DEVELOPMENT OF A CHECKLIST TO EVALUATE THE VARIOUS PERFORMANCE OF THE AUTARKY RATE OF THE HUC &
DOCUMENTATION OF THE CREATION PROCESS OF THE CHECKLIST

D.T3.2.1 and D.T3.2.2

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Title	Development of a checklist to evaluate the various performance of the autarky rate of the HUC & Documentation of the creation process of the checklist
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Content

1. Introduction

This document combines two deliverables, the deliverable D.T3.2.1 “Development of a checklist to evaluate the various performance of the autarky rate of the HUC” and the D.T3.2.2 “Documentation of the creation process of the checklist”. The combination of these two deliverables should make it easier for the reader to understand the idea of the checklist by having the checklist itself and the creation process linked to each other in one document, which is structured as follows:

1 Motivation of the checklist: This chapter is intended to give an overview on the idea of the checklist, what it contains, how it should be used and how the user will benefit from the document.

2 The structure of the checklist will describe the different sections of the checklist (protocol of the calculation, analysis of the results, etc.) in detail. The chapter will also explain shortly which input value is used for what and why the output values are chosen as they are. Moreover, it will explain how the technical, economic and ecological analysis work and how the user will benefit from them. In addition to that, the advices which are given for the storage integration in HUCs are explained.

3 Example of the checklist: One example of a checklist is shown in this chapter. The design is not finished yet and will be developed together with the Autarky Rate Tool, but the structure will be (mainly) the same in the final checklist which will be generated by the Autarky rate tool.

4 Outlook: This chapter gives an outlook on the planned activities in the coming time related to the checklist and the autarky rate tool.

Note: The calculation results of the Autarky rate tool, which are displayed in the checklist are described in chapter 3. *Structure of the checklist*. A more detailed description of the calculation process will be available in *D.T3.2.3 Establishment of the autarky rate tool & the checklist*.

2. Motivation of the checklist

Basically, the checklist is an additional output of the Autarky Rate Tool (D.T3.2.3) and will be created as a pdf file. On the one hand, the idea of the checklist is to give the user a possibility to save the calculation results and, on the other hand, it should serve as a further explanation how to interpret the calculation results correctly. Even if the tool is designed that way, that it is easy to use (e.g. by implementing a help menu which provides information about the input and output values), some additional interpretation aid might be helpful especially for non-expert users which are also addressed by the Autarky Rate Tool. If we take the autarky rate for example, which is one of the major outputs of the tool, it is probably not clear for everyone what an autarky rate of e.g. 70 % means. Therefore, the checklist does not only show the value of the autarky rate but also provides an explanation what an autarky rate in the particular range means.

These results are valid in general and not only for historical urban buildings. For the users who are planning the integration of a storage in a historical urban centres (HUC), a further page is added, which provides them with additional information and advices from the Store4HUC project. This information will be updated on a regular base with the newest findings from the project.

3. Structure of the checklist

The checklist is divided in three main parts,

- the protocol of the calculations,
- the analysis of the results, and
- things to consider when planning a storage in HUC,

which are described in detail in the following subchapters.

3.1. Protocol of the calculation

The protocol of the calculation is a summary of the inputs and results of the Autarky Rate Tool. It will give the user the possibility to safe the calculation results. The values which are part of the checklist are shortly explained in the following. Note that a more detailed description of the used parameters and the calculated results will be available in D.T3.2.3, the description of the Autarky Rate Tool.

Input Parameters:

- Country: used for the economic and ecological evaluation, as the average electricity costs, the feed-in tariffs and the share of CO_2 in the electricity is different in every country;
- useful capacity of the storage: indicates the energy amount of electric energy that can be stored in the storage in kWh;
- charging capacity: indicates the maximum power in kW the storage can be charged and discharged with. If the power of the energy source is higher than the charging capacity, the surplus energy has to be fed into the public grid, even if the storage is not completely charged. If for example the maximum charging capacity is 2 kW and the RES minus current consumption would give a 3 kW surplus, 1 kW has to be feed-in into the grid. Moreover, this value has a large impact on the storage efficiency. The larger the deviation between the maximum charging capacity and the actual charging capacity, the higher are the storage losses.
- producer: the user is able to choose between a PV plant, a small-scale water plant and a wind power plant. For each of the producers a characteristic production profile is used;
- maximum production power: is used to scale the chosen producer profile;
- consumer: the user is able to choose between different consumption profiles. For example, between different types of households (family household, single household with work, single household for someone who is retired, etc.), some types of industrial consumers or even a slope elevator profile. For each of the consumers a characteristic consumption profile is used. The household profiles are generated with the so called "Load Profile Generator"[1]. For the industrial consumers standard profiles are used.[2] The profile of the slope elevator is based on measurement data of the elevator in Cuneo;
- energy demand: yearly energy consumption of the consumer in kWh, used to scale the consumer profiles.

[1] Pflugradt Noah, Modellierung von Wasser und Energieverbräuchen in Haushalten (Load Profile Generator), Technische Universität Chemnitz, 2016

[2] APCS – Power Clearing & Settlement, Synthetische Lastprofile (online), https://www.apcs.at, 2020

Output parameters

- Autarky rate: The autarky rate (KPI_4 in D.T2.1.1) is the main output of the tool and is a parameter for the energy self-sufficiency of the system. It is the relation between the consumed energy from self-production of local RES to the total energy consumption of the pilot system for one year. In case of the Autarky Rate Tool / Checklist, by using the term energy, only electrical energy is meant. The definition is shown in equation (1).

$$Autarky\ rate = \left(\frac{E_{self\_RES}}{E_{tot}}\right) * 100\% \tag{1}$$

$E_{self\text{-}RES}$ consumed energy from self-production of local RES in one year in kWh

E_{TOT} total electrical energy consumption of the pilot system for one year in kWh

- Own consumption rate: The own-consumption rate, which is evaluated in percentage (%), is the relationship between the energy **used** from the local RES production to the total energy **produced** by the local RES. The self-used energy is composed of the energy which is directly used (without storage) and the energy which is stored in the storage before using. For the second option only, the actual useable energy is counted (RES production minus surplus grid returns). The definition is shown in equation (**2**)

$$Own\ consumption\ rate = \left(\frac{E_{self\_RES}}{E_{prod\_RES}}\right) * 100\% \tag{2}$$

$E_{self\text{-}RES}$ consumed energy from self-production of local RES in a year in kWh

E_{prod_RES} total produced energy with the local RES for one year in kWh

- Storage efficiency: Every charging and discharging cycle of the storage cause some energy losses. The efficiency of each cycle depends on the relation between the maximum charging (or discharging) capacity and the actual charging (or discharging) capacity of the storage. In general, the losses of one cycle are higher (the efficiency is lower) the more these two parameters deviate from each other. For the calculation a non-linear model is used which is based on equation **(4)**3. For a better understanding of the used values, they are visualized in

$$P_{charging\_BSS} = P_{charging} * \eta_{charging}$$

$$P_{discharging\_BSS} = \frac{P_{discharging}}{\eta_{discharging}} \tag{3}$$

[3] Copetti, J. B., Lorenzo, E. & Chenlo, F. (1993). A general battery model for PV system simulation. *Progress in Photovoltaics: Research and Applications*, 1, 283--292

$$\eta = 1 - e^{\frac{20,73*(SOC-1)}{\left(I/I_{10}\right)+0.55}}$$

$P_{charging}$	charging power of the storage in kW,
$P_{charging\_BBS}$	usable charging power on the storage side in kW (charging power minus charging losses),
$P_{discharging\_BBS}$	discharging power on the storage side in kW,
$P_{discharging}$	usable discharging power in kW (discharging power minus discharging losses),
η	charging/discharging efficiency,
SOC	State of charge, in range 0-1

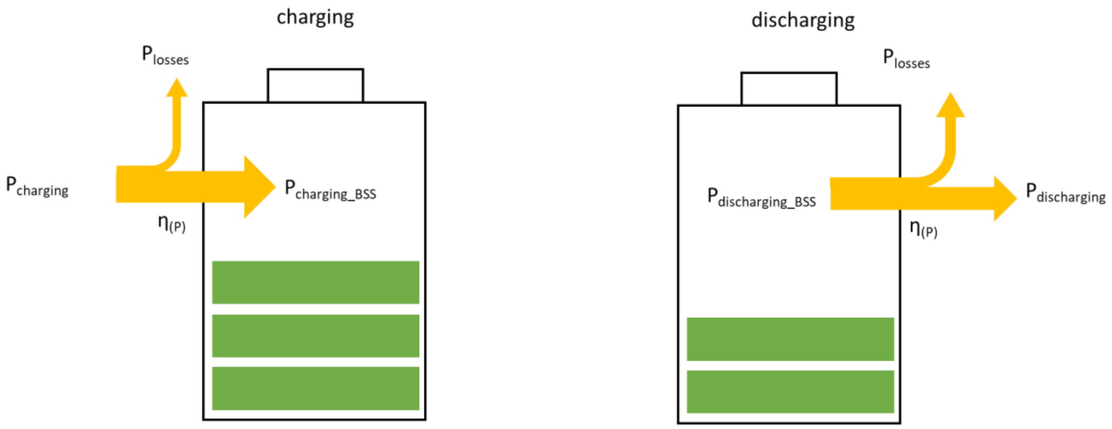

Figure 1: Visualization of a charging and discharging cycle of the storage

To calculate the overall storage efficiency, the charging and discharging efficiency of all cycles are summarized as shown in equation (4)

$$Storage\ efficiency = \left(\frac{E_{RES\_BSS}}{E_{RES\_charging}}\right) * \left(\frac{E_{RES\_discharging}}{E_{RES\_BSS}}\right) * 100\% \qquad (4)$$

E_{RES_BSS}	amount of energy which is actually stored in the storage in one year in kWh
$E_{RES\_charging}$	amount of energy from RES which is fed in the storage in one year in kWh
$E_{RES\_discharging}$	amount of energy consumption which is supplied from the storage in one year in kWh

- Energy cost savings: The energy cost savings shows the mean expected savings per year as comparison of the chosen scenario (RES + storage) and a scenario without RES and storage. The calculation method for one year is shown in (5). The electricity price as well as the feed-in tariff depend on the chosen country, on the total amount of energy consumption per year and the kind of consumer (private/industrial). Moreover, a small price change over the years is taken into account. Therefore, the savings are calculated separately for each year within the expected lifetime and the mean value is shown to the user of the tool.

$$Saving = (E_{consumption} * c_e) - [(E_{consumption} - E_{self-RES}) * c_e - E_{feed-in} * t_f] \quad (5)$$

$E_{consumption}$	energy consumption per year in kWh,
c_e	energy costs for grid consumption in €,
$E_{self-RES}$	consumed energy from self-production of local RES per year in kWh,
$E_{feed-in}$	amount of energy which is feed-in in the public grid per year in kWh,
t_f	feed-in tarif in €;

- Amortisation period: For the calculation of the amortisation period the comparison between the chosen scenario and the scenario without RES and without storage is made. A lifetime of 15 years is presumed for the new components. Even if some components have a longer expected lifetime, usually the first components have to be replaced after this time (e.g. power inverter). For the chosen scenario the investment cost (different between the chosen countries) of the RES and the storage system are taken into account. For the basic scenario no investment costs are considered.

  It has to be mentioned that the calculation of the amortisation period can only be a rough estimation, as the real investment cost are depending on many different factors. Therefore, this tool cannot replace a detailed evaluation of the particular case by an expert. However, the estimated amortisation period which is displayed by the tool is a good indicator, to give the user a first impression if the planed configuration can be economically feasible or not;

- CO_2 savings: The yearly CO_2 emission abatement (KPI_3) depend on the CO_2 emission factor of the applied energy source and the electrical energy consumption of the pilot system which is supplied by an external source and is calculated as follows:

$$CO_2\ savings = E_{c\_tot} * EF \quad (6)$$

E_{c_tot}	Total electrical energy consumption of the pilot system, supplied by external sources for one year in kWh,
EF	CO_2 emission factor to be applied to the energy source in t_{CO2}/kWh;

- Own consumption direct: The direct own consumption is the part of the self-used renewable energy which is used without buffering in the storage. If no storage would be installed, only this amount of energy could be used for own consumption (first priority*);
- Own consumption via storage: The own consumption via storage is the part of the self-used renewable energy which is buffered in the storage (second priority*). Together with the direct own consumption it results in the total own consumption;
- Feed-in in public grid: If the energy cannot be used directly and the energy storage is completely charged (or no storage is installed), the energy surplus from the RES is fed into the public grid (third priority*);
- Purchase from public grid: If the consumed energy in one timestep is larger than the energy of the RES and the storage can also not provide the (whole amount of the) energy demand, the remaining energy has to be purchased from the public grid.

* the priority indicates how the energy from RES should be used preferably. As first priority, as much energy as possible is used for direct own consumption. If the current production is higher than the current demand, the surplus energy is fed into the storage. Only if both is not possible, because the storage is completely charged, the maximum charging capacity of the storage is too small, or no storage is available, the surplus is fed into the public grid.

3.2. Analysis of the results

To give the user a better understanding what the output parameters of the calculation protocol actually mean, the second part of the checklist provides a textual interpretation assistance of them, grouped into a technical, an economical and an ecological analysis. For example, a user might ask if a resulting autarky rate of 60 % means that he has chosen an appropriate configuration or not? That is not so easily answered, because it depends on the targets the user wants to achieve with his configuration. Therefore, the checklist tries to avoid a good/bad categorization, but rather gives the user a better understanding of the analysed parameters so he is able to interpret the meaning of the results in connection with his targets.

3.2.1. Technical

1. Autarky Rate

The autarky rate is separated in 5 categories. Depending in which range the calculated autarky rate lies, a different analysis will be displayed in the checklist. For example, an autarky rate between 1 % and 25 % means that the user has to purchase a significant part of his energy from the public grid. If the autarky rate is above 25 %, he still has to purchase a larger part from the grid but compared to other configurations he has already reached an above-average autarky rate. The different categories are shown below:

- 0 %: Your Autarky Rate is zero. Probably you have no local energy source and all your energy demand has to be purchased from your energy supplier via the public grid. Think about installing a renewable energy source like a photovoltaic system to increase your independency. You can get more information by clicking on this Link (Link to the Store4HUC Homepage);
- 1 – 25 %: You have reached a lower Autarky Rate of xy %. Therefore, you have to purchase a significant amount of the energy demand from your energy supplier via the public grid. The reason therefore can be an undersized energy source or/and an undersized or non-existing storage system. You can get more information following this Link;
- 25 % - 75 %: You have reached an above average Autarky Rate of xy %. You still have to purchase a part of the energy demand from your energy supplier via the public grid, but you can also produce a significant part on your own. To further increase your autarky rate an investment in a larger storage system and/or a larger energy source would be necessary. You can get more information following this Link;
- 75 % - 99 %: You have reached a very high Autarky Rate of xy %, which means that you only have to purchase a small amount of energy (xy kWh) from your energy supplier via the public grid. For a further improvement of the Autarky Rate additional investments need to be made presumably resulting in a major investment. You can get more information following this Link;
- 100 %: Congratulations you have reached an Autarky Rate of 100 %. Which means that you are able to completely self-supply yourself. No energy must be purchased from an energy supplier via the public grid at all. You can get more information following this Link.

2. Self-supply

The self-supply shows the numbers of hours per year in which the user would be able to completely self-supply his energy demand. It is calculated as sum of the timesteps with a complete self-supply. Therefore, the value gives no information about the distribution of these hours but a general overview of the expected amount of time. As this value is easy to interpret, we have omitted the categorization in different groups.

- *You will be able to self-supply your household for about xy hours within one year.*

3. Storage efficiency

The storage efficiency is a good reference if the right storage, especially in regard to the maximum charging capacities, has been chosen. As explained above, for a high storage efficiency, the maximum and the actual charging/discharging capacity should not deviate too much. That means that if a too high maximum storage capacity is chosen, the storage efficiency is bad, but if it is too small, some peak production or some peak demands cannot be served by the storage (alone) anymore. Therefore, a good compromise has to be found. To help the user to evaluate the attained storage efficiency, the analysis has been divided in three different groups. It has to be considered that standard load profiles have been used. Therefore, there is of course a certain degree of variance depending on the actual production/demand profiles.

- >90 %: You have chosen a good system configuration! The efficiency of your storage is quite high. That means that your storage losses only amount to about xy kWh per year.
- 80 – 90% The efficiency of your storage is not optimal but is still in a good range. Maybe you can optimize the parameters of your storage system. With this configuration your storage losses will approximately amount xy kWh per year.
- <80 %: The losses of your storage (xy kWh per year) are relatively high. You should have a look at your system configuration.
- Note: The important parameters are the maximum charging/discharging capacity of the storage, the peak as well as the actual power from the local RES as well as the average power of the demand. The storage losses are higher the more the actual charging/discharging capacity of the storage differs from the maximum charging/discharging capacity of the storage. An oversized storage with a high maximum charging/discharging capacity can cause higher losses than a smaller one, if the maximum charging/discharging capacity is seldom reached.

4. Relation between own consumption rate and Autarky Rate

The relation between the own consumption and the autarky rate is a good way to evaluate the chosen system configuration. If the relation is small that means, that the autarky rate is high, but the own consumption rate is low. Therefore, much more energy than needed is produced and a high proportion of the produced energy is fed in the public grid. In contrary, if the relation is high, that means that the autarky rate is low, and the own consumption rate is high. In this case, most of the produced energy is used for own consumption, but there is also a lot of energy to be purchased from the public grid. These are the statements; the analysis is based on:

- *<0.05: The relation between the own consumption rate and the Autarky Rate is relatively low for your configuration. Therefore, you have a high Autarky Rate but a low own consumption rate. Which means, that you produce much more energy than you need, and a lot of your produced energy is fed in the public grid.*
- *0.05 - 3: The relation between the own consumption rate and the Autarky Rate is in a normal range for your configuration, but there might still be room for optimization depending on your goals.*

- *>3: The relation between the own consumption rate and the Autarky Rate is relatively high for your configuration. Therefore, you have a low Autarky Rate but a high own consumption rate. Which means, that your energy generation unit is relatively small compared to your energy demand. Most of the produced energy is used by yourself, but there is room for improvement. If possible, you could think of extending your generation unit.*
- *Autarky Rate of zero: Your Autarky Rate is zero...*

3.2.2. Economic analysis

The economic analysis deals with the achievable reduction of energy costs as well as with the estimation of the amortisation period. Moreover, a summary of public funding opportunities is shown depending on which country and RES is chosen. For the reason that these economical values are more commonly known than the technical ones, the analysis is more focused on the results than on describing the meaning of the used parameter.

1. *Your annual energy costs without any storage (or PV) solution will be approximately xy €*
2. *Your annual energy costs with a storage solution will be approximately xy €*
3. *Therefore, you can save approximately xy € per year*
4. *Considering standard investment costs, your storage solution will have an amortisation period of approximately xy years*
5. *In your country the following public funding opportunities can possibly be applied (one answers per country)*

3.2.3. Ecological analysis

The ecological analysis addresses the CO2 savings which can be achieved by installing the chosen RES + storage solution. The calculation is based on the reduction of energy which has to be purchased from the public grid and the amount of CO2 in national electricity mix as shown in equation **(6)**.

1. *With your storage solution a CO_2 reduction of xy kg yearly can be reached considering the energy mix of your country*

3.3. Things to consider when planning a storage in HUCs

The last part of the checklist is related to the specificities which accounts for the storage integration in historical urban centres. This page is intended to summarize the most important advices which are obtained from the Store4HUC project. For example, that it makes a large difference if the building or HUC itself is protected or not, or that it is advisable to contact the national office in charge for protection of historic buildings and sites at an early stage of any interventions. However, the project Store4HUC is still at a relatively early stage and therefore much more knowledge is expected to be gained in the coming time. Therefore, this section will be updated frequently.

The current version is shown in chapter 4 *Reading example of the checklist*.

4. Reading example of the checklist

On the following pages an example of a checklist is shown. The design is not final yet, but the structure will largely stay the same:

This is your individual checklist from 19.03.2020 13:29. Please consider that all results calculated by the Autarky Rate Tool are estimations based on average consumer behaviours. Therefore, the tool does not replace an individual technical configuration assessment!

Your Inputs:

Country:	Austria	
Storage:	max 4 kWh	max 2 kW
Producer:	PV	15 kWp
Consumer:	Family household	6000 kWh
Period	01.01	31.12

Results:

<table>
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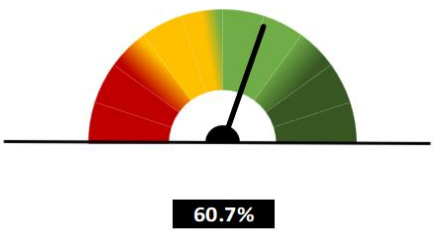
</td></tr>
<tr><td>Own consumption rate: 30 %
</td><td>Storage efficiency: 78 %
</td></tr>
<tr><td>Annual energy costs savings:
1294 €</td><td>estimation of the amortisation period:
14 years</td></tr>
<tr><td colspan="2">CO_2 emissions savings: 310 kg yearly</td></tr>
</table>

Technical analysis

1. You have reached an above-average Autarky Rate of 60.7 %. You still have to purchase a part of the energy demand from your energy supplier via the public grid, but you can also produce a significant part on your own. To further increase your autarky rate an investment in a larger storage system and/or a larger energy source would be necessary. You can get more information following this *Link*
2. You will be able to self-supply your household for about 4055 hours in one year
3. Storage efficiency: The losses of your storage (333 kWh per year) are relatively high. You should have a look at your system configuration.
4. The relation between the own consumption rate and the Autarky Rate is in a normal range for your configuration, but there might still be room for optimization depending on your target.

Economic analysis

1. Your annual energy costs **without** any storage (or PV) solution will be approximately 1380 €.
2. Your annual energy costs **with** a storage solution will be approximately 85 €.
3. Therefore, you can save approximately 1294 € per year.
4. Considering standard investment costs, your storage solution will have an amortisation period of approximately 14 years.
5. In your country the following public funding opportunities can possibly be applied: (One answer per country)

Ecological analysis

1. With your storage solution a CO_2 emissions reduction of 310 kg yearly can be reached considering the energy mix of your country.

Detailed numbers

Own consumption direct:	2477 kWh	Feed-in in public grid:	9371 kWh
Own consumption via storage:	1163 kWh	Purchase from public grid:	2359 kWh

Things to consider when planning a storage in HUCs

- **Check out if your building is protected by the preservation order**

  The location in a historical urban centre (HUC) does not automatically imply that the building or the site is protected by the preservation order. If the building is protected you are generally more limited, but this does not mean that a storage integration is not possible. Nevertheless, the absence of protection by the preservation order does not automatically waive other possible restrictions.

- **Contact the office responsible for the protection of historic buildings and sites at an early stage**

  It is advisable to contact the authority in charge at an early stage and inform them about your plans. The situation has to be evaluated frequently and separately for every case. Thereby, it is more likely to find a good solution, that follows the preservation order, if you contact them at an early stage of your planning. Moreover, it can save a lot of planning costs for things which are not possible/allowed.

  Even if your building itself is not protected, but located within a HUC, it is advisable to contact authorities beforehand and check your situation.

- **What is protected by the preservation order?**

  It might make a difference whether the whole building is under protection or only a certain part of it. For example, if it is "only" the surface, a storage integration is often possible, while the installation of a photovoltaic (PV) system, which is commonly combined with storage integration, could be more complicated. However, there are some good best practice examples available which show some ways how a photovoltaic system could still be installed. For example, in Bračak (HR) the PV system is installed on the roof of a parking lot close to a protected building. More examples are available on: *Link*

- **Which law is valid for you?**

  Be aware that the preservation order can strongly vary between different countries and sometimes also within countries. In Germany, for example, the federal states (Bundesländer) are in charge of the law. Therefore, you must take into account that if something is allowed in one federal state does not automatically apply for other federal states also. Therefore, make sure that you are aware of the applicable law for your site.

- *More to come in course of the project*

Glossary

- Country: The information about the country is used for the economic and ecological evaluation, as the average electricity costs, the feed-in tariffs and the share of CO_2 in the electricity is different in every country.
- Useful capacity of the storage [kWh]: The useful capacity of the storage indicates the maximum amount of electric energy that can be stored in the storage.
- Charging capacity [kW]: The charging capacity indicates the maximum power the storage can be charged and discharged with. If the power of the energy source is higher than the charging capacity, the surplus energy has to be feed-in into the public grid, even if the storage is not completely charged.
- Producer: The user is able to choose between a PV plant, a small-scale water plant and a wind power plant. For each of the producers a characteristic production profile is used.
- Maximum production power [kW]: This value is used to scale the chosen producer profile.
- Consumer: The user is able to choose between different consumption profiles (e.g. different types of households, industrial consumers, etc.). For each of the consumer a characteristic consumption profile is used.
- Energy demand [kWh]: The energy demand is used to scale the consumer profiles.
- Autarky Rate [%]: The autarky rate is the relation between the consumed electric energy from self-production of local RES to the total electric energy consumption of the pilot system for one year.
- Own consumption rate [%]: The own-consumption rate is the relationship between the energy used from the local RES production to the total energy produced by the local RES.
- Storage efficiency [%]: Every charging and discharging cycle of the storage cause some energy losses. A non-linear model which is dependent on the relation between the actual charging/discharging capacity and the maximum charging capacity is used. For the calculation of the storage efficiency, the amount of RES which is addressed to the storage, and the actual usable energy which is discharged from the storage over one year is set in relation.
- Annual energy cost savings [€]: The energy cost savings shows the expected savings per year as comparison of the chosen scenario (RES + storage) and a scenario without RES and storage.
- Amortisation period [year]: For the calculation of the amortisation period average investment costs are assumed based on the user inputs. It has to be mentioned that the calculation of the amortisation period can only be a rough estimation, as the real investment cost are depending on many different factors. Therefor this tool cannot replace a detailed evaluation of the particular case by an expert.
- CO_2 savings [kg_{CO2}]: The yearly CO_2 emission abatement depend on the CO_2 emission factor of the applied energy source and the annual energy cost savings.
- Direct own consumption [kWh]: The direct own consumption is the part of the self-used renewable energy which is used without buffering in the storage (first priority).
- Own consumption via storage [kWh]: The own consumption via storage is the part of the self-used renewable energy which is buffered in the storage (second priority)
- Feed-in in the public grid [kWh]: Is the amount of energy which is feed-in in the public grid (third priority)
- Purchase from public grid [kWh]: If the consumed energy in one timestep is larger than the energy of the RES and the storage can also not provide the (whole amount of the) energy demand, the remaining energy has to be purchased from the public grid.

5. Outlook

As a next step, the checklist, which is shown in chapter 4 Reading example of the checklist will be integrated in the online version of the Autarky Rate Tool. By pressing the button “Generate Checklist” a pdf version based on the respective calculation results will be generated. In the course of this, the design of the checklist will be adjusted to the design of the tool, considering the possibilities of the web application. If the tool and the checklist are ready, the tool will be presented and explained to all project partners in the “Train the trainers workshop” which is planned in autumn 2020. This workshop will also be used to collect some feedback and test the functioning. If necessary, some adjustments will be done based on this. When the final version is ready, the tool and the checklist will be online accessible for everyone and will be presented to the project stakeholders in spring 2021. In addition to that, some sections as the “things to consider when planning a storage in HUCs” or the funding possibilities will be updated frequently with the latest information.