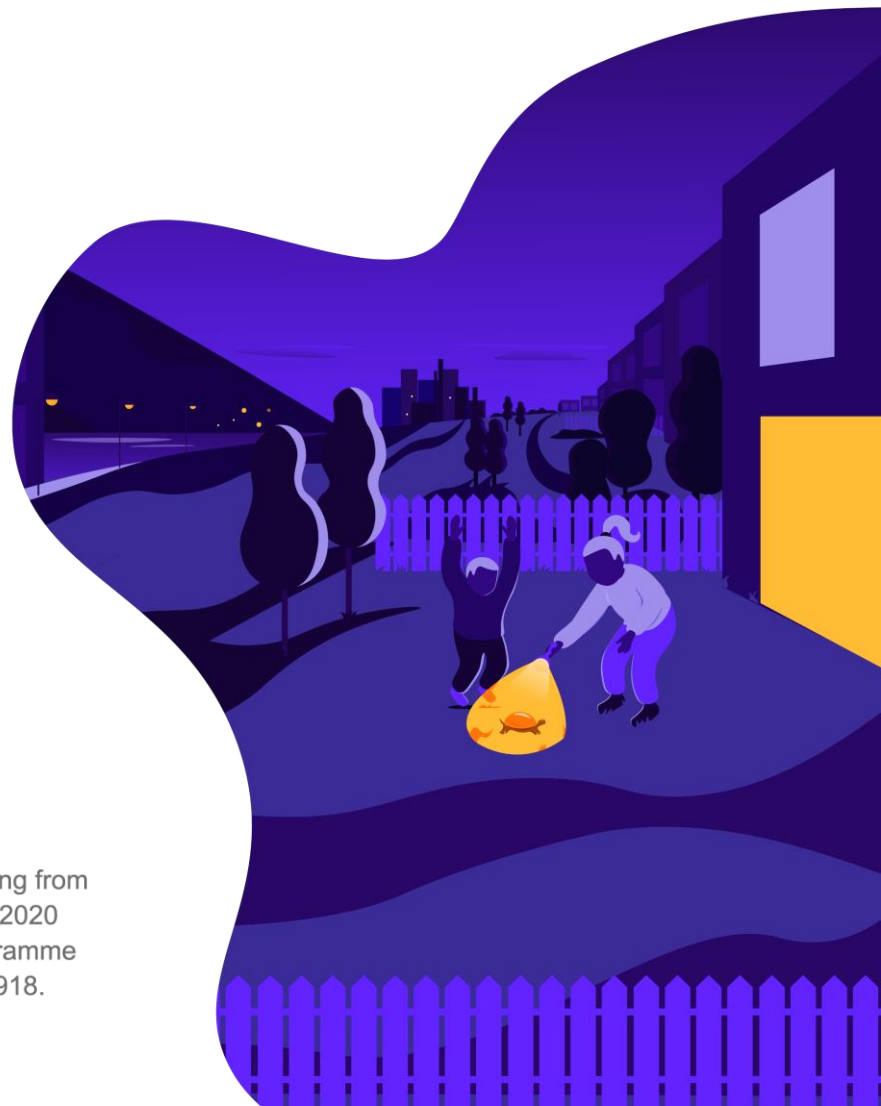


WP2 – Development and Demonstration of Plus Energy Multi-Story Apartment Buildings in Four Climatic Zones

D2.5 DEMONSTRATION CASE OF SUSTAINABLE PLUS ENERGY NEIGHBOURHOODS IN MARINE CLIMATE

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1. Revision Log:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation, or both.

PROJECT ACRONYM syn.ikia
 PROJECT NUMBER 869918
 PROJECT TITLE Sustainable Plus Energy Neighbourhoods
 WEBSITE www.synikia.eu

2. Technical References

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3. Executive Summary

A key output of the syn.ikia project is to realize four real-life demonstration projects that will serve as co-creation hubs for developing and testing of novel systems, technologies, and processes for achieving sustainable plus energy houses at the neighbourhood scale in four climatic types in Europe. The demo cases represent four different ways of realizing plus energy neighbourhoods including both new construction and renovation of apartment buildings in different European contexts.

The Dutch demo case is located in Uden, which is a typical mid-size town in the Netherlands, representing a marine climate. It includes the construction of a new residential building complex, and with syn.ikia's strategy the neighbourhood will reach the plus energy standards. This can be replicated in similar neighbourhoods in the Netherlands and other comparable contexts in Europe.

This report shortly describes the overall status of the Norwegian demonstration project as per March 2023, including illustrations, construction drawings, and photos from the site, and Key Performance Indicators.

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4. Roles and Responsibilities

Name	Role	Responsibility
Area Wonen	Demo Developer	Main responsible for the development and implementation of the demo project
TNO	Contributor	Contributor to demo project design and documentation
ABUD	Reviewer	Reviewer of the report.

5. Introduction

A key output of the syn.ikia project is to realize four real-life demonstration projects that will serve as co-creation hubs for developing and testing of novel systems, technologies, and processes for achieving sustainable plus energy houses at the neighbourhood scale in four climatic types in Europe. The demo cases represent four different ways of realizing plus energy neighbourhoods including both new construction and renovation of apartment buildings in different European contexts.

The Norwegian demo case is a new urban development in Fredrikstad, a town of approx. 90 000 inhabitants, representing the subarctic climate zone. The project is part of a larger neighbourhood development - Verksbyen, which, when fully developed, will consist of 1 500 – 2 000 units.

The Dutch demo case is located in Uden, which is a typical mid-size town in the Netherlands, representing a marine climate. It includes the construction of a new residential building complex, and with syn.ikia's strategy the neighbourhood will reach the plus energy standards. This can be replicated in similar neighbourhoods in the Netherlands and other comparable contexts in Europe.

The Spanish demo case is a new development in the suburbs of Barcelona, Spain, representing a typical Mediterranean climate. The development is a typical infill project in a dense urban area, with squares of multi-storey apartment blocks. This context is common in many European cities.

The Austrian demo case consists of 4 different projects all located in Salzburg, representing a continental climate: the transformation of the Gneis district into an energy community, and the construction of two renovation projects and one new construction project. This will become a model for sustainable plus energy neighbourhoods around Europe, and especially in Central Europe.

Together, the syn.ikia demonstration projects will serve as lighthouses for reaching the European energy efficiency and GHG goals.

This report provides a short description of the demonstration project in The Netherlands, documenting the key technical and environmental aspects of the realized neighbourhood as a Demonstrator in syn.ikia. The other demonstration projects are documented separately in reports D2.3, D2.4, and D2.6.

6. Objectives

The overarching objective of the syn.ikia project is to deliver a blueprint masterplan, including technical, financial, legal, and social issues, for the development of sustainable plus energy neighbourhoods in different contexts, climates, and markets in Europe. One of the key sub-goals of the project is therefore to demonstrate efficient ways to plan, design, and operate such neighbourhoods in different climates and context in Europe.

This report shortly describes the overall status of the demonstration project as per March 2023, including illustrations, construction drawings, and photos from the site, as well as a summary of key performance indicators.

7. Description of the Deliverable

Overall status of the demonstration project



Pictures after completion of the demo site in the Netherlands, Uden.

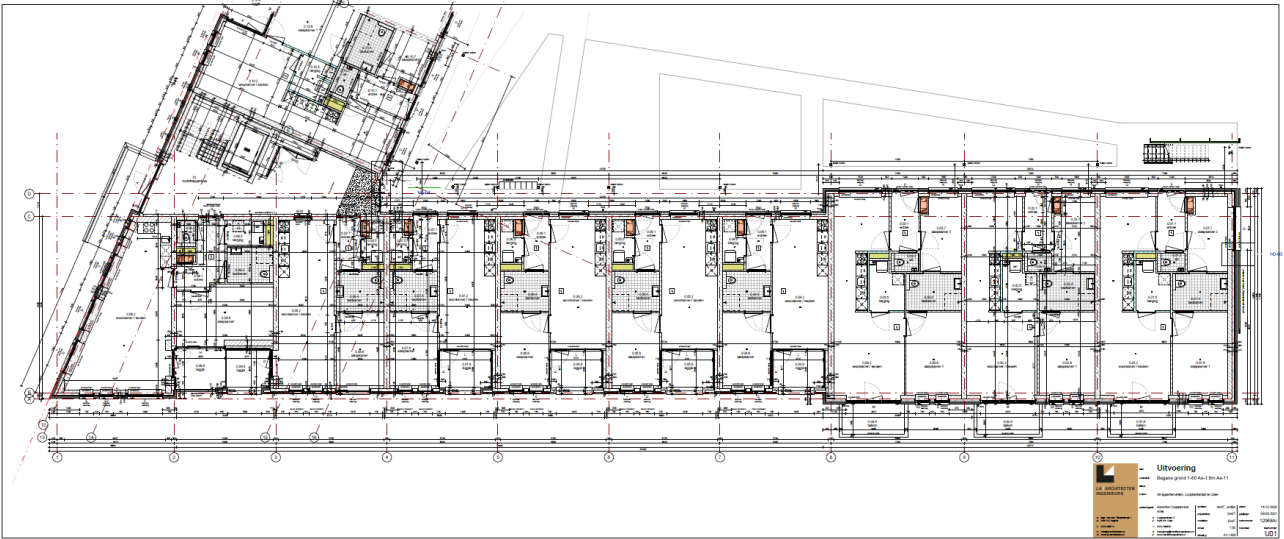
The syn.ikia demonstration project for the marine climate is located in Uden in the municipality of Maashorst, it consists of one residential building block with a total of 39 apartments, which are part of a larger development of 175 new houses, apartments, and a retirement home. The design of the building was completed in December 2020. The construction of the demo project started in January 2021 and was fully completed in May 2022. The building is fully occupied since June 2022.

During the construction phase, several sensors were installed in the apartments to monitor the energy consumption, the indoor environmental quality, and the user behaviour. The sensor data is used both as input for the digital twin and to calibrate the digital twin. This digital twin forms the basis for the model predictive controller (MPC) that optimizes the use of the on-site renewable energy production. In March 2023 the MPC is implemented in one of the apartments. In the upcoming period, the MPC will be tested in more apartments.

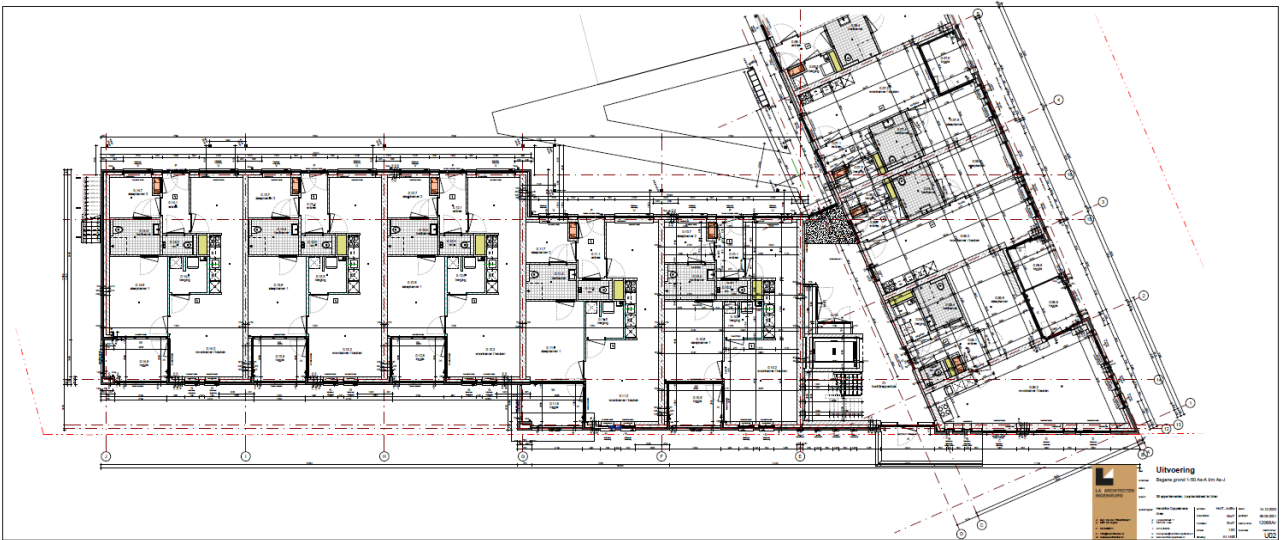
Timeline for the planning, design, construction/operation of the demo project



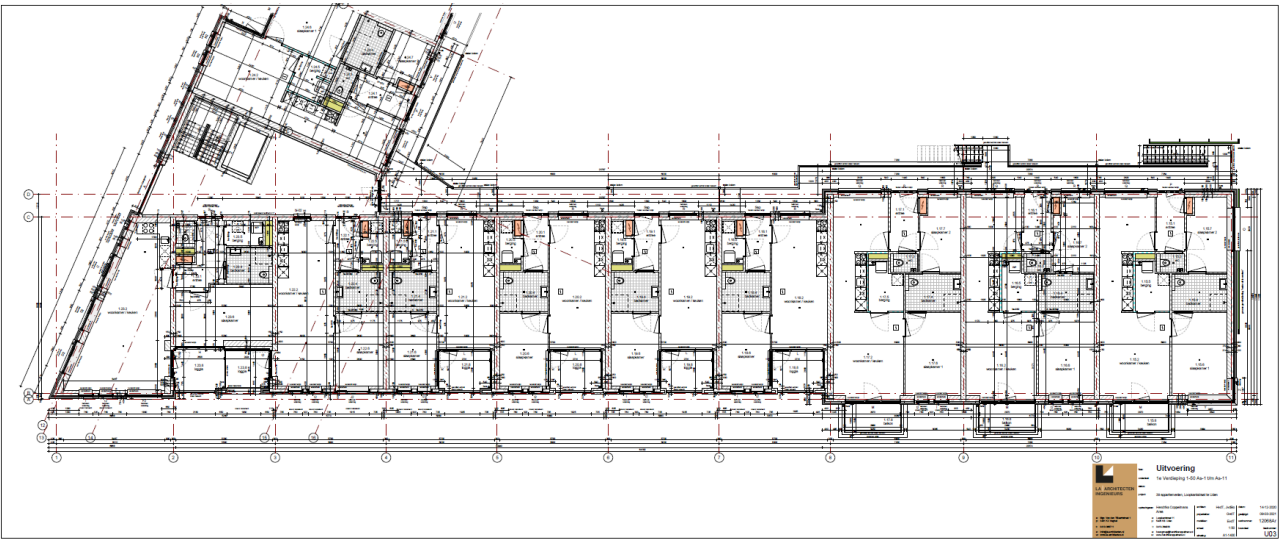




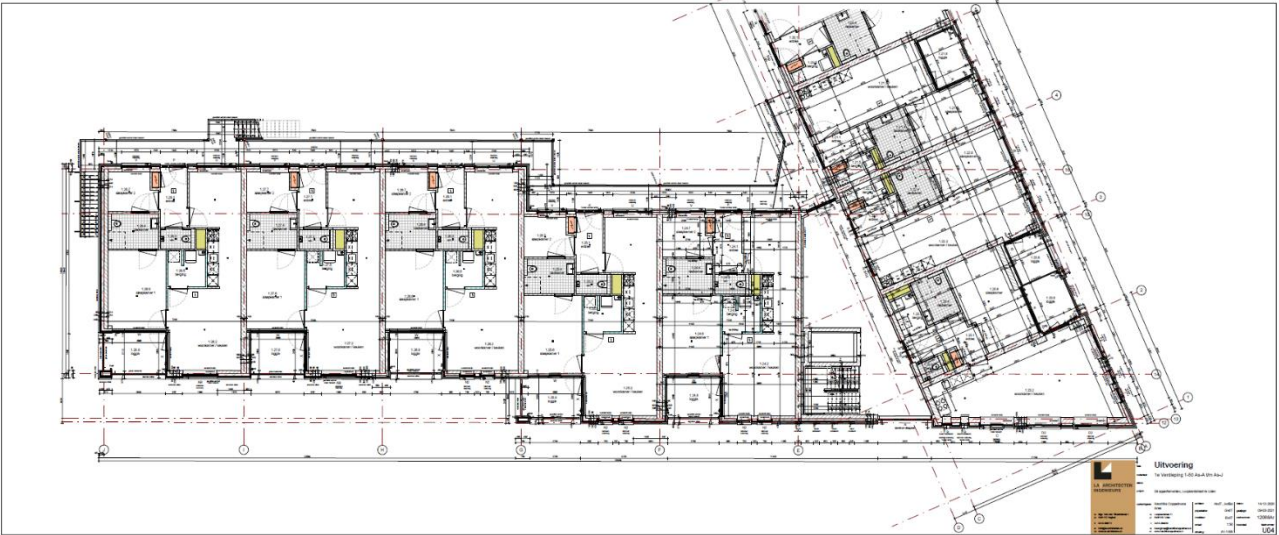
Ground floor part A



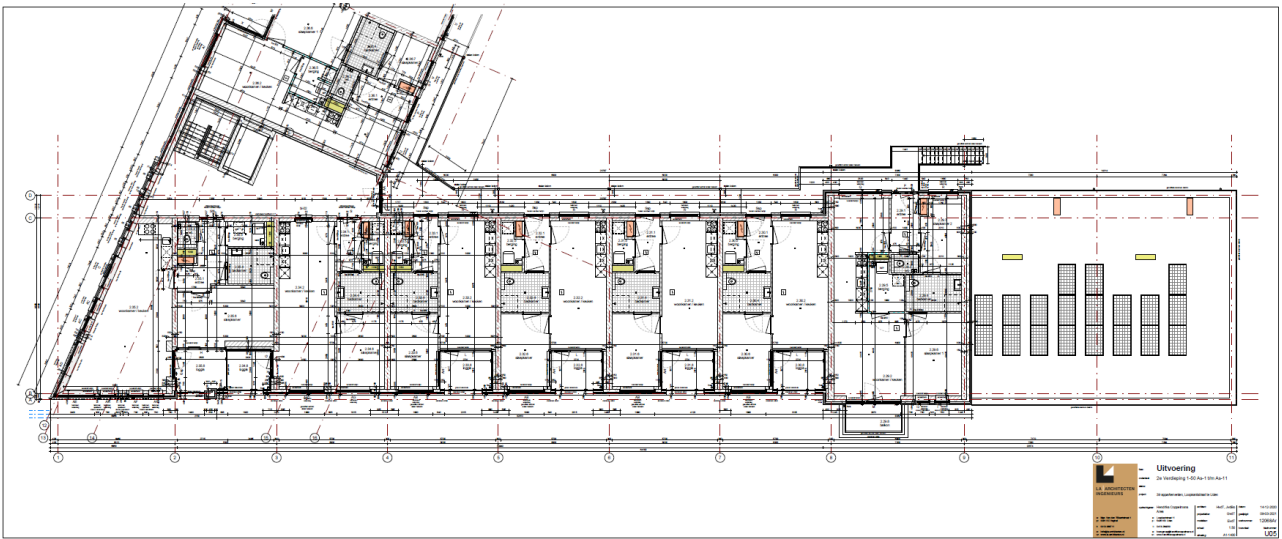
Ground floor part B



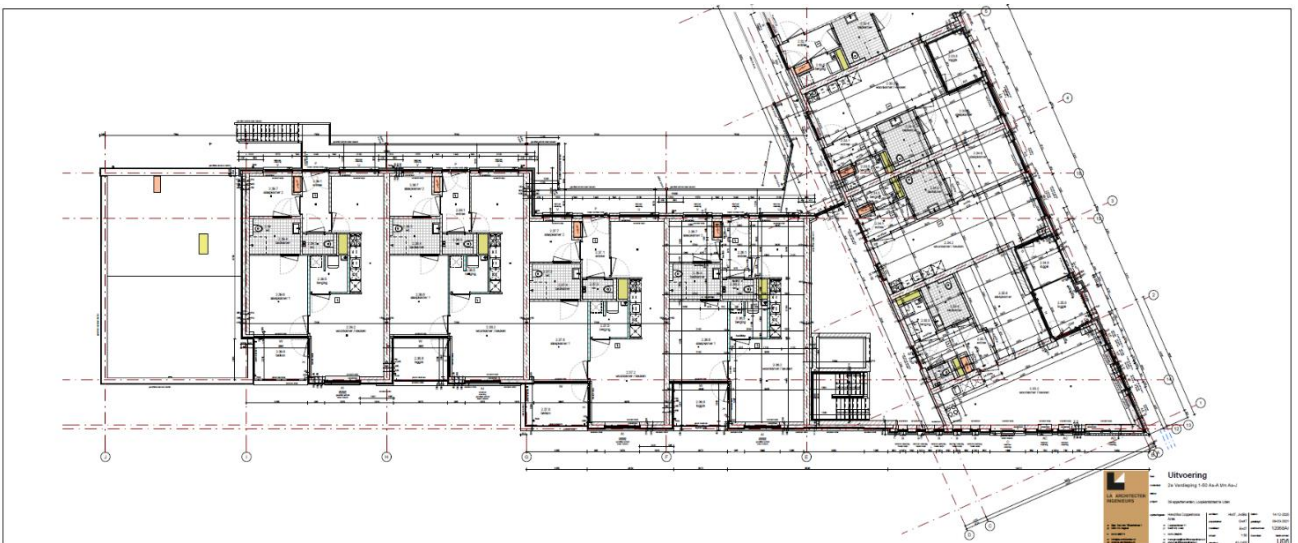
First floor part A



First floor part B



2nd floor part A



2nd floor part B

Photos from the construction of the demo project and from the finished project



March 2021



August 2021



May 2022



Key Performance Indicators

Category	Sub-category	KPI ¹	Performance [P]: Predicted/Simulated [M]: Measured [A]: Assessed	Status and plans for follow-up
Energy and Environmental performance	Overall energy performance	Non-renewable primary energy balance	-1.84 kWh/(m ² y) [P]	Number is based on simulations/predictions. The final value will be based on measurements.
		Renewable energy ratio	[M]	Number will be based on measurements.
	Matching factors	Grid purchase factor	0.67 [P]	Number is based on simulations/predictions. The final value will be based on measurements.
		Load cover factor	0.32 [P]	Number is based on simulations/predictions. The final value will be based on measurements.
		Supply cover factor	0.33 [P]	Number is based on simulations/predictions. The final value will be based on measurements.
	Grid interaction factors	Net energy	-kWh/(m ² y) [M]	Number will be based on measurements.
		Peak delivered/exported energy	0.021 kW/m ² [P]/ 0.020 kW/m ² [P]	Number is based on simulations/predictions. The final value will be based on measurements.
		Connection capacity credit	[M]	Number will be based on measurements.
	Environmental balance	Total greenhouse gas emissions	-0.65 kg CO ₂ eq/(m ² y) [P]	Number is based on simulations/predictions. The final value will be based on measurements.
	Economic Performance	Capital costs	Investment costs	3260 €/m ² [A] (Usable Area)
Operational costs		Operational costs	1542 €/app (management standard) 1499 €/app (maintenance standard)	

¹ Core KPIs as defined in D3.1 'Methodology Framework for Plus Energy Buildings and Neighbourhoods'

	Overall performance	Net present value	€ 6226818	
Indoor Environmental Quality	Indoor air quality	Carbon dioxide level	Xx ppm [M]	Will be measured during building operation
	Thermal comfort	Predicted Mean Vote	[M]	Will be based on measurements from building operation
		Predicted Percentage Dissatisfied (PPD)	[M]	Will be based on measurements from building operation
	Lighting and visual comfort	Illuminance	Xx lux [M]	
		Daylight Factor	Xx % [M]	
	Acoustic comfort	Sound Pressure Level	[A]	
Social performance	Equity	Access to services	[A]	Will be based on occupant survey during building operation
		Affordability of energy	[A]	Will be based on occupant survey during building operation
		Affordability of housing	[A]	Will be based on occupant survey during building operation
		Democratic legitimacy	[A]	Will be based on occupant survey during building operation
		Living conditions	[A]	Will be based on occupant survey during building operation
	Community	Social cohesion	[A]	Will be based on occupant survey during building operation
	People	Personal safety	[A]	Will be based on occupant survey during building operation
		Energy consciousness	[A]	Will be based on occupant survey during building operation
Smartness and Flexibility	Flexibility	Flexibility Index	[A]	Will be based on assessment once the building is constructed
	Smartness	Smartness Readiness Index	[A]	Will be based on assessment once the building is constructed



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