R-ACES
Energy Cooperation Platform

Condensed overview of results from studies and previous projects

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DATE : 28.07.2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°892429

Technical References

Project Acronym	R-ACES
Project Title	fRamework for Actual Cooperation on Energy on Sites and Parks
Project Coordinator	S-ISPT – Institute for Sustainable Process Technology
Project Duration	1 June 2020 – 30 November 2020
Project Website	www.r-aces.eu

Deliverable No.	D1.1
Dissemination level [1]	PU
Type Deliverable[2]	R
Work Package	1 : Condense
Lead beneficiary	S-ISPT - Christa de Ruyter (christa.deruyter@ispt.eu)
Contributing beneficiary(ies)	S-ISPT, CLEAN
Due date of deliverable	31st of July 2020/ Month 2
Actual submission date	28-7-2020

[1] PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

[2] R = Document, report
DEC = Websites, patent fillings, video, etc.
DEM = Demonstrator, pilot, prototype
OTHER = other

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Document history

V	Date	Author (Beneficiary)	Description
V0.1	7-7-2020	Christa de Ruyter & Max Brouwer (S-ISPT)	Initial version
V0.2	8-7-2020	Anne Blaastrup Holm (CLEAN)	Review
V0.3	14-7-2020	Christa de Ruyter (S-ISPT)	Adjustments made based on review
V1.0	23-7-2020	Christa de Ruyter (S-ISPT)	Deliverable in formal layout
V1.1	27-7-2020	Christa de Ruyter (S-ISPT)	Adjustments made based on discussion with Anne Blaastrup Holm and Max Brouwer

Project Summary

The R-ACES project is an initiative promoted by 8 partners from 6 European countries, with the vision to support high-potential industry parks and clusters to become fully fledged ecoregions that reduce emissions by at least 10 %. R-ACES means a step-change in the contribution of European Industry to the climate targets of the EU. The industry sector after all represents 25% of all energy demand – and 50% of the total cooling and heating demand on the continent; yet only 16% comes from renewables. By focusing on collective measures and clustering, the efficiency of industry can be drastically increased.

The focus of R-ACES therefore is to turn high-potential, high-impact industrial clusters into ecoregions that achieve at least a 10% reduction in emissions. They do so by exchanging surplus energy, making extensive use of renewables and tying everything together with smart energy management systems. An ecoregion is a geographic area where energy and information exchanges occur between various companies and actors to reduce waste and energy consumption. Ecoregion can be centred on an (eco-)industrial park or (eco-) business park, linked to its surroundings by a 4th/5th generation district heating/cooling network.

R-ACES is the capping stone, condensing the knowledge and experience gathered throughout EU and national projects into a set of three focused tools, namely a self-assessment tool, a legal tool and a smart energy management platform. The tools are embedded in support actions built around peer-to-peer learning, more formal coursework and webinars, and serious games. Together they enable a cluster to really become an ecoregion and set up meaningful energy collaboration. The entire package of tools and support is aimed at the high-potential clusters identified in the European Thermal Roadmap. It will be validated in three ecoregions, actively deployed in another seven regions, and disseminated to identified ninety regions European wide. In addition, the tools and support methodology will be made available to third parties in a sustainable way after the end of this project.

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Partners:

Institute for Sustainable Process Technology	https://ispt.eu/
Condugo	https://www.condugo.com/
DOWEL MANAGEMENT	https://www.dowel.eu/management_en/
Spinergy	http://www.spinergy.it/
clean	https://www.cleancluster.dk/
LE2C LOMBARDY ENERGY CLEANTECH CLUSTER	http://www.energycluster.it/en
pom antwerpen	https://www.pomantwerpen.be/
ESCI European Science Communication Institute	https://www.esci.eu

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Executive Summary

The R-ACES project intends to pave the road for effective energy exchange in industrial clusters and business parks in Europe by providing a self-assessment tool, legal tool, and energy management tool. To develop these tools, we start by investigating insights developed in previous European projects on energy cooperation. In this report, we will make a first step by making a long list of previous projects/ academic literature as well as the formulation of a barrier classification framework. The formulation of this framework is based on a quick scan of project documentation and academic literature. In the upcoming months, the framework will be used to further harmonize existing insights from those projects.

Keywords

R-ACES keywords

Industrial Symbiosis, Energy System Integration, District Heating and Cooling, Energy Cooperation, Ecoregion, Eco-Industrial Parks

Deliverable keywords

Literature review, Tool

Disclaimer

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Abbreviations

Abbreviation	Description
CHP	Combined heat and power production
CSA	Coordination and Support Action
DH	District Heating
DHC	District Heating and Cooling
EBP	Eco business park
EIP	Eco industrial park
GHG	Greenhouse Gas
KPI	Key Performance Indicator
LC	Learning Community
RE	Renewable Energy
RES	Renewable Energy Strategy
SME	Small Medium Enterprise

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1 Introduction

1.1 Objective of the work package ‘Condense’

In the scope of the work package ‘Condense’, we aim to condense the insights of previous European projects regarding district heating and cooling (DHC) as well as academic literature. Hereby, special attention is given to the identification of associated technical and non-technical barriers/drivers and ways to overcome them. The identification process is the start of a longer effort to address barriers in a more effective way. A crucial step within this process is the classification and harmonization of barriers in a single framework. This is done in the scope of D1.2 ‘Harmonization’. Later on in the project, we will use the harmonized knowledge to develop three tools: a self-assessment tool, a legal tool, and an energy management platform. The three tools together form a R-ACES Tool Box that aims to support practitioners in ecoregions to come to energy cooperation. In order to realize this goal, the tools have to tested. Therefore, we will also start with the selection of seven additional ecoregions. First, a long list will be created (D1.3). Afterwards, we define a short list by using strict selection criteria (D1.4).

1.2 Objective of the deliverable

The purpose of this deliverable is to condense the knowledge developed by previous (academic) studies and EE6, SPIRE, H2020, INTERREG projects. We collect state-of-the-art best practices on energy cooperation and joint energy services from multiple research fields and collect literature survey studies from various disciplines such as Industrial Symbiosis, Industrial Ecology, Responsible Innovation, Energy technology, Innovation research. To do this, the following sequence of actions is deployed:

- **Define inclusion criteria for literature study (2.1)**
- **Collect literature/studies (2.2)**
- **Create overview of EU projects from Cordis database (2.2)**
- **Review all literature and reports (2.3)**
- **Define barrier classification model to classify drivers and barriers (3)**

The end result is an overview of all previous studies and their identified main barriers.

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2 Methodology

Within this section, we elaborate the methodology to condense the literature. First, we define the inclusion criteria for the study. Afterwards, we describe how we collected the studies and reports. Thereafter, we address the method we used to assess the literature.

2.1 Define inclusion criteria for study

As mentioned before, this deliverable aims to condense the state-of-the-art knowledge on best practices regarding energy cooperation in ecoregions. To be able to select all these projects, we conducted multiple steps. First of all, we limited the scope to Europe in order to ensure that the results are applicable in the European context. Within R-ACES we want to promote energy cooperation in European countries. Considering this aim, studies conducted in non-European are considered to be less relevant. Secondly, we only included projects completed in the last 10 years (2010 onwards). We did this to ensure that the results are still relevant. Thirdly, we selected reports that aim to identify enablers/ disablers/ the best practices of energy cooperation. Last but not least, we made a word map of the different synonyms for energy cooperation used in the literature. We included reports that make use of one of these words. In this way, we want to ensure that we did not exclude any valuable projects that might have used slightly different terms as ecoregions or DHCs.

Figure 1: Word map of synonyms of energy cooperation

2.2 Selected projects/studies

Based on the previous criteria, we selected a number of projects by using the Cordis database and Google Scholar. In annex 1, an overview is given of the projects we found. We want to underline that all the projects in the long list might have relevant information for one or more deliverables in the R-ACES project. After we created this long list of projects, we scanned all projects (websites and reports) to decide whether they contained useful information for the development of a self-assessment tool and, or legal tool. This examination led to a short list of relevant projects. We talked to three experts in the district heating sector to check if we missed any important projects/ reports. We also asked all consortium partners to check the list. Thereupon, the short list was updated. In annex 2, we give an overview of all the projects we selected: 25 projects and nine academic reports. We also indicated whether we will use the reports for the self-assessment and/ or legal tool. However,

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it should be taken into account that the projects might also be used in other ways during the R-ACES project, for example: as a starting point for D1.3, we also indicated the number of regions/ cases that were involved in the projects.

2.3 Method to assess literature and to come to a drivers and barriers framework

After we selected the literature, we started a reviewing process. For this deliverable, we conducted two steps: (1) look at used frameworks to classify drivers and barriers in the different reports, (2) define our own drivers and barriers framework based on the earlier reports. We did this in the following way:

- We took the LESTS framework, as proposed in the project proposal:
  - Legal, e.g. liabilities, regulatory requirements, third party contracts, service agreements, rules;
  - Economic, e.g. cost savings, waste/ resource recovery value, funding mechanism, taxes & environmental considerations;
  - Spatial, including geographical proximity, planning rules and environmental considerations;
  - Technical, e.g. sharing and cascading resources, system stability, facilities;
  - Social/Managerial, e.g. with regard to workers, consumers, local communities employment, community engagement, and capacity building.

Figure 2: Photo of brainstorm session

- We labeled drivers and barriers for 1 document with the framework
- We organized a brainstorm session in which we discussed the most common ones and the evaluation methodology
- We reviewed the other selected documents
- We reviewed the framework to make it more complete

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3 Define framework to classify drivers and barriers

The collected projects (Annex 2) will require harmonization before the knowledge can be offered and used in the 10 first replication ecoregions of R-ACES. So, defining a consistent terminology and a robust classification of the identified barriers is necessary. The upcoming paragraph describes the way we came to define drivers and barriers. First, we look at the way these are defined in previous studies. Afterwards, we come with our own classification.

3.1 Ways to define drivers and barriers

The development of a DHC, requires close collaboration between stakeholders within an ecoregion and the adaptation of different processes to each other. This is a highly challenging process where a lot of obstacles can pop up. In order to ease the process, insight is necessary in the main drivers and barriers of such processes. Fortunately, a lot of studies have been conducted on drivers and barriers for energy cooperation in ecoregions. However, most of these studies use a different scope and, therefore, come to another way to define drivers and barriers. Below, an overview is given of factors that should be taken into account. For every factor, a comment is made on the standpoint of R-ACES.

3.1.1 Level of analysis

A distinction is quite often made between different levels on which barriers and drivers could play a role, for instance: (1) National level, (2) Regional level, (3) Industrial park level, (4) Firm level[1]. Some classification methods are more focused on policies at the national level, others are more focused on within firm barriers. The R-ACES project aims to look at barriers that occur at an ecoregion level. This includes barriers relevant at the regional level and the industrial park level. Barriers that occur on the national or firm level are considered to be external factors that are taken into consideration but do not form the main focus of the self-assessment/ legal tool.

3.1.2 DHC characteristics

The occurrence of specific drivers and barriers depends on the DHC's specific context. A DHC can vary in size. It can supply large areas, as for instance the Greater Copenhagen DH system spanning multiple neighborhoods, but also only small areas or villages consisting of only a few hundred houses[2]. Moreover, the previous experience of an ecoregion with DHC can differ: there is no DHC yet, there is an old fashioned DHC which is not very efficient (1st, 2nd or 3rd generation), or there is an up to date system (4th or 5th generation) that still can be optimized/ expanded. Within R-ACES we expect to handle with all kinds of DHCs. Therefore, we will aim to identify barriers that are relevant for all or most DHC statuses as well as various levels of experience with DHC networks[3].

Explaining the scope of R-ACES through an example

In Denmark, the national legislation on heat determines if a project can be granted by the municipality. Even if the local companies and the local DHC network agree with each other, they might not get a DHC project approved due to the legislation on national level. In such a case, the focus of the R-ACES tools is not on solving the barriers existing on a national level. This is an impossible task for local park managers. Instead, the tools focus on the way local park managers can deal with the existing legislation. The question is: What actions can this local park manager undertake to still get the project approved. Examples of actions could be: acquiring more knowledge on existing legal procedures, adjusting the project proposal in such a way that it is in line with the national legislation, or hiring a legal expert.

[1] THERMOS project Module 5
[2] Upgrade-DH: Barriers for upgrading existing DHC
[3] More information on this theme can be found in the scope of the CoolHeating project.

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3.1.3 Barriers vs Drivers

What makes a DHC project successful? Many projects make a division between drivers and barriers related to the development of a DHC. Drivers are seen as elements that foster the cooperation. Barriers are considered to be elements that obstruct the DHC's development. However, this difference might not always be too clear. Laws and regulations form a driver in some countries, but a barrier in other ones. Therefore, we will not make a clear distinction between drivers and barriers. Instead, we will look at themes that can function as barriers/drivers.

3.1.4 Supply vs Demand Barriers

In the Progress Heat project, a division is made between supply-side barriers and demand-side barriers. On the one hand, supply-side barriers include inhibitive factors for the implementation of renewable heating and cooling (RES-H/C) technologies. On the other hand, demand-side barriers include inhibitive factors for the use of renewable heating and cooling (RES-H/C) technologies offered by the supply side (either resulting in using an alternative non-renewable fuel or in deciding not to replace existing heating equipment entirely). For the R-ACES consortium, supply- as well as demand-side barriers are important. Both of them will be taken into consideration.

3.1.5 Classification themes that can function as barriers/drivers

Next to the different level on which barriers/ drivers could occur, there are different ways of classifying them. In every project, this is done in a different way. Some projects use the LESTS scheme (EPOS), other come with their own classification. In annex 3, a full overview is given of the used classification methods in the selected European projects. Not in every project a clear classification scheme is used: Within these projects, there is reflection by partners of the main obstacles they encountered. The results of the third annex indicate that there is not one consistent way to classify barriers/drivers. In the following paragraph, we will explain the classification model we will use within the scope of R-ACES.

3.2 R-ACES Barriers Classification Framework

For the R-ACES project, we create our own barriers classification framework. This framework cannot be too specific (exclude too much) or too abstract (lose context, understanding). Considering the various approaches to cluster the barriers, it is not possible to identify an objectively correct approach. With every framework, there are problems like ambiguous allocation. We decided to stay with the LESTS framework, as proposed in the project proposal, because in our consortium, we have a lot of experience with the application of this framework. The LESTS framework provides a nice balance between specificity and abstractness. Moreover, it helps you to find solutions in the right direction.

In the figure below, we have summarized the R-ACES classification framework. We defined inclusion principles that help us to determine whether a barrier is relevant for our project. We also defined classification principles that will be used to harmonize previous insights. Hereby, the different LESTS categories are further specified.

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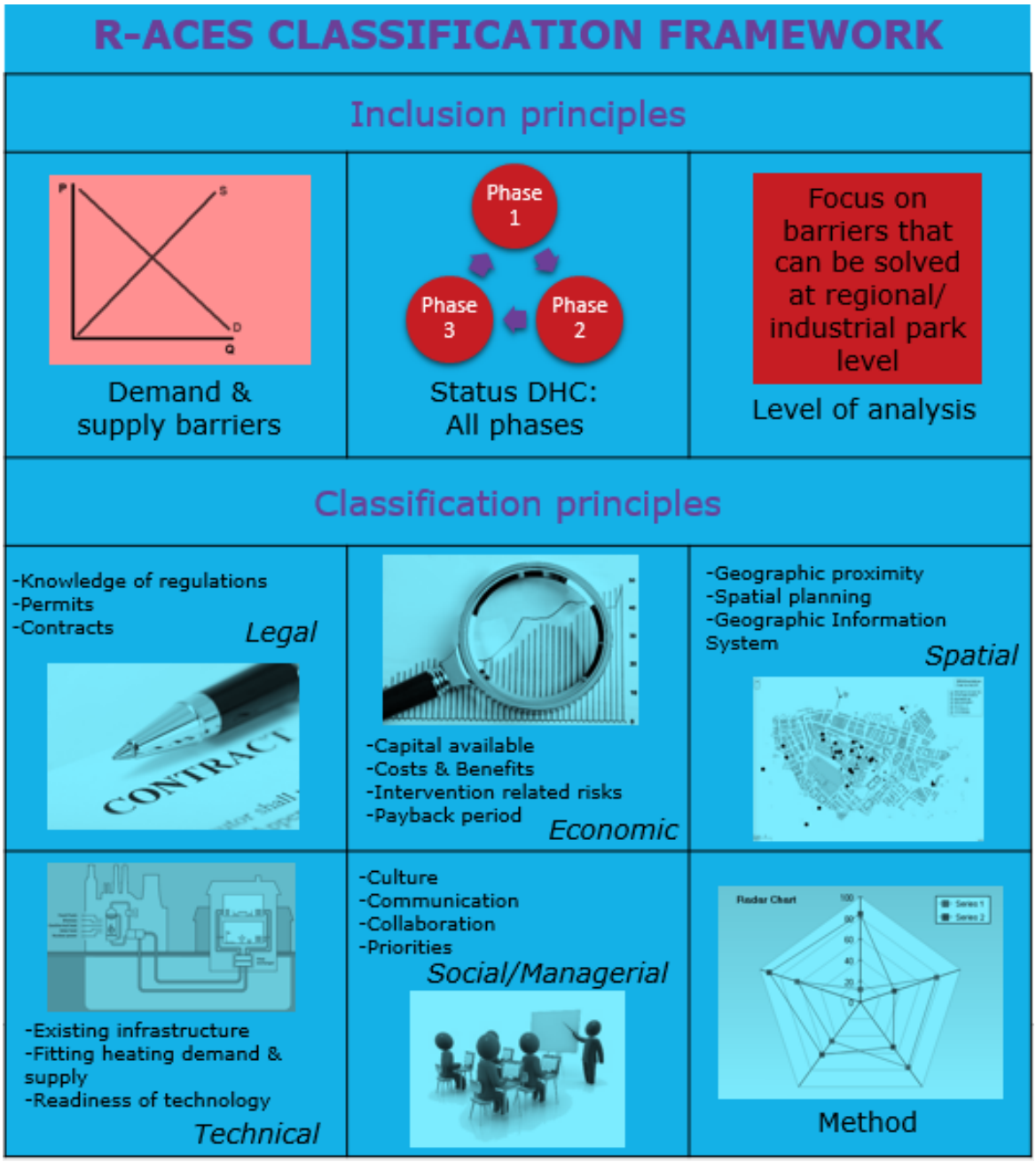

Figure 3: Barriers classification framework

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4 Conclusion

From the quick scan of project documentation and academic literature, we have decided on a classification framework that will be used for the harmonization process in D1.2. This framework is related to the scope of the R-ACES project. The deliverables' result represents a great step forwards in the R-ACES project, as it enables the identification of barriers. Another key result is that we developed a method to identify European projects in the Cordis database.

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Annex 1: Long list with projects

Short List Selected projects for the development of the self-assessment/ legal tool	**Long list** No relevant reports for development self-assessment tool/ legal tool, but still interesting projects for the creation of an ecoregion longlist	**Non selected**
CE-HEAT (Interreg, 2016) CoolHeating (H2020, 2016) District heating Scotland (Scottish national program) ENTRAIN (Interreg, 2019) EPOS (SPIRE 2030, 2015) Firece (Interreg, 2017) FISSAC (H2020, 2015) Flexynets (H2020, 2015) Go Eco (IEE, 2013) Heatnet NEW (Interreg, 2016) In Deal (H2020, 2016) Maestri (SPIRE, ProgRESsHEAT (H2020, 2015) RELaTED (H2020, 2019) REUSEHEAT (H2020, 2017) RiConfigure (H2020, 2018) SCALER (H2020, 2017) Sirene (Dutch national program) Sofie (Dutch national program) So What (H2020, 2019) S-PARCS (H2020, 2019) Stratego (IEE, 2013) TEMPO (H2020, 2018) THERMOS (H2020, 2016) UpGrade DH (2018)	BaMB (H2020, 2015) BestRES (H2020, 2016) BioVill (H2020, 2016) BodenTypeDC (H2020, 2017) BRINE MINING (H2020, 2017) CABRISS (H2020, 2015) Carbon4PUR (H2020, 2017) CIRC-PACK (H2020, 2017) CITYFIED (FP7-ENERGY, 2014) Cool DH (H2020, 2017) D2Grids (Interreg, 2018) Dream (H2020, 2016) DryFiciency (H2020, 2016) ENESCE (Interreg, 2019) ENRSYS (FP7-SME, 2012) ETEKINA (H2020, 2017) FC-District (FP7-NMP, 2010) FOUNDENERGY (FP7-SME, 2011) GrowSmarter (H2020, 2015) HeatRoadMapEurope (H2020, 2016) Hybrid GEOTABS (H2020, 2017) INNOPATHS (H2020, 2016) INTHEAT (FPE-SME, 2010) ISAAC (H2020, 2016) Love (FP7-ENERGY, 2010) MAtchUP (H2020, 2017) MOEEBIUS (H2020, 2015) MySMARTLife (H2020, 2016) NEXTEC (FP7-NMP, 2011) OPTi (H2020, 2015) Planheat (H2020, 2016) R4R (FP7-REGIONS, 2012) REMOURBAN (H2020, 2015) REnnovates (H2020, 2015) REPLICATE (H2020, 2016) RESYNTEX (H2020, 2016) Rewardheat (H2020, 2019) SECURECHAIN (H2020, 2015) SMART (H2020, 2016) SmartEnCity (H2020, 2016) STORM (H2020, 2015) SuPREME (h2020, 2015) SymbioOptima (H2020, 2015) TOPAs (H2020, 2015) WEDISTRICT (H2020, 2019)	BIS TRIS

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Annex 2: Detailed project short list

The following table provides a short description of the projects included in the shortlist. This shortlist will be used in D1.2 to harmonize previous insights regarding DHCs.

Related project or academic study	Focus area	Selected deliverables/studies	Selected reports	Indicative tool use	Indicative # of involved regions
CE-HEAT (Interreg)	Aims to improve the governance of energy efficiency by focusing on field of **waste heat utilization in Central Europe space and through increased exploitation of endogenous RES** – waste heat	2	1) Brochure: Business case to energy sector 2) Developing District Heating in North Western Europe	Self-assessment tool & Legal tool	9
CoolHeating (H2020)	Supports the **implementation of small modular renewable district heating and cooling** (DHC) grids in south-east Europe.	6	1) five reports on the framework conditions and policies in diverse European countries 2) Guideline on drafting heat/cold supply contracts between actors	Self-assessment tool & legal tool	21
District heating Scotland (Scottish project)	aims to boost the uptake of **low carbon heat technologies** in Scotland and focuses the efforts of a number of agencies working in this area	1	1) JRC scientific and policy reports	Legal tool	1
ENTRAIN (Interreg)	Wants to encourage the adoption of a **systematic and efficient energy planning** able to reduce the local carbon footprint	3	1) DELIVERABLE D.T1.2.2 2) DELIVERABLE D.T1.2.1 Italy 3) DELIVERABLE D.T1.2.1 Germany	Self-assessment tool Legal tool	5 (7)
EPOS (SPIRE 2030)	**Barriers for industrial symbiosis** implementation	1	1)#Insight 11	Self-assessment tool	5 (no link)
Firece (Interreg)	Plan territorially based **low-carbon strategies** in the frame of Regional Energy plans	1	1) D.T.1.1.1-State-of-the-Art-Analysis	Self-assessment tool	9

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FISSAC (H2020)	**Fostering industrial symbiosis** for a sustainable resource intensive industry across the extended construction value chain	1	1) D1.2 Best Practices	Self-assessment tool	0
Flexynets (H2020)	Deploy a new generation of **intelligent DHC networks** that reduce energy transportation losses	2	1) D6.4 2) Guide book	Legal tool	0
Go ECO (IEE)	**Apply a co-operative approach** to reduce energy consumption and CO2 emissions in existing business parks	1	1) Project summary	Self-assessment tool	0
Heatnet NWE (Interreg)	will address the challenge of reducing CO2 emissions in North West Europe by creating an integrated transnational NWE approach to the **supply of renewable and low carbon heat**	1	1) A guide for energy companies 2) Guide to finance 4 DHC	Self-assessment tool Legal tool	6
IN DEAL (H2020)	Will offer an innovative platform that will impose a fairly **distribution of heating and cooling among the network's buildings**	1	1) Deliverable 3	Legal tool	2
Maestri (SPIRE)	aims to advance the sustainability of European manufacturing and process industries	1	1) D1.1	Self-assessment tool	0
progRESs HEAT (H2020)	Supporting the progress of renewable energies for heating and cooling in the EU on a local level	1	1) D 3.2 Barriers	Self-assessment tool	5 (no link)
RELaTED (H2020)	Will provide an innovative concept of decentralized **Ultra-Low Temperature (ULT) network** solution with substantial efficiency and environmental benefits	2	1) Deliverable 2.3 2) Deliverable 2.5	Self-assessment tool Legal tool	4
REUSEHEAT (H2020)	Show case replicable models **enabling the recovery and reuse of excess heat** available at urban level	1	1) Scientific publication (Lygnerud)	Self-assessment tool	4
RiConfigure (H2020)	By bringing different voices together in new types of collaborations we avoid blind spots because every actor has specific	1	1) Deliverable 6.5	Self-assessment tool	0

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	competences and focus points				
Scaler (H2020)	To identify best practices and lessons learnt for scaling up **industrial symbiosis**	3	1)T2.3 "Incentives Assessment" 2)Deliverable 2.2 3)Deliverable 2.1	Self-assessment tool	25
Sirene	Analysis of three Dutch cases of regional energy networks using semi-structured interviews and focus groups. With a focus on social-organizational barriers.	1	1) Final report	Self-assessment tool	3
Sofie	Investigation of the feasibility of local system integration to accelerate the energy transition through social labs	1	1) Final report	Self-assessment tool	0
SO WHAT (H2020)	Develop and demonstrate an integrated software which will support industries and energy utilities in comparing alternative Waste Heat and Waste Cold exploitation technologies	2	1) D3.1 - REPORT ON CURRENT BARRIERS TO INDUSTRIAL WH/C RECOVERY AND EXPLOITATION 2) Report-on-current-contractual-arrengement-for-for-WHC-exploitation	Self-assessment tool Legal tool	5 Page 25
S-PARCS (H2020)	Identify, summarize and cluster the manifold barriers associated with various solutions of **energy cooperation** and mutualized energy services	2	1)Deliverable D1.2 2)Barriers assigned to solutions inventory	Self-assessment tool Legal tool	4
Stratego (IEE)	Support local authorities in taking action so that they can help their national authorities in **preparing and developing NHCPs**.	1	1) Deliverable 3.D	Self-assessment tool	43 (no link)
TEMPO (H2020)	**Crowdfunding as a financial tool** for DHCs	1	1) D6.4 Crowdfunding report	Self-assessment tool	3
THERMOS (H2020)	accelerate the development of new **low-carbon heating and cooling systems** across Europe	2	1) Baseline Replication Assessment Report 2) Module 5	Self-assessment tool Legal tool	8

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Upgrade DH	**Enabling the upgrading of district heating systems**	1	1)Handbook	Self-assessment tool	8
Academic	**Drivers and barriers of industrial symbioses/ ecoregions**.	9		Self-assessment tool Legal tool	0
Total		48			

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Annex 3: Classification of themes

Research/project	Identified themes that can function as drivers/ barriers
CE-HEAT (Interreg)	Main barriers: • **Differences between sources of heat and demanded heat** • **Lack of data**
CoolHeating (H2020)	Main focus on legal frameworks in countries. For each country, an overview is given of potential barriers (ungrouped). Main focus is on legal and cultural aspects. Results might be especially interesting for the development of a legal tool.
District heating Scotland (Scottish project)	Shows a typical project's development and offers advice to support organizations through each stage. The identified stages are: 
ENTRAIN (Interreg)	No clear classification of drivers and barriers. Surveys are conducted with several organizations. The respondents mention several drivers and barriers: Legal & Procedural, Economic & Financial (Incentives), Social, Managerial, Communication, Competition with other alternatives.

EPOS (SPIRE 2030)	LESTS scheme:
	• **Legal**
	  • **Policy/regulation**
	  • **Readiness to close deal**
	  • **Permit requirements**
	• **Economic**
	  • **Public funds**
	  • **Readiness to invest**
	  • **Payback requirements**
	• **Spatial**
	  • **Regional planning**
	  • **Readiness of land**
	  • **Transport requirements**
	• **Technical**
	  • **Existing infrastructure**
	  • **Readiness of technology**
	  • **Expertise requirements**
	• **Social**
	  • **Community acceptance**
	  • **Readiness to collaborate**
	  • **HSE/CSR impact**

Firece (Interreg)	Conducted a SWOT analysis on contribution of industry to regional energy targets:

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FISSAC (H2020)	Seven types of industrial symbiosis' barriers have been identified and could be classified as follow: • **Commitment to sustainable development** • **Financial** • **Community engagement** • **Lack of information** • **Culture of cooperation** • **Technical** • **Regulatory** In addition, seven drivers of industrial symbiosis have been identified: • **Technical innovation** • **Regulation** • **Economics** • **Information** • **Cooperation** • **Energy savings** • **Sustainablity**
Flexynets (H2020)	Reports are more interesting for legal tool. No interesting results for the classification of drivers and barriers.
Go ECO (IEE)	Describes the lessons learned during the project: • **They point out that** lacking relevant information for energy monitoring tool **is the most common barrier.** • **Another important important barrier was the fact that business parks tend to be very unstable. Therefore, the** pay back period of a project should be relatively short in order to convince actors to invest**.** • **A third, and last barrier, was the fact that** communication in business parks is difficult and lengthy **due to complex structures.**
HeatNetNew	Public vs Private ownership: Has influence on development DHC. Barrier classification: • **Financial issues**

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	• **Lack of public knowledge** • **Reliance on fossil fuels** • **Legislation and policy issues**
IN DEAL (H2020)	Describes the legal background and barriers per European country. Barriers are, for example, described in the following way: Main barriers Slovenia, that are also valid in other countries: • **High investment costs,** • **Time consuming process for obtaining necessary permits,** • **Disorderly legislation: users living in areas where a DH system using renewable sources is in place or will be developed have no obligation to connect to the DH network. They are eligible for receiving financial support to use other heating sources (i.e. heat pump, wood boiler…),** • **In direct competition with natural gas.** Other obstacles that are additionally mentioned in the French context: • **Legal obstacles such as the energy credit tax which is not applicable,** • **General lack of awareness regarding DHC and its positive contribution to the energy transition.** For each European country, the main obstacles are described. The focus of most obstacles is on legal aspects.
Maestri (SPIRE)	• **Government support & level of intervention** • **Data quality in waste production and management processes**
progRESsHEAT (H2020)	Supply-Side Barriers Financial economic • **Development costs** • **Intitial costs** • **Operating costs** Institutional-structural & market oriented • **Infrastructure** • **Regulations** • **Technology suitability** • **Policy framework** • **Multi-stakeholder issues** Perceptual-behavioural • **Bounded rationality** • **Trained workmen** Demand-Side Barriers Financial economic • **Initial costs** • **Operating costs** Institutional-structural & market oriented • **Energy demand** • **Building stock** • **Policy framework** • **Seperation of expenditure and benefit** • **Multi-stakeholder issues** Perceputual-behavioural • **Uncertainties** • **Knowledge/ awareness gaps** • **Trained workmen** • **Risk and loan aversion**
RELaTED (H2020)	Barriers for local ULT DH production • **Legislation concerning energy supply to DH** • **Pricing models for purchase of heat** • **Practical barriers**
REUSEHEAT (H2020)	Survey on barriers for urban waste heat recovery: • **Low technical maturity of existing system solutions** • **Long payback periods**

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	• **Existing incentives for RES and CHP** • **Absence of a legal framework for urban waste heat recovery** • **Absence of standardized contracts** • **Diverging views of the value of heat** The low temperature of urban waste heat
RiConfigure (H2020)	Barriers for social labs. The following ones might also be interesting for the development of DHCs: • **Lack of funding** • **Financial asymmetries** • **Fear of inefficiency** • **Lack of mandate or backing from organization** • **Lack of interest in collaboration** • **Traditional management tools and paradigms** • **Lack of national initiatives to support cross sector collaboration**
Scaler (H2020)	Barriers classification: • **Leadership** • **Intermediaries/knowledge agents (network organizations)** • **Social relationships** • **Process** • **Technology** • **Tools/modelling & measurement**
Sirene (Dutch project)	Analysis of three Dutch cases of regional energy networks using semi-structured interviews and focus groups. With a focus on social-organizational barriers. Identified barriers: Social/organizational: • **Reluctance to share (commercially) sensitive information.** • **Differences in priorities and speed of decision making.** • **Hidden priorities or conflicting interests in the project.** • **Negative experiences in collaborations between the stakeholders.** • **Changes in formal organization or shift of attention to different projects.** • **Program team is not diverse enough.** • **Culture of the organization does not align with strategy.** • **Untimely risk identification.** • **Absence of a man-on-the-moon vision (shared amongst stakeholders).** Technological/economical: • **Lock-in (security of supply and business case vs. Monopoly effect).** • **Shortage in supply or demand due to out-of-control events (e.g. building projects are delayed / on-hold).**
Sofie (Dutch project)	The barriers and success factors from project SIRENE are condensed into a list of 12 principles for regional energy exchange projects: • **Hire the right people for the job.** • **Members of consortium are representative for the stakeholder environment.** • **Monitor ever-changing stakes, motives and responsibilites of partners.** • **Clearly distinguish between program and project.** • **Address (brewing) conflicts.** • **A long-term vision is leading for chosen activities.** • **Independent program and project support.** • **Develop a transparant shared business case.** • **Monitor needs of end-users and non-users.** • **Organize learning on the individual, group, organization and network level.** • **Develop the competence for systems thinking.** • **Define concrete and abstract results from the collaboration.**

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	In addition, SOFIE also produced: • **A list of heat atlases in the Netherlands and Europe.** • **Inventarisation of 'serious games' in the Netherlands.** • **Social lab approach to facilitate opportunity recognition for exchange of energy or materials in regions.** • **A list of tools for the exploration stage of regions, e.g. multi-** • **stakeholder partnership tools.** • **A list of interventions for social lab approaches.**
SO WHAT (H2020)	Barriers which deteriorate the business case of DHCs: • **Lack of existing infrastructure** • **Low prices for competing energy sources** • **Current policy incentives promote other forms of heat supply** • **Long distance between supply and demand** • **Supply and demand not matching, not sufficiently high-grade heat, and varying seasonal demand** • **Risk that the excess heat provider will terminate its industrial activities** • **High transactional cost in terms of required time for design contract** Non-economic barriers • **Lack of financial funding** • **Low priority to non-core business** • **Lack of trust between stakeholders** • **Different views of the value of heat (price and quality)** • **Lack of knowledge about heating issues** • **Lack of knowledge about the amount of excess heat** • **Lack of knowledge about business arrangements** • **Requirement for a short payback period** • **Different views on how to plan revisions/ stops for the excess heat**

S-PARCS (H2020)	• **Economic perspective**
	  • **Financial**
	  • **Market-related**
	• **Social/Manegerial (also includes trust)**
	  • **Individual**
	  • **Mutual**
	  • **Organizational**
	• **Frameworks (Framework)**
	  • **Legal/Regulatory/ Policy**
	  • **Standardization**
	• **Technical/Engineering**
	  • **Lack of knowledge**
	  • **Technological maturity**
	  • **Resistance to innovate**
	• **Information perspectives**
	  • **Missing information**
	  • **Quality information exchange**
	
	In addition they use other categories:
	• **Waste Valorisation**
	• **Purchase**
	• **Energy production**
	• **Energy efficiency**
	• **Grid and storage**
	• **Joint cooperation solutions**
	• **Park planning**

Stratego (IEE)	Stratego mainly focusses on the role of local authorities. These are less relevant for the R-ACES project, however, the following distinction is also useful for ecoregions. The development of a DHC can be in different phases of the project: • **Mapping local heating & cooling demand & supply** • **Identification of areas of priority for intervention**

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	• **Business models for local partners** • **Involvement of local stakeholders** • **Input for local heating & cooling plans**
TEMPO (H2020)	Crowdfunding as a way to overcome financial barriers.
THERMOS (H2020)	Strong focus on market and investment barriers and opportunities. These are described at the regional/ local level and national/European level.

Upgrade DH	Non-technical aspects:
	• **Strategies and policies**
	  • **Future changes in the power sector**
	  • **Efficiency requirements**
	  • **Future heat demand**
	• **Stakeholders**
	  • **Consumers**
	  • **Managers**
	  • **Technicians**
	  • **External experts**
	  • **Politicians**
	  • **Heat supplying organizations**
	• **Financial analyses and options**
	  • **Capital costs**
	  • **Payback time**
	  • **Organizational costs**
	• **Permitting procedures**
	  • **Spatial planning**
	  • **Building/ construction**
	  • **Environmental**
	• **Contractual issues**
	  • **Planning and construction contracts with implementing companies**
	  • **Heat supply contracts with the heat consumers**
	  • **Ownership contracts with shareholders**
	  • **Contracts with energy regulators and utilities**
	  • **Contracts with fuel suppliers (for bioenergy projects)**
	  • **Land access contracts**
	  • **Operation and maintenance contracts**
	• **Business models**
	  • **Fully public model**
	  • **Private model**
	  • **Public Private Partnership**

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