Deliverable D4.3

"Information sharing process documentation"

Organization: SSSA

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Date: March, 30th, 2021

Envisioning and Testing New Models of Sustainable Energy Cooperation and Services in Industrial Parks

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 785134.

DELIVERABLE 4.3 – VERSION 1.1

WORK PACKAGE N° 4

Nature of the deliverable		
R	Document, report (excluding the periodic and final reports)	X
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, etc.	
OTHER	Software, technical diagram, etc.	

Dissemination Level		
PU	Public, fully open, e.g. web	X
CO	Confidential, restricted under conditions set out in Model Grant Agreement	
CI	Classified, information as referred to in Commission Decision 2001/844/EC	

Quality procedure			
Date	Version	Reviewers	Comments
29.01.2021	1.1	Fabio Iannone	First draft with contents
12.03.2021	1.1	Francesco Peccianti	Proof-reading
15.03.2021	1.1	Andrea Kollmann	Editing, proof-reading

Disclaimer

Acknowledgements

This report is part of the deliverables from the project "S-PARCS" which has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 785134.

More information on the project can be found at http://www.sparcs-h2020.eu/

Executive summary

This deliverable describes the process for selection and processing the information collected during main activities in S-PARCS project. For each park the different procedures and some aggregated findings are listed. Due to the publicity of this report, we include information that are considered as important and uncritical. The process how this information is shared and with whom is described in the following paragraphs.

First, regarding the process for identifying joint energy projects and collection of related information, what was observed led to three possible approaches: top-down, bottom-up and mixed method. In relation to them, two parks have followed a top-down approach (Ponte a Egola) in selecting the best energy cooperation solutions, while two of them have chosen a bottom up one (Okamika and Bildosola-Artea areas). Chemiepark Linz and Ennshafen have opted for a mixed approach. This implies that the role of stakeholders is not the same and their involvement does not happen at the same time.

Then, regarding the methodology to evaluate the energy cooperation solutions, and, therefore, the feasibility studies, we have seen that there is a need for a high quantity of information. This information is technological (e.g. available technologies, overall consumption of the park, topographic data gathered on site, etc) or non-technological (economic, social, environmental, etc). The process of collection of information could be high-intensive and, also, expensive. Therefore, if possible, could be limited to few energy cooperation solutions and, maybe, based on previous experiments or results.

Finally, regarding the managing of potential critical data, we have seen that the drafting of contractual agreements for the sharing and management of services and/or infrastructures may require the need to have information and data considered sensitive by the companies in the park. This represents one of the problems most felt by the companies of an industrial park with respect to the possible cooperation activity for energy efficiency solutions, as they believe that the sharing of energy data could provide a possible competitive advantage to competing companies belonging to the Park or that sharing critical data with 3rd parties might put them at risk.

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1 Introduction

This report aims at illustrating the procedure for the selection and processing of the information collected during the activities related to the energy cooperation initiatives[1] in the S-PARCS project.

Indeed, S-PARCS has seen the collaboration of several companies and organizations within some European Industrial Parks – so called S-PARCS Lighthouse Parks – as shown in the picture below, addressed to energy cooperation projects development. The activity of cooperation, for the most promising opportunities identified, was carried out by each Lighthouse Park representative (i.e. BSI, Cuoiodepur, EHOO and BOREALIS) with the contribution of at least one technical partner (i.e. SSSA, EI-JKU, TECNALIA.)

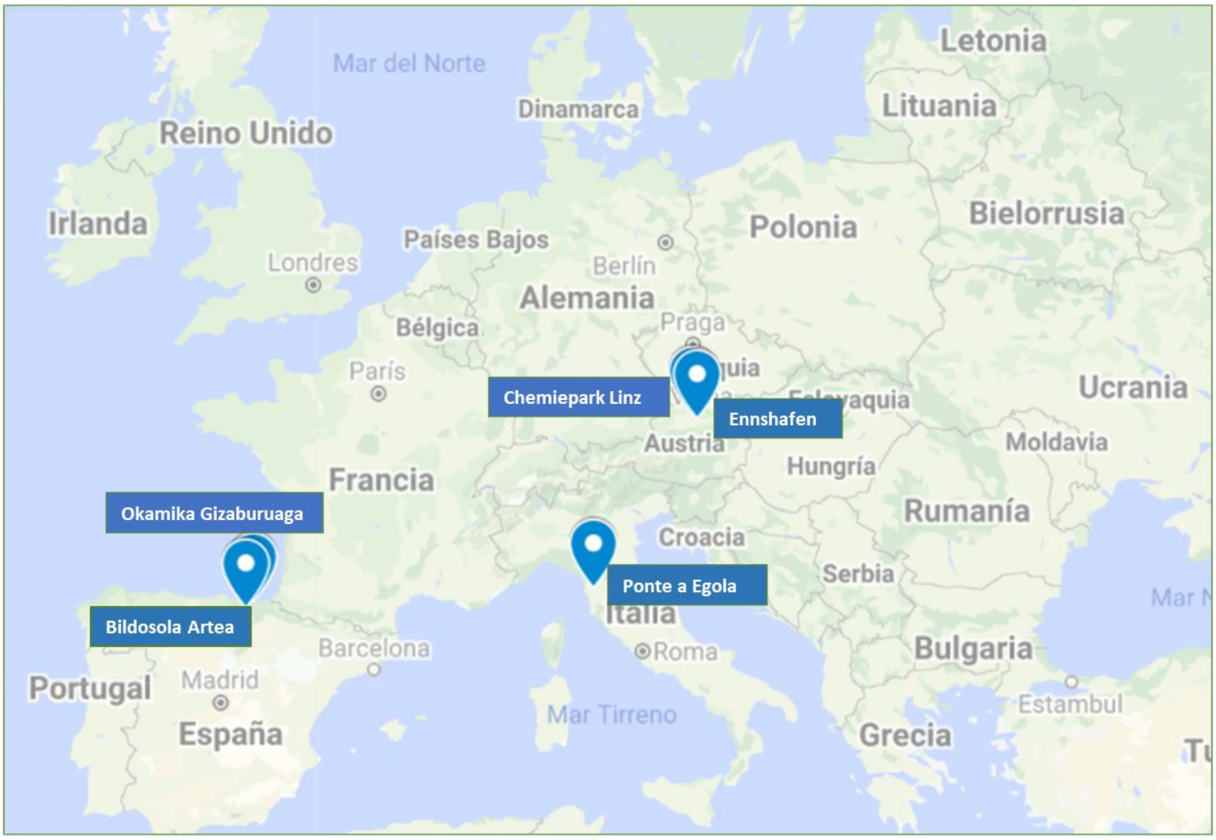

Figure 1: S-PARCS Lighthouse Parks

This document will present some crucial points for a possible replication of the process of selection and sharing of information based on the practical experiences made by the S-PARCS industrial parks and their solutions during the years 2018-2020.

[1] Energy cooperation initiatives mean at least two companies have to be involved in a cooperation concerning at least one energy-related product or service.

Chapter 2 will give an overview of lesson learned from the Lighthouse parks, showing (in Section 2.1) the methodology used to choose the best technical solutions (and, so, the information collected during this process) and, in summary, those solutions. Related to this, Section 2.3 will deal with the methodology for the feasibility study and publicly released results. In Section 2.2, an overview of possible issues and solutions associated with standards and regulation in the implementation of energy cooperation initiatives in the S-PARCS Lighthouse Parks is presented.

Chapter 3 generalizes the learnings from these practical experiences, gives suggestions for identifying, selecting and negotiating energy cooperation solutions in other territories interested in applying S-PARCS experiences and approaches (Section 3.1), the data required (Section 3.2). Finally, Section 3.3 will resume the issued related to confidentiality clauses when sharing information related the energy cooperation solutions.

Throughout this deliverable, we cross-reference several other S-PARCS deliverables, which provide the interested reader with additional or more in-depth information about specific aspects described in this report. Please find a list of these reports below.

- Deliverable 1.1: S-PARCS solutions inventory
- Deliverable 2.3: Guidance on contractual issues for joint energy services and energy cooperation
  Deliverable 2.4: Policy recommendations based on the results of the legal, regulatory & standardization analysis
- Deliverable 5.1: Presentation: energy challenges of industrial parks - first insights from the S-PARCS project
- Deliverable 5.4: Public report on the results from the feasibility studies for the most promising joint energy projects in the Lighthouse Parks
- Deliverable: 6.6: Interim report on networking activities

All deliverables are accessible via https://www.sparcs-h2020.eu/results/deliverable/.

2 Information and lessons learned from lighthouse parks

2.1 Description of the process for identifying joint energy projects and collection of related information

The process for identifying joint energy projects (JEPs) in the S-PARCS Lighthouse parks was organized according to the characteristics of the different sites as described in the following paragraphs.

2.1.1 Identifying JEPs and collection of related information in Chemiepark Linz (CPL)

Chemiepark Linz (CPL) is a multi-company park in the Austrian city Linz. CPL is managed by a private company. The eight major companies in the park are all energy intensive and are primarily active in different areas of the chemical industry. The whole park formerly was part of one chemical company. When it was split up, the shared infrastructure, such as steam and cooling water (CW) supply, were maintained. After the division into individual companies, the joint use of the supply infrastructure proved advantageous. Therefore, to identify which were the more interesting JEP, in CPL the following stages where followed:

- The chemical park representative for S-PARCS in collaboration with a research institute (EI-JKU), identified the most energy intense companies at chemical park Linz;
- Representatives of these companies were interviewed to learn about their core business, energy consumption patterns, supply and disposal needs as well as their general attitude towards energy cooperation and optimization potential;
- Based on the interview results, tailor-made energy cooperation opportunities were elaborated by EI-JKU and a roadmap was drafted and presented to the companies;
- A discussion about the most promising solutions (such as waste heat utilization) and pre-feasibility studies were carried out.
- Finally, based on the pre-feasibility results and recent developments (such as regulatory changes) the existing roadmap of the industrial park was updated in 2020 and the focus was laid on reinforcing networking activities and optimized waste heat utilization.

At the end of this process, three JEPs were identified, two of them related to strengthen the networking:

- Reinforced networking between the companies
- Reinforced networking with external entities
- Waste heat utilization.

2.1.2 Identifying JEPs and collection of related information in Ennshafen Industrial Park

The entire Ennshafen site with its integrated business park consists of a public port and private logistics and production companies and, thanks to its modern trimodal infrastructure (waterway / railway / road), houses around 60 companies with about 2,300 employees. The Ennshafen is the youngest and most modern public port in Austria, managed by a public company. The companies in the Ennshafen industrial park operate in the fields of logistics, recycling, food and feed, wood processing industry, mechanical engineering industry, industrial laundry, etc. and various service providers. This heterogeneity of activities entails difficulties in the coordination of energy consumption and energy-intensive standards. Unlike the Chemiepark Linz, the companies located in Ennshafen were created largely independently of each other.

In Ennshafen, to identify which were the more interesting JEPs, the following actions where followed:

- EI-JKU has served as initial mediator. The Research Institute performed multiple interviews to kick-start the process of exchange of information;
- Regular exchanges of information between the local companies were established (e.g. workshops);
- Basic legal and economic assessment of the feasibility of the merger of site companies in an energy community (especially for solar and water-cooling system solutions);
- Identifying the transport sector as being responsible for a large proportion of greenhouse gases and other emissions, in the park.

At the end of the process, four different solutions were identified.

- Energy-related networking in the park
- Cooperative development of energy topics (mostly solar photovoltaics (PV) and water-cooling system)
- Mobility-related aspects for the entire park (E-mobility, LNG/CNG, shore-side electricity)
- Direct exchange of heat and steam, and waste heat recovery

Concerning the energy-related networking, we assume that the workplan to develop the best energy cooperative solutions was itself a way for a continuous exchange of information. This was done through the dual purpose of selecting and inter-exchanging information by a), b) by interviewing decision makers from several companies in the park with the aim of discussing the draft cooperation strategy and the potential measures and c) periodic energy working groups with company representatives for regular mutual updates and processing of general energy-related developments and thus potential new cooperation. Every workshop focused on a specific topic (e.g. joint installation of e-charging stations in the park), was moderated by the park management, with input from EI-JKU and selected external experts for each of the specific topics. In addition to presentations as a way of sharing information, smaller break-out groups where organized in the workshops to a) establish a direct communication line between companies (where such were non-existent before) and b) gather insights into companies' perspective on energy cooperation and answer their questions. For each workshop a participant list as well as minutes are created by EHOÖ and EI-JKU, including information on the presented and discussed topics, also information and news on energy related measures and ideas of companies within the park are documented in the minutes. The minutes are shared with all invited companies (i.e. all companies of the Ennshafen), usually including an outlook for the next meeting. The topics of each meeting are decided on by the expressed interest of the companies on one side and on daily political topics on energy chosen by EHOÖ and EI-JKU on the other side.

2.1.3 Identifying JEPs and collection of related information in Okamika Industrial Park and Bildosola-Artea Industrial Park

Okamika industrial park is located in the municipality of Gizaburuaga and it was set up in 1984. It is managed by the BSI society. The municipality of Gizaburuaga, as one of the owners of the park, assumed the cost of replacing the lighting system of the park into LED and thus, cut down lighting energy consumption by half. The idea of installing roof photovoltaic panels was assessed when building up the second phase of Okamika, but it was discarded due to the high cost of the project.

The Bildosola-Artea is an industrial park set up in a rural area, halfway (45 km) between the capital cities of Bilbao and Vitoria-Gasteiz in the Basque Country. Its surface area is about 300,000 m^2 and there are 28 companies established in it. The industrial park is managed by the ECU (Entity of Urban Cooperation), a non-profit association representing all companies in the park and two municipalities (Artea and Arantzazu).

The process of identifying the JEPs was very similar in the two Basque industrial areas. Therefore, the description of the identification process is presented once:

- The BSI (Bizkaia Sortaldeko Industrialdea S.A) for Okamika and Arratiako Industrialdea, representative for the S-PARCS of their own industrial areas, in collaboration with Tecnalia (Research and Innovation Centre), through a questionnaire and individual calls and meetings, invited all the companies in the park to present the energy challenges of the industrial park;
- Then, a workshop followed (one for each park), in which the representatives of these companies participated. The aim of the workshop was to learn about the different energy options for moving towards a sustainable energy transition, the opportunities of the new legislation to create energy communities, as well as to contrast their general attitude towards energy cooperation.

- Based on the results of the workshops,feasibility studies were carried out by Tecnalia and an external engineering company for different JEPs in the parks. These JEPs have been then presented by Tecnalia and BSI Arratiako Industrialdea to the Regional Energy Administration and to ESCOs, to gather their views on the project and assess their potential interest to collaborate or invest in the JEPs, particularly their potential involvement as actors in an energy community with shared self-consumption of renewable energy (photovoltaic and mini-hydroelectric).
- Tailor-made energy cooperation opportunities were prepared by Tecnalia in collaboration with other energy actors (ESCO, engineering) with the purpose to be presented to the companies and representatives of the local municipality. In the following months, discussions on the most promising topics (such as the use of photovoltaic and mini-hydraulic energy) intensified,
- Finally, a roadmap for the industrial parks focused on promoting the creation of the energy self-sufficiency community by taking advantage of the synergies between companies was proposed.

During the process, the following solutions were identified and proposed for Okamika:

- Solar PV for shared self-consumption;
- Small hydroelectric plant.

The following solutions were identified and proposed for Bildosola-Artea:

- LED lighting;
- Small hydroelectric plant.

2.1.4 Identifying JEPs and collection of related information in Ponte a Egola

Ponte a Egola industrial park belongs to the Tuscan Leather industrial area, which extends in a territory of about 100,000 inhabitants across several municipalities between the provinces of Pisa and Florence. The Ponte a Egola industrial park is one of the leading industrial parks in the field of tanning at the Italian and international level, with more than 100 companies involved. The companies are mainly small-medium family businesses, with an average number of 12 employees and a 2.5 million euros turnover respectively.

First, the companies located within Ponte a Egola industrial park were engaged through three channels: 1) Companies were invited, by e-mail, to a first meeting in Cuoiodepur premise to present the aim of the project and potential benefits of energy cooperation (more details are available in Deliverable 5.1 and Deliverable 6.6) and kept updated by the newsletter of the project. 2) All the companies of the parks were reached by phone call in order to describe the project and ask their availability to make an interview with a representative of Cuoiodepur and SSSA. During the interview, the discussion follows the points indicated in the questionnaire (the questionnaire was reported in Deliverable 1.1), but more importantly, it allowed the tanneries to describe their experiences, feelings, knowledge, etc. about energy cooperative solutions. 3) The arrangement of workshops about energy efficiency measures and energy cooperation initiatives.

Then, the process for identifying the best JEPs has specific peculiarities in Ponte a Egola.

Since Cuoiodepur is the park manager of Ponte a Egola in S-PARCS and, also, the managing organization for an important infrastructure of the industrial park (the waste treatment plant is owned by the tanneries that paid for the wastewater treatment), an analysis on the energy consumption of the waste treatment plant was carried out in order to identify the most interesting solutions for all the companies operating in the industrial park, that is quite homogeneous in activities and needs.

In fact, most of the tanneries had a relative low consumption of electric energy; however, the consumption of thermal energy (used to dry the leather), high production of solid waste (mainly subproducts related of the raw hides processing) and wastewater (due to the high-water consumption) result in relevant environmental and economic cost.

Therefore, in order to enhance the energy cooperation, tailor-made solutions were chosen in order to maximise the potential economic and environmental benefits:

- Combined heat and power plant - CHP run by biogas (from the digestor) to produce thermal energy and electricity;
- Anaerobic co-digestor of sludge and solid waste.

These energy cooperation solutions aimed at reducing Cuoiodepur's energy consumption would affect the fee each company pays for the treating service. The potential of this energy opportunity was internally assessed by Cuoiodepur and SSSA both from a technical and economic point of view.

2.2 Standardization and regulatory issues

In relation to the replication of S-PARCS approach, the relevance of the influence of standardization and regulatory issues on the selection of energy cooperative solutions is dealt with specifically in Deliverable: *D2.4: Policy Recommendations based on the results of the Legal, Regulatory & Standardization Analysis.*

This step was essential because the implementation of energy cooperation solutions and joint energy services may be hampered by multiple barriers and risks, related – for example – to the difficulties in adapting existing systems to new layouts, in developing profitable business models and, for sure, in complying with the necessary legal requirements. In order to maximize the replicability of S-PARCS solutions, the analysis focused on different scales, from the EU one, to the regional ones, based on the specific proposed energy interventions and regulatory and standardization barriers. In addition, elements related to the specific incentives and/or binding regulations have been incorporated and presented whenever relevant.

Through an approach based on contexts' investigations (questionnaires and face-to-face interviews) aimed at both collecting details about the experience of the parks/companies in the S-PARCS projects, and at analyzing the legislative/regulatory and standardization context to analyze any potential conflict between the desired project implementation and available instruments to overcome barriers and EU/national/regional/local legislation and standards, several policy implication were found, as synthetized in the following table. After a first drafting of the document, further meeting with the representatives of the parks followed to improve the outcomes based on the identified needs.

Table 1: Summary of Policy Recommendations

<table>
<tr><th>Member State</th><th>Energy cooperation and energy efficiency solutions</th><th>Policy Recommendations</th></tr>
<tr><td rowspan="4">Spain</td><td>Use of small hydroelectric installation</td><td>A simplified license
Ensure a simplified process to obtain a license of use for assets to be dedicated to the realization of renewable energy projects and to the reduction of GHG emissions, in line with existing European targets of carbon neutrality.</td></tr>
<tr><td rowspan="3">Installation of a PV plant</td><td>Facilitation to data access
Facilitate companies' access to the hourly energy consumption data. This data is currently accessible but only after formal requests to commercialization and distribution companies. Facilitating access to data and providing tools for its analysis can be a way to increase knowledge of energy consumptions and to motivate the implementation of measures to reduce energy use and mitigate associated emissions</td></tr>
<tr><td>Flexible business models
Develop flexible business models to install and exploit renewable energy installations. Business models could combine public, private or community participation on investments and exploitation. The new regulation for self-consumption in Spain (the new RD 244/2019), was a crucial step for the development of energy communities; for example, allowing shared self-consumption between different consumers and producers, up to a distance of 500 meters</td></tr>
<tr><td>Facilitate shared-self consumption
As shown in the PV case study for Okamika, allowing for "dynamic distribution coefficients" of photovoltaic energy production between</td></tr>
</table>

		the different users of a joint installation would improve their profits. Current regulations oblige companies to predefine a "constant distribution" of energy production that each of them will use throughout the year.[2]
Italy	**CHP plant exploiting anaerobic co-digestion of vegetable tannery sludge**	**Simplify the rules** Overcome and simplify existing legal, regulatory and standardization issues by training energy cooperation advisors able to support the companies and industrial parks in the identification and adoption of suitable energy cooperation solutions, and, at the same time, support the politicians in the adoption of the proper regulatory and legislative instruments
		Facilitate the agreements Facilitate and promote formal agreements that support transition to circular economy and energy cooperation between multiple actors (e.g.: public authorities, industrial organizations, etc.), as they act as enabler and facilitator of concrete interventions
		Flexible business models Develop and allow flexible business models to exploit energy produced by high efficiency systems
		Smooth PA Adopt smooth and clear administrative processes to obtain end of waste authorizations
Austria	**Waste heat recovery**	**Easy waste** Facilitate and sustain internal use of waste heat, e.g.: through economic incentives
		Easy waste Improve and generate options for waste heat use in order to reduce primary energy demand thanks to the implementation of energy cascades
		Easy waste Improve legal basis for waste heat feed-in into DH network, as waste heat producers have to negotiate with DH network operators and no right to privileged feed-in into the network
		Transparent information Provide that district heating network operators, in the event of refusal of connection, must inform the third party and the competent authority of the reasons and point out measures that the third party can take to obtain access.
	Shore side electricity	**Tax equality** Tax equality for all types of energy carriers shall be ensured at the

[2] As of March 2021, there is a consultation process in the Ministry of Energy to discuss the implementation of dynamic distribution coefficients
https://energia.gob.es/es-es/Participacion/Paginas/DetalleParticipacionPublica.aspx?k=404

		European level
	Installation of a PV plant	**Shared electricity** Improve possibilities for electricity sharing for large enterprises, without forcing them to register as official electricity suppliers
		Land facilitation Diminish existing restrictions on direct lines, especially facilitating permissions to cross public properties or land from third parties (also applicable to other electricity generation installations)

2.3 Important and uncritical information about feasibility studies

For the purpose of this deliverable, we are presenting here the methodology adopted for the feasibility studies for each S-PARCS Lighthouse industrial park. We recommend looking up Deliverable 5.4 for more information about these feasibility studies. Moreover, we mention the methodology adopted to ensure comparability with D4.1 *S-PARCS key performance indicators*[3] *(KPIs)* that allow the comparison and assessment of different energy cooperation opportunities according to economic, sociocultural, environmental, legal and organizational factors, calculated in order to complement the overall feasibility study.

Table 2 summarizes all the solutions previously described and covered by the S-PARCS feasibility studies.

Table 2: S-PARCS Lighthouse Parks most prominent solutions

S-PARCS Lighthouse Park	Evaluated solution
Ponte a Egola, Italy	CHP network
Ennshafen, Austria	Jointly organized PV installations
	Joint e-charging stations
Chemiepark Linz, Austria	Cooperation with neighborhood outside the park: High temperature waste heat feed in to DHN
Okamika-Gizaburuaga, Spain	Solar PV for shared self-consumption
	Small hydroelectric plant
Bildosola-Artea, Spain	Small hydroelectric plant

2.3.1 Methodology for the feasibility study for Chemiepark Linz

Methodology

The experience of Chemiepark Linz is based on an approach that tries to balance both an analysis of research needs the company's perspective.

To intercept the important information, the following steps where followed:

[3] More information on the KPIs can be found in aforementioned public deliverables, also they are implemented in the Initial Assessment Tool (IAT) available at https://iat.sparcs-community.eu/.

1. Interviews performed by EI-JKU;
2. Brainstorming of potential technical solutions between RINA-C+EI-JKU+BOREALIS;
3. High level analysis of feasibility;
4. Discussion of outcomes;
5. Realization of the full feasibility study.

The methodology implemented for the feasibility study was based on two scenarios: winter (building heating via DHN) and summer (building cooling via DHN).

Winter scenario:

- Information regarding the DHN energy demand and consumption pattern was gathered by desk research and from former projects of EI-JKU.
- Same procedure for gathering information on the power plants that supply the DHN, in particular for the nearby Linz-Mitte power plant, of which the main fuels were investigated.
- Selection of suitable waste heat point sources.
- Calculation of the energy available from waste heat in winter (considering a supply time of 5 months).
- Desk research on available technologies, investment costs (CAPEX, Capital Expenditure) and energy efficiencies.
- High level design and calculation of a suitable connection for the waste heat stream to the pre-existing DHN (also called “expansion of DHN”).
- Calculation of the energy supplied by the waste heat sources to the DHN and the remaining/current energy supplied to the DHN by the power plant.
- Desk research on energy prices at the consumer level in Linz/Austria and estimation of specific operational cost of Linz Mitte power plant.
- For payback period (PBP) calculation the initial investment, operational cost directly connected to the waste heat feed-in and estimated OPEX (Operational Expenditure) of Linz Mitte were assumed, maintenance cost, interest rates and inflation were neglected.

Summer scenario:

- Same waste heat sources as for winter scenario, no additional investments for feed-in. Feed-in period is extended.
- Calculating the energy available by waste heat in summer (considering 56 summer days). The temperature the waste heat streams are cooled down to was estimated with 90 °C.
- Considering the main cooling demand in Linz have public buildings, information on the number, average size and energy demand of such buildings was determined.
- For the conversion of heat-to-cold, absorption chillers were chosen. Based on energy efficiency data and information on public buildings, the total energy demand was calculated.

- The investment, operational and maintenance costs of the decentral absorption chillers were excluded from PBP calculation as these costs were allocated to the heat/cold consumers.
- PBP has been calculated as before, however, the summer scenario was taken as an add on to the winter scenario.

2.3.2 Methodology for the feasibility study for Ennshafen

Regarding Ennshafen, the approach followed was:

1. Interviews with the companies by EI-JKU
2. Idea proposition by ENNSHAFEN + EI-JKU
3. Realisation of the studies and their presentation to the companies

In Ennshafen, four feasibility studies were performed to evaluate the possible JEPs. We are going to present here only the ones related to the JEP in Table 2 that, indeed, were done using the same method. The evaluation of the potential for the installation of PV power plants is done by use of a PESTEL analysis. The analysis is a model for an external environment analysis. The analysis lists the factors of the individual categories that can have an impact on the examined unit. It is often used by companies to examine a market and market opportunities. Following, the factors included for the analysis:

- **Socio-cultural factors** are values, lifestyle, demographic influences, income distribution, education, population growth, security.
- **Technological factors** include the technology itself, research, new products and processes, product life cycles, government research expenditure.
- **Economic factors** are microeconomic feasibility, and eventually macroeconomic factors like availability of resources, unemployment, etc.
- **Political factors** include competition supervision, legislation, political stability, tax guidelines, trade barriers, security requirements and subsidies.
- **Legal factors**, which focus particularly on legal aspects, can be integrated into the political factors, but can also be listed as an extra factor for better breakdown.
- **Environment factors** are values such as waste disposal, emission regulations or the removal of contaminated sites or the effects of the ozone hole and global warming.

Regarding E-mobility, the evaluation of the potential for the instalment of EV charging points was done by carrying out a PESTEL analysis too. The analysis focused on the comparison between AC and DC (fast-) charging points with variable input parameters.

2.3.3 Methodology for the feasibility study for Okamika

Regarding Okamika, two projects were analyzed: *Collaborative photovoltaic power plant* and *Small hydroelectric plant*.

The methodology used for the calculation of the study related to *Collaborative photovoltaic power plant* is based on the implementation of hourly energy balances for the PV production and self-consumption within the different companies in the industrial park. Electricity produced in the installations on different roofs is self-consumed if there is electricity demand, and the surplus in each hour is sold to the grid. The methodology used for the calculation of the study related to *Collaborative photovoltaic power plant* is based on the implementation of hourly energy balances for the PV production. Electricity produced is self-consumed if there is electricity demand, and the surplus in each hour is sold to the grid. The basic steps have been, in the first place, to obtain the hourly consumption of the 8760 hours of the year 2019 for the companies that entered the analysis. Then, the second step consisted in obtaining the irradiance data on the roofs of the halls where these companies are located. Then, by knowing the annual hourly consumption and the annual hourly production, the parameters mentioned above, self-consumption, surpluses and network consumption on an hourly basis can be obtained. Based on the knowledge of the annual hourly consumption and the annual hourly production, it is possible to obtain the parameters mentioned above, self-consumption, surpluses and network consumption on an hourly basis. From these results, the economic analysis started by using several economic factors. The analysis was done for a time period of 25 years as this is the average life span of these systems. The power to be installed was analyzed with the objective of making the project economically viable in the time that the installation can be used. Results from this analysis have been published in the deliverable and also a scientific paper[4].

Regarding the environmental impact evaluation, the study has analyzed through LCA the impact of the PV installation main components (PV panels, inverters, mounting system) and the avoided impact from the PV electricity generation as substitute of the power generated for the Spanish electricity network.

The methodology used for the calculation of the study related to *Small hydroelectric plant* has started from topographic data gathered on site (especially relevant the height) as well as typical hydrological data, which were retrieved from the URA agency (Basque Government). Based on such data an analysis of the current power demand was performed on the companies within the park to identify suitable modes of use. In this sense the final step was represented by the choice of the suitable equipment (turbine) and definition of its characteristics. In parallel, an economic analysis was performed on the identified equipment and design which took into account the initial investment costs, annual costs and possible revenues for operating the system in order to evaluate the economic viability.

[4] Pedrero, J.; Hernández, P.; Martínez, Á. Economic Evaluation of PV Installations for Self-Consumption in Industrial Parks. Energies 2021, 14, 728. https://doi.org/10.3390/en14030728

2.3.4 Methodology for the feasibility study for Bildosola

For the methodology of the feasibility study on Public LED lighting, the park manager, with the goal of creating value by leveraging greater bargaining power in purchasing the necessary materials and infrastructure and managing the lighting in the park, have carried out the following activities:

- Market exploration for cutting-edge solutions;
- Consultancy services for providing and organizing networking and engaging activities aimed at achieving an enhanced greater cooperation with the town hall to which the park belongs;
- Selection of equipment suppliers for the supply of materials such as LED lighting and infrastructures such as pipes.

Regarding the technical analysis of the feasibility of the *hydroelectric power plant*, it has started from topographic data gathered on site (especially relevant the height) as well as typical hydrological data, which were retrieved from the URA agency (Basque Government). Based on these data an analysis of the current power demand was performed on the companies within the park to identify suitable modes of use. In this sense the final step was represented by the choice of the suitable equipment (turbine) and definition of its characteristics. In parallel, an economic analysis was performed on the identified equipment and design which took into account the initial investment costs, annual costs and possible revenues for operating the system in order to evaluate the economic viability.

2.3.5 Methodology for the feasibility study for Ponte a Egola

In Ponte a Egola, two JEPs were evaluated: *Combined Heat and Power plant* and *Anaerobic codigestor*.

In the final project three CHP plants will be installed and this, basically, due to the technical needs and availability of the industrial actors: one in Cuoiodepur and another energy intensive company and the third one in the old (industrial area heating) TLR part that will be managed by a third energy partner (EP). The EP was already identified, and it is currently discussing about the agreement and the return rates of the investments. The energy intensive company is a company that produces fertilizers from the solid waste of the tanneries, and it is willing to join the project, because this company has a need for large amounts of electricity, but not for a large amount of thermal energy. So, the thermal energy of both, if produced by CHP, could be exploited by the tanneries.

Regarding the anaerobic codigestion of vegetable tannery sludge, the potential of this energy opportunity is internally assessed by Cuoiodepur, considering its energy consumption and the tanneries' one. The technical estimation is carried out by using the following data:

- The thermal and electrical requirements of Cuoiodepur;
- The thermal and electrical requirements of tanneries in Ponte ad Egola industrial park;
- The results of the project META (promoted by the EU and Tuscany) for the performance of anaerobic digestion, on the energy recovery and material recycling of sewage sludge produced by the two plants of the Tuscan leather industrial area. The results of the tests carried out with the experimental anaerobic digesters were used for designing the project of the anaerobic digestor and estimating the biogas production.

The economic estimation was carried out with already existing internal knowledge and experience, by using the average price of energy and disposal of sludge from Cuoiodepur and solid wastes of tanneries. The time necessary to implement the actions and the overall costs is estimated with other infrastructures built in the previous years.

3 Data requirements and procedures for replicability

The aim of this section is, starting from the S-PARCS partners' experience, to provide a standard procedure for the identification and assessment of JEPs. The procedure is also integrated with some recommendation on confidential data management.

3.1 Description of procedures for negotiating and identifying joint energy solutions

From what we have seen in the S-PARCS project, the process for identifying Joint Energy Solutions can be very different, based on the different characteristics of an industrial park. In fact, this is what happened in the different industrial parks in S-PARCS. The first step, in any case, is collecting information both for evaluating the different solutions and for involving in the process the different stakeholders. Trying to categorize the options for the selection of the most interesting energy cooperation solutions for a specific industrial park, following what we have seen in Chapter 2.1, the selection process can be carried out by assuming three different approaches:

- Technical studies carried out by park managers (top-down approach);
- Collection of needs from the companies located in the industrial park (bottom-up approach);
- Interaction between park managers and companies (mixed approach).

The first option was followed by Ponte a Egola industrial park. The reasons that led to this approach are related to the homogeneity of the companies in terms of productive process and/or their energy needs or good knowledge of companies' energy needs, and the leading role of the park managers that have the ability and authority to identify and manage JEPs. In this case a proposal was made by a preliminary identification of needs, based on the choices made by the park manager or the energy advisor in charge of the selection of JEPs. The pre-feasibility study was done on the proposals and then presented to the stakeholders. We can define this approach as top-down, because of the verticality by which the process of selection was developed.

The second case was followed basically in Okamika and Bildosola-Artea areas, where companies were invited to show their ideas in dedicated events. In this case, a high heterogeneity of companies in terms of productive process and their energy needs requires efforts to match different interests by maximizing the potential benefits associated with the implementation of energy cooperation solutions and avoiding unbeneficial outcomes. In this case, the pre-feasibility studies were done on the needs expressed by the stakeholders, met before any technical analysis. We can define this approach as bottom-up, because, ideally, information comes from the bottom level, the companies' one. Additionally to these two options, there is also a mixed approach that might be more suitable in many cases. The one adopted by Chemiepark Linz is an example of such an approach, because the research institute involved in the S-PARCS project (that can be substituted by a consultancy company or a facilitator) has identified the most energy intense companies at chemical park Linz, doing an initial pre-screening of companies and organizations to engage for the implementation of cooperative solutions. Then, representatives of these companies were interviewed to learn about their core business, energy consumption patterns, etc. and, based on the interview results, tailor-made energy cooperation opportunities were identified and developed by the research institute and a roadmap was drafted and presented to the companies, with pre-feasibility studies carried out to help the discussion for achieving a common agreement.

In Figure 2, a scheme synthetizes the possible options as briefly illustrated. The mixed approach is identified as a compromise between the two other approaches, where the collection of needs from companies and the involvement of stakeholders and pre-feasibility studies are available to interchange their roles and precedence.

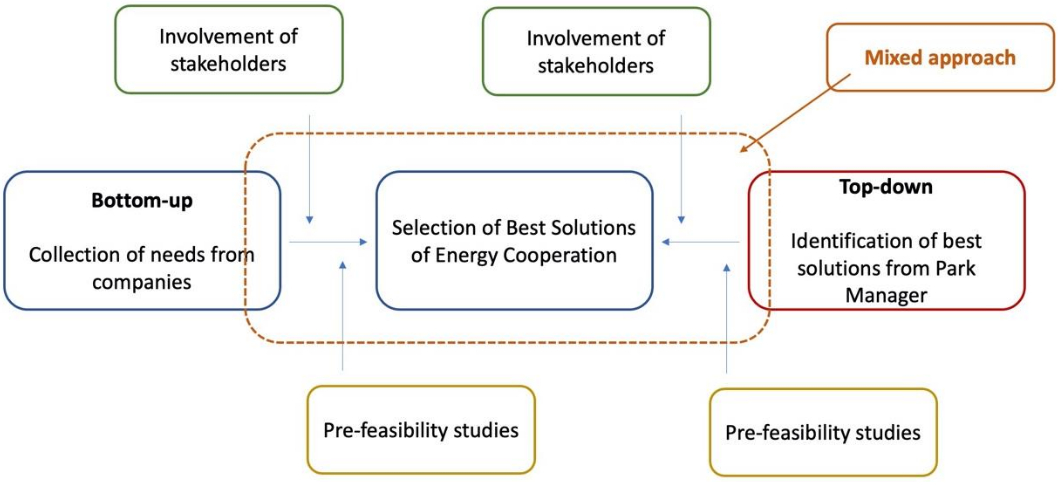

Figure 2: Three possible approaches for reaching best solutions of energy cooperation, from S-PARCS experience.

3.2 Description of data required for selection of joint energy solutions and assessing their feasibility

Generally, different types of data have to be collected for assessing and selecting energy cooperation solutions. Following what we have seen in Chapter 2.3 and the previously distinction between bottom-up and top-down processes, Table 3 classifies the information needed into two macro-areas: technological and non-technological. Regarding the three approaches (bottom-up, top-down and mixed, see Figure 2), we want to clarify here that we intend all the information to be used when needed, for every approach. The following table, therefore doesn't make a distinction between the three approaches because all the information could be useful for who manages the process.

Within non-technical info, we highlight the three pillars of sustainability: economic, social and environmental.

Table 3: Technological and non-technological info required

Technological info (and eventually related methods)	Non-technological info (and eventually related methods)
Overall energy consumption of the park	**Economic**
Desk research on available technologies[5]	Desk research on investment costs (CAPEX, Capital Expenditure) and energy costs
Topographic data gathered on site	Market exploration results for cutting-edge solutions
Results from previous experiments or tests of selected solutions	Business plan (estimated revenues and costs of the future solutions)
Estimations (regarding time) based on previous project construction	**Social**
Preferred technological options	***Tangible* factors:** demographic influences, income distribution, education, population growth, unemployment data.
	***Intangible* factors:** values, lifestyle, antropological beliefs, security.
	Contextual: supervision, legislation, political stability, tax guidelines, trade barriers, security requirements and subsidies, legal aspects.
	Environmental
	Data regarding environmental aspects, such as waste disposal, emission regulations or the removal of contaminated sites or the effects of the ozone hole and global warming.
	Specific methods: Life Cycle Assessments or Life Cycle Costing Analysis.

[5] For more information, please refer to Deliverable 1.1 on the possible solutions for energy cooperation.

Regarding the methodology of collection of data, in this paragraph it is important to highlight that a single step collection is probably insufficient. We suggest to implementing a monitoring system of the data that is constant in time and fix periods of reporting. Then, as suggested by the experience of Chemiepark Linz, there could be the necessity, while doing the pre-feasibility studies, of drafting more than one hypothesis (i.e. one for winter and one for summer seasons).

Then, the process exposed above, a point that for sure is crucial is the initial status of the industrial park involved. A park willing to replicate one of the different three approach, should have an initial assessment and, based on this, decide how to start collecting and analyzing its data. The suggested monitoring system could help in verifying the effectiveness of the implemented solution and to improve the selection of future solutions with a view to continuous improvement.

3.3 Provision of recommendation on confidential data management and Confidentiality clause

Energy cooperation between companies in an industrial park may have as its object the sharing of services and/or infrastructures, with respect to which it is necessary to stipulate contractual agreements in writing, within which aspects related to the shared management of these services and/or infrastructure are regulated. These aspects are detailed in the *Deliverable 2.3 "Guidance on contractual issues for joint services and energy cooperation"*.

In particular, the types of services and infrastructures that can be shared are manifold and may concern aspects other than energy in the strictest sense. The complete inventory of possible cooperative solutions is contained and described within *D1.1. "S-PARCS Solutions Inventory"*.

By way of example, the following services are examples of shared services: the common energy control activity, the common design of high energy efficiency buildings, the treatment and enhancement of common waste water, as well as the activities of industrial symbiosis (such solutions belong to the category called "Managerial actions" described in Section 3.4 of D.1.1); the joint purchase of electricity, the joint purchase of energy carriers (gas, fuel and wood), as well as the joint purchase of raw materials (these solutions belong to the category called "Contractual instruments", described in Section 3.5 of D.1.1).

With regard to infrastructure sharing, the following solutions are examples: the installation of renewable energy sources (RES) systems, the installation of district heating or cooling networks for the Park premises, as well as the installation of joint heat for heating a district using Power to Heat (these solutions belong to the category called "Infrastructures and energy installations", described in Section 3.1 of D1.1); the creation of a smart grid within the Park premises, the joint purchase of monitoring equipment, as well as the use of shared central servers (these solutions belong to the category called "Information and Communication Technologies (ICTs)" described in Section 3.2 of D1.1); the use of a common fleet for employees to reach the park (e.g. buses) and the purchase of joint electric vehicles/H2-based fleet, but also more efficient logistics solutions, such as the construction of shared office buildings (these solutions belong to the "Logistics and Mobility" category described in Section 3.3 of D1.1).

Table 4: Examples of solutions for sharing services and/or infrastructures

Examples of solutions for sharing services and/or infrastructures	
Example of Service sharing solutions	**Example of Infrastructure Sharing Solutions**
Managerial Action	Infrastructures and energy installations
Common energy control activity	Installation of renewable energy sources (RES) systems
Common design of high energy efficiency buildings	Installation of district heating or cooling networks for the Park premises
Treatment and enhancement of common waste water	Installation of joint heat for heating a district using Power to Heat
Industrial symbiosis	Information and Communication Technologies (ICTs)
Contractual instruments	Creation of a smart grid within the Park premises
Joint purchase of electricity	Joint purchase of monitoring equipment
Joint purchase of energy carriers (gas, fuel and wood)	Shared central servers
Joint purchase of raw materials	Logistics and Mobility
	Use of a common fleet for employees to reach the park (e.g. buses)
	Purchase of joint electric vehicles / H2-based fleet
	Construction of shared office buildings

It is important to underline that sharing a service does not necessarily imply the sharing of an infrastructure or a plant. In the event that the sharing of a service is related to the sharing of an infrastructure, the contractual agreements that will be signed by the parties must provide specific rules on both aspects; on the contrary, the case in point relating to the sharing of an infrastructure generally also accompanies the sharing of the service that is generated thanks to that same infrastructure. Therefore, in the latter case, the contractual discipline provided for by the agreements of the parties will have to take into account the aspects of both cases.

The drafting of contractual agreements for the sharing and management of services and/or infrastructures may require the need to have information and data considered sensitive by the companies in the park (e.g. data concerning their production cycles, and in particular water consumption and electricity) and this represents one of the problems most felt by the companies of an industrial park with respect to the possible cooperation activity for energy efficiency solutions, as they believe that the sharing of energy data could provide a possible competitive advantage to competing companies belonging to the Park.

In this regard, the information and lessons learned from the lighthouse parks include that relating to the importance of using “confidentiality agreements” or “confidentiality clauses” for sharing sensitive data between companies belonging to an industrial park.

In particular, the “confidentiality agreement” stands as a separate contract from any other agreements and is generally drafted in advance of the actual negotiation. Otherwise, the “confidentiality clause” is a clause that can be inserted directly into the contract that is the basis of energy cooperation (contract for the sharing of services and/or infrastructures).

Thanks to the “confidentiality clause”, it is possible to impose on the counterparty, or counterparties, the obligation of secrecy in relation to the acquisition and processing of data and information deemed sensitive. This protects the various companies signing the agreement from sharing data relating to their energy consumption.

Within the confidentiality clause it is important to clearly and unambiguously identify what knowledge you have an interest in keeping secret; in this regard there are some possibilities: a) to provide within the contract an analytical and detailed list of the knowledge on which you want to keep the secret; b) postpone the precise identification of such knowledge/information to the technical annexes of the contract; c) provide that confidential information is identified, both in the initial phase and during the course of the relationship, by means of specific indications materially affixed to documents, support material or in the communication of transmission of the same; d) provide for categories of knowledge that constitute confidential information (with the risk, however, of falling into generic forecasts).

The clause must expressly provide for the prohibition for the party receiving the confidential information to disclose it, as well as to use it for purposes other than those permitted by the contract. In addition, the duty to return or destroy the secret information received once the contract is terminated for the natural expiry of the agreed term must be provided, as well as for further cases in which the main operation no longer has any practical use. Finally, it is necessary to extend the obligation also to any persons connected to the counterpart, such as employees, collaborators, associated, affiliated or controlled companies.

The stipulation of contracts for the sharing of services and/or infrastructures that include a specific confidentiality clause within them, can be facilitated by the presence of a third party legal entity, who, as representative of the companies of the park, can effectively manage, in securely and independently, the sharing of sensitive business data, managing commercial, technical and legal aspects on behalf of the park companies. In fact, it could receive the sensitive data of individual companies in a confidential form, signing specific “confidentiality agreements” or contracts containing “confidentiality clauses” with them, preserving each company from generalized sharing with all other companies.

As described in Deliverable 2.3, this third party may have a different legal nature; in particular, three hypotheses could arise: this subject could be the park itself (as happens in many European countries in which the park owns the areas on which the production/logistic settlements of the various companies are present and directly provides for the supply, management of common services present within the park, such as: public lighting, roads, parking lots, road signs, green areas, water, electricity, railway services, port services etc.), could be a leading company located within of the park (which by virtue of its size and importance in the area, provides all other particular common services and infrastructures (e.g. roads, parking lots, railway services, etc.), or the hypothesis could arise where the park decides to be represented by a third legal entity, boasting specific stakes with respect to the same (this entity could take different on the basis of the instruments and institutes provided by the different countries; in this sense, such a subject could, for example, take on the characteristics of an “Entity”, a “Consortium”, a “Company”, but in substance, it would remain an associative and shared form between the various companies, which while delegating to the third party the competences in matters of supply and management of services and infrastructures inside the Park, would keep a more or less strong control over the same).

The different form of association between companies can affect the effectiveness of the use of the confidentiality clause. For this reason, it is important that the third party legal entity, even if it is qualified as a joint venture, does not see within it the active presence of representatives of the individual companies within the company. It is therefore important that this third-party legal entity is physically represented by individuals distinct from any representatives of individual companies; this aspect constitutes a further guarantee of the protection of the confidentiality of the companies in the Park, in order to prevent any sensitive data related to their business from being disclosed to competitors.

4 Conclusions

The document provides a resume of the S-PARCS experience regarding the process for selection and processing information collected during main activities in the project.

From what is described before, we have seen that, even if the same project umbrella, different experiences have been made in the different parks. These differences are due to several different factors:

1. Features of the companies forming the parks. It is clear that, there every park has their own specific characteristics and that no two parks are identical. Therefore, to operate in an industrial area with a high homogeneity (e.g. all companies in a park are related to the same economic sector) is totally different to operating in a heterogeneous area (e.g. companies in a park belong to different economic sectors). These effects the needs of the companies (in this case, energy needs), in the solutions to be proposed, and in the possible approaches to data/information sharing;
2. Entity that manages the park. The way a park is managed leads to different approaches in the cooperation between stakeholders, internal or external ones. There is no single "best option", but, generally, those who manage to simultaneously embrace as many different interests and communicate as much information as possible, achieve a better performance;
3. Legal Context. Every country or region has its own legal framework, which significantly impacts the replication potential of solutions. A legal pre-analysis is essential before conducting advanced technological feasibility studies;
4. Stakeholders and communities. Finally, last but not the least, to be in contact with the surrounding environment, stakeholders and local communities, is essential to propose energy solutions that fit the given framework without creating or rising already existing tensions. In this, the role of the entity that manages the park is fundamental.

Thus and based on the points described above, it is implicit that the choices made related to new energy solutions as well as the decision-making process can take many different paths, that we have tried to illustrate in Figure 2, with three opposite approaches, top-down and bottom-up and a mixed one. Given the complexity of such processes, Figure 2 can only be a simplification of reality, where putting together different interests is a complex process.

Concluding, we hope that the description done by the present document can support other industrial area or parks wanting to improve their sustainability, especially energy cooperation solutions, to overcome initial barriers, taking advantages of the process described above.