourcing of test data is similar to an electric heat pump, although the test standard is IS EN 13203-6 rather than IS EN 16147:

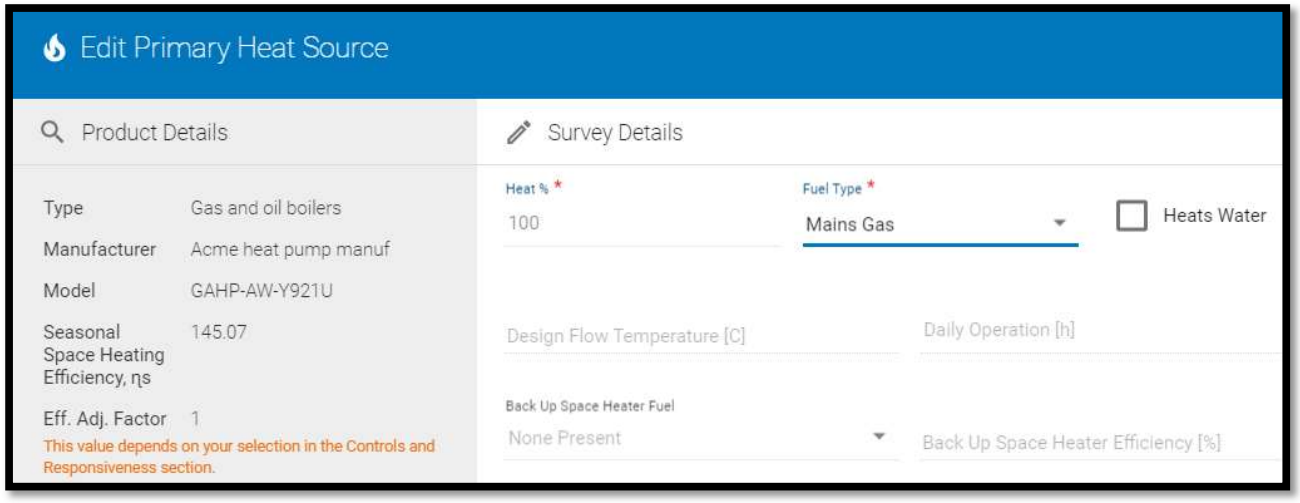


Heat Pump for Water Heating			Valid water heat pump type selected.	
Manufacturer of the installed heat pump(s)	ACME heat pump manuf		Is this heat pump electric or gas (GAHP)?	Gas fired (GAHP)
Model of the installed heat pump(s)	GAHP-AW-Y921U		What is the status of this heat pump regarding Ecodesign data?	Ecodesign applies and/or ecodesign data available
Type of heat pump	Air to Water		Heat pump fuel primary energy factor (DHW)	1.10
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Fixed Outlet		Source from Ecodesign Data	Diagnostics data in grey cells below showing summary of selections (these will be #NA if invalid options were selected in this section):
Describe the water heating heat pump arrangement	Same Heat Pump providing Space Heating and Domestic Hot Water		Source from Designer/ Installer sign off sheet or site evidence without Ecodesign	Heat pump type: Air to Water
Water Heating Test Standard	I.S. EN 13203-6			Electric or GAHP: Gas fired (GAHP)

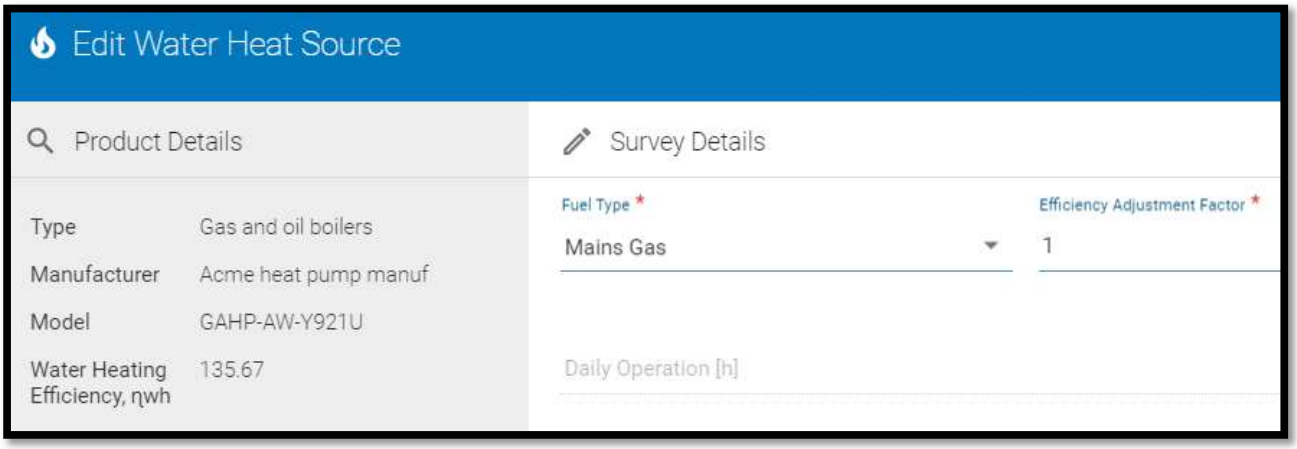
The DEAPEntries tab generates space and water heating efficiencies to be transferred into DEAP. See Table 3 and Table 4 for details:

- Main space heating is entered as a "regular non-condensing gas boiler"
- Fuel type is mains gas or LPG depending on the fuel used by the GAHP
- The main space heater does not heat water. This enables the user to enter a separate efficiency for the main water heating provided by the GAHP.
- Water heater is fueled by mains gas or LPG with efficiency from the DEAPEntries tab, and efficiency adjustment factor = 1.0.
- As the "Total renewable contribution adjustment" has a value of zero, no adjustment is required for renewables in this case

The space heating system in DEAP is as follows (and is a non-condensing regular gas boiler). The non-condensing boiler is selected as it enables DEAP to account for the efficiency from the heat pump calculator correctly and provides the user with the choice of suitable control options for a heat pump in DEAP.



Main water heating as is shown in the figure below for this GAHP.


Edit Water Heat Source
Product Details
Survey Details
Type
Gas and oil boilers
Manufacturer
Acme heat pump manuf
Model
GAHP-AW-Y921U
Water Heating Efficiency, ηwh
135.67
Fuel Type *
Mains Gas
Efficiency Adjustment Factor *
1
Daily Operation [h]

3.6 Exhaust Air-to-Air systems

Guidance for Double-duct heat pumps and heat recovery systems incorporating heat pump functionality Exhaust Air-to-Air heat pumps providing space heating are as per Section G4.3 of the DEAP Manual, however they differ from the Exhaust Air-to-Air heat pumps as the Exhaust Air to Air systems do not contain the Passive Heat Recovery element.

The DEAP Manual states:

- EN14511-2:2018 is used to test the performance of these units and this data can be used in DEAP. This includes data for the heat pump only from units tested to EN13141-7, as this standard requires the heat pump functionality to be tested to EN 14511-2.
- Source accredited EN14511-2 test data for the double duct air conditioner. As the required level of detail is not displayed in Ecodesign technical documentation or declarations of performance for these units, test data MUST be sourced on test certs from a suitably accredited body.

Follow the DEAP Manual G4.3 for guidance on sourcing and using space heating test data for Exhaust Air-to-air systems. Bear in mind that these systems are frequently installed with an accompanying hot water heat pump. This would be entered under the hot water section (similar to Section 3.3.2 above). The DEAPEntries tab is populated with the Exhaust Air space heating system and associated flowrate as per the following example:

Description:	Heat pump # 1
Type of space heating heat pump	Exhaust Air Heat Pump
Type of water heating heat pump	Heat Pump
% main space heat provided by each heat pump based on system design	100%
% main water heat provided by each heat pump based on system design	100%
Is heat pump source preconditioned?	No
Is the Heat Pump part of a Group Heating Scheme	No
If "Exhaust Air Heat Pump(s)" what is the total exhaust Air Flow Rate	44.00

The appropriate standard for Exhaust Air to Air is selected for space heating in the HP_1 tab following the guidance above:

Heat Pump for Space Heating		Valid space heat pump type selected.		
Manufacturer of the installed heat pump(s)	ACME heat pump manuf		Is this a Low Temperature Heat Pump?	Not low temperature heat pump
Model of the installed heat pump(s)	ACME heat pump model		Is this heat pump electric or gas (GAHP)?	Electricity
Type of heat pump	Exhaust Air to Air		What is the status of this heat pump regarding Ecodesign data?	Ecodesign doesn't apply and eco unavailable
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Fixed Outlet		Source from Ecodesign Data	Diagnostics data in grey cells below of selections (these will be #NA if in selected in this section):
Space Heating Test Standard	I.S. EN 13141		.	Heat pump type:Exhaust Air to Air

As this is a "to air" system, only "high temperature" application test points apply when entering space heating test data in the HP_1 tab:

Select the test Conditions according to the test data available from I.S. EN 13141	High Temperature	Yes	Source from Ecodesign Data or accredited tests to I.S. EN 13141	**GUIDANCE NOTE:** **This is a 'to-air' heat pump. Select N but High Temperature**
	Low Temperature	No		
	Medium Temperature	No		
	Very high Temperature	No		

As it is an electric heat pump, then it is entered in DEAP as an electric boiler (in the same way as shown in the examples above). The exhaust air component will always result in an adjustment to the renewable energy contribution. Once the heat pump space and water heating systems are entered in DEAP, the renewable energy total and total primary energy are sourced from DEAP for use in the DEAPEntries tab, where the adjusted RER is calculated. This is then notified to the client as it is a new dwelling in this example, and attached to the Part L compliance report:

Total renewable contribution adjustment	-310.87
Total renewables primary energy from DEAP software	1567.00
Total Primary Energy from DEAP software	3496.00
Adjusted Renewable Energy Ratio to be attached to compliance report	**0.39**

3.7 Multiple Heat Pumps in Dwelling

The DEAP software cannot cater for multiple heat pumps within a dwelling.

Follow the guidance for entering the individual heat pumps is as per the DEAP Manual Appendix G.

This example shows the use of a Low Temperature Heat Pump providing the majority of the space heating and pre heats the Hot Water, also present is a Double Duct Heat Recovery Unit with Heat Pump functionality providing hot water and conditioning the air supplied through the ventilation system.

- Heat Pump 1 = Low Temperature Heat Pump for space heating and preheats hot water
- Heat Pump 2 = double duct heat recovery unit with HP functionality providing hot water.

Description:	Heat pump # 1	Heat pump # 2
Type of space heating heat pump	Heat Pump	Heat Pump
Type of water heating heat pump	Heat Pump	Heat Pump
% main space heat provided by each heat pump based on system design	80%	20%
% main water heat provided by each heat pump based on system design	30%	70%
Is heat pump source preconditioned?	No	No
Is the Heat Pump part of a Group Heating Scheme	No	No
If "Exhaust Air Heat Pump(s)" what is the total exhaust Air Flow Rate		

The user must then complete **each of tabs** HP_1, and HP_2, corresponding with the columns Heat pump#1, and Heat pump#2 respectively in the diagram above. On completion of data entry for HP_1 and HP_2, the heat pump calculator DEAPEntries tab shows a single space heating efficiency. Likewise the water heating efficiency is derived by the heat pump calculator:

Heat pump#1: The Low Temperature Heat Pump Space Heating is entered as per 3.3.1 of this document.

Manufacturer of the installed heat pump(s)	Heat Pump Manu 1		Is this a Low Temperature Heat Pump?	Low temperature heat pump
Model of the installed heat pump(s)	HP 123		Is this heat pump electric or gas (GAHP)?	Electricity
Type of heat pump	Air to Water		What is the status of this heat pump regarding Ecodesign data?	Ecodesign applies and/or ecodesign data available
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Variable Outlet		Source from Ecodesign Data	Diagnostics data in grey cells below showing summary of selections (these will be #NA if invalid options were selected in this section):
Space Heating Test Standard	I.S. EN 14825		.	Heat pump type:Air to Water
Operation Limit Temperature (TOL)	-10.00	°C	Source from Ecodesign Data	Electric or GAHP:Electricity
Heating water operating limit temperature (WTOL)	35.00	°C	Source from Ecodesign Data	Low temp:Low temperature heat pump

Select the test Conditions according to the test data available from I.S. EN 14825	High Temperature	No	Source from Ecodesign Data or accredited tests to I.S. EN 14825			GUIDANCE NOTE: Low Temperature Application Data is a mandatory requirement under Ecodesign Directive for this heat pump so must be selected. If it is available, application data may also be selected at Medium Temperature
	Low Temperature	Yes				
	Medium Temperature	No				
	Very high Temperature	No				
	Maximum test temperature allowed for in tests to I.S. EN 14825	35				
	Test Conditions I.S. EN 14825	A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E[a] (100%) TOL
Low Temperature Application (35degC)	Source	A-7	A2	A7	A12	A-10
Standard: I.S. EN 14825	Sink	W34	W30	W27	W24	W35
Source from Ecodesign data or I.S. EN14825 Table 8 for air source. Table 12 for brine, water or DX source. [These table # references are from 2016 version of this standard]	Heating Capacity (kW)	4.50	2.50	1.50	2.00	4.00
	Coefficient of Performance (kW/kW)	3.00	4.00	5.00	6.00	2.00

- The Low Temperature Heat Pump is also partially heating the hot water, however as a Low Temperature Heat Pump it would not be on the market as a water heater and therefore would not be tested to EN 16147. Therefore, EN 14825/14511 test data may be used.

Manufacturer of the installed heat pump(s)	Heat Pump Manu 1		Is this heat pump electric or gas (GAHP)?	Electricity
Model of the installed heat pump(s)	HP 123		What is the status of this heat pump regarding Ecodesign data?	Ecodesign applies and/or ecodesign data available
Type of heat pump	Air to Water		Heat pump fuel primary energy factor (DHW)	2.08
Temperature Control (refered to as Capacity Control in Ecodesign Standard Template)	Variable Outlet		Source from Ecodesign Data	**Diagnostics data in grey cells below showing summary of selections (these will be #NA if invalid options were selected in this section):**
Describe the water heating heat pump arrangement	Same Heat Pump providing Space Heating and Domestic Hot Water		Source from Designer/ Installer sign off sheet or site evidence without Ecodesign	**Heat pump type:Air to Water**
Water Heating Test Standard	I.S. EN 14825/14511			**Electric or GAHP:Electricity**

- The COP and Capacity are based on 7°C outside temperature (or Point C in EN14825 test data) to match the source temperature used for DHW heat pump testing under EN16147.
- The reference hot water temperature is at the test condition, in this case 27°C (based on Point C of EN14825 for a variable control heat pump)
- For test data based on EN 14825/14511, the load profile, standby heat loss and volume of DHW accounted for in test are not applicable

Ecodesign based water heating tests to EN16147 (or EN13203-6 for GAHP)*				
Source of data	Coefficient of Performance, COP		Source from Ecodesign Data or accredited tests to EN 16147 (or EN13203-6 for GAHP)	
Coefficient of Performance, COP	5	kW/kW	Source from Ecodesign Data or accredited tests to EN 16147 (or EN13203-6 for GAHP)	
Equivalent Coefficient of Performance	5	kW/kW		
Reference Hot Water Temperature	27	°C	Source from Ecodesign Data or accredited tests to EN 16147, set at 40°C if unknown. (or EN13203-6 for GAHP)	
Required Source Temperature	7	°C	Based on Table 5 of EN 16147 (or EN13203-6 for GAHP)	
Capacity of Heat Pump	1.5	kW	Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147 (or EN13203-6 for GAHP)	
Declared Load Profile	M		Source from Ecodesign Data, manufacturers data or accredited tests to EN 16147 (or EN13203-6 for GAHP)	Note: 'load profile', 'standby heat loss' and 'volume of DHW accounted for in test' are irrelevant for test data based on I.S. EN 14825/14511.
Standby Heat Loss		kWh/day	Source from Ecodesign Data or accredited tests to EN 16147 (or EN13203-6 for GAHP), set as 0 if unknown	
Volume of DHW accounted for in test		litre	Source from Ecodesign Data or accredited tests to EN 16147 (or EN13203-6 for GAHP)	

- Note; the reference hot water temperature limits the % share of DHW that can be provided by the heat pump. Heat Pump #2 will need to bring the hot water up to the adequate temperature.

Max share of hot water by this HP system	Operational temp min this HP
31%	27.00

Heat pump#2 the Double Duct Heat Recovery Unit space heating is as per DEAP Manual G4.3 and hot water is as per DEAP Manual G1.1 and is entered in the HP_2 tab.

On completion of data entry for the two heat pumps, the heat pump calculator DEAPEntries tab shows a single space heating efficiency and is entered as a space heating in DEAP software. Likewise the water heating efficiency and entered as a water heater in DEAP software as derived by the heat pump calculator:

Efficiency of space heating heat pump + backup	435.61%
Space heating fuel type	Electricity
Efficiency of water heating heat pump + backup	303.14%
Water heating fuel type	Electricity
Efficiency adjustment factor for space heating and water heating	1
Group heating % of heat from space heating	n/a for individual system
Group heating % of heat from water heating	n/a for individual system

As it is an electric heat pump, then it is entered in DEAP as an electric boiler (in the same way as shown in the examples above).

Consideration should be given by the designers to the warnings highlighting where the heat pump will require back up heating. The designer should try to optimize the design for better efficiency (by limiting/ eliminating need for backup systems)

Additional errors and warnings:	Heat pump # 1 Warning: this heat pump requires backup to meet space heating load assigned to it.	Heat pump # 2 Warning: this heat pump requires backup to meet water heating load assigned to it.

3.8 Group heating system examples

The DEAP software cannot yet cater for group heating heat pump calculations. Therefore the Heat Pump Calculator must be used to generate the required efficiency data for DEAP.

3.8.1 Group heating heat pump with group heating CHP / solar space heating / boilers

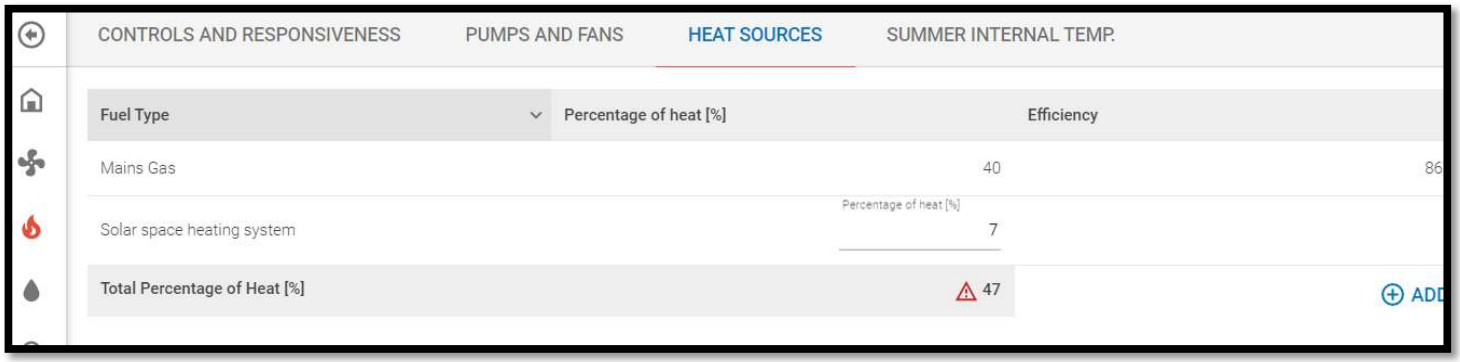
When entering a group heating heat pump, the yellow cells in the DEAPEntries tab are completed as per Table 2, such as in the following example for a block of apartments. This shows a system with a CHP system, secondary heating and a heat pump. There is also a boiler solar space heating system contributing 47% of the boiler/heat pump / solar space heating heat. Therefore, the heat pump will do the remaining 53%, bringing to the required total of 100%. DEAP Appendix C states that:

"*The proportions of heat from the CHP and from conventional boilers, and the heat and electrical efficiencies of the CHP for the calculation of CO_2 emissions, should be estimated,* ***either on the basis of operational records or in the case of a new scheme on the basis of its design specification.***"

And, DEAP Section 10 states that

"*DEAP allows for solar heating to contribute to the main space and main water heating of the dwelling. If this type of system is present, the proportion of group heating provided by the solar space and water heating system should be specified.* ***This proportion is calculated using the method detailed on*** [***https://www.seai.ie/energy-in-business/ber-assessor-support/deap/***](https://www.seai.ie/energy-in-business/ber-assessor-support/deap/) . "

The DEAP software section for the heat sources is as follows in this example, prior to completing the Heat Pump Calculator:



Data entered is entered in the DEAPEntries tab in this example as follows:

Description:	Value:		
Total heat loss (W/K) taken from DEAP	306.06		
Annual space heat requirement (total)	7106.06		
Floor Area of Dwelling	100.00		
Living area of dwelling	10.00		
Percentage of space heat from secondary system	10%		
Fraction of heat from CHP	0.12		
Output from main water heater	2512.11		
For Group Heating: Is charging based on heat consumed?	No		
Electricity Primary Energy Factor	2.08		
Volume of DHW Storage	250		
Description:	**Heat pump # 1**	**Heat pump # 2**	**Heat pump # 3**
Type of space heating heat pump	Heat Pump	None	None
Type of water heating heat pump	Heat Pump	None	None
% main space heat provided by each heat pump based on system design	53%	0%	0%
% main water heat provided by each heat pump based on system design	53%	0%	0%
Is heat pump source preconditioned?	No	No	No
Is the Heat Pump part of a Group Heating Scheme	Yes	No	No

The Heat Pump Calculator HP_1 tab estimates the relevant total heat loss in watts for the apartments served by the heat pump for the total floor area served by the group heating system, as entered by the user:

Description:	Value:	Unit:	Gu
Total heat loss (W/K) taken from DEAP	306.06	W/K	Sc fal
Heat Loss Watts	33445	Watts	Re
Is this Heat Pump part of a Group Heating Scheme	Yes		
Proportion of main space heating provided by this heat pump	53%	%	
Floor Area of Dwelling	100.00	m2	Sc
If Heat Pump serves a Group Heat Scheme, the total Floor Area served by Heat Pump is:	1100.00	m2	Sc
Heat Pump for Space Heating		**Valid space heat pum**	
Manufacturer of the installed heat pump(s)	ACME heat pump manuf		Is
Model of the installed heat pump(s)	ACME heat pump modl grp		Is
Type of heat pump	Air to Water		W Ec

The heat pump capacity is generally larger than that of a heat pump providing space and water heating to an individual dwelling:

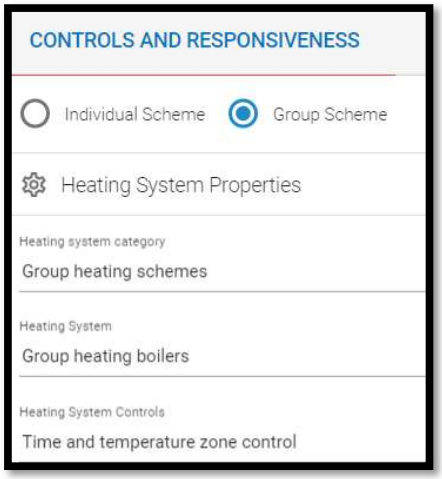
Select the test Conditions according to the test data available from I.S. EN 14825			Source from Ecodesign Data or accredited tests to I.S. EN 14825				GUIDANCE NOTE: High Temperature Application Data is a mandatory requirement under Ecodesign Directive for this heat pump so must be selected as well as any other temperature applications for which test data is available
	High Temperature	Yes					
	Low Temperature	Yes					
	Medium Temperature	Yes					
	Very high Temperature	No					
	Maximum test temperature allowed for in tests to I.S. EN 14825	55					
	Test Conditions I.S. EN 14825		A (88%) -7°C	B (54%) 2°C	C (35%) 7°C	D (15%) 12°C	E* (100%) TOL
Low Temperature Application (35degC)	Source		A-7	A2	A7	A12	A-10
Standard: I.S. EN 14825	Sink		W35	W35	W35	W35	W35
Source from Ecodesign data or I.S. EN14825 Table 8 for air source. Table 12 for brine, water or DX source. [These table # references are from 2016 version of this standard]	Heating Capacity (kW)		27.00	28.00	29.00	30.00	26.00
	Coefficient of Performance (kW/kW)		3.80	3.90	4.00	4.10	3.70
Medium Temperature Application (45degC)	Source		A-7	A2	A7	A12	A-10
Standard: I.S. EN 14825	Sink		W45	W45	W45	W45	W45
Source from Ecodesign data or I.S. EN14825 Table 9 for air source. Table 13 for brine, water or DX source. [These table # references are from 2016 version of this standard]	Heating Capacity (kW)		26.80	27.80	28.80	29.80	25.80
	Coefficient of Performance (kW/kW)		3.50	3.60	3.70	3.80	3.40
High Temperature Application (55degC).	Source		A-7	A-7	A-7	A-7	A-7

Ecodesign based water heating tests to EN16147 (or EN13203-6 for GAHP)		
Source of data	Water heating energy efficiency, ηwh	
Water heating energy efficiency, ηwh	125	%
Equivalent Coefficient of Performance	3.125	kW/kW
Reference Hot Water Temperature	55	°C
Required Source Temperature	7	°C
Capacity of Heat Pump	32	kW
Declared Load Profile	3XL	
Standby Heat Loss	19	kWh/day
Volume of DHW accounted for in test	1500	litre

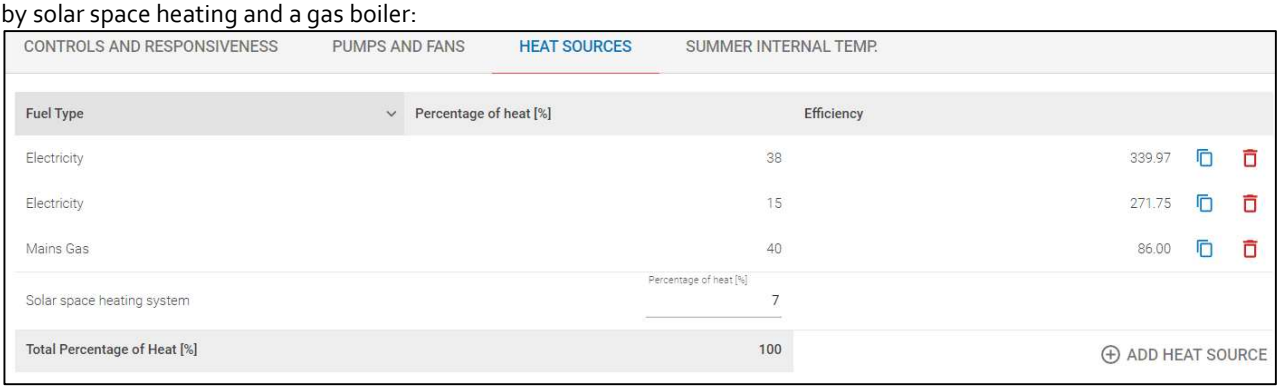
The DEAPEntries tab displays the data to complete the assessment:

Efficiency of space heating heat pump + backup	339.97%
Space heating fuel type	Electricity
Efficiency of water heating heat pump + backup	271.75%
Water heating fuel type	Electricity
Efficiency adjustment factor for space heating and water heating	1
Group heating % of heat from space heating	38.1%
Group heating % of heat from water heating	14.9%

When entering the group heating heat pump in DEAP, always enter the space heating efficiency and proportion as the first heat pump heating system, and the water heating heat pump efficiency and proportion as the second heat pump heating system in the DEAP group heating heat source section. First select "group scheme" and the level of heating controls:



Then enter the heat pump space heating efficiency and fuel type followed by the water heating efficiency and fuel type. Round their associated percentage of heat figures to the nearest integer for entry in DEAP. The remaining heat is met by solar space heating and a gas boiler:



Finally, once the heating system is completed in DEAP, derive the adjusted RER using the DEAPEntries tab:

Total renewable contribution adjustment	822.77
Total renewables primary energy from DEAP software	1206.00
Total Primary Energy from DEAP software	3994.00
Adjusted Renewable Energy Ratio to be attached to compliance report	**0.42**

3.8.2 Multiple heat pumps in the group heating system

All examples thus far in this document have been for no more than a single space heating heat pump and single water heating heat pump (and most of the examples have been cases where the space and water heating are provided by the same unit). This meant that the HP_1 tab is the only heat pump iteration used.

The heat pump calculator facilitates multiple heat pumps, and these may be in one of:

- a group heating configuration (i.e. all heat pumps heating multiple dwellings)
- an individual heating system configuration (i.e. all heat pumps only heating the single dwelling)
- a combination of group heating and individual heating configuration (e.g. heat pump(s) heating multiple dwellings in a group heating system in series with a heat pump within the dwelling).

The percentage of heat from each of the (up to three) heat pumps is based on data in the DEAPEntries tab:

Description:	Value:			Unit:
Total heat loss (W/K) taken from DEAP	306.06			W/K
Annual space heat requirement (total)	7106.06			kWh
Floor Area of Dwelling	100.00			m^2
Living area of dwelling	10.00			m^2
Percentage of space heat from secondary system	10%			%
Fraction of heat from CHP	0.12			0<=fraction <1
Output from main water heater	2512.11			kWh
For Group Heating: Is charging based on heat consumed?	No			
Electricity Primary Energy Factor	2.08			
Volume of DHW Storage	200			litres
Description:	**Heat pump # 1**	**Heat pump # 2**	**Heat pump # 3**	
Type of space heating heat pump	Heat Pump	Heat Pump	Heat Pump	
Type of water heating heat pump	Heat Pump	Heat Pump	Heat Pump	
% main space heat provided by each heat pump based on system design	27%	14%	19%	Total percentage=60%
% main water heat provided by each heat pump based on system design	15%	17%	21%	Total percentage=53%
Is heat pump source preconditioned?	No	No	Yes	
Is the Heat Pump part of a Group Heating Scheme	No	No	Yes	Group heating applies

Where there are three heat pumps providing space and water heating, a proportion of heat for each of space and water heating is required for each heat pump present as per the above example.

The user must then complete **each of** HP_1, HP_2, and HP_3, corresponding with the columns Heat pump#1, Heat pump#2 and Heat pump#3 respectively in the diagram above. On completion of data entry for all three heat pumps, the heat pump calculator DEAPEntries tab shows a single space heating efficiency and proportion of space heat (entered under heating system 1 in DEAP software -> group heating heat sources). Likewise the water heating efficiency and proportion (entered under DEAP software heating system 2) are derived by the heat pump calculator:

Efficiency of space heating heat pump + backup	466.55%
Space heating fuel type	Electricity
Efficiency of water heating heat pump + backup	197.75%
Water heating fuel type	Electricity
Efficiency adjustment factor for space heating and water heating	1
Group heating % of heat from space heating	43.1%
Group heating % of heat from water heating	14.9%

NB where there is one or more group heating heat pump in the system, then the heat pump calculator requires that the heating system is specified as a group heating system in DEAP. Where none of the heat pumps are in a group heating system (e.g. up to three individual heat pumps in a single system within the dwelling), use the HP_1, HP_2, HP_3 tabs and enter the results as individual space and water heating systems in DEAP using the "electric boiler" type system or "non condensing gas boiler" as per earlier examples in this document. .

==========END==========