



# Evaluation report on learning communities as instrument for capacity building

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# Technical References

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## 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 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 eco-Regions 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 eco-region is a geographic area where energy and information exchanges occur between various companies and actors to reduce waste and energy consumption. Eco-region 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 for clusters. 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 eco-region 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 eco-regions, 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/>



<http://www.spinerogy.it/>



<https://www.energycluster.dk/>



<http://www.energycluster.it/en>



<https://www.pomantwerpen.be/>



<https://www.esci.eu>



<https://www.euroheat.org/>





## Key Words

### *R-ACES keywords*

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

### **Deliverable keywords**

Learning communities, capacity building, KPIs

## Disclaimer

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# 1 Introduction

## 1.1 Objective of work package 4 “Expand”

The overall objective of the work package is to EXPAND the coordination and support action towards 10 regions in Italy, Denmark, Belgium, France 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 or expand 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 serves as potential content of the learning community meetings**

## 1.2 Objective of the deliverable

This report consists of an evaluation on learning communities as instrument for capacity building. In order to evaluate the learning communities, several steps will be conducted:

- **Theoretical background on learning communities and capacity building**
- **Methodology of the evaluation report**
- **Data gathering**
- **Results**
- **Conclusion**

# 2 Theoretical background

## 2.1 Theoretical background of learning communities





## 2.1.1 Energy cooperation in the ecoregions

The seven additional ecoregions all have their own characteristics. However, they have one thing in common: They want to create new forms of energy collaboration. Earlier in this project, research has been conducted on the actual state of such energy collaboration projects. In practice, many projects encounter legal/ economic/ spatial/ technical or social & managerial obstacles. Often local knowledge and skills are lacking to deal with these barriers<sup>1</sup>. The development of relevant knowledge and skills can then be seen as a crucial factor to foster energy cooperation projects within an ecoregion. R-ACES aims to facilitate this by creating learning communities.

## 2.1.2 What is a learning community?

Learning communities provide a space and a structure for participants to align around a shared goal (in this case energy cooperation). Effective communities are both aspirational and practical. They connect people, organizations, and systems that are eager to learn and work across existing boundaries. At the same time, the communities provide a common agenda and they enable participants to share results and learn from each other, thereby improving their ability to achieve rapid yet significant progress<sup>2</sup>.

The idea behind learning communities is that learning, working and innovation are ultimately connected. Thereby, the involvement of all relevant parties (key stakeholders) is important. A learning community creates opportunities to go beyond the necessary progress in building up knowledge. Through action-based learning, the development and dissemination of both knowledge and skills are efficiently promoted. The strength of learning communities lies in the fact that one learns not only individually but also as a group of colleagues (in one field or multidisciplinary groups of professionals). Participants are working on a real issue and reflecting on actual behaviour. They could, for example, compare a taken energy cooperation approach with the norms and guidelines of others in the same field. Participants are offered the opportunity to share best practices and raise problems of practice with peers in order to illuminate potential solutions. Preferably, there is a facilitator serving as a guide to the group in terms of setting topics for discussion and organizing the time efficiently. The facilitator is supported by materials developed by R-ACES.

A successful learning community is not built in one day. Instead, it consists of the following phases, which are shortly described below.

- **A definition phase in which the learning community is formed. Within the R-ACES project, we identified the following main actions:**
  - **Making a learning community format, process and reflection template**
  - **Setting the context for the learning community in each region**
  - **Selecting the relevant stakeholders for the learning community in each ecoregion**
  - **Plan activities of the learning community and decide on the way of facilitation for each learning community**
- **A starting phase, where the learning community kicks off. Thereby, the following actions should be conducted:**
  - **In each region, a learning community kick off is organized**
  - **Concrete challenges or topics of interest for the energy cooperation case are defined and formulated in each learning community**
  - **The facilitation of each learning community is further defined**
- **An implementation phase during which the participants of the learning community are learning from each other:**
  - **Meetings and activities are organized that fulfil the learning ambitions of the community**
  - **Communication expressions are made**
- **A closing phase during which the learnings of the community are wrapped up and reflected upon:**
  - **A reflection session is organized**
  - **An impact survey is conducted**
  - **An end report is written**

<sup>1</sup> S-PARCS, 2019; Scaler, 2017; Bush, 2016; Tempo, 2018; ProgRESsHEAT, 2015

<sup>2</sup> Harvard: <https://developingchild.harvard.edu/collective-change/key-concepts/learning-communities/>







### 2.1.3 What is capacity building

Capacity building is defined in the following way by OECD-DAC<sup>3</sup>: "Capacity development is understood as the process whereby people, organizations and society as a whole unleash, strengthen, create, adapt and maintain capacity over time." Capacity itself is understood as "the ability of people, organizations and society as a whole to manage their affairs successfully".

In the R-ACES context, capacity refers to the successful implementation of energy cooperation projects, such as the upgrade of a district heating network, the establishment of a hydrogen project, or the creation of a smart grid. Important for capacity building is a devolution of power and resources from central managerial control and towards local institutions and practices (Fischer, 2014). In the world of energy cooperation, the following capacities are often seen as very important<sup>4</sup>:

- **Knowledge about energy cooperation possibilities and technical solutions**
- **Cooperation between all the relevant stakeholders**
- **Ability to handle the legal issues related to energy cooperation**
- **Ability to make a business case for new energy cooperation**
- **Knowledge on how to develop energy systems that save CO<sub>2</sub>-emissions**

The list above should not be seen as an exclusive list of all the skills one needs to establish energy cooperation projects, but they compromise the most important ones<sup>5</sup>. Within the R-ACES learning communities we then try to support the development of these skills among practitioners with the use of the R-ACES tools, the serious board game, learning community templates, and so on. The exact content of the learning community depends on the wishes and needs of local participants.

## 3 Methodology of the evaluation report

To measure whether R-ACES learning communities contribute to the development of energy cooperation capacities, we developed a questionnaire that participants of the learning community meetings will fill in. In the table below, we describe how we aim to measure the progress on certain capacities. In Annex 2, you can find the exact questions.

Capacity	Way of measurement	R-ACES KPI
<i>Knowledge about energy cooperation possibilities and technical solutions</i>	<ul style="list-style-type: none"> <li>- Number of training courses</li> <li>- Number of serious game sessions</li> <li>- Description of discussed plans</li> </ul>	-
<i>Cooperation between all the relevant stakeholders</i>	<ul style="list-style-type: none"> <li>- Number of participants learning community</li> <li>- Kind of participants learning community</li> <li>- Action path to realise energy cooperation plans</li> </ul>	3,4
<i>Ability to handle the legal issues related to energy cooperation</i>	<ul style="list-style-type: none"> <li>- Number of legal contracts / amendments inspired by the learning community meetings</li> </ul>	5
<i>Ability to make a business case for new energy cooperation</i>	<ul style="list-style-type: none"> <li>- Investments inspired by the learning community meetings</li> </ul>	2
<i>Knowledge on how to develop energy systems that save CO<sub>2</sub>-emissions</i>	<ul style="list-style-type: none"> <li>- Amount of energy saved by plans inspired by learning community meetings</li> </ul>	1,6

<sup>3</sup> [OECD-DAC](#)

<sup>4</sup> Based on D1.2 of the R-ACES project: <https://r-aces.eu/wp-content/uploads/2021/01/D1.2-Harmonized-overview-v1.0.pdf>

<sup>5</sup> The indicated capacities are broadly speaking the same as the ones indicated by the Celsius toolbox: <https://celsiuscity.eu/toolbox/>






	- Amount of CO2 emissions saved by plans inspired by learning community meetings	
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# 4 Data gathering

We have sent the questionnaire to the coordinators of each learning community at four different dates: September 2021, March 2022, October 2022, and March 2023. For each learning community, a questionnaire was filled in by the coordinator of that specific learning community. Afterwards, the results were gathered and combined in an excel file.



## R-ACES

Energy Cooperation Platform

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### Contribution of the learning community meetings to fulfilling the energy cooperation ambitions

The questionnaire aims at measuring the contribution of the learning community meetings to the fulfillment of the energy cooperation ambitions of the participants.

[fabrizioook@gmail.com](mailto:fabrizioook@gmail.com) (non condiviso) [Cambia account](#)

\*Campo obbligatorio

Which is the name of the ecoregions?

Bergamo

1. What is the reporting period? \*

M1-M15 (June 2020 - September 2021)

M16 - M21 (October 2021 - March 2022)

M22 - M28 (April 2022 - October 2022)

M28 - M34 (November 2022 - March 2023)

8. Did the learning community meetings inspire any investment plans related to: \*

The recovery of excess heat that is used for district heating.

The energy reduction of business parks in the region and joint energy services.

The improved efficiency of DHC networks as a result of upgrading technology and usage of renewable energy sources.

9. Can you shortly describe discussed plans?

La tua risposta

10. Can you describe the action path you have in mind to realize the plans described above?

La tua risposta

11. Please roughly indicate how much primary energy can be saved when implementing the plans.

La tua risposta

12. Please roughly indicate the approximate CO2 emissions reduction that will occur when implementing the plans.

La tua risposta

2. How many industrial sites and/or business parks are represented by the ecoregion?

La tua risposta

3. How many DHCs are represented by the ecoregion?

La tua risposta

4. How many meetings were organized within the ecoregion? \*

La tua risposta

5. N. of participants in the ecoregion meetings

La tua risposta

6. How many participants did participate in a serious game session? \*

La tua risposta

7. How many participants did participate in Training Courses (online and offline)? \*

La tua risposta


13. Please roughly indicate the amount of investments done when implementing the plans.

La tua risposta


14. Did the learning community inspire any amendment to/ new legal contracts \* (please specify the number of contracts)? These contracts can include: Legislation/ regulation on DHC and trade of heat, Local Energy Communities and the direct exchange of heat, Grid codes and tariffs, Mechanisms to jointly own/ invest in renewable energy sources, Zoning regulations and building codes.

0   1   2   3   4   5

Contracts                     Contracts



**R-ACES**  
Energy Cooperation Platform



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Invia
Cancella modulo





# 5 Results

## 5.1 Impact

At the end of each data collection period (September 2021, March 2022, October 2022, and March 2023) all information was collected in a shared document to monitor the ongoing project KPIs:

REMINDER: ONLY FILL IN THE ADDITIONALLY REACHED HIGH PRIORITY PARKS, INDUSTRIAL SITES, BUSINESS PARKS, DHCs, AND SO ON!													
Ecoregion	High priority parks	Industrial Sites	Business parks	DHCs	N Participants Learning community	N Participants Training courses	N Participants Online Training Courses	N Participants Serious game sessions	Energy savings triggered in PJ/a	€ Investment triggered in sustainable energy	Number of contacts, policies and legal frameworks triggered	Savings Triggered in CO2-eq	
5	Sonderjylland	1	29	0	5	3	0	0	0	x	x	x	x
6	Nyborg	1	4	2	0	8	0	0	0	x	x	x	x
8	Antwerp Foodcluster	1	3	4	0	5	0	0	0	x	x	x	x
9	Antwerp Altoni Kelderma	1	1	0	1	10	0	0	0	x	x	1	x
10	Antwerp Wijnegem/Schoten	1	1	0	0	55	0	0	0	x	x	x	x
11	Antwerp Terbekehof	1	3	0	1	15	0	0	0	x	x	x	x
12	Antwerp Science Park Niel	1	1	0	1	3	0	0	0	x	x	x	x
13	Antwerp Willebroek Noord - Puzos	1	1	0	0	3	0	0	0	x	x	x	x
14	Milano	1	4	0	11	3	0	0	0	x	x	x	x
15	Bergamo	1	3	2	2	5	0	0	0	0,01692	x	1	4,56
16	Castegnato	1					0	0	0	x	x	x	x
17	Brescia	0	6	0	1	2	0	0	0	x	x	x	x
18	Emilia-Romagna	0	13	0	5	17	0	0	2	x	x	x	x
19	Novara	1	3	0	2	2	0	0	0	x	x	x	x
21	Naarden Vesting	0	1	0	2	10	0	0	0	x	x	x	x

[Template KPI Monitoring\\_v2 FG.xlsx](#)

This methodology allowed for monitoring the progress of the project and the activities carried out by each ecoregion. Several meetings were organised between the ecoregion coordinators in order to share experiences and considerations on the proper development of the ecoregions.

## 5.2 Evaluation of the learning communities

### 5.2.1 Experiences in Italy

In Italy 6 ecoregions were included in WP4, but just four signed the LoI: **Emilia-Romagna, Novara, Brescia** and **Milano**.

Since Brescia and Milano are both in the Lombardy region and geographically close to each other, common activities for these regions were carried out. Therefore, this subchapter is divided into one part about the ecoregion Brescia and Milano and a second part about the ecoregion Emilia-Romagna and third part about Novara ecoregion.

#### Brescia and Milano:

In these two ecoregions, R-ACES activities have contributed to advancing a culture of energy cooperation, although this was already quite developed. Especially in Brescia, which has the most extensive district heating network in Italy.

Although in an advanced stage for the Italian panorama, the stakeholders of Brescia and Milan expressed from the very beginning of the project a strong interest in getting to know the R-ACES network and how the project could help them in their activities, especially in the Milan area where some stakeholders wanted to work on a project to recover waste heat produced by Data Centres.



### Added value of the tools, materials & services

R-ACES therefore developed an information and know-how transfer action for these two ecoregions. Several meetings were organised in order to set up working groups on thermal industrial symbiosis. Through this method we were able to bring participants together and make known the added value that R-ACES, and its network, could provide.

In addition, three Serious Game sessions were organised with companies and universities which enabled participants to better understand the dynamics of energy cooperation. At the end of each session, a wrap-up moment was organised focusing on the future constraints and opportunities of district heating.



At the end of 2021, thanks to the work of R-ACES, a local event was then organised - within Enlit Europe - focusing on industrial symbiosis and heat recovery from data centres. At this event experts and companies intervened in order to raise awareness for the stakeholders of Brescia and Milan on the benefits and advantages of energy cooperation.

**ONLINE CONFERENCE**

**INDUSTRIAL SYMBIOSIS AS A DRIVER FOR ENERGY TRANSITION: RECOVERY OF THERMAL WASTE FOR INDUSTRIAL PURPOSES AND FROM DATA CENTRES**

ENLIT EUROPE 2021  
1 dicembre 2021 | 14:30 - 16:30

R-ACES  
The project has received funding from the European Union's Horizon 2020 research and innovation programme

LE2C  
LOMBARDY ENERGY  
CLEANTECH CLUSTER

Enlit 365  
Europe

Cluster Energia

### Indicate what tools might be used in the future in this ecoregion

We expect that all the tools will be used in the two ecoregions. Specifically, we foresee the Legal tool as a source of inspiration for future legal agreements, and the Energy Management Platform in Milan if the Data Centres project starts.

The serious game received a lot of positive feedback, especially from universities. With one technical institute we tried to include the serious game activity in an annual course, there is a good chance of this happening. There will be further developments later on.

**Impact in relation to the KPIs (quantitative part):**

The activities carried out by R-ACES in these two ecoregions (meetings, working groups, serious games and the local event) made it possible to achieve:

KPI 3	Actors that commit to energy cooperation (industrial sites, business parks, DHCs, High priority regions);	<b>+80</b>
KPI 4	Number of relevant stakeholders (e.g. ESCOs, industrial park managers) aware of and/or interested in/ implementing joint energy services;	<b>+140</b>

For the other KPIs, it is very difficult to make realistic forecasts due to the early-stage step in which the ecoregions are.

**Success stories (qualitative part):**

The above-mentioned activities allowed, in line with the needs identified at the beginning of the process, the stakeholders in Milan and Brescia to increase awareness and knowledge of energy cooperation. Specifically, the Serious Games enabled students and professors at universities to stimulate debate on district heating. While the local event successfully transferred best practices and opportunities with respect to industrial symbiosis and heat recovery from data centers. This knowledge will serve stakeholders to implement future projects.

**Reflection on:**

The Learning Community process, composed by first R-ACES presentation and the Serious Game, is valid and very useful especially for the academia world, with regard to professors and students, because it is able to transfer theoretical skills.

For the industrial world the R-ACES toolkit and materials are a bit harder to implement because industries and energy managers need more specific answers to their projects such as access to funds and technologies.

**Emilia-Romagna:**

In Emilia Romagna, thanks to the collaboration between LE2C and the Clust-ER Greentech (the regional cluster for energy and environment with 50 members from the industrial world), it was possible to work closely with regional stakeholders interested in R-ACES tools and learn about best practices of energy cooperation projects.

**Added value of the tools, materials & services**

Two meetings were organised with both the cleantech cluster and local companies to explain the R-ACES project and the advantages it could bring to the area. A concluding local training event "R-ACES: opportunità e strumenti per intraprendere progetti di cooperazione energetica" was then organized where all the tools were tested. Specifically, the Self-Assessment tool received excellent feedback as it allowed, in a simple and intuitive manner, to carry out an energy "audit" of the company.





**Indicate what tools might be used in the future in this ecoregion**

Certainly the Self-Assessment tool: in Emilia Romagna, in fact, they are working on a feasibility study for a project to recover heat from the port of Ravenna. Within this study the SA tool, as communicated by the stakeholders themselves, can be used to map the area and receive an overview of the energy potential of the place in a short time. It can therefore speed up the feasibility study of the project.

**Impact in relation to the KPIs (quantitative part):**

The activities carried out by R-ACES in this ecoregion (meetings, SA tool and the training local event) made it possible to achieve:

KPI 3	Actors that commit to energy cooperation (industrial sites, business parks, DHCs, High priority regions);	<b>+35</b>
KPI 4	Number of relevant stakeholders (e.g. ESCOs, industrial park managers) aware of and/or interested in/ implementing joint energy services;	<b>+20</b>

For the other KPIs, it is very difficult to make realistic forecasts due to the early-stage step in which the ecoregion is.

**Success stories (qualitative part):**

Unlike the stakeholders in Brescia and Milan, knowledge of energy cooperation in Emilia Romagna was quite low: R-ACES's knowledge transfer activities, combined with the use of the tools, positively impacted the regional stakeholders by helping them in their future energy cooperation projects.

**Reflection on:**

In contrast to the ecoregions of Brescia and Milan, here the Learning Community activities were very useful and received great support from stakeholders. This was probably due to a skimming exercise carried out by the regional cleantech cluster (Clust-ER Greentech) to find stakeholders with a high need for knowledge on energy cooperation issues.

**Novara:**

In Novara, thanks to the collaboration between LE2C and Spinerger, we worked closely with the largest local multi-utility in the area, Edison SpA, which was working to expand its district heating network in the territory and needed R-ACES support and know-how to carry out the energy potential of industries in this area.

**Added value of the tools, materials & services**

Two meetings were organised with local stakeholders in order to understand their needs, present the potential of the R-ACES project and finally understand their project. After the meetings, we handed over to them the mapping work carried out, replicating the methodology applied in WP3 for the Bergamo ecoregion.

**Indicate what tools might be used in the future in this ecoregion**

At the first stage the Self-Assessment tool may help Edison SpA to further map the area and receive an deeper overview of the energy potential and speed up the project. In future all the R-ACES toolkit will be able to help the stakeholder to establish a dialogue with energy-intensive industries potentially interested in an energy cooperation project.

**Impact in relation to the KPIs (quantitative part):**

The activities carried out by R-ACES in this ecoregion made it possible to achieve:

KPI 3	Actors that commit to energy cooperation (industrial sites, business parks, DHCs, High priority regions);	<b>+10</b>
KPI 4	Number of relevant stakeholders (e.g. ESCOs, industrial park managers) aware of and/or interested in/ implementing joint energy services;	<b>+7</b>

For the other KPIs, it is very difficult to make realistic forecasts due to the early-stage step in which the ecoregion is.

**Success stories (qualitative part):**

The expertise developed by R-ACES and the methodology already acquired to develop the Bergamo ecoregion in WP3 allowed the Novara stakeholders to speed up the process





of mapping the territory and getting to know the target companies. These activities unlocked the energy potential of the projects and were a push toward a future energy cooperation project.

### **Reflection on:**

The mapping activity carried out thanks also to the SA tool, and the methodology established in WP3, has enabled Edison SpA to make significant energy savings and a clear overview of potential energy-intensive companies.

## **5.2.2 Experiences in Denmark**

### **Added value of the tools, materials & services**

In the ecoregion of Sønderjylland we have only been able to present the tools online. We have, however, at several occasions been able to invite the local stakeholders to use the tools, explaining the value. The target group for our communication in the ecoregion Sønderjylland has been very broad and been to a group already knowing each other, which is an advantage when starting energy cooperation. The legal assessment tool has been presented and sent to local consultant agencies to ensure their knowledge of its existence, as they are the supporting and carrying legal body when it comes to energy collaboration between stakeholders i.e., DH companies and industries.

### **Indicate what tools might be used in the future in this ecoregion**

We expect that the tools will be used by industries and local organisations.

The Energy Management platform can definitely be relevant for the local DH companies if it becomes easy accessible.

Furthermore, the Self assessment tool can be relevant for industries already knowing their data and before involving a consultant to do the calculations. In this way they can save some consultancy money. However, this requires that the industry has the resources to do it, as well as, the knowledge of their data, which is often a big issue. Again we need to remember that their core business is their production and not the utilization of i.e., waste heat.

The legal tool will mainly be used as source of inspiration when having to elaborate a new legal contract in new energy fields. This could also be relevant for university students.

The serious board game can definitely be very relevant for students. It could also be relevant for all other stakeholders, however, my work with the stakeholders in the ecoregion of Sønderjylland showed that both municipalities, industries and local DH companies are extremely busy and will be very hard to convince to prioritize spending hours on playing a board game.



**Impact in relation to the KPIs (quantitative part):**

N KPI	Description	Estimate
KPI 1	Primary energy savings triggered by the project (in GWh/year)	250MWh/year
KPI 2	Investments in sustainable energy triggered by the project (in million Euro);	Estimated investment approx. 470.000 Euro => payback time of around 4,6
KPI 3	Actors that commit to energy cooperation (industrial sites, business parks, DHCs, High priority regions);	
KPI 4	Number of relevant stakeholders (e.g. ESCOs, industrial park managers) aware of and/or interested in/ implementing joint energy services;	40+(this includes both industries, and DHC)
KPI 5	Number of policies and legal frameworks created and/ or adapted to facilitate energy cooperation among businesses;	
KPI 6	Reduction of the greenhouse gas emissions (measured in MtCO <sub>2</sub> eq) and/or air pollutants (in kg/year) triggered by the project.	Approx 6,5 tons of CO <sub>2</sub> per year

**Success stories (qualitative part):**

R-ACES has been very helpful to establish trust and be able to unite industries, DH companies, and energy planners from the participating municipalities.

We have been able to create a common goal in the area focusing on how to identify the best solutions. Most activities have been held online, due to Covid restrictions and the results of building trust and energy communities would definitely have been better and easier to establish if meeting up physically would have been possible.

During the R-ACES project we have been able to create awareness of the importance of energy collaboration in the region. We have throughout the process been able to feel an increase in trust, however, this result would definitely have been better, if we would have been able to meet physically instead of online due to covid.

**Reflection on:**

The work of the R-ACES project in the Ecoregion has had good feedback. However, it is important to emphasize the importance of trust, and focus on how you can build up trust in a specific area. Trust is the foundation for good collaboration and investment; hence it is crucial. Due to not being able to meet up physically with the stakeholders in Denmark the phase of building up trust has been longer than expected.

Furthermore, it is very important to assure the involvement and engagement of the municipalities to assure acceptance and anchoring of the solution. In Denmark there has until June 2020 been legal barriers for utilizing i.e., waste heat. Hence this is quite a new field for many industries as we always need to remember that their core business is NOT the utilization of i.e., waste heat, hence we need to make it easily accessible for them to join in and be a part of an energy community. Often our companies do not have the resources, knowledge, and capacity.





Finally, the learning community approach is very good in theory, as there is time to elaborate ideas, establish trust and collaboration. However, in the private sector (industries and DH companies) there is no time to participate actively in several activities without reaching a fast result. Not that they do not see the value it's more a question of not having the resources to participate as the daily activities simply fill up the days.

### 5.2.3 Experiences in Belgium

#### **GHENT TERNEUZEN:**

##### **Added value of the tools, materials & services**

The serious game has been played among people who did not know each other and came from different companies and countries.

Despite the fact that stakeholders knew that this is a game and the aim is to cooperate, we saw the following behaviour:

- Own interests were put first
- People prefer –initially ‘people prefer to hold their cards to their chest’

In a second phase we asked to play ‘open card’ and to look towards a solution where everybody can benefit, but we did not go towards a ‘nice’ cooperation.

At the end, all involved parties had gained something but the overall result was sub-optimal.

Conclusion: most important step towards a cooperation is to go to full transparency if we want this game can lead towards an efficient and robust solution for an energy system/region. Off course, all involved parties need to gain something from it.

Quote: ‘Be sure every gain and give openly each other some favours’

##### **Indicate what tools might be used in the future in this ecoregion**

The serious board game can definitely be very relevant for students, stakeholders and municipalities. The most important thing is a good moderation of the game and people should be willing to really cooperate in order to achieve the maximum out of it. **Impact in relation to the KPIs (quantitative part):**

As we only played the serious game, it's not possible to quantify KPI's.

##### **Success stories (qualitative part):**

The serious game meant a start in the shared thinking on both sides of the border. This is, obviously, a first step. At this stage the governance structures were still too country-specific and thus no possibility to deploy yet a SAT. But the intention was established that a SAT will be used in further elaboration.

##### **Reflection on:**

During the R-ACES project we have been able to create awareness of the importance of collaboration in the region. We conclude that the most important issue to tackle at the start of an energy cooperation project is trust and transparency.



## 5.2.4 Experiences in The Netherlands Narden Vesting

### R-ACES tools, materials & services:

Self assessment tool concept and the serious game has been used at the region in order to start the discussion on possible cooperation. The presence of R-ACES, started at the initiation phase of the community and therefore especially the self assessment tool, serious game as well and the learning community formats were used. Presence of R-ACES and our approach proved to be helpful in initiating the discussions and exploring energy cooperation possibilities in the region.

### Impact in relation to the KPIs:

N KPI	Description	Estimate
KPI 3	Actors that commit to energy cooperation (industrial sites, business parks, DHCs, High priority regions);	7
KPI 4	Number of relevant stakeholders (e.g. ESCOs, industrial park managers) aware of and/or interested in/ implementing joint energy services;	10

**Success stories:** The waste heat exchange route is being further explored.

**Reflection on:** R-ACES has been very helpful in establishing the first contacts among the local stakeholders as well as build trust among the stakeholders. During the R-ACES project we have started the discussions and created awareness of the importance of collaboration in the region. Possible collaborations routes were discussed and partly thanks to involvement of the project and the knowledge brought in the first estimations of the probability of success of the routes could be made. Finally, we have been able to identify the best solution and focus on the waste heat exchange option for further investigation.

## 6 Concluding remarks

Although the 7 additional ecoregions were different in their needs, scope and characteristics there are some general insights regarding the R-ACES approach, energy cooperation barriers and recommendations we can retrieve from the different experiences.

First of all, all the 7 additional ecoregions experienced the importance of trust within energy cooperation projects. Trust is necessary to share data which will allow you to identify possible energy cooperations projects. As illustrated within the Serious Game, a certain extend of transparency is required to start energy cooperation planning; e.g. the amount of excess energy one can deliver, against what price, the temperature the heat will have or the pressure. Building trust is a time-consuming process. Some elements of the R-ACES method, e.g. the Serious Game, involvement of a neutral facilitator and ecoregion development exercises, stimulate the involvement of various stakeholders, therefore contributing to building trust. However, since industries are often focussed on production activities, while energy cooperation is not their primary business, little time is reserved for such activities. Sometimes, only coming together within working groups or workshops is sufficient to help break the ice between neighbouring companies. A recommendation from all the R-ACES participants is to have live meetings. Experiences from the COVID-period, where predominantly online meetings were held, did not benefit the trust-building progress.



Secondly, and related to the first point, business managers who can potentially participate in energy cooperation projects need to be convinced that you want to help sustain their business. Initially, often a sceptical response is given. Business managers have trouble trusting those who claim to be there entirely in the interests of their company. Therefore, it is important to have a 'neutral' facilitator to help initiate the energy cooperation projects. A neutral facilitator could be someone who represents the business interests of the industrial park, or a network organisation. Besides, it is recommended to involve stakeholders from governmental institutions from the start of the energy cooperation set-up. All 7 ecoregion facilitators identified the public authorities as key players, because they provide a direction, explain the laws and regulations and can give political acceptance for potential projects. Also, they can push in case there are any barriers to starting the energy cooperation. On the other hand, inclusion of the public authorities is also identified as a barrier to energy cooperation projects. Especially in Italy, the public authority is sometimes hard to reach, and involve. Therefore, projects start without their acceptance, which can delay the project in a later stadium or even hinder the implementation.

Most of the R-ACES tools and materials were used within the 7 additional ecoregions as instruments to *raise awareness* about energy cooperation. The Serious Game, knowledge hub and self-assessment tool are a great start to let stakeholders start thinking about their potential to share their excess energy (or use excess energy from a neighbouring company). When the stakeholders are already within a further stadium of the energy cooperation process, most tools became less relevant, according to the experiences in the 7 additional ecoregions. Most tools are quite generic, therefore not providing the level of detail that companies are looking for once they start working out the details of their energy cooperation project. However, the R-ACES partners do expect that the Energy Management Platform can provide more detail (the tools is further improved at the moment), therefore making itself useful in a later stage of the energy cooperation process.

It is also because of this that in Denmark the tools weren't used that much. In Denmark, there is a long tradition of energy cooperation, so that most industries already have basic knowledge about its potential and the socio-technical implications. Finally, the legal tool is experienced to be very useful, however, legal details differ in each country. Therefore, it is recommended once using the legal tool, to add / adapt it to the country's particulars.

Another relevant target audience for the R-ACES tools and materials is the academic world. The R-ACES Serious Game has been played with various university students in both the Netherlands and Italy. The game provides an excellent setting to learn about energy cooperation and the transdisciplinarity of environmental issues, addressing both technical, social, economic and legal aspects, within a multi-stakeholder environment.





## Annexes

### Annex 01

#### R-ACES definitions

**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.

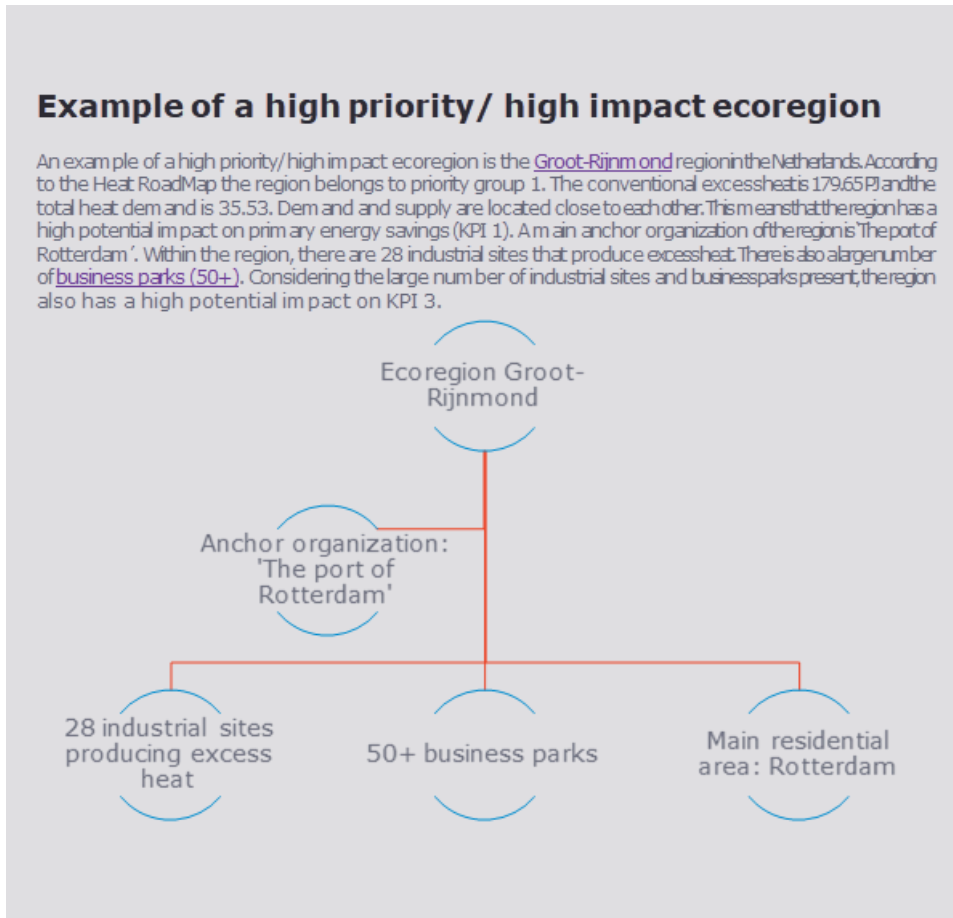
**4<sup>th</sup> generation DHCs:** *"4GDH systems provide the heat supply of low-energy buildings with low grid losses in a way in which the use of low-temperature heat sources is integrated with the operation of smart thermal grids. Smart thermal grids consist of a network of pipes connecting the buildings 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).

**5<sup>th</sup> 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)

**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 in order 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.

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

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

<sup>a</sup> Maximal theoretical levels of annually available excess heat.

<sup>b</sup> 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](#)).

**(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 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. Peer 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 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.





## Annex 02

### Questionnaire



**R-ACES**  
Energy Cooperation Platform

#### Contribution of the learning community meetings to fulfilling the energy cooperation ambitions

The questionnaire aims at measuring the contribution of the learning community meetings to the fulfillment of the energy cooperation ambitions of the participants.

Name ecoregion

Korte antwoordtekst

1. What is the reporting period? \*

- M1-M15 (June 2020 - September 2021)
- M16 - M21 (October 2021 - March 2022)
- M22 - M29 (April 2022 - November 2022)





2. How many industrial sites and/or business parks are represented by the ecoregion?

Korte antwoordtekst

3. How many DHCs are represented by the ecoregion?

Korte antwoordtekst

4. How many meetings were organized within the ecoregion? \*

Korte antwoordtekst

5. N. of participants in the ecoregion meetings

Korte antwoordtekst

6. How many participants did participate in a serious game session? \*

Korte antwoordtekst

7. How many participants did participate in a training course session\*? \*Please specify online/ offline \*

Korte antwoordtekst





8. Did the learning community meetings inspire any investment plans related to: \*

- The recovery of excess heat that is used for district heating.
- The energy reduction of business parks in the region and joint energy services.
- The improved efficiency of DHC networks as a result of upgrading technology and usage of renewable ene...

9. Can you shortly describe discussed plans?

Korte antwoordtekst

10. Can you describe the action path you have in mind to realize the plans described above?

Tekst lang antwoord

11. Please roughly indicate how much primary energy can be saved when implementing the plans.

Tekst lang antwoord

12. Please roughly indicate the approximate CO2 emissions reduction that will occur when implementing the plans.

Korte antwoordtekst





13. Please roughly indicate the amount of investments done when implementing the plans.

Tekst lang antwoord

14. Did the learning community inspire any amendment to/ new legal contracts (please specify the number of contracts)? These contracts can include: Legislation/ regulation on DHC and trade of heat, Local Energy Communities and the direct exchange of heat, Grid codes and tariffs, Mechanisms to jointly own/ invest in renewable energy sources, Zoning regulations and building codes. \*

	0	1	2	3	4	5	
Contracts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Contracts

Afb...



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