Technical Report on the Elaboration of a Cost Estimation Methodology

Work Package 3 - Estimating RHC energy costs

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Author(s): María Jesús Baez, Tomás Larriba, Ignacio Prieto
Author'(s') affiliation: Creara

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1. ASSESSMENT OF METHODOLOGIES

1.1 INTRODUCTION TO LCOHC CONCEPT

To make energy projects comparable in terms of costs[1] a common used metric is the Levelised Cost of Energy (in this case, Heat or Cold) hereinafter referred to as LCoHC. The LcoHC is defined as the constant and theoretical cost of generating one kWh of heat/cold, which is equal to the discounted expenses incurred throughout the lifetime of the investment.

To calculate the LCoHC three main parameters must be determined:

- **Heat/cold generation** throughout the life of the system.
- **Total expenditures** throughout the life of the system, including capital expenditures, operating expenditures, decommissioning costs, and financial costs if applicable.
- The appropriate **discount rate**.

The following is an illustration of the LCoHC derivation:

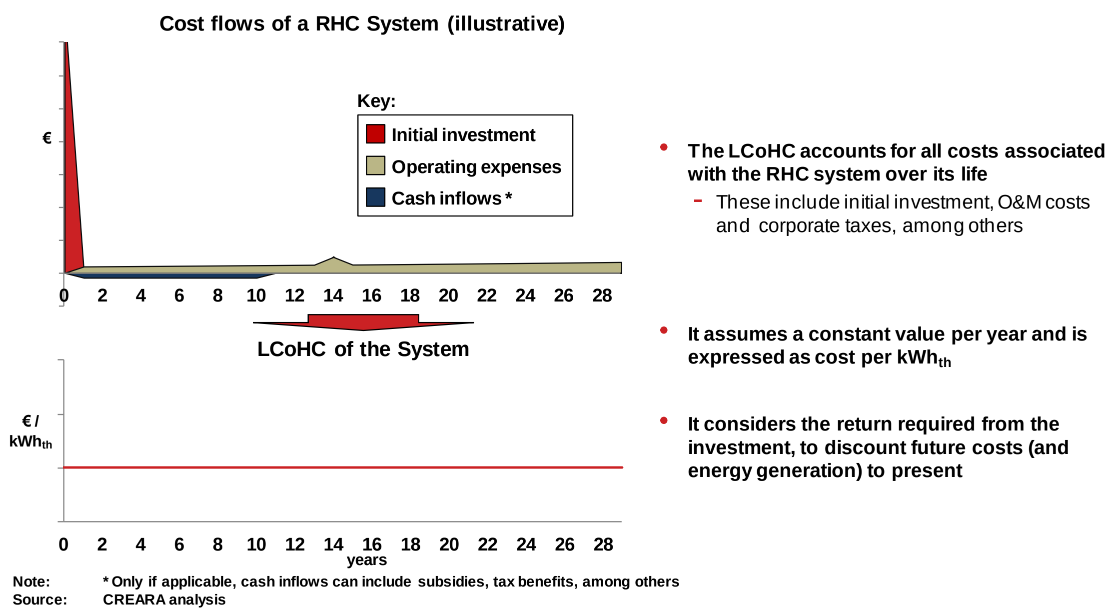

Figure 1: Ilustration of LCoHC

[1] This is particularly relevant when deciding between an investment with high upfront costs and relatively low operating costs (e.g. solar thermal water system) and one with a different cash flow pattern (e.g. natural gas water heater).

To assess the competitiveness of a given RHC technology, it is necessary to derive the costs of a particular system (accounting for its particular characteristics: technology, quality, size, location, etc.) and compare them with the specific cost of the alternative technology. In this sense, it should be stressed that the LCoHC, by definition, remains constant throughout the life of the system. Therefore, it should be compared to the levelised cost of the alternative technology (i.e. accounting for the estimated future price increases).

From the documents reviewed (see Section 6.3), it is clear that there is no single approach to estimating the cost of heat/cold from renewable energy sources (Renewable Heating and Cooling, RHC).

In many cases, the alternative methodologies used differ in terms of 2 main characteristics that define the parameters to use when estimating costs: the **point of view** of the analysis and the **level of detail** (or complexity) used.

The analysis could be performed from two main points of view:

- Project as a whole
- Investor (i.e. the consumer)

The methodology followed estimates costs from the perspective of the project as a whole. As such, it excludes financing considerations within the cash flows used.

With the aim of comparing the different alternatives, each of these elements is discussed on the following Sections.

1.2 DISCOUNT RATE

The applicable discount rate is considered equal to the minimum return required from investing in a RHC system. As such, it is unique to the characteristics and expectations of the particular investor.

In this context, we can distinguish three types of investors (or points of view):

- **Public investor**, who seeks for the benefit for society as a whole (not for its own private profitability) and in general has access to debt at attractive conditions.
- **Private investor,** who pays taxes, may receive subsidies/incentives from the government, and will invest only if the investment is profitable. There are two main groups of private investors:
  - Corporations, who pay income taxes.
  - Domestic consumers, who pay VAT.

Finally, depending on the values being used, 2 different discount rates can be used:

- **Real discount rate**, which excludes inflation.
- **Nominal discount rate**[2], which includes inflation.

Moreover, from the perspective of the project, the appropriate discount rate should consider the return required from the consumer (investor) and debt holders (if applicable). To account for this, the so-called WACC[3] (Weighted Average Cost of Capital) is commonly used to discount project cash flows (“free cash flows”). Its mathematical expression is as follows:

[2] According to the Fisher equation the relation between nominal and real discount rates is the following: 1+rnominal = (1+ rreal) $\times$ (1+i) where i is the inflation rate.

[3] WACC is a methodology that accounts for both the cost of equity and debt, estimating a weighted average between them to determine the project discount rate.

Where:

NOMENCLATURE	UNIT	MEANING
WACC	-	Weighted Average Cost of Capital
D	-	Debt fraction (i.e. financed amount / total investment)
Ke	-	Cost of equity (i.e. required return for the investor)
Kd	-	Cost of debt (i.e. required return for debt holders[4])
TR	%	Corporate tax rate (null for residential customers)

Considerations

The discount rate is a parameter that is heavily dependent on the nature of the investor and the point of view of the analysis. The methodology analyzes costs from the perspective of the project (free cash flows), which are discounted using WACC.

The tool provides guidance for three scenarios, although it allows the user to insert a more accurate value for his specific case if he can provide it.

1.3 INVESTMENT COSTS

Investment costs must include all costs, or at least the most relevant ones, related to the capital expenditure, such as:

- Equipment purchase.
- System installation and civil works.
- Costs for permitting and engineering.
- Fuel and heat storage (e.g. biomass).

Investment costs will vary depending on several parameters, chiefly: technology, system size, and location.

Considerations

Ideally, all differential capital costs incurred should be accounted for (including VAT if the investor is a natural person).

The tool gives guidance to the user on the considerations to plug in the appropriate value.

1.4 DEPRECIATION OF FIXED ASSETS

For investors that are corporations, depreciation for tax purposes is a means of recovering some part of the cost of the investment through reduced taxes. The method used (e.g. straight line or declining balance) and the depreciation period depend on the local regulation. These parameters affect LCoHC: all else being equal, a shorter depreciation period and a greater depreciation amount in the earlier years reduce the LCoHC.

[4] Our methodology assumes that the required return for debt holders is equal to the cost of debt

Considerations

To simplify, the tool calculates the tax shield on the basis of straight line depreciation. The user only has to plug-in the depreciation period in years.

1.5 REPLACEMENT COSTS

Replacement costs refer to the needed reinvestments of any equipment within the RHC system's technical lifetime.

1.6 OPERATING COSTS

Operating costs include both fixed and variable expenses related to the operation of the RHC system, such as:

- O&M costs.
- Feedstock costs.
- Auxiliary energy costs.

As it was the case of investment costs, operating costs will vary depending on several parameters, chiefly: technology, system size, and location. Moreover, to conduct a fair assessment it is necessary to estimate the annual evolution of operating costs.

Considerations

All operating costs, current and future, should be included in the LCoHC estimation. As such, the most relevant inputs are two: (i) current costs (e.g. fuel cost) and (ii) estimated cost evolution.

Given than there is great uncertainty regarding the evolution of costs, the tool provides some default values that can be overwritten by the user.

As for current O&M and feedstock prices, the tool includes guidance and typical values for all different locations included in the model.

1.7 TAXES (INCOME AND VAT)

For a private corporation, income taxes are relevant costs, which have an impact on the investment decision. Therefore, after-tax costs and depreciation tax shield must be included in the analysis from the perspective of private corporations.

In this line, for a domestic consumer, VAT is a relevant cost flow, which should be included in the analysis.

1.8 ECONOMIC AND TECHNICAL LIFE

The economic lifetime represents the lifetime of the investment, and therefore the period over which its profitability is assessed.

The lifetime of the investment depends on the characteristics of the system (technology and application). As such, it is necessary to set the appropriate lifetime accounting for the particular attributes of the system analyzed.

Considerations

The lifetime of the system should be agreed upon accounting for the specific characteristics of the investment.

The tool highlights the differences between the technical life of the system and the economic life (investment horizon). Since the model is not including re-investments beyond the technical life of the asset, the tool also includes logic to never allow the economic life to be higher than the technical life.

The user can choose between plugging in the value in years (e.g. 30 years) and selecting default values for technical lifetime of the systems. By default, economic lifetime is equal to the technical lifetime inserted.

1.9 INCENTIVES

Incentives such as subsidies and tax credits reduce LCoHC and improve the profitability of the project. Depending on the perspective of the analysis, incentives could be included within the LCoHC calculation:

- For private investors assessing the economics of the investment in RHC, it is relevant to include all elements affecting the cash flows of the project, including all incentives. Tax credits will only be considered for users paying corporate taxes.

Considerations

The methodology to calculate the LCoHC provides the option to include incentives when relevant. The tool accounts for this through a user type input in the user interface, which automatically selects the taxes and incentives to be considered.

1.10 RESIDUAL VALUE

The residual value of a RHC system is the value of the asset at the end of its useful life, which affects LCoHC in different ways depending on the situation:

- If the equipment is sold or recycled, an investor receives an inflow that increases taxable income (this cash flow reduces LCoHC[5]).
- If the technical life of the system exceeds the economic life of the investment, the value of the generation beyond the life of the investment can be considered as an inflow equal to the expected savings.

The electronic tool estimates residual value as the present value of the potential cash flows after the end of the investment lifetime and up to the theoretical end of its technical life[6].

Considerations

For a fair cost comparison between heat/cold generation sources, it is important to be consistent in the assumptions used across technologies. It can be the case that the impact of cash flows further in the future is negligible (e.g. decommissioning costs), mainly due to time value of money.

An exception is the case where the system generates energy beyond the life of the system, as the resulting energy savings can have a significant impact on the economics of the project. Therefore, the tool gives the option to the user of including the savings from the excess heat generated, a parameter which will decrease LCoHC.

1.11 ENERGY GENERATION

Energy generation has been treated differently depending on the dispatchability of the RHC technology.

For dispatchable technologies, energy generation has been assumed to be equal to the energy demand (DHW and space heating and cooling, when applicable). The following equations show how the different demands have been estimated.

Equation 2: Annual DHW demand

$$E_{DHW} = V_{DHW} \cdot C_P \cdot \Delta T \cdot 365$$

Where:

NOMENCLATURE	UNIT	MEANING
E_{DHW}	*kWh*	Annual domestic hot water energy demand (delivered heat)
V_{DHW}	*litres/day*	Daily hot water demand
C_P	*kWh/(litre·ºC)*	Specific heat capacity of water
ΔT	*ºC*	Temperature difference between cold and hot water in the system location

Equation 3: Annual space heating demand

$$E_h = S \cdot Q_h$$

[5] If there is uncertainty around this cash inflow, it can be omitted to maintain a conservative view

[6] The logic behind this estimation equates the residual value to the maximum price a consumer would be willing to pay for the RHC system at the end of the economic horizon.

Where:

NOMENCLATURE	UNIT	MEANING
E_h	*kWh*	Annual heating energy demand (delivered heat)
S	*m²*	Building living area
Q_h	*kWh/m²*	Annual heating requirements of the building, which depends on location and insulation level

Equation 4: Annual space cooling demand

$$E_c = S \cdot Q_c$$

Where:

NOMENCLATURE	UNIT	MEANING
E_c	*kWh*	Annual cooling energy demand (delivered heat)
S	*m²*	Building living area
Q_c	*kWh/m²*	Annual cooling requirements of the building, which depends on location and insulation level

There is an additional restriction applying in the model when considering the relationship between demand and generation and it is the maximal energy output of the system. The following equation represents the energy output of any heat generator:

Equation 5: Annual energy output (dispatchable)

$$E_{out} = P \times 8760 \times CF$$

Where:

NOMENCLATURE	UNIT	MEANING
E_{out}	*kWh*	Annual energy output
P	*kW*	System nominal power output
CF	*%*	Capacity factor[7]

Considering this equation, the maximal energy output will be such that CF = 100%. Thus, if the estimated demand is higher than this, the tool will take it as the annual energy generation.

Equation 6: Annual energy generation (dispatchable)

$$\begin{cases} If\ E_{dem} \leq \max E_{out} \rightarrow E_{gen} = E_{dem} \\ If\ E_{dem} > \max E_{out} \rightarrow E_{gen} = \max E_{out} \end{cases}$$

[7] Ratio between the full load-equivalent working hours and a year's number of hours. It takes into account both partial load working hours and intermittent (on/off) working.

Where:

NOMENCLATURE	UNIT	MEANING
E_{dem}	*kWh*	Annual energy demand
max E_{out}	*kWh*	Maximal annual energy output
E_{gen}	*kWh*	Annual energy generation

On the other hand, for non-dispatchable technologies (such as solar thermal collectors) the annual energy output has been calculated as shown in the following equation.

Equation 7: Annual energy output (non-dispatchable)

$$E_{out} = C_{gen} \cdot GP$$

Where:

NOMENCLATURE	UNIT	MEANING
E_{out}	*kWh*	Annual energy output
C_{gen}	*kWh/unit* (e.g. *kWh/m²* for solar thermal)	Annual energy generation capacity
GP	*Unit* (e.g. *m²* for solar thermal)	Parameter considered in generation capacity (e.g. total collector surface for solar thermal)

The annual energy generation will be equal to the energy output if, and only if, it does not exceed energy demand (e.g. domestic hot water demand for solar thermal):

Equation 8: Annual energy generation (non-dispatchable)

$$\begin{cases} If\ E_{out} \leq E_{dem} \rightarrow E_{gen} = E_{out} \\ If\ E_{out} > E_{dem} \rightarrow E_{gen} = E_{dem} \end{cases}$$

Considerations

The tool includes specific reference values for all user input parameters (DHW consumption and insulation level) and it contains location-based data for all parameters that require it.

2. OTHER REMARKS

2.1 CHP PLANTS

CHP plants produce both heat and power. As such, there are two methodologies that can be used to estimate the cost of heat:

Calculate the revenue from the electricity produced (by-product) and subtract this value from the costs within the LCoHC calculation.

Consider only the portion of expenses attributable to heat production (i.e. according to the average heat/electricity output ratio). [W. Moonmaw et al, 2011]

Among the implemented technologies in the electronic tool, there is no specific CHP option. However, considering the first aforementioned approach, CHP systems can be approximately assessed through a simulation via fictitious production-based incentives.

Revenues from production-based incentives are estimated through a simple equation:

Equation 9: CHP assessment (1)

$$Revenue\ (€) = \ Incentive\ (€/kWh_{th}) \cdot E_{gen}(kWh_{th})$$

Considering electrical energy as a by-product, it can be estimated as a fraction of thermal energy generation. So, the fictitious incentive value would be:

Equation 10: CHP assessment (2)

$$Incentive\ (€/kWh_{th}) = Electricity\ selling\ price\ (€/kWh_{elec}) \cdot CHP_{ratio}(kWh_{elec}/kWh_{th})$$

2.2 NON-FINANCIAL COSTS OF RHC

In some cases, there are additional (non-financial) costs associated to RHC worth quantifying. For instance, the DECC [DECC, 2013] considers the following costs (or barriers) when calculating the required tariff for the Domestic RHI Scheme:

- **Explicit barriers**: admin burdens, demand side barriers, and inconvenience to the household.
- **Implicit barriers**: perceived risk barriers such as risk around technology and impact on house value.

Non-financial costs reflect the perceived barriers of installing RHC as opposed to installing conventional technologies. These barriers affect parameters such as the discount rate (the higher the perceived risk, the higher the discount rate).

2.3 RHC EXTERNALITIES

Some RHC technologies have clear environmental benefits over heat produced with fossil fuels. However, in many cases the positive externalities of RHC (or, alternatively, the negative environmental effects of fossil fuels) are not internalized. As such, the documents reviewed included neither positive externalities within the LCoHC calculation nor emission costs when estimating the cost of heat from fossil fuels.

As long as RHC externalities are not completely internalized, these do not affect cash flows, and should be excluded from the LCoHC calculation.

However, it is a benefit worth quantifying, albeit as a separate metric. In the electronic tool, two externalities have been estimated: greenhouse gases emissions and energy resources consumption

3. COST ESTIMATION METHODOLOGY

The LCoHC is defined as the constant and theoretical cost of generating one kWh_{th} of heat/cold, which is equal to the discounted expenses incurred throughout the lifetime of the investment.

The methodology to estimate the LCoHC depends on the degree of complexity of the assumptions (financial, economic, and technical).

The resulting mathematical derivation is presented next:

Equation 11: LCoHC equation (1)

$$\sum_{t=1}^{T}\left(\frac{LCoHC_{\ t}}{(1+r)^{\ t}} \times E_t\right) = \mathrm{I} + \sum_{t=1}^{T}\frac{C_t - \mathrm{S_t} - \mathrm{RV}}{(1+r)^{\ t}}$$

Assuming a constant value per year, LCoHC can be derived by rearranging Equation 11:

Equation 12: LCoHC equation (2)

$$LCoHC = \frac{\mathrm{I} + \sum_{t=1}^{T}\frac{C_t - \mathrm{S_t} - \mathrm{RV}}{(1+\mathrm{r})^{\mathrm{t}}}}{\sum_{t=1}^{T}\frac{E_t}{(1+\mathrm{r})^{\mathrm{t}}}}$$

Where:

NOMENCLATURE	UNIT	MEANING
LCoHC	*€/kWh_{th}*	Levelised Cost of Heat/Cold
T	*Years*	Economic lifetime of the investment
t	-	Year t
C_t	€	Operating costs on year t (O&M, fuels, as applicable)
RV	€	Residual Value
S_t	€	Subsidies and other incentives
E_t	*kWh_{th}*	Energy generated on year t
I	€	Initial investment
r	*%*	Discount rate (WACC)

Moreover, if we assume the investor is a private corporation, after-tax cost flows must be computed:

Equation 13: Exhaustive approach for Corporations (project)

$$LCoHC = \frac{\mathrm{I} + \sum_{t=1}^{T}\frac{C_t(1-\mathrm{TR}) - \mathrm{DEP_t} \times \mathrm{TR} - \mathrm{S_t} - \mathrm{RV}}{(1+\mathrm{r})^{\mathrm{t}}}}{\sum_{t=1}^{T}\frac{E_t}{(1+\mathrm{r})^{\mathrm{t}}}}$$

Where:

NOMENCLA-TURE	UNIT	MEANING
TR	%	Corporate tax rate
DEP	€	Depreciation of fixed assets for tax purposes

An exhaustive approach such as the one presented here provides a relatively faithful representation of RHC energy costs, as it considers all relevant differential cost flows and benefits or savings throughout the life of the system. A simplified approach can also be computed, as long as the user is aware of the relative strengths and weaknesses and uses a consistent approach across technologies.

4. FINANCIAL PARAMETERS

Apart from LCoHC, there are financial parameters that help investors assess the attractiveness of the alternative options. The electronic tool calculates three of the most common ones:

- Net Present Value (NPV):

A positive NPV indicates that the project is profitable.

When choosing between alternative projects, that with the highest NPV should be undertaken.

- Internal Rate of Return (IRR):

An IRR higher than the required return indicates that the project is profitable.

When choosing between alternative projects, that with the highest IRR are not necessarily the most attractive one; in this case, the NPV rule should be followed.

- Payback period:

All else equal, a project is more attractive if the payback period is lower than a particular desired term.

This indicator should be used only in conjunction with other metric.

It is important to note that a RHC installation project will provide savings as cash inflows (derived from its lower operational costs). Thus, in order to estimate these financial parameters, it is required to base the analysis on a “reference system” (i.e. the fossil fuel-driven system that is already in place or is being assessed as alternative to the RHC one).

5. ELECTRONIC TOOL CONSIDERATIONS

This section aims to provide an insight on certain aspects, approximations and assumptions that have been considered in the methodological development of the electronic tool, and were not specifically mentioned (since they are not part of the mathematical model but part of the implementation of the tool).

5.1 RENEWABLE HEATING AND COOLING TECHNOLOGIES

The tool has been developed to estimate LCoHC for four RHC technologies, namely:

- Biomass
- Solar thermal
- Air-source heat pump
- Ground-source heat pump

5.2 USER TYPE

Two different user types have been identified:

- Natural person: It represents private individuals.
- Corporation: It represents any user paying corporate taxes and VAT exempted.

The following table summarizes the methodological differences between the two user types, which is focused on three aspects: taxes, debt and subsidies.

Table 1: User type effect on methodology

USER TYPE	CORPORATE TAX	DEBT	VAT	SUBSIDIES	TAX CREDITS
Natural person	No	No	Yes	Yes	No
Corporation	Yes	Yes	No	Yes	Yes

5.3 LOCATION

Six locations have been made available in the tool, one for each FROnT partner's home country:

- Austria
- Netherlands
- Poland
- Portugal
- Spain
- United Kingdom

The location is a relevant input as it affects several constants and user inputs in the tool.

5.4 ENERGY SERVICES

The tool is prepared to account for three different energy services demand:

- Domestic hot water (DHW)
- Space heating
- Space cooling

However, not all of the four considered technologies are able to satisfy all three energy services.

The following figure shows the relationship between energy services and RHC technologies.

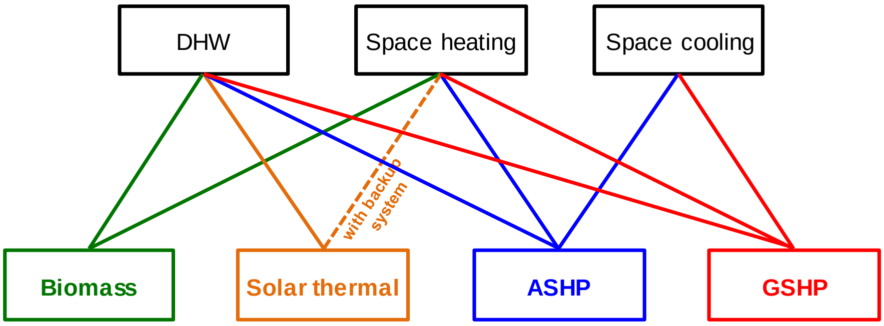

Figure 2: Energy services and RHC technologies

This creates some inconsistency issues. For instance, in the case where cooling is marked as a "desired service", a reference system providing only heating will be compared with one that is able to provide both heating and cooling. In such case, LCoHC can be calculated using the aforementioned methodology but, on the other hand, financial parameters estimation requires some clarification:

- Financial parameters estimation is based on the cash flows of installing a RHC system (including savings from replacing the existent reference system).
- When additional energy services, such as cooling, are required, an estimation of its benefits should be estimated. This would require a complex analysis and its result might have great uncertainty.
- Therefore, a simplification has been done by isolating the comparable energy services between the RHC system and the reference system.
- Mathematically, this has been translated into a current demand-weighted cash flow (i.e. RHC installation savings are calculated comparing the reference system costs with the RHC system costs associated with providing comparable energy services). The following equation represents the current demand-weighted RHC system costs calculation:

Equation 14: Current demand-weighted costs estimation

$$C_d = C_T \cdot \frac{E_h}{E_T}$$

Where:

NOMENCLA-TURE	UNIT	MEANING
C_d	€	Current-demand costs
C_T	€	Total costs
E_h	*kWh*	Current demand
E_T	*kWh*	Total energy demand

Solar thermal energy presents another issue when dealing with energy services. Given that a solar thermal system's generation is subject to the availability of solar hours, a back-up system is often required to provide space heating (and in cases domestic hot water).

Thus, apart from the LCoHC of the solar thermal energy, the tool displays the LCoHC of the so-called 'hybrid system', which accounts for the back-up system (i.e. solar thermal will be treated as a feedstock consumption reduction element in this case and not as a substitute).

5.5 SYSTEM EFFICIENCY

System efficiency is used for feedstock consumption estimation.

It is a user input with guidance from the tool. In the case of heat pumps (both air and ground source ones) the outdoors temperature has an important influence over the system COP, so efficiency values for all six locations are suggested for the tool user.

5.6 ENERGY RESOURCES CONSUMPTION

A positive externality of RHC systems is their potentially lower fossil resources consumption. This has been considered in the tool but in a simplified way, since electrical energy has been treated as an energy resource when it is only an energy carrier[8].

5.7 SENSITIVITY ANALYSIS AND LCOHC RANGE

The current tool version already contains a sensitivity assessment for all four technologies. The analysis has been done for all important parameters in order to select the most influential one and, then, use it to estimate a Max-Min LCoHC range to be presented along with the value obtained using user input values. The selection of this parameter has been done considering both its marginal effect on LCoHC and its uncertainty (i.e. its expected variation range).

[8] A complete energy resources depletion analysis would require electricity transformation into primary energy consumption, which would require present and future electricity generation mix knowledge.

6. ANNEXES

6.1 LCOHC EQUATION - SIMPLIFIED APPROACH

The simplified approach is derived from the exhaustive approach, by making a series of assumptions:

- There is no residual value: $\mathrm{RV} = 0$.
- There are no incentives: $\mathrm{S_t} = 0$.
- O&M costs do not change from year to year: $C_t = C_1$.
- The yearly heat/cold generation remains constant throughout the lifetime of the system: $E_t = E_1$.

Assuming all the above, Equation 12: LCoHC equation is simplified as:

Equation 15: Simplified LCoHC (1)

$$LCoHC = \frac{I + \sum_{t=1}^{T} \frac{C_1}{(1+r)^t}}{\sum_{t=1}^{T} \frac{E_1}{(1+r)^t}}$$

Moreover, the investments can be expressed as a constant annuity, in a way that the levelised value of such annuity throughout the lifetime of the system equals the value of the initial investment. Such annuity does not change from year to year and can be obtained via the following formula.

Equation 16: Annuity of investment cost[9]

$$AI_t = \frac{I * r * (1+r)^T}{(1+r)^T - 1}$$

Where:

- AI_t: annuitized investment cost; constant value for every year *t*.
- I: upfront investment cost.

Thus, Equation 15 can be expressed as:

Equation 17: Simplified LCoHC (2)

$$LCoHC = \frac{\sum_{t=1}^{T} \frac{AI_t + C_1}{(1+r)^t}}{\sum_{t=1}^{T} \frac{E_1}{(1+r)^t}}$$

This can be formulated as:

Equation 18: Simplified LCoHC (3)

$$LCoHC = \frac{AI_1 + C_1}{E_1}$$

[9] This expression assumes that the investment is an upfront cost, and that no additional investments, such as equipment replacement, will be carried out throughout the lifetime of the system.

6.2 RHC SCHEMATIC REPRESENTATION

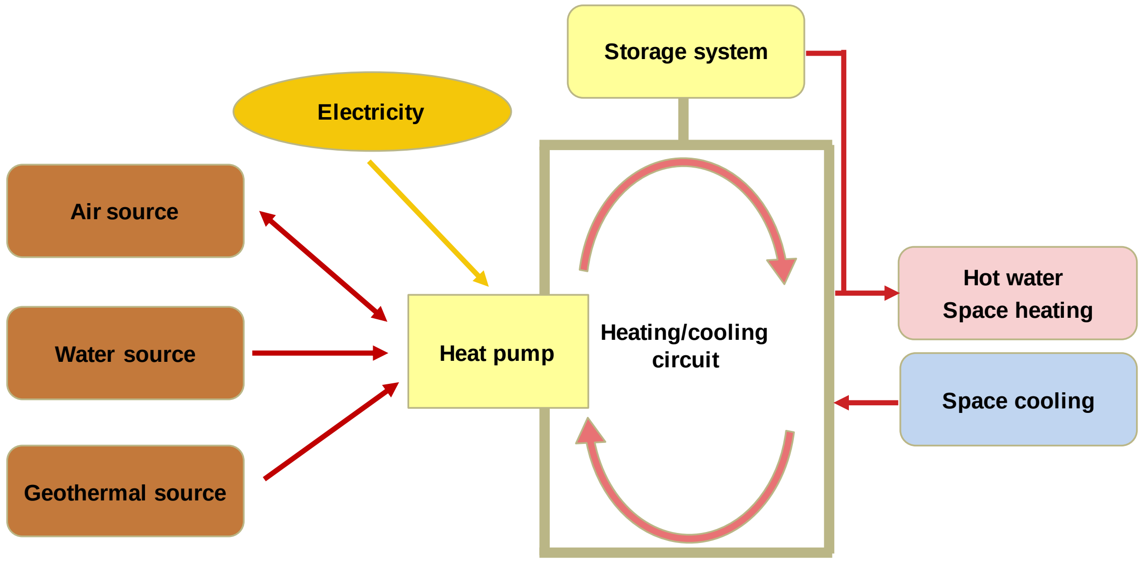

Figure 3: Heat Pumps (illustrative)

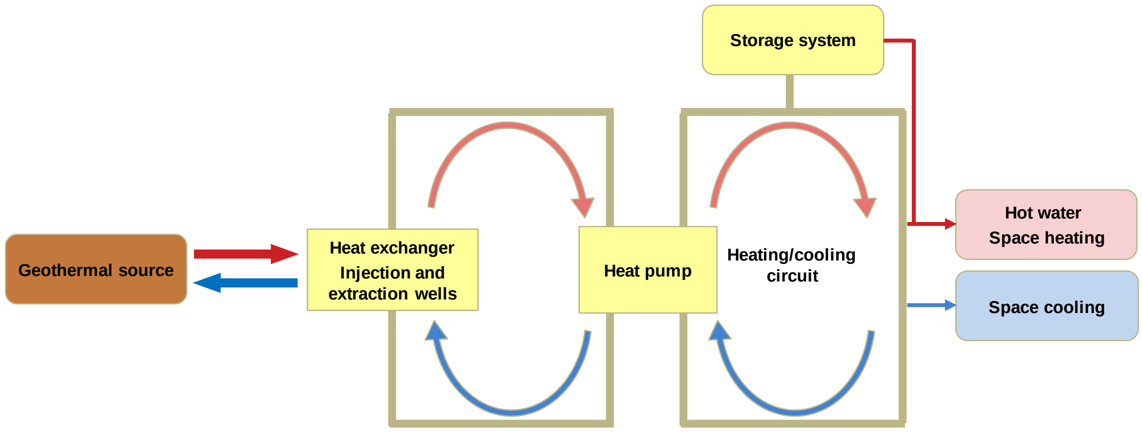

Figure 4: Shallow Geothermal (illustrative)

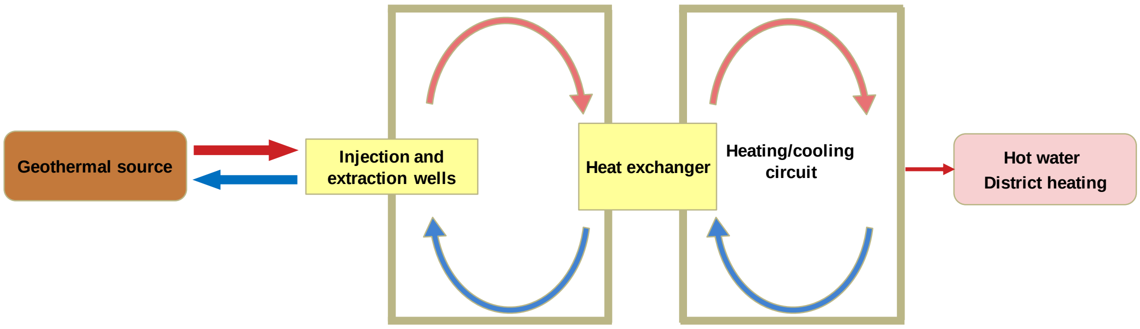

Figure 5: Deep Geothermal (illustrative)

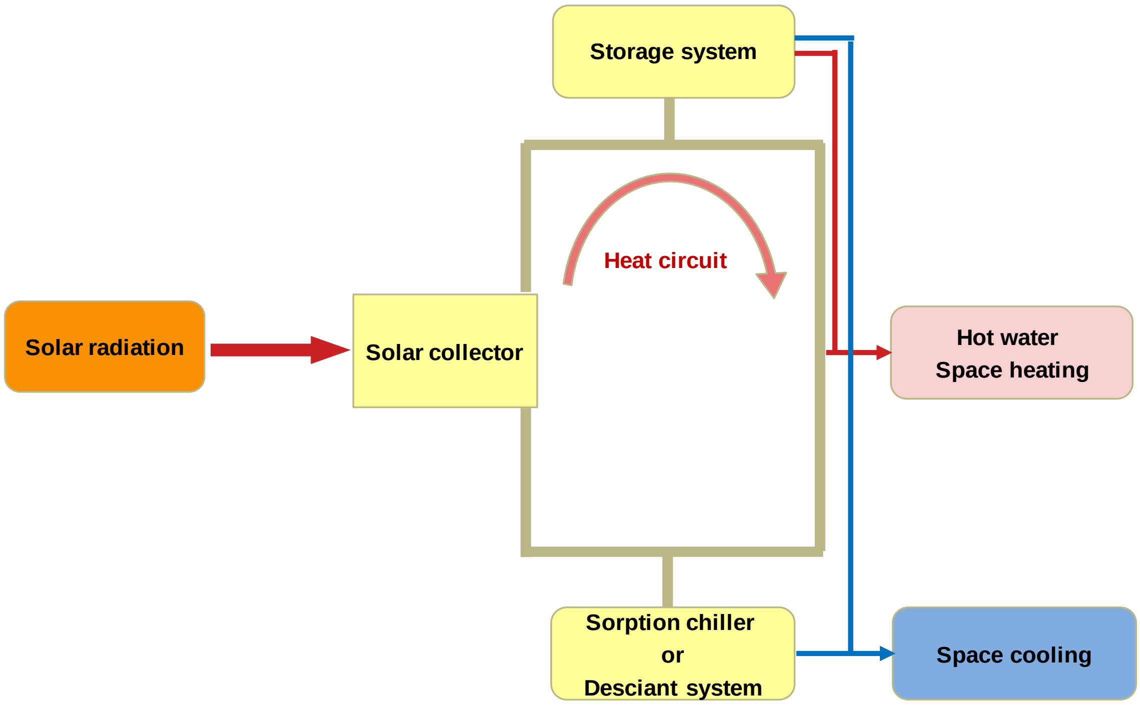

Figure 6: Solar Thermal (illustrative)

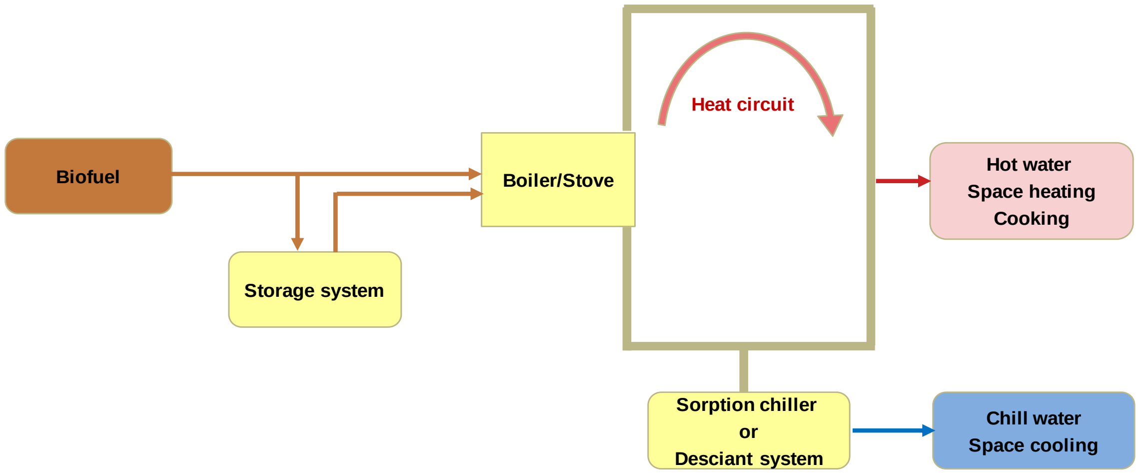

Figure 7: Biomass (illustrative)

6.3 ACRONYMS

Acronym	Meaning
ADENE	Agência para a Energia
AEBIOM	European Biomass Association
AIT	Austrian Institute of Technology
CHP	Combined Heat and Power
DECC	Department of Energy and Climate Change
DEP	Depreciation of fixed assets
DR	Debt Ratio
EGEC	European Geothermal Energy Council
EHPA	European Heat Pump Association
ESTIF	European Solar Thermal Industry Federation
EUR	Euro
FROnT	Fair RHC Options and Trade
h	Hour
i	Interest
IDAE	Instituto para la Diversificación y el Ahorro de la Energía
KAPE	Polish National Energy Conservation Agency
KWhth	Thermal Kilowatt-hour
KWth	Thermal Kilowatt
LCoHC	Levelised Cost of Heating and Cooling
m^2	Square meter
MSW	Municipal Solid Waste
MWhth	Thermal Megawatt-hour
MWth	Thermal Megawatt
O&M	Operation and Maintenance
P	Loan Principal
RHC	Renewable Heating and Cooling
RHI	Renewable Heat Incentive
T&D	Transmission and Distribution
TR	Corporate Tax Rate
UK	United Kingdom
VAT	Value Added Tax
WP	Work Package

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