Deliverable D5.2
Report on the potential for joint energy services in industrial parks

Organisation: TECNALIA Research & Innovation
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Date (31/10/2019)

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

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Nature of the deliverable

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

This is the second deliverable under *WP5 Industrial Parks - Support for enhancing energy cooperation* which is aimed at turning the solutions and respective instruments developed in S-PARCS into real-world feasibility studies and therefore providing proofs-of-concept for their implementability, efficacy and efficiency. This deliverable describes nineteen energy cooperation opportunities in five Lighthouse Parks in Italy, Austria and Spain. Although detailed assessment of the opportunities is underway and will be subject to following confidential deliverables, it already provides estimations and meaningful information in this regard. It depicts the main barriers that the industrial parks are facing push them forward, which in addition to legal and economic factors, in many cases are linked to soft factors (limited trust, perception and behavioural issues), and outlines the next steps planned to solve them. Finally, it provides some useful transferability considerations for other industrial parks looking for benchmarks to increase energy efficiency in a cooperative manner.
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1 INTRODUCTION

This is the second deliverable under WP5 Industrial Parks - Support for enhancing energy cooperation which is aimed at turning the solutions and respective instruments developed in S-PARCS into real-world feasibility studies and therefore providing proofs-of-concept for their implementability, efficacy and efficiency. This exercise is taking place in four Lighthouse Parks that are briefly introduced in Table 1-1.

Table 1-1 S-PARCS Lighthouse parks in a nutshell

<table>
<thead>
<tr>
<th>Park</th>
<th>Country</th>
<th>Surface (sqm)</th>
<th>Nº of Companies/employees</th>
<th>Economic Activity</th>
<th>Energy highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponte a Egola</td>
<td>Italy</td>
<td>1,200,000</td>
<td>100/2,400</td>
<td>☑ Belongs to the Tuscan Leather industrial area</td>
<td>The wastewater treatment plant of the park (Cuoiodepur) is very energy intensive. It treats circa 3 mio m³/year of wastewater</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑ One of the leading industrial parks in the field of tanning at an Italian and international level</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑ Average turnover: 2.5 million euro</td>
<td></td>
</tr>
<tr>
<td>Ennshafen Port &amp; Business Park</td>
<td>Austria</td>
<td>3,530,000</td>
<td>60/2,300</td>
<td>☑ Transhipment (including heavy cargo), ☑ Services: warehousing, packaging, bunkering, etc.</td>
<td>☑ Large amounts of diesel consumption, electricity and natural gas</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑ Typical Goods: general cargo, bulk material, container, Roll-on/Roll-off, High &amp; heavy</td>
<td>☑ Waste heat from industrial processes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑ Water/Land handling: approx.700,000 tonnes/year</td>
<td>☑ Great potential for PV-installation due to huge surfaces</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Container handling: approx. 350,000 TEU/year</td>
<td>☑ 2 large-scale biomass power plants</td>
</tr>
<tr>
<td>Chemiepark Linz</td>
<td>Austria</td>
<td>1,000,000</td>
<td>35/3,500</td>
<td>☑ Chemical industry: Nitrogen, production of chemical basic products, pharmaceutical products, intermediates and fine chemicals, crop protection, compounds, plastic solutions for the</td>
<td>☑ Total energy demand: 6 TWh approx.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑ The 8 major companies are all energy intensive</td>
</tr>
<tr>
<td>Opportunity</td>
<td>Industrial Park</td>
<td>Country</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-------------</td>
<td>----------------</td>
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<td></td>
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<tr>
<td>#1 Biogas combined heat and power plant</td>
<td>Tannery district of Ponte a Egola</td>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2 Joint energy management</td>
<td>Tannery district of Ponte a Egola</td>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#3 Construction of PV modules on (large) company roofs or other areas at the Ennsafen site</td>
<td>Ennsafen</td>
<td>Austria</td>
<td></td>
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<tr>
<td>#4 Utilization of waste heat flux between relevant companies</td>
<td>Ennsafen</td>
<td>Austria</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>#5 Cooperation of companies regarding electricity and gas (supply and demand)</td>
<td>Ennsafen</td>
<td>Austria</td>
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</tr>
<tr>
<td>#6 Electrification of the power supply of anchored ships</td>
<td>Ennsafen</td>
<td>Austria</td>
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</tr>
<tr>
<td>#7 Reinforced networking of the Chemiepark Linz</td>
<td>Chemiepark Linz</td>
<td>Austria</td>
<td></td>
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</tr>
<tr>
<td>#8 Analysis of the use of the Danube as a logistics route for the Chemiepark Linz</td>
<td>Chemiepark Linz</td>
<td>Austria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#9 Analysis for future cooperation of companies regarding electricity (supply and demand) and gas (supply and demand)</td>
<td>Chemiepark Linz</td>
<td>Austria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10 Solar PV for shared self-consumption</td>
<td>Okamika-Gizaburuaga</td>
<td>Spain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#11 Small hydroelectric plant</td>
<td>Okamika-Gizaburuaga and Bildosola Artea</td>
<td>Spain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#12 LED lighting</td>
<td>Bildosola Artea</td>
<td>Spain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#13 Joint purchase of electricity</td>
<td>Okamika-Gizaburuaga and Bildosola Artea</td>
<td>Spain</td>
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</table>

Chapter 2 informs about the status of the thirteen energy cooperation opportunities listed in D5.1 (submitted in November 2018) and in Table 1-2, after a more detailed description of each of the Lighthouse Parks.
Being an exploratory process that is taking place in four Lighthouse Parks that vary in terms of not only size and economic activity, but also as regards awareness level on energy efficiency or the governance model, the exploration pathways differ in pace and intensity. Besides, as in any other exploratory process, some of the opportunities have evolved, new have emerged, while others have been abandoned. Table 1-3 lists the energy cooperation opportunities that each of the Lighthouse parks is exploring right now.

**Table 1-3 Energy cooperation opportunities that are being explored currently**

<table>
<thead>
<tr>
<th>Park</th>
<th>Energy cooperation opportunities</th>
<th>S-PARCS solution</th>
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<tr>
<td>Ponte a Egola</td>
<td>The combined heat and power plant that use biogas yielded by anaerobic co-digestion of vegetable tannery sludge</td>
<td>3.4.11.1 – Biogas production in wastewater treatment plants</td>
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<tr>
<td></td>
<td>Joint Energy Management</td>
<td>3.1.1 – Installation of Renewable Energy Sources (RES) plants / 3.3.2 – Shared charging points for electric/H2 vehicles</td>
</tr>
<tr>
<td>Ennshafen por &amp; business park</td>
<td>Shore side electricity / PV / e-mobility, LNG</td>
<td>3.1.2* - District heating-cooling solutions</td>
</tr>
<tr>
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<td>Revamping of old cooling-water sewer</td>
<td>3.4.8 – Exploitation of one plant’s by-product(s) in other plant(s) – Industrial symbiosis</td>
</tr>
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<td>Industrial microgrid for waste heat recovery</td>
<td>3.1.2.1 – District heating/cooling network between the park premises</td>
</tr>
<tr>
<td></td>
<td>District heating unit within the park</td>
<td>3.4.8 – Exploitation of one plant’s by-product(s) in other plant(s) – Industrial symbiosis</td>
</tr>
<tr>
<td></td>
<td>Steam delivery from saw mill powerplant to an animal feedstock producer</td>
<td>3.4.6 – Matching companies according to energy/material demand and production / 3.1.10 – Waste heat recovery via heat pumps and/or heat exchanger</td>
</tr>
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<td></td>
<td>Usage of steam from a thermal metal recovery plant (in 5-10 years-time)</td>
<td>3.4 – Management Actions; 3.4.1 – Common energy audits</td>
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<tr>
<td>Chemiepark Linz</td>
<td>Reinforced networking among companies</td>
<td>3.5.1 – Joint purchase of electricity; 3.2.1 – Realisation of a smart grid within the park premises</td>
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### Chapter 3: Energy Cooperation Opportunities

Chapter 3 describes the potential of the most promising energy cooperation opportunities by e.g. including estimations of the overall EE and RE generation potential (and self-consumed, if possible) and the expected economic savings. The level of detail differs across Lighthouse parks due to differences in pace and intensity of the investigations performed in each park. Besides, it depends how the opportunities are placed in the agenda of each park, as resources are limited and not all of them can be explored in parallel, and other factors like complexity, data availability, access to the right expertise, etc.

The information in this deliverable is based on the outcomes of feasibility studies in a few cases (more will follow in the next months), as well as data gathered in companies through surveys and/or interviews and intra-park meetings. Additional feasibility assessments, assessment and collaboration with similar initiatives, training workshops, networking activities among Lighthouse and Follower Parks and internal park meetings are some of the tools that the S-PARCS partners are performing to build the adequate capacities for energy cooperation planning, to safeguard that the identified opportunities identified are duly followed-up, and to foster the creation of adequate enabling conditions for their roll-out. A Public report on the feasibility studies of the most promising joint energy projects in the Lighthouse Parks (D5.4) will be delivered in Month 30, prior to the elaboration of Energy Cooperation Plans for each of the six Lighthouse Parks in Month 33.

<table>
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<tr>
<th>Future cooperation regarding electricity</th>
<th>3.1.10 – Waste heat recovery via heat pumps and/or heat exchanger</th>
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<tr>
<td>Increase of waste heat utilisation</td>
<td>3.1.2.2 – Link to already existing district heating/cooling network serving local community</td>
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<tr>
<td>Encouraging cooperation with neighbourhood outside the chemical park</td>
<td>3.1.3 – Joint investment in energy efficiency</td>
</tr>
<tr>
<td>Technological options to reduce energy losses</td>
<td>3.1.1 – Installation of Renewable Energy Sources (RES) plants</td>
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<tr>
<th>Okamika-Gizaburuaga</th>
<th>Solar PV for shared self-consumption</th>
<th>3.1.1 – Installation of Renewable Energy Sources (RES) plants</th>
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</thead>
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<tr>
<td>Small hydroelectric plant</td>
<td>3.5.1 - Joint purchase of electricity</td>
<td></td>
</tr>
<tr>
<td>Joint purchase of electricity</td>
<td>3.1.1 – Installation of Renewable Energy Sources (RES) plants</td>
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<thead>
<tr>
<th>Bildosola-Artea</th>
<th>Small hydroelectric plant</th>
<th>3.1.3 – Joint investment in energy efficiency</th>
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<td>LED lighting</td>
<td>3.5.1 - Joint purchase of electricity</td>
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<tr>
<td>Joint purchase of electricity</td>
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**Okamika-Gizaburuaga**

<table>
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<tr>
<th>Solar PV for shared self-consumption</th>
<th>3.1.1 – Installation of Renewable Energy Sources (RES) plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small hydroelectric plant</td>
<td>3.5.1 - Joint purchase of electricity</td>
</tr>
<tr>
<td>Joint purchase of electricity</td>
<td>3.1.1 – Installation of Renewable Energy Sources (RES) plants</td>
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</table>

**Bildosola-Artea**

<table>
<thead>
<tr>
<th>Small hydroelectric plant</th>
<th>3.1.3 – Joint investment in energy efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED lighting</td>
<td>3.5.1 - Joint purchase of electricity</td>
</tr>
<tr>
<td>Joint purchase of electricity</td>
<td></td>
</tr>
</tbody>
</table>
2 LIGHTHOUSE PARKS AND ENERGY COOPERATION OPPORTUNITIES

The following sub-chapters describe the status of the energy cooperation opportunities that are being explored in each of the six Lighthouse, while Chapter 2 assesses their potential by looking into technical solutions, energy potential, economic viability as well as environmental and social benefits.

2.1 Ponte a Egola Industrial Park (Italy)

2.1.1 Brief description

Ponte a Egola industrial park belongs to the Tuscan Leather industrial area, which extends in a territory of about 100,000 inhabitants across the Municipalities of Castelfranco di Sotto, Montopoli Valdarno, Santa Croce sull'Arno, Santa Maria a Monte, San Miniato, Bientina (in the province of Pisa) and Fucecchio (in the province of Florence). The Ponte a Egola industrial park is one of the leading industrial parks in the field of tanning at Italian and international level, with more than 100 companies involved. Companies are mainly small-medium family businesses, with an average number of employees and turnover 12 people and 2.5 mio Euro respectively.

The park has two key stakeholders. Cuoiodepur is a public-private consortium that includes approximately 80 companies located in the local municipality of San Miniato and some municipalities of the territory. It has been established in 1985 with the aim of managing the common infrastructures of the park and, in particular, the wastewater treatment plant of the park, which treats circa 3 mio m³/year of wastewater. In 2012, Cuoiodepur was appointed as Park Manager and, in 2015, the park was awarded as Eco-Industrial Park (EIP) by the regional Government of Tuscany, after the approval of a regional legislation for incentivising the spread of EIP in the region.

The second key stakeholder is the Consorzio Conciatori di Ponte a Egola (Ponte a Egola consortium of tanners), which represents the industrial association linked to the park. It was established in 1967 and it comprehends approximately 80 tanneries, operating as suppliers of national and international luxury fashion companies. The Consortium provides different services to the associated companies: environmental related services; representation of the category with regard to Public Administrations at all levels; promotion of the products of the associates following all those initiatives aimed at the globalization of the markets and support to the participation in exhibitions, fairs, economic missions and market research; administrative support to achieve incentives for the implementation of regulations both in the environmental field and in the prevention of accidents in the workplace. Both entities are part of the project S-PARCS, Cuoiodepur as a project partner and the Consorzio Conciatori di Ponte a Egola as project supporter formalised through a letter of support.
2.1.2 Energy cooperation opportunities

Table 2-1 Energy cooperation opportunities in Ponte a Egola

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Details and relevance</th>
</tr>
</thead>
</table>
| Combined heat and power plant | • The plant is designed to use **biogas** yielded by the anaerobic co-digestion of vegetable tannery sludge to enhance the energy supply of Cuioidepur and the companies involved and maximise the use of materials coming from vegetable tannery sludge, thus reducing the solid waste treated.  
  • The plant is planned to be located in Cuioidepur, which represents the stakeholder with the higher consumption of energy.  
  • The maximum savings that can be achieved while respecting national legislation are 7500 MWh per year that might be sold to the grid (estimation). |
| Joint energy management       | • Aims at facilitating energy conservation by monitoring energy consumption, identifying various options for saving energy (for example, through energy audits), and carrying out awareness programs, all of them aimed at implementing the option for energy savings identified.  
  • Particularly important since tanneries are mostly small-medium family businesses, which face lack of specific energy-related competencies and deal with restricted financial resources, especially for non-core activities.  
  • This solution could support tannery companies in reducing costs for energy and deal with shortage of energy-related competencies, thus encouraging the investment in cost-effective energy efficiency measures |

2.1.3 Current status

During the S-PARCS project 14 tanneries\(^1\) have been already engaged to assess and discuss the energy cooperation solutions. The expectations of the companies and the park managers are as follow:

- They consider energy cooperation as a chance to highlight the efforts of industrial park towards a low carbon economy.
- Reduction of energy costs.
- Energy autonomy in order to avoid the risks associated with the volatility of energy prices and enhance the use of potential energy inputs.

---

\(^1\) These companies represent 22% of the total shares of Cuioidepur.
A more economic and environmentally sustainable management of solid and liquid waste.

In terms of engaging activities, meetings were held and periodic communications with the companies within the park were carried out. In particular, bilateral meetings were also held with the 14 companies interested in the project to collect data and information.

Table 2-2 Current status of energy cooperation opportunities in Ponte a Egola Industrial Park

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Current status</th>
</tr>
</thead>
</table>
| Combined heat and power plant | ✓ Preliminary works were carried out in order to assess the technical and economic feasibility of the solution and its potential timeline.  
✓ Technical calculations to assess the amount of input waste to be treated daily (or yearly) and the related amount of biogas it could yield.  
✓ Calculations were also carried out to determine heat and electricity available from such amount of biogas, and the expected developments related to the energy infrastructures.  
✓ The overall process was designed and structured by defining material and energy flows.  
✓ Costs estimation and timetable planning were also developed.  
✓ Meetings and engagement activities were carried out to involve relevant stakeholders – i.e. the owner of the heating infrastructures in the industrial area of Ponte ad Egola and the technology providers. |
| Joint energy management       | ✓ Companies declared their interest in performing energy audits/energy monitoring activities having a dedicated consultant for multiples companies, in order to reduce costs and identify possible energy efficiency measures for each company.  
✓ Meetings were held with companies interested in this solution to understand how to better provide this service within the park and deal with different energy audits/energy monitoring activities in different companies. |

2.2 Ennshafen Port & Business Park (Austria)

2.2.1 Brief description

The ENNSHAFEN port, located in Enns, is the newest and most modern public port in Austria. Located in the heart of Europe, the ENNSHAFEN port is ideally linked to the most important inland ports and sea ports of the continent. The trimodal transhipment centre links the main transport routes for international cargo, the Rhine-Main-Danube waterway from West to East and the North-South railway that extends from the North Sea to the Adriatic. It serves the largest continuous industrial area on the Upper Danube. Waterways, rail and road connections
empower the port as a transport hub for goods and commodities in international logistics operations and for local businesses. Currently, it employs around 2,300 persons.

The cosmopolitan and neutral port makes its infrastructure available to all transhipping and production companies. The synergy that exists between privately owned spaces and public infrastructure investment generates unique potential for development. With the neutral location concept and the continuous involvement of our logistics partners, the ENNSHAFEN port implements forward looking projects such as “DAPhNE” (Danube Ports Network), Port Digitalisation, or “LNG – fuel of the future”.

Within the Trans-European Transport Network (TEN-T) of waterways, the ENNSHAFEN port is defined as one of two Austrian core nodes in the Rhine-Danube Corridor. These perfect conditions resulted to the construction of the first LNG petrol station for trucks in Austria. The number of refuelling is developing very satisfying. Scheduled ship refuelling is in progress.

In mid-2019, a parcel distribution center of DHL Paket (Austria) will start operating at the ENNSHAFEN port. The modern sorting technology ensures a capacity of up to 8,000 parcels per hour. About 150 jobs will be created at the site.

Due to market demand and increasing turnover, the Container Terminal Enns (CTE) is expanding. This includes additional capacity for container handling and a new gantry crane, which is scheduled to be up and running in summer 2019. The total investment is about EUR 9.5 million.

2.2.2 Energy cooperation opportunities

Table 2-3 describes the energy cooperation opportunities that came out from the first S-PARCS investigations and listed in D5.1. (submitted in November 2018).
Table 2-3 Energy cooperation opportunities in Ennshafen port & business

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Details and relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV modules on (large) company roofs or other areas at the Ennshafen site</td>
<td>Great amount of logistic buildings with potential of several 10000 m² for roof-installation, and abandoned areas for ground-installation</td>
</tr>
<tr>
<td>Utilization of waste heat flux at Ennshafen between relevant companies.</td>
<td>Surplus of heat of one company can be recovered and used for building heating for another company</td>
</tr>
<tr>
<td>Cooperation of companies regarding electricity (supply and demand) and gas (supply and demand);</td>
<td>Especially relevant for electricity, due to expected changings per 01.01.2019 in Austrian laws. This should bring more options for quicker realization of new projects.</td>
</tr>
</tbody>
</table>
| Electrification of the power supply of anchored ships | ✓ An essential topic in Europe in general to reduce air pollutants by cold ironing.  
✓ A quite promising opportunity for Ennshafen and detailed planning and investigations are underway. Convenience of a new installation is now being investigated in a feasibility study: A lot of technical details have to be clarified and several partners have to be involved (transhipment partners, vessel operators, power suppliers, maybe transforming units’ provider).  
✓ Even a combined system between electricity grid and LNG-based electricity generator is being investigated.  
✓ Possibility to combine this opportunity with PV and electricity storage in the future. |

2.2.3 Current status

The opportunities described in chapter 1.2.2 have been assessed and further developed together with EI-JKU and the companies in the park in the interview process conducted in the last months. Table 2-4 describes the opportunities that are currently being explored, which include potential mutualised services between several partners, as well as one-to-one energy cooperation services:

Table 2-4 Energy cooperation opportunities under exploration in Ennshafen Industrial Park

<table>
<thead>
<tr>
<th>Energy opportunity cooperation</th>
<th>Details and relevance</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutualised services Several partners</td>
<td>Shore side electricity/PV/electromobility for cars</td>
<td>Key to meet the decarbonizing targets for the transport industry (decrease of 36% until 2030). It includes an information point (B2B) for alternative fuelling.</td>
</tr>
</tbody>
</table>
### Revamping of old cooling-water sewer

In the context of decarbonizing targets / energy efficiency targets for cooling processes in the future - energy efficiency targets will bring more water cooling instead of electricity cooling. Detailed concept is in revision with the authorities.

<table>
<thead>
<tr>
<th>Energy opportunity</th>
<th>cooperation</th>
<th>Details and relevance</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revamping of old cooling-water sewer</td>
<td>In the context of decarbonizing targets / energy efficiency targets for cooling processes in the future - energy efficiency targets will bring more water cooling instead of electricity cooling</td>
<td>Detailed concept is in revision with the authorities</td>
<td></td>
</tr>
</tbody>
</table>

#### Energy cooperation

<table>
<thead>
<tr>
<th>Energy cooperation</th>
<th>Details and relevance</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial microgrid for waste heat recovery</td>
<td>Waste heat exchange between the companies</td>
<td>In preparation</td>
</tr>
<tr>
<td>District heating unit within the park</td>
<td>New steam supply for one additional investment of a food-oil company from existing steam boiler</td>
<td>Previous commercial feasibility (4 years old) will be revised under the new energy planning for the next decades</td>
</tr>
<tr>
<td>Steam delivery from saw mill powerplant to an animal feedstock producer</td>
<td>Steam delivery from great saw mill powerplant to a granulation / pelleting unit of an animal-feedstock producer</td>
<td>Under investigation</td>
</tr>
<tr>
<td>Usage of steam from a thermal metal recovery plant (in 5-10 years-time)</td>
<td>Strategic planning for usage of great amounts of steam (MW-range) resulting from a foreseen great thermal metal recovery plant (appr. 2025-2030). It may turn into a mutualised service.</td>
<td>EIA is work in progress</td>
</tr>
</tbody>
</table>

#### 2.3 Chemiepark Linz Industrial Park (Austria)

**2.3.1 Brief description**

Chemiepark Linz is a multi-company chemical industry park in the Austrian city Linz. 35 companies are located within its area, which covers about 1 km². The 8 major companies are all energy intensive, are primarily active in the areas of nitrogen, production of chemical basic products, pharmaceutical products, intermediates and fine chemicals, crop protection, compounds, plastic solutions for the pipe, automotive and packaging industries. Most companies in Chemiepark Linz origin from the former company Chemie Linz AG of which they were a part of previously. Chemiepark Linz considers energy cooperation as an opportunity to become more competitive in the global markets, integrate the local communities, fulfil cost
savings by joint procurement of energy and important resources and make the industrial park design more attractive to companies.

S-PARCS partner Borealis is the main company in the industrial park. At Borealis Linz, one of the corporate group’s innovation centres is located. Joint and cross-company utility management can serve as a best practice example. Extensive monitoring of industrial park’s utility provision, transport and consumption are already implemented.

### 2.3.2 Energy cooperation opportunities

The main focus of the solutions presented in this report focus on reinforced networking, which is the basis for every future energy cooperation, and future handling of waste and process heat. The decision about which of the other opportunities listed in Table 2-5 (and described in the following chapters) will be investigated further, was made during the first workshop with the major companies located in Chemiepark Linz, which was held on 7th October 2019. It turned out that all topics listed in Table 2-5 are of interest for the participating companies. However, some suggested topics from Deliverable 5.1, such as “use of the Danube as a logistics route” have been excluded from the opportunities, which will be further investigated in near future.

#### Table 2-5 Energy cooperation opportunities in Chemiepark Linz

<table>
<thead>
<tr>
<th>Energy opportunity</th>
<th>Details and relevance</th>
</tr>
</thead>
</table>
| Reinforced networking among companies within industrial parks | After the integrated company Chemie Linz AG was split up, physical cooperation persisted at Chemiepark Linz. There is good cooperation, good job distribution and an excellent basis for discussion. However, changes in companies’ ownership structures and divisions of companies influence the possibilities for further development.  
To reinforce networking among Chemiepark companies, a workshop with the major companies was held in Autumn 2019 (7th October 2019). Energy communities, common energy audits and a bi-annual meeting with an intra-park working group are some of the energy cooperation measures that will be discussed there.  
**The proposal for the formation of a chemical park energy team/ intra-park working will be discussed in the context of one of the next chemical park management board meetings (policy board); approximately in the first half of 2020.** |
| Future cooperation regarding electricity                | Due to the electricity and gas market liberalization, and due to the split of former company Chemie Linz AG, there are neither joint electricity and gas network connections nor joint electricity and gas purchase. The local operator Linz Netz GmbH, which needs to act in accordance with market regulation, operates the network. Some companies thus face higher network levels, increasing electricity costs. Therefore, joint electricity purchasing pools or microgrids may be beneficial for some companies in Chemiepark.  
Cooperation concerning gas has been excluded from the cooperation opportunities for the Chemiepark due to regulatory issues. |
### Increase of waste heat utilization

In Chemiepark Linz, waste heat is already utilized and shared in some processes. Recent analyses suggest that there is still potential left (technical & economic potential are to be examined) to efficiently increase waste heat usage. This potential could be utilized internally, but also external utilization pathways would allow reinforcing the sustainable and cascaded use of waste/surplus heat e.g. excess steam. The increase of waste heat utilization can reduce primary energy input as well as energy costs and emissions. This opportunity also includes cooling water cooperation with internal and external entities as well as waste-heat-to-cold approaches.

### Encouraging cooperation with neighbourhood outside of the chemical park

The utilization of waste heat that cannot be reused internally, may be supplied to park-external companies such as the local district heating network operator, which can supply buildings and households in the Linz area with industrial waste heat. This option allows to enhance primary energy efficiency and to generate revenues for the Chemiepark Linz at the same time.

Improving relationships with external parties can represent a profitable option since it can facilitate the development of new products, open new ventures, and seek opportunities.

### Technological options to reduce energy losses

The common steam network of Chemiepark Linz consist of different pressure levels, two of which were recently merged to reduce energy losses and increase failure safety.

During the internal workshop and the follow-up bi-annual working-group meetings, technological options will be discussed and planned. This is expected to lead to a stepwise optimisation and adjustment of the energy infrastructure at Chemiepark Linz in accordance with park development as well as (legal) barrier development.

### 2.3.3 Current status

The cooperation opportunities from Table 2-5 have been discussed in the initial workshop, which was held at the Chemiepark Linz on 7th October 2019. The workshop was organised by El-JKU and Borealis Agrolinz Melamine. All companies from the Chemiepark, who were interviewed, were invited. Except for one company, all invitees participated in the workshop.

In course of the workshop and roadmap development, some of the cooperation opportunities from Table 2-5 were expanded. However, nearly all of these (new) cooperation opportunities have to be analysed and discussed in more detail in the future. The internal working group “Energy/Utilities”, which is in preparation (see table 2-5), will define the topics of biggest interest and decide which cooperation opportunities will be analysed in more detail.
<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future cooperation regarding electricity and gas</td>
<td>The following (additional) topics were discussed the in park-internal workshop. <strong>Some companies</strong> are interested in the topics; discussions that are more detailed are needed (Chemiepark internal working group):</td>
</tr>
<tr>
<td></td>
<td>o Shared power network</td>
</tr>
<tr>
<td></td>
<td>o Energy purchase via electricity purchasing pool</td>
</tr>
<tr>
<td>Increase of waste heat utilization</td>
<td>The increase of waste and process heat utilization <em>resp. efficiency</em> was discussed during the park-internal workshop, this also includes the topic of process cooling to some extent</td>
</tr>
<tr>
<td></td>
<td>The following (partial additional) topics were discussed the in park-internal workshop. Most companies are interested in the topics; discussions that are more detailed are needed (Chemiepark internal working group):</td>
</tr>
<tr>
<td></td>
<td>o Identifying technical possibilities, external utilisation (DHN) under consideration with DHN operator</td>
</tr>
<tr>
<td></td>
<td>o Evaluation of waste-heat-to-cold applications</td>
</tr>
<tr>
<td></td>
<td>o Some companies are also interested in the shared use of a park internal cooling tower infrastructure, discussions that are more detailed are needed (Chemiepark internal working group)</td>
</tr>
<tr>
<td></td>
<td>o Consideration of the individual components of the cooling water utilization for the identification of heat recovery measures.</td>
</tr>
<tr>
<td>Encouraging cooperation with neighbourhood outside of the chemical park</td>
<td>Most companies are interested in the topics; discussions that are more detailed are needed (Chemiepark internal working group):</td>
</tr>
<tr>
<td></td>
<td>o Cooperation with neighbouring steelworks to be discussed further: revival of existing working group planned</td>
</tr>
</tbody>
</table>
Technological options to reduce energy losses

- Merging of pressure levels in common steam network: Done
  - The following additional topics were discussed in a park-internal workshop:
    - Analysis of technologies for waste heat to cold and cost-benefit evaluation of potential application scenarios
    - Controlled and coordinated operation of energy-relevant systems (generation and consumption) in compliance with operational premises

Some companies are interested in the topics; more detailed discussions are needed (Chemiepark internal working group)

2.4 Okamika – Gizaburuaga Industrial Park (Spain)

2.4.1 Brief description

The Okamikako Industrialdea S.A society was set up in 1984. In 2012, after merging with Mallabiako Industrialdea S.A. was turned into Bizkaia Sortaldeko Industrialdea S.A.. This latter society takes over the management of the Okamika Industrial Park, which means that the society is in charge of the public lighting, maintenance of the park roads, green areas, etc. Due to mixed ownership, some roads and green areas are public, so the Town Council is the owner. The shareholders of BSI are SPRILUR/Basque Government (51%), Bizkaia County Council – Azpiegiturak, S.A. (39.11%) and Gizaburuaga Town Council (9.89%).

The industrial park was built in two phases (Okamika I and Okamika II). The gross surface area is 90,683 sqm, while the built surface area is 35,937 sqm.

Companies in this park have some experience in energy cooperation. Gas and fuel are purchased jointly since 1987. Price depends on oil prices in the purchase moment. The Industrial park is the owner of the gas installation and tank, so they can change the supplier whenever they want. The Industrial park and the companies share the cost of maintenance of the installations. Companies share gas and diesel tanks with an individual metering system. Besides, in the offices building, heating gas is shared for the entire building, and cost is distributed depending on individual consumption. Companies shared a waste-water treatment plant that have been running until 2012.

Single energy efficiency/RES promotion actions (no collaboration among companies and actors in the park) include replacement of the lighting systems into LED in companies and also in the park roads. The cost of changing the lighting system in the park roads was covered by the Town Council and cut down energy consumption to a half.

Installing roof photovoltaic panels was assessed when building up the second phase of Okamika. But the idea was discarded due to the high cost.

Currently, the viability of building a new pavilion is being assessed. PV panels bearing structures are taking into consideration in this planning phase. Further details on who will take
over the installation (public authorities-SPRILUR or potential buyers/tenants) and exploit it are still to be decided.

Electricity and gas consumption are monitored monthly, while fuel consumption is monitored bi-weekly. The park does not have an internal electric grid.

### 2.4.2 Energy cooperation opportunities

A meeting with several companies on the 18th of May 2018 served to kick-start the process of exploring energy cooperation opportunities. Bilateral conversations among BSI and TECNALIA, together with visits to the park lead to the identification of several energy cooperation opportunities that were presented to the companies in that meeting.

**Table 2-7 Energy cooperation opportunities in Okamika-Gizaburuaga**

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Details and relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV for shared self-consumption</td>
<td>✅ Shared self-consumption is now allowed and current conditions make self-consumption viable (RD 244/2019).</td>
</tr>
<tr>
<td></td>
<td>✅ The RD incorporates a simplified mechanism to compensate electricity produced in excess. Currently, this solution is more profitable than grid-connected PV</td>
</tr>
<tr>
<td></td>
<td>✅ Consumers are now allowed to make use of surplus of neighbours</td>
</tr>
<tr>
<td></td>
<td>✅ Interesting grants available for self-consumption installations (Basque Energy Agency)</td>
</tr>
<tr>
<td></td>
<td>✅ Sun irradiation is smaller than in other areas, so capacity needs to be assessed.</td>
</tr>
<tr>
<td>Small hydroelectric plant</td>
<td>✅ There is a small dam located in the park. Small amounts of electricity could be produced (for the park offices building)</td>
</tr>
<tr>
<td>Joint purchase of electricity</td>
<td>✅ Although companies in this park are not large electricity consumers, some savings are possible</td>
</tr>
<tr>
<td></td>
<td>✅ Some companies switch electricity suppliers frequently (supported by energy advisors) but other not</td>
</tr>
<tr>
<td></td>
<td>✅ Possibility to join a very successful experience that is running in LV (involving many actors, including several business associations at country level)</td>
</tr>
</tbody>
</table>

### 2.4.3 Current status

The energy efficiency awareness of companies and their interest in engaging in the above listed energy cooperation opportunities has been better comprehended during the data collection phase (interviews with companies). Whenever relevant, BSI and TECNALIA has teamed up with external actors to better explore some of the opportunities. In order to
encourage companies to jointly purchase electricity, the actors engaged in a successful initiative were invited to present their experience on 10th of May 2019.

Table 2-8 Current status of energy cooperation opportunities in Okamika-Gizaburuaga

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Current status</th>
</tr>
</thead>
</table>
| Solar PV for shared self-consumption | ✓ Energy consumption is not monitored on an hourly basis (so far, it has not been incentivized/obliged). Access to hourly energy consumption data for more than one company is resulting extremely challenging. Without these data, performing feasibility assessments to decide whether such kind of installation is beneficial for the companies is not possible.  
✓ Despite the numerous efforts and time consumed by BSI and TECNALIA to obtain this information (calls, emails, interviews, awareness workshops, etc.), not enough data was obtained yet. But BSI keeps on working on that |
| Small hydroelectric plant | ✓ An energy cooperative who is looking for investment projects and an ESCO have joined BSI and TECNALIA to explore this energy cooperation opportunity.  
✓ Confidentiality agreement signed among the involved parties  
✓ Trello used to plan the work and several follow-up meetings held  
✓ Valuable information and data were gathered (ownership and licence, energy and hydrological data, network connection information, etc.)  
✓ Feasibility assessment finalised (using S-PARCS resources)  
✓ The go/no go decision is still to be taken. Depends on obtaining the exploitation licence, as well as getting public grants, or investors  
✓ Next meeting planned for 14th of November (all involved parties) |
| Joint purchase of electricity | ✓ Workshop with companies on 10th of May to present a successful initiative on joint purchase of electricity in LV. Trying to engage companies. |

2.5 Bildosola – Artea Industrial Park (Spain)

2.5.1 Brief description

The Bildosola-Artea industrial park was set up 12 years ago in a rural area, 20 km away from the highway, halfway two of the three main regional cities (45 km). The surface area is approximately 300,000 sqm. 28 companies are established in this park. The industrial park is managed by a non-profit association where all companies and two Town
Councils/municipalities are represented (Entidad de Conservación Urbanística – ECU). The ECU is deemed to be a good tool to foster energy cooperation solutions in the park.

Concerning ownership of the park infrastructure, common lighting, some roads and green areas are public and owned by the town councils. Others (mainly parking lots of the buildings) are owned by the company. But management and maintenance are assigned to the non-profit association (Entidad de Conservación Urbanística – ECU).

Services within the park include wastewater treatment, maintenance (cleaning, green areas, external lighting, roads, traffic signs, waste collection, etc.). Previous experience in energy cooperation includes joint purchase of gas and fuel since 1987, as well as the waste-water treatment plant running until 2012 (as a temporary solution until this service was arranged by other authorities). PV panel are installed on some roofs.

Electricity is the only energy flux that is monitored (monthly), and the park does not have an internal electric grid.

Grid-connected photovoltaic panels are installed on the roof of some of the buildings owned by the Industrial Park operator, and electricity generated feeds directly into the grid. Half of the panels are being paid by the Industrial Park operator. Once the investment is paid-off, the Industrial Park operator will make an offer to the owners of the plots to acquire them. The other half were paid by the Basque Energy Agency (EVE) who pays a rent to the Industrial Park.

Currently, the viability of building a new pavilion is being assessed. PV panels bearing structures are taking into consideration in this planning phase. Further details on who will take over the installation (public authorities-SPRILUR or potential buyers/tenants) and exploit it are still to be decided.

2.5.2 Energy cooperation opportunities

A meeting with several companies on the 25th of May 2018 served to kick-start the process of exploring energy cooperation opportunities. Bilateral conversations among BSI and TECNALIA, together with visits to the park lead to the identification of several energy cooperation opportunities that were presented to the companies in that meeting.

<table>
<thead>
<tr>
<th>Energy opportunity</th>
<th>cooperation</th>
<th>Details and relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small hydroelectric plant</td>
<td>✓</td>
<td>There is a small dam located in the park. Small amounts of electricity could be produced (to cover part of the electricity consumption of the park offices building)</td>
</tr>
<tr>
<td>LED lighting</td>
<td>✓</td>
<td>Changing lighting system in common-use roads has proven to save electricity cost in other parks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Being public lighting, the Town Council (Artea) is the one who pays for it. Maintenance cost is assumed by the owners (ECU).</td>
</tr>
<tr>
<td>Joint purchase of electricity</td>
<td>✓</td>
<td>Although companies in this park are not large electricity consumers, some savings are possible</td>
</tr>
</tbody>
</table>
Some companies switch electricity suppliers frequently (supported by energy advisors) but other not
Possibility to join a very successful experience that is running in LV (involving many actors, including several business associations at country level)

2.5.3 Current status

The energy efficiency awareness of companies and their interest in engaging in the above listed energy cooperation opportunities has been better comprehended during the data collection phase (interviews with companies). Whenever relevant, BSI and TECNALIA has teamed up with external actors to better explore some of the opportunities. In order to encourage companies to jointly purchase electricity, the actors engaged in a successful initiative were invited to present their experience on 17th of May 2019.

Table 2-10 Current status of energy cooperation opportunities in Bildosola-Artea

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small hydroelectric plant</td>
<td>✓An energy cooperative who is looking for investment projects and an ESCO have joined BSI and TECNALIA to explore this energy cooperation opportunity. ✓Confidentiality agreement signed among the involved parties ✓Trello used to plan the work and several follow-up meetings held ✓Valuable information and data were gathered (ownership and licence, energy and hydrological data, network connection information, etc.) ✓Feasibility assessment finalised (using S-PARCS resources) ✓The go/no go decision is still to be taken. Depends on obtaining the exploitation licence, as well as getting public grants, or investors ✓Next meeting planned for 14th of November (all involved parties)</td>
</tr>
<tr>
<td>LED lighting</td>
<td>✓Feasibility assessment elaborated ✓The owners and the park operator were the one to decide that lighting system had to be changed. They convinced the city council to perform the investment. ✓Lighting system will be changed in 2020 (paid by the Town Council)</td>
</tr>
<tr>
<td>Joint purchase of electricity</td>
<td>✓Workshop with companies on 17th of May to present a successful initiative on joint purchase of electricity in LV. Trying to engage companies.</td>
</tr>
</tbody>
</table>
3 ASSESSMENT OF THE ENERGY COOPERATION OPPORTUNITIES

3.1 Ponte a Egola Industrial Park (Italy)

3.1.1 Combined heat and power plant that use biogas yielded by anaerobic co-digestion of vegetable tannery sludge

3.1.1.1 Background

Ponte ad Egola industrial park is a homogeneous industrial area since it includes tanneries or businesses related to the tannery industry. For such companies, energy costs are not particularly relevant as compared to all their costs, and the knowledge about energy management within companies is scarce. However, tanneries are interested in fostering energy cooperation solutions. Tanneries are small-medium businesses and they are usually run and owned by families living in the territory of the industrial park. As such, they run and protect the business to ensure it can sustain the family over time. Thus, energy cooperation solutions could increase tanneries’ energy independency and limit the risks associated with energy price volatility, thus strengthening the ability of the business to sustain the family. Moreover, tanneries are supplier of national and international luxury fashion companies, which are very sensitive in guaranteeing the environmental (and social) sustainability of their products. As such, tanneries could implement energy cooperation solutions to highlight their commitment towards reducing their environmental impact and fostering a low carbon economy. When considering energy cooperation solutions directed to the common infrastructures of the park, Cuoiodepur becomes the key partner. In fact, Cuoiodepur is in charge of managing such common infrastructures and, in particular, the wastewater treatment plant of the park, which is an energy-intensive facility. Since all companies of the Ponte ad Egola industrial park pay a fee to Cuoiodepur for having their wastewater treated, energy cooperation solutions aimed at reducing Cuoiodepur’s energy consumption would affect the fee each company pays for the treating service. As such, tanneries are very much interested in fostering energy cooperation solutions at the consortium level, since a reduced energy consumption for Cuoiodepur would directly affect their wastewater fee.

The first energy cooperation solution regards the development of a combined heat and power plant that uses biogas. Such plant is planned to use biogas (and further biomethane) yielded by the anaerobic digestion of sludge (from Cuoiodepur) and solid wastes (from tanneries) to produce heat and electricity for companies within the industrial park and for the wastewater treatment plant managed by Cuoiodepur. The plant is planned to be set up in Cuoiodepur, which represents the partner with the higher consumption of energy. The transport of heat and electricity from Cuoiodepur to the Ponte ad Egola industrial area would result in minimum dispersion, since the distance is less than 1 Km as the crow flies (Figure 3-1).
The **combined heat and power plant** using **biogas** is planned to be connected to already existing infrastructures – in terms of district heating pipelines – to transport heat from Cuoiodepur to tanneries. Such infrastructures are already connected to a combined heat and power facility placed in the middle of the industrial park, in the sub-area called “Romaiano” as shown in Figure 3-2. The facility is not running nowadays, but the owner has been involved in the project as key stakeholder, together with the technology providers. The tanneries involved in the project are the ones in the Romaiano area, since they are the most energy-intensive companies in the industrial area, and they can benefit from the presence of already-built district heating pipelines. The electricity produced will be used by Cuoiodepur and, if exceeding, put into the national grid. This energy opportunity requires high investment costs. Therefore, possible financing sources and incentives are currently under evaluation.

**Figure 3-2 Location of existing district heating system in Romaiano (sub-area of Ponte a Egola industrial park)**
3.1.1.2 Methods used to assess the potential of the energy cooperation opportunity

The potential of this energy opportunity is internally assessed by Cuoiodepur, considering its 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 (POR CReO FESR 2007-2013 promoted by the EU and Tuscany) for the performance of anaerobic digestion.

The research project META (ended in 2014) dealt with energy recovery and material recycling of sewage sludge produced by the two plants of the Tuscan leather industrial area: Consorzio Aquarno and Consorzio Cuoiodepur. The project experimentally examined a chain of energy recovery based on anaerobic digestion of sludge treatments. The results of test with the experimental anaerobic digesters (150L and 5 m3) were used for designing the project of the anaerobic digestor and estimating the biogas production.

The economic estimation is carried out by using the average price of energy and disposal of sludge from Cuoiodepur and solid wastes of tanneries and the internal knowledge and experience (Cuoiodepur and experts affiliated). The time necessary to implement the action and the overall costs is estimated with other infrastructures built in the previous years.

3.1.1.3 Possible technical solutions

Due to the different infrastructures that need to be integrated and built and considering the actual configuration (Figure 3-3), the project is planned to be implemented in three steps as represented in Figure 3-4. The first step includes the development of the combined heat and power plant, which would use gas from the national grid for Cuoiodepur’s internal consumption. The second step comprehends the connection of the combined heat and power plant to the district heating system already existing, for providing heat to the Ponte ad Egola industrial park. The third step includes the development of the anaerobic digestor, which produces biogas and is planned to be connected to the combined heat and power plant.

Figure 3-3 Actual configuration of Cuoiodepur facilities and its energy supply system
Figure 3-4 Three step-implementation process of the energy cooperation solution regarding the combined heat and power plant that use biogas yielded by anaerobic co-digestion of vegetable tannery sludge.
3.1.1.4 Economic viability
The first estimation on the overall investment is about 30 million of euros and the average time to implement the project is 33 months. Potential savings at the consortium level are planned to be used to reduce waste treatment fee for each company in order to share the economic benefit with all companies located in the industrial area.

3.1.1.5 Environmental and social benefits
Environmental benefits result from the use of biogas instead of traditional fossil fuels. Biogas is carbon neutral in terms of CO₂ released when burnt as compared to natural gas, it is the result of anaerobic co-digestion that increases the efficiency in the use of resources coming from waste, and it yields biomethane, whose treatment allows to recover sulphur. Additional environmental benefits derive from the use of digestate as fertilizer instead of traditional fertilizers. Social benefits refer to the enhanced ability of the businesses in the area to be less subjected to energy price volatility and to be depicted as non-sustainable, which strengthen their running in the long-term. This, in turn, ensures job and income for people living in the territory. In addition, a reduced environmental impact from industrial activities leads to a higher quality of the environment, with benefits for human health and long-term wellbeing.

3.1.2 Joint energy management

3.1.2.1 Background
As previously described, Ponte ad Egola industrial park is a homogeneous industrial area since it includes tanneries or businesses related to the tannery industry. For such companies, energy costs are not particularly relevant as compared to all their costs, and the knowledge about energy management within companies is scarce. However, tanneries are still interested in fostering energy cooperation solutions. Since tanneries are mostly small-medium family businesses, they usually tend to use their financial resources for core investments, in order to concentrate their efforts and ensure that the business runs and will run well to sustain the family. The trade-off between core and energy-related investment is usually solved in favour of the former, since energy costs are not considered do not has a strong impact in the company’s cost structure. In addition, the knowledge about energy management within tanneries is scarce, which further impairs the spreading of energy efficiency measures. Thus, energy cooperation solutions that consider a joint effort among companies in the park could represent an interesting opportunity, to ensure the concentration of financial resources on core investments without completely overlooking energy-related ones, as well as to increase the awareness of energy efficiency measures across companies and the possibility of developing them.

The second energy cooperation solution regards joint energy management. Such joint management allows the performing of joint efforts in terms of energy audits/energy monitoring activities, in order to reduce costs and identify possible energy efficiency measures for each tannery or multiple tanneries. In particular, a specialised consulting company is planned to act as a unique and dedicated consultant for tanneries that want to implement energy audits/energy monitoring activities and, eventually, energy efficiency measures. Such consulting company can thus tailor proposals, and foster energy efficiency measures within
and across tanneries, especially when considering that each tannery has its own heating system based on natural gas and that most of them do not use renewable sources for electricity production but only the electricity coming from the grid.

### 3.1.2.2 Methods used to assess the potential of the energy cooperation opportunity

The feasibility assessment of this energy cooperation opportunity is carried out by a specialised consulting company in collaboration with Cuioidepur. The technical estimation is developed by grounding on the thermal and electrical requirements of tanneries in Ponte ad Egola industrial park. The specialised consulting company also develops Key Performance Indicators (KPI) to monitor the performance of the energy saving activities implemented.

The economic estimation is carried out by the specialised consulting company in collaboration with Cuioidepur, using the average price of energy from tanneries. Costs are related to the different energy saving activities that can potentially be implemented within each tannery or across tanneries.

### 3.1.2.3 Possible technical solutions

This energy cooperation opportunity is developed by using a modular approach. The specialised consulting company develops different proposals of energy audits/energy monitoring activities, ranging from basic energy monitoring to overall audit with KPI, building-related information and potential avenues for energy efficiency deployments in cooperation with proximal companies. Even though each tannery can decide autonomously if the proposal is to be accepted and which services are to be included, the joint efforts of multiple tanneries and the joint management of the specialised consulting company allows to reduce costs and increase the odds of implementing energy efficiency measures in the industrial area.

### 3.1.2.4 Energy potential

Cuioidepur has the highest consumption and energy costs as compared with all tanneries. It thus represents the easiest target for energy savings activities, with a lot of reduction potential. Despite that, this energy cooperation opportunity is mainly directed towards tanneries, which could significantly reduce their energy consumption since they pay little attention to energy matters and experience high variability of energy costs across similar companies.

### 3.1.2.5 Economic viability

The investment and maintenance costs associated with this energy opportunity are estimated by a specialised consulting company in collaboration with Cuioidepur. Such consulting company develops the modular approach also in terms of costs: the heavier the changes that need to be carried out for energy efficiency activities, the higher the costs that need to be sustained.

The companies of the industrial area of Ponte ad Egola were categorized in three groups:

1) Energy consumption <200 TEP (small companies)
2) Energy consumption in the range between 200 and 500 TEP (medium companies)
3) Energy Consumption >500 TEP (large companies)
Moreover, it will apply a discount that will be proportional to the number of companies requesting the energy audit (that in the case of >45 companies was 65% of the original price). The consulting company carrying out energy audits will provide an “energy consumption model” for each company.

3.1.2.6 Environmental and social benefits

Environmental benefits result from the reduction of fossil fuels in the production of both heat and electricity thanks to the potential energy efficiency measures detected by energy audits. In the first case, environmental benefits would be directly related to a local environmental benefit, with less polluting emission in the area due to less natural gas combustion. In the second case, it would be a reduction of pollution at the regional/national level, which still provides the advantage of presenting the Ponte ad Egola industrial area as more environmentally friendly. Social benefits refer to the enhanced ability of the businesses in the area to be less subjected to energy price volatility and to be depicted as non-sustainable, which strengthen their running in the long-term. As previously reported, this ensures job and income for people living in the territory, and the potential creation of new jobs related to the energy developments – e.g. maintenance of energy meters, management of energy cooperative solutions across companies, etc. In addition, a reduced environmental impact from industrial activities leads to a higher quality of the environment, with benefits for human health and long-term wellbeing.

3.2 Ennshafen Port & Business Park (Austria)

The assessment of the energy cooperation opportunities is underway. Below the first findings for two of them. Outcomes of further investigations will be brought into the next WP5 deliverables.

3.2.1 Shore side electricity / PV / E-mobility

3.2.1.1 Background

We are acknowledging great developments regarding loading stations for E-vehicles in the port and business park in order to fulfill the upcoming needs of the European and Austrian climate strategy regarding Target 2030/2050. This means not only road vehicles but much more heavy-duty vehicles and especially waterway vessels. Ambitious targets are being established at different geographical levels, including the TEN-T regulation at EU level which have to be fulfilled in the next decade. This means a broad approach for loading stations with supplies ranging from 11 kW to 1200 kW supply (for vessels). Therefore, a comprehensive and combined paying and supplying system should be developed for all the different users in involved. The system shall be investigated in combination with on the spot production of PV-electricity, as high-power solutions are necessary.
This includes the set-up of an information point (B2B) for alternative fueling: Electromobility in heavy duty transport hotspot (LNG, electro, H2, etc. – directly on the spot, giving practical examples, safety items, products in use, etc.)

3.2.1.2 Methods used to assess the potential of the energy cooperation opportunity

A working group in collaboration with the port, electricity providers, users and possible system partners (business part / paying system) is investigating all relevant topics and taking the first steps of general feasibility studies (should be a system compatible to whole Austria). The general schedule is to have this first step ready by the end of 2019. The second step should be a more detailed feasibility study for the port & business park Ennshafen itself (with the mentioned partners) in connection with the master plan of step 1 in order to prepare the technical realisation.

3.2.1.3 Possible technical solutions

The identification of the most suitable technical solution is underway, and more details will be available by the end of 2019. Grid-based electricity with high power transforming units maybe combined with booster systems (like PV or LNG cogeneration of electricity and heat are investigated) is the likely technical solution.

3.2.1.4 Energy potential

The energy demand will reach several MW, but the demand hours will start with low figures > business model is a great challenge

3.2.1.5 Economic viability

Exact figures are not available now, but rough estimations and general experience shows that that the business model will be a great challenge.

3.2.1.6 Environmental and social benefits

Not calculated yet – necessity derived from new regulations

3.2.2 Revamping of old cooling-water sewer

3.2.2.1 Background

Industrial energy systems and cooperation grids between different plants need also a delivery system for surplus (even temporary surplus) of energy and low level energy streams to a rest cooling unit or a sewer; in former times a huge and comprehensive cooling sewer system (planned for a great chemical site) was built in Ennshafen; over the last decades this system has been changed in several steps regarding the written permissions of relevant authorities.
Currently, several companies in the park are evaluating the idea of reorganising the old system in alignment with planned investments and energy related activities for the next years. A consensus exists that with upcoming stricter regulations regarding energy efficiency and changes in electricity (future prizing systems, decarbonizing taxes, etc.) even cooling by water may be necessary in the future. Therefore, the old combined system shall be restructured.

3.2.2.2 Methods used to assess the potential of the energy cooperation opportunity
Written permissions of authority papers and multiuser contracts of the users.

3.2.2.3 Possible technical solutions
Updated authority permission paper with new limits for the future, perhaps some revamping actions of parts of the sewer system.

3.2.2.4 Energy potential
Not available yet.

3.2.2.5 Economic viability
Not available yet.

3.2.2.6 Environmental and social benefits
Not available yet.

3.3 Chemiepark Linz Industrial Park (Austria)

3.3.1 Reinforced networking among companies within industrial parks

3.3.1.1 Background
The companies in the Chemiepark were part of a one, large company three decades ago. When the company was split up, a distribution of competences, also in terms of energy and energy-related utilities began. This distribution of competences led to scattered information and made it more difficult for alternating owners to maintain operational contacts. There is still good cooperation between the companies in the Chemiepark regarding energy and resource topics, but according to the interviewed companies, it could be improved by increased networking with a focus on tackling energy issues together.

To keep and optimize the status of the Chemiepark energy and utility network, it is necessary to maintain and reinforce the park internal networking activities. This is best achieved through regular, institutionalized meetings that gather the relevant persons of the different companies. The convenience of setting up a park-internal working group that meets regularly and whereby all companies located in the park are represented, was discussed in the first workshop on 7th October 2019. All participants were interested in setting up a working group “Energy/Utilities”, the first regular meeting and its agenda are to be discussed. (see table 2-5)
The convenience of taking up and reinforcing cooperation with the local district heating system company and the neighboring steel production plant from voestalpine has already been considered. Since the situation changes frequently, e.g. as a result of market developments, it seems highly relevant that the companies in the Chemiepark also have regular contact with these two external companies. A working group was/is existent, but the contact could be intensified.

As already explained, the Chemiepark is an exceptional case among the parks considered in S-PARCS due to the total energy consumption, its history and the size of the resident companies. A transfer of best practices of the other S-PARCS lighthouse parks to the Chemiepark does not seem possible, as cooperation and data collection are already very advanced. Therefore, it seems appropriate to consider project-external parks of similar size or core business. Other chemical parks in Europe are suitable for an exchange of best practices and mutual learning.

In short:

Chemiepark Linz already has, based on its history, an integrative network, where many resources are shared. The aim is to maintain and improve the physical/technical and social network. This affords both, technical innovations/investments but also social networking and meetings of the Chemiepark Linz companies.

3.3.1.2 Methods used to assess the potential of the energy cooperation opportunity

In a first step an assessment of the status of the technical equipment, resource and energy demand of the individual companies at the Chemiepark was carried out by EI-JKU based on:

- Interviews with the companies are finished
- The (Initial) workshop with companies in the Chemiepark to discuss the interview results, discuss the roadmap and to identify further measures was carried out:
  - One aim is the establishment of a Chemiepark-internal working group "Energy/Utility", including the companies of the Chemiepark, which are relevant for energy and utilities, with regular bi-annual meetings to discuss current developments and potentials.
  - The next step will be to set up the working group and to define its tasks as well as potential sup-groups concerning specific energy related topics. (see table 2-5)

Part of the main tasks of the working group will be to estimate the optimisation potential based on the existing shared network and its supply gaps:

- Interconnected steam / fresh water / compressed air etc. network
- Electricity (and gas) supply are regulatory challenging topics
- Identification/Handling of other energy connected challenges in the park premises will be an important topic therefore
- Many competing interests in electricity (and gas) markets, cooling and heat exchange are less problematic but with a high potential for cooperation and efficiency; also, options for becoming more sustainable (e.g. mussels and the problems they cause in pipes)
- Etc.
3.3.1.3 Possible technical solutions

“The initial workshop (and the biannual meetings of the working group) will be a meeting point for companies to investigate and plan the next steps for the most suitable energy cooperation opportunities, partially supported by the S-PARCS scientific partners such as EI-JKU. Exploring the adequateness of the energy cooperation opportunities that are being presented in this deliverable means discussing the following technical aspects:

- 3.1.2.1. District heating/cooling network between the park premises (see Annex 2)
- 3.1.3. Joint investment in energy efficiency (see Annex 2)
- Discussion and identification of potential sub-measures (and evaluation of them) for the reduction (such as decentralized cooling circuits) or smoothing of heat loads.
- Potentials of using the cooling tower infrastructure of the adjacent facility of the local energy supplier.
- Consideration of the individual components of the cooling water utilization for the identification of heat recovery measures.
- Analysis of technologies for waste heat to cold and cost-benefit evaluation of potential application scenarios

3.3.1.4 Energy potential

Except for some general figures, production, consumption and supply values are not made public. The total energy demand of the Chemiepark Linz is approximately 6 TWh.

3.3.1.5 Economic viability

The costs of the initial workshop will be covered by the S-PARCS budget. Costs and revenues of follow-up working sessions and assessment of technical solutions cannot be summarized in numbers yet and (except for some basic calculation) must be covered by the involved companies.

3.3.1.6 Environmental and social benefits

The workshop and bi-annual follow-up meetings will strengthen the community of companies at Chemiepark Linz and draw their attention on energy (cooperation) topics. Environmental benefits will arise directly and indirectly from solutions identified in the workshop.

3.3.2 Future cooperation regarding electricity and gas (supply and demand)

3.3.2.1 Background

Under the new EU legislation, the so-called Energy Communities become possible. For many companies in the Chemiepark, it is a concrete matter that more companies are connected to the network level 3, which would result in lower network charges. For example, a buyback of electricity grids would have to be considered. It is necessary to examine whether a common appearance in the power grid can lead to benefits for all companies of the Chemiepark resp. if this is now permissible. The joint purchase of the resource "electrical energy" itself could possibly take place independently of this, i.e. individually or via a purchasing pool.

Existing legislation / regulatory standards still cause large (administrative) barriers for an interconnected electricity network. Companies at the Chemiepark could lower their costs by a
shared network with an integrative approach – same network level, same network operator, same network prices, fewer metering/billing points and possibly same energy prices.

Cooperation regarding gas has been excluded from the cooperation opportunities of Chemiepark Linz, as mentioned before.

3.3.2.2 Methods used to assess the potential of the energy cooperation opportunity

Examination of the applicability of the new EU regulations or already valid guidelines (so-called direct supply lines), as well as examination of the cost-benefit ratio of such a procedure, e.g. by SWOT analyses.

- The idea of an Energy Community was presented and discussed in the park-internal workshop
- Comparison of existing energy/network costs of the companies and potential reduced costs (economic viability) will be a topic for the new working group
- Detailed analysis of regulatory/legal/standardization issues will be carried out in case of detailed cooperation plans regarding electricity

3.3.2.3 Possible technical solutions

Technical solutions from S-PARCS to be discussed by the working group (see Annex 2):

- 3.1.1. Installation of Renewable Energy Sources (RES) plants
- 3.1.4. Electricity production from waste heat
- 3.1.5. Electrical storage installation
- 3.1.7. Joint reactive power compensation
- 3.2.1. Realisation of a smart grid within the park premises
- 3.2.3. Demand response schemes
- 3.3.2. Shared charging points for electric/H2 vehicles
- 3.4.2. Joint use of Combined Heat and Power (CHP)
- 3.5.1. Joint purchase of electricity

3.3.2.4 Energy potential

To be elaborated based on the solution regarded.

3.3.2.5 Economic viability

Special contracts for joint electrical energy purchase can reduce the current expenses without additional investments.

Shared power grid with same network level where feasible can reduce the total electricity costs within the park.

3.3.2.6 Environmental and social benefits

To be elaborated based on the (technical) solutions implemented in the future.
3.3.3  Increase of waste heat utilization

3.3.3.1  Background

At the Chemiepark Linz, huge amounts of water from the Danube River are used as cooling water by several companies. The cooling water network is organised by Borealis Agrolinz Melamine. The water is pumped out of the river at a central station, and then it is channelled to the Chemiepark companies, where it is utilized in different processes. Some companies have closed cooling cycles, which are run by river water. In these cases, only the water losses are replaced by fresh river water. Other companies/processes are cooled by open cycle processes. In this case, the heated cooling water is channelled back to a central station from where it is passed into the Danube River. The maximum temperature allowed is 30°C. This temperature is not only the maximum temperature for the collected heated cooling water but also for the transfer stations of every company (due to individual water law permits for each company). Some companies have special permits to pass cooling water with more than 30°C back into the common network.

The cooling water demand of the Chemiepark can be an operational challenge in summer. The then prevailing outside temperatures result in higher heat loads, at the same time, the fresh cooling water from the Danube has a higher temperature, which is why less heat removal per ton of water is possible. The heat discharge into the Danube must not take place at more than 30 degrees Celsius. The construction of cooling towers turns out to be administratively complex. It is true that the individual companies are subject to individual regulatory temperature and quantity restrictions, while the removal of energy is carried out purely by Borealis. A shared, coordinated approach to individual constraints and the potential for shifting heat loads could reveal some operational flexibility.

Sub-measures are, among other things, complex because the heat dissipation is decentralized. Thus, there is no concentrated waste heat stream, which is then cooled down centrally to the required level for discharge into the Danube. Nevertheless, it could be examined if technical measures can be used to exploit the (in sum considerable) waste heat potential and whether such measures are possible all year round in individual cases.

There are waste heat potentials in the Linz Chemical Park, but so far, these have mainly arisen in the summer months when external utilization was not possible (the waste incineration plant of the energy supplier covers the base load of the Linz district heating network). In connection with the meetings with external partners (energy supplier, steelworks, bakery, etc.) the utilization, possibly also of the smaller available amounts of energy in the winter half-year, should be discussed.

Studies say that in Austria in 2050, about half of the energy required for a comfortable indoor climate will be used for cooling. "Waste heat to cold" is therefore an essential issue despite the significant losses in the conversion, which can also contribute to the utilization of summer waste heat or the reduction of the cooling water demand. The production of process cooling from waste heat is also an issue to be considered.

3.3.3.2  Methods used to assess the potential of the energy cooperation opportunity

Park-internal workshop:
Discussion and identification of potential sub-measures (and evaluation of them) for the reduction (such as decentralized cooling circuits) or smoothing of heat loads.

Consideration of the individual components of the cooling water utilization for the identification of heat recovery measures.

Analysis of technologies for waste heat to cold and cost-benefit evaluation of potential application scenarios.

Currently there are temperature limits for the centralised transfer station and for the transfer stations of most companies:

Questions to be answered:

How are the temperature levels reached?

What would be the temperature range of the collected used cooling water, if every company would directly feed in their untreated cooling water under normal operating conditions?

Which technical alternatives to feeding the waste heat into the Danube exist and which of those are acceptable by the surrounding neighbours, are economically, environmentally and technically feasible?

### 3.3.3.3 Possible technical solutions

Technical solution ideas:

- Low temperature heat pumps for office heating in the park premises
- Heating of external office parks / residential buildings via heat pump
- Waste-heat-to-cold applications for buildings and processes
- Building a shared cooling tower within Chemiepark Linz

Technical solutions from S-PARCS:

- 3.1.2. District heating solutions
- 3.1.2.1. District heating/cooling network between the park premises
- 3.1.2.2. Link to already existing district heating/cooling network serving local community
- 3.1.4. Electricity production from waste heat
- 3.1.6. Thermal storage installation
- 3.1.10 Waste heat recovery via heat pumps and/or heat exchangers
- 3.4.8. Exploitation of one plant’s by-product(s) in other plant(s) – Industrial symbiosis

### 3.3.3.4 Energy potential

To be elaborated based on the more detailed solution regarded.

### 3.3.3.5 Economic viability

To be elaborated based on the more detailed solution regarded.

### 3.3.3.6 Environmental and social benefits

If the waste / surplus heat from the steam network and especially the amount of cooling water is reduced, there will be direct environmental benefits, since the Danube River will be less heated up by used cooling water. This will have good impact on the Danube River’s flora and fauna.
If there is an internal waste heat utilization, economic benefits are expected. If there is (also) an external utilization, economic and possibly social benefits are possible (e.g. heating/cooling of public buildings, etc.)

3.3.4 Encouraging cooperation with neighbourhood outside of the chemical park

3.3.4.1 Background
Several companies located at the Chemiepark Linz produce high amounts of waste heat. In the neighborhood of the Chemiepark, there is a power plant of a local energy supplier and large steelworks. Out of potential economic and environmental reasons it is judicious to evaluate cooperation opportunities with these companies in terms of waste heat. The Chemiepark Linz is open to diverse technical solutions as long they are technically and economically feasible and do not disturb the production processes of the Chemiepark companies. These solutions could include district heating and/or cooling as well as seasonal storage tanks since most waste heat is generated during summer. In addition to the reasons listed before, the cooling water demand of the Chemiepark can be an operational challenge in summer. The then prevailing outside temperatures result in higher heat loads, at the same time, the fresh cooling water from the Danube has a higher temperature, which is why less heat removal per ton of water is possible.

3.3.4.2 Methods used to assess the potential of the energy cooperation opportunity
A prerequisite is the revival of the working group, which includes entities beyond the Chemiepark, incorporating the steelworks and the local district heating network operator, e.g. through bi-annual meetings. This working group can then decide about technical and economic viable solutions.

3.3.4.3 Possible technical solutions

Technical solution ideas:
- Over the year, especially during summer time, waste / surplus heat (steam) is generated at the Chemiepark Linz. This industrial waste heat could be utilised by the Linz AG Fernwärme (District Heating Network - DHN), e.g. using the already existing DHN storage tank or additional DHN storage tanks. The industrial waste heat potential has already been assessed for Linz in 2016/2017 (Nachhaltigwirtschaften, 2016) by Linz AG, Energy Institute at the JKU Linz and AIT. Around 40 to 55 MW demand over 5500 hours over one year could be covered by industrial waste heat, of which around 15 MW (during summer time) could be covered by Borealis Agrolinz Melamine alone (Moser et al. 2016)
- Other possibilities to get rid of the waste heat without further increasing the heat load in the Danube could result in cooperation with neighbouring entities.

Technical solutions from S-PARCS:
- 3.1.2.2. Link to already existing district heating/cooling network serving local community
- 3.1.2.3. New district heating/cooling network serving local community
3.3.4.4 Energy potential
To be elaborated based on the more detailed solution regarded.

3.3.4.5 Economic viability
If the waste heat can be utilized in the DHN, the measure allows the Chemiepark (resp. ESIM and Borealis Agrolinz Melamine) to reduce energy losses while revenue is generated. At the same time, Linz AG can reduce its own energy input and/or extend its district heating network. The possibility of a shared use of the existing cooling towers is yet to be discussed and analysed.

3.3.4.6 Environmental and social benefits
Waste heat utilization in DHN generates direct environmental benefits by the reduced energy losses to the environment (air and Danube River). Additionally, there are indirect environmental benefits generated by the cascaded use of energy and the total primary energy demand of the DHN and the Chemiepark, which is reduced while the final energy consumption stays the same. Furthermore, if the new feed-in into the Linz AG DHN allows extending the DHN, more households but also companies will change their central heating system to DHN, which also reduces the environmental impact and (fossil) primary energy consumption.

“The LINZ AG district heating network is growing continuously: more than 90 percent of all public buildings in Linz and about 76,500 apartments in Linz, Traun and Leonding are already being heated by district heating”. (Linz AG website\(^2\), translated from German to English)

Linz alone has around 116,000 apartments and houses\(^3\), Traun around 12,000\(^4\) and Leonding around 13,000\(^5\). This means already around 54% of the apartments and houses in the three municipalities are heated by district heating (own calculation). According to Moser et al., around 70% of the apartments and 90% of public buildings in Linz, Traun and Leonding are heated by DHN.

In case of using the cooling towers, the environmental impact on the Danube could be reduced significantly.

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\(^2\) Linz AG / Fernwärme: Web: 

\(^3\) Own calculation based on: Stadt Linz: Web: 

\(^4\) Own calculation based on: Statistik Austria, Ein Blick auf die Gemeinde: Web: 

\(^5\) Own calculation based on: Statistik Austria, Ein Blick auf die Gemeinde: Web: 
3.3.5 Technological options to reduce energy losses

3.3.5.1 Background
Borealis Agrolinz Melamine already implemented the merging of the two pressure levels of the common steam network at Chemiepark Linz. The steam network consists of several sub-networks with formerly four, now three, pressure levels, of which 25 bar is the highest. The 20 and 25 bar pressure levels were recently merged into a 25 bar network.

3.3.5.2 Methods used to assess the potential of the energy cooperation opportunity
Operational experience led the responsible managers to the conclusion that merging the two pressure levels, and therefore the reduction of total steam generation, would lead to higher operational and energy efficiency and therefore generate economic benefits and increase security of supply.

3.3.5.3 Possible technical solutions
Merging pressure levels of steam network, eventually an adaption of some processes needed.

3.3.5.4 Energy potential
Reduced steam losses and reduced primary energy input are expected. The real energy and cost savings can be determined after a minimum operation period (1 year at least).

3.3.5.5 Economic viability
Due to the system change to one pressure level, less energy input is needed and therefore, energy costs are reduced. Furthermore, less maintenance is needed, which also reduces operational costs. Additionally, the merging increases the failure safety of the whole system. Therefore, the main economic viability lies within trouble-free operation, which cannot be calculated but is very high.

The real energy and cost savings can be determined after minimum one operation period (1 year)

3.3.5.6 Environmental and social benefits
This technical measure mainly has indirect environmental benefits, since the (fossil) energy input is reduced and less steam losses are generated.

3.4 Okamika-Gizaburuaga Industrial Park (Spain)

3.4.1 Solar PV for shared self-consumption

3.4.1.1 Background
The companies in the industrial park are very small. Their energy consumption is not very high and energy management/efficiency is not a priority for them. Companies belonging to larger groups have their own energy management system, but this is the case of just one company
in the park, and we need more than one to investigate the feasibility of such an installation (PV for shared consumption). So far, the legal and regulatory landscape has not incentivized/obliged companies (particularly smaller ones) to monitor their energy consumption (on an hourly basis). Besides, not all companies have smart metering systems. And companies using the 3.0A and 3.1A electricity rates (the most common one among SMEs) may not even have hourly data.

3.4.1.2 Methods used to assess the potential of the energy cooperation opportunity

Access to hourly energy consumption data for more than one company becomes extremely challenging. Without these data, performing feasibility assessments to decide whether such kind of installation is beneficial for the companies is not possible.

Despite the numerous efforts and time consumed by BSI and TECNALIA to obtain this information (calls, emails, interviews, awareness workshops, etc.), not enough data was obtained.

3.4.1.3 Possible technical solutions

The strategies to increase the feasibility of self-consumption, include demand management to shift electric loads to daytime, electric storage, conversion of thermal loads to electric ones through heat pumps,

3.4.1.4 Energy potential

Data gathered does not allow a detailed assessment of the energy potential. If significant potential is not guaranteed, convincing companies will be rather challenging due to high investments and long payoff time.

3.4.1.5 Economic viability

Data gathered does not allow to assess the energy potential

3.4.1.6 Environmental and social benefits

Data gathered does not allow to assess the energy potential
3.4.2 Small hydroelectric plant

3.4.2.1 Background

The Bengolea dam is in km 12 of the Lea river, in the Okamika neighbourhood, and is 4.5 metres high (usable). The dam was used for milling in an ironwork dated back in the 17th century. Installations are now in ruins. The license has expired. Water quality is high, and the river is home to several community interest fauna and flora species.

BSI and TECNALIA engaged an ESCO and an energy cooperative in the exploration of this initiative. A confidentiality agreement was signed among the four parties, and two meetings held to plan the work to be done (e.g. gather information about the owner and license, energy and hydrologic data, network connection information, feasibility assessment, etc.). Feasibility assessment was prepared by in March 2019. Some information revealed by the feasibility assessment cannot be disclosed in this public deliverable and is kept for confidential ones.

3.4.2.2 Methods used to assess the potential of the energy cooperation opportunity

The actors involved in the exploration of this opportunity are experienced in assessing the feasibility and pushing forward RES initiatives, in particular when it comes to hydroelectric power. The work was structured around the following elements: figuring out ownership of the dam and status of exploitation license, gathering of energy and hydrologic data, and data of the closest connection point. Several meetings were organised to follow-up the investigations related to those elements. The feasibility assessment, finalised in March 2019, revealed meaningful information about the energy the potential, economic viability, pros and cons of the two possible technical options, as well as environmental and social benefits. BSI is now trying to get additional funding and get investors.

3.4.2.3 Possible technical solutions

After comparing two technologies in terms of cost, efficiency, versatility, debris tolerance, maintenance, fish flow and environmental impact, one of them is deemed the most appropriate.

3.4.2.4 Energy potential

According to the feasibility assessment, self-consumption is more appropriate than putting the electricity into the grid. This would cover part of the energy consumption in common buildings.
3.4.2.5 Economic viability
Payback time with current aid scheme is around 12 years

3.4.2.6 Environmental and social benefits
Environmental benefits range from sustainable energy production, emissions reduction and primary sources of energy, protecting the river and its ecosystem.

3.4.3 Joint purchase of electricity

3.4.3.1 Background
Joint purchase of electricity is an energy cooperation opportunity that does not require significant investments, searching for big amounts of data, or time-consuming feasibility assessments. Instead, hiring an energy advisor that manages the energy consumption and bills of several companies and arranges the auctions, is enough to cut the electricity bill. TECNALIA and BSI knew about the joint purchase of electricity initiative managed by AFV for its associated foundries several years ago, and AFV was invited to join the S-PARCS consortium to disseminate this good practice, and why not, transfer it to other Industrial Parks in Europe. 47 foundries connected to high voltage participate in the joint purchase of electricity organised by AFV in collaboration with ASE Consultores. But this initiative has proven to be effective also for low voltage companies belonging to diverse economic sectors. It is the case of the initiative initiated by a local business association (SEA) and ASE Consultores. Since 2015, six auctions have been organised, and the initiative is already supported by thirteen Business Associations in Spain. In the first four auctions the participating companies (more than 1,000) achieved electricity prices savings ranging from 14% to 20%). The last auctions took place in the unfavourable context of extremely high electricity prices. But still, the companies participating in the initiative were able to keep the average raise in electricity price below 10% (20% cheaper than the average market prices). Both initiatives have been presented to companies located in this park, first during the local kick-off meeting in May 2018, second during a workshop on 17th of May 2019.

3.4.3.2 Methods used to assess the potential of the energy cooperation opportunity
This opportunity is about pooling several companies together for the joint purchase of electricity. This way, companies can achieve lower electricity prices than by negotiating on their own.

3.4.3.3 Possible technical solutions
This initiative builds upon several principles:
- Collaboration among companies: Pooling energy demand saves money as better prices can be negotiated
- Trust: Business Associations safeguard the interests of the participating companies supervising the purchase and contracting process
- Market knowledge: Continuous analysis of the market and determining the adequate moment to purchase
Trustworthy and transparent methodology: The methodology is reliable, auditable, transparent and contrasted with the purchasing companies as well as with the electricity suppliers. Several electricity providers are invited to the auctions to offer a price for the entire electricity pool. The auction organiser selects the supplier that offers the lowest price. Benefits are socialised.

### 3.4.3.4 Energy potential

This solution is not directly influencing the efficiency in the energy consumption.

### 3.4.3.5 Economic viability

Viability is guaranteed if the savings achieved are enough to pay the fee of the energy advisor.

### 3.4.3.6 Environmental and social benefits

Such an initiative could impact positively on the competitiveness companies that are already established in the park. Besides, this could attract new companies to the park. All this is helpful to keep existing jobs and creating new ones, for the benefit of the local economy.

#### 3.5 Bildosola-Artea Industrial Park (Spain)

**3.5.1 Small hydroelectric plant**

**3.5.1.1 Background**

*Figure 3-6 The Bildosola dam*

The Bildosola dam is in km 15 of the Arratia river, in Artea, and is 3.5 metres high (usable). The dam was used for milling in an ironwork dated back in the 18th century. Installations are now in ruins. The license has expired. Water quality is moderate, and the river is home to several community interest fauna and flora species.

BSI and TECNALIA engaged an ESCO and an energy cooperative in the exploration of this initiative. A confidentiality agreement was signed among the four parties, and two meetings held to plan the work to be done (e.g. gather information about the owner and license, energy and hydrologic data, network connection information, feasibility assessment, etc.). Feasibility assessment was prepared in March 2019. Some information revealed by the feasibility assessment cannot be disclosed in this public deliverable and is kept for confidential ones.
3.5.1.2 Methods used to assess the potential of the energy cooperation opportunity

The actors involved in the exploration of this opportunity are experienced in assessing the feasibility and pushing forward RES initiatives, in particular when it comes to hydroelectric power. The work was structured around the following elements: figuring out ownership of the dam and status of exploitation license, gathering of energy and hydrologic data, and data of the closest connection point. Several meetings were organised to follow-up the investigations related to those elements. The feasibility assessment, finalised in March 2019, revealed meaningful information about the energy the potential, economic viability, pros and cons of the two possible technical options, as well as environmental and social benefits. BSI is now trying to get additional funding and get investors.

3.5.1.3 Possible technical solutions

After comparing two technologies in terms of cost, efficiency, versatility, debris tolerance, maintenance, fish flow and environmental impact, one of them is deemed to be most appropriate.

3.5.1.4 Energy potential

According to the feasibility assessment, self-consumption is the most adequate production system.

3.5.1.5 Economic viability

Payback time with current aid scheme is around 12 years

3.5.1.6 Environmental and social benefits

Environmental benefits range from sustainable energy production, emissions reduction and primary sources of energy, protecting the river and its ecosystem.

3.5.2 LED lighting

3.5.2.1 Background

The Industrial Park has 90 lamps and 16 light projects. The consumption is paid by the Town Council and the maintenance by the non-profit association managing the park (Entidad de Conservación Urbanística – ECU). Taking 2017 as reference year, maintenance costs are 26.52% of lighting supply cost.

3.5.2.2 Methods used to assess the potential of the energy cooperation opportunity

A feasibility assessment was hired by the owners (ECU) and performed in January 2019.

3.5.2.3 Possible technical solutions

The feasibility assessment builds upon installing PHILIPS LED 120 light projectors and SIMON NATH 100 lamps. The current system is made up by HALOGENURO 400w projectors and 250HPI-T lamps,
3.5.2.4 Energy potential
Energy saving potential is 70% (compared to the current installation)

3.5.2.5 Economic viability
Total expected annual savings are 20% in the electricity bill. Pay-back time is around 5 years.

3.5.2.6 Environmental and social benefits
Expected energy savings avoid the emission of 12.418 Kg/year of CO2

3.5.3 Joint purchase of electricity

3.5.3.1 Background
Joint purchase of electricity is an energy cooperation opportunity that does not require significant investments, searching for big amounts of data, or time-consuming feasibility assessments. Instead, hiring an energy advisor that manages the energy consumption and bills of several companies and arranges the auctions, is enough to cut the electricity bill. TECNALIA and BSI knew about the joint purchase of electricity initiative managed by AFV for its associated foundries several years ago, and AFV was invited to join the S-PARCS consortium to disseminate this good practice, and why not, transfer it to other Industrial Parks in Europe. 47 foundries connected to high voltage participate in the joint purchase of electricity organised by AFV in collaboration with ASE Consultores. But this initiative has proven to be effective also for low voltage companies belonging to diverse economic sectors. It is the case of the initiative initiated by a local business association (SEA) and ASE Consultores. Since 2015, six auctions have been organised, and the initiative is already supported by thirteen Business Associations in Spain. In the first four auctions the participating companies (more than 1,000) achieved electricity prices savings ranging from 14% to 20%). The last auctions took place in the unfavourable context of extremely high electricity prices. But still, the companies participating in the initiative were able to keep the average raise in electricity price below 10% (20% cheaper than the average market prices). Both initiatives have been presented to companies located in this park, first during the local kick-off meeting in May 2018, second during a workshop on 10th of May 2019.

3.5.3.2 Methods used to assess the potential of the energy cooperation opportunity
This opportunity is about pooling several companies together for the joint purchase of electricity. This way, companies can achieve lower electricity prices than by negotiating on their own.

3.5.3.3 Possible technical solutions
This initiative builds upon several principles:
- Collaboration among companies: Pooling energy demand saves money as better prices can be negotiated
- Trust: Business Associations safeguard the interests of the participating companies supervising the purchase and contracting process
Market knowledge: Continuous analysis of the market and determining the adequate moment to purchase

Trustworthy and transparent methodology: The methodology is reliable, auditable, transparent and contrasted with the purchasing companies as well as with the electricity suppliers. Several electricity providers are invited to the auctions to offer a price for the entire electricity pool. The auction organiser selects the supplier that offers the lowest price. Benefits are socialised

3.5.3.4 Energy potential
This solution is not directly influencing the efficiency in the energy consumption

3.5.3.5 Economic viability
Viability is guaranteed as long as the savings achieved are enough to pay the fee of the energy advisor.

3.5.3.6 Environmental and social benefits
Such an initiative could impact positively on the competitiveness companies that are already established in the park. Besides, this could attract new companies to the park. All this is helpful to keep existing jobs and creating new ones, for the benefit of the local economy.
4 CONCLUSIONS

The park operators are facing several barriers when trying to investigate and push forward the energy cooperation opportunities. Although technical, economic and administrative obstacles are ranked high as hindering factors, the investigations point also to the need of dealing with factors such as trust and risk perception (in many cases due to limited information), uncertainty about organisational issues, conflicting interests that lead to long negotiations, etc. The right resources and skills must be put in place to solve not only the technical, economic and administrative burden, but also the soft factors, as the latter may hinder or slow down the implementation phase, also when the technical, economic and administrative obstacles are no longer relevant. Reinforcing trust and solving perception issues, multi-stakeholder consensus building, etc. are closely linked to social and cultural factors and therefore no one-fit-all solution exists in this regard. However, the usefulness of looking into the mechanisms and tools that proved to be successful in industrial parks elsewhere should not be underestimated.

4.1 Barriers and next steps

4.1.1 Ponte a Egola Industrial Park

Table 4-1 Barriers and next steps in Ponte a Egola

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Barriers</th>
<th>Next steps</th>
</tr>
</thead>
</table>
| The combined heat and power plant that use biogas yielded by anaerobic codigestion of vegetable tannery sludge | **Barriers:**  
✓ Investment: Cannot be assumed just by tanneries and Cuioidepur  
✓ Trust of tanneries  
**Solutions**  
✓ Ongoing active search of funding (regional, national and EU level + private institutions  
✓ Dedicated events to present the proposal to tanners  
✓ Active role of Consorzio Conciatori di Ponte a Egola to engage its associates | **Feasibility study to better determine:**  
✓ Average time to implement the project and the sub-steps necessary to do it  
✓ Maximum savings that can be achieved while respecting national legislation  
✓ Average payback-time  
✓ Cost comparison present system / new system  
✓ Potential longer-term improvements  
✓ Identify financing resources  
✓ Precise assessment of the energy needs of the industrial area for correctly structuring the infrastructures of the project.  
✓ A good feasibility plan may affect this final decision to implement this energy cooperation opportunity |
| The joint energy management | **Barriers**  
✓ Economic risks perceived as a result of energy cooperation (data exchange | **Feasibility study to better determine:**  
✓ Tanneries agreeing of being involved the energy cooperation opportunity |
and supporting market competitors)

- Trust of tanneries

Solutions

- Confidentiality of the data shared is ensured to tanneries, ensuring that their competitiveness is not undermined

- Dedicated events to present the proposal and feasibility to tanners

- Active role of Consorzio Conciatori di Ponte a Egola to engage its associates

- Definition of the proposal on energy audits/energy monitoring activities that each tannery wants to implement, based on the modular approach previously described

- Average time to implement the proposal and the sub-steps necessary to do it

- Maximum savings that can be achieved while respecting national legislation

- Average payback-time

- Cost comparison present system / new system

- Potential longer-term improvements

- Precise assessment of the energy needs of the tanneries for the correct development of the cooperation opportunity

### 4.1.2 Ennshafen port & business park (Austria)

As the assessment of the energy cooperation opportunities is underway, information about barriers and next steps is ready just for two of them. This information will be further elaborated in following WP5 deliverables.

**Table 4-2 Barriers and next steps in Ennshafen port & business park**

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Barriers</th>
<th>Next steps</th>
</tr>
</thead>
</table>
| Shore side electricity / PV / E-mobility | ✓ Economic: high investments are required (electricity supply is challenging). A Long-term pay-back time requires a consistent business plan and model for all the users involved.  
✓ Technology: economic feasibility of the technology options linked to each of the items (too expensive), or technical restrictions (e.g. for heavy duty vehicles or vessels) | Feasibility assessments for the topics in detail, the first results regarding shore side electricity shall be finished before the end of 2019; other topics will follow subsequently |
| Revamping of old cooling-water sewer | ✓ Administrative burdens: Written permissions of authorities; a new application is just in preparation and should be | Application to authority to modify existing written permission (Autumn 2019) |
4.1.3 Chemiepark Linz Industrial Park (Austria)

Table 4-3 Barriers and next steps in Chemiepark Linz Industrial Park

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Barriers and solution</th>
<th>Next steps</th>
</tr>
</thead>
</table>
| Reinforced networking among companies within industrial parks | **Barriers**  
- Uncertainty about quantification of effects  
- Uncertainty about organizational issues of energy cooperation (e.g. who runs the new/joint plant)  
Company head offices and owners are spread all over the world, therefore, decisions take very long and cannot be made locally  
**Solutions**  
- Promotion of industrial park energy efficiency plans  
- Communication with all levels of management who can influence energy cooperation projects. This must happen for specific cooperation projects as well as for a public park strategy on energy cooperation | ✓Park-internal workshop in autumn 2019 to inform companies and discuss possible solutions and next steps. Status: Finished  
Next step: Establish internal working group “Energy/Utilities” and keep communication between companies ongoing |
| Future cooperation regarding electricity | **Barriers**  
Some companies handle the energy purchase centralized (purchase done by head quarter, not by site company)  
**Solutions**  
Joint purchase of remaining companies if they can benefit since, they are a small group and rather normal-type customers among the residual companies | ✓Discuss the topic in the park-internal workshop  
Next step: Discuss the topic in the working group “Energy/Utilities” |
| Increase of waste heat utilization | **Barriers**  
- Economic waste heat potentials are used. Other waste heat potentials currently remain unused as they are too distributed, too cold or too costly to recover.  
- For some waste heat potentials, no heat sinks are available | ✓Discuss the topic in the working group “Energy/Utilities”: Identify possibilities to reduce and/or utilize waste heat  
Next step: Workshop with other chemical parks to identify new solutions |
Encouraging cooperation with neighbourhood outside of the chemical park

**Barriers**
- The district heating network has a heat demand in winter months and no heat demand in summer months, i.e. no payback half a year per year.
- Implementation affords long negotiations due to several park-internal and external partners involved.

**Next steps**
- Further negotiations followed by implementation needed
- Discuss the topic in the working group “Energy/Utilities”
- Revive a former working group, which consist of Chemiepark and external companies

Technological options to reduce energy losses

**Barriers**
- Eventually adaption of existing processes to 25 bars needed (overcome)

**Next steps**
- Merging is already implemented.

### 4.1.4 Okamika-Gizaburuaga Industrial Park (Spain)

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Barriers and solution</th>
<th>Next steps</th>
</tr>
</thead>
</table>
| Solar PV for shared self-consumptions | **Barriers**
- Difficulties to engage more than one company and get the hourly energy consumption data
  **Solutions**
- High commitment of BSI to get companies engaged
- Energy audits and similar measures are being incentivised (in the long run) | **BSI is supporting companies in getting the data provided by their electricity meter reading**
- The new building will include a PV panel-bearing structure |

| Small hydroelectric plant | **Barriers**
- Administrative burden: Any company in the park can request the licence to exploit the dam. But the administrative procedure is quite long and complex.
- Conflicting interests: The licence request includes a round for claims, whereby we may have to deal with different views and opinions within the public authorities, as well as civil society (environmental and cultural interests)
- If energy potential is not significant, high investment and long pay-back time discourages companies to invest on this | **Go/no go decision**
- Request license
- Engage companies take a share of the investment
- Get commitment of public authorities
- Look for investors |
4.1.5 Bildosola-Artea Industrial Park (Spain)

<table>
<thead>
<tr>
<th>Energy cooperation opportunity</th>
<th>Barriers and solution</th>
<th>Next steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small hydroelectric plant</td>
<td><strong>Barriers</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Administrative burden: Any company in the park can request the licence to exploit the dam. But the administrative procedure is quite long and complex.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Conflicting interests: The licence request includes a round for claims, whereby we may have to deal with different views and opinions within the public authorities, as well as civil society (environmental and cultural interests)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ If energy potential is not significant, high investment and long pay-back time discourages companies to invest on this</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Solutions</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Request license</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Go/no go decision</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Engage companies in the self-consumption model</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Get commitment of public authorities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓ Look for investors</td>
<td></td>
</tr>
<tr>
<td><strong>LED lighting</strong></td>
<td>Not applicable, as this will be already executed in 2020</td>
<td>Implementation</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>Joint purchase of electricity</strong></td>
<td><strong>Barriers</strong>&lt;br&gt;Limited interest in this opportunity due to several factors:&lt;br&gt;✓ Companies in the park are not energy intensive, so saving energy costs is not top on the agenda of the companies. Some of them rely on energy advisors and do not devote too much time to following-up their electricity bills and finding ways to decrease the electricity costs.&lt;br&gt;✓ Limited trust of companies: The still low energy cooperation culture is a drawback. Another hampering factor is that some companies are still not used to switch electricity providers (despite the energy markets were liberalised in the late nineties).&lt;br&gt;<strong>Solution</strong>&lt;br&gt;✓ Awareness raising activities&lt;br&gt;✓ Joining the running initiative</td>
<td>✓ Bilateral meetings with the main energy consumers in the park&lt;br&gt;✓ Approach Basque Energy Agency (EVE) to coordinate the participation of the industrial parks in this initiative.&lt;br&gt;✓ Join the running initiative that involves thirteen Spanish business associations and where more than one thousand companies participate.</td>
</tr>
</tbody>
</table>
4.2 Lessons learnt and transferability

Table 4-4 summarises the energy cooperation opportunities explored in S-PARCS in such a way that any industrial park looking for benchmarks to increase energy efficiency in a cooperative manner can first pick the experiences that fit them best. Second, looking at the success factors, park operators can better comprehend whether they can count on those elements to trigger energy cooperation opportunity in their parks or not. In some cases, success factors are place-based and highly dependent on historical and cultural factors or particular legal contexts. In other cases, they point out the adequateness of certain technologies or the pivotal role that consulting companies can adopt, so shed some light on where to start with when trying to implement such an initiative. Besides, the table warns about the main critical points linked to each of the energy cooperation opportunity, so that park operators can figure out a timely plan to tackle them. Opportunities for transferability will be further detailed in subsequent deliverable as energy cooperation opportunities are furthered assessed in the following months.

Table 4-4 Transferability considerations

<table>
<thead>
<tr>
<th>ENERGY COOPERATION</th>
<th>WHO could adopt it</th>
<th>Success factors</th>
<th>Watch out</th>
<th>Other considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>PONTE A EGOLA (IT)</td>
<td>Traditional wastewater treatment plants or plants producing biodegradable solid waste looking for more sustainable approaches (incl. more efficient use of resources in industrial areas where biodegradable waste is produced)</td>
<td>The reaction produced by the digestor (1) reduces biodegradable waste (usually sent to disposal), while (2) producing biogas</td>
<td>High investment cost</td>
<td>Unexplored potential: Industrial symbiosis (waste to energy)</td>
</tr>
<tr>
<td>Joint Energy Management</td>
<td>Any industrial park looking for joint energy efficiency initiatives</td>
<td>The pivotal role of the consulting company to act as a</td>
<td>The need to tackle doubts and fear of companies that can invest in the</td>
<td></td>
</tr>
</tbody>
</table>
| *S-PARCS* | **Shore side electricity / PV / e-mobility, LNG** | Could be a benchmark for other ports/business parks having the same infrastructure demands  
Engagement of all vessel operators, owners of buildings and other surfaces, users of trucks, reach stackers, vessels, users of cars; | Cost and pricing systems | High investments, business concepts; markets new technologies are not developed now > investors must go into “uncertain markets and payback times” | Regulatory aspects of energy markets |
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENNISCHAFEN (AT)</strong></td>
<td>Revamping of old cooling-water sewer</td>
<td>All plant and ground owners and users of land or plants</td>
<td>Pricing system, authority allowance</td>
<td>High maintenance cost for the future</td>
</tr>
<tr>
<td><strong>CHEMIEPARK LINZ (AT)</strong></td>
<td>Reinforced networking among companies</td>
<td>Any industrial park interested in reinforcing networking among companies, particularly those that used to have strong cooperation ties.</td>
<td>The companies in the Chemiepark were part of a one, large company three decades ago. Based on its history, it has an integrative network, where many resources are shared.</td>
<td>The physical/technical and social network needs to be maintained and reinforced</td>
</tr>
<tr>
<td></td>
<td>Future cooperation regarding electricity</td>
<td>Any company interested in reducing the electricity bill</td>
<td>Multinational companies often have their own electricity buying syndicates for all their sites, therefore some companies might not be</td>
<td>The liberalized electricity and gas markets are international markets. Unification of customers does not need to happen locally</td>
</tr>
<tr>
<td>Activity</td>
<td>Description</td>
<td>Interested in</td>
<td>Challenges</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>---------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Increase of waste heat utilisation</td>
<td>Any industrial park in which this is feasible technically and economically</td>
<td>Especially external waste heat generation can generate additional revenue for a company and at the same time can produce better acceptance of a production site within a municipality with high share of private houses, e.g. with district heating</td>
<td>Informational and social barriers, also technical challenges</td>
<td></td>
</tr>
<tr>
<td>Encouraging cooperation with neighbourhood outside the chemical park</td>
<td></td>
<td></td>
<td>The district heating market is poorly regulated (at least in Austria), therefore waste heat feed-in is not guaranteed to the companies</td>
<td></td>
</tr>
<tr>
<td>Technological options to reduce energy losses</td>
<td>A reduced number of steam networks are enough to reduce losses, reduced maintenance, etc.</td>
<td></td>
<td>Extensive process adaption or similar is seldom needed</td>
<td></td>
</tr>
<tr>
<td>Solar PV for shared self-consumption</td>
<td>Any park with available roof space and significant sun irradiation</td>
<td>Creating their own energy fits with the philosophy of the park (rural area, set up to create and maintain jobs, avoid migration towards larger cities)</td>
<td>Back-up feasibility assessment/decisions in strong evidences (information is sometimes incomplete)</td>
<td></td>
</tr>
<tr>
<td>Small hydroelectric plant</td>
<td>Any park with a dam nearby</td>
<td></td>
<td>Pay-back time is normally high unless investors or grants are obtained</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Energy potential might not meet the expectation of companies</td>
<td>Legal complexity may slow-down the process</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trust can be an issue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Joint purchase of electricity | Any group of companies interested in reducing the electricity bill | Joining an up and running group may be beneficial (instead of creating a new one) | This measure may work better in companies with significant electricity costs
Trust can be an issue |
|-------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Small hydroelectric plant     | Any park with a dam nearby                                      | Creating their own energy fits with the philosophy of the park (rural area, set up to create and maintain jobs, avoid migration towards larger cities) | Back-up feasibility assessment/decisions in strong evidences (information is sometimes incomplete)
Pay-back time is normally high unless investors or grants are obtained
Energy potential might not meet the expectation of companies
Legal complexity may slow-down the process
Trust can be an issue |
| LED lighting                  | Any industrial park willing to replace lighting in common areas/park roads, etc. | Governance: Town Council pays for the electricity bill (public lighting in park roads), the park pays for the maintenance through the ECU (Entidad de Conservación Urbanística, where all companies are represented) |  |
| Joint purchase of electricity | Any group of companies interested in reducing the electricity bill | Joining an up and running group may be beneficial (instead of creating a new one) | This measure may work better in companies with significant electricity costs
Trust can be an issue |
5 References


6 Annexes

6.1 Annex 1: Energy cooperation opportunities in D5.1.

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Industrial Park</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Biogas combined heat and power plant</td>
<td>Tannery district of Ponte a Egola</td>
<td>Italy</td>
</tr>
<tr>
<td>#2 Joint energy management</td>
<td>Tannery district of Ponte a Egola</td>
<td>Italy</td>
</tr>
<tr>
<td>#3 Construction of PV modules on (large) company roofs or other areas at the Ennshafen site</td>
<td>Ennshafen</td>
<td>Austria</td>
</tr>
<tr>
<td>#4 Utilization of waste heat flux between relevant companies</td>
<td>Ennshafen</td>
<td>Austria</td>
</tr>
<tr>
<td>#5 Cooperation of companies regarding electricity and gas (supply and demand)</td>
<td>Ennshafen</td>
<td>Austria</td>
</tr>
<tr>
<td>#6 Electrification of the power supply of anchored ships</td>
<td>Ennshafen</td>
<td>Austria</td>
</tr>
<tr>
<td>#7 Reinforced networking of the Chemiepark Linz</td>
<td>Chemiepark Linz</td>
<td>Austria</td>
</tr>
<tr>
<td>#8 Analysis of the use of the Danube as a logistics route for the Chemiepark Linz</td>
<td>Chemiepark Linz</td>
<td>Austria</td>
</tr>
<tr>
<td>#9 Analysis for future cooperation of companies regarding electricity (supply and demand) and gas (supply and demand)</td>
<td>Chemiepark Linz</td>
<td>Austria</td>
</tr>
<tr>
<td>#10 Solar PV for shared self-consumption</td>
<td>Okamika-Gizaburuaga</td>
<td>Spain</td>
</tr>
<tr>
<td>#11 Small hydroelectric plant</td>
<td>Okamika-Gizaburuaga and Bildosola Artea</td>
<td>Spain</td>
</tr>
<tr>
<td>#12 LED lighting</td>
<td>Bildosola Artea</td>
<td>Spain</td>
</tr>
<tr>
<td>#13 Joint purchase of electricity</td>
<td>Okamika-Gizaburuaga and Bildosola Artea</td>
<td>Spain</td>
</tr>
</tbody>
</table>

6.2 Annex 2: Solution Summary Table from D1.1 p. 58

The table below lists all the solutions identified in D1.1. and describes the implementation easiness, the replication potential and the environmental impact as low (L), medium (M) and high (H).

<table>
<thead>
<tr>
<th>Sector of intervention</th>
<th>Implementation easiness</th>
<th>Replication potential</th>
<th>Environmental impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1. New physical installations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1.1. Installation of Renewable Energy Sources (RES) plants</td>
<td>EQUIP+ELECT+THERM+PARKDES</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>3.1.1.1. Joint biomass based CHP</td>
<td>EQUIP+ELECT+THERM+PARKDES+ WASTE</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>3.1.2. District heating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>solutions</td>
<td>THERM+EQUIP+PARKDES+WASTE</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>3.1.2.1. District heating/cooling network between the park premises</td>
<td>THERM+EQUIP+WASTE</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>3.1.2.2. Link to already existing district heating/cooling network serving local community</td>
<td>THERM+EQUIP+WASTE</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>3.1.2.3. New district heating/cooling network serving local community</td>
<td>THERM+EQUIP+WASTE</td>
<td>M</td>
<td>N/A</td>
</tr>
<tr>
<td>3.1.3. Joint investment in energy efficiency</td>
<td>EQUIP+ELECT+THERM+PROC</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>3.1.4. Electricity production from waste heat</td>
<td>EQUIP+THERM+ELECT+PROC</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>3.1.5. Electrical storage installation</td>
<td>EQUIP+EL+HEAT+PROC</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>3.1.6. Thermal storage installation</td>
<td>EQUIP+ELECT</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>3.1.7. Joint reactive power compensation</td>
<td>EQUIP+ELECT+THERM</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td>3.1.8. Joint sustainable/self-produced fuel (power-to-gas, biogas)</td>
<td>EQUIP+ELECT+THERM</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>3.1.9. Joint heat pumps for district heating purposes via power-to-heat</td>
<td>EQUIP+THERM+ELECT</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>3.1.10 Waste heat recovery via heat pumps and/or heat exchanger</td>
<td>THERM+EQUIP+ELECT+WASTE</td>
<td>M</td>
<td>H</td>
</tr>
</tbody>
</table>

3.2. Information and Communication Technologies

| 3.2.1. Realisation of a smart grid within the park premises               | EQUIP+ELECT+THERM+PARKDES+PROC | L   | M   | H  |
| 3.2.2. Joint purchase of monitoring equipment | EQUIP+ELECT+THERM+PROC+FIN | H | H | H |
| 3.2.3. Demand response schemes | ELECT+PROC+EQUIP | M | M | M |
| 3.2.4. Energy management System at industry/park level | EQUIP+ELECT+THERM+WASTE+PROC+EMPL | H | H | H |
| 3.2.5. Shared central servers | EQUIP | M | H | L |

## 3.3. Logistics and Mobility

<table>
<thead>
<tr>
<th>3.3.1. Joint mobility solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1.1. Joint fleet for employees to reach the park (i.e. buses)</td>
</tr>
<tr>
<td>3.3.1.2. Joint car pooling</td>
</tr>
<tr>
<td>3.3.1.3. Joint electric vehicles/ H₂ based fleet</td>
</tr>
<tr>
<td>3.3.2. Shared charging points for electric/H₂ vehicles</td>
</tr>
<tr>
<td>3.3.3. Shared office buildings</td>
</tr>
<tr>
<td>3.3.4. Joint logistics</td>
</tr>
</tbody>
</table>

## 3.4. Managerial Actions

| 3.4.1. Common energy audits | PROC+FIN+ELECT+THERM+PARKDES+WASTE | H | H | H |
| 3.4.2. Joint use of Combined Heat and Power (CHP) | PROC+ELECT+HEAT | M | H | H |
| 3.4.3. Joint energy manager | EMPL+FIN+ELECT+THERM+WASTE | M | H | M |
| 3.4.4. Clustering of common processes | PROC+EMPL+MAT+PARKDES+EQUIP | L | M | L |
| 3.4.5. Common | FIN+PARKDES | M | M | M |
| 3.4.6. | Matching companies according to energy/material demand and production | PARKDES+PROC+ELECT+THERM+WASTE+MAT+FIN | M | M | H |
| 3.4.7. | Joint emergency plan of the area | PARKDES+EMPL | H | M | L |
| 3.4.8. | Exploitation of one plant’s by-product(s) in other plant(s) – Industrial symbiosis | PARKDES+PROC+ELECT+THERM+WASTE+MAT+FIN | N/A | N/A | N/A |
| 3.4.9. | Joint waste management and disposal | WASTE+FIN+PARKDES | H | H | L |
| 3.4.10. | Joint organic waste treatment energy valorisation (via biogas or waste incineration) | WASTE+EQUIP+THERM+ELECT+PARKDES | M | M | L |
| 3.4.11. | Joint sewage water treatment and valorisation | WASTE+EQUIP+FIN+PARKDES | M | H | L |
| 3.4.11.1. | Biogas production in wastewater treatment plants | WASTE+EQUIP+ELECT+THERM | L | M | M |

### 3.5. Contractual instruments

<p>| 3.5.1. | Joint purchase of electricity | FIN+ELECT | H | H | L |
| 3.5.2. | Joint purchase of energy carriers (gas/fuel/wood) | FIN+MAT+PARKDES | H | H | L |
| 3.5.3. | Joint purchase of raw materials | FIN+MAT+PARKDES | M | M | L |
| 3.5.4. | Joint insurance provider | FIN | M | H | L |</p>
<table>
<thead>
<tr>
<th>3.5.5. Joint ancillary services providers</th>
<th>FIN</th>
<th>M</th>
<th>H</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5.6. Creation of a park ESCO</td>
<td>FIN+ELECT+THERM+EQUIP</td>
<td>L</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>