MAKING-CITY

Innovation Action (IA)

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Groningen PEDs (North, Southeast) interventions detailed design - Initial version

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Summary

The main purpose of this deliverable is to report about the progress of the actions in two PED districts in Groningen. It provides a clear overview to the Groningen partners of the consortium, but also to the other members of the consortium. Currently, it is not meant to share this input with members outside of the consortium. Eventually, there will be many different target groups, like policy makers, investors, citizens, research institutes, etc. In November 2019 an initial version, D3.13, was delivered. This deliverable is planned as 'final' but due to changes in the intervention design and the situation regarding COVID, this is not a final version yet.

Approval

Date	By
2021-11-01 10:43:34	Mr. Jasper TONEN (GRO)
2021-11-02 12:12:18	Mrs. Cecilia SANZ (CARTIF)

Innovation Action

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D3.13 Groningen PED interventions detailed design - Initial Version -

WP3, Task 3.1

November 2019 [M12]

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Abbreviations and acronyms

Acronym	Description
BIPV	Building Integrated Photovoltaics
CHP	Combined Heat and Power
COP	Coefficient of Performance
DHS	District Heating System
KPI	Key Performance Indicator
LED	Light-emitting diode
PED	Positive Energy District
PV	Photovoltaic
PVT	Photovoltaic thermal
SECAP	Sustainable Energy and Climate Action Plan
UFM	Urban Financial Metabolism model
WP	Work Package

Executive Summary

Two PED will be deployed in Groningen in two neighbourhoods located in the North and the Southeast of the city. Groningen North consists of the residential area Paddepoel and the University Campus Area Zernike. Groningen Southeast consists of the Europapark and business park Zuidoost districts.

The progress of the actions in these two PED districts in Groningen is described in this deliverable.

1 Introduction

1.1 Purpose and target group

The main purpose of this deliverable is to report about the progress of the actions in two PED districts in Groningen. It provides a clear overview to the Groningen partners of the consortium, but also to the other members of the consortium. Currently, it is not meant to share this input with members outside of the consortium. Eventually, there will be many different target groups, like policy makers, investors, citizens, research institutes, etc.

1.2 Contribution partners

In this section the contributing partners to this report and their responsibilities are explained.

Table 1: Contribution of partners

Partner nº and short name	Contribution
3 – GRO	The Municipality of Groningen is the leading partner for task 3.1 and D3.13. Also the WP3 work package leader. In the lead regarding actions 6, 11, 15, 16, 20, 31, 33, 35, 41, 42, 43, 44, 48, 49, 51, 52, 53, 54.
3a - WAR	WarmsteStad is a thirded linked partner of GRO and in charge of the district heating grids in both the North and Southeast PED. In the lead regarding actions 27, 39, 40. Virtually in the lead of actions 20 and 22.
4 -TNO	The Netherlands organization of applied scientific research is a non-profit research organization and contribution to many research related action in the project. In the lead regarding actions 9, 10, 32, 38, 49. Virtually in the lead of action 46.
5-GPO	Grunneger Power is a community-owned energy cooperative, specialized in citizen participation. In the lead regarding actions 2, 11, 13, 18, 19, 23, 24. Virtually in the lead of actions 50 and 51.
6-SEV	The Energy Valley association aims to accelerate knowledge sharing, energy project, investments and job creation in the energy sector. In the lead regarding actions 5, 45, 46.
7-WAM	Waarborg Vastgoed is a real estate investor and responsible for the activities regarding the Mediacentrale and Powerhouse in the Southeast PED. In the lead regarding actions 3, 4, 11, 14, 21, 22, 26, 30.
8-NIJ	Nijestee is the largest housing corporation in the City of Groningen. Responsible for the two apartment building in the North PED. In the lead regarding actions 1, 11, 12, 17, 25, 28, 29, 33.
9-CGI	CGI has a worldwide expertise in the fields of business consulting, system integration and managed services. In the project CGI is as key partner in ICT solutions. In the lead regarding actions 8, 34, 36, 37.

10-SB	Sustainable Buildings is a young high-tech software company and provides a unique cloud-based energy management system for buildings. In the lead regarding action 7.
11-RUG	The University of Groningen (faculty of Spatial Sciences, department of planning and environment) contributes to WP3 by supporting the evaluation framework and assisting in the creation of the new 2050 City vision.
12-HUAS	The Hanze University of Applied Sciences delivers input into the development for both technical and social developments for the transformation of Groningen on its way to energy neutrality.

1.3 Relation to other activities in the project

The complete set of actions has a strong relation to all the other work packages. The technical action that are planned in the PED districts will be followed closely for its replication potential in WP4, but might also provide insights for the selection of techniques in the follower cities regarding the setting up of a PED district in WP1. WP1 is also closely connected to multiple non-technical action related the creation of a long term city vision. This also incorporates the citizen engagement and social related actions. The business cases that belong to the actions and the setting up of innovative business models are closely related to WP6. The evaluation and monitoring of the actions will also find its way in WP5. It is important to share good (but also bad) practises with other project in WP8 and broader in WP7. As Oulu is the other lighthouse City in the project there is a logical connection to WP2 as well.

2 Groningen Description

2.1 Groningen as lighthouse city

The City of Groningen is very ambitious related to the energy transition and specialized in how to attract citizens in this process. It has developed the district energy planning process as a tool to transfer towards a carbon neutral situation district by district. Because of its ambitions it was chosen by the EC as Lighthouse City under the Smart Cities and Communities lighthouse project Making City.

2.1.1 General description of the city

Figure 1: The City of Groningen

The Municipality of Groningen (231,037 inhabitants, 1367 per km^2, 2019) is the main municipality as well as the capital city in the province of Groningen in the Netherlands. The municipality of Groningen consists of the city of Groningen (202.000 inhabitants; >2000 inhabitants km2), the suburb of Haren (17.000 inhabitants) and a rural area mostly east of the city (12.000 inhabitants). The City has grown rapidly since the end of world war II and has doubled in size.

Groningen is an old city (The oldest documents referring to Groningen's existence dates from 1040, and the first settlement has traced back to the 3rd century AD). As a consequence, Groningen has a relatively large share of old housing; 16% was built before 1925 and 44% before 1965. It has always been an important trade City as part of the Hanseatic Cities. The baken of Groningen is the Martinichurch in the center of City. The current building was built between 1469 and 1482 and has a height of 96.8 meters. Unofficially it is not allowed to construct buildings that are larger in height than the Martinichurch.

The city of Groningen is by far the largest urban area in the North of the Netherlands, making it also the centre of education, commerce, services and jobs for an area of about 10,500 km2 with over 1.7 million inhabitants. The city hosts over 135,000 jobs, two large Universities (HUAS and RUG) and over 60,000 students, resulting in a large share of its population being made up of students. Education, health care, energy and government are prime employers in the city, while the city has only little industry.

Relevant features of the city of Groningen are its high share of bicycles in transportation, with over 60% of all trips made on bicycle, making it the world's leading bicycle city. With an average age of 36,4 years, Groningen is also the youngest city of the Netherlands.

Groningen and its region have historically been closely related with energy. Especially after the discovery of the Slochteren gasfield in 1959. Since the exploitation started in 1963 the yearly extraction was on average 40 billion cubic metres of natural gas, reaching its peak in 1975 (90 billion cubic metres). The ongoing extractions caused soil depletion and resulted in local earthquakes. Since the region was not built to deal with the effects of earthquakes this caused serious social distress in the area. Finally, in 2019 the national government decided to stop exploiting gas in the Groningen area as of 2022.

Groningen is intrinsically committed to push for a swift transition from a fossil fuel-based energy system to one that is based on renewables. In doing so, both generation and efficiency are prime targets. Groningen generates 6.1% (2018) of renewable energy generation in its mix, with the first largest projects on both efficiency and generation being completed in the last years and several others still under development. It is expected that with ongoing projects growth will increase to 9.4% in 2022. The final goal is to reach a CO2 neutrality by 2035.

2.1.2 Geographical and Climatic Characteristics

The total area of the municipality reaches 180.21 km^2 from which 168.93 km^2 land area. The City is positioned in the Northeast of the Country having the North Sea close by. This also results in an oceanic temperature climate, with relatively warm and wet summers (on average 22 ^oC during daytime) and cool winters, just above freezing on average.

2.1.3 Urban structure and Land Use

To be included

2.2 District North as Positive Energy District

2.2.1 Description of North district

The North location, is composed by more than 100 building of different typologies. The district is basically split into three area, the Zernike Science park (source of the district heating system and home to the Energy Academy Europe building, EAE), Paddepoel North and Paddepoel South. Paddepoel North (2 Nijestee flats and one terraced house) is a residential area composed with terraced houses (approximately 2,000) and some high rise flats. Most of the current buildings are supplied with natural gas for heating and have been built in the 1960's. It is meant to transform this part into a complete district heating area. Paddepoel South (two terraced houses) is also a residential area with terraced houses and some high rise, but has the building typology is different, a part is poorly constructed and undergoes a transformation of rebuild and new built. Another part of the area is relatively new built, after the 2000s. The main solution for these buildings is an all-electric variant.

A sample of reproducible buildings (6) has been taken to start the process of becoming fully positive in this area. The city council is committed to scale up the results after the project following the same principles, so the approach affecting MAKING-CITY will address a limited number of buildings of different typologies (3 residential individual, 2 high-rises and 1 tertiary) with very low consumption regarding the national regulation codes. The energy performance will be based on an extensive use of RES on-site. District heating is the key of the thermal energy supply system, that allows to avoid energy input from outside the district. A very small part of the energy demand is will most likely be covered from the natural gas network, so it is taken from outside. Some PV facilities compensate the electricity consumption, in particular a big facility in the tertiary building allows to supply an excess of energy and provide an energy surplus reaching a positive yearly balance.

2.2.2 Summary of interventions and actions

2.3 District Southeast as Positive Energy District

2.3.1 Description of Southeast district

The second PED district covers a large area in the southeast of the City and is completely different compared to the North PED. This area is mainly characterized with industrial, tertiary buildings and a few residential buildings. Also, the FC Groningen soccer stadium is situated in the area. The district is a mix of older and new buildings. The selected buildings are a representing this, the old very energy intensive Mediacentrale with its offices, the new Powerhouse that is a combination of offices and apartments and the new sports complex that has an energy positive configuration already. In addition in the Southeast PED two solar parks are situated that provided power to the district. The district heating grid is already in place, but will extend during the project period and also connect for instance the Powerhouse building.

2.3.2 Summary of interventions and actions

3 Detailed conceptual design of the actions

3.1 Actions in High Performance Buildings

A1: Retrofitting of two multi-owner residential buildings (7400 m2) NIJ

Technical Description

Building 1 (Planetenlaan 551 - 765)

The renovation work that had to be completed is finalised. No MakingCity budget was required for these actions.

What we have done (highlights):

- insulate facades, roof and floor
- make ventilation CO2 controlled per home
- building connected to heat network of Warmtestad (ready in nov/dec 2019) [A27], [A39]
- Solar panels on the roof (56x) for building-related energy [A11].
- Installation of a hot water meter per home.
- move cold water pipe to prevent legionella

The theoretical energy savings have been calculated based on the intended package of measures.

Figure 2: Nijestee flat 1 before renovation

Figure 3: CO_2 ventilation controlled ventilation

Building 2 (PLanetenlaan 2 - 216)

The renovation work that had to be completed is almost finalised. No Making City budget was required for these actions.

What we have done (highlights):

- insulate facades, roof and floor
- make ventilation CO2 controlled per home
- building connected to heat network of Warmtestad (ready in nov/dec 2019) [A27], [A39]
- Solar panels on the roof (56x) for building-related energy [A11].

The theoretical energy savings have been calculated based on the intended package of measures.

The real energy savings are dependent on the energy usage of the residents.

Next year the monitoring will start [A7].

Figure 4: Nijestee flat 2 before renovation

Expected energy savings flat 1	Between 9-42% depending on the location of an apartment in the building.	**Other linked actions:**	[A7], [A8], [A9], [A11], [A12], [A17], [A25], [A27], [A28], [A29], [A33], [A39]
Expected energy savings flat 2	Between 9-42% depending on the location of an apartment in the building.		
RC values façade Roof floor	To be supplied		

Status of the action				
Design phase				100%
Equipment selection				100%
Installation				90%
Starting up	N.A.			
Monitoring	25%			

Management structure	
Action Leader:	NIJ
MAKING-CTIY	GRO, WAR, SB, TNO, CGI

partners involved:	
Other key stakeholders involved:	N.A.

Financial Plan & Business Models

Action Cost:	1.2 million euros	MAKING-CITY budget:	N.A.

Flat 1: €700,000. €50,000 for PV, 10% for project management, insulation (not funded, but specified), demand based ventilation. Sums up to roughly €700,000

Flat 2: €500.000

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action (subtask 3.1.1)

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18)

PESTEL Analysis (Barriers / Enablers)

Political	N.A.
Economic	The building is renovated. Other option was completely demolishing and new-built. The chosen option is cheaper, but more energy intensive.
Social	The comfort in the building is improved
Technical	N.A.
Environmental	Refurbishment is beneficial from a material perspective. Building energy consumption reduced significantly.
Legal	N.A.

A2: Retrofitting of three terraced private houses (360 m2) GPO

Technical Description

In the initial Grant Agreement, three examples of demo houses are described. To give all homeowners an equal change in participating in the project, a small campaign has been set-up in the spring of 2019, to make the inhabitants of the north PED aware of being able to sign up as possible demo house. 19 people signed up for the pre-selection.

After gathering all necessary data to make a proper selection, consortium partners GRO, TNO and GPO made an anonymous selection, based upon predetermined criteria. 6 out of 19 houses were selected for a technical scan, which forms the basis for a technical plan of action per individual house. The scans were carried out during September, plans of action written in October and discussions about these plans are planned in November. The plans contain scenarios that can make the house energy positive, by definition of the Making City project.

Each plan for each house contains multiple technical scenarios, which on their turn have different financial consequences for the homeowners. Together with all the homeowners, discussions are now taking place to find out which scenario or scenario's the homeowners are comfortable with, which of the 6 houses will be selected to be in the final 3 demo houses and how the financial aspects of the installation of the scenarios can be handled.

For the two relatively new demohouses, an all-electric scenario will be applied. Two of the four households will be selected to be demohouses in the project. With the older demohouse, an alternative strategy will be followed. Since the district heating network will be developed in the area of the older households, the temperature levels of this district heating network will be simulated. During the simulation, the house will be measured and the homeowners will be frequently asked if they experience a loss of comfort. If so, that is where to start with insulation. The district heating network will have a sustainable source within the district, so all energy needed for heating is from within the district.

A final decision of the participants will follow in December 2019.

A list of all optional innovative technical interventions can be shared with the project partners.

Other linked actions:	[A7-8], [A11], [A13], [A18], [A19], [A23], [A24]

Status of the action

Design phase			75%	
Equipment selection	25%			
Installation	5%			
Starting up				
Monitoring				

Management structure

Action Leader:	05 GPO

MAKING-CTIY partners involved:	03 GRO / 04 TNO / 10 SB
Other key stakeholders involved:	Homeowners, Invent (technical consultant)

GPO is in the lead of acquiring the three demo houses, where the homeowners need to feel comfortable in (I) retrofitting their houses, as well as (II) spending their money in a right way.

Financial Plan & Business Models

Action Cost: € 80.000	(Approximately)	**MAKING-CITY budget:**	€55.300

Since the final 3 demo houses and associated have not been finally chosen yet, the cost breakdown cannot be discussed in detail yet. The aim of the partners is to make an equal distribution of the available budget amongst the three houses, as has been described in the Grant Agreement.

To fill the gap between the action cost and the Making City budget, GPO is thinking of renting extra budget. They can charge this budget over a period to the homeowners, in a sort of lease construction. Dutch laws and regulations are checked to see what the ideal situation is in this case.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

When the three demo houses have been chosen, still six different plans of actions (containing different scenario's) have been made. Since the housing types in the North PED are not heterogeneous, these plans can be implemented in more than one single house. The idea is to see if a parallel project can be started in the second year of the project, focussing on finding more local citizens to become enthusiastic about retrofitting their houses.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18)

PESTEL Analysis (Barriers / Enablers)

Political	The municipality has the wish to no longer use the gas network for heating purposes in the district.
Economic	Energy prices may/will rise in the future, becoming energy positive will lead to fewer dependency.
Social	If the demo houses really become a demo for the other households, social acts will be involved. Innovations, like acoustic heat pumps, are more socially acceptable in the neighbourhood than current standard ones (louder).
Technical	Technical innovations are needed to make the district energy positive.
Environmental	The municipality and inhabitants strive for CO2-neutral district.
Legal	Business cases/models for homes or homeowners need to be developed legally. This is not yet possible in the Netherlands.

A3: New Powerhouse apartments (7,800 m2) WAM

Technical Description

The newly built apartment complex 'Powerhouse' is expected to ready by the end of 2019. There will be 79 apartments realized and 1,500 m2 of office space. The complex will have a heating system based on a heat pump and geothermal energy, connected to district heating [A27]. Regarding Powerhouse there will not be invested in BIPV panels [A14] and PVT [A22]. Instead PV panels will be installed (the capacity is not yet clear), and possible other alternative measures for Powerhouse might be separate offices heating (the inclusion of a smaller heat pump suited for office heating) and using waste heat out of the ventilation system for balancing wells.

Figure 5: Powerhouse building after construction

RES on building		Other linked actions:	[A7[, [A8], [A14], [A22], [A27], [A31],
Avoided CO2 emissions			

Status of the action

Design phase				100%
Equipment selection			*75%*	
Installation			75%	
Starting up	N.A.			
Monitoring				

Management structure

Action Leader:	WAM
MAKING-CTIY partners involved:	WAR
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	€ 16.000.000	**MAKING-CITY budget:**	€ 139,000

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18)

PESTEL Analysis (Barriers / Enablers)	
Political	
Economic	
Social	
Technical	
Environmental	
Legal	

A4: Retrofitting of the office building-Mediacentrale (14,400 m2) WAM

Technical Description

The Mediacentrale was built in the 1930s as an energy plant and was repurposed as office building in 2005. The retrofitting of this building of 14,400 m2 consists of implementing thermal energy storage combined with a geothermal heat pump [A26]. In addition smart thermostats for temperature control will be installed [A7] and combined with a 'HeatMatcher' concept [A10]. Uncertain actions are implementing new HR+++ glass [A4], PV on roofs and parking lot [A11], PVT [A21] and thermal storage in Mediacentrale [A30]. Furthermore, the wastewater installation was supposed to be modified, but this seemed to be to a extremely drastic measure in the building for only a very small profit, thus [A31] is cancelled.

Next to the building 10 smart charging were planned, but these charging stations have been placed on a different location in the PED area last summer. This means the construction of [A33] has been completed, but on behalf of GRO.

Much has been invested in energy saving measures.

Some of the actions seem not to be possible due to a combination of reasons [A11, A21]. Alternative measures for Mediacentrale might be the installation of an additional hybride heatpump to lower the energy consumption and increase the efficiency of the system. Possibly green gas can be used as extra source and possibly the waste heat of the local radio and television company could be regenerated and used to cover a part of the total heat demand.

Figure 6: The Mediacentrale in current state

RES on building		Other linked actions:	[A7], [A8], [A10], [A11], [A21], [A26], [A27], [A29], [A31], [A33]
Avoided CO2 emissions			
Energy saved			

Status of the action

Design phase				100%

Equipment selection			75%	
Installation			75%	
Starting up			75%	
Monitoring	25%			

Management structure

Action Leader:	WAM
MAKING-CTIY partners involved:	GRO
Other key stakeholders involved:	ITBB/GeoComfort

Financial Plan & Business Models

Action Cost:	€ 1,320.000	MAKING-CITY budget:	€ 250,000

The costs of retrofitting the building were roughly € 800,000. On top of this some extra Making City action have been planned, with a total investment budget of € 520,000 from which € 250,000 is EU funding. This does not include personal costs. Changing or cancelling some of the proposed actions could have an effect on the financial plan. Suited alternatives will be proposed to the commission.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18)

PESTEL Analysis (Barriers / Enablers)

Political	The management structure of WAM consists of shareholders who have to decide on investments. This sometimes hampers the efficiency of implementation.
Economic	Every measure needs to have a solid BC that is supported by the shareholders.
Social	N.A.
Technical	Not every technique can be realised considering the old construction of the building.
Environmental	The current environmental impact is rather bad, but will be improved significantly after the execution of all the measures.
Legal	Always applies.

A5: New high performance Energy Academy Europe (9,636 m2) SEV

Technical Description

General building information:

The Energy Academy Europe is a tertiary building which houses both lecture rooms and offices with a surface of 9,636 m2 and was completed in 2016. It is the most sustainable teaching building in the Netherlands due to a BREEAM Rating Outstanding score of 89.62%. This building contains a geothermal heat pump and has 1,600 solar panels on the roof. The panels are arranged in various angles to allow more panels on the roof and thus increase energy performance. The total construction budget was xxx million euro, which is almost 50% higher than traditional buildings. The main reason for this is that the building is earthquake resistant to cope with the consequences of natural gas production and its accompanying earthquakes. Out of the total budget, roughly xx million euro is reserved in energy related measures, such as the ATES and the solar panels.

Figure 7: Energy Academy Europe building completely covered with solar PV.

Structural design and technical installations:

To be supplied

Monitoring

The building is currently monitored, but the data are not yet included into the making city monitoring program. Therefore, a monitoring package will be installed in the building in 2020.

RES

To be supplied

RES on building		Other linked actions:	[A7], [A8]
Avoided CO2 emissions			

Status of the action

Design phase				100%
Equipment selection				100%
Installation				100%

Starting up				100%
Monitoring		50%		

Management structure	
Action Leader:	06 SEV
MAKING-CTIY partners involved:	11 RUG / 10 SB
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:		MAKING-CITY budget:	None
To be supplied			

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	
Economic	
Social	
Technical	
Environmental	
Legal	

A6: New high performance Sport Complex Europahal (5,315 m2) GRO

Technical Description

General building information:

The sports complex building combines sports-, educational-, office- and meeting room facilities. The sports facilities have a total surface area of 4208 m2, while the remaining occupies 1107 m2 of space. The construction of this energy positive building was finished by the end of 2018. WarmteStad provided heating and cooling to the building [A27]. The 88 PVT panels [A20] are mainly used for the balance of the hot and cold wells of the geothermal heat pump system, but also provide electricity for the building. The PV panels on the roof provide enough electricity for the building to become energy positive [A11].

In the surrounding area 180 Floating solar pontoons (156.6 kWp) are planned [A15], as well as an innovative SolaRoad [A16], consisting of a dedicated bike lane with solar panels integrated (70 kWp). For the purpose of energy monitoring and demand/response smart controls will be installed [A7-A8].

Figure 8: Sportcomplex Europapark.

Structural building design:

- Floor: Rc = 3.5 m²K/W
- Walls: Rc = 4.5 m²K/W
- Windows: Uw = 1.1 W/m²K; ZTA 0.30
- Roof: Rc = 6.0 m²K/W
- Infiltration: qv;10 = 0.30 dm³/s.m²

Technical installations:

Heating

- Simaka Heatpump (Simatron WP 201/2 WW-R407C, 200 kW). Source based upon a district geothermal heatpump system.
- 800 L buffer tank
- Low temperature heating between 35-45oC, depending on the weather conditions.
- COP W10/W35: 6.02, COP W10/W45: 4.61
- Expected energy consumption: 61,043 kWh

- Avoided CO2 emissions: 37.3 ton (compared to standard gas fired boiler)

Cooling

- Geothermal heat pump system used for cooling
- High temperature cooling (10-16 oC)
- Expected energy consumption: 7,931 kWh
- Avoided CO2 emissions: 29.2 ton (compared to standard air-conditioning system (COP 2.5)

Hot Water

- Sports facilities: Central boiler (2000L) with electric flow device (ŋ=1.00). Heat supplied by simaka heat pump (Simatron WP 50/2 WW- R134a, 50 kW). COP W10/W65: 4.0.
- 2000 L buffer tank
- Expected energy consumption: 32,847 kWh
- Avoided CO2 emissions: 14.4 ton (compared to standard gas fired boiler)
- Other facilities: electro boiler with small buffers for on the spot solution. Heat is instantly available and no heat losses for transport.

Ventilation

- Sports facilities: Mechanical in and output combined with heat recovery system (ŋ=0.70) and CO2 controlled
  Capacity: 3800 dm3/s, minimal recirculation 20%, fan energy 8.8 kW
- Other facilities: Mechanical in and output combined with heat recovery system (ŋ=0.70) and CO2 controlled
  Capacity: 3400 dm3/s, windows can be opened for ventilation boost, fan energy 8.0 kW

Lighting

- Sports facilities: 8 W/m2, including detection system and dimmen Dali based, LED based,
- Other facilities: 6 W/m2. Daylight and presence detection

RES on building

- 88 PVT panels (Solaris) (200 m2). Expected heat generation: 71,240 kWh hot water (55 oC) and 17,640 kWh electricity (PV=165 Wp/m2).
- 1040 PV panels, 280 Wp (291 kWp). No optimizers are used, thus the generation will be lower than anticipated. Expected generation: 247 MWh/y.

RES on building, expected:	Electricity: 265 MWh/y Heat/hot water: 71 MWh/y	**Other linked actions:**	[A7], [A8], [A11], [A16], [A17], [A27], [A31]
Avoided CO2 emissions:	78 ton		
RES surroundings, expected:	Pontoons: 133 MWh/y Solar road: 60 MWh/y Solar parks share: 22 MWh/y		

Status of the action

Design phase				100%
Equipment selection				100%
Installation				100%
Starting up				100%
Monitoring		50%		

Management structure			
Action Leader:	GRO		
MAKING-CTIY partners involved:	WAR		
Other key stakeholders involved:			
Financial Plan & Business Models			
Action Cost:	€ 15,550,000	**MAKING-CITY budget:**	none
The building costs including the PV investments are €15.5 million. The costs for the related actions have been specified separately.			
Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action			
N.A.			
KPIs for the Evaluation of the Action			
To be updated for the final version, after finalising the KPIs in D5.2 (M18).			
PESTEL Analysis (Barriers / Enablers)			
Political	Such an ambitious building has a strong political support.		
Economic	Because of the political and social benefits it was allowed to invest more than usual.		
Social	The facilities of the building strongly promotes sports activities and a healthy life style.		
Technical	The building is energy positive and also has a great deal of extra smart functionalities.		
Environmental	Very positive. Carbon neutral.		
Legal	Followed the standard regulations.		

A7: Advanced energy metering SB

Technical Description

Within the context of MAKING-CITY project, SB is responsible for an Advanced Energy Metering solution, starting with data collection. More specifically, at each intervention, the following real-time of 1-minute frequency data is collected:

1. Real-time electricity consumption and demand for the whole building
2. Real-time sub-metering for electricity consumption and demand
    a. Elevators
    b. Lighting of shared spaces
    c. Ventilation of shared spaces
    d. Consumption of all residents combined
3. Real-time gas consumption and demand for the whole building
4. Real-time sub-metering for gas consumption and demand for hot water
5. Real-time electricity generation from solar panels on the roof of the building

The advanced energy metering solution includes necessary hardware installation as well as a software platform that is able to collect the data according to the requirements of the MAKING-CITY project. Furthermore, the SB platform should satisfy the requirements of a big data collection and processing platform, such as device heterogeneity, system scalability, dynamic adaptability, and sensor data fault tolerance, just to name a few.

In terms of hardware, possible devices and equipment for data measurement and collection are selected. Depending on specific situations at each intervention, suitable devices and equipment are used in order to properly collect required data from the intervention. In some interventions, hardware is not required, instead, additional software components are developed to integrate with current existing hardware and software infrastructure at the interventions. In this way, required data will be extracted and collected for the purposes of the MAKING-CITY project.

To ensure a smooth system integration for data collection, the data format and communication protocol between hardware devices and software platforms are designed and now being implemented. The data is received via REST or via AMQP. Each measurement we receive have the following specified, where applicable:

1. Id of the measurement
2. Timestamp
3. Specifications
    a. Type of data, electricity generation, consumption, etc.
    b. Unit: kWh, m3, etc.
    c. Tariff
4. The actual measurement as windowed data, what was consumed between the last and this measurement, or if not possible, a meter value.

The APIs for integration between the hardware and the SB software platform are designed and now under development. The first version has been tested.

More specific progress and status of the action for each intervention is as follows:

- **Intervention 1 - Two Nijestee High-rise buildings:** Design phase is completed. Equipment and installation company is selected. The installation process is in progress.

- **Intervention 2 - Three terraced private houses:** Design phase is completed. The criteria for house selection and data collection are defined. There have been six potential houses are selected and now in progress of finalizing the house selection. After that, specific equipment will be selected for measuring within the houses.
- **Intervention 3 - Energy Academy Europe:** The investigation phase for the building has been completed. Possibilities of data collection are identified. This building is equipped with an advanced Siemens building management system (BMS). Detailed energy data is available within the BMS, including the required data for the MAKING-CITY project. As the next step, how the data should be collected from the building will be discussed and designed between relevant partners, namely University of Groningen and SB.
- **Intervention 4 – Mediacentrale:** Design phase is completed. Equipment and installation company is selected. The installation process is in progress.
- **Intervention 5: Sports complex Europahal:** The investigation phase for the building has been completed. Possibilities of data collection are identified. This building is equipped with an advanced BRControls devices and building management system (BMS). Detailed energy data is available within the BMS, including the required data for the MAKING-CITY project. As the next step, how the data should be collected from the building will be discussed and designed between relevant partners, namely Sport050 from the Municipality of Groningen and SB.
- **Intervention 6: Powerhouse:** This is a new building, which is still being built at the moment of writing. Therefore, the investigation of the building is still on going. After knowing the future situations of the building, we will be able to work on the design of an advanced energy meter solution for this intervention.

Other linked actions:	[A1-A6]

Status of the action

Design phase				95%
Equipment selection			75%	
Installation	25%			
Starting up	0%			
Monitoring	0%			

Management structure

Action Leader:	SB
MAKING-CTIY partners involved:	TNO, CGI, NIJ, WAM, GPO, GRO, RUG, WAR
Other key stakeholders involved:	

Financial Plan & Business Models

Action Cost:		**MAKING-CITY budget:**	

To be included

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

N.A.

A8: Demand response/Smart Grid CGI

Technical Description

Energy flexibility information is collected by Sustainable Buildings, TNO and the EV charging operator. The combined monitoring information is analyzed in the Energy Islands platform. It includes for example, electricity consumption and production, EV charging information from connected charging poles [A34], heat flexibility information from the TNO Heat Matchers [A9 and A10].

Instead of controlling the flexibility centrally, the demand/response decisions are taken locally (within the buildings or in charging poles), but with input from the central Urban Data Platform enabling optimization of the available flexibility in the whole district. (See also A34 and A36)

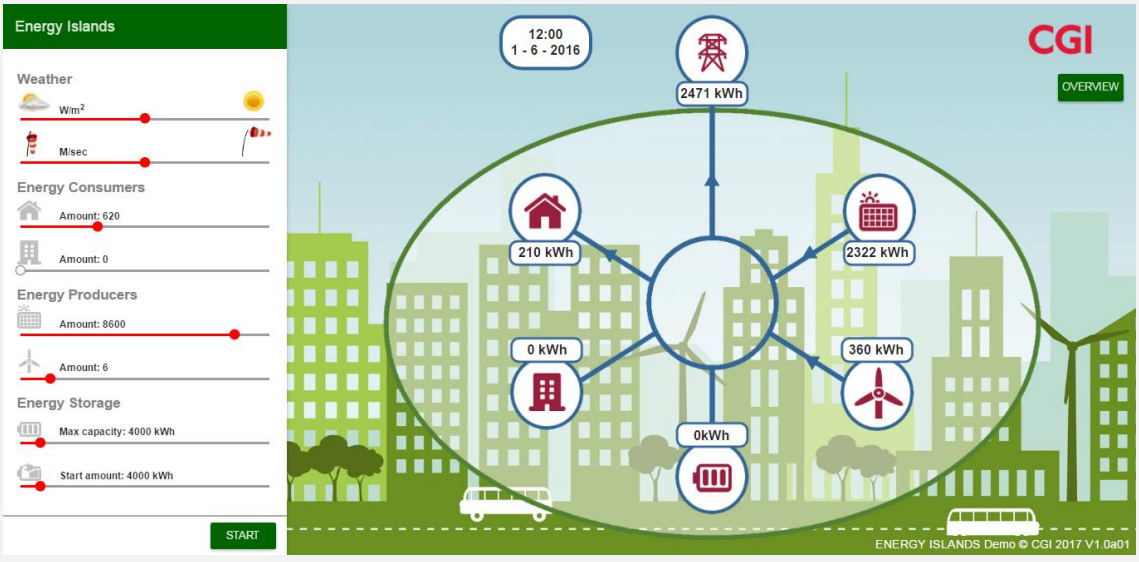

Figure 9: Energy Islands platform.

Other linked actions:	[A9], [A10], [A34], [A36] and [A37]

Status of the action				
Design phase	25%			
Equipment selection		50%		
Installation	25%			
Starting up				
Monitoring				

Management structure	
Action Leader:	09 CGI
MAKING-CTIY partners involved:	11 RUG
Other key stakeholders involved:	04 TNO / 10 SB

Financial Plan & Business Models			
Action Cost:	€ 25,000	MAKING-CITY budget:	€ 25,000

See [A36] for more details about the financials of the Energy Islands platform.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action	
Energy Consumption	
Energy Savings	
Flexibility	

PESTEL Analysis (Barriers / Enablers)	
Political	Less energy consumption straightforward to communicate.
Economic	More locally produced, renewable energy is used, which is cheaper that "grey" energy.
Social	It's creating greater awareness that renewable energy is cheaper (and cleaner) so citizens will consume energy on in other timeframes.
Technical	Integration with several different platforms working together to use the available flexibility.
Environmental	Consume or store when it's produced, so no loss of renewable energy.
Legal	GDPR compliance is necessary.

A9: HeatMatcher for Nijestee TNO

Technical Description	
This action aims to coordinate multiple energy producing and consuming components to determine the optimal balance between producers and consumers of heat and cold. In the original planning Heat Matcher would be implemented in the two buildings of Nijestee to combine the thermal flows of geothermal district heating, PVT, heat pumps and thermal storage. However, at the moment of writing, there are no additional (flexible) heating resources planned for the Nijestee building. This means that there is only one potential source of heating, and no buffering. This means that Heat Matcher cannot improve on the efficiency or cost of the energy usage, since there are no degrees of freedom. For this reason, Action 9 is put on hold until there are additional heating resources available.	
Other linked actions:	[A1], [17], [A25], [A27], [A29]

Management structure	
Action Leader:	04 TNO
MAKING-CTIY partners involved:	08 NIJ
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	N.A.	**MAKING-CITY budget:**	N.A.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action	
Energy demand and consumption	CO2 emission reduction
Energy Savings	Return on Investment (ROI)
Degree of energetic self-supply by RES	

PESTEL Analysis (Barriers / Enablers)	
Political	
Economic	
Social	
Technical	Lack of heating resources
Environmental	
Legal	

A10: HeatMatcher for Mediacentrale TNO

Technical Description

This action aims to coordinate multiple energy producing and consuming components to determine the optimal balance between producers and consumers of heat and cold. HeatMatcher will be implemented in the Mediacentrale building to optimize the thermal flows and usage of PVT, heat pumps and thermal storage.

HeatMatcher is a distributed agent-based system that is based on a virtual market approach where energy is being traded by software agents, each representing a technical component in the installation or network. The algorithm proceeds in short-cycle bidding rounds, with each agent advertising a bid curve to a virtual market telling how much energy it will produce or consume depending on market price. The control algorithm then determines the market equilibrium price, where demand and supply match. All agents adhere to a corresponding contract stating the amount of energy to be produced/consumed. Bidding rounds are repeated ever so often as real-time dynamics of supply and demand require.

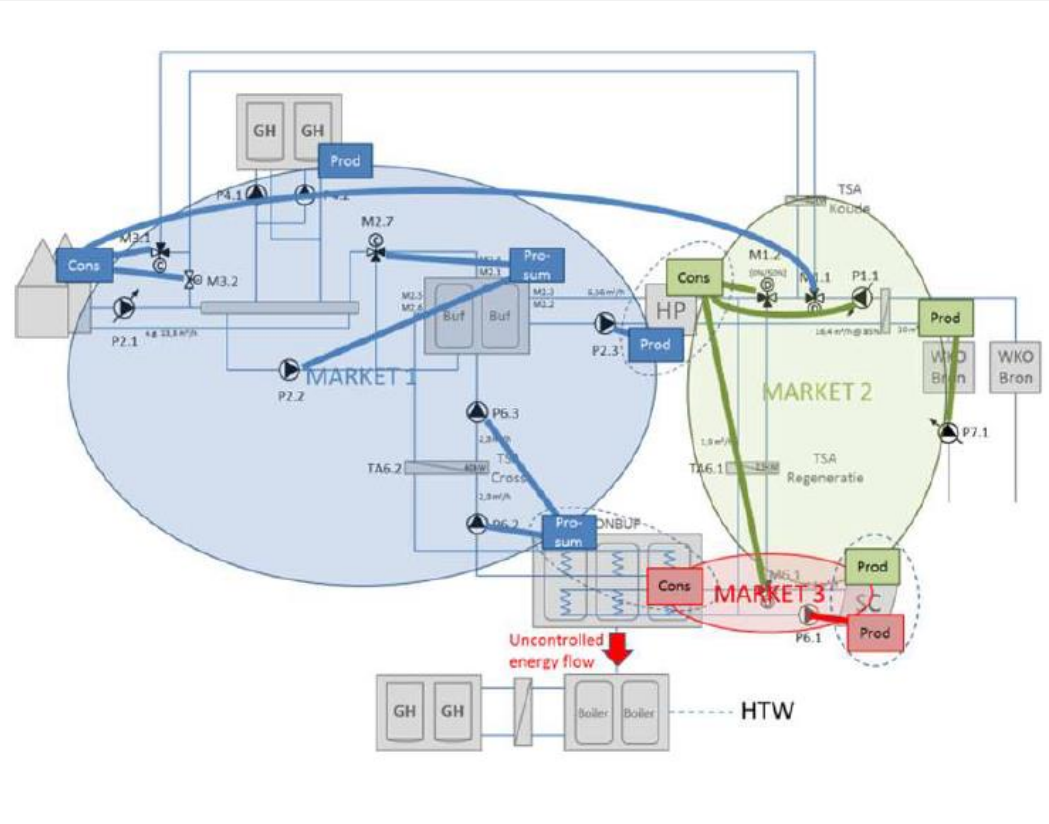

Figure 10: Schematic overview of Heatmatcher principle.

Status of the action

Design phase			75%	
Equipment selection		50%		
Installation	0%			
Starting up	0%			

Monitoring				

Management structure

Action Leader:	04 / TNO
MAKING-CTIY partners involved:	07 / WAM
Other key stakeholders involved:	

Financial Plan & Business Models

Action Cost:	€ 25,000	MAKING-CITY budget:	€ 17,500

The HeatMatcher algorithm has shown to decrease energy expenses by up to 30%. In an office building like the Mediacentrale with sufficiently large energy requirements this quickly makes the investment profitable. WAM controls the investment budget for equipment.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N/A

KPIs for the Evaluation of the Action

Energy demand and consumption	CO2 emission reduction
Energy Savings	Return on Investment (ROI)
Degree of energetic self-supply by RES	

PESTEL Analysis (Barriers / Enablers)

Political	
Economic	Reducing energy expenses
Social	
Technical	Optimization of heat resources
Environmental	Reduction of greenhouse gas emissions
Legal	

3.2 Actions in Renewable Energy Systems Onsite

A11: PV in roofs and parking lot (600 kWp) [NIJ, GRO, WAM, GPO]

Technical Description

Terraced Houses, [A2] (3.14 kWp), GPO

Since the selection of the three terraced houses has not been completed, we cannot give an estimate on the amount of solar power that needs to be implemented on the roofs of these houses. But, the considered capacity will most likely be reached.

Nijestee flats, [A1] (50 kWp), NIJ

Building related energy-savings by PV-panels on roof-tops:

Building 1: 56 panels have been installed on the roof with a capacity of 295 WP. So a total of 16520 WP or 16.52 kWp.

Building 2: 56 panels have been installed on the roof with a capacity of 295 WP. So a total of 16520 WP or 16.52 kWp.

Total in this action: 33 kWp. Space has been left open on the roof for 20 extra PV panels or around 10 PVT panels per building. Giving an extra 12 kWp in total if chosen for PV-panels. Extra kWp's in case of PVT has to be investigated.

Figure 11: Part of the PV on Nijestee flat 1 (left) and Nijestee flat 2 (right).

Mediacentrale, Building, [A4] (77.6 kWp), parking lot (131.1 kWp), WAM

After reconsidering the business case and complexity of the installing the panels on the roof WAM decided not to realise PV at the mediacentrale building. This has serious consequences to the energy balance and proper alternatives are being investigated. GRO is investigating the possibility of

realizing innovative PV on a parking lot within the PED boundaries.

Sport Complex, [A6] (335.3 kWp), GRO
The building contains 1040 PV panels, each 280 Wp. 1150 panels were expected, so the total capacity is slightly lower (291.2 kWp). No optimizers are used, thus the generation is most likely lower than anticipated.

Nominal power [A1] **Panels installed [A1]** **Energy production [A1]**	33 kWp 112 PV panels 28 MWh		
Technical Figures [A2]:	N.A.	**Other linked actions:**	[A1], [A2], [A4], [A6]
Technical Figures [A4]:	N.A.		
Nominal power [A1] **Panels installed [A1]** **Energy production [A1]**	291 kWp 1040 PV panels 247 MWh		

Status of the action

Design phase		50%		
Equipment selection		50%		
Installation		50%		
Starting up		50%		
Monitoring	25%			

Management structure

Action Leader:	Action related to: [A1]: NIJ, [A2]: GPO, [A4]: WAM, [A6]: GRO
MAKING-CTIY partners involved:	NIJ, GPO, WAM, GRO
Other key stakeholders involved:	N.A.

Financial Plan & Business Models

Action Cost:		**MAKING-CITY budget:**	None

To be included separately for [A1], [A2], [A4] and [A6].

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	PV is generally accepted as standard solution to increase energy balance.
Economic	The BC is valid for regular PV.
Social	Positive
Technical	PV keeps improving its performance, but there are no constraints.
Environmental	
Legal	

A12: BIPV in Nijestee (52.5 kWp) NIJ

Technical Description

Research is currently being conducted into whether it is possible to install PV panels on the façade. This involves looking at whether it is structurally possible and which parties can achieve this. There must also be consultation with the municipality about the possibilities.

Nominal Power flat 1	25 kWp	Other linked actions:	[A1]
Nominal Power flat 2	30 kWp		
Panels installed flat 1	150 panels, 250 m2		
Panels installed flat 2	200 panels, 330 m2		
Energy production flat 1	19 MWh/y		
Energy production flat 2	25 MWh/y		

Status of the action

Design phase		50%		
Equipment selection	25%			
Installation				
Starting up				
Monitoring				

Management structure

Action Leader:	NIJ
MAKING-CTIY partners involved:	GRO
Other key stakeholders involved:	N.A.

Financial Plan & Business Models			
Action Cost:	Flat 1: € 105,000 Flat 2: € 140,000	**MAKING-CITY budget:**	Flat 1: € 50,000 Flat 2: € 67,000
The mentioned costs are expected values.			

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18)

PESTEL Analysis (Barriers / Enablers)	
Political	How favourable is BIPV, as part of the urban structural design
Economic	BIPV is more expensive compared to regular PV
Social	N.A.
Technical	Can the building hold that amount of PV panels on the vertical walls.
Environmental	How much CO2 emissions are reduced
Legal	Which rules apply, for instance PV higher than 5 metres to prevent vandalism.

A13: BIPV in terraced houses (0.51 kWp) GPO

Technical Description			
As has been explained in [A2] description, the demo houses have not been selected yet, as well as the different scenarios. Therefore none advances have been done during this year and more updates will be provided in next version of this deliverable.			
Nominal Power:	0.51 kWp		
Panels installed:	6.6 m2	**Other linked actions:**	[A2]
Energy production:	510 kwh		

A14: BIPV in Powerhouse (60 kWp) WAM

Technical Description			
After discussions with the investors and architect it proved it is not possible to implement this action. Even with subsidy it is not possible to realize a positive business case for this building, apart from the unwanted aesthetical changes of the building. It is proposed to be substituted by conventional PV solution on the top of the building. In this case a total of 164 panels (300 Wp each, total 49.2 kWp) is expected to be installed on the building, this should provide roughly 42,000 kWh/y. The BIPV budget would then no longer be needed for this action and might be used for alternative measures.			
Nominal Power	49.2 kWp		
Panels installed	164 panels	**Other linked actions:**	[A3]
Energy production	42,000 kwh/y		

A15: Floating solar pontoons (156 kWp) GRO

Technical Description			
In the surrounding area of the Sport Complex building [A6] floating solar pontoons are planned. 180 panels (156 kWp) are allocated. These very innovative doubled-sized floating panels will make full use of the reflecting properties of the water allowing the usage of two-sided solar panels increasing the yield of solar power. Originally the channel behind the building was foreseen as appropriate location, but this was not approved because of interference with shipping lanes. Two alternative locations are being explored. Several appropriate companies have been consulted. The intention is to implement more panels than was originally considered in order to maximize the solar energy production and to make a more solid business case. The implementation is slightly delayed because of the drawback regarding the location.			
Nominal power	156 kWp		
Panels	180 panels/600 m2	**Other linked actions:**	[A6]
Energy production	133 MWh/y		

Status of the action				
Design phase	25%			
Equipment selection	25%			
Installation				
Starting up				
Monitoring				

Management structure			
Action Leader:	GRO		
MAKING-CTIY partners involved:	-		
Other key stakeholders involved:			
Financial Plan & Business Models			
Action Cost:	€ 217,000	MAKING-CITY budget:	€ 105,000

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

The city of Groningen is investigating the possibilities of exploiting RES in public area's and reinvesting the profits in the district energy planning measures.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	Competition between building, energy and environmental department.
Economic	
Social	It is preferred that the profits are reinvested in district energy measures.
Technical	Building on water can be done, but is also a challenge
Environmental	Can be both an enabler and barrier. The goal is building with nature.
Legal	

A16: SolaRoad (70 kWp) GRO

Technical Description

The implementation of the SolaRoad is planned to be in parallel with the construction of a new bicycle lane that is also planned in the area. New to this is the desire that also small motorised vehicles should be able to pass the lane. Several companies have been consulted about the implementation and although the BC seems very negative at the moment, the action is still preferred to continue as planned, also because of the interesting research perspectives and the final potential of using infrastructure not only for transport, but also for energy generation.

Nominal power	70 kWp	Other linked actions:	[A6]
Panels installed	595 m2		
Energy production	59.5 MWh/y		

Status of the action				
Design phase		50%		
Equipment selection				
Installation				
Starting up				
Monitoring				

Management structure	
Action Leader:	GRO
MAKING-CTIY partners involved:	
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	€ 816,000	MAKING-CITY budget:	€ 408,000

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	Enabler
Economic	Poor BC
Social	
Technical	Interesting research potential
Environmental	Double use of space, no need for asphalt
Legal	Possible need for more heavy vehicles

A17: PVT in Nijestee (50 kWp) NIJ

Technical Description
It is currently being investigated whether it is possible to install PVT panels on the roof of both flats. There is room for this on the roof. See also action A1. Around 10 or 12 PVT panels can be installed, so 50 kWp is not achieved with this.

Nominal power flat 1 Nominal power flat 2	25 kWp 25 kWp	Other linked actions:	[A1], [A9], [A28]
Panels installed flat 1 Panels installed flat 2	166 m2 166 m2		
Energy production flat 1 Energy production flat 2	26 MWh/y 26 MWh/y		

Status of the action				
Design phase		50%		
Equipment selection	25%			
Installation				
Starting up				
Monitoring				

Management structure	
Action Leader:	NIJ
MAKING-CTIY partners involved:	
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	€ 120,000	MAKING-CITY budget:	€ 81,000

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	
Economic	
Social	
Technical	
Environmental	
Legal	

A18: PVT in terraced houses (1.76 kWp) GPO

Technical Description			
As has been explained in [A2] description, the demo houses have not been selected yet, as well as the different scenarios. Therefore none advances have been done during this year and more updates will be provided in next version of this deliverable.			
Nominal power	1.8 kWp		
Panels installed	7 m2	**Other linked actions:**	[A2]
Energy production	850 kWh/y		

A19: Ridge boiler in terraced houses GPO

Technical Description			
As has been explained in [A2] description, the demo houses have not been selected yet, as well as the different scenarios. Therefore none advances have been done during this year and more updates will be provided in next version of this deliverable. The ridge boiler is an innovation that did not make it to the consumer market, so will be replaced by another innovation.			
Nominal power	1.8 kWp		
Panels installed	7 m2	**Other linked actions:**	[A2]
Energy production	850 kWh/y		

A20: PVT in Sport Complex (54.8 kWp) GRO, WAR

Technical Description
The 88 (200 m2) PVT panels (type: PowerCollectors) have been placed on top of the sport complex building by Solaris. Both heat and electricity is generated. These types of innovative solar collectors generate 3 times as much energy compared to regular PV. The heat production is mainly used for the balance of the geothermal district heating system and thereby contributes to the RES of the district heating system. The generated electricity is used for the energy balance of the building.

Figure 12: PVT on top of the Sport Complex Europapark building.

Nominal Power	Heat: 114 kWp Electricity: 22.8 kWp	Other linked actions:	[A6], [A27], [A40]
Panels installed	88 panels, 200 m2		
Energy production	Heat: 71.2 MWh/y Electricity: 17.6 MWh/y		
Reduced CO2 emissions	44 ton CO2		

Status of the action				
Design phase				100%
Equipment selection				100%
Installation				100%
Starting up				100%
Monitoring (in Making City)		50%		

Management structure	
Action Leader:	GRO
MAKING-CTIY partners involved:	GPO
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	To be included	MAKING-CITY budget:	None

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	Enabler
Economic	Positive BC
Social	
Technical	Very interesting connection with geothermal heat pump system. Optimal use of space.
Environmental	Avoids CO2 emissions
Legal	

A21: PVT in Mediacentrale (31 kWp) WAM

Technical Description			
At the moment it is uncertain whether or not PVT provides a suitable business case for the investors of WAM. Not realizing PVT would cause a loss of 26,400 kWh_e and 122,160 kWh_h. The heat demand could be covered with the geothermal heat pump system.			
Nominal power	31 kWp electricity		
Panels installed	120 panels 200 m2	**Other linked actions:**	[4]
Energy production	26.4 MWh/y electricity 122.2 MWh/y heat		

Management structure	
Action Leader:	WAM
MAKING-CTIY partners involved:	
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	€ 90,000	**MAKING-CITY budget:**	€ 41,400

A22: PVT in Powerhouse (54.8 kWp) WAM, WAR

Technical Description			
The heat generated by the PVT panels was supposed to be used as source for the heat grid system [A27], [A40]. This is no longer required, meaning this action will no be executed. Checking the initial energy flows it was noticed that the heat generated out of PVT was not part of the calculations and therefore most likely no negative effect on the energy balance is caused. Instead PV will be realized on top of the building.			
Nominal power	54.8 kWp	Other linked actions:	[A3], [A27], [A40]
Panels installed	218 m2		
Energy production	46.6 MWh/y		
Management structure			
Action Leader:	WAM, should be WAR		
MAKING-CTIY partners involved:			
Other key stakeholders involved:			
Financial Plan & Business Models			
Action Cost:	€ 80,000	MAKING-CITY budget:	€ 33,000
The budget is allocated to WAR and will not be invested for this action.			

A23: Acoustic Air heat pump in terraced house (20 kW) GPO

Technical Description			
As has been explained in [A2] description, the demo houses have not been selected yet, as well as the different scenarios. Therefore none advances have been done during this year and more updates will be provided in next version of this deliverable. Very recently the City of Groningen conducted a research towards the noise of heat pumps and the effects on neighbours. There is a fair change that sound regulations will be implemented. The need for heat pumps that produce less sound is therefore pregnant. The acoustic heat pump is part of the scenarios.			
Technical Figures [1]:		Other linked actions:	[A2]
Technical Figures [2]:			
Technical Figures [3]:			
Status of the action			
Design phase	25%		

Equipment selection				
Installation				
Starting up				
Monitoring				

Management structure

Action Leader:	GPO
MAKING-CTIY partners involved:	GRO
Other key stakeholders involved:	

Financial Plan & Business Models

Action Cost:	€ 13,000	MAKING-CITY budget:	€ 7000

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

By realising the acoustic heat pump and demonstrating that the sound effects are significantly lower compared to regular heat pump this increases the social acceptance of this action.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	Enabler
Economic	Currently too expensive, but technique has not yet fully penetrated the market.
Social	Reduction of noise
Technical	
Environmental	Reduces CO2 emissions
Legal	Can become an enabler

A24: Acoustic Hybrid heat pump in terraced house (5 kW) GPO

Technical Description	
As has been explained in [A2] description, the demo houses have not been selected yet, as well as the different scenarios. Therefore none advances have been done during this year and more updates will be provided in next version of this deliverable. A hybrid solution is no longer desired, since this would result in the need for natural gas. We strive for a more ambitious solution, for instance a high temperature heat pump. After the alternative scenarios have been finalised, the houses are selected and the homeowners are satisfied with the proposed solution this action can be changed.	
Other linked actions:	[A2]

A25: Geothermal heat pumps for Nijestee (20 kW) NIJ

Technical Description	
This action does not apply because the buildings are connected to the heat network of Warmtestad.	
Other linked actions:	[A27], [A39]

A26: Geothermal heat pumps for Mediacentrale (45 kW) WAM

Technical Description			
The installed geothermal heat pump (A26) has the following characteristics: • Type: Mono source, 45 m3/h. • Temperature: 40-50 °C • Cooling capacity: 665 kW, 532 MWh/y • Heating: capacity 713 kW, 949 MWh/y • Energy demand: Cooling: 531.9 MWh, Heating 845.3 MWh • Energy consumption heat pump system: Cooling: 37,020 kWh/y, Heating: 297,578 kWh/y • Energy reduction: Cooling: 79%, heating: 48%, combined: 57%. • CO2 reduction: Cooling: 65 ton, Heating: 88.2 ton, combined: 153.2 ton. • COP Cooling: out of storage 40, regeneration: 6. COP heating: 4.2 The heat pump is providing 89% of the heating demand of the building. Therefore, the gas installation is still in place. The desire is to add an extra air to air heat pump to cover the last part of the demand.			
Capacity	Cooling: 665 kW Heating: 713 kW	**Other linked actions:**	[A4]
Electricity consumption	Cooling: 37 MWh/y Heating: 298 MWh/y		

Energy consumption reduced	Cooling: 79% Heating: 48%		
COP	Cooling: 6/40 Heating: 4.2		
CO2 emissions reduced	153.2 ton		

Status of the action				
Design phase				100%
Equipment selection				100%
Installation				100%
Starting up				100%
Monitoring				

Management structure	
Action Leader:	WAM
MAKING-CTIY partners involved:	
Other key stakeholders involved:	Xettel Holding BV, Installect Advies B.V., Baja Projecten

Financial Plan & Business Models			
Action Cost:	€ 637,856	MAKING-CITY budget:	?

The investments of a conventional system would be € 302,447, meaning that the extra investments are € 335,409. The energy savings each year compared to the conventional system are € 55,337. By not including NPV the payback period would 6.1 years compared to the conventional system. When a yearly energy-price increase of 4% (very plausible) is considered the extra costs of the system can be recovered after 5.4 years. (Not included the lifetime of the system, which is 25 years, while a conventional system has a lifespan of 15 years).

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	
Economic	A positive BC
Social	

Technical	
Environmental	Large reduction in CO2 emissions
Legal	

A27: Geothermal District Heating WAR

Technical Description

Two District Heating systems based on RES are located in PED North and PED South and will be the main responsible to supply thermal energy to the buildings located in both PEDs.

<u>District heating network PED North:</u>

The most ambitious, most complex investment project of WarmteStad is the so-called: Warmtenet Noordwest project. Within Warmtenet Noordwest some 10,000 – 12,000 households equivalents will be supplied with sustainable heat via an alternative heating district network. WarmteStad has already started with the construction of the network. In 2017 the first part is realized in the Zernike part. The district heating network is currently extended to the Paddepoel neighborhood. The network will be connected to several residential buildings.

At the end of the summer in 2018 the national mining authority (SodM) decided to refuse the permit for the use of geothermal energy at a depth of roughly 3 km. The SodM was not 100% sure about the interference risks with the Groningen gas field, which is nearby. This was a major drawback for the City of Groningen, but luckily it was already decided that the district heating network was to be rolled out and contracts were already signed.

In June 2019 the City council and water company decided that the new renewable local energy source will be waste heat from two datacenters (Bytesnet and QTS). In October 2019 WarmteStad, the City council and the water company signed the contract for financing the construction of the whole district heating network including the sustainable heating source.

The two datacenters are both situated in the North PED district just across the original location of the geothermal energy source. WarmteStad receives according to forecasts 1,5 MW waste heat from with a temperature of 23°C. WarmteStad extracts 5°C of the waste heat which is used to raise the return water of the district heating from 50 °C up to 75 °C by using Heat pumps. If necessary during the winter we can raise the temperature up to 90 °C by using a CHP and/or gas boilers.

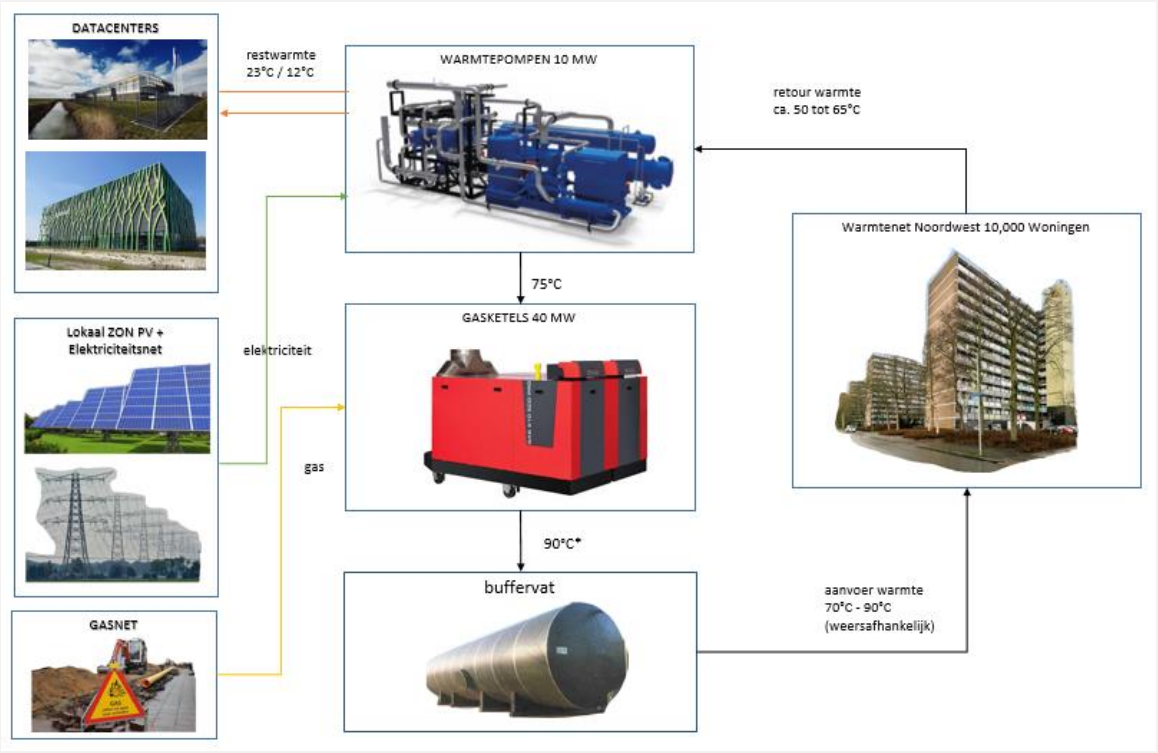

Figure 13: Schematic overview district heating network North PED.

Figure 14: Construction of heating grid next to Nijestee flat 1.

ATES network PED South

Another project within WarmteStad's portfolio that has been realized is an aquifer thermal energy storage system (ATES) at the business park, Europapark. The project is started in 2014 and has been expanded each year since. Via a collective system for the entire business park, excess heat in the summer is stored in the groundwater for beneficial use in the winter. During the winter the process is reversed and the stored heat is used to heat the buildings while the excess cold is stored for use in the summer. WarmteStad is currently providing heat and cold for six major buildings, indicated with the red numbers on the map below. The two green buildings (including Powerhouse), will be connected to the ATES within the next half year.

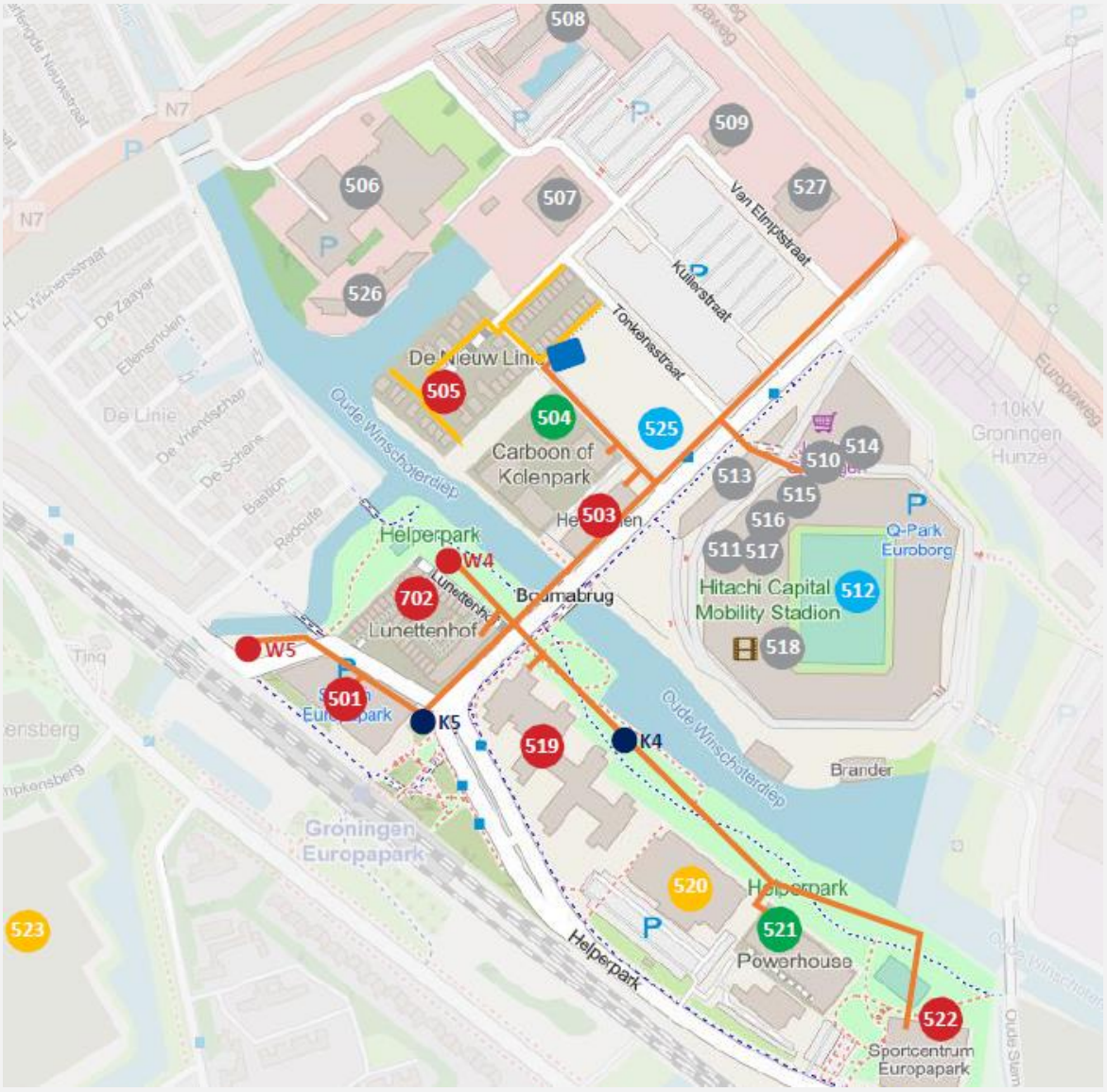

Figure 15: The district heating grid in the Southeast PED area.

Technical Figures [1]:		Other linked actions:	[A39], [A40]
Technical Figures [2]:			
Technical Figures [3]:			

Status of the action				
Design phase			75%	
Equipment selection		30%		
Installation	20%			
Starting up	15%			
Monitoring				

Management structure			
Action Leader:	WAR		
MAKING-CTIY partners involved:	NIJ / WAM / GRO		
Other key stakeholders involved:			
Financial Plan & Business Models			
Action Cost:		**MAKING-CITY budget:**	

For the district heating project in the PED North WarmteStad made a business case. The business case is about the heating distribution network, connecting buildings, peak- and backup facility and the production of sustainable heat. The business case is also external reviewed and agreed by our shareholders. For the additional budgets for funding WarmteStad will use funds of the shareholders and external funding. The investments comply with the Dutch and the European procurement rules.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

Many general information meetings were held during the preparation of the project. In addition, intensive coordination is taking place with the building owners. The aim is to properly and clearly inform residents about the activities and to give them the opportunity to ask their questions. Ultimately it is the choice of building owners to switch to a sustainable heating method. In practice, nothing will change for the residents, except that they will receive an invoice from Warmtestad in the future.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	In this project the local government and the local politics are involved. Social unrest can lead to political questions. In this project questions from politicians are answered adequately (at the moment there is no open question/ barrier).
Economic	The energy transition involves high costs. This requires investments from building owners, external financiers and from the heat company itself.
Social	The population is increasingly aware of the fact that something needs to change and we need to combat the climate change. A positive trend is gradually emerging. Our customers understand why this project is needed.
Technical	In general there can be more innovative techniques we don't know yet, which are better than the technique we will use. But this is for now no issue.
Environmental	With this project we will reduce the CO2 footprint.

Legal	In the exploitation of our project we have to operate under the national heat law. In general this law is for protecting consumers for monopoly on heat. The coming years the law will change. The challenge is to be compliant to this law. For now we do comply.

A28: Neighbourhood electro storage facility-(600 kWh) NIJ

Technical Description			
It is being investigated whether it is interesting to make an electricity storage. This will depend on the revenues from the pv and pvt panels.			
Other linked actions:	[A1]		
Management structure			
Action Leader:	NIJ		
MAKING-CTIY partners involved:	GRO		
Other key stakeholders involved:	Enexis (distribution system operator)		
Financial Plan & Business Models			
Action Cost:	€ 140,000	**MAKING-CITY budget:**	€ 97,000
Even by a great deal of support from the project the BC is difficult, since no direct profits can be earned out of storage solutions.			
Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action			
Potentially, neighbourhood energy can be stored and shared later.			
KPIs for the Evaluation of the Action			
To be updated for the final version, after finalising the KPIs in D5.2 (M18).			
PESTEL Analysis (Barriers / Enablers)			
Political			
Economic	Difficult		
Social	Can become an enabler		
Technical	Location is needed. Solution is very beneficial for net balancing.		
Environmental			
Legal	How to bill and share energy without paying the usual energy taxes.		

A29: Thermal storage in Nijestee NIJ

Technical Description			
Both flats are connected to the Warmtestad heating network. Together with Warmtestad, it is being investigated whether it is possible to connect the flats on the return pipe of the Warmtestad network in order to save energy. When this can be realized thermal storage might become interesting. This also affects the implementation of the heatmatcher, which is only useful when multiple heat sources are present that can be tuned. Storage also applies to the PVT when this can be installed with suitable volumes.			
Other linked actions:		[A1], [A9], [A17], [A25]	
Management structure			
Action Leader:	NIJ		
MAKING-CTIY partners involved:	WAR		
Other key stakeholders involved:			
Financial Plan & Business Models			
Action Cost:	€ 23,000	**MAKING-CITY budget:**	€ 14,000
No yet considered			
Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action			
N.A.			
KPIs for the Evaluation of the Action			
To be updated for the final version, after finalising the KPIs in D5.2 (M18).			
PESTEL Analysis (Barriers / Enablers)			
Political			
Economic			
Social			
Technical			
Environmental			
Legal			

A30: Thermal storage in Mediacentrale WAM

Technical Description	
The added value of this action needs to be research further. Possibly in combination with the heatmatcher this action becomes feasible.	
Other linked actions:	[A4], [A10], [A21], [A26]

A31: High pressure waste water digester (250,000 kWh/yr) GRO

Technical Description	
High pressure digester: After investigating the environmental and safety requirements of building such an installation it was decided that this specific technique might not be suited for this area. The technique will now be tested at the Waddeneiland Texel on the same location as the local waste water treatment facility. Not realising this action will affect the impact of the project. Therefore alternatives are being investigated. Currently, the potential for energy generation out of local food wastes is considered. Waste water adjustment: The action implied to reconfigure the complete drain pipe system in the building, thus demolishing large parts of the building construction. This deemed not realistic and far too expensive for such a small impact. This technique is very much suited for newly constructed building. In a different disctrict in the City this technique is being implemented in several new houses. The so called grey and black water streams (added with the food waste crusher residue) are separated, and the black water is used to generate biogas from, while the grey water is filtered by using a helofytenfilter after which the water can be disposed as surface water.	
Other linked actions:	[A3], [A4], [A6]

3.3 Other Technical Actions

A32: Modelling, simulation, adapting & validation of planned innovations TNO

Technical Description
For [A32], the ESDL modelling language will be used to model the innovations. This enables modelers to formally describe energy system at the start of the project, and any alterations defined by the actions in the PED. The ESDL models will be used as the input for the ESSIM simulation environment which will provide the expected effect of the innovations as planned, but also on the effects of any other potential scenario. For this reason the following 5 scenario's are planned: 1. The *baseline scenario* is defined by the energy system as it is in reality before the start of the project. 2. The *planned scenario* is defined by the plans as originally were envisioned in the project proposal 3. The *project scenario* is the scenario as how the interventions actually will be carried out according to any changes or updates in the plan 4. The *zero-usage* scenario is the minimal scenario which would lead to a zero-energy consumption district 5. The *dream scenario* is a hypothetical scenario in which the perfect system would be deployed in which the best possible interventions would be implemented
Other linked actions:

Status of the action				
Design phase			90%	
Equipment selection			75%	
Installation		50%		
Starting up				
Monitoring				

Management structure	
Action Leader:	04 TNO
MAKING-CTIY partners involved:	
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:		MAKING-CITY budget:	

The models of the energy district will provide valuable insight in which interventions will be most cost effective. The different scenarios allow the tools to be validated, creating a more reliable tool to make more informed decisions for (future) PEDs.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
Publishing the results of the simulations leads to a greater insight in why certain interventions are done, leading to more involved citizens.

KPIs for the Evaluation of the Action	
Citizen consciousness	

PESTEL Analysis (Barriers / Enablers)	
Political	Data is key for accurate modelling. There may be political reasons why some data might not be available
Economic	
Social	
Technical	Computational complexity of simulations is not expected to be an issue
Environmental	
Legal	Data is key for accurate modelling. There may be legal reasons why some data might not be available

A33: 14 Smart charging stations GRO, NIJ

Technical Description
In the south PED 10 smart charging station are allocated to WAM. Realizing these smart charging has no priority at the moment for WAM. GRO had the opportunity to realize 10 smart load balancing charging stations within the PED area. This was realized in 2019. The other 4 smart charging station are planned in the North PED. Many discussions have been held about the location and functionality. Currently, it is foreseen that 2 stations could be connected to the grid connection of the elevators of the apartment buildings. The elevators at the Nijestee flat (as most flats) have a extended connected to the grid, while the full capacity is used very little. Thus, by connecting the charging station to the elevators it is potentially possible to prevent extra stress on the electricity grid. The other 2 stations in the North PED have not yet been allocated. It was suggested to introduce a social electric taxi that can be used for car sharing, but also to facility the elderly to be transported from A to B, this would mean a more social innovation rather than a technical innovation.

Other linked actions:	[A1], [A4]

Status of the action				
Design phase		60%		
Equipment selection		50%		
Installation		50%		
Starting up		50%		
Monitoring				

Management structure	
Action Leader:	GRO
MAKING-CTIY partners involved:	GPO, NIJ, WAM
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	€ 57,000 (10 charging stations Souteast PED)	MAKING-CITY budget:	€ 5400

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	It is expected that electric driving will increase significantly and therefore solid solutions are necessary
Economic	Charging stations are a service, not a valid BC
Social	Implementing more public charging stations lowers the threshold for EV
Technical	Connection to the distribution system network is a challenge. For most the capacity of the network
Environmental	
Legal	Who is the network aggregator? Can the charging station owner make a profit when they assist the DSO in balancing?

A34: Connection of the charging stations to the local demand response system CGI

Technical Description

The platform provided by the operator of the charging stations will be connected to the Urban Data Platform of Groningen. Data will be collected about energy consumption and charging cycles. The charging stations are expected to support dynamic charging based on the available energy flexibility available in the local energy system. Where needed, the operator platform will be provided with the required flexibility information via the Urban Data Platform [A35].

Other linked actions:	[A1-6], [A33]

Status of the action

Design phase		50%		
Equipment selection	25%			
Installation				
Starting up				
Monitoring				

Management structure

Action Leader:	09 CGI
MAKING-CITY partners involved:	03 GRO
Other key stakeholders involved:	

GRO in the lead for the placement of the charging poles and selection of the operator [A33]. CGI will then discuss integration options with the operator.

Financial Plan & Business Models

Action Cost:	€ 25.000	**MAKING-CITY budget:**	€ 25.000

PM budget

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	Locations for the charging poles.
Economic	The urban data platform can be expanded for other data.
Social	Increase awareness of EV.
Technical	Data standardization.
Environmental	Facilitate switch from ICE to EV.
Legal	GDPR compliance is necessary.

A35: Open urban platform adaptation GRO

Technical Description

The existing data platform will be integrated with other platforms as part of the MAKING-CITY project to create an Urban Data Platform storing and publishing any Open Data created as part of the project.

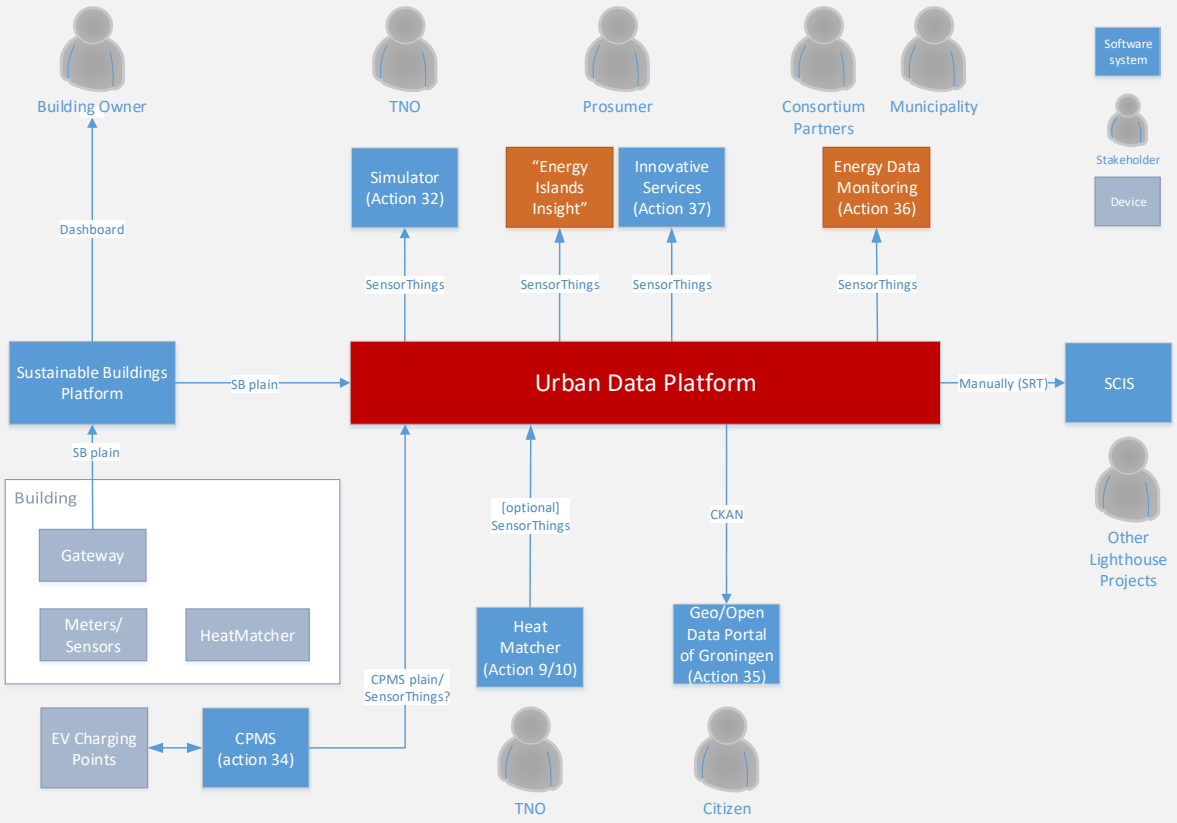

Figure 16: Schematic overview of Urban data platform.

Other linked actions:	[A1-A6], [A36], [A37], [A46]

Status of the action				
Design phase			75%	
Equipment selection			75%	
Installation		50%		
Starting up		50%		
Monitoring			75%	

Management structure	
Action Leader:	03 GRO
MAKING-CTIY partners involved:	09 CGI
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:		MAKING-CITY budget:	

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
N.A.

KPIs for the Evaluation of the Action	
Open Data in the city	

PESTEL Analysis (Barriers / Enablers)	
Political	Municipality owner of data generated in the city.
Economic	The urban data platform can be expanded for other data.
Social	Increase awareness data available in the city.
Technical	Data standardization.
Environmental	-
Legal	GDPR compliance is necessary.

A36: Energy data monitoring of PED CGI

Technical Description

As part of task 3.7.1 the existing Energy Islands platform created by CGI is adapted and integrated with other ICT platforms in Groningen to create an Urban Data Platform. The purpose of the Urban Data Platform [A35] is to collect relevant data about the city and make it available to stakeholders in the city via standardized interfaces.

The measurements by Sustainable Buildings are aggregated by the Energy Islands platform to enable monitoring of the PED and calculation of the Project KPIs. The objective is to provide information for the city planners, policy makers and decision makers to help them in the definition of strategies to upscale the concept of PED in other places of the city.

Other linked actions:	[A1-A6], [A35]

Status of the action

Design phase				100%
Equipment selection			75%	
Installation	25%			
Starting up	25%			
Monitoring	0%			

Management structure

Action Leader:	09 CGI
MAKING-CITY partners involved:	10 SB / 04 TNO / 03 GRO
Other key stakeholders involved:	

Financial Plan & Business Models

Action Cost:	€ 200.000 (including previous investments)	**MAKING-CITY budget:**	€ 80.000

CGI's vision for the energy market in the Netherlands involves a shift to locally balanced energy systems and the Energy Islands platform is created to support this development. With the consumption based model of the cloud, Energy Islands is suitable for small-scale demonstrations, but scalable to city level when needed.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action	
Energy Consumption	
Energy Savings	
Flexibility	

PESTEL Analysis (Barriers / Enablers)	
Political	Municipality owner of data generated in the city.
Economic	Investment in urban data platform needed.
Social	Increase awareness of the impact of the PEDs.
Technical	Scalable platform needed.
Environmental	-
Legal	GDPR compliance is necessary.

A37: Integration of new services to the data platform CGI

Technical Description

As part of task 3.7.1 the existing ICT platforms in Groningen are adapted and integrated to create an Urban Data Platform. The purpose of the Urban Data Platform [A35] is to collect relevant data about the city and make it available to stakeholders in the city via standardized interfaces. It enables services built on these standards to be used within the city.

For more information see deliverable D3.20.

Expected services: Sustainable Buildings data collection and analysis, TNO EDSL and ESSIM simulations, Groningen Open Data Portal, CGI Energy Islands Insights.

Other liked actions:	[A35], [A36]

Status of the action				
Design phase				100%
Equipment selection				100%
Installation	25%			
Starting up	25%			
Monitoring	25%			

Management structure	
Action Leader:	09 CGI
MAKING-CTIY partners	10 SB / 04 TNO / 03 GRO

involved:			
Other key stakeholders involved:			
Financial Plan & Business Models			
Action Cost:	?	MAKING-CITY budget:	€ 25.000

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	Enables new services in the city for citizens.
Economic	Created services can be monetized.
Social	Services generate awareness about PEDs.
Technical	Adhering standards ensure the collected data is easily accessible.
Environmental	-
Legal	Data ownership with the municipality.

A38: Installation of IoT infra TNO

Technical Description

This action has not been worked on in the first year.

A39: Adjust geothermal district heating for using low temperature WAR

Technical Description

The geothermal district heating network in Groningen NORTH [A27] is initially designed as a high temperature network. However the heating source has been changed to waste heat of datacenters instead of geothermal energy. The district heating network has been adjusted to an high to medium temperature district heating network. This means that the temperature would be approximately 75 °C in summer and up to 90 °C during cold days in the winter.

To connect the retrofitted buildings of Nijestee to a high temperature heating network instead of gas, the existing local heating system has to be adjusted by installing a mix heat transformer. This innovated mix injection will be used to control the supply temperature to the apartments of Nijestee buildings independently from the supply temperature of the heat grid.

The connection between the heat grid and the retrofitted buildings of Nijestee has been made last month. The last adjustments on the local heating system are currently made. WarmteStad will provide heat for the retrofitted buildings of Nijestee from the beginning of next year.

Grunneger Power (GPO) is developing its own community owned heat network for the terraced houses in the PED North area. It is expected that at the end of 2019 a final decision can be made about this new heat grid.

Other linked actions:	[A1], [A2], [A27]

Status of the action

Design phase				100%
Equipment selection				100%
Installation			80%	
Starting up				
Monitoring				

Management structure

Action Leader:	03a WAR
MAKING-CTIY partners involved:	08 NIJ
Other key stakeholders involved:	

Financial Plan & Business Models

Action Cost:	€ 354.000 (estimate)	**MAKING-CITY budget:**	€ 78.000 (estimate)

For the district heating project WarmteStad did made a business case. The business case is about the heating distribution network, connecting buildings, peak- and backup facility and the production of sustainable heat. The BC is also external reviewed and agreed by our shareholders. For the additional budgets for funding WarmteStad will use funds of the shareholders and external funding. The investments comply with the Dutch and the European procurement rules.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

Many general information meetings were held during the preparation of the project. In addition, intensive coordination is taking place with the datacentres. The aim is to make a successful project and to extract the waste heat out of the datacentres. For citizens it's most important to know that the heat is sustainable and for the consumers that the heat is payable at the end.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	In this project the local government and the local politics are involved. Social unrest can lead to political questions. In this project questions from politicians are answered adequately. At the moment there is no open question/ barrier.
Economic	The energy transition involves high costs. This requires investments from building owners, external financiers and from the heat company itself.
Social	The population is increasingly aware of the fact that something needs to change and we need to combat the climat change. A positive trend is gradually emerging. Our customers understand why this project is needed.
Technical	In general there can be more innovative techniques we don't know yet, which are better than the technique we will use.
Environmental	With this project we will reduce the CO2 footprint. The switch from geothermal to residual heat has also increased the reduction of CO2.
Legal	In the exploitation of our project we have to operate under the national heat law. In general this law is for protecting consumers for monopoly on heat. The coming years the law will change. The challenge is to be compliant to this law. For now we do comply.

A40: Connection to the low temperature district heat WAR

Technical Description

In the PED South a collective aquifer thermal energy system (ATES) will be connected to a ground source heat pump of the Powerhouse and the Sportscomplex. WarmteStad is not going to realize a connection for the Mediacentrale. Mediacentrale realized its own geothermal heat pump connection with its own independent ground source.

WarmteStad made for both the Sportscomplex and Powerhouse WarmteStad a connection with the ATES. In order to switch between groundwater for heating and groundwater for cooling a wheatstone bridge is installed. The groundwater is subsequently used as a source for the heat pumps or directly for passive cooling.

WarmteStad has installed for both projects a high efficiency high-temperature heat pump. In the Sportscomplex are two heat pumps installed. One heat pump for central heating (weather-dependent controlled temperature between 35 °C and 45 °C) and one for domestic hot water production (65 °C). In the Powerhouse project is one heat pump installed for both central heating and domestic hot water production (65 °C). Despite the large temperature difference, the heat pump works very efficient.

Technical data Sportscomplex

Heat pump central heating
Brand: Simaka
Type: Simatron WP 201/2 WW- R407C
Heating power: 200 kW
COP W10/W35: 6,02
COP W10/W45: 4,61

Heat pump domestic hot water production
Brand: Simaka
Type: Simatron WP 50/2 WW- R134a
Heating power: 50 kW
COP W10/W65: 4,0

Central heating:
Expected energy consumption using a heat pump: 61.043 kWh
Expected energy consumption using a traditional gas boiler: 36.932 m^3 natural gas
Avoided CO_2 emissions in comparison with a traditional gas boiler: 37.323 kg CO_2

Domestic hot water production:
Expected energy consumption using a heat pump: 32.847 kWh
Expected energy consumption using a traditional gas boiler: 16.826 m^3 natural gas
Avoided CO_2 emissions in comparison with a traditional gas boiler: 14.354 kg CO_2

Cooling
Expected energy consumption using groundwater: 7.931 kWh
Expected energy use with traditional air-conditioning system: 63.444 kWh
Avoided CO_2 emissions in comparison with an air-conditioning system: 29.200 kg CO_2

Total avoided CO_2 emissions in comparison with traditional systems: 80.877 kg CO_2

Figure 17: Heat pump and heat exchanger Sportscomplex (October 2018).

Technical data Powerhouse

Heat pump central heating and domestic hot water production
Brand: Alpha Innotec
Type: SWP 850H
Heating power: 3 x 100 kW
COP W10/W65: 2,9

Central heating:
Expected energy consumption using a heat pump: 120.690 kWh
Expected energy consumption using a traditional gas boiler: 39.841 m^3 natural gas
Avoided CO_2 emissions in comparison with a traditional gas boiler: 11.418 kg CO_2

Domestic hot water production:
Expected energy consumption using a heat pump: 62.739 kWh
Expected energy consumption using a traditional gas boiler: 23.300 m^3 natural gas
Avoided CO_2 emissions in comparison with a traditional gas boiler: 10.802 kg CO_2

Cooling
Expected energy consumption using groundwater: 3.681 kWh
Expected energy use with traditional air-conditioning system: 29.444 kWh
Avoided CO_2 emissions in comparison with an air-conditioning system: 13.552 kg CO_2

Total avoided CO_2 emissions in comparison with traditional systems: 35.722 kg CO_2

Figure 18: Heat pumps and heat exchanger Powerhouse before installation (October 2019).

Energy consumption combined: heating, DHS, cooling	187 MWh [A3] 102 MWh [A6]	Other linked actions:	[A3], [A6], [A20], [A22], [A27]
CO2 emissions avoided	133 ton [A3] 36 ton [A6]		

Status of the action				
Design phase				100%
Equipment selection				100%
Installation			75%	
Starting up		50%		
Monitoring				

Management structure	
Action Leader:	03a WAR
MAKING-CTIY partners involved:	03 GRO / 07 WAM
Other key stakeholders involved:	

Financial Plan & Business Models			
Action Cost:	€ 548.000	MAKING-CITY budget:	€ 23.550

For each building to connect to the low temperature district heating network WarmteStad makes a business case with socially responsible return. The BC is part of an investment decision by our shareholders. For the additional budgets for funding WarmteStad will use funds of the shareholders. The investments comply with the Dutch and the European procurement rules. The financial payback period has been calculated to be 12 years, by applying a ROI of 6.5%.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

In this project we only connect newly realised projects. So there are no customers beforehand. Many general information meetings were held during the preparation of the project. When the pipes are going into the ground we inform the neighbourhood about the nuisance they may experience. The aim is to properly and clearly inform residents about the activities and to give them the opportunity to ask their questions. Ultimately it is the choice of building owners to switch to a sustainable heating method and with them we make contracts.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	In this project the local government and the local politics are involved. Social unrest can lead to political questions. In this project questions from politicians are answered adequately. At the moment there is no open question/ barrier).
Economic	The energy transition involves high costs. This requires investments from building owners, external financiers and from the heat company itself.
Social	The population is increasingly aware of the fact that something needs to change and we need to combat the climate change. A positive trend is gradually emerging. Our customers understand why this project is needed. That helps us a lot.
Technical	In general there can be more innovative techniques we don't know yet, which are better than the technique we will use. But this is for now no issue.
Environmental	With this project we will reduce the CO2 footprint.
Legal	In the exploitation of our project we have to operate under the national heat law. In general this law is for protecting consumers for monopoly on heat. The coming years the law will change. The challenge is to be compliant to this law. For now we do comply.

3.4 Non-Technical Actions

A41: New 2050 Groningen Vision GRO

Technical Description
The City of Groningen has developed the City vision towards 2030 in 2018 which provides the basic input for the 2050 city vision. The activities carried out in WP1 task 1.1 (D1.1 and D1.21) are used as starting point for the new process. Task 1.1 provided insights into the current way of working and organizational structure of the urban planning department.

Other linked actions:	[A42], [A43], [A44], [A45], [A48], [A49], [A50], [A51]

Status of the action				
Design phase	10%			
Starting up				
Monitoring				

Management structure	
Action Leader:	GRO
MAKING-CTIY partners involved:	RUG, TNO, GPO, HUAS
Other key stakeholders involved:	

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
The new citizen engagement strategy that is described in D3.23 will finally be used as input for the City vision on how to involve citizens and to which degree.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	For politics it is difficult to make a vision for such a long term. The current 2030 has a great deal of political support, which makes this an enabler. [A43] will take city policies into account.
Economic	Can both be an enabler and barrier. Not necessarily during the development of the vision, but rather during the path towards 2050 when the City might flourish economically, but this cannot be predicted. New business models are part of [A45].
Social	This is one of the most important indicator for the City of Groningen. Everything that is developed in the City finally is meant to serve its inhabitants. [A50] and [A51] are all about

	social research.
Technical	From the energy perspective the solution is not so much technical, but rather that the technique required is much more expensive compared to the traditional system. Therefore, regulations should be altered to make large scale implementation possible.
Environmental	This is an important motive for transition, but not without social support and not at every cost.
Legal	Legal barriers are a major constrain in the large scale implementation. The current system is protected very strictly (of course), but other solutions will be supported legally at some point. [A48] is closely related to this.

A42: SECAP monitoring and update of actions GRO

Technical Description
Not worked on in 2019

A43: City Policies Update (taxes, subsidies) GRO

Technical Description					
Task 1.1 is focused on analysing the current policies and organisation in the City. This resulted in D1.1 and D1.23 that provides the first indicators on how the City could adapt its policy in order to better facilitate the transition pathway and contribute to the new 2050 City vision [A41]. This specific action has been worked on in 2019.					
Other linked actions:	[A41]				
Status of the action					
Design phase	5%				
Starting up					
Monitoring					
Management structure					
Action Leader:	GRO				
MAKING-CTIY partners involved:	RUG, HUAS, TNO				
Other key stakeholders involved:					

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
The involvement of citizens is of outmost importance.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	Political support is needed, but can be very complicated considering all the different views in the City council.
Economic	Important barrier or enabler. The City uses taxes and subsidies to guide the development of the City into a certain direction.
Social	Crucial, but very complicated.
Technical	
Environmental	Newly suggested policies should effect the environment positively.
Legal	Very complicated

A44: Deployment and evaluation of energy zoning plans GRO

Technical Description

As a result of combining the energy transition ambition with the current and future needs, preferences and limitations of the city expressed at district level, will result in the so-called district energy plans (EZPs). Rather than a one-size-fits-all approach that characterises the energy transition plans that cities (or countries) usually make, these district energy plans are innovative as they take into account local circumstances on both supply as well as demand sides. And also not only solely based on the technical configurations, but also consider social coherence, financial status and the presence of other infrastructural objects.

This year the City has finalised the overall district based strategy and process on how to become carbon neutral by 2035: https://gemeente.groningen.nl/sites/default/files/Strategie-en-aanpak-stap-voor-stap-naar-aardgasvrije-wijken-en-dorpen.pdf
This approach basically follows 4 steps:

1) Analyse the district (district vision)
2) Make choices (district plan)
3) Develop execution plan (district execution plan)
4) Execution phase

Within the districts of Reitdiep, Noorderplantsoenbuurt and Paddepoel (which is part of the North district) the City has experienced how such processes are conducted. Based on this experience the district energy approach was developed. While most districts are just about to start developing a vision (which does not mean there is no implementation at all) the first three are ready for the implementation phase. These districts, together with the South district are representative of the entire city, thereby enabling optimal replication of the project results.

Other linked actions:	[A41], [A43], [A45], [A48], [A50], [A51]

Status of the action

Design phase	25%			
Starting up				
Monitoring				

Management structure

Action Leader:	GRO
MAKING-CTIY partners involved:	GPO, HUAS, TNO, RUG
Other key stakeholders involved:	Citizens, building owners, DSO

Financial Plan & Business Models

Action Cost:	-	**MAKING-CITY budget:**	PM

There is not a single financial strategy or plan in the configuration of the different districts. A major obstacle however is the investment that is needed to transform a single house, building, block of buildings or district. The building owner is responsible for the investment, but in the case of citizens in a many cases unable to make the investment or not willing to invest. The City is investigating different solution to tackle the most important hurdle in the transition.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

Without co-creation and cooperation with citizens the City will not be able to successfully achieve its goals. A lot of effort has been put in to local empowerment the last years and the City wants to intensify this. Therefore, the citizen engagement and empowering strategy has been developed as part of task 3.8.2 and deliverable D3.23. See also action 50, citizen social research.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	Political support is of utmost importance
Economic	Functional financial plans are crucial
Social	Very important
Technical	Important, but rather a fact than barrier
Environmental	Enabler, no barrier. The final goal is becoming more sustainable
Legal	Barrier. For instance the (logical) protection of the Dutch gasgrid

A45: Innovative business models development for PED (e.g. Energy Cooperative) SEV

Technical Description

In this Action, effective business models for different types of districts and solutions will be defined to make these business cases more attractive for both public and private investments. The action allows a joint approach for building refurbishment and to finance, install, own, operate and maintain the onsite energy generation projects. This task has been subdivided into a number of subtasks, all consisting of a type of business model that can be replicated.

Development of business models for homeowners

This business model will be deducted from the interventions on the terraced houses where an energy cooperative representing citizens is aggregating demand and production of green energy. This specific business model has a wide replication potential (in Groningen and other cities).

Energy Exploitation Company

The consortium will develop a concept for a local Energy Exploitation Company (Energie-exploitatie-maatschappij, EEM in Dutch) with two aspects:

- a rationale behind the EEM, by calculating the added value of an integrated approach to energy and other related smart city aspects. The consortium will use the TNO developed Urban Financial Metabolism tool (see also Action 46) to facilitate these calculations.
- an initial structure of the EEM that can serve as a blueprint for replication purposes.

Heat Grid business model including roll-out approach

Heat grids suffer from high initial investments, which decrease willingness to invest. Based on best practices developed in the roll-out by Warmtestad, we will develop business cases and discover early replication potential.

Energy Poverty approach

The consortium will develop business cases with specific attention to the alleviation of energy poverty, based on the use cases in Paddepoel (terraced houses) and the Nijenstee renovation.

Other linked actions:	[A41], [A43], [A44], [A48], [A49], [A51]

Status of the action

Design phase	10%			
Starting up				
Monitoring				

Management structure

Action Leader:	06 SEV
MAKING-CTIY partners involved:	04 TNO / 12 HUAS / 05 GPO / 03 GRO
Other key stakeholders involved:	Buurtwarmte 050

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
The process of developing new business models has to involve citizens. There is a fair chance that co-design sessions will be organised.
KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	
Economic	
Social	Privacy aspects, willingness to cooperate with large projects
Technical	
Environmental	
Legal	Legality of Privacy and data acquisition

A46: Open data business models SEV

Technical Description

Data that is generated in the pilot in Groningen will be analysed and used to load the Urban Financial Metabolism model, which has been developed by TNO. The Urban Financial Metabolism model is a first step in improving cross-domain and cross-actor synergies. UFM provides in-depth insight in the cash flows that run through a neighbourhood and allows to generate societal cost benefit analysis on multiple aspects, such as energy, water, health etc. The hypothesis is that such insight facilitates policy makers and private partners to further align their activities within a neighbourhood an seek for mutual benefits.

The UFM platform will be closely linked to the urban platform and draw from its data [A35].

An example of an UFM-analysis for the municipality of Zwolle can be found in the picture below.

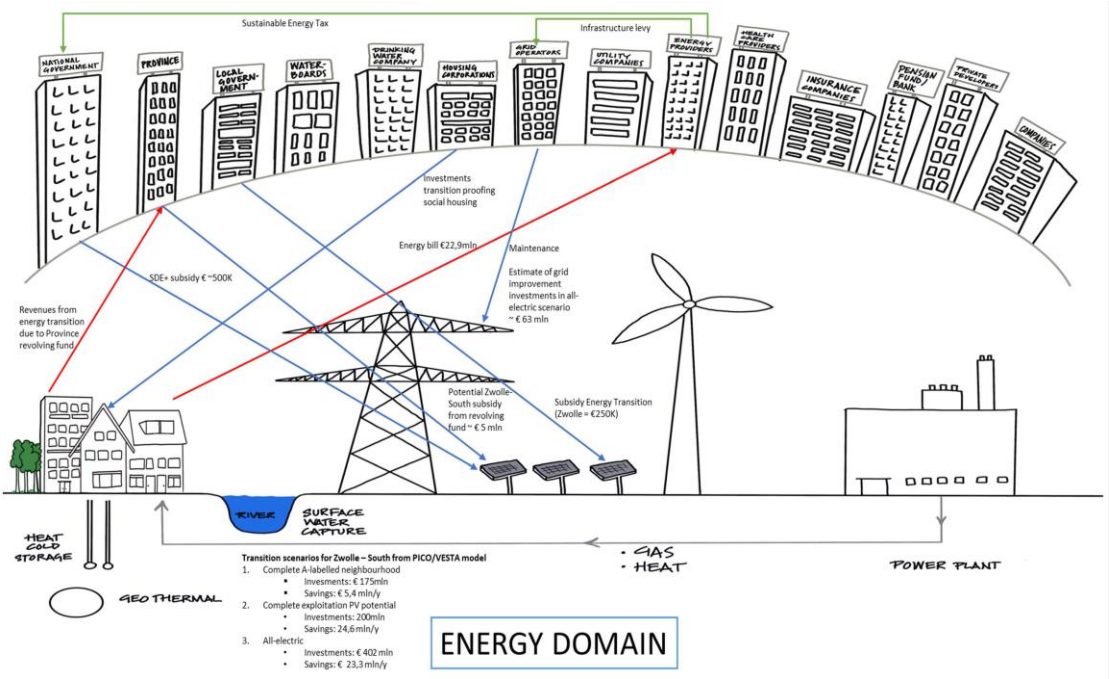

Figure 19: Picture of the UFM model concept.

Other linked actions:	[A35], [A41], [A43], [A45], [A51],

Status of the action

Design phase	25%			
Starting up				
Monitoring				

Management structure

Action Leader:	TNO
MAKING-CTIY partners involved:	SEV, GPO, GRO
Other key stakeholders involved:	

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	
Economic	

Social	
Technical	
Environmental	
Legal	

A47: Blockchain CGI

Technical Description	
Action no longer applicable or relevant for the Groningen PEDs. An alternative action will be proposed in which the main objective of the project is to share power in a real-life environment (Reitdiep district) by using an innovative blockchain platform. In addition, we map out the preconditions (technical, financial, legal, social) for households to exchange energy with each other – including financial transactions - via the public electricity grid by using the blockchain platform. This action will be carried out by GRO, in cooperation with RUG and HUAS.	
Other linked actions:	

Status of the action				
Design phase	25%			
Starting up				
Monitoring				

Management structure	
Action Leader:	Currently CGI, taken over by GRO
MAKING-CTIY partners involved:	RUG
Other key stakeholders involved:	Spectrol

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
The newly proposed action will involve citizens directly. A group of neighbours will test this concept in real life.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	N.A.
Economic	Could potentially benefit both the prosumer and consumer of energy
Social	It causes more social coherence in a district

Technical	Technique is ready. Software might need some more finetuning.
Environmental	N.A.
Legal	Very interesting, sharing energy between neighbours without the involvement of grid taxes. Can this be done and how?

A48: Assessment of legal barriers & solutions GRO

Technical Description

This action is part of task 3.8. The HUAS is investigating legal barriers for the implementation of PED and also more specifically the large scale deployment of carbon neutral solutions. Legal barriers can occur on local, national and European scale. A major barrier in the Netherlands is the inequality between the gas grid and heat grid infrastructure. While the gas grid is socialized, the investments for the heat grid infrastructure needs to be fully covered by the local heat consumers, while both systems provide heat to buildings.

Other linked actions:	[A41], [A43], [A44], [A45], [A51]

Status of the action

Design phase	25%			
Starting up	25%			
Monitoring				

Management structure

Action Leader:	GRO
MAKING-CTIY partners involved:	HUAS
Other key stakeholders involved:	-

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

N.A.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	Can both be an enabler (the more progressive part of the council) and barrier (the more conservative part of the council)
Economic	

Social	
Technical	
Environmental	
Legal	Large scale solutions face major barriers

A49: Standardization of PED and energy balance in districts GRO, TNO

Technical Description

This action aims to develop a standardized concept as well as the calculation method to calculate the annual energy balance. No work has been done for this action so far. First, it has to be proved that the current method is working and adapted according to the results generated.

Other linked actions:	[A32], [A36] and all other technical actions

A50: Citizen social research GRO, GPO

Technical Description

Social-economic data will be collected in order to construct a profile of the neighbourhood(s) to be investigated. In addition, at several checkpoints during the process (still to be determined), data will be collected (but is not limited to) the following areas of interest:

- Significance/implications of the citizen engagement actions to the district.
- The building and maintaining of social relations / networks.
- Perceptions and motivations of the different stakeholders and actors involved (towards the PED, the district and in general).
- Expectations and desires pertaining to energy supply.
- (Cultural) context.
- Role of communication: between stakeholders, within the community, (social) media.
- Identification of challenges, barriers, issues, drivers and conditions.

The data will be used as input for co-creation / citizen engagement activities at several phases within the Cooperative Approach (see next section) resulting in an iterative process, which allows for fine-tuning of the activities according to data collected and feedback received. Examples of activities that might be organised are interactive design workshops/charettes, serious games, participatory mapping, storyboarding and service ecology mapping. In addition, custom tools or activities might also be developed. Ideally, participants would consist of various stakeholder groups, including citizens, local government, members of energy collectives/cooperations, professional (energy) experts, designers and academics.

Parallel during the research, both GPO and GRO will continue assisting (new) initiatives, which results will contribute to the research.

Other linked actions:	[A41], [A44], [A51], [A52], [A53]

Status of the action

Design phase	25%			
Starting up				
Monitoring				

Management structure

Action Leader:	GPO
MAKING-CTIY partners involved:	GRO / HUAS / TNO / RUG
Other key stakeholders involved:	District initiatives (not necessarily energy based)

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

The Cooperative Approach [see also A51] provides a central role for the citizens in the development of the district (energy) plans. The plans can focus on the energy transition, but can also describe the transformation of the district on another level, such as liveability. Along the way, the citizens are coached and trained by professionals in order to enter a level playing field with the municipality and third parties.

KPIs for the Evaluation of the Action

To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)

Political	Energy plan in neighbourhoods need political approval
Economic	The initial financial investment is the largest barrier for citizens. New financial constructions are needed.
Social	Involvement of citizens is crucial in the success of the transition
Technical	Each district needs a differten technical solution.
Environmental	
Legal	Governmental institutions strive for a big support base for energy plans.

A51: Energy communities as part of the district energy transition strategy GRO, GPO

Technical Description	
From the past, the municipality of Groningen (GRO) knows that citizen engagement is an essential aspect to execute any plan that contains change. One type of plans that maybe need citizen engagement the most to achieve a successful execution are the district energy plans. Both GRO and Grunneger Power (GPO) have first-hand experience in this field, collaborating with citizens in districts. GPO has documented this in the 'Cooperative Approach' in which the experience from the past is gathered. All possible barriers (technical and economical, but also social, legal and governmental) are taken into account. The approach does also not only focus on the development of energy communities, but communities within districts. GRO and GPO will start with a list of initiatives that both parties have been collaborating or are collaborating with. Next, they will decide which of the new initiatives they will coach and empower, on a way to create a support base for the district heating plan in the end. Other partners will carefully analyze all actions that will take place. This action is also part of D3.23.	
Other linked actions:	[A41], [A44], [A45], [A50], [A52]

Status of the action				
Design phase	25%			
Starting up				
Monitoring				

Management structure	
Action Leader:	GRO
MAKING-CTIY partners involved:	GPO, HUAS, TNO, RUG
Other key stakeholders involved:	Citizens and local cooperatives

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
This action is all about social innovation.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	Citizen engagement has a strong political support
Economic	N.A.
Social	Most important enabler
Technical	N.A.
Environmental	Not necessarily a factor. Social coherence is sometimes more important.

Legal	How can energy communities organise impact?

A52: City Mentoring GRO

Technical Description

In the course of WP1, and partially in WP8, the most important insights acquired during the project execution in Oulu and Groningen will be selected for a mentoring campaign that will be promoted among the rest of cities participating in the project (Bassano del Grappa, Trencin, Kadıköy, Vidin, Lublin and León). This action aims at fostering the activities of the existing energy working group of the municipality, integrated by staff of different services, to take advantage of the project to develop their capacity in terms of energy innovation through the exchange with other partner cities. Not only the Municipality, but also other members of Oulu and Groningen local team will be selected as mentors so that they can explain in detail their experience and guide about the application of these topics that were identified in the other cities.

The HUAS developed the We-energy game, https://www.we-energy.eu, that creates more awareness and shows the complex playing field in the energy transition goals. This game is ideally played by local stakeholders. During the consortium meeting May in Groningen (2019) this game was played together with some of the cities that are part of the project. It is planned to have a local stakeholder session in each City during consortium meetings.

Other linked actions:	[A41], [A43], [A44], [A45], [A48], [A53]

Status of the action

Design phase	25%			
Starting up				
Monitoring				

Management structure

Action Leader:	GRO
MAKING-CTIY partners involved:	HUAS / GPO / RUG / TNO
Other key stakeholders involved:	-

Financial Plan & Business Models

Action Cost:		MAKING-CITY budget:	

The We-energy game can be a stakeholder engagement business model.

Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action

As part of the City mentoring process Groningen believes citizen engagement and empowering is very important.

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	How to change the organisation to make the transition smoother, as part of WP1
Economic	Show how innovative business models can provide added value, not only direct economic benefits. Part of A45.
Social	Help other Cities with engagement tools
Technical	Show which solution work and which do not
Environmental	Are there possibilities to combine energy measures with for instance adaptation measures.
Legal	EU and national law that is hindering the large scale out roll of solutions.

A53: Policy forum on energy transition GRO

Technical Description
This action has not been worked on so far. First the energy policy analysis is conducted in WP1. The outcomes provided by this analysis will be delivered to local decision makers and stakeholders (incl. citizen) through the development of local policy forum on energy transition where the experiences learned from the project will be transmitted to a wider audience at city scale. Moreover, municipality staff will communicate these insights in international forums.

Other linked actions:	[A43], [A52]

Status of the action				
Design phase				100%
Starting up				
Monitoring				

Management structure	
Action Leader:	GRO
MAKING-CTIY partners involved:	-
Other key stakeholders involved:	-

At this moment none of the other partners are involved. Might be that some can provide support in organising policy forum sessions.
Social Innovation Strategy. Citizens' empowering, Co-design and Co-creation in the action
GPO can be a suitable partner for co-creating solutions with citizens.
KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	decision making processes.
Economic	
Social	Presenting energy transition solutions to citizens
Technical	
Environmental	
Legal	

A54: Collaboration with Covenant of Mayors Office to communicate SECAP experiences GRO

Technical Description
The City of Groningen is Covenant of Mayor member. Groningen is monitoring the CO2 impact of the entire municipality, as is displayed on https://www.groningenco2neutraal.nl/co2-monitor. This information forms the basis of the SECAP. The monitoring results also provide input for the 2050 vision [A41].

Other linked actions:	[A41], [A42]

Management structure	
Action Leader:	03 GRO
MAKING-CTIY partners involved:	-
Other key stakeholders involved:	-
The Municipality of Groningen is solely responsible for this action.	

KPIs for the Evaluation of the Action
To be updated for the final version, after finalising the KPIs in D5.2 (M18).

PESTEL Analysis (Barriers / Enablers)	
Political	SECAP results can be used for decision making processes.

Economic	
Social	
Technical	
Environmental	Good practises can be promoted in others Cities for adoption
Legal	