READY - Resource Efficient Cities Implementing Advanced Smart City Solutions

Final publishable summary report

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READY

READY - RESOURCE EFFICIENT CITIES IMPLEMENTING ADVANCED SMART CITY SOLUTIONS

Final publishable summary report - full duration of project

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List of Abbreviation

BEST	Building Energy Specification Table
BOPS	Building Operation Power Supply (excl. apartments appliances etc)
BTES	Borehole Thermal Energy Storage
CO_2	Carbon dioxide
DC	District Cooling
DH	District Heating
DNMP	National Program on Modernisation of Multi-apartment Buildings
DSO	Distribution System Operators
EC	European Commission
ESCO	Energy Service Company
ESS	Energy Storage System
EV	Electric Vehicle
GOP	Green Operation centre
HP	Heat Pump
IoT	Internet of Things
IPR	Intellectual Property Rights
LTDH	Low Temperature District Heating
N/A	Not Available
nZEB	Nearly Zero-Energy Buildings
O&M	Operation and Maintenance
PE	Primary Energy
Ph.D.	Doctor of Philosophy
PUE	Power Usage Effectiveness
PV Yield	Photo-Voltaic Yield
READY	Resource Efficient Cities Implementing Advanced Smart City Solutions
RES	Renewable Energy Sources
RME	Rapeseed oil Methyl Ester
RUE	Rational Use of Energy
SPB	Simple Pay-back Period
ST yield	Solar Thermal Yield
TRL	Technology Readiness Level
WW-HR	Waste Water Heat Recovery (heat pump)

1 Executive summary

1.1 Project objectives

The READY project (READY - **R**esource **E**fficient cities implementing **AD**vanced smart cit**Y** solutions) aims to demonstrate a "whole city approach", such as a balanced and holistic approach towards affordable retrofitting of residential buildings and offices towards the zero-energy consumption, development and demonstration of new low-temperature district heating solutions, smart energy flexible solutions in buildings and introduction of renewable energy and heat recovery technologies.

The activities of the READY project are integrated and demonstrated in two communities, Aarhus in Denmark, and Växjö in Sweden, while Kaunas in Lithuania participates as observer community.

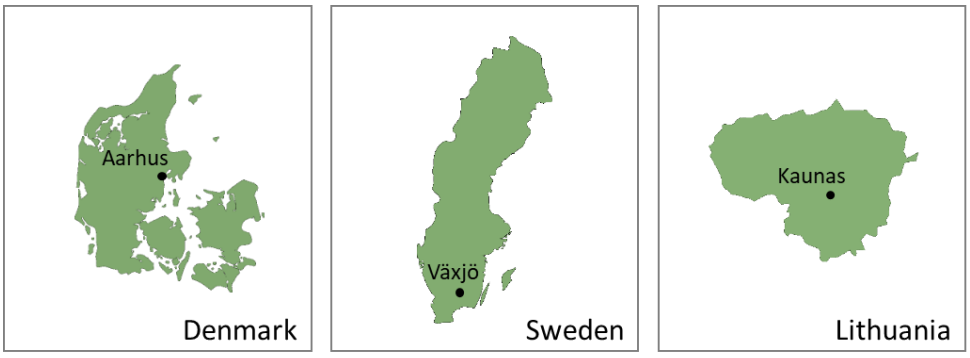

Figure 1: Maps representing the three READY communities

1.2 Main results of the total project period

READY project started in December 2014 and ended in November 2020. As it was mentioned the project aimed to introduce innovative solutions and create frontline demonstrations of future energy communities and smart cities, involving building retrofitting projects to reduce energy consumption, introducing new solutions for waste heat recovery, RES integration, smart energy hub and development of EVs network. The project fulfilled the expectations leading to

outstanding results not only in terms of savings of both CO_2 and energy consumption, but it provided countless inputs for the further development of innovative solutions and insights of the positive impact of smart energy solutions and how they can provide a solid base to the introduction of RES in the energy market to support the green transition .

Based on thorough integrated climate planning the READY project demonstrates a whole city approach including:

1. Demo of a balanced and holistic approach towards affordable retrofitting of residential buildings and offices.

2. Development and demo of new solutions for low temperature district heating, components, and management ICT systems.

3. Development and demo of flexible combined grid balancing/energy storage solutions for buildings and RES systems including combined heat pumps for heating and cooling, electrical vehicles charging, new PVT systems and 2nd-life reuse of EV batteries in buildings.

4. New heat pump technology for large scale sea water heat pumps, using water as refrigerant.

5. Solutions for water efficiency and wastewater energy recovery.

6. Demo of new innovative industrial equipment for use of RES and integration of demand and supply, – based on business plans, and follow-up by promotion and dissemination activities.

These measures demonstrate how the demand of energy and particularly the needs for fossil fuels and release of CO_2 can be considerably reduced to nearly zero and show a sustainable way to go for other European cities.

Demonstration takes place in 2 cities; Aarhus (DK – 280,000 inhabitants), which is representative for north-western parts of Europe and Växjö (SE – 94,000 inhabitants) representatives for the Baltic Sea region. Both cities have a long-standing technical experience and for years been frontrunners in respect of setting and carrying out ambitious climate and smart city polices. Kaunas (LT – 300,000 inhabitants) took part to bring in Eastern European experience with a most relevant context.

The project team consist of internationally well-known industrial companies, energy supply companies, SME's, housing companies, universities, consultants, and other organisations that formed the consortium to realise the project. All participants are devoted to improving RES integration in energy supply systems and housing standards towards nZEB.

The key figures of the project give a good overview of the remarkably impact that READY had in the involved communities. The refurbished residential buildings considered 817 apartments and one single family house for a total gross

floor area of 77,830 m². Furthermore, 2 office buildings were retrofitted for a total gross floor area of 4,786 m².

The energy savings for the actual reference year due to building refurbishment was approx. 9.1 GWh or 63% compared to the BEST Reference consumption. This corresponds to an annual CO2 emission reduction of approx. 1,923 tons. The local heat and electricity production from RES for the actual reference year was approx. 487 MWh. This corresponds to an annual CO2 emission reduction of approx. 230 tons per year.

2 Project details

2.1 Contact persons for the project partners

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2.2 Project participants

25 project partners have participated in the project. Besides the coordinators, the partners have included municipalities, housing companies, energy suppliers, universities, and other research institutions. In Table 1 below a full list of the project participants is shown.

Table 1: List of project participants

No.	Participant organisation name	Country	Short name
1	COWI A/S	DK / SE	COWI
2	Aarhus Municipality incl. AffaldVarmeAarhus AVA	DK	MUN-DK
3	Aarhus University	DK	UNI-DK
4	Boligforeningen Ringgården AmbA	DK	HOUSE-DK
5	KAMSTRUP A/S	DK	KAM-DK
6	Racell Saphire Aps	DK	RAC-DK
7	Danfoss A/S	DK	DANF-DK
8	Lithium Balance A/S	DK	LB-DK
9	Danish District Heating Association, Grøn Energi.	DK	DDHA
10	DONG Energy –DONG-DK Energy Sales & Distribution A/S – terminated	DK	DONG-DK
11	Växjö Municipality	SE	MUN-SE
12	Linnaeus University	SE	UNI-SE
13	Energy Agency for Southeast Sweden	SE	ESS-SE
14	Växjö Energy AB	SE	VEAB-SE
15	Växjobostäder AB	SE	VXH-SE
(16)	IKEA - terminated	DK	IKEA
17	CA-Fastigheter AB	SE	CA-SE
18	VÖFAB - terminated	SE	VFAB-SE
19	Kauno Energija	LT	DHC-LT
20	Lietuvos Energetikos Institutas	LT	LEI-LT
21	AIT Austrian Institute of Technology	AU	AIT
22	LGI Consulting	FR	LGI
23	E.ON Denmark	DK	EON-DK
24	Wexnet AB	SE	VEX-SE
25	CA I Växjö AB	SE	CA-SE2

2.3 Project website

During READY project a dedicated website (Figure 2) - link: http://www.smartcity-ready.eu/ - has been created to keep track of the process and share the activities and the results obtained.

The website gives good insights of the project with a general overview of the targets in the three communities Aarhus, Kaunas and Växjö and then with more detailed information about the different Work Packages (WP) and deliverables. Most of the results achieved in the deliverables are presented with a short summary, while for the public ones, the final report is always available for consultation. For people interested in specific arguments, the "Technologies" section gives direct access to the main topics involved in the project, with articles and post regarding appliances, district heating, mobility and batteries, buildings, heat pumps, photovoltaic and solar thermal panels.

Lastly, the website collects a series of links, mainly containing videos related to the activities of the project.

The website contains also all the activities and events where the project partners were present throughout the duration of the project, for dissemination, presentations or other related activities.

In general, the website has been a useful tool throughout the project to present the project and the results to people that were not directly involved the project's activities. A confirmation of the active role of the website can be seen when its main statistics are checked, which on the 8th of January 2021 on the "Visit counter" showed 158,243 visitors, while the "Page view counter" showed 191,184 visualizations.

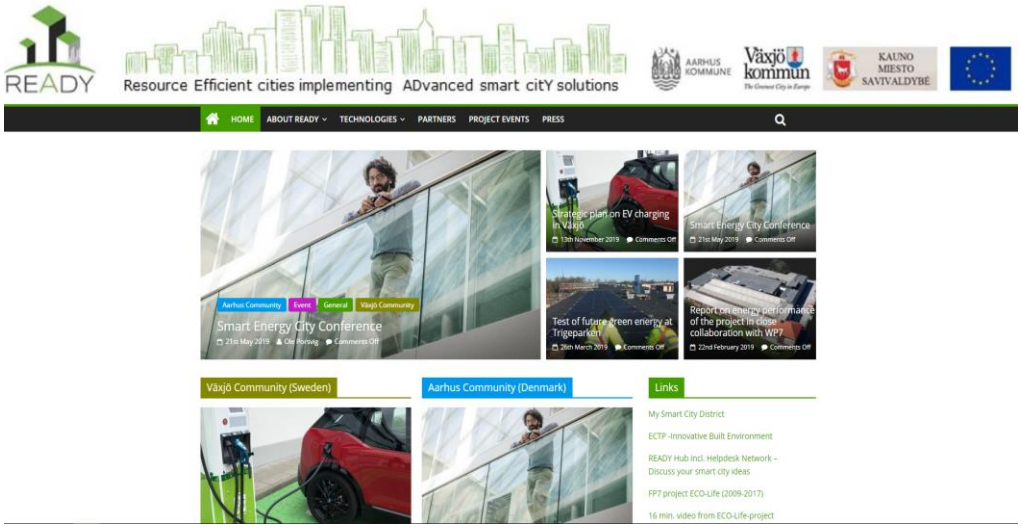

Figure 2: Screen dump from the project website – http://www.smartcity-ready.eu/

3 Project content and objectives

3.1 General project objectives

The central theme of the project is the combination of energy efficiency in buildings with maximum use of renewable energy sources and not least the introduction of innovative approaches for the involvement and engagement of the citizens to ensure long-term sustainable development.

Project participants regard this as the way to contribute to Europe's goals for a sustainable future. The scientific and technological objectives and ambitious of empowerment of the project are hence to establish the technological and socio-economic basis for and to demonstrate innovative integrated energy concepts on the supply and demand sides of successful zero-carbon communities in Lithuania, Sweden and Denmark.

In short, the READY project objectives were:

- To establish a real lighthouse living lab and visible impact in the countries, guiding the transformation of urban areas of a significant size towards CO_2 neutral communities.

- Improvement of quality of life and energy efficiency in the three communities in all aspects, hereunder the use of improved technologies, the integration of advanced RES, RUE and poly-generation and communication technologies are important elements.

To reach the target of the project, a detailed plan was defined and divided in sub-activities. The first steps were to create a solid basic knowledge from where it was possible to develop new solutions as well as the definition of the comprehensive and strategic approach to ensure that the demonstrated refurbishments would meet the technical, energy, resource and quality targets at each demonstration site. The first steps are shortly summarised in the following bullet points:

- Prepare, elaborate and transfer best practices from start of project and further on when monitoring results and experiences are available.

- Provide specific analysis on solutions for solar energy, wastewater heat recovery, building, energy management and retrofit materials for smart living.

- Ensure result driven, effective and coordinated implementation between the two communities and partners in general and disseminate and share experiences between actors in the building chain.

Once the strategic approach was defined, the focus of the project was moved towards the complete analysis of all the different demonstration activities and solutions for heat recovery, short-term storage and recovery of waste heat in

buildings. Furthermore, in was studied how to enable LTDH by developing consumer DH solutions in combination with distributed integration of RES technologies like PVT and heat pumps.

Afterwards, when the analysis was done, the main objective was to complete the development of solutions for demonstrations including integrated PV power and heat generation, integrating transport and electricity systems, use of batteries and intelligent control through the integration of smart energy HUBs.

The implementation of the designed solutions for the demonstration activities in Aarhus and Växjö considered the tender work and afterwards the complete construction in the different locations.

To finalize and demonstrate the implementation of the new solutions, the monitoring activities was defined and conducted.

Lastly, one of the main objectives of the project was to communicate and disseminate the results obtained throughout the entire project by participating in conferences, publishing articles and updating the READY website, which considers also several video presentations of the project. Furthermore, specific sessions of READY Advanced Training Programme were organized.

3.2 Community specific objectives

3.2.1 Aarhus, Denmark

Renewable energy supply (RES)

- 325 kWp photo voltaic plants (PV)
- 743 m^2 combined solar thermal and PV (PVT)
- 36 kW PVT heat pumps
- 10 (8+2) kW wastewater heat recovery heat pumps
- 1 MW Seawater heat pump

Energy efficiency in buildings (RUE)

- 174 m^2 refurbishment of single family house
- 47,442 m^2 refurbishment of multi-family buildings (43,425 m^2 supported in READY)
- 1,446 m^2 office building (administration/ service offices)

Waste treatment

- Installation of 18 food waste disposers in multi-family buildings
- Waste sorting facilities and terrain

Integration of RES and RUE

- Improving of buildings' energy efficiency by various RUE actions, such as improvment of insulation, new windows, updating of heating and ventilation systems
- Introduction of RES to cover part of the energy demand of the buildings. The surplus energy is shared with the grids supplying the community
- Integration of new types of batteries storage technology and controls
- Improvement of efficiency of DH generation and supply
- EV battery charging of electric cars
- Intelligent 2-way energy metering, information and control equipment

Specific innovations

- New types of user installations will be integrated for the development of low-temperature DH
- New and 2nd life battery storage technology in buildings to optimise the electricity utilisation from PV system and increase the network flexibility
- Integration of surplus/waste heat recovery technologies from wastewater
- Integration of new innovative PVT panels and system solutions
- Integration to the Virtual Power Plant - Smart Building Energy Hub

Transport

- A mobility study that evaluates and present solutions regarding transportation with EV and installation of chargers
- Installation of the first 113 intelligent EV chargers (56 chargers with 2 outlets and 1 fast charger) of 208 chargers with a strategic perspective in interaction with public transportation solutions

3.2.2 Växjö, Sweden

Renewable energy supply (RES)

- 215.8 m^2 with 36 kWp photo voltaic plants PV(T)
- 96 m^2 + 17.31 kWp combined solar thermal and PV (PVT)
- 15 kW wastewater heat recovery heat pump

Energy efficiency in buildings (RUE)

- 3,361 m^2 refurbishment of dwellings to low-energy demand special house
- 28,149 m^2 refurbishment of multi-family buildings to low energy demand

Waste treatment

- Waste sorting and socio-economic follow-up activity

Integration of RES/RUE and Polygeneration

- Improving of buildings' energy efficiency by various RUE actions, such as improving of insulation, new windows, updating of heating and ventilation system
- Local Low-temperature district heating grid
- An innovative cooling system with the integrated piping system has been built in Växjö, and through an intelligent flow the cycle contribute to an efficient way of transferring energy three times, utilizing it twice for cooling and once for heating.
- Two separate cooling network was integrated, with two different techniquies of production in the plants which makes the system more efficient, environmental friendly and economical beneficial.
- A combined heat and cooling substation for district heating and cooling.

Specific innovations

- Integration of "Interface of Life", a solution for measuring energy and water consumption in real time, and visualise the data on common user devices
- Integration of a smart heating and cooling grid

Transport

- EV charging strategy

4 Main science and technology results

4.1 Methodologies and approaches

The demonstration activities in READY, which are co-ordinated with the communities' on-going activities, are based on both the demand (buildings & RUE) and the supply side (RES). The demonstrations were designed using a "Whole City Design Approach" in order to ensure the largest possible energy saving potential and to ensure coherence in all activities. The priorities of the Whole City Design Approach are as follows:

Reduce the demand for heating, cooling, electricity and ventilation.

Supply the necessary heating, cooling, electricity and ventilation in the most efficient way and supply use of renewable energy sources.

Ensure coherence of all decisions and solutions within all parts of the community concerning energy, environment, economy and life quality of the citizens.

Continuous dissemination and training to support the optimization the above-mentioned priorities.

Energy concepts are developed for each demonstration and are based on:

Actual demand assessments.

Sketching solutions, both innovative (including necessary development activities) and traditional.

Economic effects and energy effects for the whole community.

Dialog with end users using multi-criteria discussion approach.

Selection of optimal energy solution for the community, investors and end users.

Implementation of selected solutions (in coherence with other local aspects).

Providing necessary training towards facility managers and end users.

Lessons learnt and dissemination-

4.2 Aarhus, Denmark

4.2.1 Major achievements

READY project had a considerable impact on Aarhus Community, where several innovative solutions and demonstration projects were undertaken, aiming to push the community closer to its sustainability targets. In fact, high priority is

set to the reduction of fossil fuel with the consequent lower carbon dioxide emission in the atmosphere.

Four different demonstration projects of buildings retrofitting were undertaken to reduce the energy demand of the final users and make the dwellings ready for LTDH supply. Besides the renovation projects, several innovative RES solutions were introduced in the demonstration projects such as the innovative small- and large-scale heat pumps, waste heat recovery, implementation of food waste disposers, local production and storage of electricity with the introduction of a smart energy hub and development of EVs charging network

Building retrofitting

In Aarhus, four different retrofitting projects were undertaken, three with residential buildings and one with an office building. The main residential retrofitting projects were conducted in two different departments of the Danish housing association "Boligforeningen Ringgården", while the third was conducted in a single-family house. The two departments consist of several multifamily buildings for a total of approximately 480 apartments. In these buildings, several innovative smart city oriented and RES solutions were implemented to create one of the first examples of future energy communities. The building retrofitting locations and implementation of renewables are presented in Figure 3, while the detailed figures are presented in Table 2.

The project includes refurbishment of 49,062 m², and installation of renewable energy systems, producing 380 MWh in 2020.

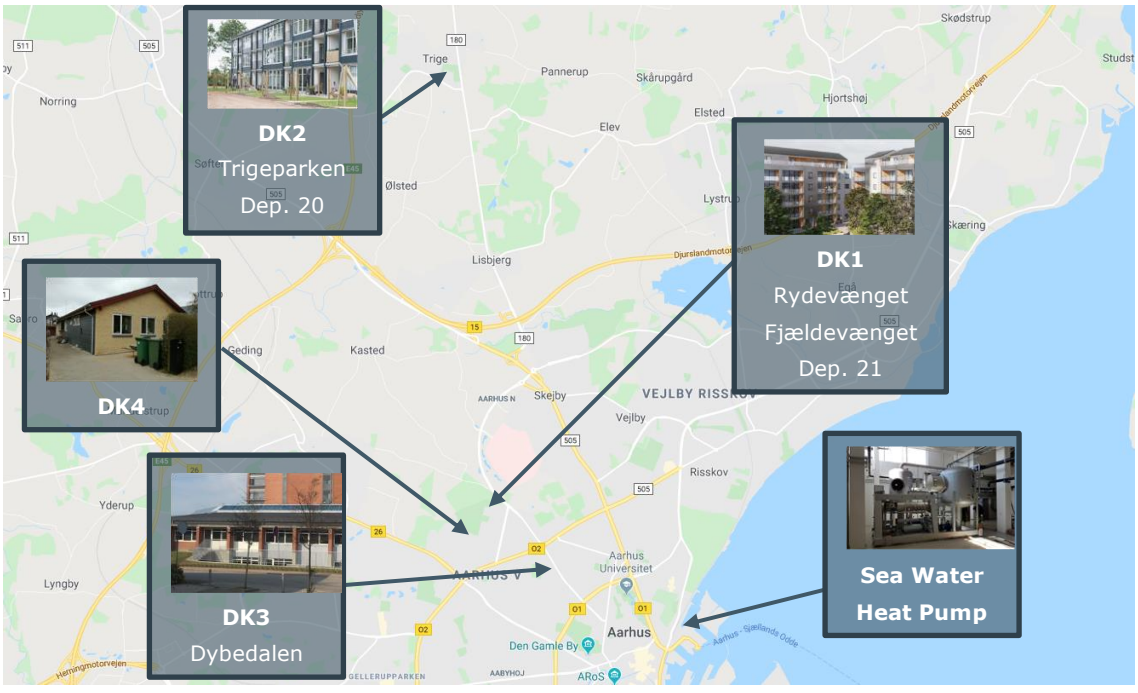

Figure 3: Overview map of demonstrations in Aarhus Community.

Table 2: Specific figures of all demonstrations in Aarhus.

	Refurbish-ment	New building	PV	Heat pump	Solar thermal (PVT)
	m²	m²	kWp	kW	m²
Ringaarden department 20 –Trigeparken	19,140	-	143	44	743
Ringaarden department 21 –Rydevænget	28,302	-	157.4	2	-
Administration office – Dybedalen 1A	1,446	-	29	-	-
Junivej 36	174	-	-	-	-
Sea Water Heat Pump at Aarhus Ø	-	-	-	1,000	
Total	**49,062**	**-**	**329.4**	**1,046**	**743**

The following figures (Figure 4, Figure 5, Figure 6, Figure 7 and Figure 8) show the renovated buildings in Aarhus community, particularly in DK1, DK2 and DK3 demo sites.

Figure 4: Rydevænget (DK1 part 1).

Figure 5: Fjældevænget (DK1 part 2).

Figure 6: Trigeparken west-blocks (DK2).

Figure 7: Trigeparken east-blocks (DK2).

Figure 8: Office building at Dybedalen 1A (DK3).

PVT system (Combined photovoltaic and thermal solar panel)

The READY project had a remarkably contribution to the development a new type of PVT heat absorber, which were developed by the project partner Racell Saphire.

The product is revolutionary for the thermal part of a PVT panel as it can theoretically be delivered in up to 3 x 6 m size for one panel. In the project, the PVT implemented in Denmark used 1.5 x 3.8 m panels (Figure 9), as they were easier to handle and could fit better to the actual size of the roof. The new technology eliminates the use of glass cover, the absorber consists of capillary tubes that equalise the flow pattern and improve the heat transfer. Furthermore, this type of panels can be used as building component since it comes in different

colours and it can be glued to existing roofs and still utilise heat transfer from both sides though a vented aluminium-sandwich plate. The panel can be produced with a weight of less than 12 kg/m², so that two persons can carry a 5 m² panel.

A PVT system can exploit both the production of heat and electricity when connected to a heat pump for generating CO_2 neutral heat at very low cost. The PVT solution was implemented both in Aarhus, where the largest PVT system in Denmark is installed, and in Växjö as a hybrid solar system combined with a ground source heat pump (BTES).

Figure 9: Large PVT panels installed on the roofs in Trigeparken (DK2)

Battery storage and smart energy hub

READY project has driven innovation also in the battery sector for the use in residential buildings. The project partner Lithium Balance developed a residential battery pack of 120 kW battery installed in one of the retrofitting projects related to READY, which is formed by 79 kW of new cells, and additional 40 kW of 2nd-life cells.

The use of 2nd-life batteries is based in the prolonged use of used batteries having about 50% capacity left compared with new batteries. The cost of quality testing and pairing elements of different degradation in a total system comes as high in cost as the saving in battery cost compared with new batteries, but from an environmental view it is very good to prolong lifetime and upcycle the used batteries in systems for stationary use.

Furthermore, Lithium Balance has developed a Smart-Building-Energy-Hub, which consists of two main parts a local controller called "Site Controller" and a "Cloud" part. The site controller is located within the battery energy storage system and it physically connects the components of the battery system to the cloud but also the other parts like energy meters and potentially also other devices. The cloud collects all the data and from equations, forecast, local consumption/production and user inputs, generating a schedule for the battery behaviour. Further developments are expected to the mathematical model, which takes input data such as forecast demand, forecast PV production, forecast

electricity price, feed-in tariff, ESS (Energy Storage System) related parameters, and provide output which is an suggested optimal ESS charge/discharge profile to control the ESS behaviour is under implementation.

Through a basic user interface, the users can see the status of the battery, the inverter, building consumption and PV production.

Large-scale seawater heat pump

The two READY project partners Affaldvarme Aarhus and COWI have collaborated to introduce the seawater heat pump, which is one of the core demonstration activities in Aarhus. The system will deliver heat to the DH network thanks to a 1 $MW_{thermal}$ heat pump, which uses seawater as primary energy source. The heat pump (Figure 10) is located in a bespoke machine building in an area where a boost in the local DH supply is needed. The large-scale heat pump is also expected to contribute to a better integration of the DH system with the electricity market. The 1 MW unit is only the first of 12 modules that are considered to installed in the dedicated building, so that total capacity will reach 12 MW. The Danish ambitions for introducing heat pumps in the district heating supply is significant and the Aarhus' heat pump and its achievements is followed with great interest.

The unit was first officially inaugurated on the 11th of January 2020 and taken into real-life operation as of February 2020. The building was designed to allow public access and raise awareness about heat pumps and the Aarhus DH system.

Figure 10: New type seawater heat pump with water as refrigerant

Small-scale heat pump for wastewater heat recovery

In the retrofitting cases, several RES solutions were implemented to reduce CO_2 emissions of the residential buildings. The two READY project partners Boligforeningen Ringgaarden (housing association) and COWI introduced two small-scale heat pump systems for recovering heat from wastewater. In Ringgaarden's department named Trigeparken, a special heat exchanger was installed in a prefabricated plastic manhole. The manhole (Figure 11) collects wastewater from two building blocks (36 apartments) and the heat pump connected to the heat exchanger uses the wastewater as heat source, which is then used to produce domestic hot water and space heating for one of the two blocks.

Figure 11: Manhole and installed heat exchanger of the wastewater heat recovery system in Aarhus (DK2)

A second heat recovery system was installed in Ringgaarden's department named Rydevænget, where a similar system was implemented to recover heat from the wastewater. In this case, the heat exchanger is installed to replace part of a drain downpipe and the heat pump system connected reuses the heat to produce domestic hot water and cover circulation losses for the same building.

EV-charging network development

The READY project partners Aarhus Municipality and E.On Denmark collaborated to strength the EV charging network in Aarhus Municipality by installing 208 public accessible charge points with 106 of these located centrally in Aarhus, as shown in Figure 12. All charge points are installed in cooperation with NRGI NETS, who is the DSO in the area. NRGI NETS delivers the necessary grid connection and capacity to the charging station (two outlets) which is 32 Amp or 63 Amp, depending on the desired output, which can be either 11 kW or 22 kW.

Figure 12: EV chargers in Aarhus with promotion of the READY project

The objective of Aarhus Municipality is to promote sustainability and to reduce congestion and changing citizens behaviour. Various campaigns have been launched to change the behaviour mainly aiming to reduce use of fossil fuel cars and increase use of other vehicles, e.g. bicycles and EV-cars. Some of the campaign were: "365 days on a bike" "Is your second car an electric bike?", "Mobile bicycle library" and "Test an electric bicycle".

4.2.2 Energy savings and CO_2

The total final energy consumption measured during the monitoring activities in the different demonstration sites in Aarhus Community was about 2,886 MWh, when referring to the actual reference year. It was evaluated that the achieved energy saving as direct consequence of the building refurbishments undertaken during READY project was approximately of 6,303 MWh, when comparing to the BEST reference consumption. The weighted buildings total final energy consumption was 187 kWh/m² for the BEST reference case and was reduced to approximately 59 kWh/m² for the actual reference year. The actual consumption resulted 69% less than the BEST reference as shown in Figure 13, and resulted even lower than the renovation target defined in the BEST tables.

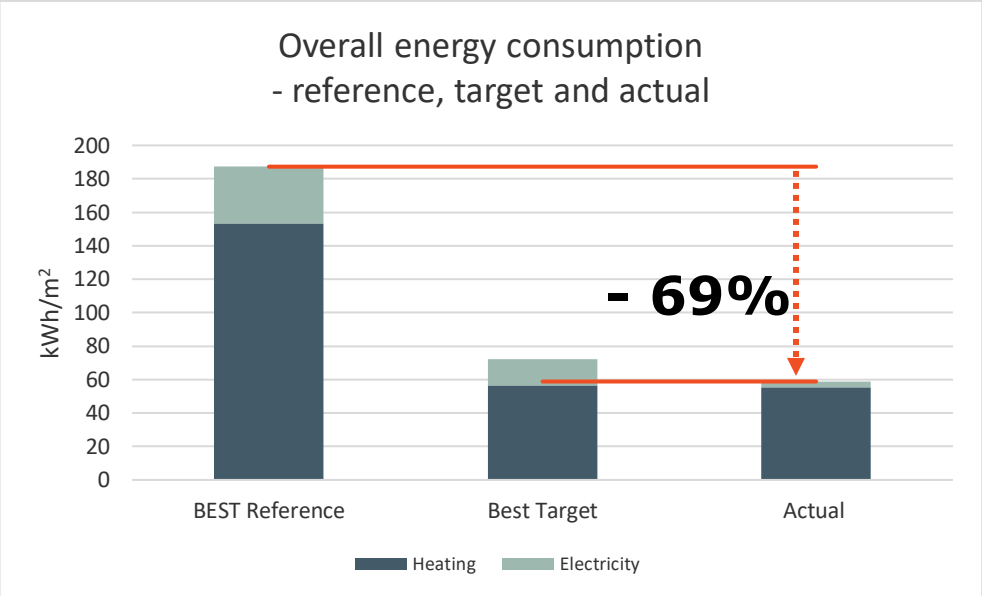

Figure 13: Total energy consumption per square meter in Aarhus Community demonstration sites

In Aarhus Community, 49,062 m² of both residential and non-residential buildings were refurbished, considering a total investment cost of 28,389,530 EUR with the EC support equal to 2,375,021 EUR. It was calculated that the average payback time for the additional cost for the energy related part of the refurbishments in the demonstration sites was 5 years with the EC grant and 9 years without the EC grant, see Table 3. Remaining part of refurbishment cost is considered as upgrading and maintenance cost.

Table 3: Feasibility of refurbished buildings, 2015 DK. Factor is an estimated energy refurbishment factor. SPB is abbreviation for "simple payback time".

Demo site	Area	Energy saving 2020	Total investment costs	O&M vent	Extra costs for energy measures in new buildings	SPB on total invest. WITHOUT EC grant	Energy refurbishment factor*	Energy refurbishment costs	EC grant	SPB WITH EC grant	SPB WITH-OUT EC grant
	m²	Euro	Euro	Euro	Euro	Years	-	Euro	Euro	Years	Years
DK-1	28,302	353,068	10,359,200	12,509	7,955,317	29	0.34	2,737,043	1,368,521	4	8
DK-2	19,140	203,217	16,440,000	8,460	5,380,000	81	0.34	1,851,000	925,500	5	10
DK-3	1,446	12,557	1,563,430	1,309	506,000	125	0.42	214,570	72,300	13	19
DK-4	174	2,260	26,900	0	52,200	12	0.45	23,490	8,700	7	11
TOT.	**49,062**	**571,103**	**28,389,530**	**22,279**	**13,893,516**	**50**	**-**	**4,826,103**	**2,375,021**	**5**	**9**

* Factor that considers only the energy related costs (Single factors: ventilation 0.9; windows 0.25; building envelope 0.2)

The expected CO_2 emission from the demonstration buildings was calculated to be approximately 429 tons normalised to a standard reference year, which results in a reduction of approximately 80% compared to the BEST reference value, equal to 1,668 tons. The average weighted reduction is about 34 kg/m² pr. year as shown in Figure 14.

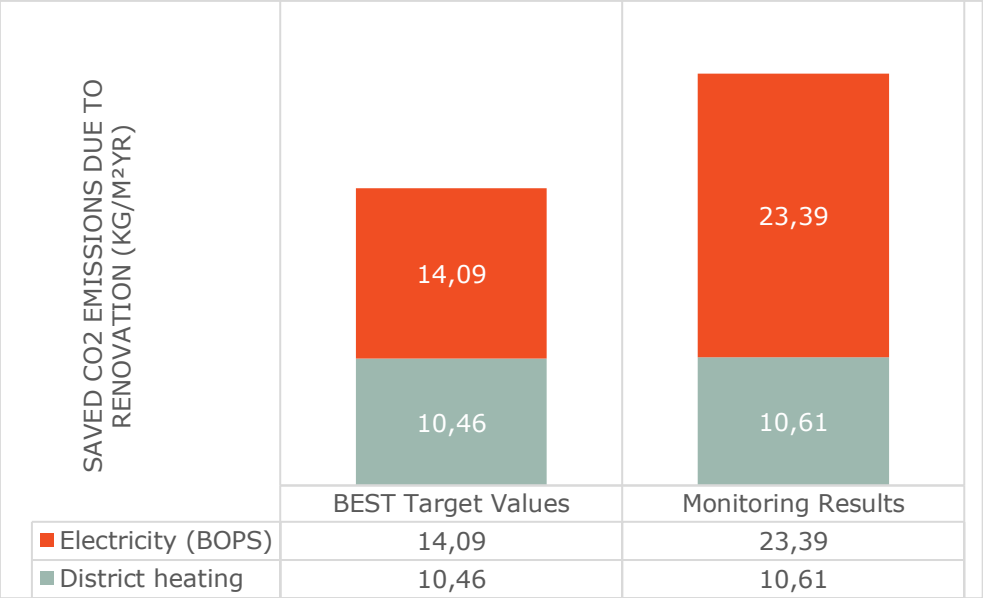

Figure 14: BEST Target Values and Monitoring Results regarding the CO_2 emission savings due to energy savings Aarhus (area weighted average).

The demonstrated local renewable energy systems produced 380 MWh in the actual reference year, which corresponds to a displacement of 218 tons of CO_2. An extra reduction of CO_2 emission of 648 tons is the expected by heat production of the seawater heat pump. The average weighted CO_2 reduction is about 17.5 kg/m² pr. year, as shown in Figure 15. Total investment cost for the RES systems was 2,188,670 EUR while the EC grant was equal to 724,058.5 EUR.

The average payback time of the local RES system is 10 years with the EU grant, and 16 years without the EU grant, see Table 4.

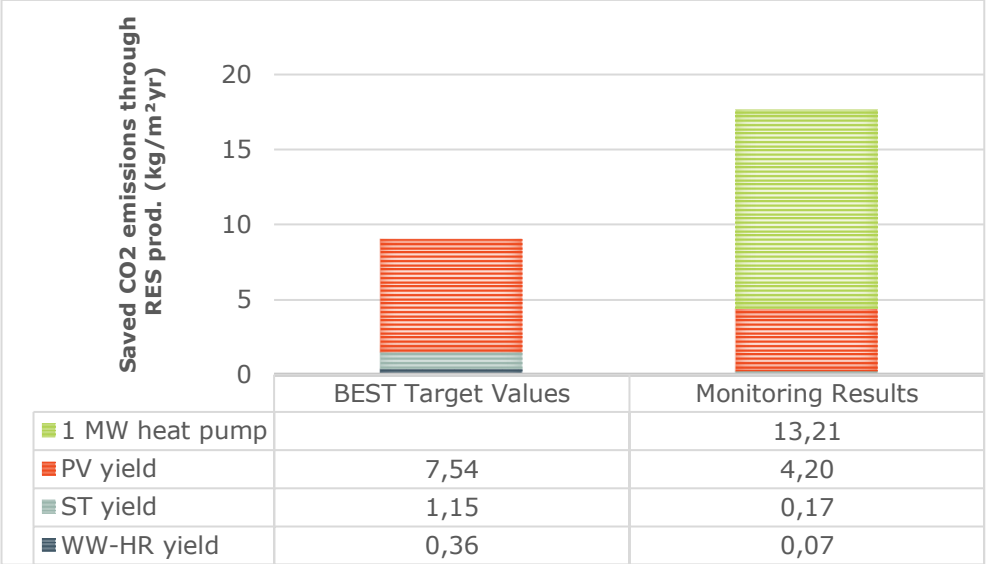

Figure 15: *BEST Target Values and Monitoring Results regarding the CO_2 emission savings due to the energy production from RES in Aarhus (area weighted average).*

Table 4: *Feasibility of renewable energy plants in Aarhus, 2020 DK.*

Type	Demo site	Electricity production / consumption	Heat production (1)	Installed capacity	O&M	Annual savings	Investment costs	EC grant	SPB WITH EC grant	SPB WITHOUT EC grant
		kWh	kWh	kW	EUR	EUR	EUR	EUR	Years	Years
PV	DK1 – Rydevænget	144,449 (2)	0	157.4	3,144	29,179	299,353	0	11	11
WW-HR	DK1 – Rydevænget	-2,487 (3)	9,949	2	49.8	497	15,000	7,500	15	30
PV(T)-E	DK2 - Trigeparken	95,693 (2)	75,221	143 HP: 36	6,277	23,843	524,747	262,374	15	30
WW-HR	DK2 - Trigeparken	-9,949 (3)	39,796	8	199	1,989	103,000	51,500	26	52
PV	DK3 – Dybedalen	27,366 (2)	0	29	466	5,536	46,570	0	9	9
Sea water HP	Aarhus Ø	-2,000,000 (4)	6,000,000	1,000	11,200	88,800	1,200,000	402,685	9	14
TOT.						**139,950**	**2,188,670**	**724,058**	**10**	**16**

1) Heat price: 0.06 €/kWh
2) Electricity price: 0.202 €/kWh
3) Electricity price PV: 0.02 €/kWh
4) Electricity price utility: 0.13 €/kWh

CO_2 and inhabitants

The demonstrations in Aarhus expect a gradually increasing number of inhabitants. However, Aarhus Municipality is expecting an increase of the inhabitants. Figure 16 illustrates the development in number of inhabitants and the corresponding total CO_2 emission per inhabitant in the municipality, which has decreased from 8.4 tons per inhabitant in 2009 to 3.9 tons per inhabitant in 2018.

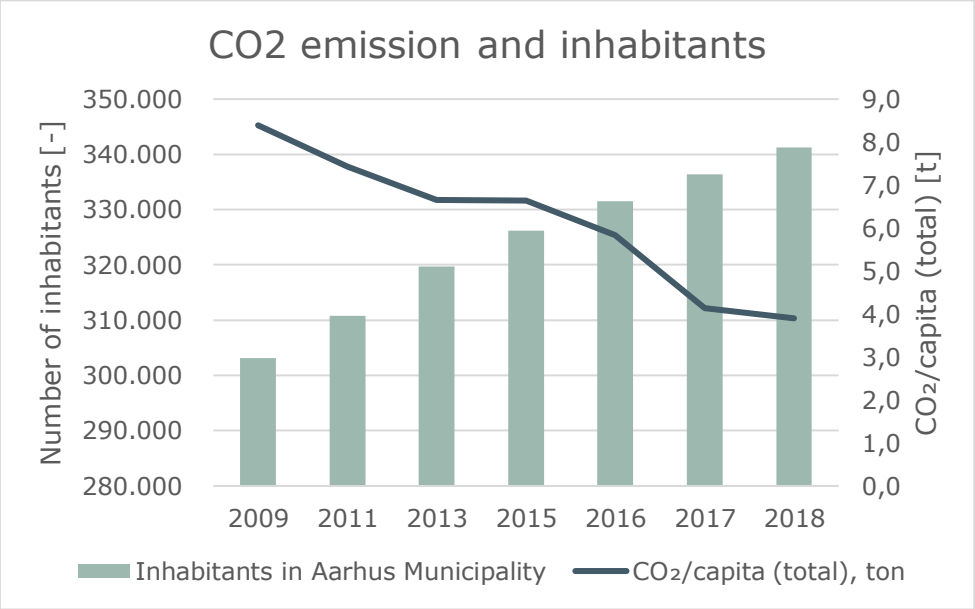

Figure 16: Development of number of inhabitants in Aarhus Municipality in 2009-2018 and corresponding total CO_2 emission per inhabitant (Including: Transport electricity and heating supply, electricity import, non-energy, industry and individual heating).

4.2.3 Socio-economic characteristics

Aarhus is the second biggest city in Denmark, with approximately 280,000 inhabitants. It is an important and active economic and cultural centre, resulting the largest centre for trade, services, industry, and tourism in Jutland.

Aarhus is a frontrunner of the green transition, seriously addressing the problems of global warming and climate changes. Sustainability and reduction of CO_2 emissions are highly prioritized in the action agenda, introducing green technologies across many different sectors.

In fact, READY had a remarkably impact on Aarhus community, introducing newly developed technologies that will lead the transition towards the CO_2 neutral society and the creation of the first examples of the future energy communities.

The retrofitting projects supported by READY project have increased the quality of the buildings in areas with socio-economic challenges, where the population was characterised by several cultural backgrounds.

Among the activities related to the READY project, several campaign for changing the inhabitants' behaviour were launched. Particularly, the transition towards EVs transportation was prioritize as well as the focus on using alternative means of transportation such as public transportation or bicycles both normal and electric. The phase-out of the fossil fuel from the urban transport can lead to a better environment, with less pollution in the air, improving the life of the inhabitants. Furthermore, the use of bicycles for short and long itinerary, would have many benefits for the society, decreasing traffic and pollutions, but also improving the health of the users.

Lastly, the social benefit of READY project was reflected also on the support to 3 Ph.D. scholarships and 1 post doc at Aarhus University on topics related to READY. The contribution to a higher education level can help the society tackling with the new challenges of climate change and green transition.

4.3 Kaunas, Lithuania

Kaunas took part to READY project as observer city in order to bring in Eastern European experience with a most relevant context.

During READY project several investigations were conducted to evaluate the dissemination and implementation for building retrofitting projects, integration and upgrade of DH technologies and development of a DC network.

It emerged that DC is not yet implemented in Kaunas, due to the limited demand and the non-economic feasibility of implementing a new DC network, mainly due to the distance of demand and supply in case of exploiting the free cooling potential or the high dependence on industrial consumers that can close or move anytime. An evaluation conducted during READY project showed the higher cost of establishing a DC network compared to the use of local compressor technologies.

Regarding the DH development, it was shown that Kaunas has been through a great development, since it passed from being a state monopoly to free competition, resulting in much lower energy prices and even from renewable energy. Many local boilers were established in the last years, increasing the competitiveness in the DH market, but also increasing the challenges for the network's hydraulic models. Investing in DH network upgrades and dispatching system is needed to ensure reliable and safe heat supply for consumers.

The experience with deep renovations of old multiapartment building (Soviet type) show the huge potential for energy savings, even though it remains difficult to find funding. For example, the government support for renovation is subject to very bureaucratic and complicated management; besides, the governmental support program lacks funding.

As a replication case, a building block in Kaunas (Figure 17) was studied and retrofitted based on the principles used in READY and has led to a successful full-scale demonstration of building retrofit with new district heating substation,

self-adjusting balancing flow and use of heat pump to recover heat from exhaust air. The recovered heat is reused for towel heaters in bathrooms, so that during summer the main space heating supply can be switched-off. Energy consumption is reduced by more the 50% and is now 46 kWh/m² per year. Further a pilot city district in Kaunas is now chosen to be a demo case for different similar initiatives under various funding schemes.

Figure 17: The replication block in Kaunas before and after retrofit of building envelope and installations.

The most realistic and beneficial approach of buildings modernization is to use support provided by the DNMP (The National Programme on Modernization of Multi-apartment Buildings) and support form structural funds and other grants e.g. as seen from the German State.

The buildings modernization process, especially application of the ESCO model, is complicated due to existing compensations to tenants for heating and hot water.

It is feasible to motivate inhabitants to modernize buildings while proposing them a scenario, which significantly reduce their expenses for building energy consumption and maintenance.

To make buildings modernization attractive for the inhabitants and seeking to attract private investors, the project IRR should be higher than 4-7%.

4.4 Växjö, Sweden

4.4.1 Major achievements

In Växjö Community several innovative solutions tested at a large scale (Figure 18) aiming at decreasing the need for fossil fuels and the emissions of carbon dioxide have been carried out. The project has carried out demonstration projects

for both district heating and district cooling, renewable energy, building renovation, energy recovery, storage and balancing. READY has also come to demonstrate how smart data can be used for green business solutions.

The demonstrations include the energy refurbishment of 301 apartments in Alabastern (Figure 19 and Figure 20), which is part of the Araby housing district, as well as Tvinnaren (Figure 24), an office building located in the City Centre. Two computer server centres have been renovated and connected to the smart district cooling loop. In Alabastern READY have developed and demonstrated new solutions for district heating networks with reduced supply temperature, installed PVT-systems and implemented solutions for wastewater and exhaust air energy recovery (Figure 22). The office building called Tvinnaren has installed a new combined district heating and cooling substation and the computer server centres have installed PV-systems.

The refurbished apartments have been connected to the fibre-optic broadband net to supply the tenants with a platform for visualization of their use of electricity, hot and cold water and to enable communication with the landlord, Växjöbostäder. The platform has evolved to a portal called "Interface of Life", which has become the starting point for the smart city (Figure 23). Växjöbostäder has thereafter installed the platform in all their 9000 apartments. The main objective is to change the behaviour of the tenant to decrease the use of cold and hot water, electricity, and heat. Additionally, behavioural campaigns have been implemented in the area to further reinforce the results.

The READY project has integrated two grids for district cooling as well as demonstrated how energy can be converted and used three times in an innovative energy loop (Figure 26).

Moreover, the project has included other activities such as integration of READY experience into the Sustainable Energy and Climate Action Plan (SECAP) and development of a strategic plan for chargers for electrical vehicles.

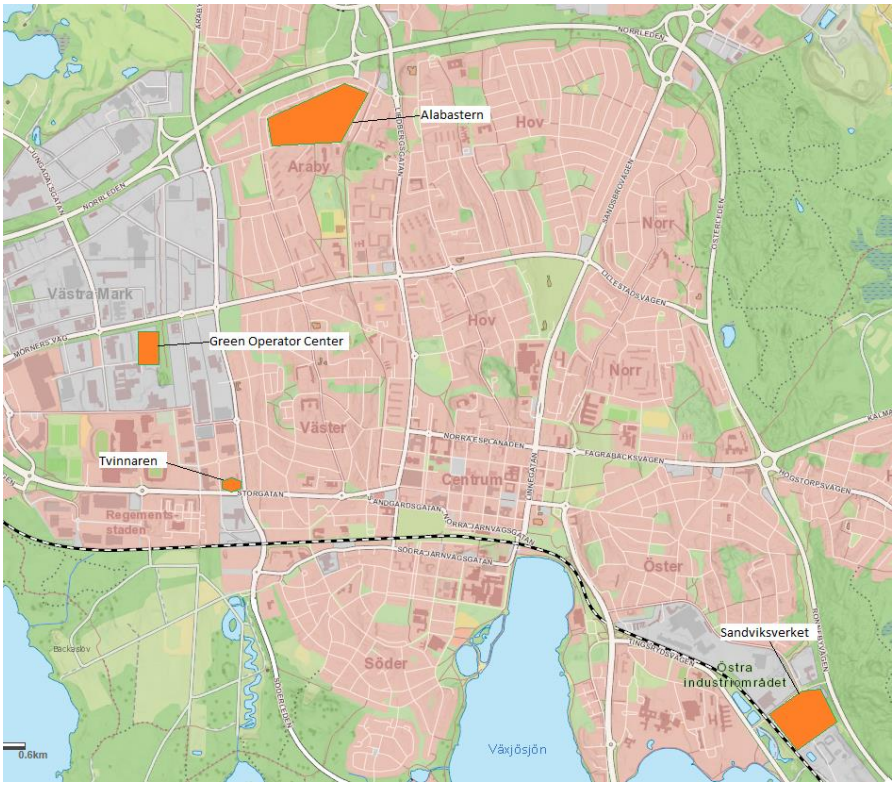

Figure 18: Overview of demonstration sites in Växjö.

Table 5: Specific figures of all demonstrations.

	Refurbish-ment	PVT (so-lar ther-mal)	PV	WasteWat er heat re-covery	Low temp DH
	m²	m²	kW	kW	m
Alabastern	31,577*	96	17.31	15	582
Tvinnaren	3,340				
Green Operat-ing Center			36		
Integration of two DC-networks					2,202
Total	34,917	96	53.31	15	2,784

*) whereof 3,361 m² refurbishment of special houses with prototype installations.

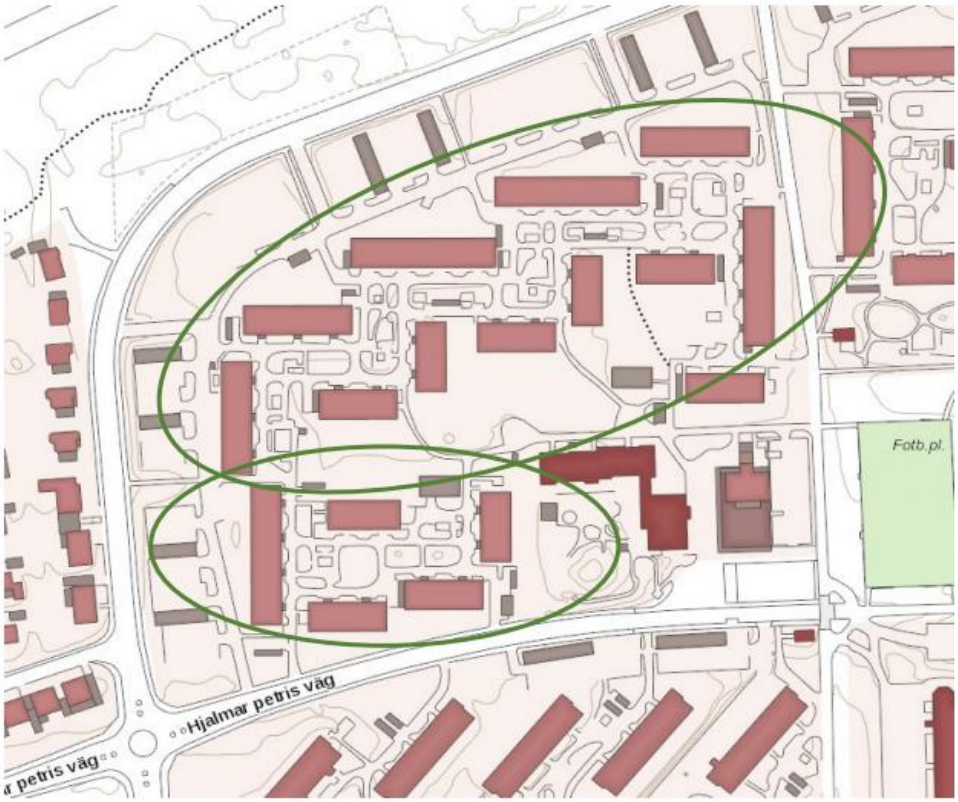

Figure 19: Overview of the Alabastern housing district in Araby, Växjö.

Figure 20: Alabastern: 301 apartments refurbished.

Figure 21: Alabastern: biomass-based low-temp DH-supply.

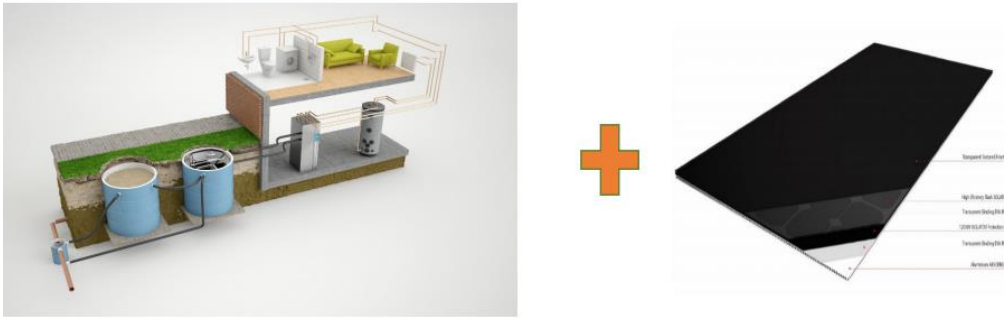

Figure 22: Alabastern: Special House, wastewater heat recovery, innovative PVT-panels.

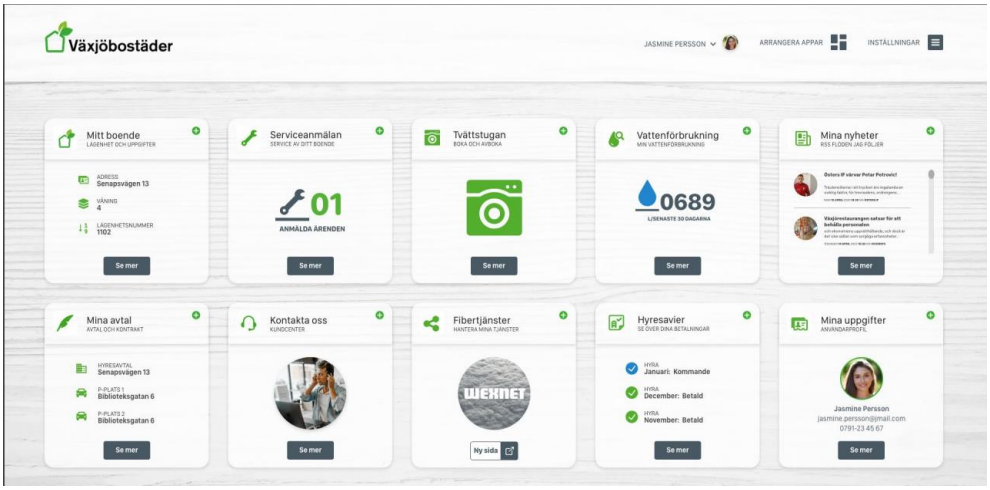

Figure 23: Alabastern: BoPortalen – innovative communication system.

Figure 24: Tvinnaren: Refurbished office building, combined district heating and cooling substation.

Figure 25: Green Operator Center and Central Nod Växjö, renovated and part of the energy loop.

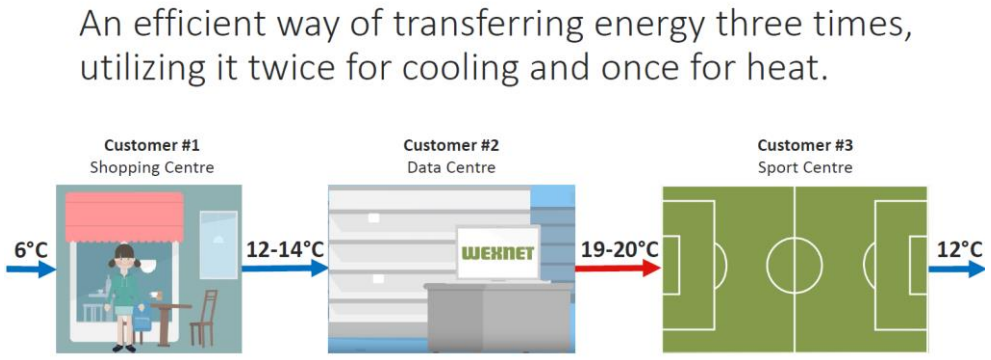

Figure 26: The loop in which energy is converted and used three times.

4.4.2 Energy savings and CO_2

The refurbishment has reduced the energy consumption in the family houses in Alabastern by more than 50% and the office building Tvinnaren with 33% compared to the BEST-tables. In the so called "special house" at Alabastern the reduction is even higher.

An integration between two different district cooling networks have been made in Växjö, which have lowered the electricity consumption by 25% compared to before the integration.

At Alabastern in Växjö, where refurbishments of multi-family houses are taking place, a low temperature district heating system has been built.
Heat losses are reduced in a low temperature district heating network compared to a traditional district heating system with traditional pipes, insulation, and temperatures. The heat losses after the installation are 4-5% compared to 11-12% in other parts of the traditional DH network. Reduced heat losses in the district heating network means that the energy of the water can be utilized to a greater extent. A lower return temperature back to the local CHP plant Sandviksverket allows READY partner Växjö Energi AB VEAB to produce more green electricity.

A combined heating and cooling sub-station has been installed at the office building Tvinnaren. The solution contributes to the energy reduction of the entire office building.

The Green Operating Centre (GOP) in Växjö is progressing, an innovative cooling system with an integrated piping system is connected to the computer centre to cool down the server hall with district cooling return water. Further, GOP will be designed with efficient hot and cold aisles, which makes it possible to utilize the heat from servers, which in other ways have been wasted. In this way it will reduce the PUE (Power Usage Effectiveness) value from 2.2 to 1.2.

Smart Heat Grid technology solution is installed at VEAB local production plant in Rottne, a small 3rdG District Heating grid which makes the grid more competitive compared to alternative heat sources. By utilizing this technology, VEAB enables to balancing the production and the consumed energy in a very efficient way. By using the controlling system, the peaks in demand have been reduced, which in turn have decreased the RME oil production and reach energy savings. Even though only a small amount of buildings was controlled, the results show that peak bio-oil costs are expected to be decreased by 16.61 MEUR per year. This leads to a total cost reduction of 0.421 EUR per MWh.

Software sensors and control equipment enable VEAB to optimize the operation of the district heating network and increase safety of district heating supply. By moving the work from distribution pumps at Sandviksverket to booster pump stations in the network, the electricity for operating the distribution pumps are minimized. The energy is calculated to decrease by 10%. The control system enables automatically start and stop of booster pump stations. This minimize energy being produced by electricity. Estimated savings of the electricity for the

period September to October and April to May is 85%, which corresponds to approximately 4,730 EUR. VEAB will be able to deliver a much safer and better product to a lower cost and increase customers satisfaction.

The heat driven kitchen appliances intended for the project comprise drying cabinets. These energy efficient drying cabinets are placed in common laundries used by the tenants and the energy consumption result in a reduction of 57.8%.

The total final energy consumption measured during the monitoring activities in the demonstration sites in Växjö Community was 2,835 MWh, when referring to the actual reference year. The energy saving as a direct consequence of the building refurbishments undertaken during READY project was evaluated to be approximately 2,413 MWh, when comparing to the BEST reference consumption. The weighted buildings total final energy consumption was 156 kWh/m² for the BEST reference case and was reduced to approximately 72 kWh/m² for the actual reference year. The actual consumption resulted 54% less than the BEST reference as shown in Figure 27, which resulted also lower than the target defined in the BEST tables.

It was evaluated that a possible renovation of the building stock in Växjö similar to the one implemented during READY project, could lead to a reduction of energy delivered by the DH network to the buildings in the community of approximately 28%.

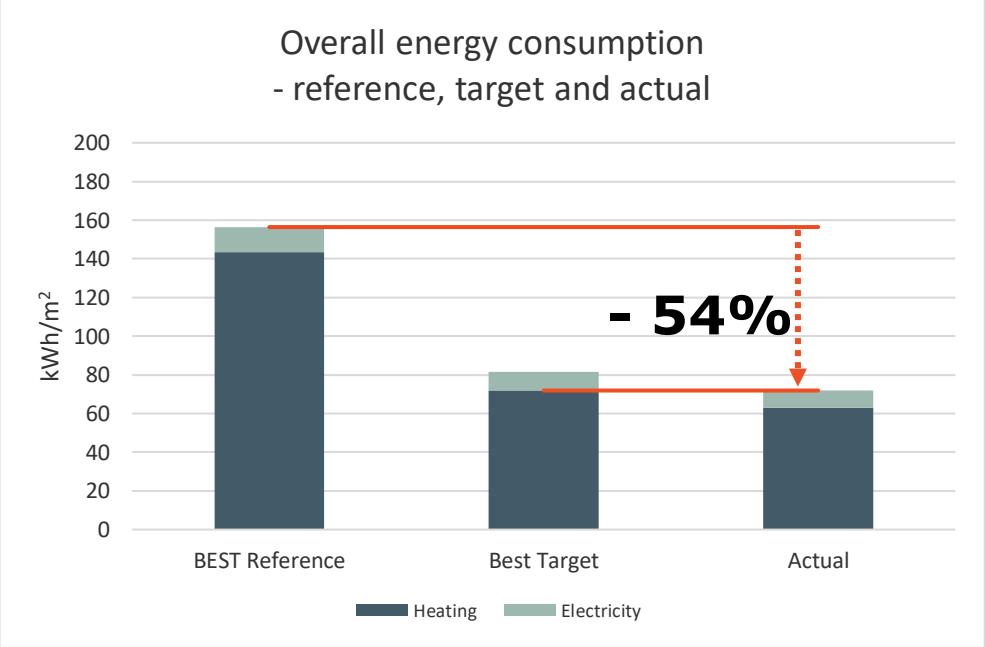

Figure 27: Total energy consumption per square meter in Växjö

In Växjö Community, 33,554 m² of both residential and non-residential buildings were refurbished, considering a total investment costs in the project of 39,212,550 EUR with the EC support equal to 1,677,700 EUR. It was calculated that the average payback time for the energy related refurbishments in the building demonstration site was 56 years with the EC grant and 70 years without the EC grant, see Table 6.

Table 6: Feasibility of refurbished buildings 2020 SE. Factor is an estimated energy refurbishment factor. SPB is abbreviation for "simple payback time".

Demo site	Area	Energy saving 2020	Total invest. costs	O&M vent	Extra costs for energy measures in new buildings	SPB on total invest. WITHOUT EC grant	Energy refurbishment factor*	Energy refurbishment costs	EC grant	SPB WITH EC grant	SPB WITH-OUT EC grant
	m²	Euro	Euro	Euro	Euro	Years	-	Euro	Euro	Years	Years
SE1	26,853	112,366	32,492,130	21,751	23,899,170	289	0.27	6,552,132	1342650	57	72
SE1.1	3,361	16,003	4,100,420	2,722	3,024,900	256	0.27	826,806	168050	50	62
SE3	3,340	18,801	2,620,000	5850	1,750,000	139	0.46	813,000	167,000	50	63
TOT.	**33,554**	**147,171**	**39,212,550**	**30,323**	**28,674,070**	**266**	**-**	**8,191,938**	**1,677,700**	**56**	**70**

* Factor that considers only the energy related costs (Single factors: ventilation 0.9; windows 0.25; building envelope 0.2)

The expected CO_2 emission from the demonstration buildings was calculated to be approximately 276 tons for the actual reference year, which results in a reduction of approximately 48% compared to the BEST reference value, equal to 255 tons. The average weighted reduction is about 7.6 kg/m²pr. year as seen in Figure 28.

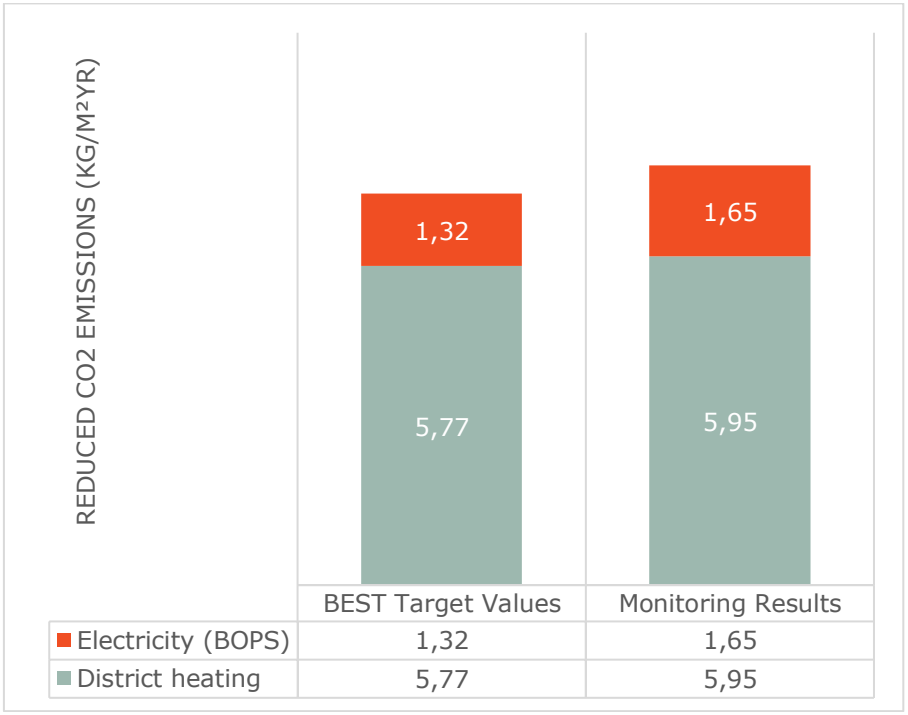

Figure 28: BEST Target Values and Monitoring Results regarding the CO_2 emission savings due to energy savings in Växjö (area weighted average).

The demonstrated local renewable energy systems produced 107 MWh in the actual reference year, which corresponds to a displacement of 12 tons of CO_2. The average weighted reduction is about 0.42 kg/m² pr. year, as shown in Figure 29. Total investment cost for the RES systems was 328,316 EUR while the EC grant was equal to 164,158 EUR.

The average payback time of the local RES system is 45 years with the EU grant, and 89 years without the EU grant, see Table 7.

Additionally, the improvement of the district heating network in Alabastern district saves 7.3 tons every year, while the innovative district cooling project "energy used three times" in Växjö reduce the CO_2 emission for at least 230 tons per year.

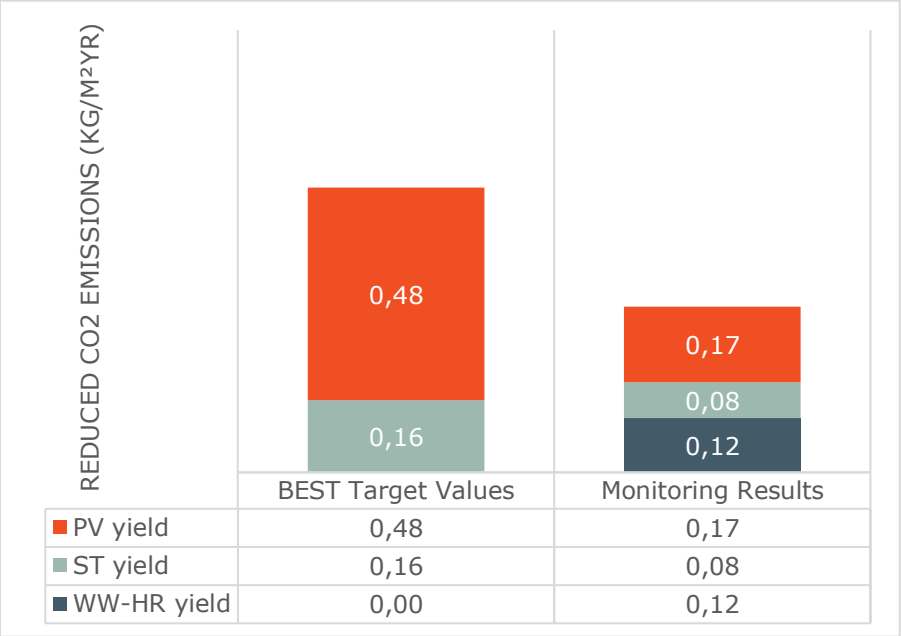

Figure 29: BEST Target Values and Monitoring Results regarding the CO_2 emission savings due to the energy production from RES in Växjö (area weighted average).

Table 7: Feasibility of renewable energy plants in Växjö, 2020 SE.

Type	Demo site	Electricity production / consumption (2)	Heat production (1)	Installed capacity	O&M	Annual savings	Investment costs	EC grant	SPB WITH EC grant	SPB WITHOUT EC grant
		kWh	kWh	kW	EUR	EUR	EUR	EUR	Years	Years
PV(T)	SE1.1 Alabastern	14,329	36,644	17.3	2,043	2,076	170,316	85,158	41	82
WW-HR	SE1.1 Alabastern	-18,655	74,619	15	373	1,604	158,000	79,000	49	98
TOT.						**3,680**	**328,316**	**164,158**	**45**	**89**

1) Heat price: 0.06 €/kWh
2) Electricity price: 0.134 €/kWh

CO_2 and inhabitants

The demonstrations in Växjö expect a gradually increasing number of inhabitants. Figure 30 illustrates the development in number of inhabitants and the corresponding CO_2 emission per inhabitant in the whole municipality, which has decreased from 3.02 tons per inhabitant in 2009 to 1.88 tons per inhabitant in

2018. Of this, the residential sector represented 0.27 tons per inhabitant in 2009 and 0.15 tons per inhabitant in 2018.

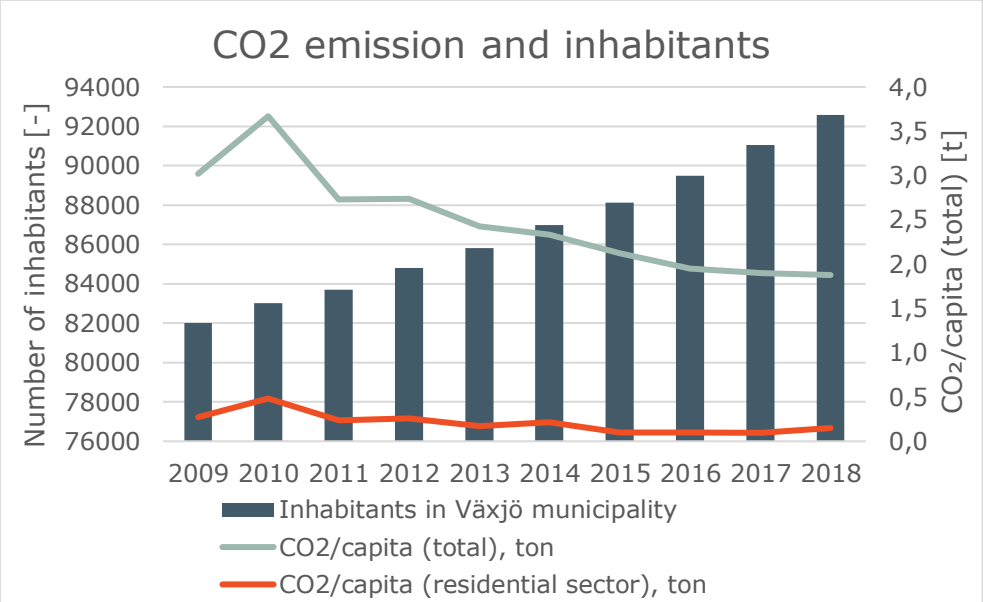

Figure 30: Number of inhabitants in Växjö municipality and corresponding CO_2 emission per inhabitant in total as well as in residential sector.

4.4.3 Socio-economic characteristics

Växjö is a town in the inland of southern Småland Region and the central town in Växjö municipality. It is also the residential town for Kronoberg County. Växjö, which received its city rights in 1342 became a university city in 1999 and is Sweden's 19th largest urban city.

Växjö is categorized by a strong and diversified business sector complemented with both national and regional institutions. The citizens are of mixed nationalities and lives in all kind of dwellings including single-family houses and multi-family buildings.

The Araby housing area in which Alabastern is situated has a population which includes a significant number of people with a nationality different from the Swedish. In 2019, about 19% of the citizens of Växjö were born outside Sweden. In the Araby district, there are about 6 600 citizens, of which 55% were born outside Sweden, and 74% had foreign background. Only 70% of the people voted in the last election, compared to 89% in Växjö in average. Araby is in general the area in Växjö with the highest socio-economic challenges.

During the project, the tenants of Alabastern have been invited to meetings to obtain information and discuss the developments. There has also been a daily representative answering all possible questions. The tenant query has shown that the tenants found it hard to temporarily move out of their homes during the renovation. It did also show that the tenants became very satisfied with their new homes after the renovation and that the moving factor is as low as before,

that the tenants are proud of their neighbourhood and that their view regarding security and outdoor environment has increased.

A behavioural campaign consisting of questionnaires, surveys, interviews, home visits, evening meetings, and distribution of information material in multiple languages was implemented. The aim was to understand sustainable behaviour of the tenants, mainly on household waste recycling. As reported by the respondents, the main reasons for improper waste recycling in the area include lack of awareness and attitude, language problem, sense of insecurity, lack of means to transport bulky waste, inadequate design of the recycling room, and inadequate action by the housing company. There was significant variation in energy and water use among the households probably due to behavioural variation.

5 Project achievements related to state-of-the-art

5.1 Technologies developed

5.1.1 Aarhus

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	Time for **commercial** use	Patents or other **IPR** protection	**Owner** & Other Partner(s) involved
Building refurbishment	Experience in finance, legal, organisation, design & operation	Housing Multi-family buildings	Available on market 2020 TRL9	N/A	HOUSE-DK COWI
Building refurbishment	Experience in legal and DH	Housing Single-family houses	Available on market 2020 TRL9	N/A	MUN-DK
Building refurbishment	Experience in organisation, design and operation	Office buildings	Available on market 2020 TRL9	N/A	HOUSE-DK COWI
PV(T) - E system and heat pump integration	PV(T), Energy absorber, Heat Pumps and controls Experience in design and O&M	RES Integration / Energy	Available on market 2021 TRL7-9	N/A	COWI RAC-DK DANF-DK HOUSE-DK
Waste Water Heat Recovery system with heat pump	Experience in legal, design and operation	RES Integration / Energy Efficiency	Available on market 2021 / Development TRL8	N/A	COWI HOUSE-DK
Battery storage and Smart Building Energy Hub	Battery Energy Storage and controls BESS. Experience in legal, design, manufacture, control & operation	RES Energy Integration Flexibility, Management.	Available on market 2020 TRL8-9	IPR	LB-DK HOUSE-DK COWI
Seawater heat pump with water as refrigerant	New type of heat pump and seawater inlet /filtration Experience in design, manufacture and operation	Energy / RES -Integration Sector coupling /	Development TRL8 - Modified version available on market 2021-2022	IPR	Johnson Control COWI MUN-DK

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	Time for **commercial** use	Patents or other **IPR** protection	**Owner** & Other Partner(s) involved
LTDH development	Experience in organisation, design, transformation and operation	Energy Integration	Available on market 2021 TRL8-9	N/A	MUN-DK DANF-DK COWI
EV charger network development	Intelligent EV chargers Experience in finance, legal, organisation, design O&M	Mobility / Energy	Available on market 2020 TRL9	N/A	EON-DK MUN-DK
PV(T) panels	Customised PV and PV(T) panels Experience in design, manufacture and operation	Construction Building Integrated / Applicated Solar systems	Available on market 2021- TRL8	Patent	RAC-DK COWI

5.1.2 Växjö

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	Time for **commercial** use	Patents or other **IPR** protection	**Owner** & Other Partner(s) involved
Building refurbishment	Experience in finance, legal, organisation	Office buildings	Available on market 2020	N/A	CA-SE
Combined DHC substation	Design O&M	DH / DC Substation	Available on market 2020	N/A	VEAB-SE CA-SE
Building refurbishment	Experience in legal, finance, organisation, social issues, communication, commissioning, evaluation, monitoring & targeting	Housing Multi-family houses	Available on market 2020	N/A	VXH-SE ESS-SE
PV(T) & Energy storage in the ground	Experience in design and operation	Special houses	Available on market 2021	N/A	VXH-SE COWI
Wastewater heat recovery	Experience in design O&M	Special house	Available on market 2020	IPR	VXH-SE COWI
IoT – Smart Home &	A software platform, a portal, a	Housing companies, urban city	More installations are planned in	N/A	VXH-SE, WEX-SE

Exploitable Knowledge (description)	**Exploitable product(s) or measure(s)**	**Sector(s)** of application	Time for **commercial** use	Patents or other **IPR** protection	**Owner** & Other Partner(s) involved
Communication platform	new digital marketplace.	broadband nets, energy companies and smart cities.	autumn 2020 in Lund and Malmö.		and the software company Labs2 Sverige AB
Biomass-based low-temp district heating	Design & operation	Integration / Energy	Available on market 2020	N/A	VEAB-SE
Interconnection of DC networks	Design & operation	Integration / Energy	Available on market 2020	N/A	VEAB-SE
Smart Heat Grid Tech. - Sensor control equipment	Optimisation	Integration / Energy	Available on market 2020	N/A	VEAB-SE DANF-DK
Software sensor, control equipment	Optimisation	Integration / Energy	2020	N/A	VEAB-SE
Renovation computer server center(s)	Experience in organisation, design & operation	Integration / Energy	Depends on the circumstances	N/A	WEX-SE
PV-panels	System design & operation	Integration / Energy	Available on market 2020	N/A	WEX-SE COWI
Loop in which energy is converted and used 3 times	Design & operation	Integration / Energy	Available on market 2020	N/A	VEAB-SE

5.2 Aarhus

5.2.1 Lessons learned beyond state of the art

It was found that it is difficult and time consuming to persuade single-family homes owner to carry out energy refurbishment. However, if the house in any case needs maintenance and a general update to preserve its value in the market, then the refurbishment will be prioritised and of course in an energy efficient way.

On the other hand, it is much more hand able to carry out deep renovation of social housing as soon as the democratic decision processes have been passed and tenant decisions are taken, and finance approved from Landsbyggefonden where there is a cue to get the share in available funding at attractive condition. The impact is however significant when the project is up running, due to the large number of dwellings handled in each project.

It was also found that central plants that ensures the sustainable energy supply per building serving several dwellings in a multifamily building are suitable as they are invisible and work automatically with-out interference by the tenant. An exception is individual ventilation plants in the apartments. The precondition for this lesson is that the metering and monitoring systems work well and that a motivated skilled janitor is available to supervise and ensure maintenance of the systems.

It was found that wireless metering is not plug and play and mature - but takes a lot of effort by different parties to provide the data and protocols that is intended, the difficulties relate both to versions of communication protocols, registration issues, GDPR rules and organisation.

It was also on the Danish side found difficult to get approval for the connection of large (>50 kWp) PV and battery systems to the grid as the DSO's have interests against the liberalisation of distributed utilisation of local RES.

5.3 Växjö

5.3.1 Lessons learned beyond state of the art

The project has demonstrated how an area with social challenges can be transformed and supplied by renewables.

The project has learned and demonstrated how full focus on the tenants is key - to motivate the tenants of an in deep renovation of their neighbourhood, giving the 'new ecological elements' an additional social significance and providing opportunities for a nice new neighbourhood.

The project has also learned that a large variation in waste recycling and energy and water consumption among households means that it is important to focus on household behaviour as much as technical measures.

The project has provided knowledge and strengthened the relations and collaboration between local actors.

The project has identified partnering, solution-oriented work and a thorough knowledge about the own buildings as success factors regarding refurbishment.

The project has successfully demonstrated local energy efficiency solutions, that can be scaled up such as heat recovery from exhaust air system, wastewater heat recovery and PVT/heat pump system

The project has shown all contributors that the impossible is possible. Measures which in the beginning of the project was perceived as science fiction is today not only possible but perceived as "business as usual".

The project has demonstrated that district heating pipe losses can be reduced significantly using new twin pipes with increased insulation and pipe dimensions and is operated at low temperature than for traditional systems.

The project has proven the strength of a strong vision and the importance of starting small. During the project the communication portal for READY partner Växjöbostäder and its tenants has turned into the springboard for the smart city. The "Interface of Life" solution has initiated a sustainable, open infrastructure and market for digital energy, environmental, security and welfare services that reach all households in the public interest (Figure 31).

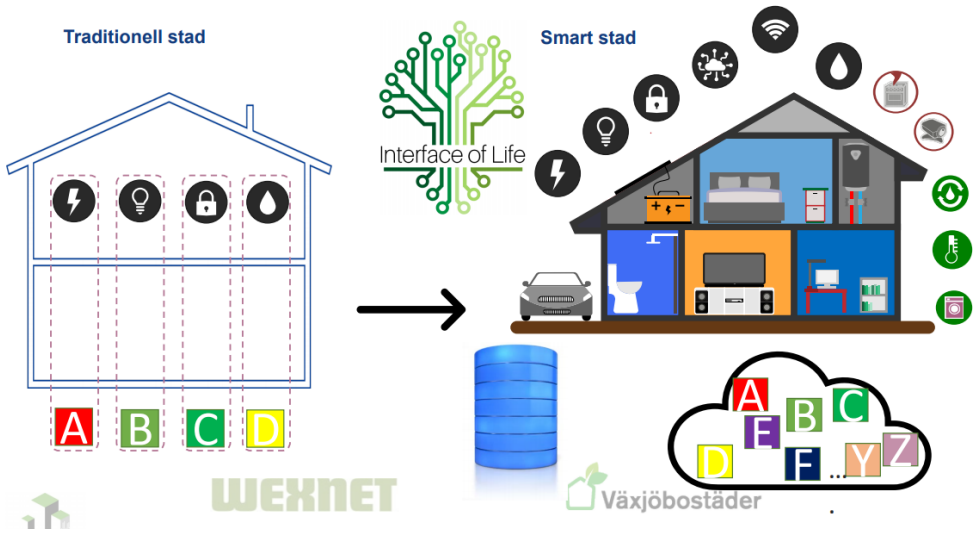

Figure 31: Overview of Interface of Life

The project has proven that a process that is started continues its course although it may not be done within the frame of the READY project. The district Bärnstenen, an adjacent housing area to Alabastern, that originally was planned to be renovated within READY has started its refurbishment process of 613 apartments from August 2020.

The project has also distilled four keys to success on a municipal level: political will, monitoring, collaboration and financial support.

- The political will entails long term goals, engagement and pride over results as well as agreement over political boundaries.
- Measurement, monitoring and results are crucial, both as a basis for future decisions, but also to follow-up of goals and communicate the results, fuelling the development process.
- As no organisation can do everything alone collaboration is essential.
- Finally, financial support helps to do the little extra, enable knowledge transfer and put Växjö on the map, further fuelling the development processes.

5.4 Kaunas

5.4.1 Lessons learned beyond state of the art

The project found that it is difficult to deeply refurbish social housing which is collectively owned by the inhabitants (energy bills are paid by the municipality to the socially weak – so there is no incitement energy saving). If financing sources e.g. structural funds can be combined with other funds that together will pay more than 50% of the cost, then it can be possible.

The action plans in Lithuania focus so far mainly on increasing biomass in the energy supply systems, which is done very successfully with many independent suppliers feeding into the overall DH grid.

6 Impact of the project on relevant sectors

The transfer of experience across borders in this project has been of good inspiration and value for the partners working with planning and consultancy.

The project has had a profound impact not only locally but also regionally and nationally in different relevant sectors.

6.1 Political and regulatory sector

Work developed in the READY project has led to the cooperation between the representatives of political and regulatory sector at local, regional and national level. Nowadays, energy efficient refurbishment of cities is a major concern for city managers and policy makers as well as the integration of RES solutions and the development of energy communities and smart cities. In order to develop an adequate urban plan design for areas already constructed, it is necessary to have a close collaboration between the different political actors.

The project was expected to have a large replication potential and the Municipalities have met the challenge and encouraged neighbouring communities to start their own path of energy-efficiency. READY project is one of the first examples of test and implementation of all the main components for the future energy communities, which are based on building retrofitting, RES integration, green mobility, energy storage, waste heat recovery, smart energy hubs and poly-generation.

READY project aimed to be a frontrunner project in the development of energy communities through the retrofitting of residential buildings and offices, integration of RES and smart energy solutions as well as influencing the mobility habits of the citizens towards more sustainable solutions. The project has attracted much attention from local stakeholder and politicians and is regarded as a lighthouse and a remarkable project, which set new standards for the green transition.

The high interest of different administrations was also confirmed by the participation of some representants at the conferences organized by READY project partners. In particular, the former MP Energy and Climate Minister of the Danish Government Lars Christian Lilleholt, was guest in one of READY's conference, as well as several representants of the Climate Department of the City of Aarhus or the Environmental Department of Växjö Municipality.

6.2 Municipalities

The municipalities involved in the communities have gained an increased focus on energy efficiency, RES integration and smart cities solutions. Furthermore, they have improved and updated the climate action plans during the project.

Neighbouring Municipalities have been inspired by the project and have carried out similar initiatives leading to new projects.

The involved Municipalities will continue the green transition aiming to achieve their long-term target of being 100% fossil fuel free in the next decade. The strategy of the administrations is to act in all the relevant sectors, such as energy supply, buildings, mobility, industry and population development. To achieve the ambitious targets, projects such as READY can bring knowledge and new technologies that will facilitate the transition towards more sustainable and green communities and even positive energy districts.

6.3 Population

The population was a constant factor considered throughout the duration of READY project. It is important to receive constant feedbacks from the citizen to better address the development of the communities. Furthermore, it is important to increase the awareness of the population in relation to the challenges that the green transition requires, since in a limited period of time many changes must be implemented to reach the targets.

The citizens have been involved in the project with meetings to obtain information and discuss the developments, opening hotlines for questions or eventual complaints. Furthermore, behavioural campaigns consisting of questionnaires, surveys, interviews, home visits, evening meetings, and distribution of information material in multiple languages were implemented.

A group of volunteers participated to a research regarding the changes of mobility habits to support more sustainable means of transport, such as the use of bicycles, which can also lead to the health improvement of the users.

As mentioned, the challenges of the green transition require increased awareness of the citizens also about the technologies adopted to achieve the targets. A good example of this strategy is the seawater heat pump installed in the City of Aarhus. The first unit was officially inaugurated on the 11th of January 2020. Besides the public inauguration, as shown in Figure 32, the building is designed to always allow public visitors access and raise awareness about heat pumps and the city's DH system. Furthermore, as part of this effort, the project was designed in a 3D digital virtual reality model, so installers and visitors could walk around in the room and see how the final installations would appear, when all the units will be finally installed.

Figure 32: Inauguration of the seawater heat pump and public opening to citizens (11th January 2020).

6.4 Technicians and professionals

READY project has had a direct impact not only on the architects, engineers and other professionals participating in the project as partners of third parties but also on other professionals visiting or seeing the work being developed thanks to the great dissemination of the project.

New models for energy communities, energy efficient constructions and retrofitting have been developed within the project and have had a direct impact on the area in the future. In that way, the READY project has contributed to setting new standards for the green transition, showing that different technologies can be involved to achieve the targets.

READY project had an influence on the development of new technologies and products that in the future can be largely implemented in similar projects by technicians and professional. The activities developed and the lessons learned in the project will allow them to compare the current situation with new opportunities of development.

6.5 Construction and industry sector

The project had a large impact on the construction sector of the involved communities and had encouraged industries to play a leading role in the sustainable urban development. READY gave the possibility to several companies in different sectors and with different backgrounds to develop new and innovative products, which are becoming fundamental for the green transition and the implementation of the future energy communities and smart cities.

During the project, **Lithium Balance** developed a modular **battery pack** and a **smart building energy hub**, from the initial idea, through the first pilot test in the company's facilities and finally to the implementation at the demonstration site with the final version of the products. The combination of the new battery pack with the smart building energy hub gives the possibility of optimizing the

electricity consumption, with a larger contribution from the PV system and a reduction of the energy bought from the grid. Furthermore, the algorithms of the energy hub could eventually control other electrical equipment, such as heat pumps, in order to optimize their use based on electricity price. The annual market potential for the developed system is estimated to 5 billion EUR/yr.

The development of **PVT elements** by **Racell Saphire** was encouraged by READY project and they were finally implemented both in Aarhus and in Växjö. The interesting features of these type of elements are their dimensions, since they can be produced in large dimensions up to 3 x 6 m, and their customised design, with-out frames or glazing. They can have different surface colours, which allow them to become part of the building design, also considering the limited thickness and the smart fitting system. On top comes the multifuctional use as PVT-E elements where the E stands for the Energy absorber for the heatpump besides the T, which is the direct Thermal use of the solar energy. From the monitoring in Växjö it is seen that the thermal output is about twice the electrical output, i.e. in total 3 times the energy output of a normal PV panel.

Part of READY project consisted in introducing **heat pumps**, both in **small and large scale**, to produce heat, to directly supply the DH network or to supply part of the demand in the buildings. The large **seawater heat pump** implemented in the DH system serving **Aarhus**, which will play a main role in the future of the DH heating supply and the sector coupling incl. flexibility in supply depending on load and the fluctuating cost of electricity for North Pool. The system is quite unique, and its development will have an import impact in the future transition to sustainable heat sources for the DH system. READY project supported the first module of the system, which Aarhus Municipality already planned to enlarge, to reach a total of 12 MW. During 2020 about 80 large heat pumps, in the several MW class and based on traditional technology, were installed in Denmark. This shows the rapid growing market for large heat pumps to be implemented as part of the green transition and electrification of the energy sector. The new developed heat pump system demonstrated in READY is now ready to enter this growing market.

Smaller heat pumps were introduced at building/department level, which will contribute to the heat supply of the multi-family buildings. The technologies combined with components from amongst others **Ecoclime** and **Grundfos** allow to **recover heat from wastewater** in a prefabricated manhole, thanks to heat special exchangers connected to a heat pump. In the same way, the company **Metro Therm** developed a high efficient temperature tolerant micro heat pump and heat exchanger that allows to recover heat from wastewater flowing in the down / drainpipe as demonstrated in READY.

Lastly, many of READY project partners operate in several countries, and for this reason the potential number of replications of demonstrated READY technologies is high. Experience from READY has already been promoted through several internal and external channels and networks, and it is expected to inspire and to be replicated in several projects.

6.6 Perspectives of READY project

Standing on the exit doorstep of the READY project, a look back on the extensive amount of the activities, experiences and joint forces lead to some reflections. It is a fact that the READY project has become a very successful project with many demonstrations and activities. It has influenced and pushed the political agenda in a direction of more sustainability and created a ripple effect of green transition activities spreading to neighbouring communities.

It seems that the reason for this achievement is, that is had been possible to create and maintain long lasting and well-integrated partnerships between project participants. When entering the project, the project partners engaged and committed themselves to the long-term objectives in the project scope. The obligations of the consortium and the continuity of the project have inspired and caused partners to aim high when for instance trying out new technologies. The project can be considered like a training session for the involved businesses and contributed maturing decisions and developments.

Municipalities, utilities, housing companies, consultants and industries have worked together in transverse activities and on specific challenges. The READY project has indeed prepared participants to launch further developments and will make future efforts towards fossil fuel free communities more cost efficient.

Several of the innovative solutions developed in READY are now to be replicated hereunder in 10 large housing districts, with support from "Landsbyggefonden" (National Building Fund for Social Housing) in the greater Copenhagen area. The aim is to create new standard solutions that will be demanded as prerequisite to get attractive funding schemes for renovation of multi-family housing. It is primarily the solutions with PV(T), batteries, EV charging, microgrid and distributed heat pumps. This impact together with the developed battery storage systems are considered as a big success for the impact of the READY project.

Developments in READY are partly supported by patents as seen in the following table:

LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS.					
Type of IP Rights	**Confidential**	**Foreseen embargo date**	**Application reference(s)**	**Subject or title of application**	**Applicant (s)** **(as on the application)**
Patent	NO	(US) 27/ 06/ 2033 ---------- (EP & more) 20/ 11/ 2029	1 US PATENT APPLICATION US13/928,567 ---------- 2 EUROPEAN EP2359401B1 and other countries	Solar Module having integrated electronic devices and related method to manufacture it	Saphire Solar Technologies ApS
Patent	NO	(EP & more) 28/ 09/ 2031	3 EUROPEAN EP2646176B1 and other countries	Solar module with cleaning system comprising light sensor	Racell Saphire Technologies ApS
Patent	NO	(EP & more) 18/ 08/ 2036	4 EUROPEAN EP3338363A1 and other countries	All-in-one integrated multifunctional triple power module "itm"	Saphire Solar Technologies ApS
Patent	NO	n.a.	5 WO08055505	Modular battery management system	Ivan Loncarevic
Trademark	NO	n.a.	6 VA201802338	XOLTA	Lithium Balance A/S

7 Dissemination

7.1 Dissemination results

Because of the results obtained in the READY project, dissemination activities, including newspapers, online articles and TV, have reached about 4.6 million people across Europe. Since the beginning of the project, more than 190,000 hits have been registered on the READY project website. Demonstration projects have been nominated for or received several awards:

Trige Parken (READY site DK2) in Aarhus received a nomination for the "Renoverprisen (the Refurbishment Prize) as Denmark's best refurbishment in 2019.

> Link: https://renover.dk/projekt/80er-bebyggelse-med-helt-nyt-ansigt-trige-parkvej/ (Danish)

Trige Parken (DK2) in Aarhus also received a nomination for the Aura Energi Green Prize "Fra ghetto til grøn" (From ghetto to green) in 2020.

> Link: https://stiften.dk/artikel/200-000-kroner-p%C3%A5-spil-energirenoverede-boliger-k%C3%A6mper-med-om-aura-energis-gr%C3%B8nne-pris (Danish)

The cooling network with triple use of the energy in Växjö was nominated for the Global District Energy Climate Awards as one of the best and sustainable cooling systems demonstrated.

> Link: https://www.districtenergyaward.org/innovative-district-cooling-cycle-network-vaxjo-sweden/

The innovative distributed energy solutions developed in READY are now to be replicated in 10 Danish housing districts in the Greater Copenhagen Region with support from "Landsbyggefonden" (National Building Fund for Social Housing). It is primarily the solutions with PV(T), batteries, EV charging, microgrid and distributed heat pumps. This is considered at big success for the READY project.

As part of READY project different Advanced Training Programme on Smart Cities Development session were organized in Denmark, Lithuania and Sweden. The evaluation forms handed out to the participants showed high interest in the topics presented and good dissemination results.

The final conference and site visit were held in Aarhus on 22nd of October 2020. The conference had participants from more than 10 countries thanks to the possibility of being connected online, due to the COVID-19 restrictions. The session was filmed and supplemented with videos that can be streamed on READY website.

7.2 Summary of plan for using and dissemination of knowledge

One of the main objectives of the READY project is the replication of the activities developed in the project into other areas, and the boosting of energy efficiency criteria in construction and retrofitting mainly at regional and national level.

The plan for further disseminating of the knowledge obtained is:

- To participate in forums, congresses, and conferences
- To participate in projects with similar technology in focus
- To prepare 1:1 training and follow-up for technicians operating the buildings
- To disseminate the project news to newspapers, technical journals, TV, radio, internet etc. and maintain the project webpage also after end of READY project

Municipalities will continue to use the READY material in connection with visits and collaboration with other stake holders.

The READY criteria and solutions in the urban development plans of other areas is already seen in Aarhus and in Aalborg (Northern Denmark) and Hvidovre (Capital Region).

Aarhus Municipality is interested in continuing the development of the seawater heat pump. After the first module of 1 MW supported by READY project, the second was implemented late 2020 and additional 10 modules are planned to be implemented in the coming years.

In Kaunas, high interest was showed to continuing the retrofitting of existing buildings as well as to introduce RES solutions.

The housing associations involved in the project showed interest in continuing the implementation of the innovative technologies that was implemented during READY project. Boligforeningen Ringgaarden in Aarhus is planning to introduce the wastewater heat recovery system in other departments. Furthermore, housing associations external to the project showed interest in implementing similar solutions.

E-On is planning to improve and enlarge the EV charging network in other main cities in Denmark. And in Sweden the EV charging is also rolled out

Lithium Balance experienced a remarkably growth during READY project and is expected to further grow supplying the battery control systems developed also for the automotive market from 2021.

Following videos have been produced in the project period and are all published and uploaded project website www.smartcity-ready.eu.

READY project in Aarhus:

https://www.youtube.com/watch?v=XVqFCaPAcKg&feature=youtu.be

Demonstration sites in Aarhus and innovative technologies:

https://vimeo.com/468916488/d373340162

Wastewater heat recovery system in Växjö (in Swedish):

https://www.youtube.com/watch?v=-iUz6cZZwoA

Figure 33: Holistic renovation during READY project. Trigeparken west-blocks (DK2). A light house reference project.

Selected major dissemination activities are listed in the following table in appendix **Error! Reference source not found.**.

8 Appendices

8.1 Dissemination list

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
1	MUN-DK	03.12.2014	Press and brochures	Online article	Aarhus tester nye energieffektive løsninger *Aarhus is testing new solutions*	www.energy-supply.dk	Public (professionals)	15.000	Danish
2	MUN-DK	03.12.2014	Press and brochures	Online article	Aarhus tester nye energieffektive løsninger *Aarhus is testing new solutions*	www.building-supply.dk	Public (professionals)	15.000	Danish
3	COWI-DK	04.12.2014	Press and brochures	Online article	Brugte batterier fra elbiler skal gøre renoverede lejligheder til strømlagre *Used EV batteries as electric storage in refurbished appartments*	www.danskfjernvarme.dk	Public (professionals)	3.400	Danish
4	MUN-DK	04.12.2014	Press and brochures	Online article	Brugte batterier fra elbiler skal gøre renoverede lejligheder til strømlagre *Used EV batteries as electric storage in refurbished appartments*	www.ing.dk	Engineers	25.000	Danish
5	COWI-DK	04.12.2014	Press and brochures	Online article	Aarhus-boliger bliver bedre end BR2020 *Aarhus dwellings will be better than nZEB*	www.bygtek.dk	Public (professionals)	30.000	Danish
6	COWI-DK	04.12.2014	Press and brochures	Online article	Aarhus bliver laboratorium for grøn omstilling *Aarhus becomes living lab for green transition*	www.cowi.dk	Public	10.000	Danish
7	HOUSE-DK		Other activity	Radio inverview	Interview with Palle Jørgensen, Ringgaarden	Danish Radio P4 national channel	Public	100.000	Danish
8	MUN-DK	07.12.2014	Press and brochures	Online article	EU-millioner til kæmpeprojekt *EU millions for giant project*	www.jyllandsposten.dk	Public	247.000	Danish
9	UNI-DK	17.12.2014	Internet platforms	Post on LinkedIn	Smart city millioner til Aarhus *Smart city millions for Aarhus*	www.linkedin.dk	network on LinkedIn for Steffen Petersen	500	Danish
10	MUN-DK	Jan. 2015	Press and brochures	News note	Nyhedmagasinet *News magazine*	Danske Kommuner	Public	10.000	Danish
11	COWI-DK	13.01.2015	Press and brochures	Online article	READY	www.danskfjernvarme.dk	Public (professionals)	3.400	Danish
12	COWI-DK	01.03.2015	Internet platforms	Launch of public website	http://www.smartcity-ready.eu/	http://www.smartcity-ready.eu/	Public	Visitor count: 23.495	English
13	UNI-DK	23.04.2015	Networks and EU events	Speak	Invited talk at Minestry of Cities	Conference	Invited	60	Danish
14	UNI-DK	30.04.2015	Other activity	Announcement	Renoverprisen 2016 *Refurbishment prize 2016*	http://renover.dk/aarhus-vaertsby-for-energirenovering-i-verdensklasse	Architects / engineers	6.000	Danish
15	UNI-DK	May 2015	Networks and EU events	Speak	Invited talk at CISBO annual meeting	Conference	Invited	50	Danish
16	ESS-SE	28.05.2015	Workshops with stakeholders	Workshop	Svenska städer i Smart Cities *Swedish towns in Smart Cities*	Workshop	Climate partners	14	Swedish
17	UNI-DK et al	20.08.2015	Networks and EU events	Paper & presentation	Heller A, Wyckmans A, Zucker G, Petersen S, Haider C. Buildings interaction with the Energy Systems – A Research Agenda.	Seventh Passivhus Norden Sustainable Cities and Buildings conference. Copenhagen, Denmark	Public	1.500	Danish
18	COWI-DK	28.08.2015	Press and brochures	Online article	Potentialet for varmedrevne hvidevarer i Sverige *Potential for heat driven appliances in Sveden*	www.danskfjernvarme.dk	Public (professionals)	7.000	Danish
19	MUN-SE	28.08.2015	Press and brochures	Newspaper article	Så ska Växjö göre Europa lidt grönnare *Now Växjö will make Europe become greener*	360 COWI (COWI AB)	Public (professionals)	15.000	Swedish
20	LGI	20.09.2015	Networks and EU events	Presentation of READY-poster	READY - Ressource efficient cities implementing Advanced smart citY solutions	Set Plan Conference	Conference participants	600	English
21	MUN-SE	07.10.2015	Press and brochures	Online article	Workshop om lavenergibyggeri , Växjö *Workshop on low energy building*	www.danskfjernvarme.dk	Public (professionals)	3.400	Danish
22	HOUSE-DK	14.10.2015	Press and brochures	Newspaper article	Trige-bebyggelse siger ja til stor renovering *Inhabitants in Trige building district says yes to refurbishment*	Aarhus Stifttidende	Public	14.000	Danish
23	ESS-SE	19.10.2015	Workshops with stakeholders	Workshop	Svenska städer i Smart Cities *Swedish towns in Smart Cities*	Workshop	Climate partners	14	Swedish
24	ESS-SE	02.12.2015	Networks and EU events	COP 21 European Forum	The experience of Växjö City: Actions for the reduction of energy demand and CO_2 emissions	Programme of summit	World regions and citizens	50.000	English
25	MUN-DK	02.12.2015	Workshops with stakeholders	Workshop	Transition to a non-fossil future in Aarhus	Workshop	Climate partners	35	Danish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
26	MUN-DK	03.12.2015	Press and brochures	Press release	Kæmpe energirenoveringsprojekt i Aarhus *Giant energy renovation project in Aarhus*	www.aarhus.dk	Public	300.000	Danish
27	MUN-DK	03.12.2015	Press and brochures	Press release	Kæmpe energirenoveringsprojekt i Aarhus *Giant energy renovation project in Aarhus*	www.gogreenwithaarhus.dk	Public	300.000	Danish
28	RAC-DK	05.02.2016	Workshops with stakeholders	Workshop	RATIO Architects workshop at Life Science University -READY presentation	Workshop	Architects	20	Danish
29	ESS-SE	26.04.2016	Networks and EU events	Conference	Dialogue about hindrances and possibilities for municipalities	Sveriges Kommuner och Landsting Conference material https://skl.se/tjanster/kurserochkonferenser/dokumentation/alldokumentation/dokumentationbostaderforallamenhur.9394.html	Politicians, decision makers in Municipalities	50	Swedish
30	UNI-DK	May 2016	Scientific publications	Paper & presentation	Kristensen M.H. and Petersen S. Does embodied energy in windows affect their energy-efficiency ranking?	12th REHVA World Conference CLIMA. Aalborg, Denmark	Engineers & researchers	700	English
31	LGI	March 2016	Internet platforms	Press release	READY HUB	Internet	Engineers, students, researchers and others	10.000	English
32	AIT + RAC-DK	30.05.2016	Other activity	Online newsletter	READY project uses innovative photovoltaics modules developed by the Danish company RACELL	SCIS Newsroom http://www.smartcities-infosystem.eu/Newsroom/news/ready-project-uses-innovative-photovoltaic-modules-developed-danish-company-racell	Subscribers to newsletter	10.000	English
33	LGI / DDHA	June 2016	Networks and EU events	Webinar	"Food for thought", District heating & cooling - during the Sustainable Week, 13-17 June 2016	www.mysmartcitydistrict.eu	Climate partners	100	English
34	MUN-DK	16.06.2016	Networks and EU events	Webinar	Lunch academy webinar - District heating & cooling	European Sustainable Energy week: http://www.eusew.eu/energy-days/lunch-academy-webinar-district-heating-cooling	Conference participants, followers, twitter users, website visitors	2100 participants, 12400 tweets reaching 18 mill. accounts	English
35	UNI-DK	aug-16	Scientific publications	Journal article, 10 pages	"Choosing the appropriate sensitivity analysis method for building energy model-based investigations", by M.H. Kristensen, and S. Petersen	Energy and buildings, volume 130, Elsevier	Professionals	?	English
36	AVA-DK	27.09.2016	Scientific publications	Presentation	Session 12: Future district heating production and systems", on the topic "Applications of a heat load forecast with dynamic uncertainties	2nd International Conference on Smart Energy Systems and 4th Generation District Heating	Professionals	100	English
37	AVA-DK	27.09.2016	Scientific publications	Presentation	Session 14: Low-temperature district heating and buildings", on the topic "Direct and indirect district heating network energy savings from building retrofit	2nd International Conference on Smart Energy Systems and 4th Generation District Heating	Professionals	100	English
38	AIT	27-28.09.2016	Scientific publications	Presentation	Evaluation of smart energy management measures for DHN - Network modelling methodology	2nd International Conference on Smart Energy Systems and 4th Generation District Heating	Professionals	100	English
39	MUN-SE	28.09.2016	Press and brochures	Press release	Workshop i Växjö inom READY-projektet "Workshop in Växjö about in the READY-project"	www.mynewsdesk.com	Professionals	100	Swedish
40	ESS-SE	29.09.2016	Internet platforms	Facebook post	On partner meeting	https://www.facebook.com/EnergikontorSydost/	Municipalities (decision makers, public servants) stakeholders	136 followers	Swedish
41	ESS-SE	28.09.2016	Other activity	Calendar post	READY Workshop	ESS web page, calendar post	Municipalities (decision makers, public servants) stakeholders	2000	Swedish
42	ESS-SE	30.09.2016	Press and brochures	Online article	Workshop i READY	ESS web page	Municipalities (decision makers, public servants) stakeholders	2000	Swedish
43	ESS-SE	30.09.2016	Other activity	Newsletter	Energikicken #7 2016	Energikicken #7 2016	Municipalities (decision makers, public servants) stakeholders	1000	Swedish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
44	LB-DK	04.10.2016	Workshops with stakeholders	Presentation	"Battery Systems for Photovoltaics"	Denmark-China Bilateral Workshop on Energy Conversion and Storage	Scientists	28	English
45	UNI-DK	15.10.2016	Scientific publications	Scientific article	"Choosing the appropriate sensitivity analysis method for building energy model-based investigations. ", by Martin Heine Kristensen and Steffen Petersen	Journal of Energy and Buildings	Professionals	6.000	English
46	ESS-SE	26-28.10.2016	Networks and EU events	Conference	Energy renovation projects in Växjö in EU-project READY	Conference – Front Meeting of Skills, MeNs www.mens-nzeb.eu	Professionals, researchers	50	Swedish
47	AIT + RAC-DK	17.10.2016	Internet platforms	LinkedIn post	Factory Visit of RACELL, an Innovator for Hybrid Solar Collectors (PVT) Demonstrated in Project READY	LinkedIn	Professionals, LinkedIn network	177	English
48	ESS-SE	31.10.2016	Other activity	Newsletter	Energikicken #8 2016	Energikicken #8 2016	Municipalities (decision makers, public servants) stakeholders	1000	Swedish
49	AVA-DK	21.11.2016	Press and brochures	Annual magazine	Fremtidens fjernvarme afprøves i Aarhus "Aarhus is testing the district heating of tomorrow"	Annual magazine for the climate work 2016. "Free of coal and what next?. Go Green with Aarhus.	Public	200.000	Danish
50	ESS-SE	25.11.2016	Internet platforms	Facebook post	On seminar Bioenergy Day	https://www.facebook.com/EnergikontorSydost/	Municipalities (decision makers, public servants) stakeholders	136 followers	Swedish
51	ESS-SE	07.12.2016	Internet platforms	Facebook post	On READY general assembly	https://www.facebook.com/EnergikontorSydost/	Municipalities (decision makers, public servants) stakeholders	136 followers	Swedish
52	ESS-SE	07.12.2016	Internet platforms	Twitter	On READY general assembly	https://twitter.com/energikontorSO/status/806502214227345408	Municipalities (decision makers, public servants) stakeholders	442 followers	Swedish
53	LGI	31.01.2017	Press and brochures	Online article	Green Business Models: The Key Enabler for Smart Cities in Europe	http://sdg.iisd.org/commentary/guest-articles/green-business-models-the-key-enabler-for-smart-cities-in-europe/	Public and professionals	10.000	English
54	UNI-DK	17.02.2017	Scientific publications	Scientific article	"Space heating demand response potential of retrofitted residential apartment blocks"	Journal of Energy and Buildings	Professionals	6.000	English
55	MUN-SE	22.02.2017	Networks and EU events	Presentation	Växjö - green transition in practice	Scottish Renewables: Low-Carbon Cities Conference in Edingburgh	Professionals	100	English
56	LGI	28.02.2017	Networks and EU events	Poster presentation	Green Business Models for an electrical integrated solution in buildings	The World Sustainable Energy Days conference www.wsed.at/en/world-sustainable-energy-days.html	Professionals	1.000	English
57	MUN-DK	March 2017	Press and brochures	Paper	Climate Plan 2016-2020, City of Aarhus	Go Green with Aarhus http://reader.livedition.dk/aarhuskommune/749/html5/	Public	10.000	English
58	HOUSE-DK	03.03.2017	Press and brochures	Article in newspaper	Det bliver ligesom at flytte ind i en helt ny lejlighed "It will be like moving into a completely new apartment"	JP Aarhus	Public	75.000	Danish
59	UNI-DK	06.03.2017	Scientific publications	Scientific article	Using ensemble weather predictions in district heating operation and load forecasting by Dahl, Magnus; Brun, Adam; Andresen, Gorm.	Journal of Applied Energy	Professionals	6.000	English
60	LB-DK	13.03.2018	Networks and EU events	Presentation at network event	Battery storage for housing associations and non-residential buildings	ELFORSK Dagen	Professionals	200	Danish
61	AVA-DK	30.03.2017	Networks and EU events	Booth at fair	Building Green Messe i Aarhus "Building Green Fair in Aarhus"	Building Green	Public	2.400	Danish
62	MUN-SE	06.04.2017	Other activity	Presentations and discussions	Vill du vara med och göra Tönsberg grönare "Do you want to help make Tönsberg more green?"	Presentation	Municipal workers, inhabitants in Tönsberg, politiacians	55	Swedish/norweigian
63	LB-DK	13.04.2017	Networks and EU events	Presentation	Batterilager til boligforeninger og erhvervsbygninger "Battery storage for housing associations and nonresidential buildings"	24 timer med ELFORSK. Netværksdøgn. 24 hours with ELFORSK. Networking day	Professionals	100	Danish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
64	MUN-SE	26-28.04.2017	Networks and EU events	Presentations and discussions	A DEMONSTRATION OF INNOVATIVE ENERGY EFFICIENCY MEASURES IN VÄXJÖ AND AARHUS	Energy Cities Annual Conference in Stuttgart	Professionals	300	English
65	AVA-DK	01.05.2017	Press and brochures	Article in magazine	Martin skabte målerenhed til her-og-nu-data "Martin created measurement device for here-and-now-data"	Avisen - AffaldVarme Aarhus	Employees at AVA-DK	400	Danish
66	AVA-DK	01.05.2017	Press and brochures	Article in magazine	Vores besøgstjeneste har fået en tveægget tvilling "Our visiting service has had a double-edged twin"	Avisen - AffaldVarme Aarhus	Employees at AVA-DK	400	Danish
67	ESS-SE	04.05.2017	Internet platforms	Twitter	On READY project workshop	https://twitter.com/EnergyAgencySwe/status/860047445618720769	Municipalities (decision makers, public servants) stakeholders, journalists	99	Swedish
68	AVA-DK	29.05.2017	Networks and EU events	Presentation	Presentation by Grethe Føns Hjortbak (AVA-DK) of WP5.3 activities	Smart Energy Network	Professionals, researchers, municipalities	43	English
69	ESS-SE	31.05-01.06. 2017	Networks and EU events	Conference	Best practice from Sweden: the READY-project	Conference - Growing Smart Energy Cities www.berliner-e-agentur.de	Professionals, researchers, municipalities	25	English
70	ESS-SE	31.05.2017	Press and brochures	Online article	Önskelista över studiebesök - vad vill ni se? "Wish list for study visit - what di you want to see?"	ESS web page http://energikontorsydost.se/sv/a/onskelista-over-studiebesok-vart-vill-ni-aka	Municipalities (decision makers, public servants) stakeholders, journalists	2000	Swedish
71	MUN-SE	02.06.2017	Press and brochures	Award	"European Green Leaf Award"	European Green Leaf Award, Essen, Germany	Audience, Jury, delegation memebers	200	English
72	LGI	06.06.2017	Networks and EU events	Presentation	Green business models for an electrical solution in buildings	Smart Energies Expo www.smart-energies-expo.com	Professionals	1.000	English
73	UNI-DK	11-14 June 2017	Scientific publications	Conference proceedings, 6 pages	Explaining variability in metered energy use for similar buildings using Bayesian inference	11th Nordic Symposium on Building Physics, NSB2017, Trondheim, Norway	Professionals	200	English
74	AVA-DK	30.06.2017	Other activity	Presentation	Educational aspects of PPP between municipal companies and education institutions, by Kirsten Dyhr-Mikkelsen (AVA-DK)	Meeting, Aarhus University	Professors and master students from Aarhus University	20	Danish
75	MUN-SE	June 2017	Press and brochures	Article in magazine	Etapp 2 i full gång "Phase 2 initiated"	Nytt från Växjöbostäder, June 2017	Tenants at Växjöbostäder	1.000	Swedish
76	UNI-DK	7-9 August	Scientific publications	Conference proceedings, 5 pages, and poster	Bayesian calibration of residential building clusters using a single geometric building representation, by M.H. Kristensen, R. Choudhary, R.H. Pedersen, and S. Petersen	IBPSA Building Simulation Conference 2017, San Francisco, USA	Proffesionals	300	English
77	AVA-DK	21.08.2017	Networks and EU events	Presentation	Innovation and partnerships in relation to READY, by Kirsten Dyhr-Mikkelsen (AVA-DK) and Lars van Hauen (EON-DK)	Climate-KIC Nordic meeting	Professionals	51	English
78	MUN-SE	21.08.2017	Study visits	Presentation	Site visit kv Alabastern, sustainable growth in Växjö.	-	Leading politicians and public servants of Växjö	20	Swedish
79	AVA-DK	31.08.2017	Study visits	Presentation	Presentation of READY in general, by Kirsten Dyhr-Mikkelsen	Swedish study visit in Aarhus	A delegation of Swedish (Skåne) municipal energy and climate advisors	25	English
80	MUN-SE	05.09.2017	Networks and EU events	Network meeting	Miljönätverksmöte med fokus Energi "Environmental network meeting with focus on energy"	-	Employees at Växjö Municipality working with environmental questions in different departments.	14	Swedish
81	VEAB-SE	05.09.2017	Workshops with stakeholders	Network meeting	Kundträff näringsidkare i Växjö "Network meetning for costumers in Växjö"	-	Property owners, board members, housing associating directors, service personnel	47	Swedish
82	ESS-SE	07.09.2017	Press and brochures	Press release	Innovative District Cooling Cycle Network, Växjö Sweden	Global District Energy Climate Awards http://www.districtenergyaward.org/innovative-district-cooling-cycle-network-vaxjo-sweden/	Public and professionals	10.000	English

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83	AIT	12.09.2017	Scientific publications	Presentation	Simulation based assessment of storage integration & operation in the district heating network of Aarhus, by C. Marguerite, R-R. Schmidt, G. Andresen, R. Pedersen, M. Dahl, K-R. Gautam (only presentation, no paper review)	3rd International Conference on smart Energy Systems and 4th Generation District Heating in Copenhagen, Denmark (12-13/09/2017)	Scientists	300	English
84	AIT	12-13.09.2017	Scientific publications	Presentation at conference	Simulation based assessment of storage integration & operation in the district heating network of Aarhus. Authors: C. Marguerite, R-R. Schmidt, G. Andresen, R. Pedersen, M. Dahl, K-R. Gautam	3rd International Conference on smart Energy Systems and 4th Generation District Heating in Copenhagen, Denmark (12-13/09/2017).	Scientists	300	English
85	UNI-DK	13.09.2017	Scientific publications	Conference abstract in proceedings, 1 page	"Long-term production planning in large district heating systems", by M. Dahl, G. Andresen, and A. Brun	3rd International Conference on Smart Energy Systems and 4th Generation District heating	Scientific	300	English
86	LGI	20.09.2017	Networks and EU events	Paper & presentation	Green business models for an electrical solution in buildings	Energy and sustainability 2017 http://www.wessex.ac.uk/conferences/2017/energy-and-sustainability-2017	Professionals	1.000	English
87	UNI-DK	21.09.2017	Scientific publications	Journal article, 11 pages	Decision rules for economic summer-shutdown of production units in large district heating systems, by M. Dahl, A. Brun, and G. Andresen	Applied Energy, Volume 208, pages 1128-1138, Elsevier	Scientific	1.000	English
88	UNI-DK	Fall 2017	Scientific publications	Paper	Space Heating Demand Response Potential for Retrofitted Residential Apartment Blocks.	-	Scientists	1.000	English
89	MUN-SE	4-8.10.2017	Scientific publications	Presentation at conference	Optimisation of centralized and decentralized storage integration, by Marguerite, G. Andresen, M. Dahl	12th Conference on Sustainable Development of Energy, Water and Environment Systems, in Dubrovnik, Croatia	Scientists	300	English
90	MUN-SE	19.-21.09.2017	Press and brochures	Brochure of best practices	EC-Link, Intercity Lab Water Management, Solid Waste Management, Clean Energy	Europe-China Eco-Cities Link	Municipalities (both decision makers and public servants), professors and researchers, journalists	150 (hereof 25 from European cities: Liverpool, Berlin, Mannheim, Hamburg, Barcelona, Valencia and Bordeaux)	English and Chinese
91	UNI-DK	October 2017	Scientific publications	Conference proceedings, SDEWES2017-0856, 17 pages	Machine learning techniques for district heating load forecasting incorporating human behaviour, by M. Dahl, A. Brun, and G. Andresen (http://www.dubrovnik2017.sdewes.org/programme.php/)	12th Conference on Sustainable Development of Energy, Water and Environment Systems (SDEWES)	Scientific	300	English
92	MUN-DK	October 2017	Press and brochures	Article	Aarhus Ø for synlig forsyning	Fjernvarmen vol. 6 2017	Professionals	2.000	
93	WEXNET	09.11.2017	Networks and EU events	Presentation	Innovationer inom byggbranschen! by Per Bengtsson "Innovation in building sector"	Energiting Sydost	Public and professionals	200	Swedish
94	MUN-DK	16.11.2017	Other activity	Film	Future of cities	EU Parlament had this film produced by Marken Film in Berlin. Illustrates the benefits of a EU coorporation. https://owncloud.markenfilm-crossing.de/s/0LKClT9NccTkHyV	Restricted to EU visit centres (Berlin, Brussels, Copenhagen etc.) And may be used at conferences. Prohibited to share online.	300	English
95	LIBAL	Fall 2017	Press and brochures	Online magazine	Store batterier skal holde balance i energisystemet "Large batteries balancing the energy system"	Connect, AAB costumor magazine page 12-13 http://ipaper.ipapercms.dk/ABBDanmark/kundebladet-connect/2017/connect-3-17/?page=12	Public and professionals	800	Danish
96	MUN-DK	01.10.2017	Press and brochures	Article in magazine	Aarhus Ø får synlig forsyning "Aarhus Ø gets visible heat supply"	Fjernvarmen vol. 6 2018	Professionals	3.000	Danish
97	LB-DK	10.01.2018	Networks and EU events	Presenation at network event	Temadag om batterier i elnettet, "Theme day on batteries in the electricity supply system"	Energinet	Proffesionals	100	Danish
98	HOUSE-DK + COWI-DK	22.01.2018	Press and brochures	Online article	Til kamp mod udgifter til el og varme - med den gratis sol som våben "Fight the cost of electricity and heat - with free solar energy as weapon"	Landsbyggefonden https://lbf.dk/magasin/til-kamp-mod-udgifter-til-el-og-varme-med-den-gratis-sol-som-vaaben/	Public and professionals	3.000	Danish

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99	MUN-DK	01.02.2018	Press and brochures	Article in magazine	Realisér værdien i at lukke anlæg ned om sommeren "Realise the value of shutting down heat plants during the summer"	Fjernvarmen vol. 1 2018	Professionals	3.000	Danish
100	MUN-DK	01.02.2018	Other activity	Competion	Klima100 - REAL Dania contest of the 100 best climate projects in Denmark	REAL Dania	Professionals	1.000	Danish
101	DDHA-DK	February 2018	Publication in Magasin	Article in printed magasin Fjernvarmen vol 1 – also available online	Realiser værdien i at lukke anlæg ned om sommeren, by Magnus Dahl "Realise the value of closing down plants during summer"	http://ipaper.ipapercms.dk/DanskFjernvarme/Fjernvarmen2015/2018/fjernvarmen-12018/?page=36	Public	3.000	Danish
102	MUN-DK	19.-20.04.2018	Study visits	Visit Aarhus	Study trip to learn about culture and smart solutions within transport and digitalisation. Participants were 18 members of Municipal council and City directors from Jönköping, Habo, Mullsjö, Vaggeryd, and Aneby. Aarhus Climate Secretariat gave an introduction to READY and smart city.	-	Members of Municipal council and City directors from Jönköping, Habo, Mullsjö, Vaggeryd, and Aneby	18	Swedish
103	UNI-DK	20.04.2018	Scientific publications	Scientific article	Cost sensitivity of optimal sector-coupled district heating production systems, by M. Dahl, A. Brun, and G. Andresen	Energy, arXiv:1804.07557 [physics.soc-ph]	Professionals	300	English
104	UNI- DK	23.04.2018	Scientific publications	Scientific article	"Hierarchical calibration of archetypes for urban building energy modelling", by M.H. Kristensen, R.E. Hedegaard, and S. Petersen	Submitted to Energy and buildings, Elsevier	Professionals	300	English
105	DDHA-DK	28.05.2018	Press and brochures	Online news	I Litauen varmes boligblokke med flisvarme "In Lithuania the housing blocks are heated by district heating"	https://www.danskfjernvarme.dk/groen-energi/nyheder/arkiv/2018/180528-i-litauen-er-fjernvarmen-p%C3%A5-flis	Public	2.000	Danish
106	AIT+UNI-DK	June 2018	Scientific publications	Paper	Multi-criteria analysis of storages integration and operation solutions into the district heating network of Aarhus – A simulation case study C.Margueritea G.B.Andresen M.Dahl	Energy, volume 158, Elsevier, september 2018, pages 81-88	Professionals	1.000	English
107	UNI-SE	12.06.2018	Workshops with stakeholders	Seminar	Information meeting waste water heat recovery, Ecoclime	-	Tenants at Växjöbostäder	30	Swedish
108	UNI-DK	01.08.2018	Scientific publications	Journal article, 10 pages	Predicting Danish residential heating energy use from publicly available characteristics, by M.H. Kristensen, A. Brun, and S. Petersen	Energy and buildings, volume 173, Elsevier	Professionals	1.500	English
109	MUN-DK	15-24.08.2018	Other activity	Exhibition	Public exhibition of the READY project as one of 100 selected climate projects	Traffikhallen, exhibition centre Aarhus	Public	2.000	Danish
110	DDHA-DK	03.09.2018	Press and brochures	Online news	Ph.D.- thesis in the READY-project	https://www.danskfjernvarme.dk/groen-energi/nyheder/arkiv/2018/180903-ready-magda	Public	2.000	Danish
111	MUN-SE	05.09.2018	Other activity	Presentation at a morning meeting at LBE Architects	Innovative energy efficiency	Innovative energy efficiency	Architects	1.500	Swedish
112	DANF-DK	9-12.09.2018	Scientific publications	Abstract	The role of district heating in coupling of the future renewable energy sectors, by Marek Brand	16th International District Heating Symposium (www.dhc2018.eu) in Hamburg	Scientists	400	English
113	UNI-DK	13.09.2018	Scientific publications	Journal article, 13 pages	Cost sensitivity of optimal sector-coupled district heating production systems, by Magnus Dahl, Adam Bruun, Gorm B. Andresen	Energy 166, (2019), p. 624-636	Scientists	400	English
114	MUN-SE	15.09.2018	Conference	Presentation	Klimatkommunernas årsmöte 2018 i Växjö. Presentation of "Växjö - Renewable energy and energy efficient heating of buildings"	Växjö Kommun	Municipalities and public servants	200	Swedish
115	MUN-SE	Continous	Other activity	Social Media Post	Updates on website	https://vaxjo.se/sidor/hallbar-utveckling/klimat-energi-resor-transporter/energi/energiprojekt.html	Municipalities (decision makers, public servants) stakeholders, journalists	200	Swedish
116	VXH-SE	24-26.09.2018	Networks and EU events	Presentation	Short presentation of READY	Eurbonet	Municipalities from Europe	25	English
117	DDHA-DK	02.10.2018	Press and brochures	Online news	Nyt Ph.D-kursus i overgangen til 4. generations fjernvarme "New Ph.D. course in transition to 4. Generation district heating"	https://www.danskfjernvarme.dk/groen-energi/nyheder/arkiv/2018/181002-nyt-kursus-i-4-generations-fjernvarme	Public	2.000	Danish
118	ESS-SE	25.10.2018	Other activity	Social Media Post	Dissemination at seminar	https://twitter.com/EnergyAgencySwe/status/1055465561856065536	Municipalities (decision makers, public servants) stakeholders, journalists	524	Swedish
119	ESS-SE	02.11.2018	Other activity	Social Media Post	Post on READY Advanced Traning Programme in Blomstermåla	https://www.facebook.com/EnergikontorSydost/posts/2164516933580888	Municipalities (decision makers, public servants) stakeholders, journalists	217	Swedish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
120	ESS-SE	02.11.2018	Other activity	Social Media Post	Post on READY Advanced Traning Programme in Blomstermåla	https://twitter.com/energikontorSO/status/1058257487650930689	Municipalities (decision makers, public servants) stakeholders, journalists	524	Swedish
121	ESS-SE	16.11.2018	Other activity	Social Media Post	Post on READY Advanced Training Programme in Blomstermåla	https://twitter.com/energikontorSO/status/1063396540864229377 https://twitter.com/energikontorSO/status/1063388646642991104 https://twitter.com/energikontorSO/status/1063370968998047744	Municipalities (decision makers, public servants) stakeholders, journalists	524	Swedish
122	WEX-SE	16.11.2018	Networks and EU events	Conference	Advanced Training Program for Ready Interface of Life	Energiting Sydost	Municipalities (decision makers, public servants) stakeholders, journalists	100	Swedish
123	VXH-SE	20.11.2018	Networks and EU events	Study visit	Study visit Alabastern Karlskronahem	Study visit Alabastern Karlskronahem (Wexnet)	Municipalities (decision makers, public servants) stakeholders, journalists	15	Swedish
124	UNI-DK	26.11.2018	Scientific publications	Journal article, 14 pages	Design and optimisation of a novel system for trigeneration, G.B. Andresen and A. Arabkoohsar	Energy, volume 168 (2019), 247-260, Elsevier	Professionals	2.000	English
125	VXH-SE	23.01.2019	Networks and EU events	Study visit	Study visit Nydalavägen 22A – local newspaper	Newspaper Smålandsposten	Journalists	39.700	Swedish
126	WEX-SE	15.02.2019	Networks and EU events	Presentation	Connecting Ready Interface of Life to research regarding visualization and behaviour.	RISE Research Institutes of Sweden and Linnaeus University	Professors and Phd	10	English
127	COWI-DK	22.02.2019	Workshops with stakeholders	Seminar	Green growth - from recommendations to actions	COWI Decision Seminar	Professionals Politicians incl Minister of Housing	150	Danish
128	MUN-SE	02.03.2019	Press and brochures	Article in newspaper	Nyrenoverade lägenheter utrustas med sensorstyrd teknik "Newly refurbished apartments equipped with sensor controlled installations"	Smålandsposten	Private	40.000	Swedish
129	HOUSE-DK COWI-DK	23.03.2019	Press and brochures	Article in newspaper	Klimaet på dagsordenen: Her testes fremtidens grønne energi "Climate on the agenda: Test of the green energy of the future"	Aarhus Stifttidende	Private	70.000	Dansk
130	HOUSE-DK COWI-DK	23.03.2019	Press and brochures	Article in newspaper	Kæmpebatteri forsyner boligblokke med strøm "A giant battery supplies building block with electric power"	Aarhus Stifttidende	Private	70.000	Dansk
131	HOUSE-DK COWI-DK	23.03.2019	Press and brochures	Article in newspaper	Solceller og større lejligheder: Trigeparken skal være moderne "PV-panels and larger apartments: Trigeparken becomes modern"	Aarhus Stifttidende	Private	70.000	Dansk
132	HOUSE-DK COWI-DK	23.03.2019	Press and brochures	Article in newspaper	Nye solceller optager 90 procent af solstrålers energi "New type of PV-panels utilises 90 percent of the energy from the sun"	Aarhus Stifttidende	Private	70.000	Dansk
133	DDHA-DK	26.03.2019	Press and brochures	Sociamedia post	Dansk Fjernvarme_Trigeparken	LinkedIn	Private	3.319	Dansk
134	HOUSE-DK COWI-DK	04.04.2019	Press and brochures	Article in newspaper	Boligselskab integrerer nye solceller med varmepumpe, fjernvarme og batterilager "Housing company integrates heat pump, district heating and a battery storage"	Gridtech	Proffesionals	500.000	Dansk
135	COWI-DK	10.04.2019	Press and brochures	Online article	Innovative installation can produce three times as much energy as traditional solar cells	COWI Portal www.cowi.com	COWI employees	2.000	English
136	MUN-SE	11.04.2019	Networks and EU events	Presentation for ERASMUS students	READY and the greenest city in Europe	-	Students	20	Swedish
137	VXH-SE	01-04-2019	Press and brochures	Online article	EU-samarbete gav renoveringen mervärde "EU-coorporation led to higher value of the project"	https://renoveringsinfo.byggtjanst.se https://renoveringsinfo.byggtjanst.se/projekt-i-fokus/eu-samarbete-gav-renoveringen-mervarde/46826	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish
138	VXH-SE	02-04-2019	Press and brochures	Online article	Energianvändningen halverades i kvarteret Alabastern "Reduction of energy consumption in Alabastern with more than half"	https://renoveringsinfo.byggtjanst.se https://renoveringsinfo.byggtjanst.se/projekt-i-fokus/energianvandningen-halverades-i-kvarteret-alabastern/46824	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
139	ESS-SE	02.05.2019	Other activity	Social Media Post	Promotion for READY Advanced Training Programme in Växjö	http://gantrack.com/t/pm/1849445679869/?fbclid=IwAR2F0_FyJBgmHuDAF9cXaLU9rFqsqznwK-nw7PI1JnFRFfA5WYj2PUB1m1w	Municipalities (decision makers, public servants) stakeholders, journalists	1.054	Swedish
140	ESS-SE	02.05.2019	Other activity	Social Media Post	Promoting newsletter	https://%3A%2F%2Fwww.facebook.com%2FEnergikontorSydost%2Fposts%2F2441347522564493	Municipalities (decision makers, public servants) stakeholders, journalists	217	Swedish
141	ESS-SE	02.05.2019	Other activity	Social Media Post	Promoting newsletter	https://twitter.com/energikontorSO/status/1123919610007388163	Municipalities (decision makers, public servants) stakeholders, journalists	524	English
142	ESS-SE	06.05.2019	Press and brochures	Online article	Promotion for READY Advanced Training Programme in Växjö	http://www.energikontorsydost.se/a/kunskapsutbyte-i-slovenien	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish
143	ESS-SE	21.05.2019	Networks and EU events	Seminar	Smart Cities Conference. Advanced Training Workshop.	Youtube.com https://www.youtube.com/watch?v=J0Xbdqy1xMg&feature=youtu.be	Internet	10.000	English
144	ESS-SE	21.05.2019	Other activity	Calendar post	Promotion for READY Advanced Training Programme in Växjö	http://www.energikontorsydost.se/sv/c/kalender/e/smart-energy-city-conference	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish
145	ESS-SE	21.05.2019	Other activity	Social Media Post	Posts on READY Advanced Training Programme in Växjö	https://twitter.com/energikontorSO/status/1130804310072340481	Municipalities (decision makers, public servants) stakeholders, journalists	524	English
146	ESS-SE	22.05.2019	Other activity	Social Media Post	Posts on READY Advanced Training Programme in Växjö	https://twitter.com/EnergyAgencySwe/status/1131110053589770240 https://twitter.com/EnergyAgencySwe/status/1131132797928837121 https://twitter.com/energikontorSO/status/1131102961072005121	Municipalities (decision makers, public servants) stakeholders, journalists	524	English
147	ESS-SE	23.05.2019	Other activity	Social Media Post	Sharing a post from participant in READY Advanced Training Programme in Växjö	https://www.facebook.com/plugins/post.php?href=https%3A%2F%2Fwww.facebook.com%2FEnergikontorSydost%2Fposts%2F2476684135697498	Municipalities (decision makers, public servants) stakeholders, journalists	217	Swedish
148	ESS-SE	26.05.2019	Press and brochures	Online article	Kvarteret Alabastern fokus för seminarium om hållbart byggande "District Alabastern focus at seminar for resillient buildings"	http://www.energikontorsydost.se/a/kvarteret-alabastern-fokus-for-seminarium-om-hallbart-byggande	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish
149	ESS-SE	28.05.2019	Press and brochures	Online article	Internationell konferens lockade deltagare från hela Europa "International conference visited by participants from all over Europe"	http://www.energikontorsydost.se/a/internationell-konferens-lockade-deltagare-fran-hela-europa	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish
150	ESS-SE	29.05.2019	Press and brochures	Online article	20 year aniversery Newsletter for ESS-SE. Jubileumsnummer maj 2019. Energikontor Sydost firar 20 år	http://gantrack.com/t/pm/1930120792745/?fbclid=IwAR2vgCRLh_cS2Min0GmQTgczb_CNK2KY-dUU1PALRzxVEXm6c8D8006z7Ko	Municipalities (decision makers, public servants) stakeholders, journalists	1.041	Swedish
151	DDHA-DK	01.06.2019	Publication	Article in printed magazine Fjernvarmen vol 4 – also available online	Energifleksible bygningers potentiale i fjernvarmesektoren, by Rasmus Elbæk "Energyflexible buildings potential in the district heating sector"	https://ipaper.ipapercms.dk/DanskFjernvarme/Fjernvarmen2015/2019/fjernvarmen-42019/?page=42	Public	3.320	Danish
152	ESS-SE	03.06.2019	Other activity	Social Media Post	Promoting newsletter from May 29th	https://www.facebook.com/plugins/post.php?href=https%3A%2F%2Fwww.facebook.com%2FEnergikontorSydost%2Fposts%2F2495489383816973	Municipalities (decision makers, public servants) stakeholders, journalists	217	Swedish
153	ESS-SE	03.06.2019	Other activity	Social Media Post	Promoting newsletter from May 29th	https://twitter.com/energikontorSO/status/1135448294149316611	Municipalities (decision makers, public servants) stakeholders, journalists	524	Swedish
154	HOUSE-DK COWI-DK	07.06.2019	Press and brochures	Online article	Aarhusiansk boligforening klar til solceller og batterilager "Housing association in Aarhus ready for photovoltaics and battery storage"	https://www.energy-supply.dk/article/view/661138/aarhusiansk_boligforening_klar_til_solpaneler_og_batterilager	Proffesionals	6.000	Dansk

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
155	HOUSE-DK COWI-DK	07.06.2019	Press and brochures	Online article	Mere end solceller og energirenovering "More than photovoltaics and energy refurbishment"	https://www.energy-supply.dk/article/view/661146/mere_end_solceller_og_energirenovering	Proffesionals	6.000	Dansk
156	HOUSE-DK COWI-DK	07.06.2019	Press and brochures	Online article	Fakta: Om READY "Facts about READY"	https://www.energy-supply.dk/article/view/661139/fakta_om_ready	Proffesionals	6.000	Dansk
157	HOUSE-DK COWI-DK	07.06.2019	Press and brochures	Article in newspaper	Aarhusiansk boligforening klar til solpaneler og batterilager "Housing association in Aarhus ready for solar panels and battery storage"	Licitationen	Proffesionals	20.000	Dansk
158	VXH-SE	27.06.2019	Networks and EU events	Study visit	Study visit at Alabastern from South Africa	Study visit at Alabastern from South Africa	Municipalities (decision makers, public servants) stakeholders, journalists	20	English
159	VXH-SE	June/July 2019	Press and brochures	Article in newspaper	Hälften kvar av elnotan "Only half of the electricity bill left"	Energi & Miljö	Proffesionals	10.200	Swedish
160	DDHA-DK	01.08.2019	Publication	Article in printed magazine Fjernvarmen vol 5 – also available online	Timeopløst forbrugsdata skaber viden om fremtidens fjernvarme, by Martin Heine "Hourly segmennted userdata creates knowledge about district heating for the future"	https://ipaper.ipapercms.dk/DanskFjernvarme/Fjernvarmen2015/2019/fjernvarmen-52019/?page=30	Public	3.320	Danish
161	ESS-SE	07.11.2019	Other activity	Calendar post	Promoting study visit to Alabastern at Smart City seminar	ESS web page http://www.energikontorsydost.se/sv/c/kalender/e/ar-en-smart-stad-hallbar-ar-en-hallbar-stad-smart	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish
162	WEX-SE	20.11.2019	Networks and EU events	Conference	Ready Interface of Life	Conference for Stadsnät I Syd	Managers in urban city broadband net I south of Sweden	50	Swedish
163	COWI-DK	21.11.2019	Networks and EU events	Seminar	Decision Seminar - Byer for Mennesker "Cities for Humans"	COWI + Arkitema	Proffesionals, Housing Companies, Municipalities, officials Inkl. Minister of Housing	120	Dansk
164	VEAB-SE	Continous	Press and brochures	Social Media Post	Promotion of project	https://www.veab.se/om-oss/miljo/projektet-ready/	Proffesionals	238	Swedish
165	WEX-SE	11.01.2020	Press and brochures	Online article	Klimatsatsning ska ge stabilare nät "Climate project will secure more stable internet"	http://www.smp.se/nyheter/klimatsatsning-ska-ge-stabilare-nat/	industry magazine for professional groups	2.000	Swedish
166	MUN-DK	11.01.2020	National Television	Danish Radio	Havvand skal opvarme Aarhusianske stuer	https://www.dr.dk/nyheder/regionale/oestjylland/havvand-skal-opvarme-aarhusianske-stuer	Public	6 mio	Danish
167	MUN-DK	11.01 2020	National Television	TV2	Aarhusianske hjem bliver opvarmet af havvand	https://www.tv2oestjylland.dk/aarhus/aarhusianske-hjem-bliver-opvarmet-af-havvand	Public	6 mio	Danish
168	MUN-DK	11.01.2020	Press and brochures	AVA homepage	Havvandsvarmepumper i maskinrummet	https://affaldvarme.aarhus.dk/om-os/varmeforsyning-i-aarhus-omraadet/projekter-og-innovation/havvandvarmepumper-i-maskinrummet/	Public	2.000	Danish
169	MUN-DK	11.01.2020	Press and brochures	AVA homepage	Night view	http://kollision.dk/en/urban-machine	Public	2.000	Danish
170	WEX-SE	14.01.2020	Press and brochures	Online article	Coromatic får i uppdrag att effektivisera Wexnets äldsta datacenter "Coromatic chosen to energyoptimising of the oldest datacentre of Wexnet"	http://www.kylavarme.se/artikel/coromatic-far-i-uppdrag-att-effektivisera-wexnets-aldsta-datacenter-	Industry magazine for professional groups	2.000	Swedish
171	WEX-SE	14.01.2020	Press and brochures	Online article	Solceller på Wexnets datorcenter Green Data Center i Växjö "PV at Wexnets Green Data Centre in Växjö"	https://www.industritorget.se/nyheter/moderniserin g+av+datacenter+minskar+wexnets+energia nvändning+ytterligare/26764/	Industry magazine for professional groups	2.000	Swedish
172	WEX-SE	15.01.2020	Press and brochures	Online article	Coromatic mindskar Wexnets energianvänding "Coromatic reduces the energy consumption of Wexnet"	https://www.nordiskaprojekt.se/2020/01/15/coromatic-minskar-wexnets-energianvandning/	Industry magazine for professional groups	2.000	Swedish
173	WEX-SE	15.01.2020	Press and brochures	Online article	Driftsäkrar datacentret "Optimisation of operation of the data centre"	https://www.uochd.se/article/view/694940/driftsakrar_datacentret	Industry magazine for professional groups	2.000	Swedish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
174	WEX-SE	15.01.2020	Press and brochures	Online article	Modernisering av datacenter minskar Wexnets energianvändning ytterligare "Modernization of data centre results in further reduction of energy consumption for Wexnet"	https://it-kanalen.se/modernisering-av-datacenter-minskar-wexnets-energianvandning-ytterligare/	Industry magazine for professional groups	2.000	Swedish
175	ESS-SE	01.02.2020	Press and brochures	Calender post	Promoting dissemination event May 27th	http://energikontorsydost.se/sv/c/kalender/e/energismart-stad	Municipalities (decision makers, public servants) stakeholders, journalists	2.000	Swedish
176	COWI-DK	05.02.2020	Workshop	Workshop with HOFOR	Experience exchange with the Copenhagen utility HOFOR	Workshop	Technical specialists from utility	12	Danish
177	VXB-SE	05.02.2020	Press and brochures	Newsletter	Idag driftsätter vi värmeåtervinningen	https://insidan.vaxjobostader.se/Pages/Idag-driftsatter-vi-varmeatervinningen.aspx	Coworkers VXB	100	Swedish
178	MUN-SE	17.02.2020	E-mail post	Social Media Post	Promoting dissemination event May 27th	E-mail goup of regional environmental coordinators	Municipalities	20	Swedish
179	ESS-SE	28.02.2020	Press and brochures	Newsletter	Promoting dissemination event May 27th	http://gantrack.com/t/pm/2678756898834/	Municipalities (decision makers, public servants) stakeholders, journalists	1.300	Swedish
180	VXB-SE	25.03.2020	Press and brochures	Newsletter	Innovativa solpaneler på Nydalavägen 22	https://insidan.vaxjobostader.se/Pages/Innovativa-solpaneler-pa-Nydalavagen-22.aspx	Coworkers VXB	100	Swedish
181	ESS-SE	31.03.2020	Press and brochures	Newsletter	Promoting dissemination event May 27th	http://gantrack.com/t/pm/2825722788041/	Municipalities (decision makers, public servants) stakeholders, journalists	1.300	Swedish
182	MUN-SE	28.04.2020	Press and brochures	Newsletter	Promoting dissemination event May 27th	Climate Municipalities' monthly newsletter	Municipalities (decision makers, public servants) stakeholders, journalists	800	Swedish
183	ESS-SE	30.04.2020	Press and brochures	Newsletter	Promoting dissemination event May 27th	https://twitter.com/energikontorSO/status/1255763012763484160	Municipalities (decision makers, public servants) stakeholders, journalists	529 +160 followers	Swedish
184	ESS-SE	30.04.2020	Facebook post	Social Media Post	Promoting dissemination event May 27th	https://www.facebook.com/plugins/post.php?href=https%3A%2F%2Fwww.facebook.com%2FEnergikontorSydost%2Fposts%2F3200873889945182	Municipalities (decision makers, public servants) stakeholders, journalists	220 followers	Swedish
185	VEAB-SE	30.04.2020	Social media	Linked-in	Promoting dissemination event May 27th	https://www.linkedin.com/feed/update/urn:li:activity:6661578615882428416/	The public, customers and other stakeholders	558 views, 8 reactions	Swedish
186	WEX-SE	30.04.2020	Social media	Linked-in	Promoting dissemination event May 27th	https://www.linkedin.com/feed/update/urn:li:activity:6661578906820317184/	The public, customers and other stakeholders	109 views, 2 reactions	Swedish
187	ESS-SE	04.05.2020	Press and brochures	Newsletter	Promoting dissemination event May 27th	http://gantrack.com/t/pm/3099994373851/	Municipalities (decision makers, public servants) stakeholders, journalists	1.041	Swedish
188	VEAB-SE	Continous updates	VEAB Homepage	Web page	Information about READY project	https://www.veab.se/om-oss/hallbarhet/goda-samarbeten/projektet-ready/	The public, customers and other stakeholders	10	Swedish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
189	VEAB-SE	05.05.2020	Press and brochures	Newsletter	Promoting dissemination event May 27th	https://www.veab.se/globalassets/dokumentarkiv/information/energismart-stad---ett-webbinarium-i-fyra-fristaende-delar_619097-2.pdf	Corporate customers	478	Swedish
190	WEX-SE	05.05.2020	Press and brochures	Newsletter	Promoting dissemination event May 27th	https://s3-eu-central-1.amazonaws.com/wexnet/wp-content/uploads/2017/02/Energismart-stad-ett-webbinarium-i-fyra-fristaende-delar_619098-1.pdf	Corporate customers	211	Swedish
191	VEAB-SE	25.05.2020	Social media	Linked-in	Promoting dissemination event May 27th	https://www.linkedin.com/feed/update/urn:li:activity:6670572449110798336/	The public, customers and other stakeholders	218 views, 3 reactions	Swedish
192	VXB-SE	25.05.2020	Internet platforms	News on website	Promotion Boportalen	https://vaxjobostader.se/aktuellt/entry/valkommen-till-boportalen	Tenants (costumers Växjö Bostäder)	n.a.	Swedish
193	VXB-SE	25.05.2020	Internet platforms	News on website	Description Boportalen	https://vaxjobostader.se/kundcenter/boportalen	Tenants (customers Växjö Bostäder)	n.a.	Swedish
194	VXB-SE	25.05.2020	Internet platforms	News on website	Promotion Boportalen	https://www.mynewsdesk.com/se/_preview/pressreleases/3001980	Municipalities (decision makers, public servants) stakeholders, journalists	2.066	Swedish
195	VXB-SE	25.05.2020	Social media	Twitter	Promotion Boportalen	https://twitter.com/MariaSaterdal/status/1265024517803573249	Municipalities (decision makers, public servants) stakeholders, journalists	276	Swedish
196	WEX-Se	25.05.2020	Social media	Linked-in	Promoting dissemination event May 27th	https://www.linkedin.com/feed/update/urn:li:activity:6670572758331654144/	The public, customers and other stakeholders	25 views, 1 reaction	Swedish
197	VXB-SE	26.05.2020	Social media	Linked-in	Promotion Boportalen	https://www.linkedin.com/feed/update/urn:li:activity:6671038225877889024	Municipalities (decision makers, public servants) stakeholders, journalists	200	Swedish
198	VXB-SE	26.05.2020	Press and brochures	Newsletter	Promotion Boportalen	https://app.bwz.se/vaxjobostader/b/v?vid=42&v=16&share=1&ucrc=9CCA67ADDC	Municipalities (decision makers, public servants), stakeholders	65	Swedish
199	VXB-SE	26.05.2020	Social media	Facebook post	Promotion Boportalen	https://www.facebook.com/vaxjobostader/posts/968806913590101	Tenants (our costumers), stakeholders	1.800	Swedish
200	VXB-SE	26.05.2020	Social media	Twitter	Promotion Boportalen	https://twitter.com/MariaSaterdal/status/1265206883025129472	Municipalities (decision makers, public servants) stakeholders, journalists	276	Swedish
201	VXB-SE	27.05.2020	Press and brochures	Folder	Promotion	Printed folder distributed and published at website ttps://vaxjobostader.se/kundcenter/boportalen	Tenants (customers Växjö Bostäder)	9.041	Swedish

	Beneficiary	Date of publication	Type of activity	Sub type	Title	Name of media	Type of audience	Approximately size of audience	Language
202	WEX-SE	Continuos updates	Internet platforms	Hompage	Information about READY project	https://wexnet.se/om-wexnet/miljo/projektet-ready/	The public, customers and other stakeholders	38	Swedish
203	HOUSE-SE	23.09.2020	Press and brochures	Newspaper and Online article	Energirenoverede boliger kæmper om Aura Energis grønne pris "Energy refurbished housing competes about Aura Energy's Green Prize"	Stiften https://stiften.dk/artikel/200-000-kroner-p%C3%A5-spil-energirenoverede-boliger-k%C3%A6mper-med-om-aura-energis-gr%C3%B8nne-pris	Regional Newpaper	22.000	Danish
204	MUN-DK	22.10.2020	Conference	Conference & sitevisit	READY Smart Energy City in Aarhus, Denmark	https://teams.microsoft.com/dl/launcher/launcher.html?url=%2F_%23%2Fl%2Fmeetup-join%2F19%3Ameeting_NjI3NDA0ZTUtODU1Ny00YTQ2LWEwN2EtNTRlYjJhZTNjOTkz%40thread.v2%2F0%3Fcontext%3D%257b%2522Tid%2522%253a%25228c44204a-53ce-4c25-a2de-c7aae3f3069e%2522%252c%2522Oid%2522%253a%252281b2dfb7-9da8-43b3-aaed-8e1b5db4a28e%2522%252c%2522IsBroadcastMeeting%2522%253atrue%257d%26anon%3Dtrue&type=meetup-join&deeplinkId=de04ab20-222c-418a-8400-cb51675552b0&directDl=true&msLaunch=true&enableMobilePage=true&suppressPrompt=true&promptSuccess=true	International (10 countries)	55	English
205	COWI-DK	Dec 2020	COWI Homepage	Online article and videos	Ready, denmark - makes Aarhus ready for a green and climate friendly future	READY gør Aarhus klar til en energi- og klimavenlig fremtid (cowi.dk)	Homepage	10.000	Danish/ English
206	HOUSE-DK	Dec 2020	District Newsletter	Article	Afd. 20 – Et år efter renoveringen, en blandet efterårsbuket fra Trige parkvej (Trigeparken Dept 21 A year after renovation - a mixed bucket from Trige Parkvej)	Nyhedbrev Afd. 20 Trige Parkvej	Citizens /Tenants	600	Danish
207	WEX-SE	Jan 2020	Promotion of interface of life solutions - after end of project	U-tube video	BREAKING SILOS - A short film from the deep Swedish Forests	https://eur01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DOOq3YXwXApI&data=04%7C01%7CRMH%40cowi.com%7C506aa3c1fa144627f21808d896b62d66%7C11be153879d8493982b8b767805d825b%7C0%7C0%7C637425056471376000%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=tiJahbWPJRLr4vM5apXPj9FTuhTcHqZb5h13j0Z3kTq%3D&reserved=0	Public		English

8.2 List of deliverables

Del. no.	Deliverable name	WP no.	Nature[1]	Dissemination level[2]
D. 1.1.1	Input to inception report M10	WP1	O	CO
D. 1.1.2	Establishing of internal knowledge sharing entry on project webpage M3 (COWI)	WP1	O	RE
D. 1.2.1	Workshop 1. results and findings - presented on project webpage (COWI)	WP1	O	RE
D. 1.2.2	Workshop 2. results and findings - presented on project webpage (ESS-SE)	WP1	O	RE
D. 1.2.3	Workshop 3. results and findings - presented on project webpage (DDHA)	WP1	O	RE
D. 1.2.4	Workshop 4. results and findings - presented on project webpage (COWI)	WP1	O	RE
D. 1.2.5	Workshop 5. results and findings - presented on project webpage (MUN-DK)	WP1	O	RE
D. 1.2.6	Workshop 6. results and findings - presented on project webpage (MUN-SE)	WP1	O	RE
D. 1.2.7	Decision note regarding use of sustainable community development certification schemes (COWI)	WP1	O	RE
D2.1.1	Simulation and LCC assessments - decision note on design options (COWI DK+SE), M12 COWI, VXH-SE, CA-SE	WP2	O	RE
D2.1.2	Input to final design and methods used as specification to tender documents for retrofit, M30 (COWI)	WP2	O	RE
D.2.2	Decision report for housing companies on solar and storage solutions DK+SE, (UNI-DK)	WP 2	R	RE
D.2.3	Market & technical status report on heat driven appliances., M6 (ESS-SE)	WP 2	R	PU
D.2.4.1	Description of concepts on resource effective homes and kitchens, M9 (IKEA)	WP 2	R	RE
D.2.4.3	Feasibility study of food waste disposers from households. (UNI-DK)	WP 2	O	RE
D.2.5	Pilot for multifamily building unit for heat recovery, M21	WP 2	P	RE

[1] **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

[2] **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)

Del. no.	Deliverable name	WP no.	Nature[1]	Dissemination level[2]
D.2.6	Pilot for ICT/Smart TV solution + decision report for housing companies on ICT/Smart TV solutions, M12 (WEX-SE)	WP 2	P	RE
D.3.1.1	Report describing the feasibility of heat recovery from wastewater, PVT and heat storage in multi-family buildings and recommendations for demonstration including final design notes (UNI-DK)	WP 3	R	PU
D.3.1.2	Report on feasibility of the investigated technologies for utilising surplus heat from industry. (UNI-DK)	WP 3	R	RE
D.3.1.3	Design note for implementing ORC technology. (VEAB-SE)	WP 3	O	RE
D.3.2.1	Report with design notes on low-temperature district heating consumer substations for demonstration in multi- and single-family buildings (DANF-DK)	WP 3	R	PU
D.3.2.2	Report describing energy system benefits of low-temperature district heating (UNI-DK)	WP 3	R	RE
D.3.3.1	Guidelines for smart metering implementation and data collection for use in DH system optimization (MUN-DK)	WP 3	R	RE
D.3.3.2	Documentation of model development for optimised DH network operation based on smart metering data (MUN-DK)	WP 3	O	RE
D.3.4.1	Report with design notes and analysis of District Cooling (DC) demonstration projects in Växjö (UNI-DK/VEAB-SE)	WP 3	R	RE
D.3.4.2	Report describing the innovative solutions for DC developed and proposed for the district in Aarhus. (UNI-DK)	WP 3	R	RE
D.3.4.3	Report describing the dissemination case study featuring the city of Kaunas (UNI-DK/LEI-LT)	WP 3	R	RE
D.3.5.1	Report describing the outcome of task 3.4.1-3.4.3 in relation to analysis of innovation level and suggestions for improvements in demonstration projects. (UNI-DK)	WP 3	R	RE
D.3.5.2	Report describing the concept for holistic design of integrated energy systems for high performance-energy districts (UNI-DK)	WP 3	R	PU
D.3.5.3	Report describing the replication pilot for holistic design of integrated energy systems in Kaunas (UNI-DK/LEI-LT)	WP 3	R	PU
D.3.5.4	Ph.D. thesis on pricing (MUN-DK)	WP3	R	PU
D.3.5.5	Ph.D. thesis on consumer incitements to be flexible in consumption patterns and the consequence of this on future renewable energy-based supply systems. (MUN-DK)	WP3	R	RE

Del. no.	Deliverable name	WP no.	Nature[1]	Dissemination level[2]
D.3.5.6	Ph.D. thesis on optimization of building retrofit in an integrated energy system based on renewable energy (UNI-DK)	WP3	R	RE
D.4.1.1	Report on feasibility of PVT including recommendations for installation and final design note (RAC-DK)	WP4	R	RE
D.4.2.1	Report on benefits of application of batteries (LB-DK)	WP4	R	RE
D.4.2.2	Prototype of a battery pack unit based on batteries including charge controller (LB-DK)	WP4	P	PU
D.4.2.3	Result note on pilot test of battery pack solution (LB-DK)	WP4	O	RE
D.4.2.4	Final design note of battery pack solution for demonstration and the integration with an energy system with a high amount of renewables (LB-DK)	WP4	O	RE
D.4.3.1	Report, consisting of final design notes and business models for remotely controlled EV charging spots – for intelligent charging of electrical vehicles and balancing on the electricity market and grid stabilisation (EON-DK)	WP4	R	RE
D.4.4.1	Report, including final design notes of integrated power hub solutions for buildings and the energy system (DONG-DK)	WP4	R	RE
	(D.4.5.1 was a left over from a previous draft, it must be deleted as there is no task associated)	WP4		
D.4.6.1	Report on models for mobility management (MUN-DK)	WP4	R	PU
D.4.6.2	Strategic plan on EV charging infrastructure in Växjö (MUN-SE)	WP4	O	PU
D.4.7.1	Report on three mature proofs of concepts for innovative technologies for energy system of the future, ready for demonstration (UNI-DK)	WP4	R	RE
D.5.1.1	Documentation of performed refurbishment - hand-out certificate (HOUSE-DK)	WP5	O	RE
D.5.2.1	Documentation of demonstration of wastewater heat recovery by heat pump, installation manholes (HOUSE-DK)	WP5	D	RE
D.5.2.2	Documentation of demonstration of PVT systems (RAC-DK)	WP5	D	RE
D.5.3.1	Documentation of large-scale demonstration of low-temperature district heating supply and consumer units (district heating substations and flat stations) (DANF-DK)	WP5	D	RE
D.5.3.2	Documentation of smart DH metering: DH distribution optimisation and consumer engagement (MUN-DK)	WP5	D	RE

Del. no.	Deliverable name	WP no.	Nature[1]	Dissemination level[2]
D.5.4.1	Documentation of renewable district heat production by a large-scale heat pump and integration of DH and renewable electricity systems, including ancillary services - hand out certificates (MUN-DK)	WP5	D	RE
D.5.5.1	Documentation of use of 2nd life batteries and the integration with an energy system with a high share of renewables (LB-DK)	WP5	D	RE
D.5.5.2	Documentation of EV battery charging demonstration (EON-DK)	WP5	D	RE
D.5.5.3	Documentation of Smart Building Energy Hub (LB-DK)	WP5	D	RE
D.5.6.1	Documentation of implementation of different mobility solutions, such as car-pooling including electric vehicles and their charging (MUN-DK)	WP5	D	RE
D.5.7.1	Note on food waste disposers pilot (MUN-DK)	WP5	O	RE
D.6.1	Report on energy performance of the project in close collaboration with WP7 (VXH-SE)	WP6	R	RE
D.6.2	Report on energy performance of the project in close collaboration with WP7 (CA-SE)	WP6	R	RE
D.6.3	Report on energy performance of the project in close collaboration with WP7 (VEAB-SE)	WP6	R	RE
D.6.4	Report on energy performance of the project in close collaboration with WP7 (VEAB-SE)	WP6	R	RE
D.6.5	Report on energy performance of the project in close collaboration with WP7 (WEX-SE)	WP6	R	RE
D.6.6	~~Behavioural campaign in close collaboration with WP5 (UNI-SE)~~ moved to 8.8	WP6	O	PU
D.6.7	Updated Sustainable Energy Action Plans (SEAPs) for Växjö and Kaunas WP6 (MUN-SE)	WP6	R	PU
D.6.8	Documentation of implementation of EV charging infrastructure (MUN-SE)	WP6	R	PU
D.7.1	Report on city strategies and related performance indicators including future demand and supply scenarios. (AIT)	WP7	R	PP
D.7.2	Report on the existing operational monitoring and data processing plans for the demonstration projects and common monitoring procedure. (AIT)	WP7	R	PP
D.7.3	Report on the evaluation of the operational monitoring data of the demonstration projects. (AIT)	WP7	R	PU
D.7.4	Report on the strategic development and possibly policy measures related to Aarhus and Växjö and the assessment of the possible future impact of the demonstration projects. (AIT)	WP7	R	PU

Del. no.	Deliverable name	WP no.	Nature[1]	Dissemination level[2]
D.8.1	Open innovation website, O, PU, M4 (LGI)	WP8	O	PU
D.8.2	Innovation management achievements report (LGI)	WP8	R	CO
D.8.3	Market assessment for READY set of solutions (LGI)	WP8	R	CO
D.8.4	Green business model options for READY solutions (LGI)	WP8	R	CO
D.8.5	Replicability assessment for READY solutions (LGI)	WP8	R	CO
D.8.6	READY Project Communication and Dissemination Action Plan (COWI)	WP8	R	CO
D.8.7	READY project public website (COWI)	WP8	O	PU
D.8.8	READY behavioural campaign for energy efficiency and smart living solutions module & report (UNI-SE)	WP8	R	CO
D.8.9	READY Training module for the advanced training programme and report (ESS-SE)	WP8	O	PU
D.9.1	Project portal (COWI) – M1	WP9	O	PP
D.9.2	Kick off meeting M2 (MUN-DK)	WP9	O	PP
D.9.3.1	Global Quality Management Plan (COWI) – Month 3 (COWI)	WP9	R	PP
D.9.3.2	1st Progress/Intermediate report including cost statements (COWI)	WP9	R	PP
D.9.3.3	2nd Progress/Intermediate report including cost statements (COWI)	WP9	R	PP
D.9.3.4	3rd Progress/Intermediate report including cost statements (COWI)	WP9	R	PP
D.9.3.6	4th Progress/Intermediate report including cost statements (COWI) – update of report for period 3	WP9	R	PP
D.9.3.5	Final report including cost statements (COWI)	WP9	R	PP

8.3 Report on Societal Implications

A General Information *(completed automatically when **Grant Agreement number** is entered.*	
Grant Agreement Number:	ENER/FP7/609127/READY
Title of Project:	Resource efficient cities implementing advanced smart city solutions READY
Name and Title of Coordinator:	Reto Michael Hummelshøj Leading Project Manager

B Ethics	
1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	*No*
2. Please indicate whether your project involved any of the following issues (tick box) :	*No*
RESEARCH ON HUMANS	
• Did the project involve children?	
• Did the project involve patients?	
• Did the project involve persons not able to give consent?	
• Did the project involve adult healthy volunteers?	
• Did the project involve Human genetic material?	
• Did the project involve Human biological samples?	
• Did the project involve Human data collection?	
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	
• Did the project involve Human Foetal Tissue / Cells?	
• Did the project involve Human Embryonic Stem Cells (hESCs)?	
• Did the project on human Embryonic Stem Cells involve cells in culture?	
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	
PRIVACY	
• Did the project involve processing of genetic information or personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	
• Did the project involve tracking the location or observation of people?	
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	
• Were those animals transgenic small laboratory animals?	
• Were those animals transgenic farm animals?	
• Were those animals cloned farm animals?	
• Were those animals non-human primates?	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	
DUAL USE	
• Research having direct military use	
• Research having the potential for terrorist abuse	

C Workforce Statistics		
3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).		
Type of Position	**Number of Women**	**Number of Men**
Scientific Coordinator	1	12
Work package leaders	5	4
Experienced researchers (i.e. PhD holders)	1	3
PhD Students		3
Other	30	33
4. How many additional researchers (in companies and universities) were recruited specifically for this project?		7
Of which, indicate the number of men:		4

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project? ○ Yes ○ No

6. Which of the following actions did you carry out and how effective were they?

	Not at all effective				Very effective
❑ Design and implement an equal opportunity policy	○	○	○	○	○
❑ Set targets to achieve a gender balance in the workforce	○	○	○	○	○
❑ Organise conferences and workshops on gender	○	○	○	○	○
❑ Actions to improve work-life balance	○	○	○	○	○
○ Other:					

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify
○ No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

○ Yes- please specify: PhD course
○ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

○ Yes- please specify: Videos & training material
○ No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

○ Main discipline[10]: 2.1
○ Associated discipline[11]: 2.2 ○ Associated discipline[11]:

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)* ○ Yes ○ No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

○ No
○ Yes- in determining what research should be performed
○ Yes - in implementing the research
○ Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	○ ○	Yes No

12. Did you engage with government / public bodies or policy makers (including international organisations)

○	No
○	Yes- in framing the research agenda
○	Yes - in implementing the research agenda
○	Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

○	Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
○	Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
○	No

13b If Yes, in which fields?

Agriculture		Energy	x	Human rights	
Audiovisual and Media		Enlargement		Information Society	
Budget	x	Enterprise	x	Institutional affairs	
Competition		Environment	x	Internal Market	
Consumers	x	External Relations		Justice, freedom and security	
Culture		External Trade		Public Health	(x)
Customs		Fisheries and Maritime Affairs		Regional Policy	x
Development Economic and Monetary Affairs		Food Safety		Research and Innovation	x
		Foreign and Security Policy		Space	
Education, Training, Youth		Fraud		Taxation	
Employment and Social Affairs		Humanitarian aid		Transport	x

13c If Yes, at which level?	
○	Local / regional levels
○	National level
○	European level
○	International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	**2**
To how many of these is open access[11] provided?	**2**
How many of these are published in open access journals?	**2**
How many of these are published in open repositories?	**0**
To how many of these is open access not provided?	**0**
Please check all applicable reasons for not providing open access:	
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[12]: ……	**N/A**

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		1
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	1
	Registered design	1
	Other	0
17. How many spin-off companies were created / are planned as a direct result of the project?		N/A
Indicate the approximate number of additional jobs in these companies:		

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑	Increase in employment, or	❑	In small & medium-sized enterprises
❑	Safeguard employment, or	❑	In large companies
❑	Decrease in employment,	❑	None of the above / not relevant to the project
❑	Difficult to estimate / not possible to quantify		

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:* *200*

Difficult to estimate / not possible to quantify	☐

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

○ Yes ○ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Yes ○ No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

☐	Press Release	☐	Coverage in specialist press
☐	Media briefing	☐	Coverage in general (non-specialist) press
☐	TV coverage / report	☐	Coverage in national press
☐	Radio coverage / report	☐	Coverage in international press
☐	Brochures /posters / flyers	☐	Website for the general public / internet
☐	DVD /Film /Multimedia	☐	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

☐	Language of the coordinator	☐	English
☐	Other language(s)		

Question F-10: Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]

1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

1.3 Chemical sciences (chemistry, other allied subjects)

1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)

1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY

2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]

2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as

geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES
3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohematology, clinical chemistry, clinical microbiology, pathology)
3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)
3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES
4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)
4.2 Veterinary medicine

5. SOCIAL SCIENCES
5.1 Psychology
5.2 Economics
5.3 Educational sciences (education and training and other allied subjects)
5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES
6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)
6.2 Languages and literature (ancient and modern)
6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]