CLIMATE-NEUTRAL URBAN DISTRICT

Flagship project
Solar-powered buildings /
energy-efficient cities

in Esslingen am Neckar

NEUE WESTSTADT
KLIMAQUARTIER

"CLIMATE PROTECTION MADE IN GERMANY – GREEN HYDROGEN TECHNOLOGIES ARE OF UTMOST IMPORTANCE FOR THE FUTURE VIABILITY OF GERMANY AS AN INDUSTRIAL LOCATION."

National Hydrogen Strategy,
Federal Ministry of Education and Research

der Geb-
darf und
den kon-
otovoltaik
Systeme

THE "NEUE WESTSTADT" – A CLIMATE-NEUTRAL URBAN DISTRICT

FLAGSHIP PROJECT AND RESEARCH DISTRICT

Germany has set ambitious climate protection targets: By 2050, annual greenhouse gas emissions are to be reduced by 80 to 95 percent compared to 1990 levels. New solutions are required in all areas of life: transport and mobility, consumption and energy as well as urban development.

In the Swabian city of Esslingen am Neckar, the site of the old freight depot is being turned into a research district: the innovative and sustainable "Neue Weststadt" will be built here on an area of 100,000 m2 – offering 450 apartments, office and commercial space, as well as a new building for the Esslingen University of Applied Sciences.

In terms of urban planning, the district integrates the use of hydrogen with the aim of achieving annual CO2 emissions of less than one ton per resident for housing and mobility and to support the first urban climate goal of reducing CO2 emissions within the city of Esslingen by a quarter. The climate-neutral district will also play a key role towards achieving the city's climate goals.

LIVING IN THE NEIGHBORHOOD

Apartment blocks Béla (B) and Citadis (C) are already inhabited, blocks (A) und Desiro (D) are currently under construction. Together, the four residential blocks have more than 450 apartments, surrounded by green spaces, local amenities and a central district square. Modern workplaces, diverse residential areas and a wide range of leisure activities make it an attractive urban neighborhood. The buildings within the district were named after famous trains and locomotives.

STUDYING IN THE NEIGHBORHOOD

A new building for Esslingen UNIVERSITY of Applied Sciences including lecture halls, seminar rooms, offices, a cafeteria, a computer center and a library is being built on an area of 18.500 square meters.
In the first construction phase, four buildings are planned, each with five full floors above ground and a connecting basement. The district's residential and commercial blocks, as well as the city center and train station, are in close proximity to the new campus.

ARBEITEN IM QUARTIER

The "Crystal Rock" is an architectural highlight of the development. This modern office and commercial building was commissioned by Saarbrücken-based investor RVI GmbH and designed by MVRDV from Rotterdam, one of the world's most successful architectural firms. The design "The Milestone – a Crystal Rock" forms the basis for the construction of Block (E) and reflects the city's topography.

WE LOVE HYDROGEN

For the first time, modern hydrogen technology is successfully integrated ecologically, socially and efficiently at the neighborhood level. Green electricity is converted into green hydrogen and processed for use in the district, mobility and industry.

→ **For the innovative energy concept at a glance, see page 16.**

THE URBAN DEVELOPMENT CONCEPT WAS INITIATED BY MAYOR DR. JÜRGEN ZIEGER

ENERGY-OPTIMIZED BUILDINGS

High-quality thermal insulation of the buildings provides the basis for low energy consumption and high living comfort. The roof areas are consistently used to generate electricity using photovoltaics, while the buildings are supplied with regenerative heat via innovative systems. With its planned wood-hybrid construction and innovative solar frontage, the Crystal Rock is intended to demonstrate that sustainable construction can also be visually appealing.

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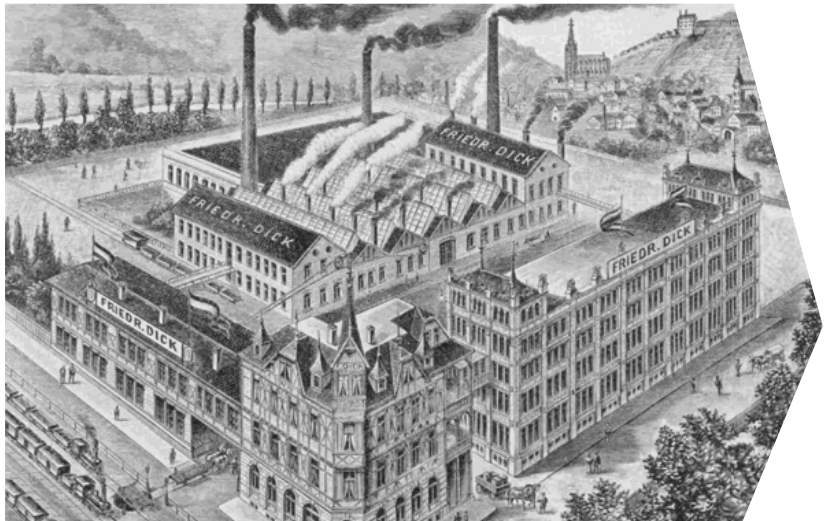
INNOVATIVE STRENGTH IN ESSLINGEN

The Esslingen Weststadt has always been a place that keeps up with the times, where innovation is lived and experienced. Here, Swabian inventiveness and entrepreneurship have ensured economic prosperity for over 100 years.
High-quality products such as steam locomotives, files and knives as well as delicatessen products were exported all over the world from Esslingen am Neckar. Covering more than twelve hectares, construction of the "Neue Weststadt" is the most important urban development project in the city.

ILLUSTRATION OF THE BUILDING COMPLEX OF THE COMPANY FRIEDR. DICK GMBH & CO. KG FROM ABOUT 1898



BEING A ROLE MODEL

Realization of the project goes along with technical and social innovations. If all the ideas are successfully implemented, a virtually climate-neutral urban district will emerge that will contribute to the energy transition. A role model worth living by – for future development projects and for citizen participation in other municipalities.

OTHER FLAGSHIP PROJECTS IN GERMANY

In addition to the "Neue Weststadt" in Esslingen, other flagship projects funded in Germany include: "Quarree100" in Heide, "Stadtquartier 2050 – Solving Challenges Together" in Stuttgart (Olgahospital) and Überlingen, "Pfaff" – former factory site in Kaiserslautern, "ZED" – zero-emissions district in Zwickau and "ENaQ – Energetic Neighborhood" in Oldenburg.

A TOTAL OF 4,200 SQUARE METERS OF PHOTOVOLTAICS HAVE BEEN INSTALLED ON THE ROOFS OF THE RESIDENTIAL BLOCKS, WITH AROUND 10,000 IN THE ENTIRE URBAN DISTRICT.

SOLAR-POWERED BUILDINGS AND ENERGY-EFFICIENT CITIES

The “Neue Weststadt” was selected from more than 60 competitors as one of six flagship projects for urban planning in Germany that are being funded by the Federal Ministry for Economic Affairs and Energy (BMWi) and the Federal Ministry of Education and Research (BMBF). The interdepartmental funding initiative “Solar-powered buildings/energy-efficient cities” is looking for ways at neighborhood level to achieve the goal of a climate-neutral building stock by 2050.

HOW WILL WE LIVE IN THE FUTURE?
HOW WILL WE MOVE AROUND?

PROJECT MANAGER PROF. DR. MANFRED NORBERT FISCH:
“CLIMATE NEUTRALITY IS ONLY POSSIBLE WITH A SOLAR-POWERED HYDROGEN ECONOMY.”

CLIMATE-NEUTRAL DISTRICT II

COMPLETION OF CRYSTAL ROCK IN
2024

INAUGURATION OF CLIMATE-NEUTRAL DISTRICT I
06/2021

COMPLETION OF THE UNIVERSITY BUILDING
2023/2024

ENERGY-USER INTERFACE FOR RESIDENTS
Raising consumption awareness
06/2021

INITIAL OPERATION OF THE HYDROGEN GENERATION, SUPPLY TO THE GAS GRID
05/2021

APPROVAL TO OPERATE THE ELECTROLYZER
04/2020

COMMISSIONING OF THREE ADDITIONAL ELECTRIC HYBRID BUSES
01/2020

FOUNDING OF THE GHE
(operating company for hydrogen production)
03/2019

COMMISSIONING OF TWO ELECTRIC HYBRID BUSES
08/2019

FIRST RESIDENTS OF APARTMENT BLOCK B MOVE IN
2018

FEASIBILITY STUDY
Preparation of the research project Es_West_P2G2P application
2015–2017

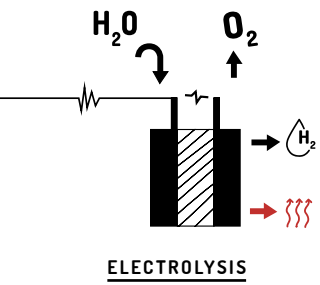
URBAN DEVELOPMENT COMPETITION
Contract and framework for the “Neue Weststadt”
FROM 2013

GREEN HYDROGEN
THE KEY TECHNOLOGY OF THE URBAN DISTRICT

POWER TO GAS TO POWER (P2G2P) – HERE'S HOW IT WORKS

Renewable energy (power) – generated by local photovoltaics and from supraregional electricity generation – is converted by electrolysis. Green hydrogen (gas) is produced. The gas can be stored and used to substitute fossil fuels, according to demand, in mobility and industry or fed into the gas grid. Waste heat from the electrolysis process is used to supply heat to the neighborhood. This procedure significantly increases the overall efficiency of the system.

The sustainable energy concept at the neighborhood level is being developed as part of the research project "Climate-neutral urban district – Neue Weststadt Esslingen". Thus, implementable and widely transferable solutions for the use of green hydrogen in urban areas are being developed in Esslingen. These innovations are also an important step towards realizing municipal climate protection goals.



GREEN HYDROGEN IN NUMBERS

IS IT MUCH, IS IT LITTLE?

Hydrogen is the energy carrier with the highest energy density of 33.33 kWh/kg. In the "Neue Weststadt" district, **85 tons** of green hydrogen are produced annually. This annual hydrogen production from the climate-neutral district **is equivalent to ...**

... the annual electricity consumption of **726 three-person households** (= 2,800 MWh/a)

... **circumnavigating the earth 212 times** by car. 1 kg of green hydrogen allows a car to travel around 100 km in a climate-neutral manner.

... **280,000 litres of oil.**

THE FUTURE INHABITANTS OF ESSLINGEN ...

The residents of the “Neue Weststadt” will live and experience what it means to save resources and be energy-conscious. The innovative concept connects electricity, heating and cooling, resulting in a holistic solution. Sustainable mobility is also part of the concept.

... WILL LIVE IN THE CLIMATE-NEUTRAL NEIGHBORHOOD AND SUPPLY THEIR OWN ELECTRICITY.

The energy concept of the “Neue Weststadt” achieves a high degree of self-sufficiency, which in turn increases the overall efficiency of the neighborhood: photovoltaics on the roofs of the buildings supply renewable electricity from within. Additionally, energy is supplied externally, for example from wind farms in the Swabian Alb.
All surplus electricity can be stored as hydrogen and converted back into electricity at a later date or made available via the gas grid. The waste heat generated in the process is also used for the residential district.

... WILL BE WELL CONNECTED AND SMARTLY INFORMED.

An app will inform residents of the neighborhood, for example, about free time slots for the shared washing machine or how much electricity is currently generated by the photovoltaics installed on the roof. They can also monitor their energy footprint: How much electricity or water do I consume over a certain period of time? ... and in comparison to other residents? Who is the most energy-efficient resident in the Béla apartment block? Being generated internally, the electricity in the building is cheaper for the tenants than electricity from external suppliers.

... WILL DRIVE AN ELECTRIC CAR OR FILL UP WITH H_2

The locally generated solar electricity will charge private electric vehicles as well as car-sharing vehicles. As a result, mobility will be mostly emission-free, coming from renewable energy sources from the neighborhood (PV electricity, H_2 from electrolysis). A broad range of public and semi-public charging stations for electric vehicles is being built. In the future, residents will be able to use the district’s own app to access information on energy consumption and to book car-sharing vehicles.

... WILL TAKE THE ELECTRIC HYBRID BUS

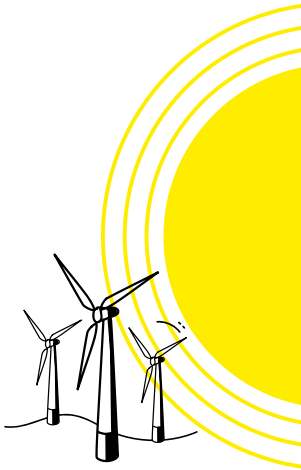
The newly acquired urban electric hybrid buses can – with a 20 percent expansion of overhead contact lines – quadruple the electrically driven routes, which corresponds to a 100 percent coverage. The “Neue Weststadt” research project is investigating how previously unused recovery energy from the contact wire network of local public transport can be used.

MOBILITY AND TRANSPORTATION

ON FOOT OR BY BIKE THROUGH THE CITY
BY ELECTRIC BUS TO SURROUNDING AREAS
BY COMMUTER TRAIN OR LONG-DISTANCE TRAIN
TO MORE DISTANT LOCATIONS

THE "NEUE WESTSTADT" OFFERS INDIVIDUAL MOBILITY CONCEPTS AND COMBINATIONS OF MEANS OF TRANSPORT

THE NEW RESIDENTIAL AND COMMERCIAL BLOCKS ARE CLOSE TO ESSLINGEN CITY CENTER AND THE TRAIN STATION.



HIGHLY INDIVIDUAL – PRIVATE OR PUBLIC

In addition to hydrogen cars, electric vehicles or car-sharing, transportation on foot or by bicycle will also become increasingly popular in the future. For the residents of the "Neue Weststadt", the central location and proximity to Esslingen train station as well as sufficient charging stations for e-bikes in the neighborhood offer a convenient option for using these services. With Esslingen's Municipal Transport Services (SVE), the entire local public transport system is also becoming more ecological – nitrogen oxides and particulates are increasingly being avoided: The city of Esslingen is already a pioneer in this respect, as it is one of the three municipalities in Germany in which electric-powered trolleybuses provide a large proportion of public transport services. The diesel buses still in operation will gradually be replaced by electric hybrid buses in order to achieve the long-term goal of fully electrifying Esslingen's public transport network. Esslingen would then be the first city in Germany to operate its urban route network 100% purely electrically.

PROJECT AND NETWORK PARTNERS

As the main applicant, the city of Esslingen is working with a total of 13 partners to develop the basis for supplying sustainable energy to a climate-neutral urban district. The Steinbeis Innovation Center (SIZ) energieplus in Stuttgart is responsible for the overall scientific and organizational coordination. The wide range of topics in terms of content and expertise requires an interdisciplinary team from the areas of research (technology and social sciences), application and citizen participation.

THE PROJECT TEAM IS COMPOSED OF:

STADT ESSLINGEN AM NECKAR

THE CITY OF ESSLINGEN AM NECKAR

Main tasks in the research project:
Public relations and citizen participation, urban planning

siz energieplus
steinbeis innovations zentrum

STEINBEIS INNOVATION CENTER (SIZ) ENERGIEPLUS, STUTTGART

Main tasks in the research project:
Overall scientific coordination, development of energy supply concept, monitoring and optimization of operations

COOPERATING INSTITUTIONS:

Berliner Institut für Sozialforschung GmbH

BIS, BERLIN

Main tasks in the research project:
Socio-scientific monitoring

BLUMBERG

AGENTUR BLUMBERG GMBH

Main tasks in the research project:
Conception and support of public relations and information center

GREEN HYDROGEN ESSLINGEN

GREEN HYDROGEN ESSLINGEN GMBH

Main tasks in the research project:
Operation of energy center with electrolyzer, H_2 filling station, electricity storage and development of operator models

HyEnTec GmbH

HYENTEC GMBH

Main tasks in the research project:
H_2 mobility and H_2 utilization

IGS

IGS, TECHNISCHE UNIVERSITÄT BRAUNSCHWEIG

Main tasks in the research project:
Further development of the simulation tool "QuaSi"

inem
Institut für Nachhaltige Energietechnik und Mobilität

INEM, HOCHSCHULE ESSLINGEN

Main tasks in the research project:
Development of mobility concepts (individual and public transport), technical monitoring

mondayVision

MONDAYVISION

Main tasks in the research project:
Development of user interfaces in private and public spaces

polarstern

ÖKOENERGIEVERSORGER POLARSTERN

Main tasks in the research project:
Operation of energy centers in the Béla and Citadis blocks, development of electricity concepts for tenants

RVI

RVI GMBH, SAARBRÜCKEN

Main tasks in the research project:
Investor and housing association (Blocks A to E)

STÄDTISCHER VERKEHRSBETRIEB ESSLINGEN AM NECKAR

SVE, ESSLINGEN

Main tasks in the research project:
Emission-free public transport

ZSW

ZENTRUM FÜR SONNENENERGIE UND WASSERSTOFFFORSCHUNG, STUTTGART

Main tasks in the research project:
Consultancy on H_2 generation and utilization, safety concept

INFORMATION CENTER
INTERACTIVE AND MULTIMEDIA-DRIVEN

ABOUT THE FLAGSHIP PROJECT

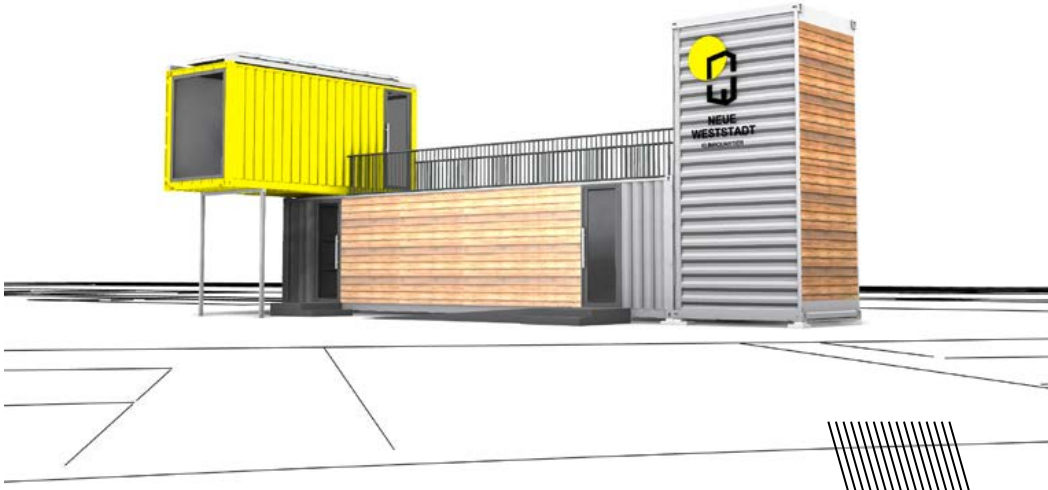
The visitor and information center for the climate-neutral district "Neue Weststadt" on the station plaza in Esslingen welcomes interested citizens, experts as well as guided groups and delegations. Interactive information points and a multimedia exhibition provide fascinating insights – both inside the container and in the integrated outdoor areas. Single structural elements and communication areas represent a wide variety of topics and messages. They are part of the scenographic concept, information and knowledge transfer.

HOW DO THE TECHNICAL PROCESSES AND THE ENERGY SUPPLY WORK?

IN WHICH RESEARCH FIELDS ARE NEW FINDINGS EXPECTED?

WHO CAN I CONTACT TO GET A GUIDED TOUR OF THE CLIMATE-NEUTRAL NEIGHBORHOOD?

SUSTAINABLE VISITOR AND INFORMATION CENTER

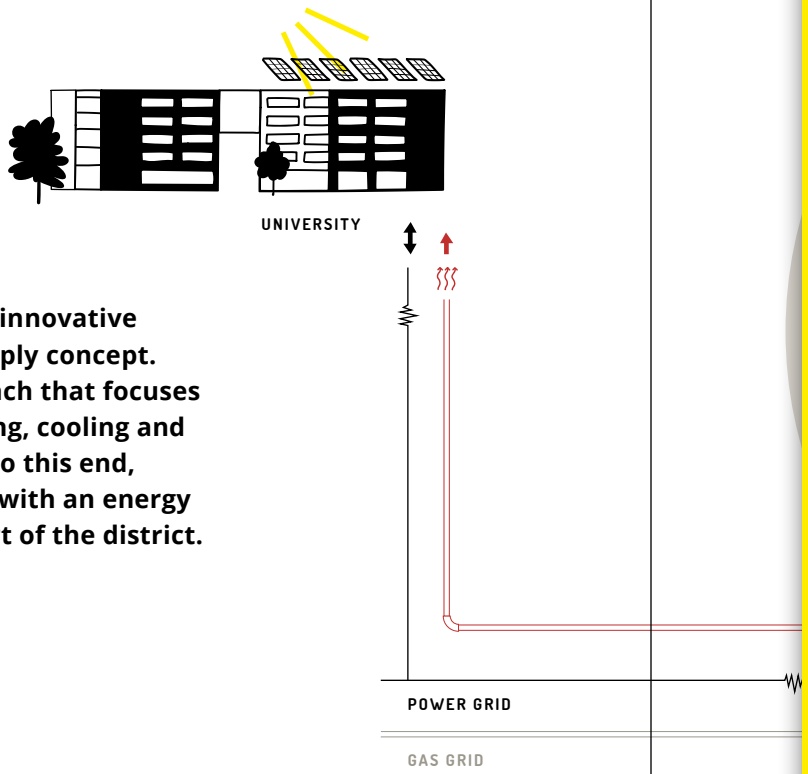


GUIDED TOURS AND EXCURSIONS

Delegations, experts and groups are welcomed at the Information Center. Guided tours to the climate-neutral neighborhood through the research district in the nearby "Neue Weststadt" are available for booking.

→ WWW.NEUE-WESTSTADT.DE/INFOZENTRUM

ENERGY SUPPLY IN THE NEIGHBORHOOD



The core of the technologically innovative urban district is the energy supply concept. It pursues a sustainable approach that focuses on linking the electricity, heating, cooling and mobility sectors at local level. To this end, a central supply infrastructure with an energy center is being built at the heart of the district.

ENERGY CENTER

An electrolyzer forms the technical heart of the energy center, which is designed as an underground installation. It converts surplus renewable electricity into green hydrogen (H_2) thus making the energy storable. With an electrical output of 1 MW, the electrolyzer produces up to 400 kg of hydrogen per day or 85 t per year. The electricity required comes from local photovoltaic systems in Blocks Desiro (D) and (E), the UNIVERSITY and from supraregional generation. High overall efficiency plays an important role in the production of the green hydrogen. The waste heat from the electrolysis process contributes to the heat supply in the district. In addition, the heat generated during the cooling of the power electronics and electrical switchgear is made usable with the help of a heat pump.

GREEN HYDROGEN

For seasonal long-term storage and decarbonization of the gas sector, the green hydrogen produced will initially be fed into Esslingen's local natural gas grid. In addition, the locally produced green hydrogen in the long run will be made available for use in industry and mobility beyond the neighborhood. Via an H_2 pipeline, the green gas could be transported to nearby industrial areas and from there be used to supply customers in the mobility sector (popular refueling stations and public transport depots) via trailer filling. The marketing of green hydrogen thus follows the principle of decentralized energy cycles and generates a high local added value.

THE FUTURE BEGINS IN ESSLINGEN

In Esslingen am Neckar, energy-conscious and resource-saving homes and workplaces are being brought to life. The district's energy supply will generate virtually no climate-damaging emissions and reduce energy consumption without loss of comfort. With state-of-the-art technologies, interdisciplinary know-how and a holistic, socially and ecologically sustainable approach to energy supply, the district is taking on a pioneering role in construction, living and energy efficiency.

"THE REALIZATION OF THE CLIMATE-NEUTRAL NEIGHBORHOOD IS AN IMPORTANT STEP TOWARDS ACHIEVING THE CITY'S CLIMATE GOALS"

Dr. Jürgen Zieger,
mayor of Esslingen am Neckar

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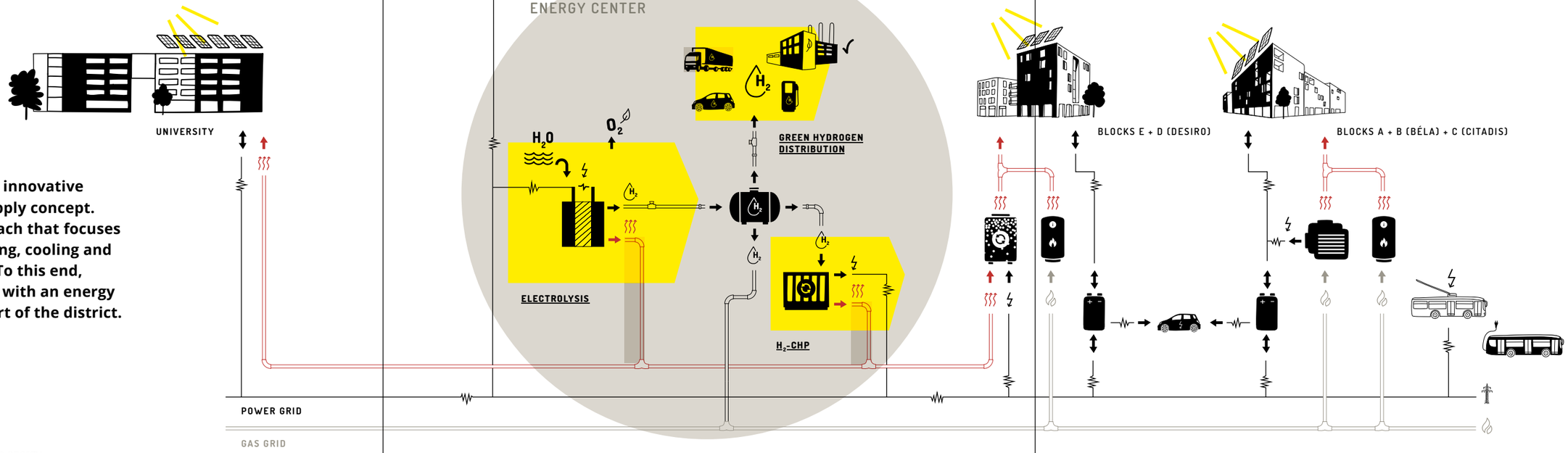

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POWER-TO-GAS-TO-POWER (P2G2P)

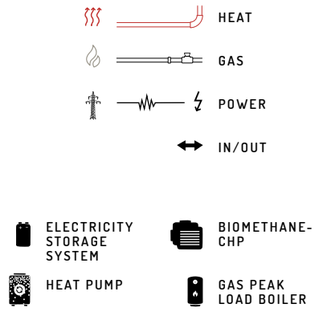
A small share of the green hydrogen produced can be used directly in the energy center to generate energy. If electricity and heat are needed in the buildings at times when there is not enough photovoltaic power from the neighborhood, the hydrogen can be quickly and easily converted back into electricity in the energy center using the bivalent combined heat and power units (H_2 and natural gas) (P2G2P).

HEAT SUPPLY

In Blocks (B) and Citadis (C) the heat supply is decentralized – a BIOMETHANE COGENERATION UNIT generates most of the heat in a separate technical center. A GAS PEAK-LOAD BOILER is used to cover peak demand. Heat is supplied to Blocks Desiro (D) and (E) and to the new UNIVERSITY building via a separately constructed local heating network, which is fed with heat from the energy center (ELECTROLYSIS and HEAT PUMP).

ELECTRICITY STORAGE

The photovoltaic systems on the roofs and the combined heat and power plants (H_2- and GAS-CHP) supply the neighborhood with electricity. ELECTRICITY STORAGE SYSTEMS are used to compensate for short-term deviations between energy generation and demand in the district's power grid. In addition, the storage units can serve to stabilize the power grid when needed. The battery storage units are to be used to provide the necessary charging power for electromobility at any time.



WWW.NEUE-WESTSTADT.DE

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STADT ESSLINGEN AM NECKAR

siz energieplus
steinbeis innovations zentrum