

Centre for Environment-friendly Energy Research (FME) The Research Centre on Zero Emission Neighbourhoods in Smart Cities – ZEN



Illustration: Snøhetta
Project: Zero Village Bergen by ByBo

ZEN Centre Facts

- Host: Norwegian University of Science and Technology - NTNU
- Research partners: SINTEF Building and Infrastructure and SINTEF Energy Research
- 31 user partners

- Start date: March 2017, when contract with Research Council of Norway has been signed

- Total budget: ca. 380 MNOK (2017 – 2024)
- Approximately 20 PhD candidates and 5 post docs will be hired

10 Public partners	Oslo, Bergen, Trondheim
	Bodø, Elverum, Steinkjer
	Sør-Trøndelag fylkeskommune
	Statsbygg
	NVE – Norges vassdrag og energidirektorat
	DiBK – Direktoratet for byggkvalitet
21 Industry partners	ByBo, Elverum Tomteselskap
	TOBB
	Snøhetta, Reinertsen, Asplan Viak
	Multiconsult, SWECO, Civitas
	FutureBuilt
	Energi Norge, Norsk Fjernvarme
	NTE – Nord-Trøndelag Energiverk
	Hunton, Moelven
	Norcem
	Numascale
	Smart Grid Services Cluster
	Skanska
	GK, Caverion
Research partners	NTNU
	SINTEF

Main objective

The main objective of ZEN is to develop knowledge, competitive products and solutions that will lead to realization of sustainable neighbourhoods that have zero emissions of greenhouse gases related to their production, operation and transformation.



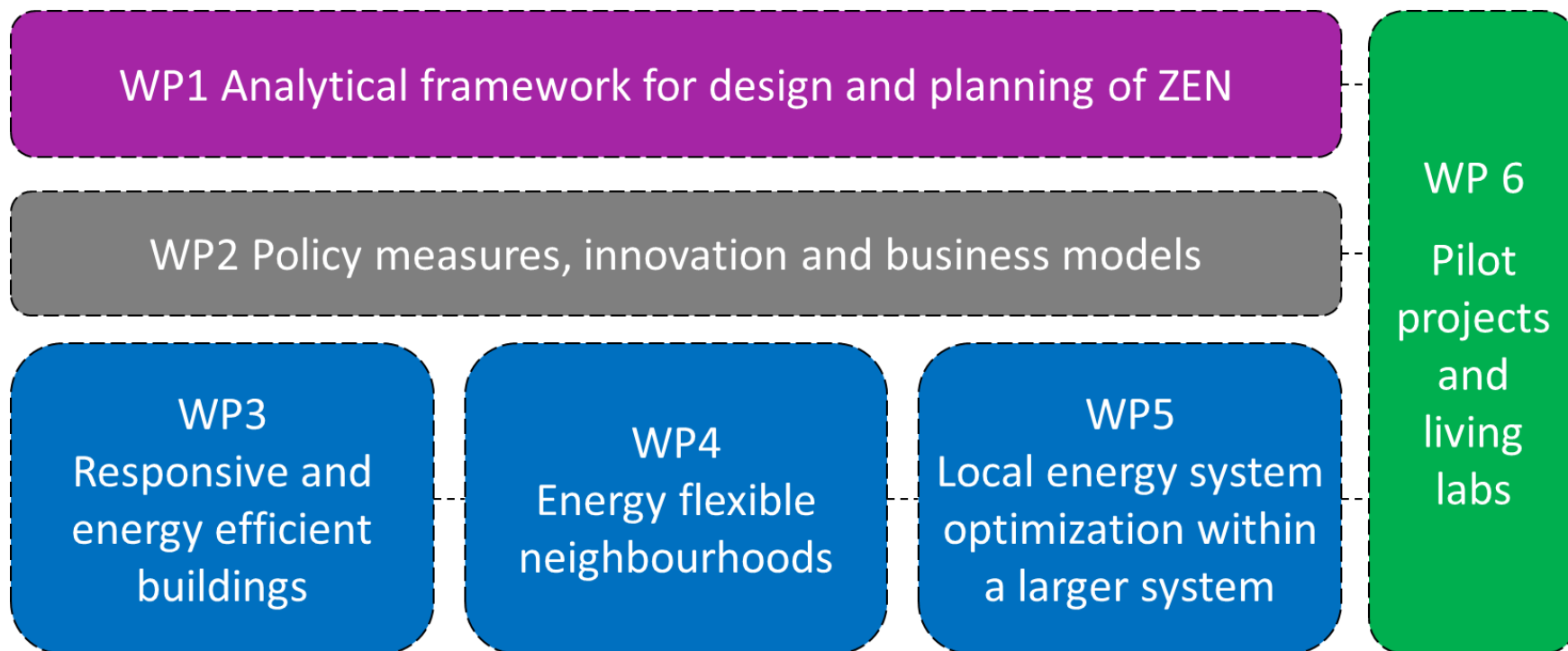
*Illustration: Snøhetta
Project: Zero Village Bergen by ByBo*

www.ntnu.no/zen

Why focus on the neighbourhood dimension?

- By looking at more buildings at the same time, synergies can be realized between the energy demand profiles of individual buildings. When one building has a surplus of heat/energy, another building can use it.
- Not all buildings can be built/refurbished into zero emission buildings, e.g. protected/listed buildings or buildings on a challenging site.
- Optimizing at the neighbourhood scale can reduce the strain on the grid (synergies between buildings, PV, charging stations for electrical vehicles, etc.)
- The neighbourhood dimension is large enough to have an impact, but small enough to allow demonstration of technologies and interaction with users.

Work Packages



WP1

Analytical Framework for design and planning of ZEN

Goal:

Develop definitions, targets and benchmarking for ZEN, based on customised indicators and data (quantitative + qualitative); Develop life cycle analysis methodology for energy and emissions at neighbourhood scale; Develop a citizen-centred architectural and urban toolbox for design and planning of ZEN, incl visualisation and decision support.

Task 1.1 Definitions, metrics, data management and monitoring

Task 1.2 Life cycle analysis

Task 1.3 User-centered architectural and urban toolbox

WP2

Policy measures, innovation and business models

Goal:

WP2 will evaluate possible transition pathways towards ZEN consisting of integrated studies of policy measures, different forms of public private collaboration, different financial and business models and instruments as well as improved innovation processes.

Task 2.1 Development of transition strategies in their contexts

Task 2.2 Public private collaboration and business models

Task 2.3 The innovation system for zero emission neighbourhoods

WP3

Responsive and energy efficient buildings

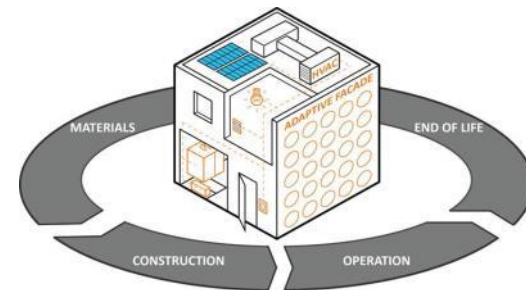
Goal:

WP3 will create cost effective, responsive, resource and energy efficient buildings by developing low carbon technologies and construction systems based on lifecycle design strategies

Task 3.1 Resource efficient materials and construction systems

Task 3.2 Low emission building services

Task 3.3 Architecture and building design procedures



WP4

Energy flexible neighbourhoods

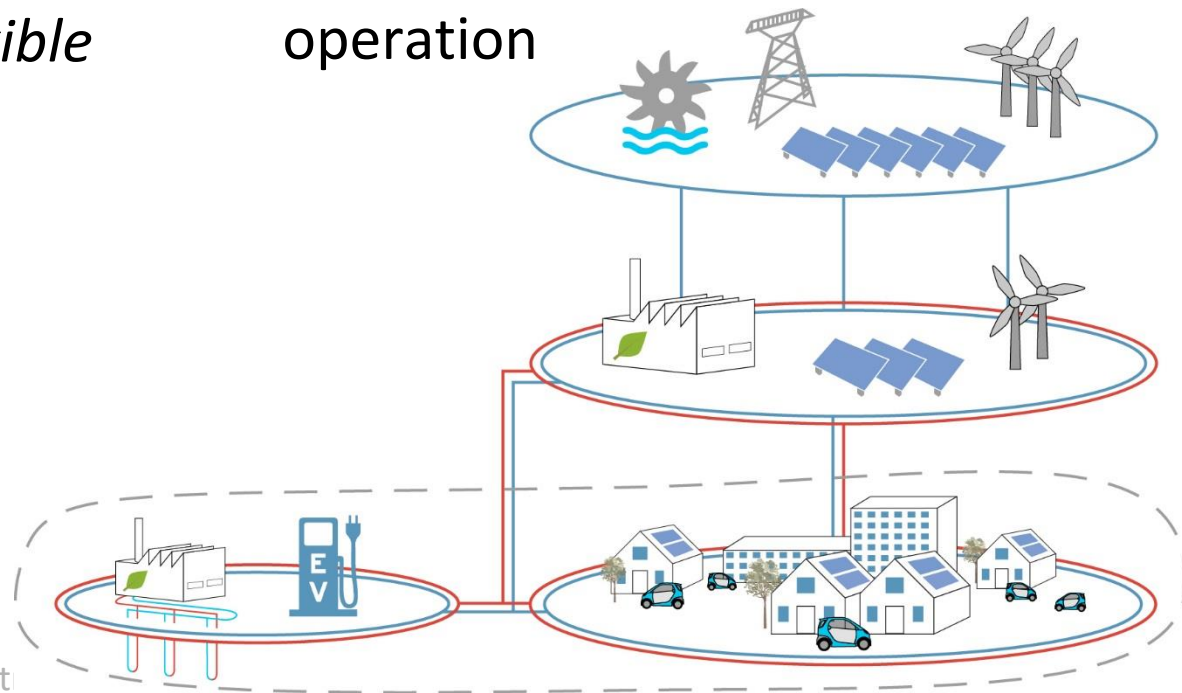
Goal

The aim of WP4 is to develop knowledge, technologies and solutions for design and operation of energy flexible neighbourhoods.

Task 4.1 Local thermal grids, generation and storage

Task 4.2 Local electrical generation and storage

Task 4.3 Energy flexible operation



WP5

Neighbourhoods in the larger energy system

Goal

WP5 aims to develop and apply methodologies that identify the socio-economic optimal operation and expansion of energy systems within demarked areas.

Task 5.1 ZEN-modules and algorithms

Task 5.2 KPIs and ZEN constraints

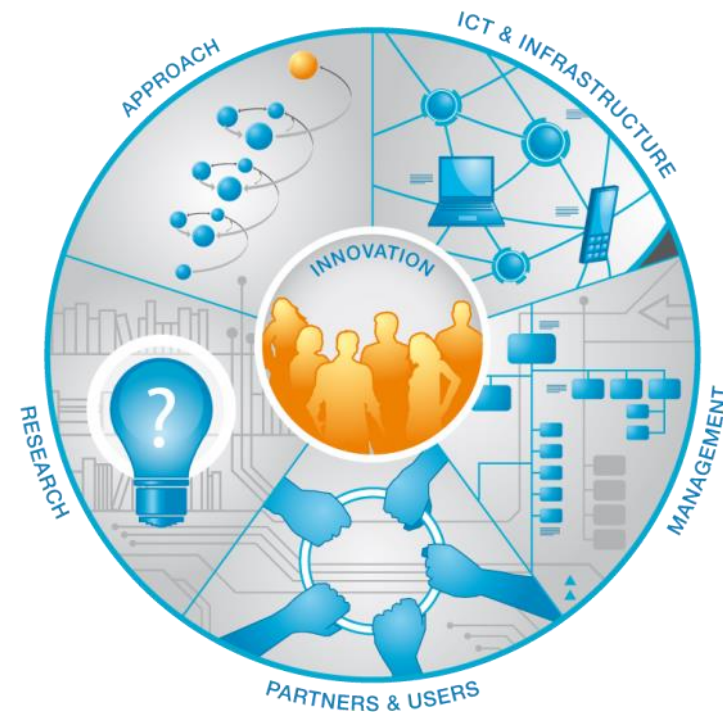
Task 5.3 Energy system impacts

WP6

Pilot projects and living labs

To realize at least 7 pilot projects for ZEN concepts in Norway.

- *innovation hubs* for co-creation between researchers and building professionals, property developers, municipalities, energy companies, building owners, and users;
- *living labs* to verify, document and optimize the real-life performance of the solutions developed in the ZEN Centre;
- *lighthouse projects* to learn, inspire, and disseminate ZEN-related knowledge.



Pilot Projects/Living Labs

Oslo: Furuset

Bergen: Zero Village Bergen

Elverum: Ydalir

Trondheim: Knowledge Axis, NTNU Campus

Bodø: Airport area

Steinkjer: Residential area

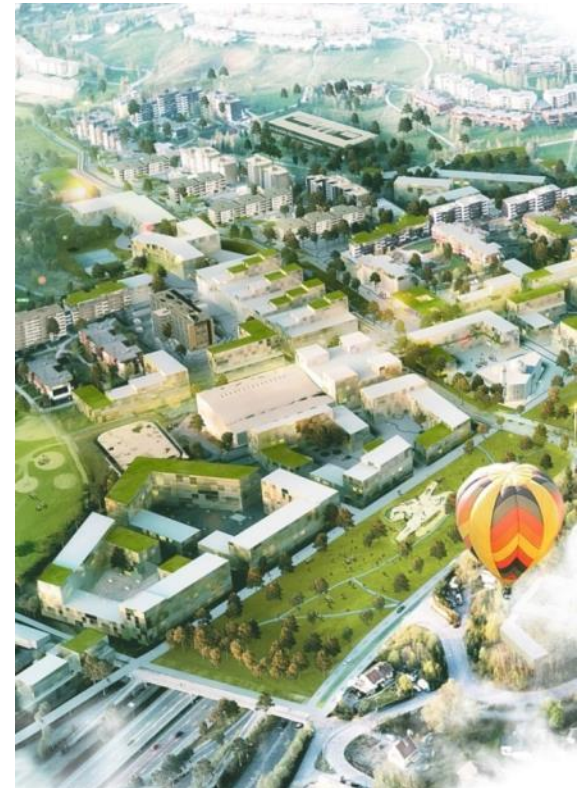
Evenstad: Campus

Population of 30 000 people

Built floor area of more than 1 million m²

ZEB Flexible Lab office building, NTNU Campus

ZEB Living Lab residential building, NTNU Campus

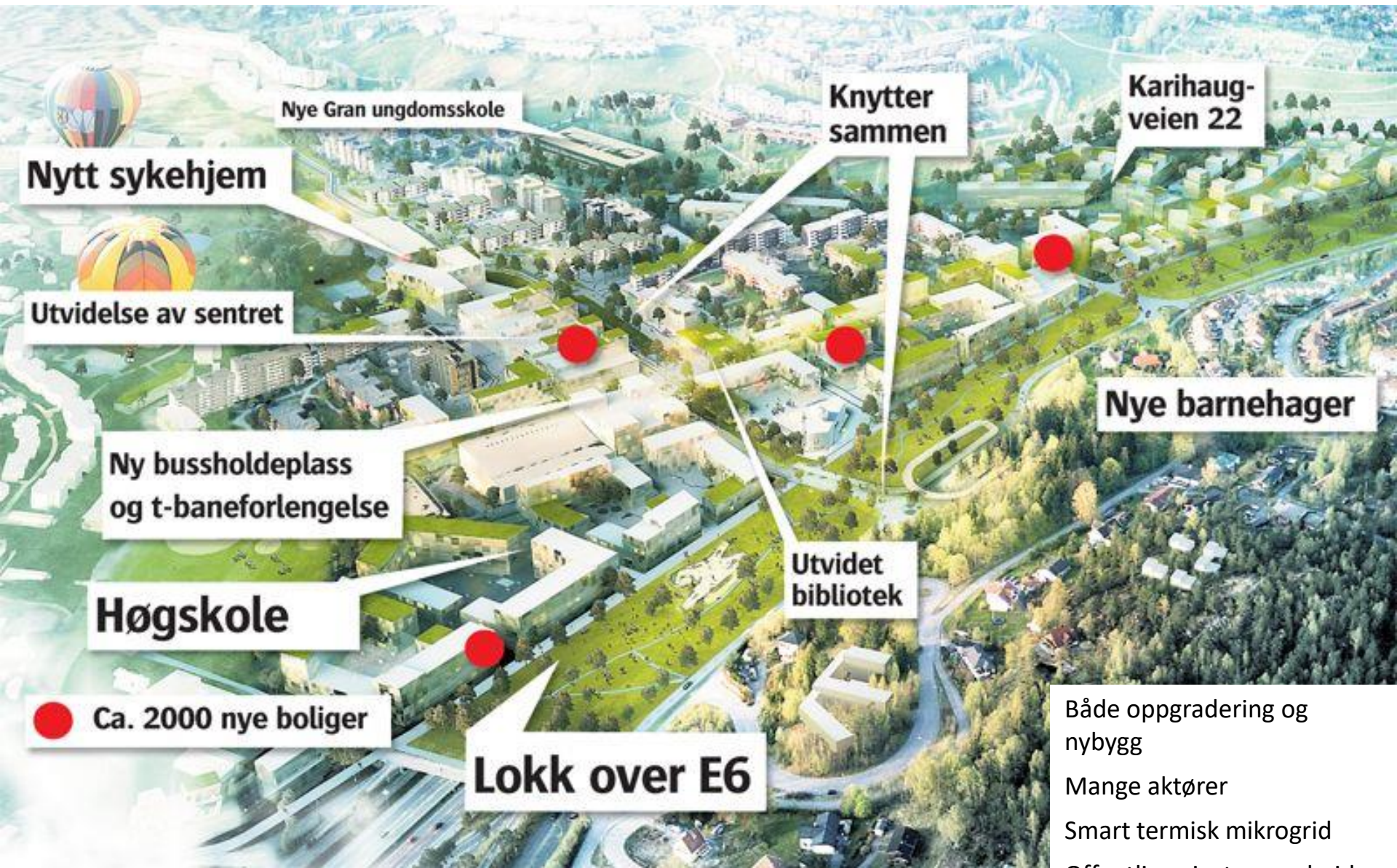


Campus Evenstad

- Statsbygg/Høgskolen i Hedmark
- Mini ZEN
- Nytt adm/undervisningsbygg ZEB
- CHP på gasifisering av flis
- Solceller
- Solvarme



Furuset



Nytt sykehjem

Nye Gran ungdomsskole

Knytter sammen

Karihaugveien 22



Utvidelse av sentret

Ny bussholdeplass og t-baneforlengelse

Nye barnehager

Høgskole

Utvidet bibliotek

Ca. 2000 nye boliger

Lokk over E6

Både oppgradering og nybygg

Mange aktører

Smart termisk mikrogrid



Adland

Zero Village Bergen

6-800 boliger
Barnehage
Forretningsbygg

- Privat utbygger
- Samarbeid BKK
- Nærvarmesystem
- Utveksling av solstrøm
- Kobling mot elektromobilitet

Kunnskapsaksen – Campus, Trondheim



Revitalisering Elgesetergate
Sambruk
Nybygg og oppgradering
Nærvarme/Fjernvarme

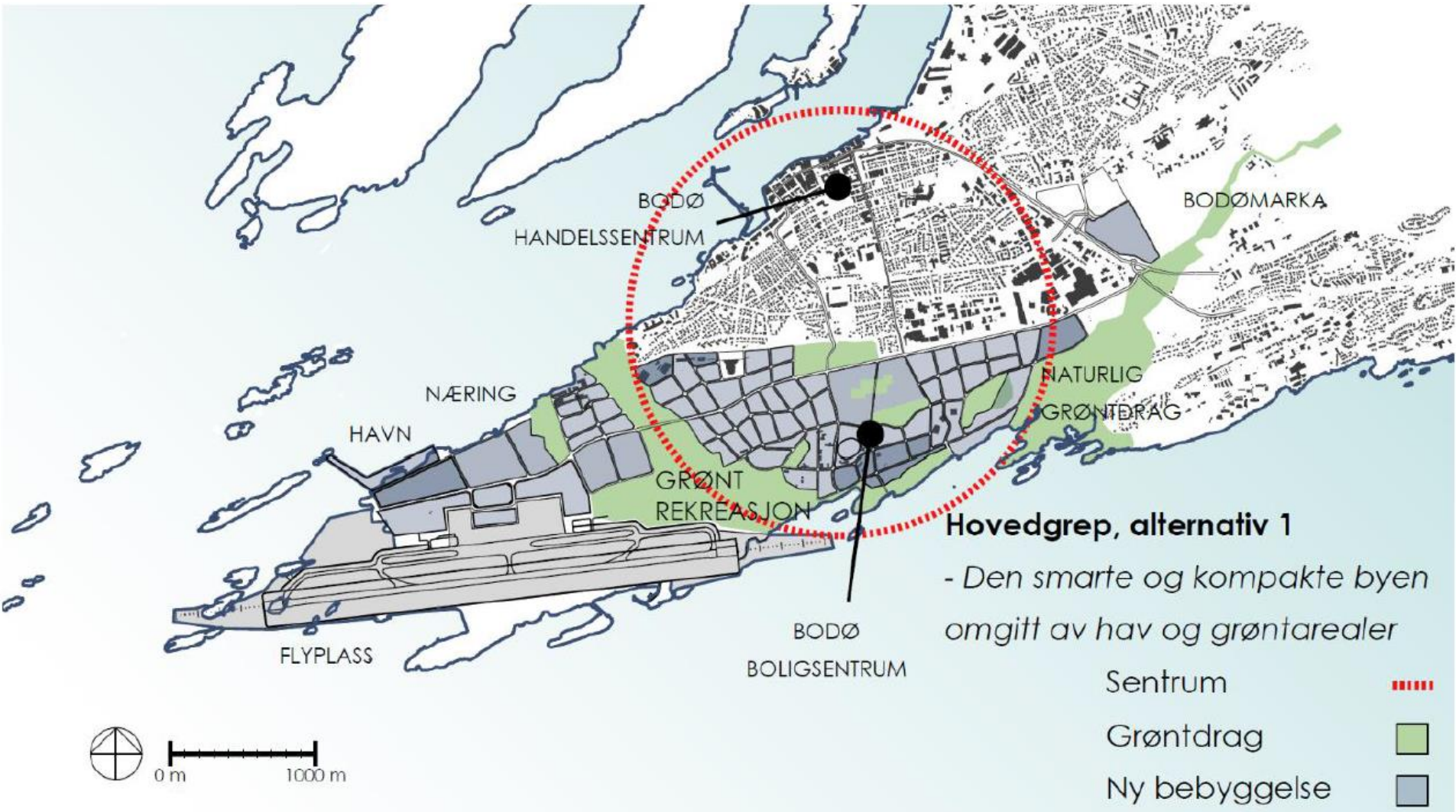
Ydalir, Elverum



Ny bydel de neste 10-15 årene
Elverum tomteselskap

- Ca 1000 boliger
- Skole og barnehage
- Grunnvarme
- Bruk av tre
- Smart mobilitet

Flyplassutvikling, Bodø



Steinkjer



- Ombygging av gamle NRK bygg på Lø til barnehage evt. nybygg + 10-12 boliger
- Utveksling av energi
 - Felles energisentral
 - Gjenbruk
 - Smart mobilitet

Status February 2017

- Consortium agreement being signed by ZEN Partners
- Contract to be submitted to the Norwegian Research Council by February 25

- Draft work plan ready

- 7 PhD and post doc positions announced (5 more to be announced)
- 1 Project developer position announced (1 more to be announced)

Work plan 2017 – Examples of activities

- We will establish a set of definitions and key performance indicators (KPI) for ZEN, e.g. start to work on the ZEN definition
- We will identify, evaluate and develop modeling principles and methods for consistent use of LCA in ZEN
- Develop a definition of the concept of "Responsive buildings" and "energy flexible neighbourhoods"
- Start to work with ZEN Pilot projects
- ...
- Mix of research at NTNU (mainly by PhD and post docs) and SINTEF (researchers)
- Establish a ZEN PhD Course
- Establish a communication and innovation strategy/plan

PhD and post doc positions announced

- LCA methods for zero emission neighbourhood concepts (PhD Fellowship)
- Transition pathways towards zero emission neighbourhoods (PhD Fellowship)
- Dialog based public procurement as a driver of creating effective public-private collaboration and business models for ZEN development (PhD Fellowship)
- IEQ flexibility, control strategies and resulting energy efficiency (PhD Fellowship)
- Interaction between Zero Emission Neighbourhoods and District Heating system (Postdoctoral Fellowship)
- Investment planning models for local energy systems (PhD Fellowship)
- ZEN Living Labs (PhD or Postdoctoral Fellowship)

Deadline: February 15, 2017 - <http://www.ntnu.edu/vacancies>

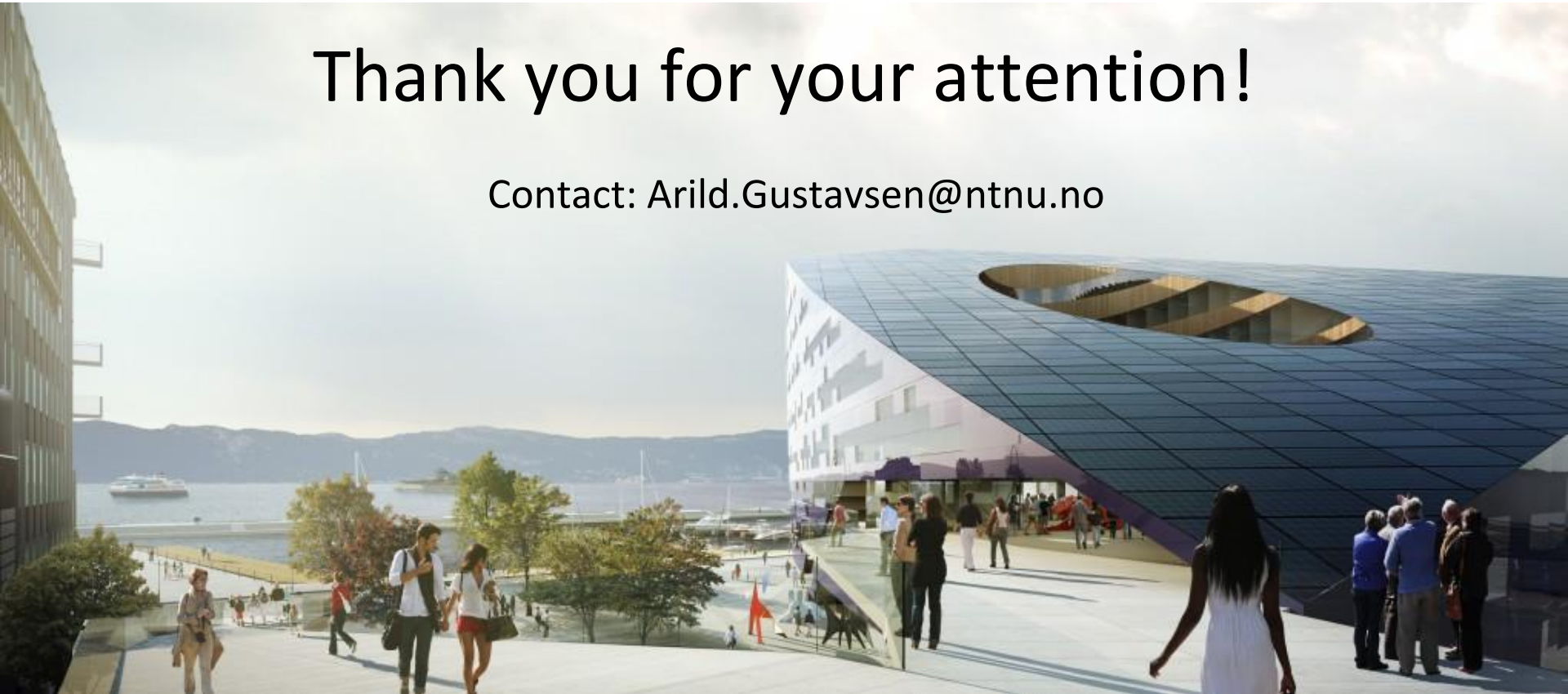
Position as project developer

- The ZEN Centre is seeking to expand the team with a fixed-term position as Project Developer in the area of zero emission buildings and neighbourhoods (three years, with potential for extension).
- The main responsibility of the position is to develop and write applications for national and international programmes together with group members, especially aiming for the EU H2020 work programme.

Deadline: March 1, 2017 - <http://www.ntnu.edu/vacancies>

Thank you for your attention!

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*Illustration: Snøhetta/MIR
Project: Powerhouse Brattørkaia*