TKI URBAN ENERGY
Topsector Energy

Netherlands Enterprise Agency

Projects supported by the TKI Urban Energy program in 2020

relevant for Heat Pump Water Heaters and related topics.

Note: This is not an overview of all projects, but just a selection made by Phetradico

Although this overview has been compiled with the greatest possible care, TKI Urban Energy and RVO cannot accept any liability for any errors.

Contents

1. Components and heat pump developments

As there is no real manufacturer of component technologies for heat pumps in Netherlands, except for the larger compressor types (Grasso) and for the storage tanks (Inventum, ITHO-Daalderop, etc), developments focus on either very innovative aspects like Blue Heart or fundamental work in combination with other technologies, like Solar PVT and PCM's.

1.1 The Blue Heart - the adaptive heat pump

Background

The Netherlands is facing the challenge of renovating more than 7 million homes into well-insulated natural gas-free homes. To this end, a large number of renovations and installation adjustments will have to be carried out. The task is to implement these with 20-40% less costs in highly efficient production, construction, renovation and installation processes. The heat pump plays an important role in the concepts of natural gas-free homes and neighbourhoods.

The current generation of heat pumps, the compression heat pumps, do not optimally fit into the pursued renovation concepts. Compression heat pumps have:

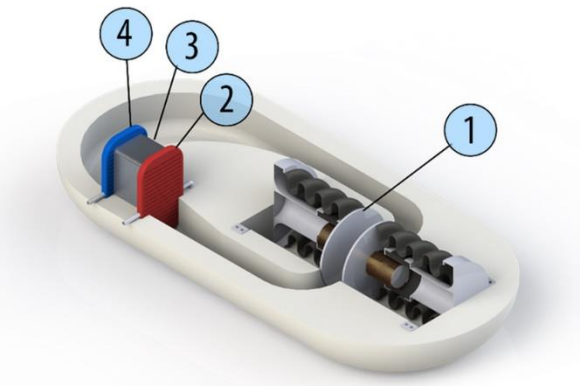
- limited operating range of source and output temperature;
- limited possibilities for modulating the capacity;
- difficulty with sources with a variable supply temperature and can cause noise nuisance.

As a result, additional adjustments to the installation concept are often necessary for proper integration of the heat pump, which has a delaying and cost-increasing effect. Despite this, the optimum comfort is not always offered in practice.

A better heat pump is needed. A heat pump that is easy and affordable to use in any renovation concept and provides optimal comfort.

Project goals

The aim of the project is the development of this heat pump. The project is developing a heat pump based on thermo-acoustics that can be easily applied in any renovation concept, regardless of the available source and offers good efficiency at every temperature range. The heat pump is fully geared to the requirements and wishes of those involved in the renovation concepts. From users / owners to installers, OEMs and manufacturers. This heat pump fits more universally into any renovation concept so that concepts can be implemented faster and cheaper and offers more comfort to the residents.



Result

The project develops the thermo-acoustic heart of the adaptive heat pump: the TA unit.

The TA unit:

- can be easily and effectively incorporated into any renovation concept;
- is adaptive to the source systems and the delivery systems in the home;
- provides for the entire housing requirement for heat and cold, without additional systems or adjustments;
- contains all the technology to thermo-acoustically regulate heat and cold;
- has a market-based COP and, due to its temperature flexibility, has a higher than average SCOP. The thermal capacity is geared to market demand;
- contains no harmful refrigerants and greenhouse gases (no GWP);
- can be used flexibly in terms of temperature range, sources and release, temperatures up to 80 ° C can be supplied;
- has a continuously adjustable output power;
- has a silent effect;
- is suitable for different installation types in terms of dimensions and weight; - is affordable in terms of cost price for mass production.

The prototype of this was realized at the end of the project.

Short description of the activities

1. The project is carried out by Blue Heart Energy, TNO, BDR Thermea Group (= Remeha) and Exasun. They carry out the following activities:
2. Research into and definition of the customer requirements, the system requirements, the functional requirements and the technical requirements of the TA heat pump for renovation concepts. Blue Heart Energy is the driving force in this. TNO, Remeha and Exasun are co-executors.
3. Development of installation concepts TA heat pumps for renovation concepts. TNO is the driving force in this. Blue Heart Energy, Remeha and Exasun are co-performers.
4. Benchmarking of installation concepts with TA heat pumps for renovation concepts. TNO is the driving force in this. Blue Heart Energy, Remeha and Exasun are co-performers.
5. Technical validation of the functional prototypes TA heat pump. Blue Heart Energy is the driving force in this. Remeha is co-performer.
6. Optimizing TA components and drawing up design rules for upscaling. Blue Heart Energy is the driving force in this. TNO is co-operator.
7. Development and delivery of a prototype of the market product of the TA heat pump. This is carried out by Blue Heart Energy.

Implementing project management and knowledge dissemination: This is carried out by Blue Heart Energy.

Location (s) of the project is being carried out (city, country)

The project is done at the locations of the project partners.

Secretary	Blue Heart Energy B.V.
Partners	Exasun B.V., TNO, BDR Thermea Group B.V.
Time Schedule	01.11.2020 – 31.12.2023
Support program	MOOI 2020 Gebouwde omgeving

1.2 Propane heat pump and PVT3.0 for Use of Smooth Energy Transition (PPIVET)

Background

The Dutch government has set itself the goal of removing all homes from natural gas by 2050. This amounts to about 600 homes per working day if we start now. After 2030, this will be 1,100 houses per working day. These numbers make it clear that we really need to start now with the renovations for the energy transition, and postponement is no longer possible if we want to achieve the targets. However, most current solutions are expensive, not suitable for all houses and moreover have major drawbacks (eg lack of space, ground drilling, noise pollution).

Homeowners are often faced with a decision to either invest huge sums and remodel their entire home, or postpone some of the gas remodel for a while. Understandably, the second option is often chosen at the moment. Triple Solar aims to develop a middle ground, with which home owners can invest step by step in a natural gas-free home.

Project goal

Triple Solar aims to develop a small heat pump for a hybrid setup, coupled with a renewed PVT system. This saves up to 80% on gas. In contrast to existing hybrid solutions, this system does not need to be replaced with a larger heat pump when it is decided to turn off the gas entirely. The heat pump can get stuck and the gas boiler can be replaced with an extra heat pump. The two pumps can then function together as one integral solution. Between installation of the 1st and 2nd heat pump, the home owner can gradually make the necessary renovations to the home at his own pace, according to what is possible, logical and comfortable for the home owner. The PVT panel serves as an outdoor unit for the heat pump (exchanging heat and cold with outside air) and as a source of electricity from sunlight.

By bringing the development processes of these different components together in one project, instead of the separate development processes customary up to now, the components will link up much better and previously untapped possibilities can now be tapped.

Short description of the activities

In this project, the technology is being developed to test the intended hybrid complete solution with a small propane heat pump and PVT3.0 panels on a pilot scale. This mainly concerns development of the small heat pump, the PVT3.0 panel and control technology. After successful development, these parts will be built in a test set-up, with which a pilot test will be carried out in various homes of private individuals via Sunergetic and the Heuvelrug Wonen housing corporation. The project is being carried out by Triple Solar, where knowledge and expertise will be contributed at own expense and risk by Metro Therm, LS Control and Consolar.

Result

The intended result of this project is:

- A developed pilot version of the hybrid complete solution, with small propane heat pump, PVT3.0 panel and control system.
- Pilot results with regard to the technical operating principle on a pilot scale in relevant practical conditions, in which measurements are made and findings are recorded.

- A report on the functional and technical specifications of the installation, and an evaluated business model for further development and upscaling.

Secretary	Triple Solar B.V.
Partners	SunErgetic B.V., Stichting Heuvelrug Wonen
Time Schedule	05.08.2020 – 04.08.2021
Support program	DEI+ 2020 – aardgasloze woningen, wijken en gebouwen

2. Systems

Much emphasis is on the integration in building concepts and adaption of heat pumping configuration.

2.1 Low Temperature Tap Water System (LTTS)

Background

The built environment must become more sustainable, the ambition is to have all buildings from gas by 2050 at the latest. Many renovation concepts are currently under development, for example for the systematic approach to insulation. For heating, the heat pump is also increasingly in the picture, because it can now also be used with radiators or convectors instead of underfloor heating. However, the tap water supply remains an issue. Because tap water must be supplied at a minimum of 55 ° C, a boiler tank is installed in individual systems and a high-temperature heat pump is often installed for the tap water in collective systems.

In the first case, sufficient space is needed, which is by no means always available. Residents also sometimes experience this as uncomfortable because there is a limited supply of hot water that can run out. In the second case, there are energy losses, because making water at the required temperature is more inefficient, there are more distribution losses and there are also more losses during delivery in the home. A tap water system that functions safely and comfortably at a lower temperature would solve these problems and make existing buildings more sustainable.

Project goal

The goal of the LTTS project is to demonstrate that a low-temperature tap water system, where the water is supplied at 40 ° C, functions safely and properly, is accepted by the user and is economically profitable.

This is demonstrated in a demo project at 252 apartments with a central heat source and in each apartment an LTTS unit with a weekly, automatic legionella loop. The interaction of the users with the booster function is mapped and the total energy consumption is monitored. This practical data is required for acceptance of the LTTS application in existing buildings. Project LTTS is in line with the Natural gas-free homes, neighborhoods and buildings scheme, because the low-temperature tap water system simplifies the implementation of heat pump systems in buildings, and also reduces energy consumption and avoids peak consumption as much as possible. As a result, buildings can be made more sustainable more quickly at the lowest possible total costs (for end-user and social costs).

Short description of the activities

Schouten Techniek will start building a test setup, in which a central heat pump will be connected to 5 dummy homes that will be built in the hall near Schouten. An LTTS system will be installed for each dummy house. The dispensing sets, mixers and legionella loop are adjusted and tested for temperature, energy consumption and power if several homes have a DHW demand at the same time. Based on this, the control for the demo is adjusted. In the demo project, 252 apartments will be equipped with a collective soil source (WKO) and central low-temperature heat pump, with a climate set and LTTS system in every home.

The installation is installed and remains the property of Eteck Warmte Eekhoorn BV. The energy consumption and the interaction of the users with the LTTS unit is monitored in order to identify possible improvements for large-scale market roll-out. The system and the results of the demo project are also discussed with installers and

customers and designs are made for application in existing homes, so that this system can be rolled out quickly after the project has been completed.

Result
The main result of the LTTS project is the realization and assessment of the functioning of the first practical installations of the low-temperature tap water system, so that sufficient data is available for acceptance by the market.
The concrete results that are delivered are:

- Regulated legionella course in 5 test installations that is sufficiently stable for a minimum period of time (minimum 20 minutes at 60 degrees).
- Elaborated systems for application in existing homes, both ground-level and apartment complexes.
- Demo project with 252 working LTTS units in an apartment complex.
- Report with the results of energy use and how residents deal with the booster function.
- Elaborated business case, including energy savings and production and installation costs of the necessary parts for larger-scale production.
- Request to amend standard NEN1006 and include the LTTS in the calculations for NTA8800 and NEN7120.

Secretary	Eteck Warmte Maarsbergenstraat B.V.
Partners	Schouten Techniek B.V.
Time Schedule	01.11.2020 - 01.10.2021
Support program	DEI+ 2020 – aardgasloze woningen, wijken en gebouwen

2.2 In two steps to a natural gas-free and comfortable Dutch living environment

Background

The demand for alternatives to natural gas use is high in the Netherlands. However, it is still difficult for the home owner to make this sustainable investment in natural gas-free systems.

Switching from an existing natural gas-fired home to a 100% natural gas-free home in one go is an exciting step. This step is associated with high costs and the outcome of the comfort in the home is usually uncertain. Certainly parties with large housing stocks, such as housing corporations, are afraid of the scenario in which residents will complain afterwards about the consequences of the measures. This includes complaints about the temperature in the home, the amount of tap water, comfort and the disappointing costs of the energy bill. The result of the above is that many parties decide to do little or even nothing. As a result, the energy transition that we consider important in the Netherlands is not really getting underway. In order to speed up the transition, this consortium wants to invest in the development of a system that can easily be converted from hybrid to 100% natural gas-free. This system will consist of a heat pump and a hydronic module with a complete indoor installation, an air extraction system and PCM radiator conversion.

Project goals

With this project, the consortium wants to make the step to investing in a natural gas-free system less exciting, reliable and above all better. We do this by developing a system that makes it possible to make the 1st step towards a hybrid system (partly using natural gas) in making homes more sustainable at low cost. As a result, a natural gas reduction and financial savings are immediately realized in the 1st step. We are also working on the development of a heat pump with a medium and high temperature. This gives a better efficiency in use. Subsequently, after extensive monitoring of the system and with the user experiences of residents, the next second step towards making the house 100% natural gas-free can be made by means of an adjustment of the existing installation. This last step is much easier to take with the knowledge and experience gained in the 1st step. The home owner now does not run the risk of taking too few insulating measures, causing comfort complaints to the residents or, conversely, doing too much and therefore incurring too much costs. We also speak of the reverse energy transition: first the installation of a hybrid heat pump, which immediately results in significantly lower gas consumption, then the targeted structural adjustments (insulation) to achieve a natural gas-free installation.

The project aims to initiate technological development as well as to simplify / unburden the customer journey (guiding users through the purchase and optimization of the system).

The project has 5 clear goals:

- Developing two heat pump systems for medium and high temperature. These systems are compact and with a complete indoor setup.
- Developing a heat pump system that, in combination with a hydronic module, can be converted from a hybrid set-up to a 100% natural gas-free set-up.
- Developing a monitoring method to achieve a 100% natural gas-free system.
- Developing a Phase Chance Materials (PCM) radiator conversion and an air extraction system for heated air.

By developing a proposition towards the most promising target group (s).

Short description of the activities

In this project the following activities are carried out by the consortium. Project leader Enzavu directs, coordinates and monitors the project and, together with Oudman Engineering and OC Auktarius, develops the technological improvements of the systems. Hanze University of Applied Sciences tests and advises on technological improvements. FctrE / ZON researches the market and supplies information that can be used in setting up the monitoring system and develops the proposition for promising target groups. The activities take place in 4 phases; preliminary research and design, engineering and prototype building, prototype testing and system configuration, system test and market proposition.

Result

The project provides a new system that directly contributes to the acceleration of the energy transition in the Netherlands. The barriers of uncertainty for home owners to make the switch to natural gas-free homes are being removed. Also, after installation of the system, there are no comfort complaints among end users. Through monitoring, the system fits in well with the needs of the end user.

In short, the results of the system are:

- System is quick and easy to install (no specialist knowledge required);
- System can be converted from hybrid to 100% natural gas-free;
- System is tailored to market needs.

Secretary	Enzavu B.V.
Partners	Stichting Hanzehogeschool Groningen, Autarkis B.V., Oudman Engineering, theFCTRE B.V.
Time Schedule	01.09.2020 – 31.12.2021
Support program	TSE GO 2020

3. Installer Focused Plug&Play solutions

This type of projects target to integrate heat pumping technologies and other energy technologies in the building process either already in the design of the overall system or in the industrialisation of the building components, to make the renovation of building easier and less expensive. This can focus on components and plug & play solutions for small renovation or at overall project development.

3.1 Digital ®evolution: Automated preparation of gas-free home renovation projects

Background

During renovation to Zero-on-the-Meter (NOM), homes will be provided with a new outer shell. The preparation of such a renovation project consists of a number of steps, including scanning the homes that will be renovated. The aim of this is to be able to design the best possible fitting façade and roof that will be placed against the existing façade and roof.

BAM Wonen now uses a static 3D laser scanner to measure the exterior facade. The measurement data is then manually converted into 3D components for the production of the façades, roof elements and window frames. This current method takes a long time (approx. ¾ years per project) and the measurement accuracy is not optimal, which means that additional manual actions are required to generate an optimal outer shell.

A consortium consisting of BAM Wonen, BAM Bouw en Techniek, BAM Materieel and Droneview has the wish to arrive at a faster and more accurate way of scanning the exterior façade of homes, in combination with a. automated processing of the measurement data to BIM models in modeling packages, without manual intermediate steps.

Project goal

The aim of the project is to develop and validate accelerations in the preparation process through a new method based on the dynamic measurement of the existing homes and the automatic processing of this data into new (digital) facades with frames and roof elements. This allows the renovation process of homes to be accelerated considerably, with a higher quality. This contributes to the cheaper, better and faster renovation of homes to natural gas-free, making upscaling possible.

Short description of the activities

The project is carried out in 5 work packages. First, the new scanning method is developed and then tested in a field trial, after which the translation of the measurement data into a 3DBIM model is developed and tested in practice.

The project is being carried out by BAM Wonen BV (secretary), BAM Bouw en Techniek BV, BAM Materieel BV and Droneview BV. BAM Wonen is responsible for the application of the new working method in the preparation of renovation projects, and also develops and tests the solution in practice; BAM Bouw en Techniek is co-developer and tester of the new scanning method and conversion of scan data into 3D BIM objects; In this project, BAM Materieel is responsible for tachymetric measurement of the Ground Control Points for the Photogrammetry scanning method; Droneview collects and processes data using drones and develops algorithms for the automatic recognition of building components, and is helping to test the solution in field trials.

Result

The intended results of this project are:

- Prototype of a new scanning method based on dynamic scanning and of the automatic conversion of scans into 3D-BIM objects for NOM renovation projects;
- Verification of the expected performance of the new scanning method and translation of scans into 3D-BIM objects in practical tests with regard to the expected benefits faster, better and cheaper, resulting in a report;
- Identification of additional optimizations required in the new scanning method and translation of scans into 3D BIM objects, recorded in a report. Where possible, optimizations are realized in this project.

Secretary	BAM Wonen Renovatie Concepten
Partners	BAM Advies & Engineering, BAM Materieel B.V., Droneview B.V.
Time Schedule	16.04.2020 – 30.06.2022
Support program	DEI+ 2020 – aardgasloze woningen, wijken en gebouwen

3.2 Pilot Sanura Flatmate (PSF)

Background

An important point of attention in the transition to natural gas-free living is the preparation of hot tap water. In practice, both heat pumps and low temperature heat networks require additional installations for the preparation of hot tap water, such as an additional heat pump with buffer tank, or an electric boiler. This results in additional investments and / or high electrical energy consumption. About 80% of the domestic hot water in a household is used in the shower. By using a shower heat exchanger (shower heat recovery), the hot tap water demand is significantly reduced, which leads to energy savings and lower investment costs. Current shower heat recovery units are built into the shower floor, shower drain, or wall. In existing bathrooms this leads to high costs for demolition, plumbing and repair work. In addition, this leads to inconvenience for the residents. At the moment, hardly any shower heaters are installed in existing bathrooms. The Sanura Flatmate is a radically new type of shower heat exchanger that can easily be connected to a standard shower tap and is specifically intended for use in existing bathrooms.

Project goal

In this project, the design of the Flatmate is adapted for serial / mass production. Subsequently, 100 prototype Flatmates are produced, placed in practice and monitored over a period of 3 months. The aim of the project is to find areas for improvement for the Flatmate in terms of efficiency, robustness, production costs and user-friendliness, in order to arrive at an end product with which the market can be approached on a large scale. By applying the Flatmate, costs for making homes natural gas-free are reduced and energy costs are saved in the usage phase and CO2 emissions are avoided. No renovation is necessary with the Flatmate; it is simply connected to the existing shower. This means that Flatmates can be implemented quickly and on a large scale, which contributes to accelerating the energy transition.

Short description of the activities

- WP1: Adapting the design of the Flatmate for serial / mass production, in collaboration with manufacturers of parts and including performing model calculations and small-scale experiments.
- WP2: Production and assembly of 100 prototype Flatmates.
- WP3: Determining the efficiency of the Flatmate prototype, both in an efficiency measurement in accordance with NEN7120, and in practical measurements.
- WP4: Selection of rental homes from De Alliantie and installation of prototype Flatmates in these homes.
- WP5: Monitoring the technical condition and user experience of the prototype Flatmates during the period of use by recording questions / complaints, interviews, surveys and technical inspection.
- WP6: Reporting and completion, including dissemination of project results.

Results

Concrete results are a public final report with the project findings and a list of points for improvement for the Flatmate. With the knowledge gained, the Flatmate will be further developed into a market-ready end product with intended market introduction from the end of 2021.

Secretary	Sanura B.V.
Partners	Stichting de Alliantie, Stichting Green Village
Time Schedule	10.09.2020 - 01.07.2021
Support program	DEI+ 2020 – aardgasloze woningen, wijken en gebouwen

3.3 High Impact Low Effort Energy transition Installations

With the creation of these MOOI and MMIP objectives, extra emphasis has been placed on accelerating the energy transition. This is necessary because the speed of the transition is lagging behind the set goals. Too little progress is being made in the built environment and houses are not being made sustainable fast enough. Maintaining living space is also essential. Current sustainability options such as the w-w heat pump and standing boiler tanks take up a lot of space in places where residents do not want it. This is particularly important in the social housing segment. In addition, improvement of the indoor climate, comfort and ventilation are the greatest motivator for the occupant / tenant of the home to participate in a renovation.

Project goal

The project partners of High Impact Installations recognize the necessity of the energy transition and want to jointly develop a sustainable and energy-efficient renovation concept for serial renovations that are in line with the transition visions of the Dutch municipalities.

The objective is as follows: A scalable, compact, energy-efficient, fast, comfortable and cost-efficient renovation concept (High Impact concept) has been developed, consisting of a flexible choice of heat sources, smart control, optimal plug-and-play installation method and high efficiency.

Short description of the activities

In Result 1, a (prefab) roof element with integrated PVT panels is delivered. In Result 2, miniaturized w-w heat pumps are developed in combination with durable insulation material. In Result 3, the various heat sources (software and hardware) are linked and the heat pump integrated. In Result 4, the solution is tested in a living lab setting. Housing association Stichting Area makes a house available for this purpose.

Results

The following results will be delivered in this project:

- PVT panel, lightweight and higher efficiency.
- (Prefab) roof in which PVT and piping are integrated.
- Water-water heat pump including (tap water) buffer that is suitable for alternative sources, integrated and durably insulated.
- Software / Hardware link sources and W-W heat pump for high efficiency.
- Multifunctional SKID with standing / lying boiler for optimal integration into the home.
- A sustainable, affordable and user-friendly integrated package to convert the existing home to energy-neutral with regard to the building-related installations.

Locations

This project has an impact on the Regional Energy Strategy Hoeksche Waard (Itho Daalderop Schiedam and Aqua Power Store De Lier). Developments are also being carried out at Itho Daalderop (Tiel) in the Brabant Energy Workshop, RC-Panels and Remon Aardwarmte represent the north of the country with the Regional Energy Strategy West Overijssel and RES Region Groningen. Because the Area Foundation makes a home available as a Living Lab, some of the results will fall in the Brabant Energy Workshop (Uden) region. The smart integration and link between the two sustainability technologies in combination with a miniaturized w-w heat pump ensures that this concept can be applied almost everywhere in all Regional Energy Strategy regions in the Netherlands.

Secretary	Daalderop Royal Holland Pewter
Partners	Aqua Power Store B.V., Remon Aardwarmte B.V., Merford Noise Control B.V., Rc Panels B.V., Area
Time Schedule	07.10.2020 – 30.09.2024
Support program	MOOI 2020 Gebouwde omgeving

3.4 Intelligent Heat Generation (IWP)

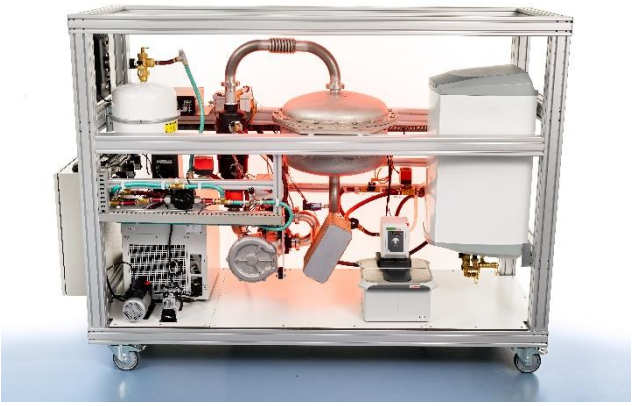
The energy transition in the built environment in the Netherlands includes a number of crucial social and innovation challenges:

- The Netherlands wants to “get rid of gas”, which requires a major roll-out of sustainable energy. In the shorter term, the ambition is already sharp: by 2030, approximately 1.5 million homes and 15% of non-residential buildings must be heated using natural gas-free and sustainable heating.
- Acceleration of the energy transition. The time to become natural gas-free is short. With the current, limited construction capacity, this means, above all, the search for quickly scalable, industrialized and standardized solutions.
- It is emphatically necessary to look for solutions in sustainable heat, in addition to full-electric solutions. Recent studies (including Berenschot 2019, Profit 2020) also underline that the sustainable heat route is often a cheaper route than that of full-electric.

Project goal

The aim of the project is a cost-effective and flexible "mass-customizable" (large-scale customization) prefab "heat pump – heat shield heat battery" renovation solution for gas-free, sustainable heating and cooling of series ground-based homes. The intended reduction of energy consumption from the electricity grid is at least 60% compared to the same use case with air heat pump, without compromising comfort. Our project integrates 2 international breakthrough technologies - a heat facade and a heat battery - with existing heat pump technology in a new prefab concept with an activated house shell.

- The heat facade is an innovative, aesthetically versatile solar thermal facade collector, which effectively harvests solar energy at low outdoor temperatures. This breakthrough innovation opens up the path to the facade as a sustainable energy supplier.
- The heat battery is the first completely loss-free heat storage, 10 times cheaper than electrical storage and much more compact than water or PCMs. This heat battery meets the innovation task of MMIP4.3, Smart Compact Heat Battery and the KPIs envisaged there.



Prototype Heat Battery by Cellsius

Both are approaching market maturity and reinforce each other's performance in an integrated system combined with a heat pump.

Results

The result is a validated, integrated prefab renovation solution of heat extraction and cooling in the housing shell with heat storage and heat pump. This integrated concept includes:

- An integrated prefab house shell, manufactured according to the principles of mass customization, flexibility in aesthetics, inexpensive and consisting of prefab building elements for roof / facade renovation of serial housing construction.
- A heat battery that stably supplies heat or cold at times of scarcity of sustainable energy, is optimally compact and fits into the limited housing space, and can also be charged at low temperatures, which greatly improves the efficiency of the entire concept.
- Optimal communication and control (soft / hardware) of these components with an optimized heat pump, so that the roll-out is facilitated by installers, architects, developers and policymakers.

The project will deliver an integrated and validated prototype during its term. The further route to market introduction is being explored and worked out.

Activities

The activities include further development of both breakthrough technologies, integration in a total renovation concept and full validation of the first prototype in a test environment, including potential users. An iterative approach to design, production, testing and validation is the guiding principle.

Further development:

- The heat facade development focuses on the aesthetics and the production process, by Emergo, AkzoNobel, Aldowa Green and TNO.
- The heat battery development by Cellcius BV, TBRM, TNO and TU / e emphasizes optimization with component improvement.

Integration:

- The focus is on the development of software / hardware for communication and control between the heat envelope, heat battery and heat pump. End users are also involved here.

Validation:

- Primarily of the individual components, inside (MEC lab) and outside (SolarBEAT). Secondary with an integral test of the components, including communication and control in the SolarBEAT environment. The Municipality of Eindhoven will also provide first validation in real conditions in its network.

Locations where the project is carried out

- Eindhoven, Delft, Rotterdam, Sassenheim, Almelo, Stadskanaal.

Secretary	Emergo Business Partners B.V.
Partners	TNO, TU/e, Aldowa Green B.V., TBRM-Engineering Solutions B.V., Cellcius B.V., Gemeente Eindhoven, AKZO Nobel Decorative Coatings,
Time Schedule	01.03.2021 - 28.02.2025
Support program	MOOI 2020 Gebouwde omgeving

3.5 BIPVT levert MOOI energie! (BIPVNL2)

Background

A promising solution for making the built environment more sustainable is BIPV (T), which integrates the worlds of PV, heat and construction, whereby the building envelope is fully utilized as an energy source, both electrical and thermal. The BIPV (T) market has the potential to grow rapidly and to support and accelerate the sustainability task substantially. It is only logical to use building surfaces for energy generation and for energy storage to take place close to the user: it is scalable and can be applied in a modular way per building.

Due to this modularity, sustainability can be improved relatively quickly, no additional expensive collective infrastructure is required and the solutions fit into the Dutch built landscape. Maintaining aesthetics and smart construction are very important here. BIPV (T) offers various application areas where solar cells or panels are integrated in a building element or building material, such as aesthetically pleasing BIPV (T) glass, roof and facade solutions. Moreover, BIPV (T) elements not only generate energy, they also have a function in the building, such as sun protection, thermal insulation or security.

Project goals

The aim of the project is an innovative, integrated renovation approach for a CO2-free built environment by realizing a programmatic chain approach for the renovation market, with which from 2025 at least 2500 renovation homes and 2500 new homes per year can be quickly and easily (re) built into Plus-On-the-Meter homes based on integratable, affordable and scalable BIPV (T) elements including electrical and thermal (storage) system. Energy harvest from the building envelope, integral modular construction with BIPV (T) for both low-rise and high-rise buildings, and an integral cost price reduction of 40% is achieved through the use of circular materials, smart BIPV (T) solutions with optimal energy efficiency, lean production processes and plug & play construction principles with a reduction of manual work in the construction column. Industrialization and upscaling of production numbers provides an additional reinforcement towards reliability and cost reduction throughout the chain. An integral solution, with a custom construction system with standard modules, the Basic Building Blocks and a consortium for development and implementation.

Tooling for buyers / users, chain players and financiers provides early insight into solutions.Resultaat

The result of this project program consists of four parts:

1. An integrated renovation total package, consisting of interchangeable, standardized systems for BIPV (T) generation and storage, including construction processes with which renovation homes produce at least 150% of their own electricity consumption and 120% of their own heat consumption.
2. The development of at least 9 new affordable, integratable and scalable BIPV (T) modules for roof, facade and glass and thermal properties, made of at least 50% circular material, plus the associated production lines for scaling up to mass production
3. A developed system for the electrical and thermal coupling between the building parts, the BIPV (T) modules and the building envelope for climate control and energy supply, including electrical and thermal “in-house” storage and data management for climate control.
4. A strengthened ecosystem with ditto chain cooperation and marketing for BIPV (T) driven renovation packages, through knowledge dissemination and tool development for the end user / home owners, construction and installation sector and educational programming.

Short description of the activities

Brief description of the activities provides a project program that is carried out with a majority of the most important players from the entire chain to develop a complete pallet of BIPV (T) building blocks with associated production facilities that provide a boost in the market. The main driving force is the upscaling, industrialization and standardization of the entire BIPVT chain, including the development of plug & play BIPV (T) modules, the development and standardization of production processes and the application of modular construction in the construction sector. This creates a wide range of modules that can be used that can be linked together like LEGO as a Basic Building Block building system. We start with an inventory phase of the requirements for the different building types, the architectural characteristics, building processes and organizational structures.

In parallel, a complete set of requirements is established for all types of BIPV (T) modules. After that, work can be done more independently in parallel on individual solutions for combinations of BIPV (T) modules and manufacturing processes. Integral system tests are carried out at several specifically suitable locations and the eco-system is gradually built up.

Location (s) where the project is being carried out (place, country)

The Netherlands, at the locations of participating parties. An overview of the achievements in Netherlands.

Secretary	Stg. Building. Integr. Photo Voltaic Nederland
Partners	TU/e, New Horizon Oogstbedrijf B.V., Twinsense 360 B.V., Best Architecten B.V., HyET Solar Netherlands B.V., Solinso B.V., Solar Energy Booster B.V., QRoof B.V., Universiteit Utrecht, PowerWindow B.V., Wallvision B.V., Soluzon B.V., Ketenstandaard Bouw & Techniek B.V., Stichting Fontys, Stafier Solar Systems BV, Solarix Concepts, Zuyd Hogeschool, Stichting ROC Summa College, Timmerfabriek Frank van Roij B.V., Universiteit Maastricht, Stichting Hogeschool Utrecht,
Time Schedule	01.01.2021 – 31.12.2024
Support program	MOOI 2020 Gebouwde omgeving

3.6 Future Factory (FF)

Background

The Future Factory consortium consists of experienced parties who realize that the scale envisaged in the MMIP entails an enormous innovation task. The current products and production facilities are not suitable for both the price level and the delivery volume required for the 200,000 home renovations per year as envisaged in the climate agreement. The consortium contains the most successful producers / suppliers of deep renovation propositions in the Netherlands who know what it means to industrialize and digitize. Also parties that are aware that, even from these leading positions, enormous steps still need to be made for breakthroughs in new products and investments in production resources.

MMIP, multi-year mission-driven innovation, offers the opportunity to accelerate development agendas and, above all, to focus on integral proposition development (architectural, installation technology, production technology, process in the entire chain from supplier, concept provider to buyer / user, via sales to delivery and service). and design the production facility together.

Goals of the innovation plan

The aim of this innovation plan is to develop a Future Factory that can deliver 25,000 renovations annually by 2025 that will fit 40% of homes in the Netherlands. The renovation propositions are available to both private owners and landlords through tailor-made delivery and sales channels.

The renovation involves a combination of affordable insulation systems and fossil-free energy systems. Through integral proposition development and scale in sales, delivery and production, costs have decreased by 40% and the quality and customer experience of products or renovations have been greatly improved (comfort, energy efficiency, renovation nuisance, noise, nicer / finer house).

The entire renovation process and associated sales channel is developed in continuous interaction with the home owners and residents. After all, they must decide to proceed with a renovation and will only do so if they are enthusiastic about it. The current market can be seen as a living lab for the development of the proposition and production facility of the future. The consortium members who are already making substantial volumes of renovation (> 500) can make good use of this. By testing product developments over a number of generations and under practical conditions, they gain new knowledge with which they can shape the Future Factory. As a result, in addition to technology development, the focus is mainly on solutions that people ultimately want.

Brief description of the projects and other activities within your plan

Based on a programmatic approach, the consortium is developing the Future Factory, a production, supply and sales company with which homes and residential buildings can be made more sustainable on a large scale. Three generations are working on the system change that is necessary for this unprecedented scale. The upscaling from generation 1 (current production facilities) to prototype generation 2 production facilities and ultimately the 3rd generation production facility that can supply 25,000 homes per year. The customer interaction takes place within the program. However, not every product is suitable for mass production. The necessary research and development of the building components is done along the lines, roof module, facade module and installation module.

Consortium partners use the current production facilities and part of their market as a “field lab”, where tests take place and new knowledge is gained. This makes it possible on the one hand to scale up production in volume and

capacity (generation 2). On the other hand, this ensures that some of these developments are brought to the market during this MMIP, in the form of improved renovation propositions.

This in turn provides experience for the final offer and process. This approach ensures that knowledge only stays “in the lab” for a short time; results of subprojects can be implemented quickly and have an immediate impact on the price in the market. The customer interaction also takes place here within the program. It is expected that the current production potential of the System Integrators (the "core group" being Factory Zero, Rc Panels and Dijkstra Draisma) can thus grow within the program by a factor of 2, with the price already falling by 20%. As a result, the knowledge only remains “in the lab” for a short time, results from sub-projects can be implemented quickly and have an immediate impact on the price in the market.

At the same time, new knowledge is being acquired within the program with which a third generation production facility can be built after the end of the program. (Mega Factory, 25,000 home renovations per year). To this end, the program has a number of projects / work packages that systematically work on research and development of:componenten tot geïntegreerde renovatieconcepten;

- implementation of new technology such as: thermochemical storage, Phase Change Materials (PCM), integrated solar (BIPV), heat-resistant coatings, frameless facades, smart scanning techniques, smart-grid-ready installations, miniaturization of heat pump systems, integration of ventilation and heating in building components, integrated sales channels, big data analysis, smart control and monitoring;
- processes with far-reaching automation, digitization: industrialization of production; process optimization of the on-site construction process; logistics; customer and sales channel;

Pilot projects of new configurations of existing techniques and the development of new techniques.

Future Factory is not just a product development program. Product innovation is being worked on both for the attractiveness of the product itself and for making cost savings possible. However, the product development steps are in the light of gaining knowledge for a system change, with the concrete goal of developing the mega production and supply and sales company in 2025 that will deliver attractive renovation packages in a market where the other barriers for consumers also exist. taken away.

Results

1. Create at least two production facilities, within the target term of 5 years, for the production of renovation packages for approximately 5,000 home renovations per year; with significant improvements in quality and cost compared to today.
2. Development of a production facility for the production of roof and facade elements with integrated energy systems with a capacity of 25,000 home renovations per year, for homes that are typologically common (approx. 3.5 million homes in the Netherlands). Cost result

Components (off-site):	20% cost reduction through smarter design, engineering and processing and the removal of actors and margins in the supply chain (chain integration). In addition to this, a 20% cost reduction by achieving upscaling with numbers of> 5,000 per year.
Activities and process (on-site):	20% cost reduction through other methods and processes. In addition to this, 20% cost reduction through scale and optimisations when building flows> 5,000 units per year are used.

3. Improve a number of other market conditions so that consumers can purchase an attractive product, in an appropriate regulatory framework to finance this product, through comprehensible and attractive sales channels.

Secretary	Factory Zero B.V.
Partners	Rc Panels B.V., Bouwgroep Dijkstra Draisma Beheer B.V., Dura Vermeer Onderhoud en Renovatie Midden West B.V., Stichting Hogeschool van Arnhem en Nijmegen, Stichting Hogeschool Utrecht, Daalderop Royal Holland Pewter, Woonstichting Jutphaas, Orange Climate B.V., Woningstichting Hellendoorn, REIMARKT CONCEPT B.V., Stichting Saxion, TU Delft faculteit EWI, Stichting Welbions, Vereniging 'De BredeStroomversnelling', Buro De Haan B.V., Ir. Abe Bonnema Stichting, Woningstichting Domijn, Stichting Pioneering, Stichting Wonion, Chemelot Campus B.V., Croonwolter&dros B.V., TU/e,
Time Schedule	01.01.2020 – 31.01.2024
Support program	MOOI 2019 Gebouwde omgeving

3.7 Integrale Energie Transitie Bestaande Bouw (MMIPIEBB)

Backgrounds

Good, user-friendly, cheap and scalable technologies are needed to achieve a renovation rate of 200,000 homes per year. Currently available solutions are too expensive, labor-intensive, do not meet expectations and do not meet the needs of residents sufficiently.

The IEBB consortium consists of more than 125 participants from knowledge institutions, the construction, engineering and design sector, governments, home owners and residents and will contribute to the energy transition by developing affordable, robust and user-friendly renovation concepts that will enable the required pace to be achieved. .

The consortium focuses on innovative solutions for heat conversion and storage, industrialization concepts, chain integration and forms of cooperation. In order to convert the current fragmentation and competition in the sector into a multi-year broad collaboration, the IEBB consortium applies a new way of collaboration between requesting parties, offering parties and knowledge institutions. Based on a joint development agenda, new technologies are developed in an open innovation fashion through a broad, integrated approach.

Objective

The aim of the program is to make the energy transition in existing buildings feasible, scalable and affordable, aimed at achieving 200,000 renovations per year by 2030.

IEBB will develop solutions that lead to a sustainable, structurally embedded energy transition (the long-term objectives), whereby it is continuously strived to have the interim results available for implementation in the short term (the short-term objectives).

The concrete objectives of the IEBB are to realize solutions at the system level, including partial solutions for this, while ensuring that these combined lead to affordable and workable renovation solutions at the residential level:

- industrialized renovation concepts leading to a cost reduction of 20% -40%; o user-friendly and robust renovation concepts that meet the required performance with regard to energy, comfort and indoor climate;
- quiet, compact, smart and cost-efficient heat pumps; o smart and compact heat storage systems; o tools, collaboration and organizational models for increasing support and enthusiasm for energy renovations.

Short description

The IEBB consortium stands for an integrated approach to 9 themes, which the consortium believes are all necessary to achieve the desired upscaling in the coming years. The 9 themes are:

- Renovation concepts,
- Performance monitoring,
- Industrialization,
- Digitization,
- Supported energy transition
- Assessment framework for building owners
- Chain innovation

- Heat pumps
- Heat storage.

The activities within the 9 themes are organized in projects, which together form a coherent program.

Within the program, a number of steps are taken towards renovation concepts for common housing typologies and buildings (MMIP 3). Some critical components for sustainable heating and cooling are also being developed into widely accepted installations (cost reduction, less noise nuisance and volume use). Loss-free / low-loss decentralized heat storage makes a shift in supply and demand possible (part of MMIP 4).

Within the program, developments are monitored and controlled via a “stage-gating” process.

Results

The program will lead to affordable, scalable and accepted solutions that are necessary for the complete renovation task. Before 2030, renovation cost reductions of 20-40% will be achieved for upscaling to 200,000 renovations per year. Sustainable heating techniques, renovation concepts, industrialization, robotization and digitization, new forms of chain cooperation and social innovations are being developed and tested in a programmatic context with various chain partners.

In the first years, the focus will be on terraced houses and stacked construction, and a cost reduction of 10–40% is expected for all-electric renovations and a reduction of 20% for connection costs to a heat network.

In follow-up projects, the knowledge will be applied to other building types, so that solutions will become available for all building types around 2025. The integrated approach breaks through the current fragmentation of research and development, whereby available knowledge is widely shared and the space for innovation is used with maximum efficiency. The link with other initiatives, such as Renovation Accelerator and the Natural gas-free neighborhoods program, ensures a rapid roll-out of the results.

Secretary	TNO
Time Schedule	01.01.2020 – 31.12.2024
Support program	MOOI 2019 Gebouwde omgeving

4. Smart Grids

Future energy systems are more and more depending on electricity generated by a great number renewable sources giving potential imbalance on the grid as the supply does not always match with the demand. Management of both demand and supply, supported by storage technologies are the key of smart grid developments. The governmental program IPIN started up in 2010 created the environment for a number of successful pilots.

4.1 The Indië site: A smart neighbourhood battery in the old weaving mill (Indië-neighbourhood battery)

Reason

System innovation is needed to make our energy system affordable, reliable and sustainable in the future as well. Instead of grid reinforcement, the realization of flexible electricity capacity from and for the built environment can offer a solution. Due to the smart application of storage systems, the supply and demand of electricity can be flexibly arranged. Applying a smart user-centered local energy system based on a Vanadium Redox Flow Battery (VRFB) and heat buffer are new for the built environment. System innovation

by means of local flexibility also requires new roles and different economic processes from users. It is important here that end users are given the opportunity to play a more active role in the energy system. This is in line with the wish from the Climate Agreement and the EU Clean Energy Package to give citizens a more central role in the energy transition. Using the sustainable housing energy concept to be developed for flexibilisation can be omitted, project costs and social costs can be saved, and (housing) organizations can fulfill their social responsibility.

Project goal

The objective is to make the (local) electricity system more flexible by means of a user-centered VRFB battery and heat storage by means of smart energy management. The aim is to make the supply of / demand for energy so flexible that congestions in energy networks are prevented. This is done by means of a smart energy management system done pro-actively and in real-time at times of surplus or scarcity of energy within the limits of the connection to the energy grid. The intention is to generate as much energy as possible yourself (PV panels) and by means of storage (VRF battery and heat buffer) as much as possible to consume themselves (including heat pumps), and also to realize new (scalable) organizational and financial constructions for residents. In summary, this pilot project will work on the experimental development and application of a user-centered smart electricity and heat storage system under Dutch practical conditions in a housing project on the Indië site in Almelo. Based on these results, Ter Steege Bouw Vastgoed, Contour Advanced Systems, SolarFreezer and Loohuis want to roll out the residential energy concept widely in the market.

Example project

Short description of the activities

To system innovation by means of To be able to realize a user-centered local VRFB battery and heat storage system, the system must be designed as an organizational and technical unit. The new roles and economic processes of the users are central to the organizational system design. Among other things, they will design and apply new contractual frameworks for a scalable, flexible local energy system. Research will be conducted into:

1. acceptance and participation,
2. behavior and behavioral change,
3. economic benefits,

4. organizational / contractual frameworks for local energy communities.

The second aspect is the development of an effective energy management system for the available local flexibility, i.e. for a user-centered system with VRFB storage and local use of solar energy from households, and smart control of heat pumps and heat storage (SolarFreezer). Technical challenges here lie in the control system, which must be modular and adaptable in order to be widely applied. For this hybrid energy system, existing tools and calculation models (TRIANA concepts) are further developed and tested.

Result

The intended end result is an operational pilot under Dutch practical conditions for flexibility from buildings with a central role for residents. In an old weaving mill building, homes will be built with a user-centered local energy system with energy storage in VRF batteries and heat buffers. To this end, an effective energy management system will be developed for the available local flexibility. Result 1 is the management and coordination of energy flows in the short term (electricity) and long term (seasonal heat), and the control of the hybrid energy system with multiple energy carriers (electricity, heat and cold) on two levels (household and building). Result 2 is the implementation of organizational / contractual frameworks for a local energy system (including joint use of installations). The intention is to develop a residential energy concept that is aimed at residents and can be used for upscaling and integration with other system elements. Based on the project results, the applicants want to roll out the residential energy concept broadly in the market for (rental) homes of the future that promote the flexibility of the electricity system.

Location of the project - Indië-terrein te Almelo.

Secretary	Ter Steege Bouw Vastgoed Hardenberg B.V.
Contact	
Phone	
E-mail	
Partners	Contour Advanced Systems B.V., Universiteit Twente
Time Schedule	01.10.2020 – 30.09.2022
Support program	DEI+ 2020 - flexibilisering van het elektriciteitssysteem

4.2 Built Environment Electrification Innovation Platform (GO-e)

Background

Electrification is an essential part of the energy transition in the built environment. This is visible in the growth in the number of heat pumps, electric cars and solar panels. This poses major challenges for regional (and national) grid operators in preventing grid congestion. It also offers opportunities. Grid reinforcement is the common solution, but is not always feasible and desirable due to limited resources (money, turnaround time and technical personnel).

The large-scale deployment of smart flexibility services is an alternative to make the best possible use of the available grid capacity. In addition, flexibility (often abbreviated to flex) can ensure better local use of decentralized, sustainably generated electricity. The application of flex services and products can only succeed if they are developed based on systems thinking: solutions must not only deliver value for the suppliers of flex services and products, but also for consumers, business energy users and grid operators. It also requires institutional adjustments. This requires cooperation, or at least coordination, between all stakeholders in the electricity system.

Project goal

The GO-e consortium of regional network operators, service and technology suppliers, advisers and knowledge institutions fulfills the objectives of MMIP 5 with value for these parties and users.

In concrete terms: (1) Scalable flex services that contribute to a better utilization of local energy sources and contribute to a reduction of (the increase in) peak load of regional networks; (2) Standardization, interoperability and cybersecurity are integral parts of these services and products so that flexibility becomes affordable and securely available on a large scale. (3) Regional grid operators can make substantiated decisions about whether, when, where and how flexibility should be used to prevent grid congestion; (4) To this end, grid operators and service providers have insight into the impact of electrification in the built environment and into the potential of solutions such as flex services; and (5) Consumers and business energy users are central to the design of the flex services and products in GO-e by using the innovative "participation by design". GO-e solutions must be applied in the electricity system for the first time by 2025 at the latest.

Result

The results of GO-e are:

- Prototypes of scalable and supported flex services for consumers and business energy users.
- Protocols and architecture for open and scalable flexibility access. o Supported strategy for successful rollout of flexibility access.
- Assessment framework for the use of flexibility for congestion management in the built environment.
- Selection of flex call-off mechanisms for regional grid management.
- "Recommended practice" for mitigating potentially negative side effects of large-scale implementation of new optimization or control algorithms.
- Calculation model chain for analyzes of the impact of electrification and future flexibility needs and potential on medium and low voltage networks.
- Practical application of calculation models for substantiating the investment agenda of grid operators.

The entire flex chain is represented in GO-e. By working together with end users, this forms a strong consortium with a wide scope and customer base. This collaboration results in integrated and coordinated system solutions. This enables GO-e to introduce results with a large impact to the market.

Short description of the activities

The project consists of four related work packages (WPs): o WP1. Develop prototypes of flexibility services and associated technical facilities for consumers and business users, supplemented with user research;

- WP2. Inventorying and developing existing protocols for large-scale access to flex. Develop a technical architecture with attention to chain integration, and validate this in order to arrive at a supported implementation strategy;
- WP3. Perform analyzes to determine the social costs, benefits and effectiveness of flex for congestion management. Making an assessment framework for the "if and how" use of flex. Design selection tool for flex call-off mechanisms. Drafting "recommended practice" for recognizing and mitigating negative side effects of new algorithms and mechanisms;
- WP4. Analyze scenarios to gain insight into the impact of electrification of the built environment and into availability of and demand for flex. Integrating existing models and applying them for the investment agenda of regional grid operators.

Location (s) where the project is being carried out (city, country)

All project participants are located in the Netherlands. In addition to the office locations, facilities and labs of the participants, research is also carried out in the following Living Labs:

- Ecowijk Mandora in Houten, the Netherlands (residential area);
- Distribution Center Albert Heijn Zaandam, the Netherlands;
- Smart Grid Heeten, The Netherlands (residential area);
- Community-based Virtual Power Plant Loenen, the Netherlands (residential area / industrial site).

Secretary TNO
Partners Alliander, Enexis, Stedin, Stichting ElaadNL, Greenchoice, Recoy B.V., Daalderop Royal Holland Pewter, ETPA B.V., Technolution B.V., Phase to Phase B.V., DNV GL Netherlands B.V., Witteveen+Bos, TU Delft faculteit EWI, TU/e,
Time Schedule 01.03.2021 – 29.02.2024
Support program MOOI 2020 Gebouwde omgeving

4.3 The Dutch heat pump factory: Serial production of high-temperature air-water heat pumps.

This project puts the collective high-temperature heat pump on the map, suitable for replacing the central heating boiler for residential complexes (from 25 homes) without making major adjustments to the delivery systems. A large number of obstacles have been identified in the current pilot of Wonen Limburg in Venray en Weert. These can only be eliminated with an innovative method and this technique will be successful. The heat pump must be made suitable for series production. This provides the necessary price reduction and speed increase.

Background

The energy transition and making the built environment free of natural gas requires alternatives to the natural gas-fired central heating boiler. Where there is residual heat, district heating is created, where this is lacking, the air / water heat pump is an interesting technique. A pilot project was started in 2019 for 320 homes of Wonen Limburg. The investment is almost 8 million euros. A high temperature air / water heat pump is used. This heat pump provides 8 residential blocks of approximately 48 households with sustainable heat and tap water. The unit is outside and is similar in size to a sea container. Natural refrigerants have been chosen. In September 2020, the first residential complex was successfully disconnected from natural gas in one day. The prospects for a successful pilot are positive. The basic idea, boiler out - heat pump in, seems technically possible but requires plenty of innovation. A video for a short impression: https://youtu.be/H2QtSHexFBo.

The Netherlands has 339 housing associations with a total of 2.4 million homes. The multi-storey buildings are ideal for the air / water heat pump. Innovation is needed to realize a payback period of 10 to 15 years on an installation. The estimate is a potential in the Netherlands of 30,000 units.

Project goal

The aim of the project is to make the energy transition successful with the implementation of the high-temperature heat pump. Technically speaking, the challenge is: significantly faster production and a lower cost price. Non-technical aspects are: involvement of residents, fast and reliable elaboration for housing corporations and compliance with not (yet) suitable laws and regulations.

Producer Servex focuses on lowering prices and increasing the pace of production. Wholesale Rensa is developing an infrastructure for W-installers with all the necessary components for the transition. Installers Feenstra and Kemkens are developing an instrument to integrate the heat pump and associated modifications in a structured E and W side. The pilots with Housing Corporation Wonen Limburg are used in the development of a package to explain to various stakeholders what the transition entails and what permission is required. Solutions are being developed for the bottlenecks in current legislation and regulations. Sparkling Projects is developing a design tool to fit the heat pump into a Smart Grid configuration, both in terms of E-infrastructure and W-infrastructure.

Result

The intended result is to market the collective high temperature air / water heat pump as a competitive alternative to the central heating boiler. The whole consists of setting up the chain in which the core is formed by the “Dutch Heat Pump Factory”. A series production of large-scale heat pumps with the production capacity of one heat pump per week is being developed in this factory. The factory will have a test facility to fulfill legal and regulatory requirements.

The consortium that will realize this consists of the parties that have committed themselves to the pilot project of applying this innovative heat pump in 8 residential complexes of Wonen Limburg. This project provides both technical and organizational knowledge and experience. At the end of this collaborative project, this heat pump

must be able to be integrated into the built environment without any significant problems. It is expected that 20 projects will be completed by 2024.

Short description of the activities

The consortium will commit to the following activities

- Setting up a standardized series production line
- Investment of machines and test facilities to reduce costs and increase the pace.
- Training project leaders and technicians
- Quality assurance performance and assurance for maintenance
- Setting up a distribution line, instructions and maintenance facilities
- Develop work processes and methods for E and W installers
- Developing an approach for municipalities, corporations and residents to enable the transition from natural gas to heat pump
- Integrating collective heating projects into E-infrastructure
- Business plan to develop a Dutch heat pump factory.

The 8 residential complexes in Venray and Weert are an important source of knowledge gathering.

Location (s) where the project is being carried out (city, country)

The first heat pumps are being realized in Venray and Weert in Limburg. Projects will be realized elsewhere in the country at a later stage. Parties are located in Limburg and Gelderland. The Servex production location is being built in Panningen.

Secretary	Sparkling Projects B.V.
Partners	Servex Holding B.V., Kemkens Installatieburo B.V., Feenstra Verwarming B.V., Gafco Altron B.V.
Time Schedule	07.10.2020 – 06.10.2024
Support program	MOOI 2020 Gebouwde omgeving

4.4 Local Inclusive Future Energy (LIFE) City Platform (LIFE)

Backgrounds

The Dutch transition towards carbon-neutral cities is in full swing and the share of local solar and wind energy is growing rapidly. Volatile renewable energy supply, higher peaks in demand, and the dynamic interactions between increasingly interconnected electricity, heat, and transport networks introduce significant complexity for future grid planning - particularly in the built environment. This challenge is further compounded by the emergence of new technologies, market mechanisms, and distributed flexibility services, which make it even more difficult to grasp the impacts of future energy scenarios.

DSO Liander has forecasted that 17 out of 25 substations in Amsterdam will reach peak overloads by 2030 - hence the urgency to find alternatives to infrastructure upgrades. In other areas, limited grid capacity has put a halt to new solar and wind projects, demanding solutions for better integration of renewables into the built environment. Therefore, smart energy solutions which unlock the full potential of flexibility from buildings and assets such as batteries, E.V chargers, and heat pumps, for multiple stakeholders, are essential for enabling the evolution of our sustainable energy system.

Project goal

The LIFE project aims to develop a district-scale energy management platform to resolve grid problems while integrating local stakeholder interests in its design and implementation. This innovation and experimentation will take place in an iconic area with existing grid issues (ArenApoort, including Venserpolder and the Urban Interactive District) as part of the wider sustainable urban development. The project will realise a replicable, innovative, integrated and future-proof energy system for similar mixeduse districts in The Netherlands and abroad.

LIFE will accelerate the energy transition by:

1. simplifying the integration of different types of sustainable generation into local energy systems;
2. improving the business case of sustainable development by adding value to flexibility and system performance;
3. optimising (multi-)energy infrastructure, improving security of supply and avoiding grid reinforcement;
4. making better use of local sustainable energy (heat and electricity) via smart distribution to the surrounding neighbourhood, and
5. working on inclusiveness to enable all stakeholders access to the benefits.

Project results

The key result of this project is a district-scale ICT smart energy management platform (LIFE) connected to a wide variety of energy devices/assets. This platform will strive for maximum societal acceptability by developing a technical and legal framework for local communities and stakeholders to access the benefits of flexibility. The platform will monitor and control multiple devices, simulate the effects of control measures using a Digital Twin and optimise flexibility with an intelligent algorithm while integrating with various energy markets. The platform will improve self-reliance on local clean energy, create financial value for flexibility and engage locals in the process.

This will be adaptable to many districts where grid congestion occurs, areas with a significant amount of flexible power available that can be used to provide energy services at a local level, and/or areas with identified opportunities for the exchange of energy between local producers and users. This project will also identify the conditions that such an area must meet in order to unlock and deploy flexibility, and reach out to these areas and the wider public to foster replication and upscaling.

Short description of the activities

This project involves applied innovation that will achieve the results through:

- Development of the LIFE Platform with input from all partners and co-designing with stakeholders.
- A Digital Twin is utilised for energy-services design, enabling simulation and scenario analysis. An integrated data hub and inventory of the area's devices is set up.
- Sensors /data connections will be implemented for the various energy devices to collect realtime data and establish a control process within LIFE.
- A MultiMarketModel optimisation algorithm is developed to make decisions considering all the integrated assets, grid limits, markets and various objectives, and will decide on how best to utilize the flexibility within the system.
- Inclusive governance and organisation requires mapping of stakeholders with a focus on vulnerable consumers. Human-centered energy services are developed with community engagement designed with local socio-economic demographics in mind.

The replicability of LIFE will be ensured through evaluation and assessment of the project and translating lessons learned into improving the LIFE platform and process as part of the urban energy transition toolkit.

Location(s) where the project is carried out (city, country)

The LIFE project focuses on the ArenApoort urban district, located in the borough AmsterdamSoutheast of Amsterdam, The Netherlands. This district includes some of the largest entertainment venues of the Netherlands, such as the Johan Cruijff ArenA (JCA), Ziggo Dome and AFAS LIVE. The ArenApoort is one of the most high-ranking economic districts of the Netherlands, with a wide variety of headquarters and offices of large companies, including ING Bank and Vattenfall. Bordering the JCA on the other side of the busy train station Bijlmer Zuid, there are 5000 homes built in the 1980s, focused on lower income homeowners.

This project aims to bridge the 'energy' interests of all these stakeholders. The area is part of the 'Energieregio Noord-Holland Zuid', and specifically drafted its own energy vision Amsterdam Zuidoost 2040. A study of the applicability of the LIFE system will also be conducted in Schiebroek, a district in Rotterdam, to ensure that the development process can safeguard the upscaling potential.

Secretary	Stadion Amsterdam N.V.
Partners	Gemeente Amsterdam, Spectral Enterprise B.V., Alliander, Universiteit Utrecht faculteit Geowetenschappen, Amsterdam Energy Arena B.V., Stichting CoForce, EnerTrans, Hedgehog Applications B.V., Gemeente Rotterdam, Stichting Amsterdam Institute for Advanced Metropolitan Solutions, TU Delft
Time Schedule	01.01.2021 – 31.12.2024
Support program	MOOI 2020 Gebouwde omgeving

4.5 Intelligent flexibility through integrated hybrid storage technologies (FLEXINet)

Background

Social developments towards gas independence and 'green' mobility will lead to a sharp increase in electricity demand in the coming years. In addition, the penetration rate of renewable energy sources with an intermittent character, such as wind and sun, is increasing strongly. These unprecedented changes create major technical and societal challenges for distribution networks in the areas of congestion management, power quality, stability, reliability, spatial integration and social acceptance. They require large investments to strengthen the energy network.

Project goals

The objective of this project is to develop an integral system for the intelligent and integrated control and implementation of hybrid energy storage technologies in the built environment. FLEXINet focuses on (renovation) arrangements for homes and utility buildings, including making the collective heat supply more sustainable and the general energy consumption more sustainable. The smart system will improve the flexibility and sustainability of electricity supplies by combining stationary battery storage, reused batteries, electric vehicle charging, vehicle-to-grid technology and flexible heat pumps. FLEXINet offers a complete solution that is attractive to the intended users and that has been validated in living labs.

Result

FLEXINet follows a research model that consists of 4 layers:

1. Flexibility-enabling Hardware,
2. Integration, conversion and smart management,
3. System Flexibility and Living Labs
4. Social Acceptance and Learning Community.

The hybrid energy storage technologies that are being developed in layer 1 will be integrated in (renovation) arrangements for homes and utility buildings, for making the heat and cooling facilities more sustainable and for the integration of renewable energy sources and electric vehicles. The smart solutions developed in layers 2 and 3 improve the flexibility and sustainability of electricity supplies by combining stationary battery storage, reused batteries, electric vehicle charging, vehicle-to-grid technology and flexible heat pumps and storage. We strive for the most complete, integrated and validated solution that is attractive to users who are further involved in layers 3 and 4. The end result of the project is an integral system for the intelligent and integrated control and implementation of hybrid energy storage technologies in the built environment.

Short description of the activities

FLEXINet works via four linked layers. The activities belonging to the first layer of Flexibilityenabling hardware concern the development of innovative low-cost and high-energy battery chemistries and power electronics for hybrid energy storage systems, including the design, development and testing of prototypes. In the second layer Integration, conversion and smart control, the activities concern the design of an underground heat storage system, the development of a life-extending battery optimization, the design and testing of a generic and open-source EMS platform and the development of intelligent hybrid EMS algorithms that later in the System Flexibility and Living Labs layer lead to new services and revenue models for reliable networks. Demonstration, testing and validation of the FLEXINet solution is also done here (TRL4-6). In the fourth layer Social acceptance and learning community, the activities concern the investigation of social acceptance and knowledge

dissemination. In this way we offer a complete and integrated solution to exploit the potential flexibility of the built environment through hybrid energy storage systems.

Location (s) of the project (city, country)

All project participants except VITO are based in the Netherlands. VITO is located in Belgium. In addition to the office locations of the participants, research will also be conducted in two Living Labs: in Delft and Hilversum, the Netherlands.

Secretary	TU Delft
Partners	Power Research Electronics B.V., Summerheat Group B.V., HET: coöperatie Hilversumse Energie Transitie U.A., Dr. Ten B.V., Emmett Green B.V., Heliox B.V., Leydenjar Technologies B.V., Recoy B.V., TU/e, Vlaamse Instelling voor Technologisch Onderzoek, DC Opportunities R&D B.V.
Time Schedule	01.04.2021 – 01.04.2025
Support program	MOOI 2020 Gebouwde omgeving

4.6 Sorption Heat and Cold Storage System 2 (SWEKOS 2)

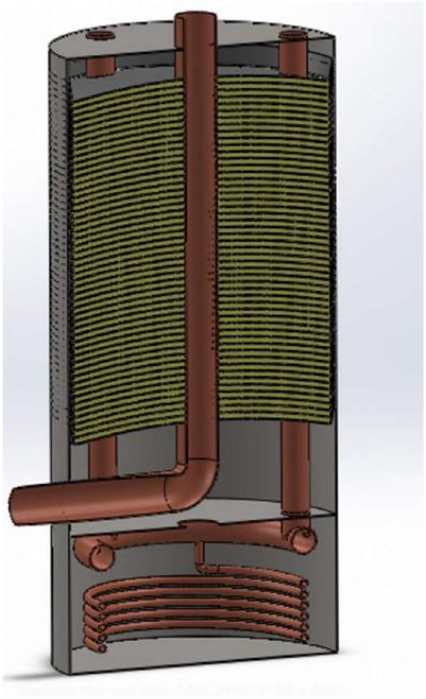
Background

For some time now, thermochemical storage has been seen as a solution route with great potential, especially for the use of sustainable energy sources. The advantages are high storage density and virtually loss-free and with a large energy-saving effect. However, important hurdles that still need to be overcome for large-scale application as a full-fledged product are: stability, processability and optimization properties of a thermo-chemical material, tailored industrial and scalable production process, long service life and excessive system costs.

Project goals

The TKI SWeKOS and Energypad 2.0 projects have been successful so that a complete system based on a TCM can now be built and tested. The conclusion from these 2 projects is that a follow-up process can be started in which the active substance is a thermo-chemical material (TCM) (based on absorption) that leads to a system that has a market-based cost price, that can be easily produced and that the desired energy has storage parameters (compact, 5 * more storage than water and loss-free in the long term). During these projects it was also shown that a coating that is resistant to the action of Na2S can be applied well and remains sufficiently stable over a longer period of time. The production of the residual gas H2S from the TCM Na2S requires a different approach. Research at TNO has developed an effective variant of Na2S that produces less H2S. This modified TCM is used, as well as CaCl2 and / or K2CO3.

The complete SWeKOS system with TCM is designed, built and tested. Optimization of the system and production are further investigated so that a market-compliant product with regard to cost price, functionality, sustainability and production can be made. The integration of the SWeKOS system for a number of different heat and cold installations of a home and office is also being worked out, including hydraulic integration and connections, Support program and control.



Energy Battery with pads

Short description of the activities

- Reactor module with TCM: tests with regard to functionality and performance
    - Equipped with the energy pad, coating and Support program
    - Equipped with modified Na2S (TNO) and CaCl2 or K2CO3
    - Testing in lab with cycle for production of tap water, heating and cooling: therefore capacity and power.
    - Verify calculation model
- Optimization of the integration of the SWeKOS system in an energy installation in homes and buildings
- Complete SWeKOS system made, and tested in test setup at RTB.
- Tailored testing at TNO with focus on the functional properties and performance of the SWeKOS system under defined conditions.
- Test protocol developed.
- Measurement results

- Industrialization: production research, positioning and business case

Result

A complete sorption heat and cold storage system, including Support program, control and control, is designed, built and lab tested. This SWeKOS system is equipped with an active TCM. 1 lab prototype will be built consisting of 1 module and 1 complete system.

The test results are used to verify a detailed calculation model. This model is used to perform the optimization and to design a complete prototype.

Technical design and integration guidelines are being worked out so that the SWeKOS system can be properly integrated into an installation of a home or office. Insight into production process, cost price, market positioning and sustainability is obtained.

Secretary	ArtEnergy B.V.
Partners	De Beijer “RTB” B.V., TNO, TU/e
Time Schedule	01.11.2020 – 01.11.2022
Support program	TSE GO 2020

5. Combination with other technologies

In traditional approach developers used to have blinkers on not taking notion of other technologies then those they are working on. However already in 1975 it was proposed to combine unglazed Solar Thermal with Heat Pumps (. This research was not continued at that timed. Later on Solar Thermal became an option to regenerate ground sources for hedat pumps

5.1 Prefabricated thermo buffer with hybrid generation: gas-free and network-relieving (SummerHybrid)

Background

By 2030, 49% CO2 must be reduced nationally and about 15% of the housing stock should be independent of natural gas in the coming decade. Energy buffering is essential in this transition to sustainable energy management. Because sustainable generation cannot always be planned and has a strong seasonal character. Until now, this is usually not a problem because the share of renewable energy in the Dutch mix is still relatively small and peaks in sustainable generation can always enter the grid, although grid operators are already facing major challenges.

But as the installed capacity grows, the energy grid starts to crack. For many locations in the Netherlands, no transport indication is issued for the time being. And the peaks on the electricity grid are also increasing on the demand side. With the decision to make gas-free homes the norm, the growing use of heat pumps (especially in winter) means an increasing demand on the electricity grid. Innovations that focus on solving these problems are crucial. Ultimately, with the current solutions (more sun and wind) and grid buffering for later use (all-electric homes), we keep an enormous dependence on the grid and ultimately also on fossil sources.

Project goal

The aim is to design, develop and test a prototype underground buffer (SummerHybrid) that, in conjunction with other components, will be developed into an optimal hybrid for a typical renovation situation in the Netherlands. A standard 1970s terraced house that has been renovated to label B will be heated all electric by means of the hybrid system.

This with the help of the following components:

- A standard air-water heat pump but with less power because the peak demand is smoothed out.
- Six solar panels. o Three heat pipe solar collectors.
- An underground buffer (approx. 2 x 4 meters) that fits under the terrace of any ground-based home (net volume of approx. 4 m3).
- A delivery set including controls.

Owners of an all-electric home will face price increases in the future as a result of the abolition of the netting scheme. In addition, the introduction of fluctuating / variable energy prices is expected. By having a hybrid buffer solution, these effects can be largely mitigated or even result in an advantage (by purchasing energy at favorable times and charging the buffer for extraction at an expensive moment). The buffer plays a central role in this. It is placed underground, under the garden terrace, without restrictions on the living and outdoor space.

Short description of the activities

The activities consist of developing one SummerHybrid prototype, placing it at an existing 1970s house and testing and monitoring for performance. Input for the development are the requirements and wishes of construction companies, housing corporations and residents (parties present in the partnership). The project validates the energetic performance of the generation, the energetic performance of the buffer, the energy output and some crucial technical assumptions in practice. In this way, the aspects that influence the long-term performance and continued performance are monitored and simulated.

Result

The result is a validated SummerHybrid prototype, supported by market parties, which is linked to a renovated 1970s terraced house. Data has been collected and models have been validated to arrive at a design optimization to bring the first version to the market by mid / end of 2022.

The SummerHybrid significantly reduces energy dependence compared to existing solutions with heat pumps: in the middle of winter under unfavorable conditions, a minimum of 4 days can always be bridged and much more in the early and late seasons.

The SummerHybrid also pays for itself well in the current market with only a slightly longer payback period than a heat pump without a buffer and, with the established reduction in netting, has a shorter payback period than a home without a buffer. In addition, the SummerHybrid is future-proof because it can use the expected variable energy prices to convert electricity into heat that can be added to the heat buffer at times of low prices. In a market with fluctuating energy prices, the resident is given the opportunity to spend cheaper instead of more expensive. With home renovation, it is already a financially attractive choice to install such a buffer, knowing that the financial savings will increase annually.

Secretary	Summerheat Group B.V.
Partners	TNO, Stichting WoonFriesland, Bouwgroep Dijkstra Draisma B.V.
Time Schedule	15.04.2020 – 30.09.2021
Support program	DEI+ 2020 - aardgasloze woningen, wijken en gebouwen

5.2 DEI720009 - HYDR100GREEN (HYDR100GREEN)

Backgrounds

There is a major challenge to achieve the ambitious target of 49% less CO2 emissions in the Netherlands by 2030 - followed by 95% in 2050. The built environment must be climate neutral by 2050, although this sector currently still contributes 15% to the total CO2 emissions of the Netherlands. There is an enormous task here. There is still insufficient insight into suitable technologies for large-scale application for the transition to natural gas-free systems. For example, technologies such as heat networks, green gas and all-electric heat pumps have individual shortcomings. Green hydrogen is seen as a crucial link in making the existing built environment free from natural gas from 2030; however, it is important to map out the options for using this right now. Green hydrogen offers opportunities to relieve the load on the electricity grid and to buffer energy. In addition, the existing gas infrastructure can be used permanently. Use of green hydrogen i.c.m. hybrid heat pumps have an important advantage: buffered green hydrogen can be used during peak loads and a climate advantage is achieved. This unique concept will be applied in HYDR100GREEN.

Project goal

The aim of HYDR100GREEN is to increase the speed at which existing homes make the transition to natural gas-free, by demonstrating on a large scale a system in which sustainably generated green hydrogen is used in hybrid heat pumps. For this, green hydrogen will be odorised and subsequently buffered under relatively low pressure in buried pipes. After this, green hydrogen will be distributed via the existing gas infrastructure and then used in hybrid heat pumps for heating existing homes in the Groningen village of Wagenborgen. HYDR100GREEN is a sustainable alternative to natural gas use in the built environment, which will reduce CO2 emissions. The specific goal of the project partners is to gain experience based on a realized demonstration system, in order to scale up this concept at a faster pace. In this way, HYDR100GREEN contributes to increasing the transition to natural gas-free homes in a cost-effective way for both society and the end user.

Short description of the activities

The demonstration project HYDR100GREEN builds on preparatory work, pilots and R&D activities carried out. The project period is divided into the following four work packages: technical project management (WP1), engineering and purchasing (WP2), purchase and construction (WP3) and commissioning and validation (WP4). The engineering and purchasing work package concerns the preparation of technical specifications for KPIs for the demonstration process and the preparation of an integral design package for upscaling within the project. Within the purchasing and construction work package, the purchasing procedure is completed and parts, equipment and infrastructure works are prepared for the project. Subsequently, the HYDR100GREEN system will be built in this phase. The entire system will be ready for commissioning and validation from 2022, resulting in the final work package. The demonstration project will be completed by the end of 2022.

Result

With successful implementation of HYDR100GREEN, a CO2 reduction of 147 tons per year will be achieved at the project location in Wagenborgen. In addition, the knowledge and experience gained from this project will result in an accelerated upscaling of the natural gas-freeing of homes through the application of green hydrogen in the built environment. In this way, the application of green hydrogen can form a cost-effective CO2-reducing technology for the transition to natural gas-free homes, neighborhoods and buildings. Enexis aims to set up a second similar project in 2025. This means that a total CO2 reduction of 1,029 tons can be achieved within a period of 5 years after commissioning. It is expected that several thousand homes will make the transition to gas-free by 2030. In this way, the knowledge acquired in HYDR100GREEN will also be applied in green hydrogen projects set up by parties other than those involved in HYDR100GREEN. As a result, the potential CO2 reduction at a national level will be many times higher.

Secretary Enexis
Partners Enpuls B.V., Enexis Personeel B.V., Woonstichting Groninger Huis, Energiewacht N.V., Intergas Verwarming B.V.,
Time Schedule 28.09.2020 – 30.11.2022
Support program DEI+ 2020 – aardgasloze woningen, wijken en gebouwen

5.3 TEUE919001 - Helena all-electric energyconcept (Helena all-electric)

Background

The energy issue is often approached from the individual techniques and associated business models. This creates sub-optimization. For example, a solution from MMIP 3 has a relationship with a solution from MMIP 4, heat pumps are dependent on smart heat-cold and power grids, thermal storage, geothermal energy, locally generated energy and an energy manager for flexible deployment for their power supply and power supply.

The Helena all-electric energy concept and business model offer an integrated solution, in which all these technologies and business models are brought together. For example, a smart compact heat pump is being developed to replace the central heating boiler, so that radical renovations are no longer necessary or can be better planned with major maintenance. The open heat and cold network is fed by heat / cold from a collective geothermal energy system. A smart energy management and storage system ensures that the existing energy networks do not have to be drastically upgraded. An integral business model makes it financially attractive for all parties involved. It is being investigated how enthusiasm can be aroused.

Goal of the project

The aim is to develop an integrated energy concept and business model that covers the entire energy chain and can be universally applied to all types of residential areas without drastic changes to the homes and the existing local electricity grid.

We assume that in the final situation, local generation of electricity from solar panels, local energy storage, generation and distribution of local sustainable heat and various flexibility options will be used locally as much as possible to cover the use of electricity, (electric) transport and heat. only on an annual basis, but also on a quarterly, hourly and daily basis and between seasons.

To this end, a smart open heat and cold network (5-20 ° C) is linked to a collectively closed geothermal energy system. This smart heat cooling network will eventually replace the existing gas infrastructure. Newly developed silent compact ground source heat pumps are connected to this to replace the existing central heating boilers. For the generation and storage of electricity, PV solar panels and vehicle to grid (V2G) electric cars are connected to each other.

Brief description of the projects and other activities

The sub-projects consist of developing:

1. An all-electric energy concept and business model suitable for all types of residential areas, through cooperation of companies in the energy chain (production, storage, transport & distribution, supply and purchase), with a new business model for a large-scale neighborhood approach for making CO2 emissions free. of residential areas.
2. A smart open cold heat network to replace the gas network. This smart heat and cold network is linked to a closed (deep) geothermal energy system. An associated smart energy management and storage system makes it possible to flexibly balance energy supply and demand and prevent peak loads in the energy networks.
3. A quiet, compact, smart, affordable heat pump to replace the central heating boiler. The new heat pump system coupled to a smart energy management and storage system flexibly delivers almost the same thermal capacity and temperature as the central heating boiler. The houses and the electricity grid do not then need to be drastically modified.

4. Research into how home owners and parties involved can be made enthusiastic about the transition.

Result

The result is a well thought-out and tested integral energy concept and business model, with which all types of existing residential areas can be accelerated from gas to (almost) CO2 emission-free in 10-15 years with the same housing costs.

Smart open heat cooling networks (5-20 ° C) connected to a collectively closed (deep) geothermal energy system replace the gas network. The heat is locally generated and stored in the soil and supplemented in the summer from heat from PVT solar panels or aquatherm.

The existing central heating boilers are being replaced one-to-one by newly developed silent compact modulating ground source heat pumps. These heat pumps are suitable for both low-temperature heating (30-45 ° C) and existing high-temperature heating (45-70 ° C), so that no major modifications to the home are required. This smart heat pump is connected to a smart energy management and storage system that prevents the existing electricity grid from being overloaded.

Residents / home owners and all directly involved parties are supported, unburdened and enthusiastic with a transition enthusiasm package.

Secretary	Helena Sustainable Innovations B.V.
Partners	Quooste B.V., GEO Energie B.V., PicoEnergy Gmbh & Co KG, FuturePower4All B.V., Collective Minds Group, Van Gelder Groep B.V.,
Time Schedule	01.03.2020 – 31.12.2024
Support program	MOOI 2019 Gebouwde omgeving

5.4 TGOM120007 - TOMAHAWK II (TOMAHAWK II)

Background

The energy transition is in full swing! The regional energy strategies will be delivered this year and the first Transition Visions Heat are already available. In the coming years, these visions will be developed into concrete implementation plans and realizations, including technical designs for low-temperature heat networks and associated business cases for the stakeholders involved.

Low-temperature heat and cold networks, (also called kowanets, cool heat networks or exchange networks), have a completely different technical design and business case than traditional heat networks: supply of cold and heat, a ring / mesh topology, decentralized demand-driven circulation pumps , focus on the exchange (matching) of (residual) heat and (residual) cold and a lot of thermal (seasonal) storage.

Creating a technical design and business case requires information and knowledge from a wide variety of disciplines: building physics, building renovation concepts, hydraulics, supply and demand matching, spatial planning, financing, economic flows, soil layers and underground spatial impact. These exercises have so far been calculated manually, requiring a lot of effort and time. Project development is therefore expensive and forms a barrier to the realization of these kowanets.

Goal or project

TOMAHAWK II makes an objective and accessible contribution to shortening the doorTime Schedule and lowering the development costs for the realization of sustainable neighborhoods with kowanets.

TOMAHAWK II integrates multiple (digital) tools and manual processes into a fully structured and largely automated process. The project development therefore has a doorTime Schedule of only 3 months. These three months include a sharp analysis of heat scenarios, including area-level heat networks. The process includes technical design, business case and step-by-step plan of the chosen solution direction for all buildings (existing and new-build homes and utility) in an area. Taking into account the spatial impact on the topsoil, shallow and deep subsoil.

Kowanets have a lot of thermal buffering, which can match supply and demand. This thermal buffer capacity, in combination with the existing circulation, source and heat pumps, makes a kowanet flexible for a smart grid. TOMAHAWK II therefore also quantifies the electrical flexibility of kowanets for Smart Grids applications.

Short description of the activities

The activities take place around six aspects of kowanets:

- For the buildings in the development area, both residential and non-residential, including demolition and new construction, the heat and cold demand profiles are calculated using building physics calculation methods using open data.
- Existing and new data from energy sources for (residual) heat and cold are stored in Geodan's GIS data map tool.
- The potential for underground thermal storage, both shallow (eg Ecovat, HoCoSto) and deep (ATES) is being mapped out. This is in line with the developments surrounding the Basic Data on Spatial Subsurface.

- The technical manual developed in the TKI project Kowanet is used to generate, dimension and calculate hydraulic calculations (various variants of) a kowanet largely automatically.
- Financial key figures and stakeholders are assigned to individual assets with which a complete business case is calculated per stakeholder.
- The potential for electrical flexibility for Smart Grids is quantified.

Result

The result is a software-as-a-service tool for stakeholders that the consortium aims to market as freemium / premium within a year of the end of the project.

- Partial results of this tool are:
- Method to calculate heat and cold profiles of utility buildings on the basis of open data.
- Method for configuring and dimensioning kowanets largely automatically.
- Kowanet business case generator, in which multiple stakeholders (eg grid operator, source manager, supplier) can be assigned to assets in order to realize open heat networks. o System to quantify electrical flexibility for smart grids of kowanets.
- Structured process flow for the project development of a kowanet.
- In addition, the tool is demonstrated to stakeholders through individual demonstrations and through participation in workshops, fairs and conferences. The consortium will actively approach stakeholders. Interested stakeholders are, however, welcome to express their interest to us.
- TOMAHAWK II will be applied in two concrete cases, which ultimately (outside the scope of the project) lead to the implementation of a kowanet.

Secretary	EnergyGo B.V.
Partners	Geodan Software Development & Technology B.V., Stichting Waternet
Time Schedule	01.11.2020 – 31.10.2022
Support program	TSE GO 2020

Case: Buikslotermeer