

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

D2.3 DEMONSTRATION CASE OF SUSTAINABLE PLUS ENERGY NEIGHBOURHOODS IN SUBARCTIC CLIMATE

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30/04/2023 - M44



This project has received funding from
the European Union's Horizon 2020
Research and Innovation programme
under Grant Agreement N 869918.

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This deliverable contains original unpublished work except where clearly indicated otherwise.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

Deliverable (number)	D2.3			
Deliverable Name	Demonstration case of Sustainable Plus Energy Neighbourhoods in Subarctic Climate			
Work Package (number)	2			
Task number and Title	2.1 Demonstration Case in Subarctic Climate			
Dissemination Level	PU			
Date of Delivery	30.04.2023			
Lead Beneficiary	Ole-Edvin Utaker (ArcaNova)			
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Reviewers	Abel Magyari, ABUD, Niki Gaitani NTNU			
Status	Final version			
Document history		Name	Role	Date
	V0	Inger Andresen	WP2 lead	01.03.2023
	V0.1	Ole-Edvin Utaker, Tonje Healy Trulsrud	Demo lead, contributors	25.03.2023
	V0.1	Inger Andresen	WP2 lead	31.03.2023
	V.02	Abel Magyari	Reviewer	15.04.2023
	V.1	Inger Andresen	WP2 lead	25.04.2023

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 sustainable plus energy neighbourhoods (SPENs) including both new construction and renovation of apartment buildings in different European contexts.

The Norwegian demo case is a new development in Fredrikstad, representing a cold climate. It includes the construction of two residential apartment blocks as part of a larger development of plus energy houses. The project and associated land areas are fully owned by the private developer Arca Nova Bolig AS. The area will be the first large development of plus energy houses in Norway, with approximately 1500-2000 units when it is finished.

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
ArcaNova	Demo Developer	Main responsible for the development and implementation of the demo project
NTNU	WP 2 leader, Task 2.1 leader.	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 sustainable plus energy neighbourhoods including both new construction and renovation of apartment buildings in different European contexts.

The Norwegian demo case is a new development in Fredrikstad, representing a cold climate. It includes the construction of two residential apartment blocks as part of a larger development of plus energy houses. The project and associated land areas are fully owned by the private developer Arca Nova Bolig AS. The area will be the first large development of plus energy houses in Norway, with approximately 1500-2000 units when it is finished.

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 Norway, 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 D2.4, D2.5, 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

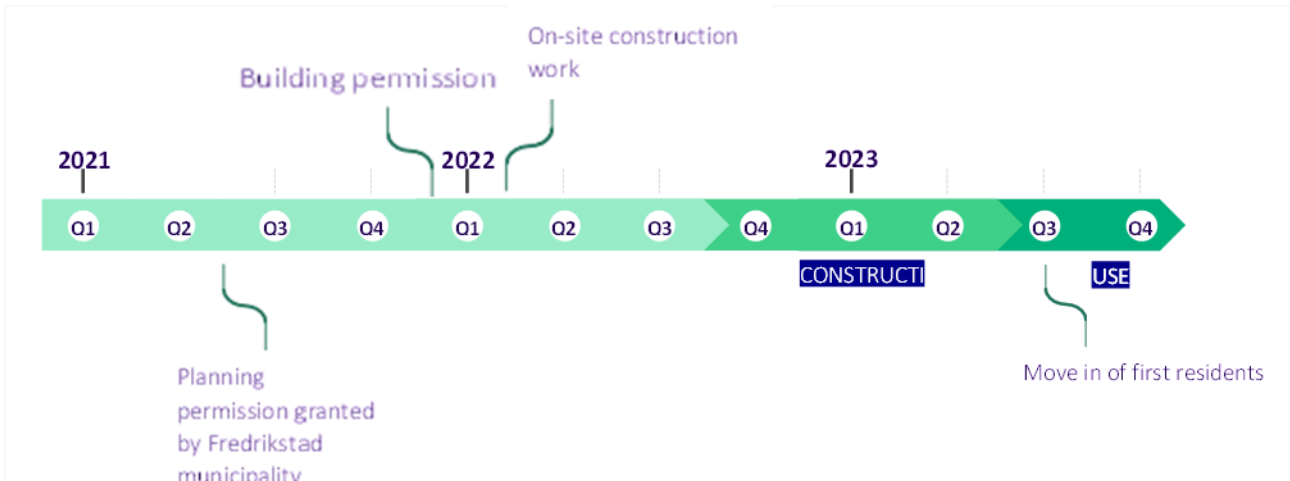
Overall status of the demonstration project

The new syn.ikia demonstration project for subarctic climate is located in Verksbyen in Fredrikstad, it consists of two residential building blocks with 44 apartments, which are part of a larger development of 1500-2000 new apartments, parks, and playgrounds. The designs of the buildings are completed, and the construction of the blocks has started. Performance simulations show that the project meets the ambitions of the syn.ikia project.



Illustration of the demo site in Verksbyen, Fredrikstad

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



Construction drawings/plans

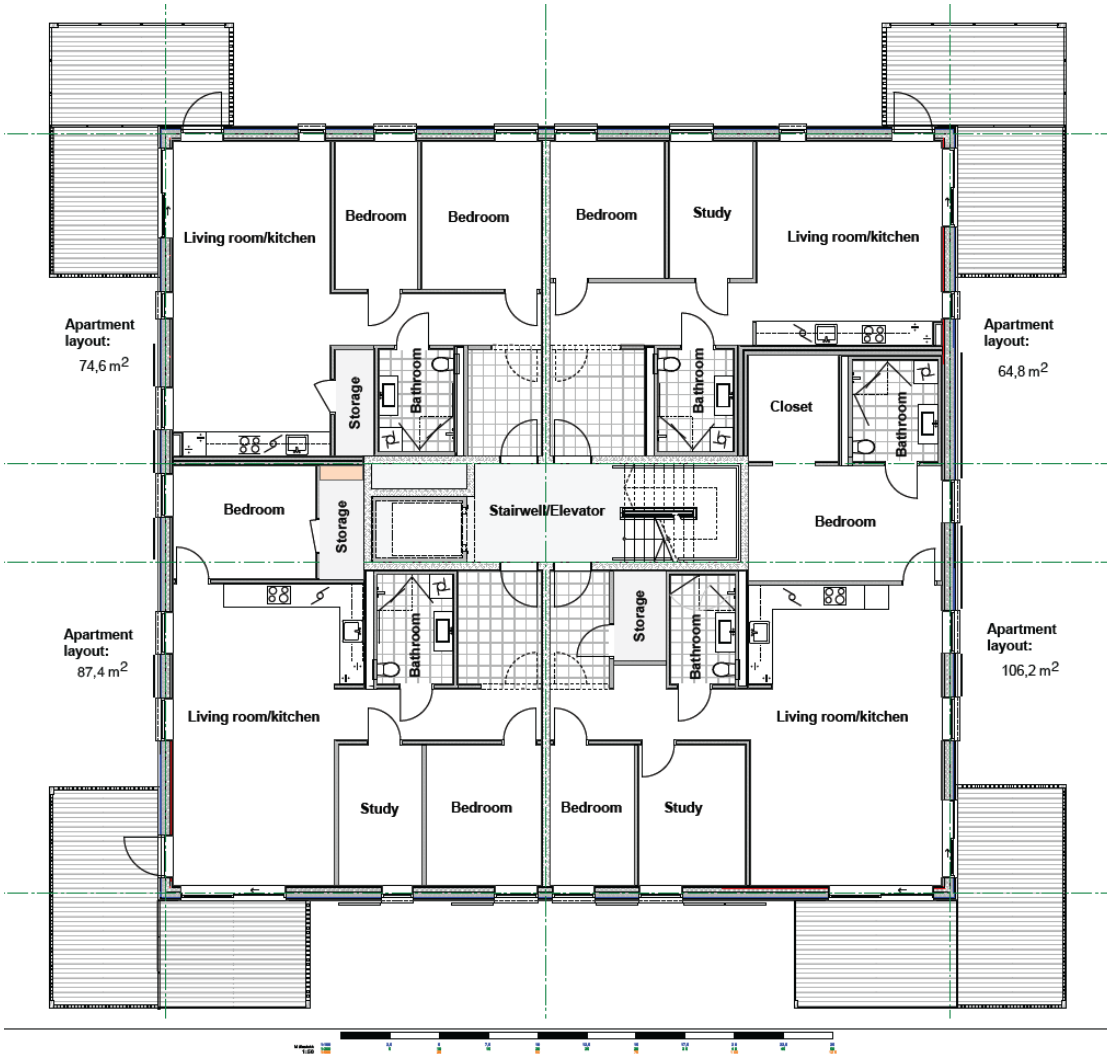


Figure 1 Typical floor plan with 4 different apartment layouts. 4th floor of Panorama – building K



Figure 2 Elevation for building K



Figure 3 Elevation for building K

Photos from the construction of the demo project



Figure 4 Photo from the construction site, June 2022



Figure 5 Photo from the construction site, January 2023

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	-2.85 kWh/(m ² y) [P]	Number is based on simulations/predictions. Final value will be based on measurements.
		Renewable energy ratio	0.88 [P]	Number is based on simulations/predictions. Final value will be based on measurements.
	Matching factors	Grid purchase factor	0.22 [P]	Number is based on simulations/predictions. Final value will be based on measurements.
		Load cover factor	0.78 [P]	Number is based on simulations/predictions. Final value will be based on measurements.
		Supply cover factor	0.68 [P]	Number is based on simulations/predictions. Final value will be based on measurements.
	Grid interaction factors	Net energy	-4.82 kWh/(m ² y) [P]	Number is based on simulations/predictions. Final value will be based on measurements.
		Peak delivered/exported energy	0.018 kW/m ² [P]/ 0.022 kW/m ² [P]	Number is based on simulations/predictions. Final value will be based on measurements.
		Connection capacity credit	0.39	Number is based on simulations/predictions. Final value 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. Final value will be based on measurements.

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

Economic Performance	Capital costs	Investment costs	Xx €/m2 [A]	Not available yet. Will be updated once the construction is finished.
	Operational costs	Operational costs	Xx €/m2 [A]	Will be available once the construction is finished.
	Overall performance	Net present value	Xx € [A]	Will be calculated once the construction is finished.
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]	Will be based on measurements once the building is constructed
		Daylight Factor	Xx % [M]	Will be based on measurements once the building is constructed.
	Acoustic comfort	Sound Pressure Level	[A]	Will be based on occupant survey after construction
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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