R-ACES
Energy Cooperation Platform

Educational online environment

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Technical References

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[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

Document history

	Date	Author (name, organisation)	Description
V0.1	10-5-2022	Christa de Ruyter & Max Brouwer	First version of the deliverable
V0.2	30-08-2022	Christa de Ruyter & Max Brouwer	Final version after review

Project Summary

The R-ACES project is an initiative promoted by 7 partners from 6 European countries, with the vision to support high-potential industry parks and clusters to become fully fledged eco-Regions 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 decision support tool, and a smart energy management platform for clusters. The tools are embedded in the 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.

Partners

Institute for Sustainable Process Technology

https://ispt.eu/

Condugo

https://www.condugo.com/

Spinergy

http://www.spinergy.it/

energy CLUSTER DENMARK

https://www.energycluster.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

EUROHEAT & POWER

https://www.euroheat.org/

Executive Summary

Within R-ACES we facilitate ecoregions that want to engage in energy cooperation projects. For many ecoregions energy cooperation is a relative new concept. There are a lot of aspects of energy cooperation that are unknown to the ecoregion members. Through the educational environment presented in this deliverable, we want to enable people to find materials developed by R-ACES and other European Projects. We think this is important, because a lot of materials are created by SPIRE, H2020, and Interreg project that compromise technical, economic, legislative, and other knowledge. The development of the educational online environment helps to disseminate the available knowledge to a larger public.

Key Words

R-ACES keywords

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

Deliverable keywords

Learning Environment, Courses, Templates

Disclaimer

Introduction

Objective of the work package "Expand"

The overall objective of the work package is to EXPAND the coordination and support action towards 10 regions in Italy, Denmark, Belgium, and the Netherlands which are the countries of the industrial partners of R-ACES. These regions are selected and approached during the project lead-time and R-ACES aims to trigger energy cooperation actions in the regions and to commit management of sites, DHC's, industrial parks to start energy cooperation actions. The regions will benefit from the development of the tools and experience during validation in the three main ecoregions of the project (work package 3).

The main way to coordinate the expansion is through the means of learning communities (LC). A learning community within R-ACES refers to a local group of stakeholders that are (a) directly involved with the energy collaboration on a site; and (b) engaging in both organised and informal exchange of knowledge and best practices over the course of the project period. These groups are the first beneficiaries of instruments like the use case libraries, the R-ACES tools, and the R-ACES serious game. Learning communities from different sites in this project will eventually be brought into contact with each other to further stimulate the exchange of best practices. Learning communities are seen as important to facilitate innovations related to energy cooperation projects. So, they build innovation capacity in the ecoregions.

To reach the overall objective, the following actions will be conducted:

- Formulate an expansion roadmap in which the actions to roll out the learning communities in the ecoregions are described
- Make a template for the learning community meetings
- Evaluate the learning communities as a way for capacity building
- Make a serious game that serves as potential content of the learning community meetings
- Set up an educational online environment that can be applied to generate knowledge and awerness among the learning community members

Objective of the deliverable

This deliverable focuses on the educational online environment.

Within R-ACES we facilitate ecoregions that want to engage in energy cooperation projects. For many ecoregions energy cooperation is a relative new concept. There are a lot of aspects of energy cooperation that are unknown to the ecoregion members. During the R-ACES project we asked them what kind of topics they would like to know more about. A topic list was established. Afterwards, we selected relevant course materials developed in the scope of other European projects. These courses were promoted to the ecoregion members and on the R-ACES website. To make the course material available to other partners, we introduce search filters.

The online education environment

On the R-ACES website an online education environment was included under the top level section "Knowledge Hub", the R-ACES Training materials archive . On this webpage, training materials selected or made by the R-ACES consortium can be found.

Learning modules

We propose 3 learning modules that can be used as a training material. Each module discusses a heat exchange related theme and is set up of several lessons. Each lesson is comprised of one or various reports, exercises, use cases, presentations and / or workshop materials. The lessons finish with an evaluation exercise.

The goal of the modules is to enhance your understanding of the social, economic, and technological aspects of energy cooperation (module 1 & 2) or provide a methodology for the creation of an ecoregion (module 3).

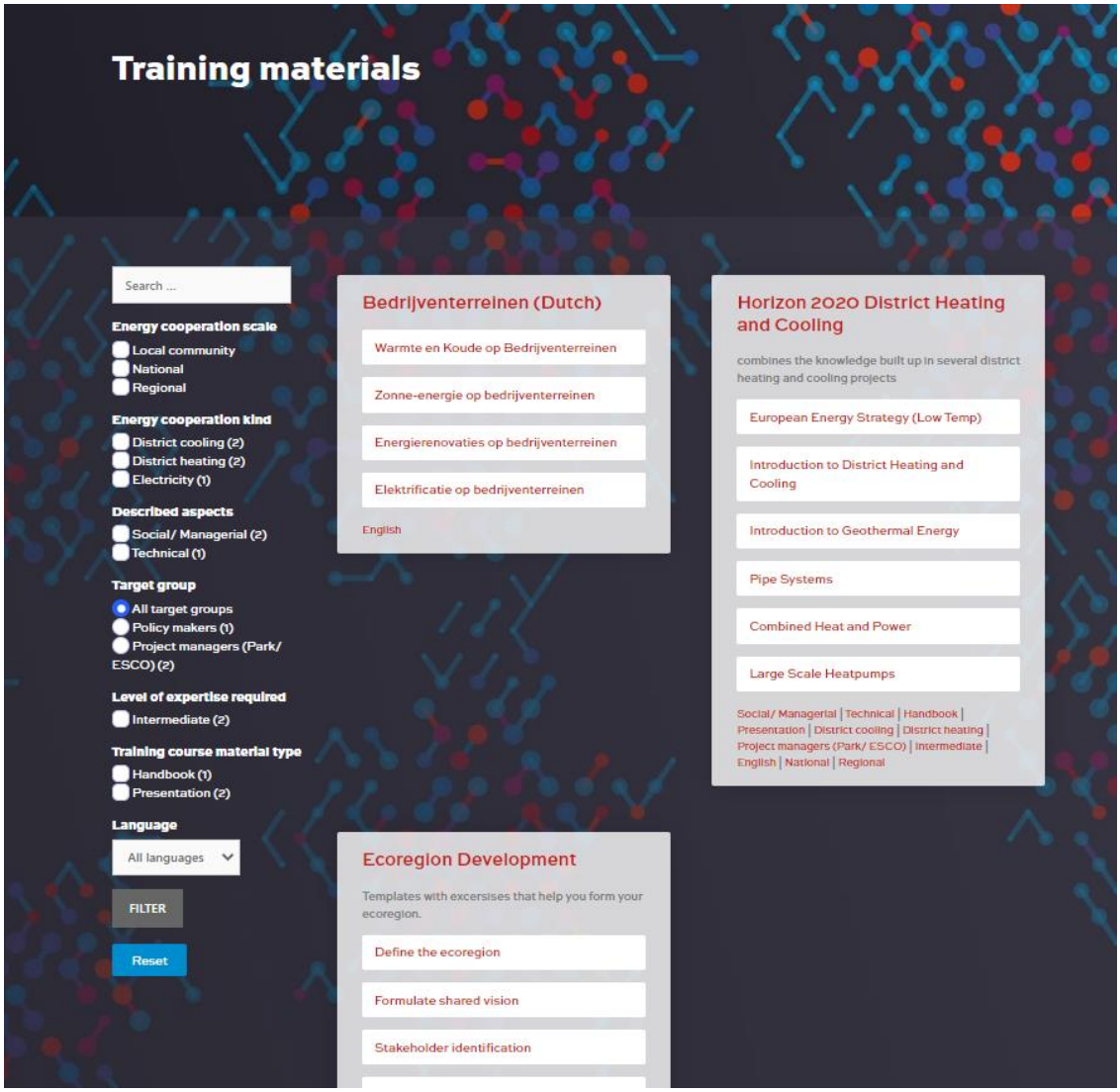
The lessons form a comprehensive overview of a particular theme, however, if interested in one topic, the lessons can be followed as stand-alone courses.

Following modules are included:

- **Ecoregion Development - Templates with excersises that help you form your ecoregion. For more information on the module go to:** Horizon 2020 District Heating and Cooling - R-Aces
- **Horizon 2020 District Heating and Cooling- Combines the knowledge built up in several district heating and cooling projects. For more information on the module go to:** Ecoregion Development - R-Aces
- **Bedrijventerreinen (Dutch) - A webinar series about increasing the sustainability of industrial areas. For more information on the module go to:** Bedrijventerreinen (Dutch) - R-Aces

Usage

Below, one sees a screenshot the training materials web page. On the left, the different search filters were created for an easier way to find adequate materials. On the right, the different courses are depicted.



Example of a course: Horizon 2020 District Heating and Cooling

Each course starts with a short introduction and consists of different lessons. The Horizon 2020 District Heating and Cooling course, consists of the main materials developed by H2020 projects. In the course, you will:

- Learn about European Energy Strategy
- Be introduced to a selection of presentations, text documents and videos on how district heating and cooling can contribute to Paris Agreement targets in Europe. The course was built on knowledge and materials from projects in the Horizon2020 and Interreg programmes.
- Practice and reflect on the lessons using evaluation materials as well as use cases from the R-ACES use case library.

Energy cooperation kind: District cooling, District heating

Described aspects: Social/ Managerial, Technical

Target group: Project managers (Park/ ESCO)

Expertise level: Intermediate

Course material type: Handbook, Presentation

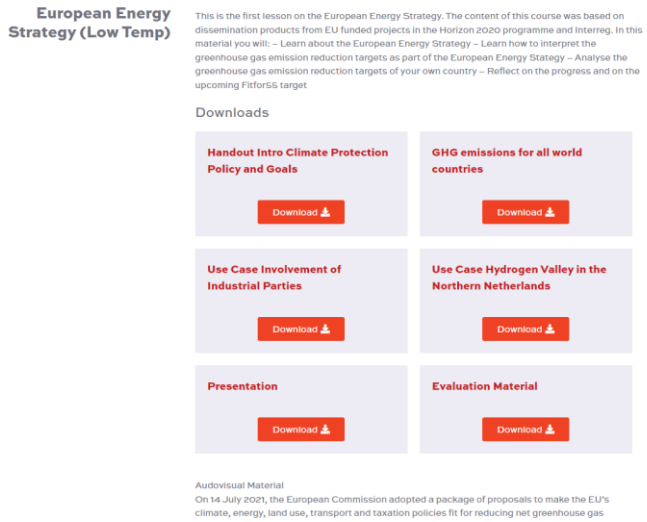
Language: English

The Horizon2020 project Heat Roadmap Europe has shown that the heating and cooling sector in Europe can be fully decarbonized based on technologies and approaches which already exist, are market-ready and have been successfully implemented in Europe. The heating and cooling sector represents the largest energy sector today. By redesigning the energy system and combining end-use savings with heat pumps and district heating and cooling using excess heat, efficiency and renewable sources, over 4.340 Mton CO2 emissions can be reduced accounting for a reduction of 86% compared to 1990. In addition, this is an economic transition creating jobs, increasing expenditures in local energy efficiency and use of local resources, creating a heat supply more resilient to fuel price fluctuations [HRE, Deliverable 6.4, 2018]

This course manual is part of the R-ACES course 'Horizon 2020 District Heating and Cooling'. It combines the knowledge built up in several district heating and cooling projects within Horizon2020 as well as a few Interreg projects in one focused course structure. The goal is to provide an introductory-level course on district heating and cooling in Europe. It first introduces the European Energy Strategy, followed by six lessons on various district heating and cooling technologies.

Each lesson is filled with presentations, videos, use cases and evaluation material. In the lesson introduction, you find the learning goals of the lesson. You are asked to read the several materials and watch the audovisual material. Afterwards, you can answer the questions formulated in the evaluation material document.

In total, this course exists of six lessons. Each lesson is filled with presentations, videos, use cases and evaluation material. In the lesson introduction, you find the learning goals of the lesson. You are asked to read the several materials and watch the audio-visual material. Afterwards, you can answer the questions formulated in the evaluation material document. The following screenshot gives an impression of lesson 1.



Conclusion & outlook

We hope the educational environment as presented in this demonstrator helps professionals in the energy world to acquire more information on different aspects of energy cooperation. If more relevant material is made and is available to share, we will add this to the environment.

1 Annexes

Annex 01

R-ACES definitions

Project Glossary

Definition of Key Concepts in the R-ACES project

Business park: An area of land in which many office buildings are grouped together with a common infrastructure (Wikipedia). Business parks, like industrial sites, often have similarities in heating and cooling demand. Certain businesses may even have residual energy streams, for example data centers. As such, business parks may also organize as an ecosystem or eco business park (EBP) and become an important stakeholder within an ecoregion.

Eco Business Park: *"An eco-industrial park is a community of businesses located on a common property in which businesses seek to achieve enhanced environmental, economic and social performance through collaboration in managing environmental and resource issues. This is known as industrial symbiosis, which is a means by which companies can gain a competitive advantage through the physical exchange of materials, energy, water and by-products, thereby fostering inclusive and sustainable development."* (United Nations Industrial Development Organization)

Communicate: professional and public coverage of the project results and achievements, benefits and potential deployment. This will be realised via the adoption of a large variety of distribution channels, including already existing platforms focusing on energy cooperation in industrial sites and business parks and energy exchange/cooperation at large.

Disseminate: exploitation of the project results to relevant stakeholders in the regions. It intends to ensure a low threshold in accessibility, usage of R-ACES tools and methods. This includes access to the tools, to the use case libraries and to the training and capacity building material and related self-explanatory instruction manuals.

DHC: Abbreviation of District Heating and Cooling. A system for distributing heating/cooling generated in a centralized location through a system of insulated pipes for residential and commercial heating requirements such as space heating/cooling and water heating/cooling.

> 4th generation DHCs: *"4GDH systems provide the heat supply of low-energy buildings with low grid losses in a way in which the use of low-temperature heat sources is integrated with the operation of smart thermal grids. Smart thermal grids consist of a network of pipes connecting the buildings in a neighbourhood, town centre or whole city, so that they can be served from centralised plants as well as from a number of distributed heating and cooling producing units (or decentralised units) including individual contributions from the connected buildings. The concept of smart thermal grids can be regarded as being parallel to smart electricity grids. Both concepts focus on the integration and efficient use of potential future renewable energy sources as well as the operation of a grid structure allowing for distributed generation which may involve interaction with consumers."* (adapted from Lund et al, Energy 68; 2014, p1-11).
>
> 5th generation DHCs: *"5GDHC is a highly optimized, demand-driven, self-regulating, energy management system for urban areas. Its key features are: 1) ultra-low temperature grid with decentralized energy plants; 2) closed thermal energy loops ensuring hot and cold exchange within and among buildings; 3) integration of thermal and electricity grids."* (D2grids, Interreg NWE)

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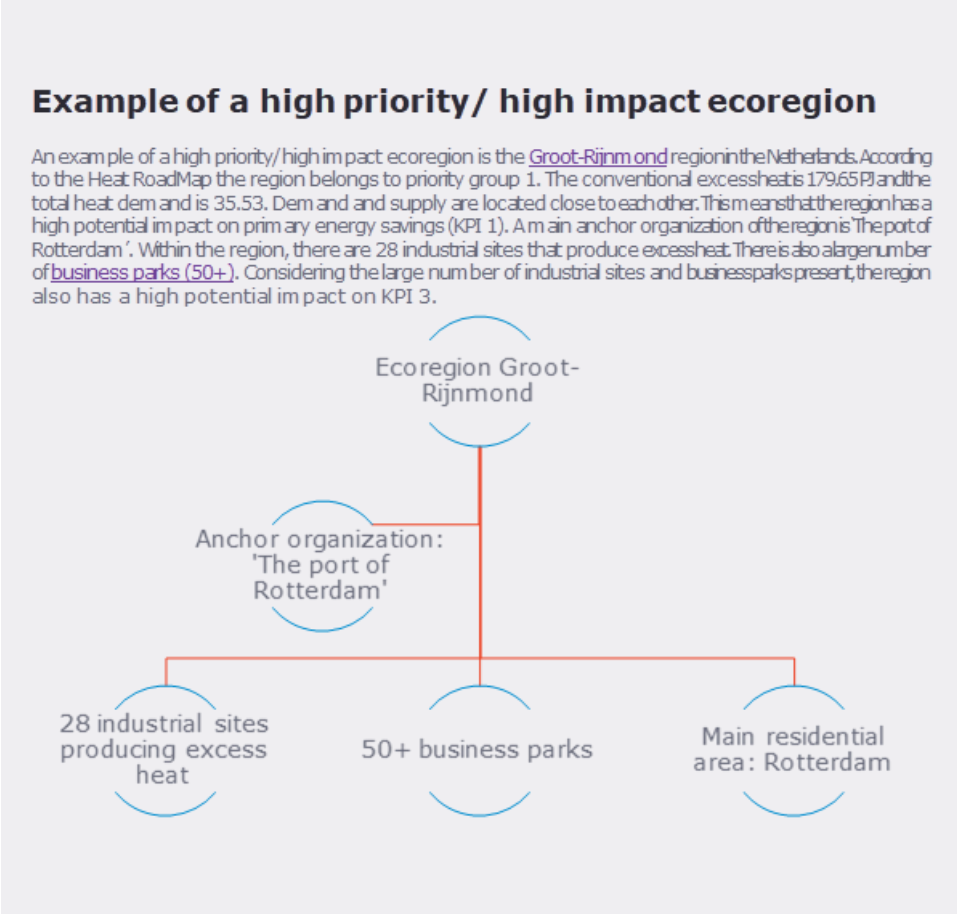
Ecoregion: An ecoregion within the R-ACES project is a geographic area where energy and information exchanges occur between stakeholders of various types to reduce energy consumption. Geographical size does not matter (the size of an ecoregion can be as small as a business park or as large as a city). Important is that an ecoregion relies on an anchor organization responsible for managing the area (for example park management). Another aspect is the proximity of stakeholders to ensure interconnected energy flows (continuity of supply, quality of supply, quantity). Within an ecoregion, a wide range of assets could be involved: office parks, data centers, multimodal centers, technological centers, agro-centers, science parks, brain parks, lighthouse parks, chemical parks, eco-industrial parks, and cluster/business parks. For the demand of heat, also residential areas could be taken into account. As such, the term ecoregion functions as an 'umbrella term'.



High priority region: A high priority region is an Ecoregion, as defined above, that has balanced potential match of heating/cooling supply and heating/cooling demand in both quantitative (amount of heating/cooling) and qualitative (temperature, form of heat) terms. The region should be identified by heat roadmap studies (for example, the Heat RoadMap Europe or Stratego) or other research activities. In addition, the regions should have networking possibilities. The regions can include industrial sites, business parks and residential areas.

The table below gives an indication of the priorities. R-ACES will focus on priority group 1 +2.

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Table 2.19. Excess heat ($E_{heat,o}$) and heat demand (Q_{tot}) characteristics for the definition of priority groups to identify heat synergy regions

	Characteristics			
Priority group	**Excess heat[a] [PJ/a]**	**Heat demand[b] [PJ/a]**	**Priority status**	**Comment**
1	$\sum E_{heat,o} > 10$	$Q_{tot} > 10$	Very high	High levels of both $E_{heat,o}$ and Q_{tot}
2	$1 < \sum E_{heat,o} < 10$	$Q_{tot} > 10$	High	Moderate levels of $E_{heat,o}$ and high Q_{tot}
3	$\sum E_{heat,o} > 10$	$1 < Q_{tot} < 10$	Moderate	High $E_{heat,o}$ and moderate levels of Q_{tot}
4	$1 < \sum E_{heat,o} < 10$	$1 < Q_{tot} < 10$	Low	Both $E_{heat,o}$ and Q_{tot} at moderate levels
0	$\sum E_{heat,o,max} < 2.5$	$Q_{tot,max} < 25$	No priority	Both $E_{heat,o}$ and Q_{tot} at low levels

[a] Maximal theoretical levels of annually available excess heat.
[b] Space heating and domestic hot water preparation in residential and service sectors.

High potential region: Within the project proposal, sometimes the term high potential ecoregion is mentioned. From now on, this term will not be used within the scope of the R-ACES project.

High impact (in R-ACES terms): Regions that have a high potential impact on the R-ACES KPIs. More specifically, regions are meant that have a high potential impact on KPI 1: Primary energy savings, and KPI 3: Number of plant sites and number of industrial parks where businesses commit to energy cooperation.

Energy cooperation: Energy cooperation activities between industries, which include physical clustering (e.g., of buildings and processes, energy exchange, collective production) and/ or service clustering (e.g., joint contracting). Both can deliver a more stable cumulative demand, economy of scale for larger installations with higher efficiencies and smaller spatial footprint and an optimized demand response. Within R-ACES, the focus is mainly on energy cooperation through the exchange of heating and cooling.

Energy Management Platform: is an ICT-tool that makes energy flows transparent; allows energy consumption and production to be allocated to specific installations, stakeholders and nodes; and identifies anomalies and opportunities. A key feature is that it is very easy to use for a wide range of stakeholders. In this way, it is possible to deploy it in a cluster and give access to the different company and cluster managers – each at their level of detail and with the information they should have access to. On the ecoregion level, there will be a dashboard that shows different energy flows.

ESCO: Abbreviation for Energy Service Company. An ESCO is a business that provides a broad range of energy solutions including designs and implementation of energy savings projects, retrofitting, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management.

Facilitator: someone who helps to bring about an outcome (such as learning, productivity, or communication) by providing indirect or unobtrusive assistance, guidance, or supervision. This task does not include technical expert know-how, instead facilitators are trained to facilitate interaction between multiple actors.

Industrial cluster: Within the project proposal, sometimes the term Industrial cluster is used. From now on, this term will not be used within the scope of the R-ACES project.

Industrial park: Within the project proposal, sometimes the term Industrial park is used. From now on, this term will not be used within the scope of the R-ACES project.

Industrial region: Within the project proposal, sometimes the term Industrial region is used. From now on, this term will not be used within the scope of the R-ACES project.

Industrial site: An area zoned and planned for the purpose of industrial development. An industrial site can be thought of as a more "heavyweight" version of a business park or office park, which has offices and light industry, rather than heavy industry. They may contain oil refineries, ports, warehouses, distribution centres, factories, and companies that provide manufacturing, transportation, and storage facilities, such as chemical plants, airports, and beverage manufacturers (Wikipedia).

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(R-ACES) Learning community: Local group of stakeholders that are (a) directly involved with the energy collaboration on a site; and (b) engaging in both organised and informal exchange of knowledge and best practices over the course of the project period. These groups are the first beneficiaries of instruments like serious gaming. Learning communities from different sites in this project will eventually be brought into contact with each other to further stimulate the exchange of best practices.

Learning network: *"Allow for enduring relationships built on trust to develop among companies within an industrial site. In turn these relationships encourage information sharing, creative solutions, long term planning and governance among stakeholders. Social aspects increase interactions among stakeholders and strengthen collaborations and partnerships including industrial ones"* (Scaler, 2018). To establish such learning networks, the R-ACES project will use learning communities.

(R-ACES) Legal support tool: A tool that supports practitioners by giving the legal decision support for joint contracts. A low threshold for usage is a critical requirement. The tool is self-explanatory, application oriented, using well-defined and clear terminology. The tool should be able to deal with a high diversity of local situations. For practical reasons, the name of the legal tool might change during the R-ACES process. In this case, the consortium will be informed.

LESTS framework: Abbreviation for Legal, Economic, Spatial, Technical and Social/Managerial. LESTS is a framework that is used in the project to categorize barriers and drivers in ecoregions. The different categories include: 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.

Lock-in: Exchange of by-products will lead to long term reliance on an outside company, which will restrict flexibility of the involved companies and possibility for innovation, or possibility to relocate the site.

Longlist (for example longlist of regions): Exists of lists of items (rows), for example regions, that have been selected on the basis of loose selection criteria (columns). The long list is a first step in creating a short list. The long list should cover all potential subjects that might be of interest to the short list. Example:

Region	Region	Country	Source	# DHCS	# Industrial sites	# Business parks	Contact person	Contact details
1	Maasvlakt	Nederland	...					
2	Chemelot	Nederland	...					
3	Terneuzen	Nederland	...					

Long-term: Long-term impact of R-ACES is gained after the end of the R-ACES project (in KPI terms).

Peer2peer: A network of peers (R-ACES stakeholders) that perceive each other as equal. The peers interact with each other in order to learn from each other. The peer2peer learning context is a formal or informal setting, in small groups or online. Pear learning manifests aspects of self-organization. By this is meant, that there is no hierarchical structure within a peer2peer network (Wikipedia).

(R-ACES) Self-assessment tool: A tool that helps ecoregions to determine the next steps they have to take in the energy cooperation process. The tool exists of a number of questions practitioners have to answer. Based on the answers, the practitioners will get a score and some practical considerations they should take into consideration.

Serious gaming: A method for learning-through-experience that presents participants with a case study in which they have to play pre-assigned roles to each reach a pre-defined objective as quickly as possible. The interactive & competitive gaming element increases the attractiveness and the learning outcome of the case study. Serious gaming addresses cooperation elements among a large variety of practitioners and focus at creating acceptance and awareness, where the learning communities focus at sharing experiences between peers.

Shortlist (for example shortlist of regions): List of items, for example regions, that have been selected from a long list on the basis of (strict) selection criteria. Hereby, the advantages and

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disadvantages of each item are considered (OpenLearn). The shortlist contains items that have a high potential and likelihood to contribute to the R-ACES goal.

Short-term: Short-term impact of R-ACES is gained during the R-ACES project.

Use case: A written description of the sequence of steps performed by an ecoregion to come to fruitful energy cooperation.

Use case library: A library that contains multiple use cases.

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Annex 02

Subtitle

Text about Subsection of Annex 2

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

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