Zero Village Bergen

Norges mest ambisiøse område med nullutslippsbygg

Presentasjon Bærekraftuka, NTNU, 19.10.2015

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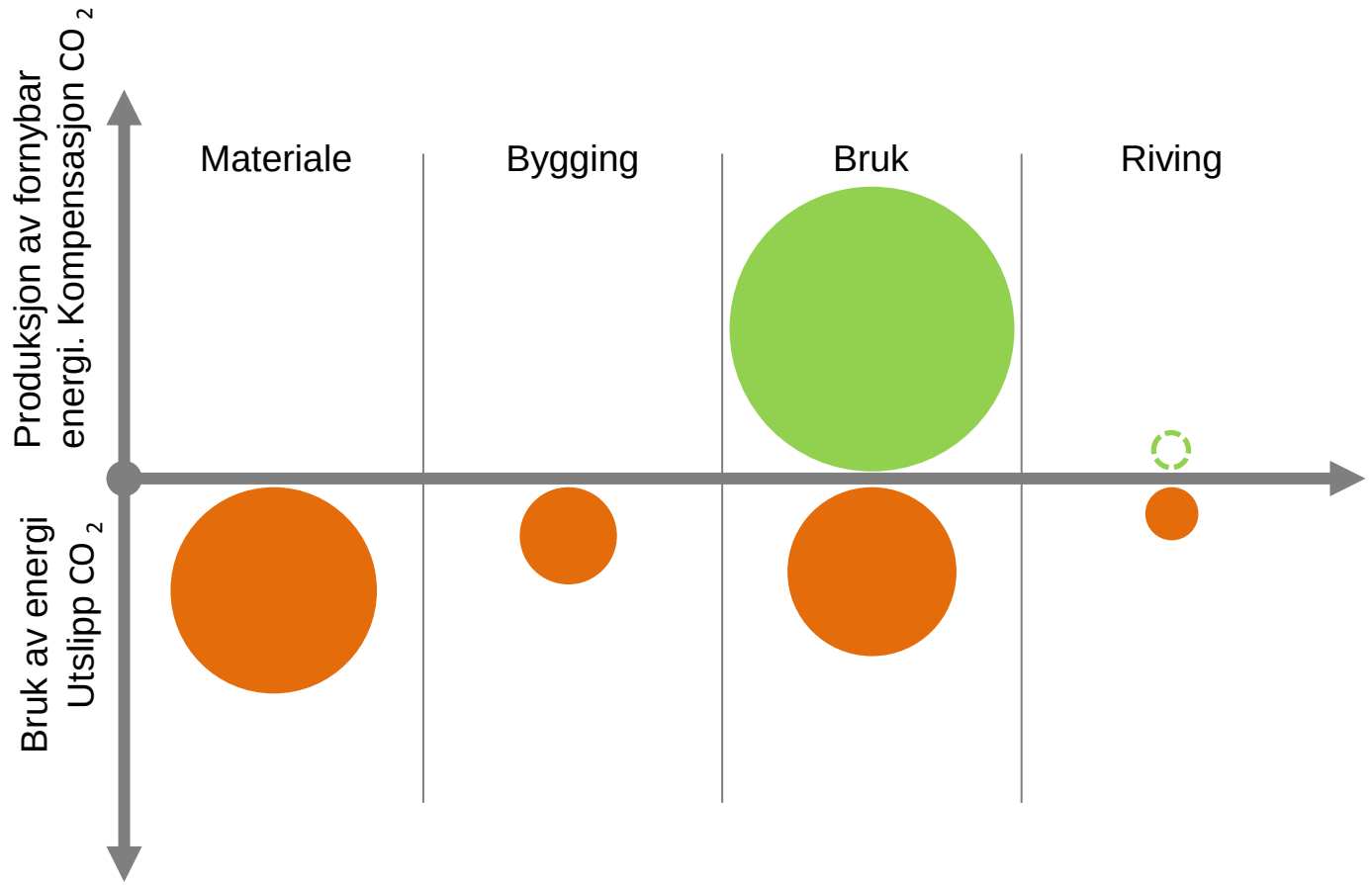
ZEB – et nasjonalt forskingssenter

The main objective of ZEB is to develop competitive products and solutions for existing and new buildings that will lead to market penetration of buildings with zero greenhouse gas emissions related to their production, operation, and demolition.

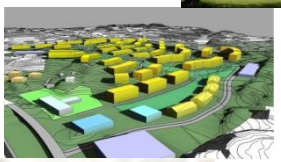
Hva er et nullutslippsbygg?



ZEB-Pilot Buildings

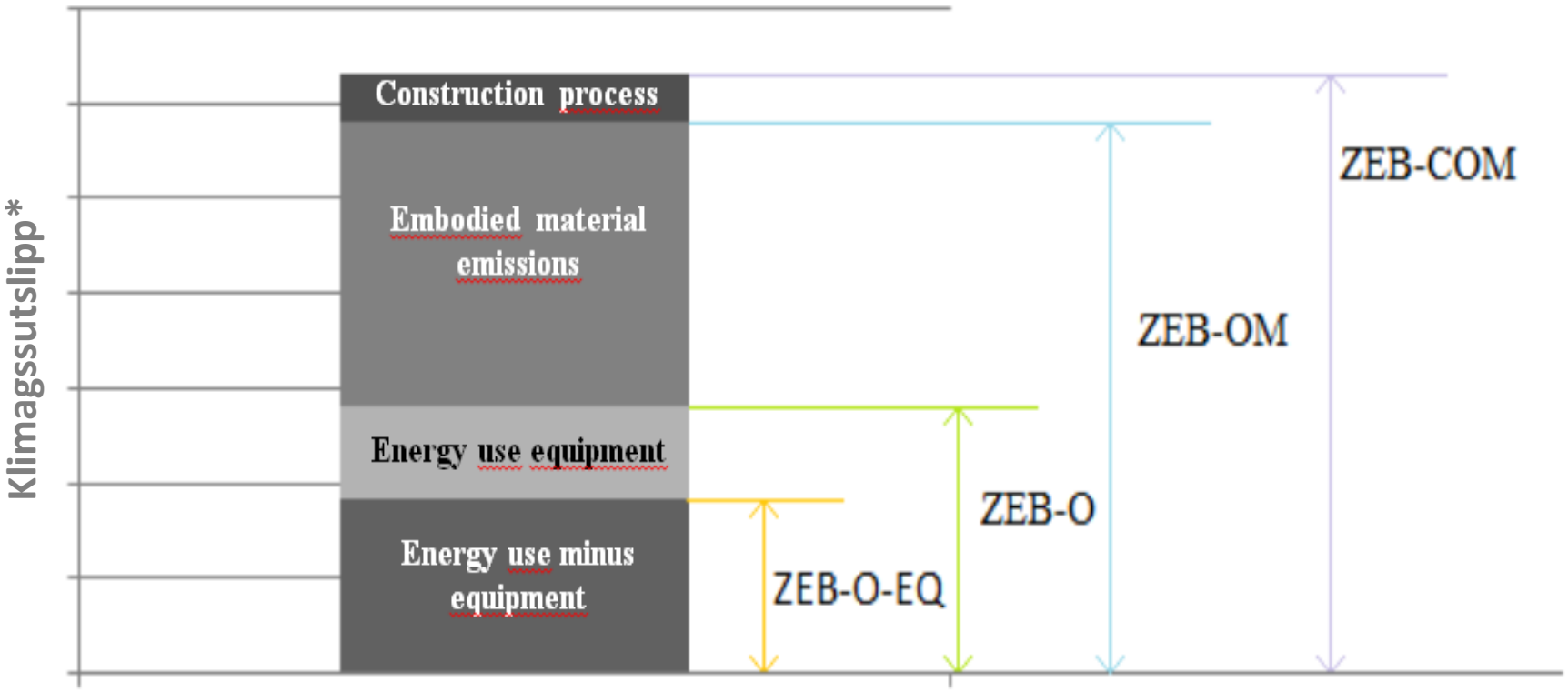
1. Skarpnes Arendal: 37 dwellings, ZEB-O.
2. Powerhouse Kjørbo, Sandvika: Renovation of 2 office blocks, ZEB-OM÷EQ.
3. Multikomfort-hus, Larvik: Single family house, ZEB-OM.
4. Ådland, Bergen: +500 dwellings, ZEB-O.
5. Powerhouse Brattørkaia, Trondheim: Large office building, ZEB-OM÷EQ.
6. FLO Administrasjonsbygg, Haakonsvern, Bergen: Small office building, ZEB-O÷EQ.
7. ZEB Living Lab, Trondheim: Single family house on NTNU campus. ZEB-OM
8. Heimdal VGS, Trondheim: ZEB-OM







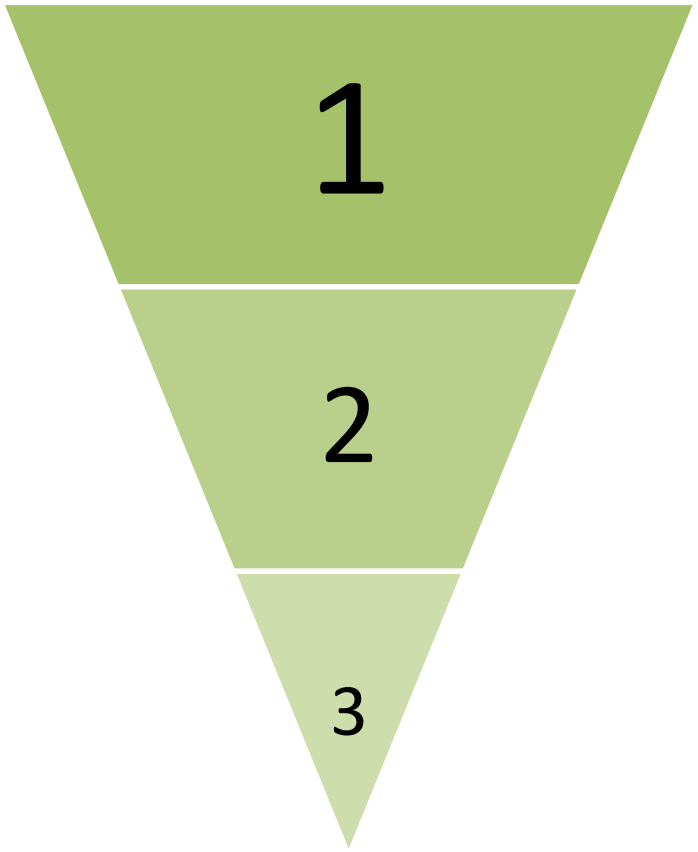
Ulike ambisjonsnivåer for ZEB



* Klimagassutslipp regnet i kg CO_2-ekv pr m^2 BRA pr år (lagt ut over 60 års levetid)

Strategi

1. Reduser energibehovet til drift av byggene
2. Reduser energibruken til fremstilling av materialer og konstruksjoner
3. Dekk det resterende behovet med produksjon av fornybar energi

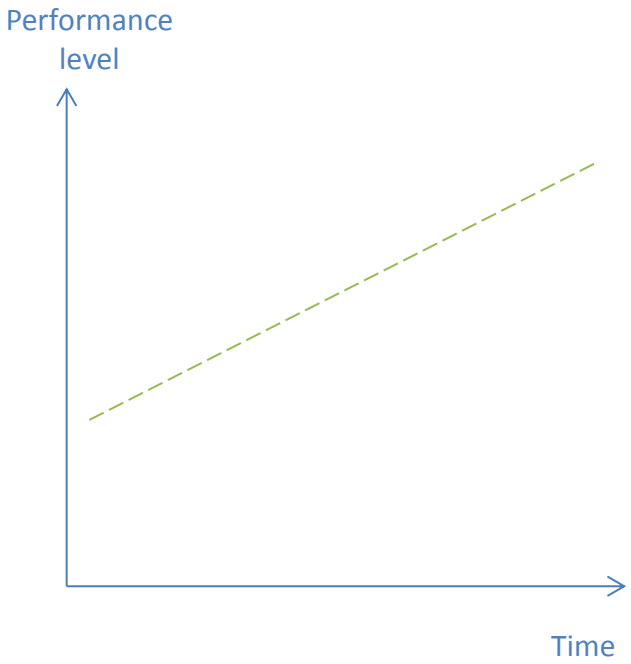


www.zerovillage.no

- Ca 800 nye boliger på Ådland utenfor Bergen
- Utvikler: ByBo AS
- Arkitekt: Snøhetta
- Energirådgivere: ZEB senteret: SINTEF, NTNU, Multiconsult, Skanska

ZEB performance goals for ZVB

- The area as a whole should reach the ZEB-O level
- The lowest performance level for single buildings should be ZEB-O÷EQ
- Within 2 years of project start, the ambition level should be raised to ZEB-OM.
- Within 4 yeas of project start, the ambition level should be raised to ZEB-COM.
- For projects with ZEB-O÷EQ level, there should be minimum requirements with regards to emissions from materials



Illustrasjon: Snøhetta

Zero Village Bergen
En totalvurdering rundt bærekraftig ressursforvaltning

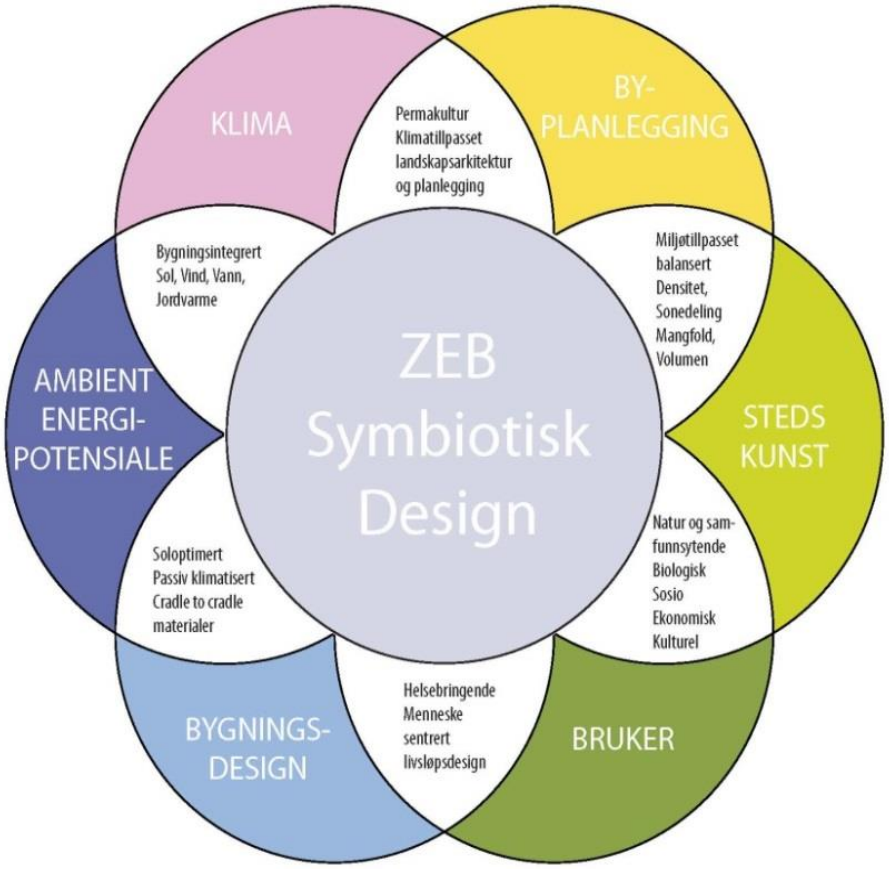


Diagram: Andreas Eggertsen, Snøhetta/ZEB

Mobilitet

Infrastruktur og arealplanlegging

Tomteforhold og klima

Økologisk mangfold

Bygningsdesign

Bruk av lokale energiressurser

Materialer og løsninger

Kunder

Status

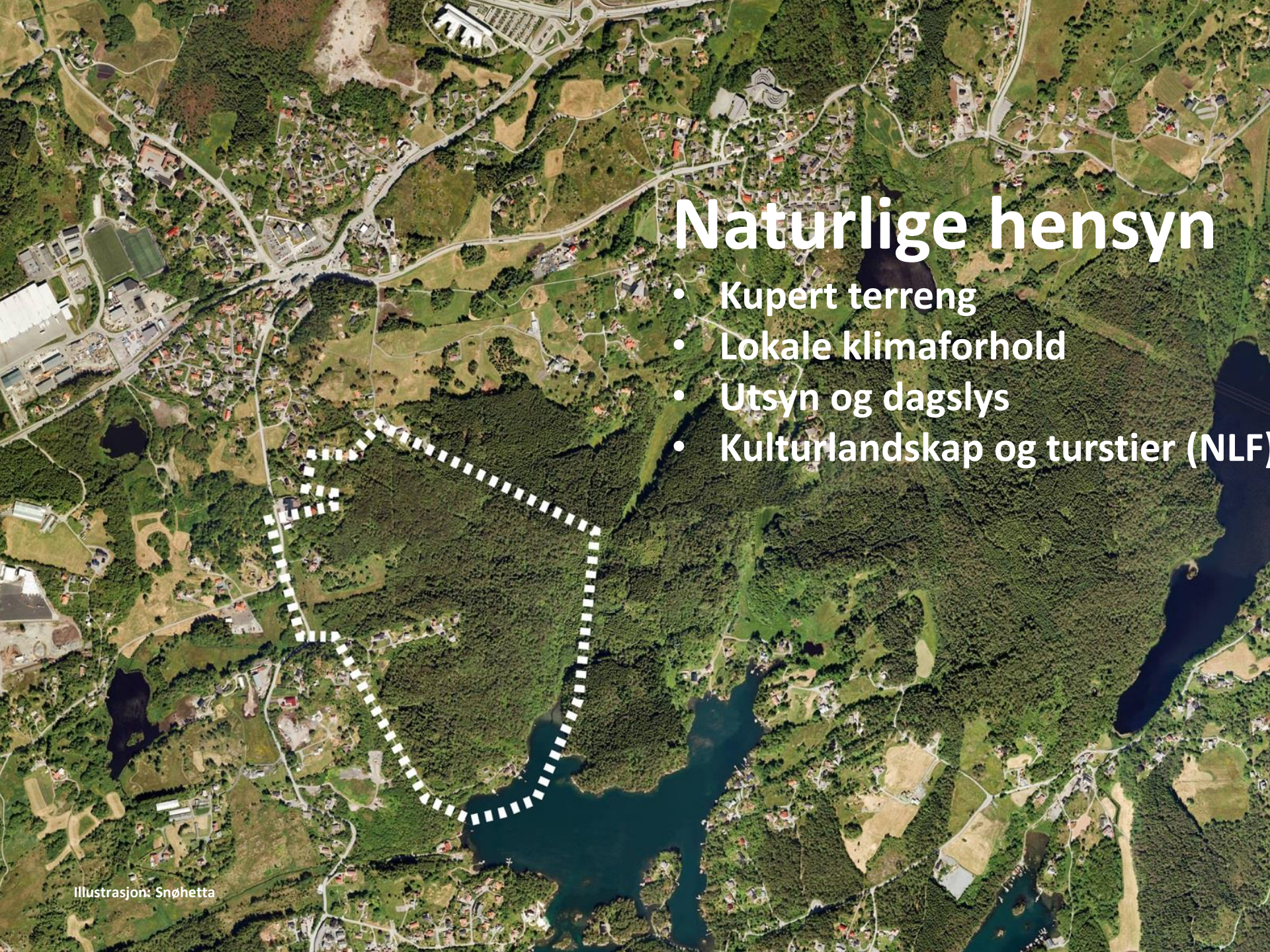
Illustrasjon: Snøhetta

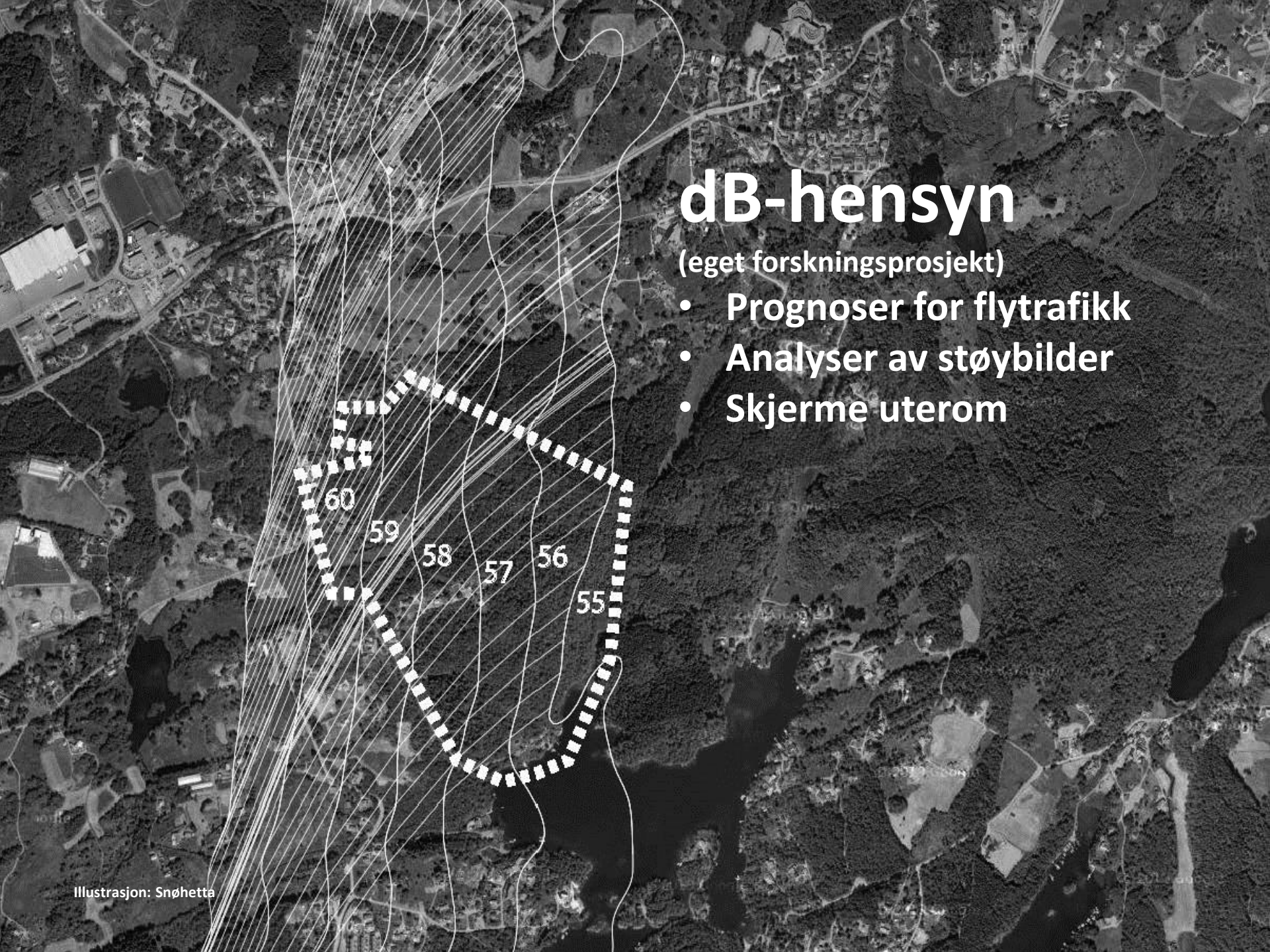
ZEB konferansen 2014

https://youtu.be/Tl2mbHZ3XNE


Naturlig fokus
• Landskap og uterom
• For alle
• For de som skal bo her
• For fremtiden!


BK-fokus
• Universell utforming
• 30 m2 fellesareal pr boenhet
• 50% sol ved vårjevndøgn
• Tilkomst og P-dekning


Naturlige hensyn
• Kupert terreng
• Lokale klimaforhold
• Utsyn og dagslys
• Kulturlandskap og turstier (NLF)
Illustrasjon: Snøhetta

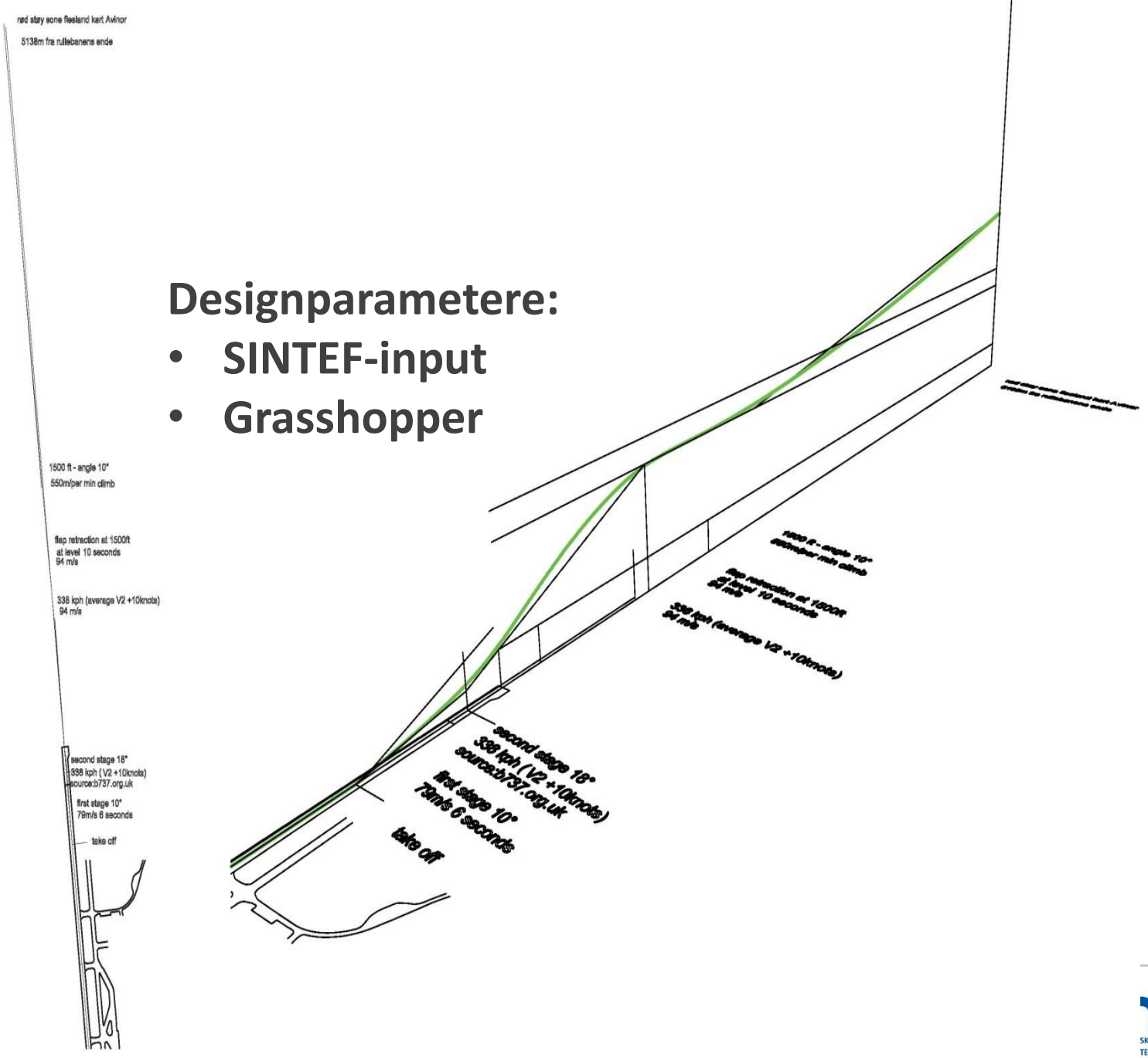


dB-hensyn

(eget forskningsprosjekt)

- **Prognoser for flytrafikk**
- **Analyser av støybilder**
- **Skjerme uterom**

Illustrasjon: Snøhetta

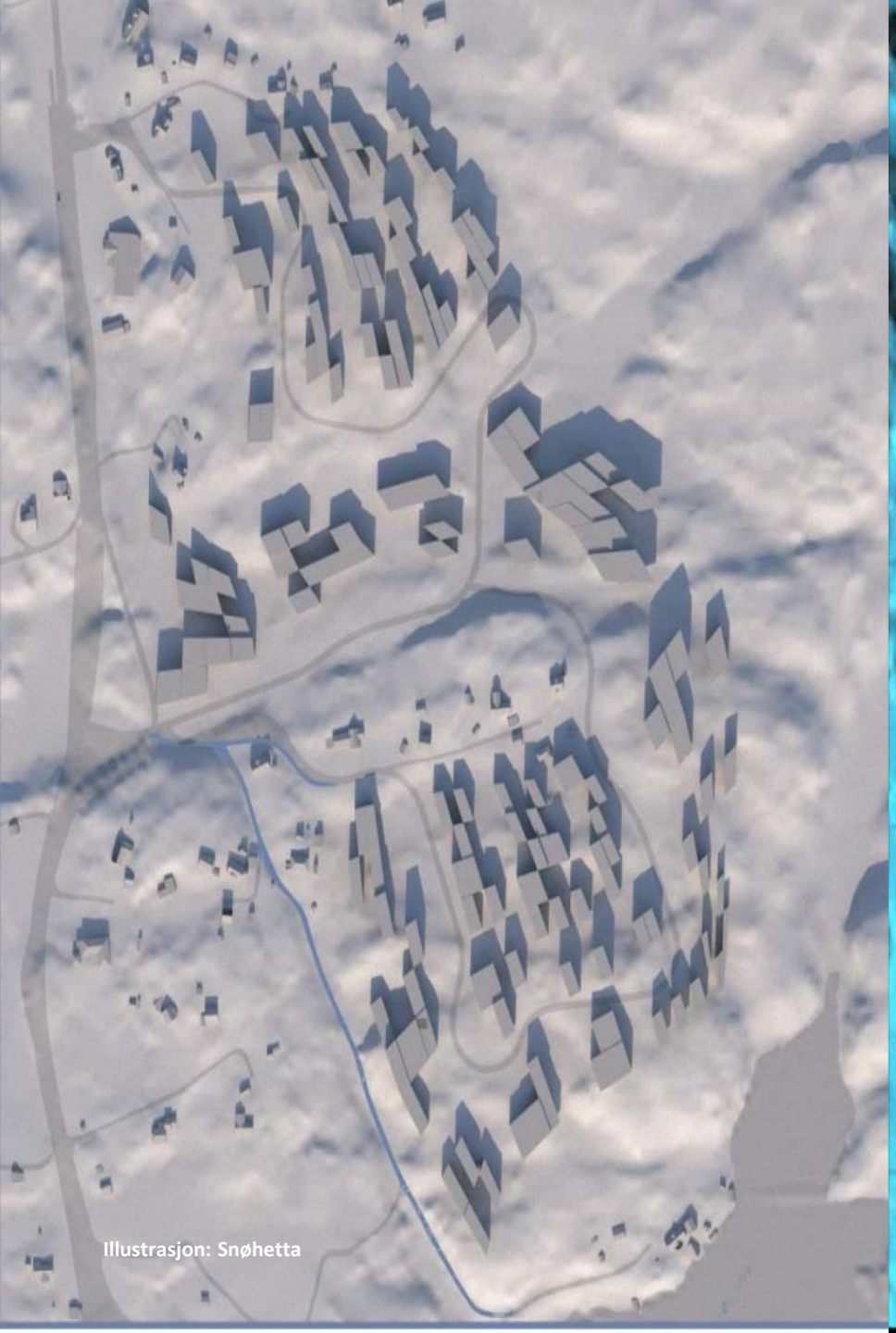


Designparametere:

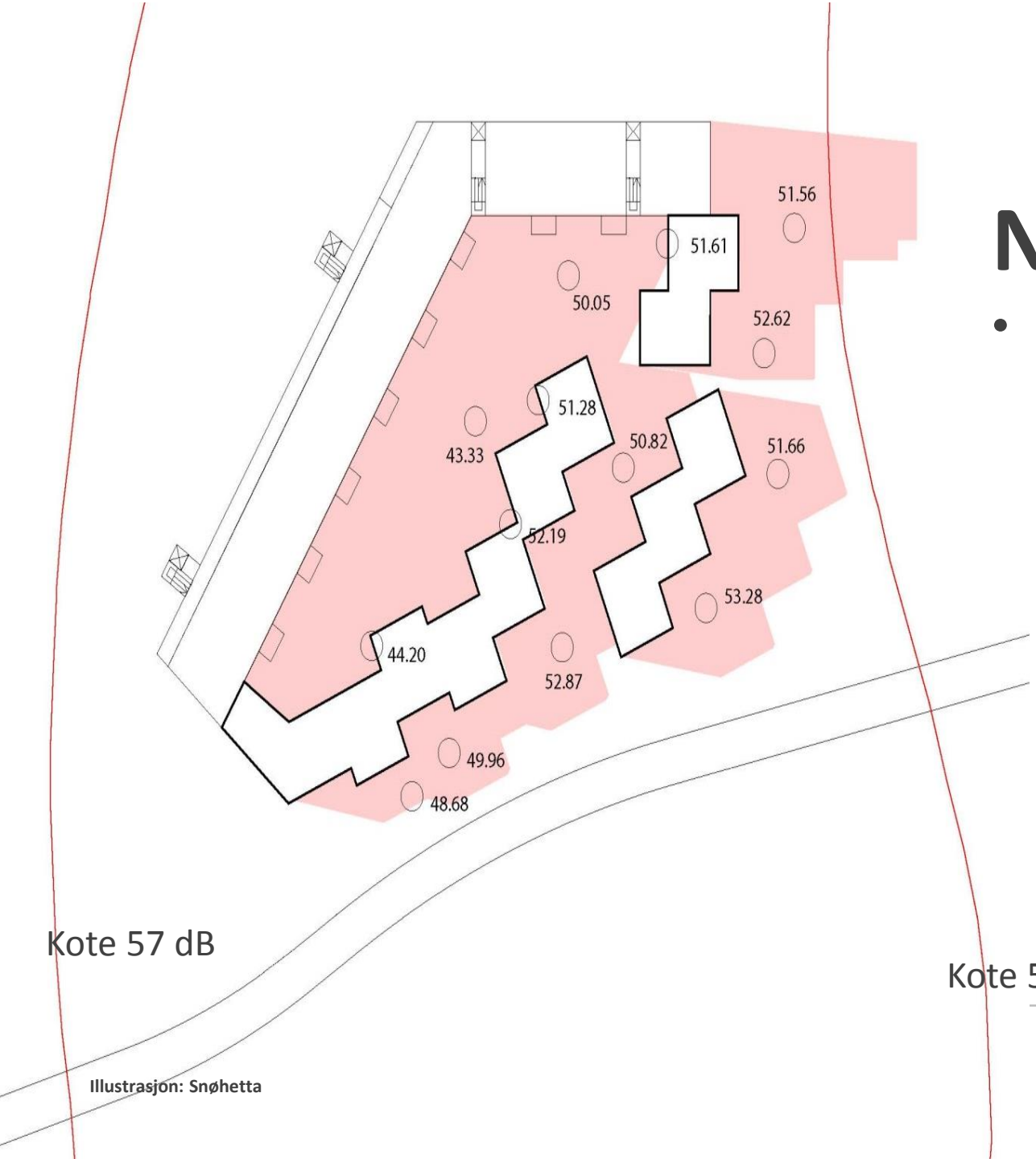
- **SINTEF-input**
- **Grasshopper**

Ny metodikk

- «Lydskygge»



Illustrasjon: Snøhetta



Ny typologi

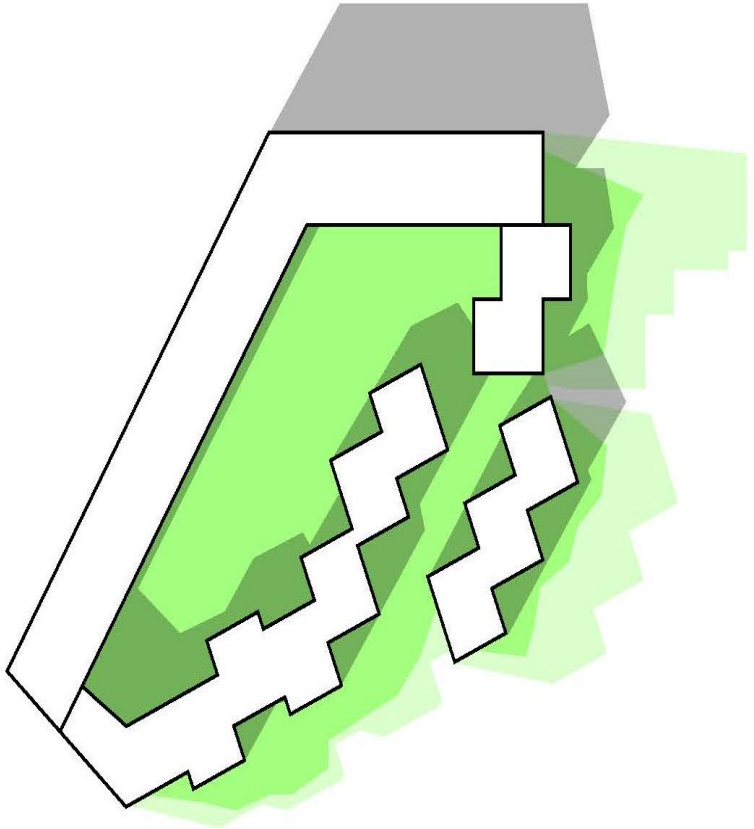
- **Kvartaler og tun**

Kote 57 dB

Kote 56 dB

Illustrasjon: Snøhetta

FME FORSKNINGS-SENTER FOR MILJØVENNLIG ENERGI



Illustrert eksempel programmering:

Støyskygget oppholdsareal -
Totalt ca 3000 m2

Støyskygget oppholdsareal <52db -
Totalt ca 2000 m2

Støyskygget oppholdsareal i skygge (sol) ved vårjevndøgn -
Totalt ca 900 m2 = under 50%
(Bergen krav: under 50% av oppholdsareal skal ha skygge 21.3 kl.15)

Totalt oppholdsareale <52 dB/med sol 21.3 kl 15 - 1100 m2

Bergen retningslinjer for uteoppholdsareal:

Blokk 4 etasjer - **30 m2 pr enhet - 50% i sol ved vårjevndøgn**:
Eks: Leiligheter - 40 enheter á100 m2 BRA- ca 1200 m2 uteoppholdsareal

Rekkehus 2 etasjer: - **75 m2 pr enhet - 50% i sol ved vårjevndøgn:**
Eks: 10 enheter á160 m2 BRA - ca 750 m2 uteoppholdsareal

Totalt behov for oppholdsareal <52 dB - ca 1950 m2
50% i sol ved vårjevndøgn = ca 975 m2

Illustrasjon: Snøhetta

Illustrasjon: Snøhetta

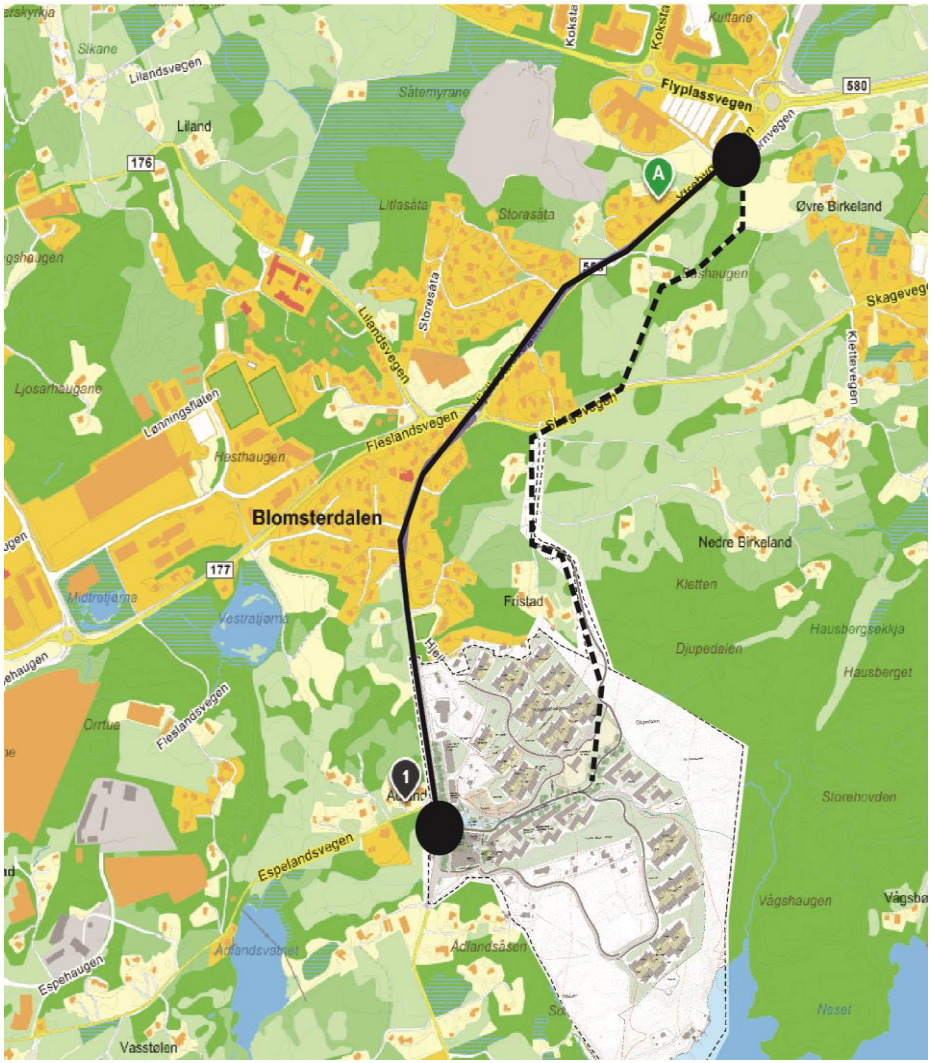
MD/KDP-hensyn

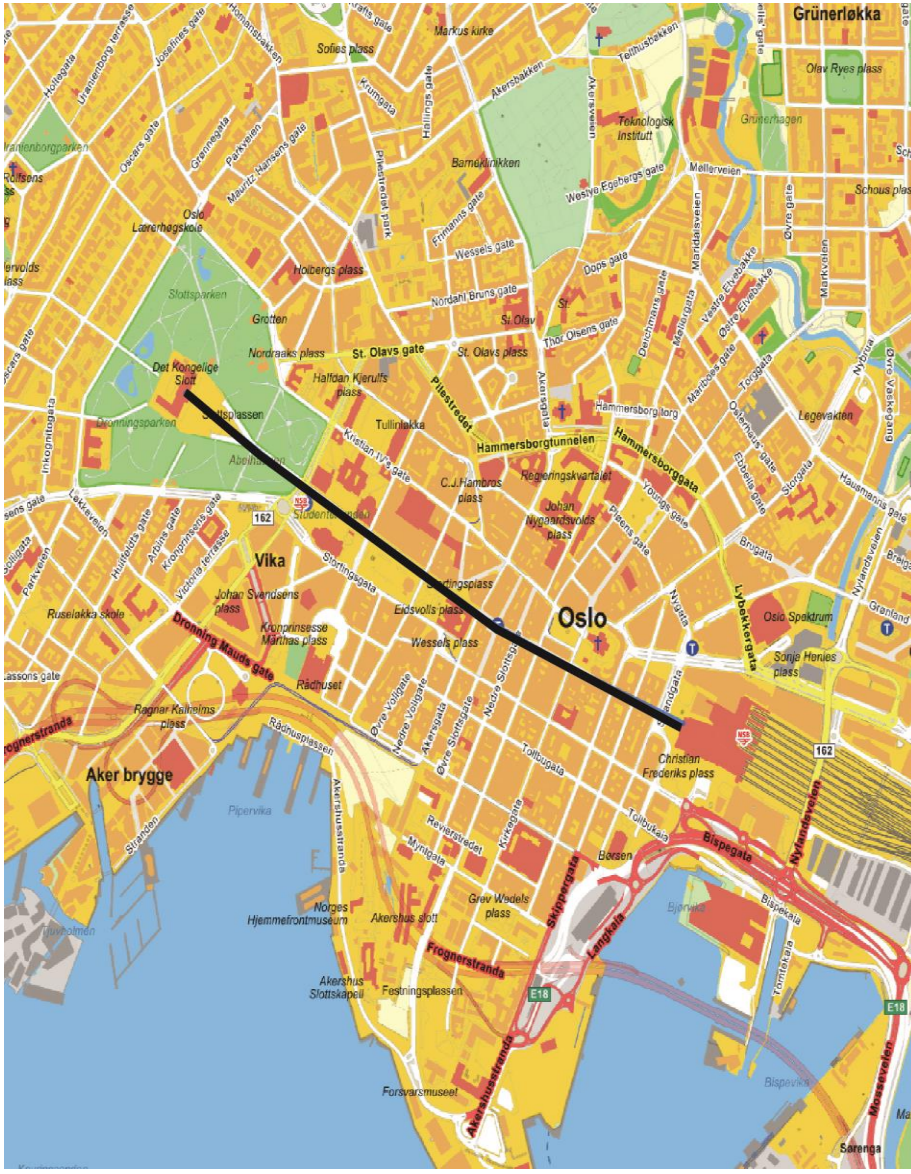
- **Mobilitet**

Illustrasjon: Snøhetta

Bybanen - 1,5 km

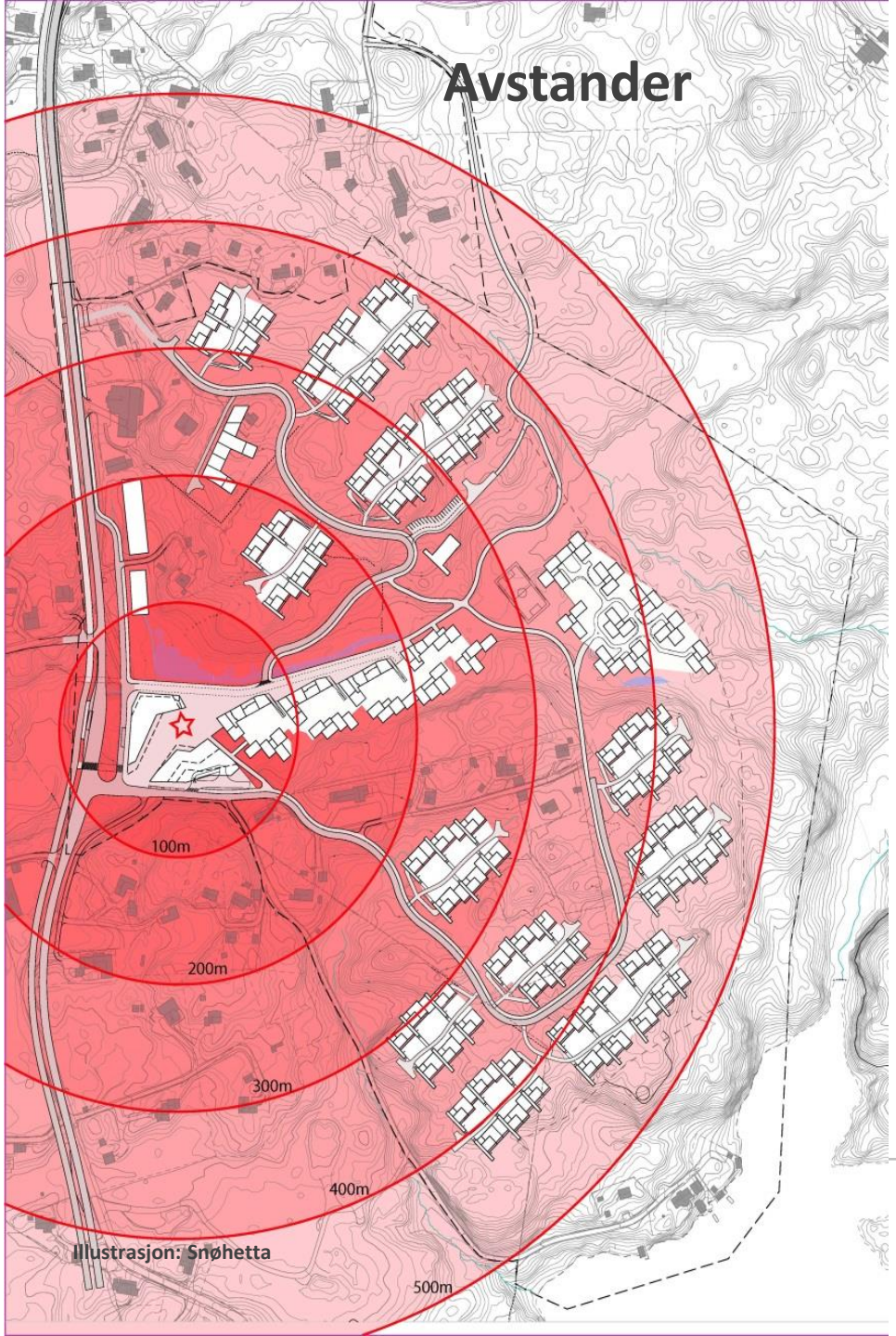
- Sykkel: 8 min
- Buss: 5 min
- Gange: 18 min

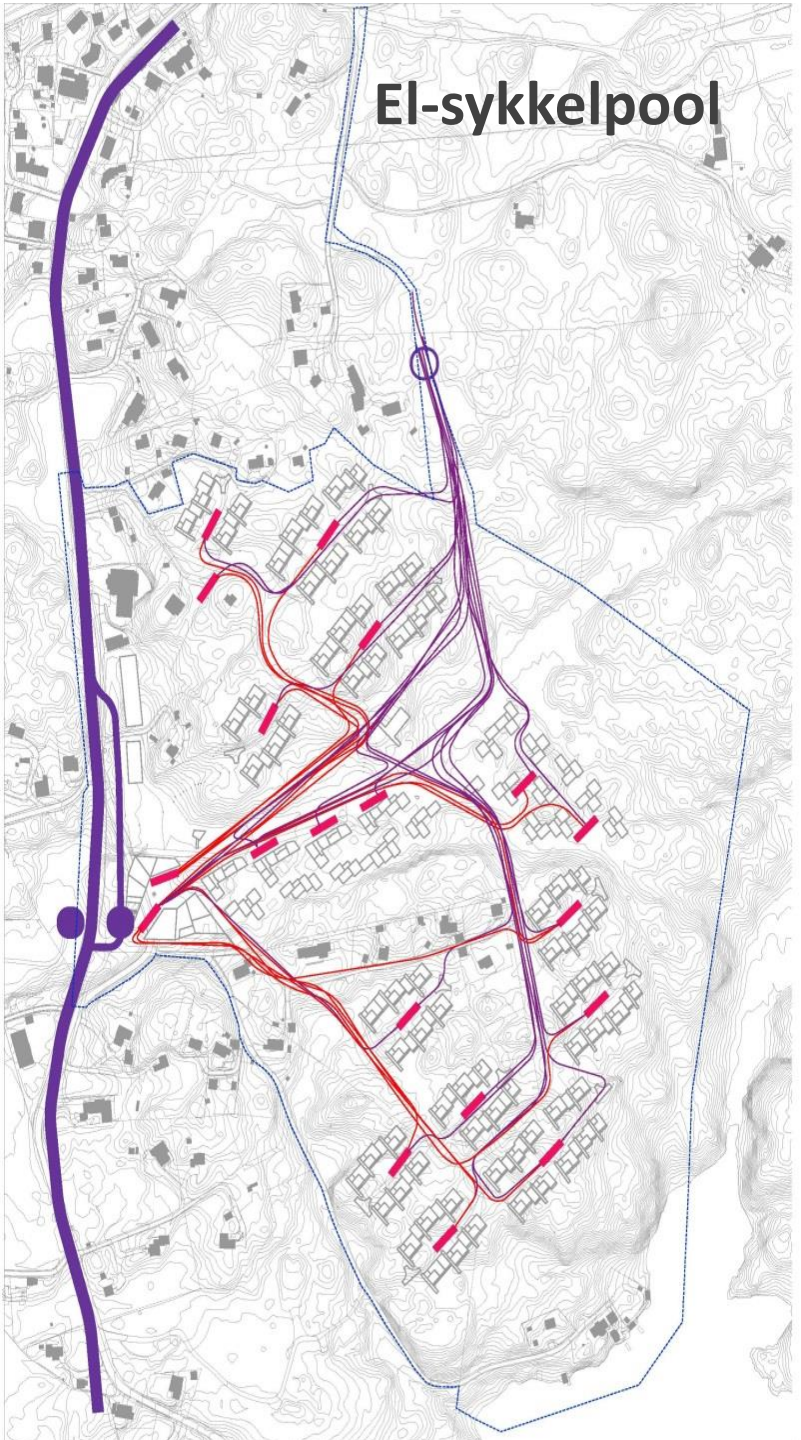


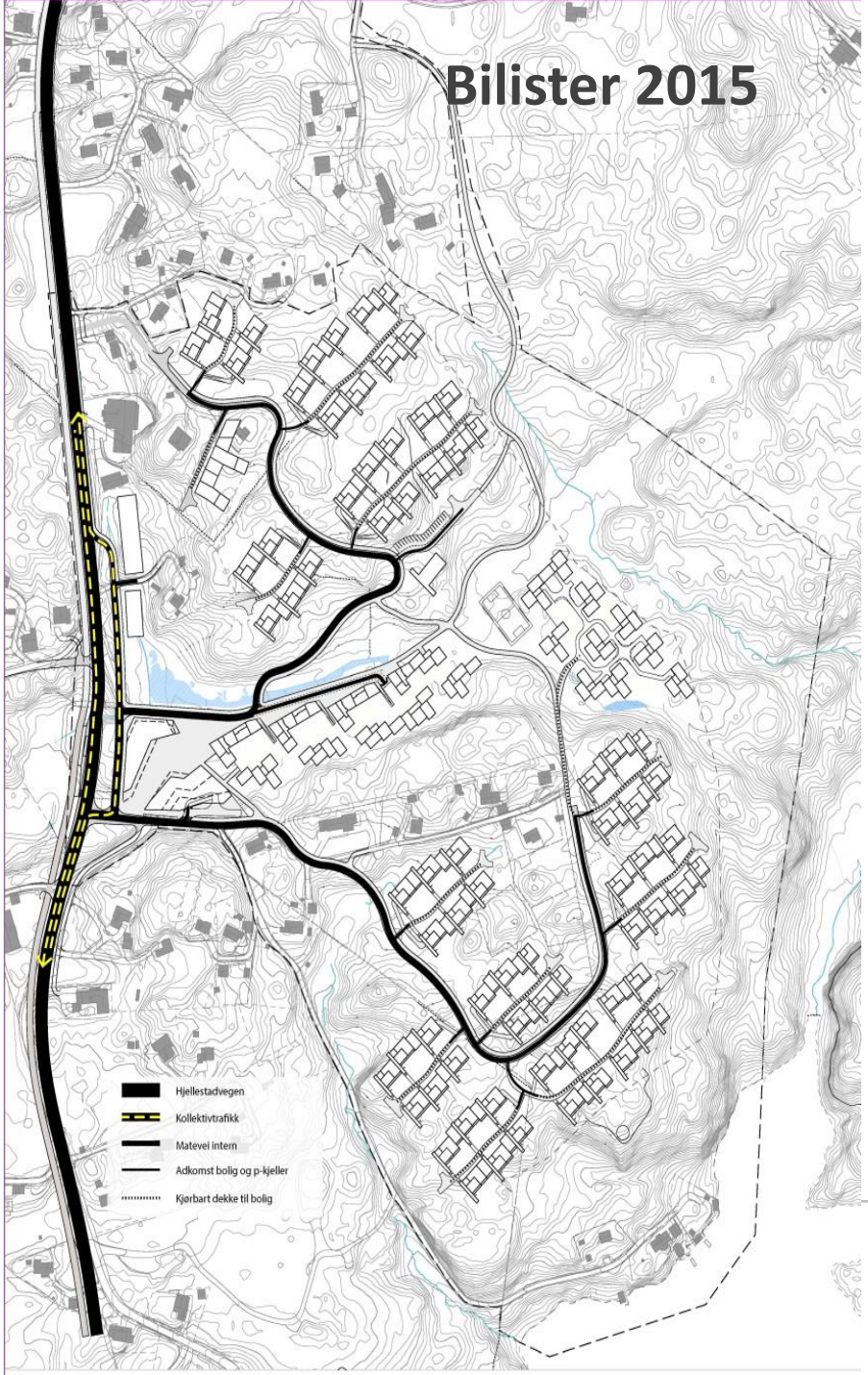


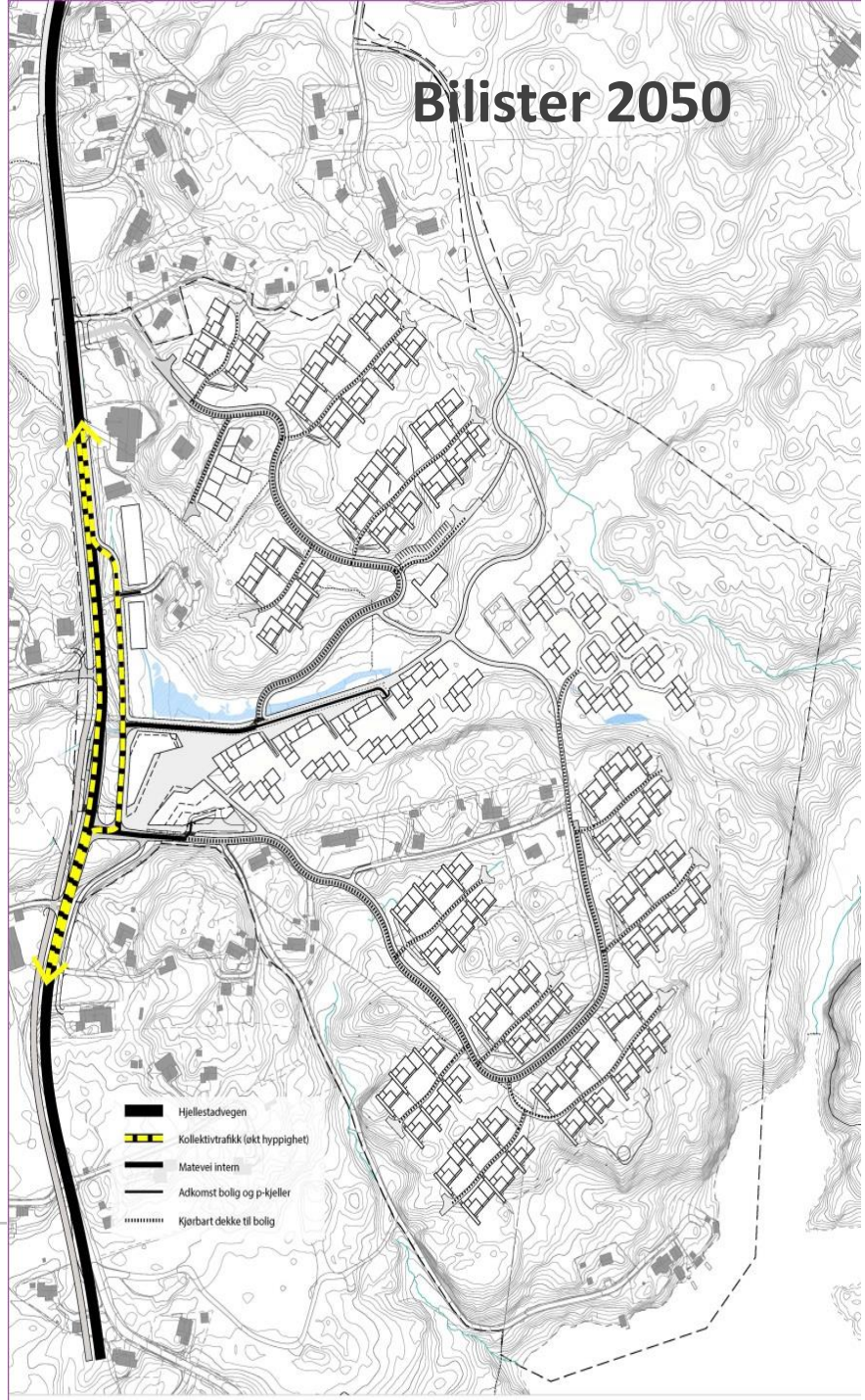
The Research Centre on Zero Emission Buildings

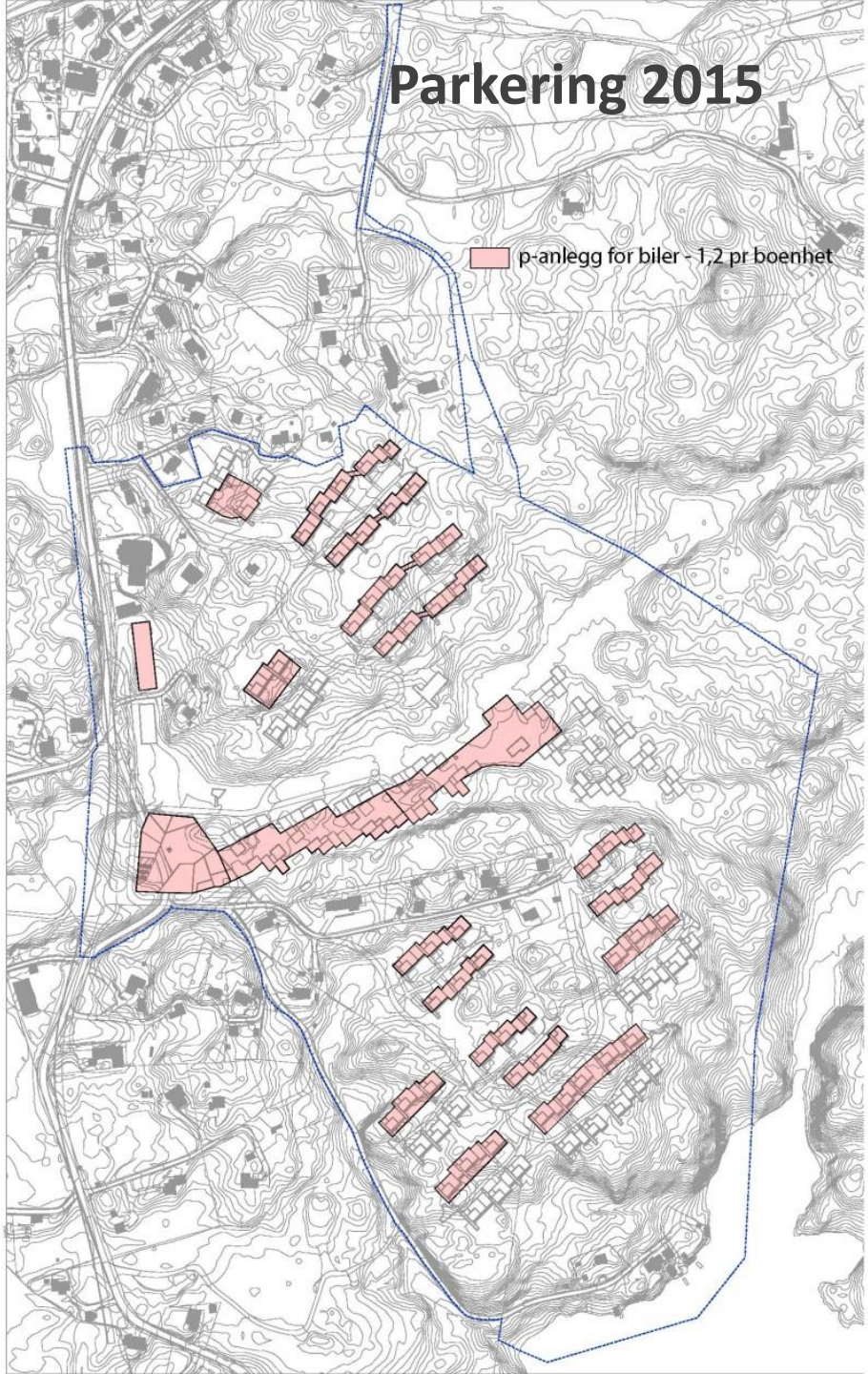
FME FORSKNINGS-SENTER FOR MILJØVENNLIG ENERGI

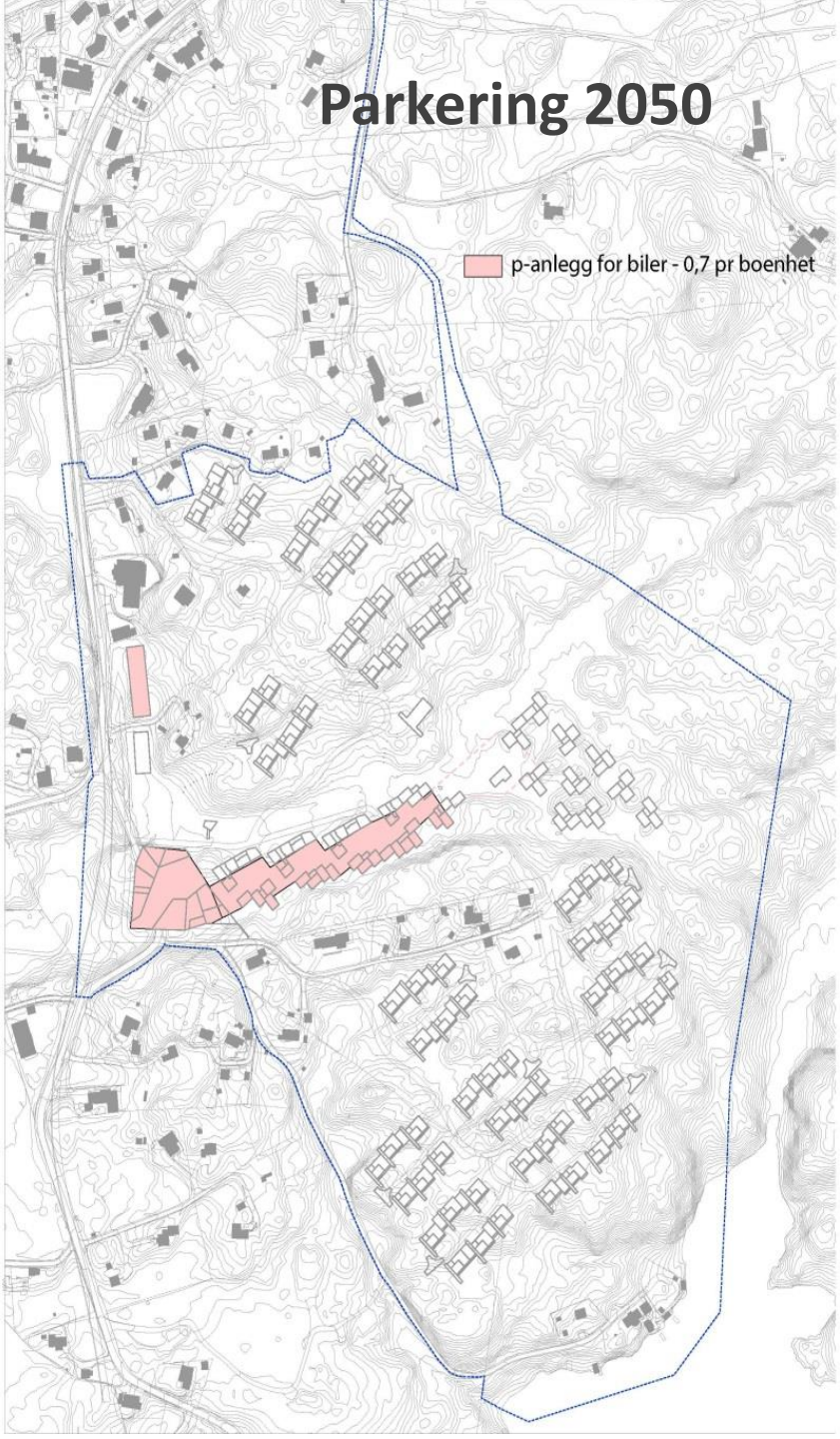

Avstander
100m
200m
300m
400m
500m
Illustrasjon: Snøhetta


El-sykkelpool


Bilister 2015
Hjellestadvegen
Kollektivtrafikk
Matevei intern
Adkomst bolig og p-kjeller
Kjørbart dekke til bolig


Bilister 2050
Hjellestadvegen
Kollektivtrafikk (økt hyppighet)
Matevei intern
Adkomst bolig og p-kjeller
Kjørbart dekke til bolig


Parkering 2015
p-anlegg for biler - 1,2 pr boenhet


Parkering 2050
p-anlegg for biler - 0,7 pr boenhet

ZEB-hensyn

- Takflater med PV mot sør
- Klimaskall og dagslys
- Materialer og byggeteknikk
- P-kjeller i trekonstruksjon
- Mobilitet og CO2
- Livsstil


Sensor activated lighting

Super Efficient appliances


Cradle to cradle Materials

Area efficiency


Super insulated building envelope

Calculated energy consumption


Green mobility


Interior landscaping


Mixity


Local energy production wind

Actual energy consumption


Electrical car pool


Efficient water Installations

Low energy lighting


Monitoring of building energy performance

Calculated local energy production


Electrical car loading station


Local energy production ground source heat pump


Local energy production photo voltaic cells


User consumption monitoring

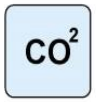
Actual local energy production


Very low infiltration


Local energy production combined heat and power


Local energy production solar thermal


Local energy production heat pump



CO2 Emissions


Daylight optimization


User information and advice


Local energy production geothermal

Noise reduction

Green surface factor


Ecological food


Waste management


Covered bicycle stand

Diagram: Andreas Eggertsen, Snøhetta/ZEB

Bybo-hensyn

- Variasjon og atmosfære
- Urban identitet og fellesskap
- Markedstilpassede boliger

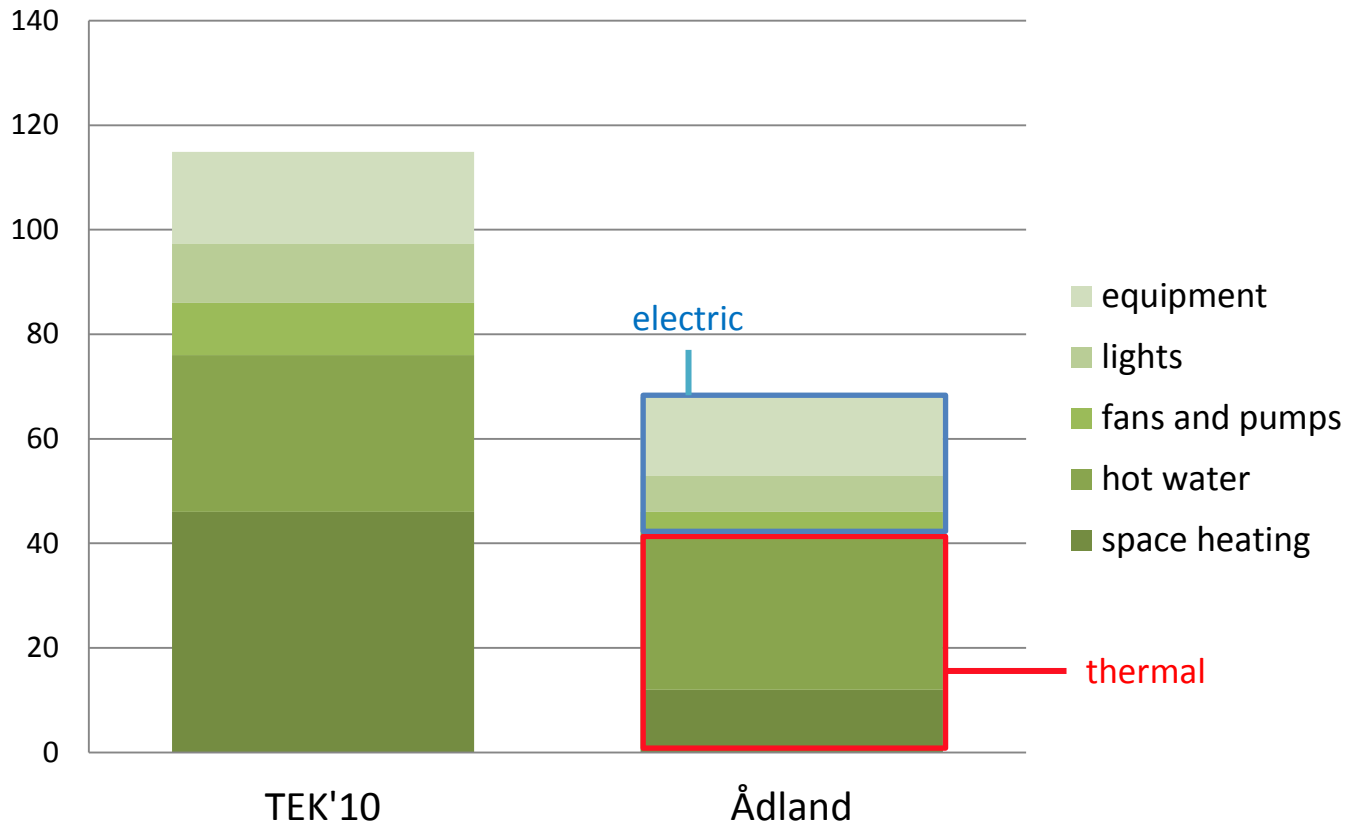
- BYGGBART!

Energy concepts - 1st analysis

	Alternative 1	Alternative 2
Building envelope and technical installations	Passive house standard Highly efficient ventilation system with heat recovery Natural ventilation and passive cooling in summer Lighting based on LED Hot fill washing machines	Passive house standard Highly efficient ventilation system with heat recovery Natural ventilation and passive cooling in summer Lighting based on LED Hot fill washing machines
Energy supply systems	Thermal solar collectors Ground source heat pump Photovoltaics	Thermal solar collectors Biogas based CHP Photovoltaics

Yearly net energy demand for operation

[kWh/m2 HFA]

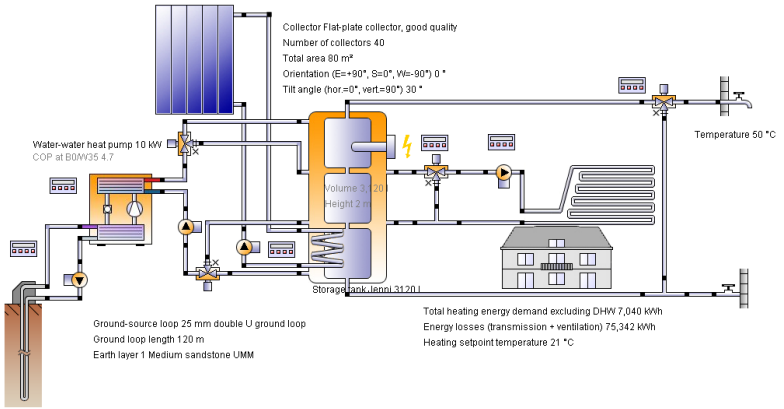


Alternative 1:

Solar collectors + Ground source heat pump + PV

- Local energy central
- Solar collectors, designed to cover 40 % of yearly demand. Gives 5.5 m^2 per 100 m^2 HFA.
- Heat pump covers auxilliary thermal energy.

  Seasonal COP = 2.7

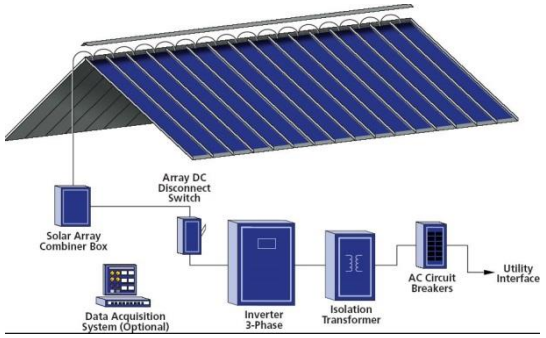


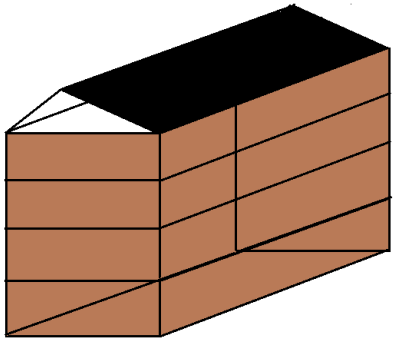
Alternative 1:

Solar collectors + Ground source heat pump + PV

In order to achieve Zero yearly balance:

- PV needs to cover 1430 MWh/yr
- Efficiency 15% and yearly solar flux of 902 kWh/m^2 gives 135 kWh per m^2 PV area.
- Need 10 560 m^2 PV, or 22 m^2 per dwelling.
- Available roof area in preliminary design: 10 630 m^2.
- Need also 2500 m^2 for thermal collectors.





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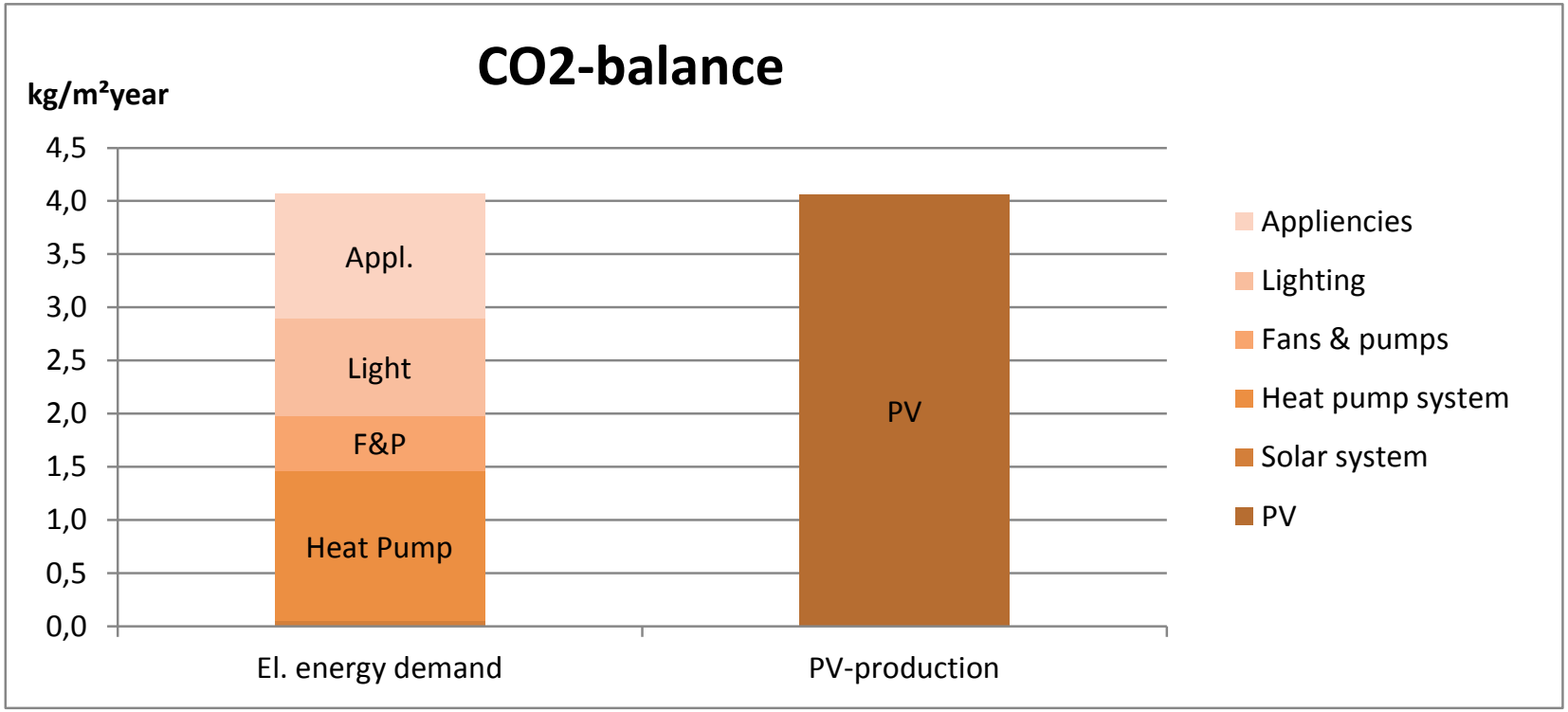
Solar collectors + Ground source heat pump + PV



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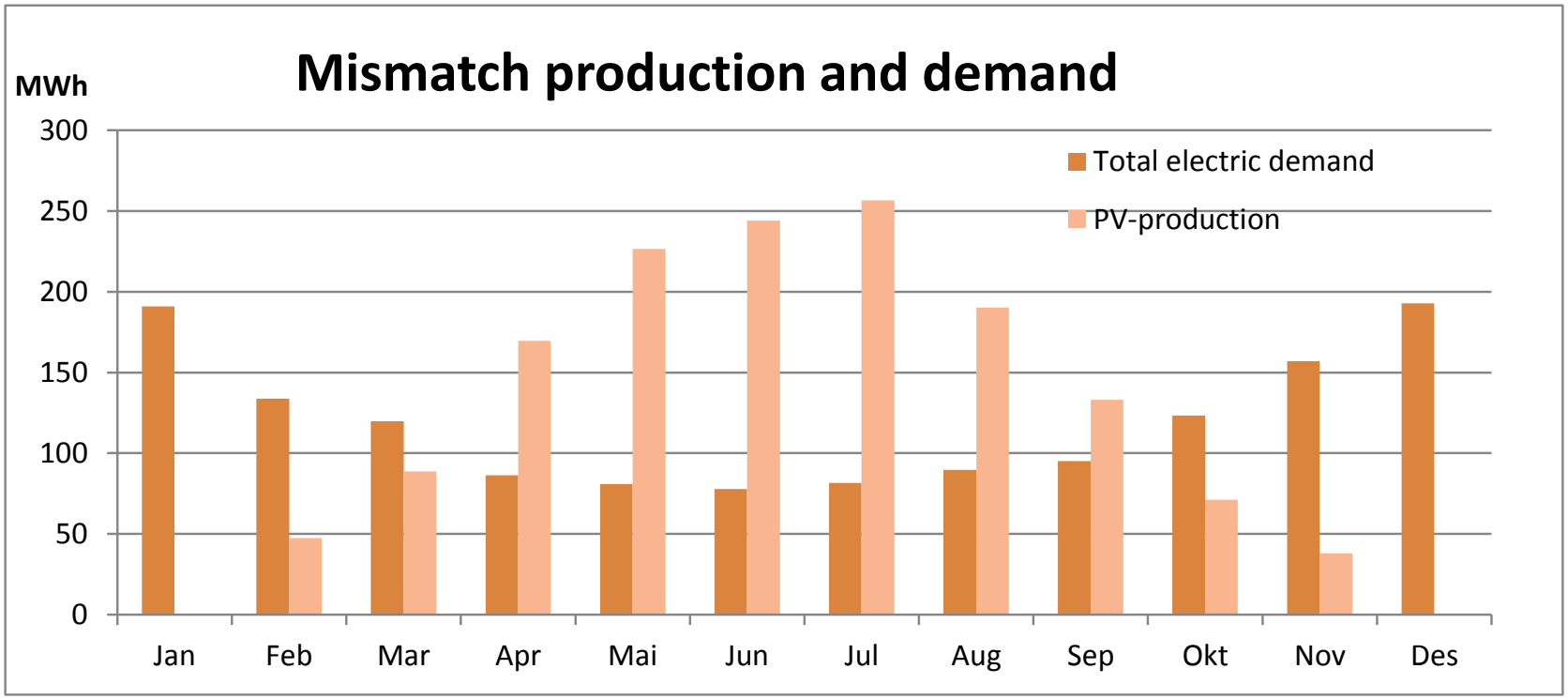


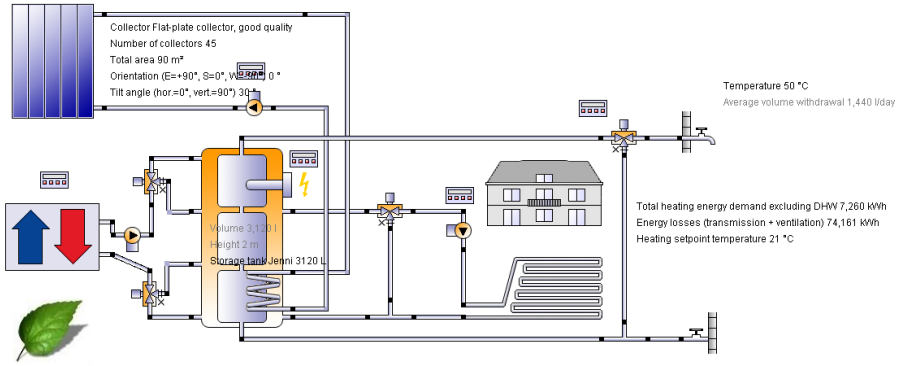
Monthly calculation: 50% electricity exported/imported from grid

Larger if hourly calculations

Alternative 2:

Solar collectors + CHP + PV

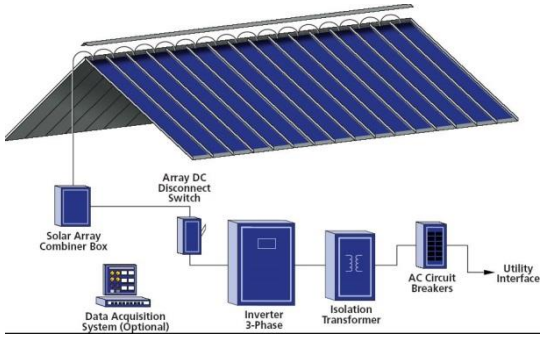
- Local energy central
- Solar collectors on roofs, designed to cover 40 % of yearly demand. Gives 5.5 m^2 per 100 m^2 HFA.
- Bio-gas CHP covers auxilliary thermal energy. Thermal efficiency 55 % and electrical efficiency 35 %.

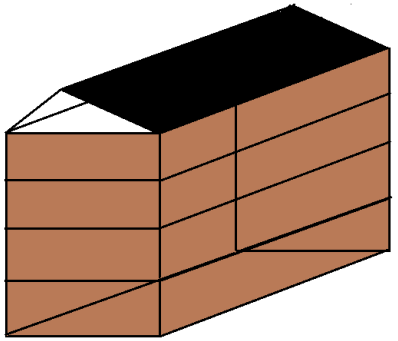


Alternative 2:
Solar collectors + CHP + PV

In order to achieve Zero yearly balance:

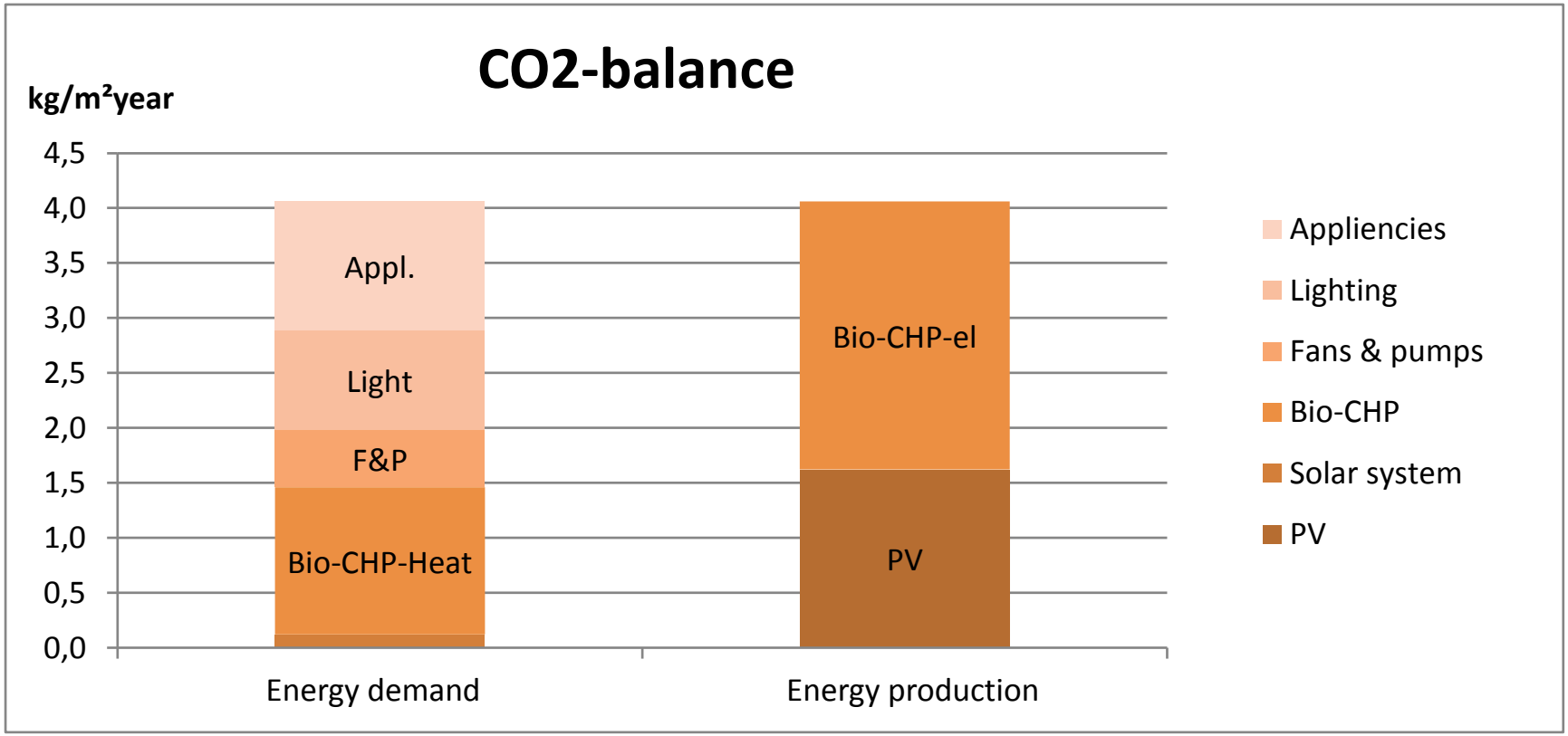
- PV needs to cover 570 MWh/yr
- Efficiency 15% and yearly solar flux of 902 kWh/m² gives 135 kWh per m² PV area.
- Need 4215 m² PV, or 9 m² per dwelling.
- Available roof area in preliminary design: 10 560 m².
- More than room for 2500 m² of thermal collectors on the roofs.





Alternative 2:

Solar collectors + CHP + PV



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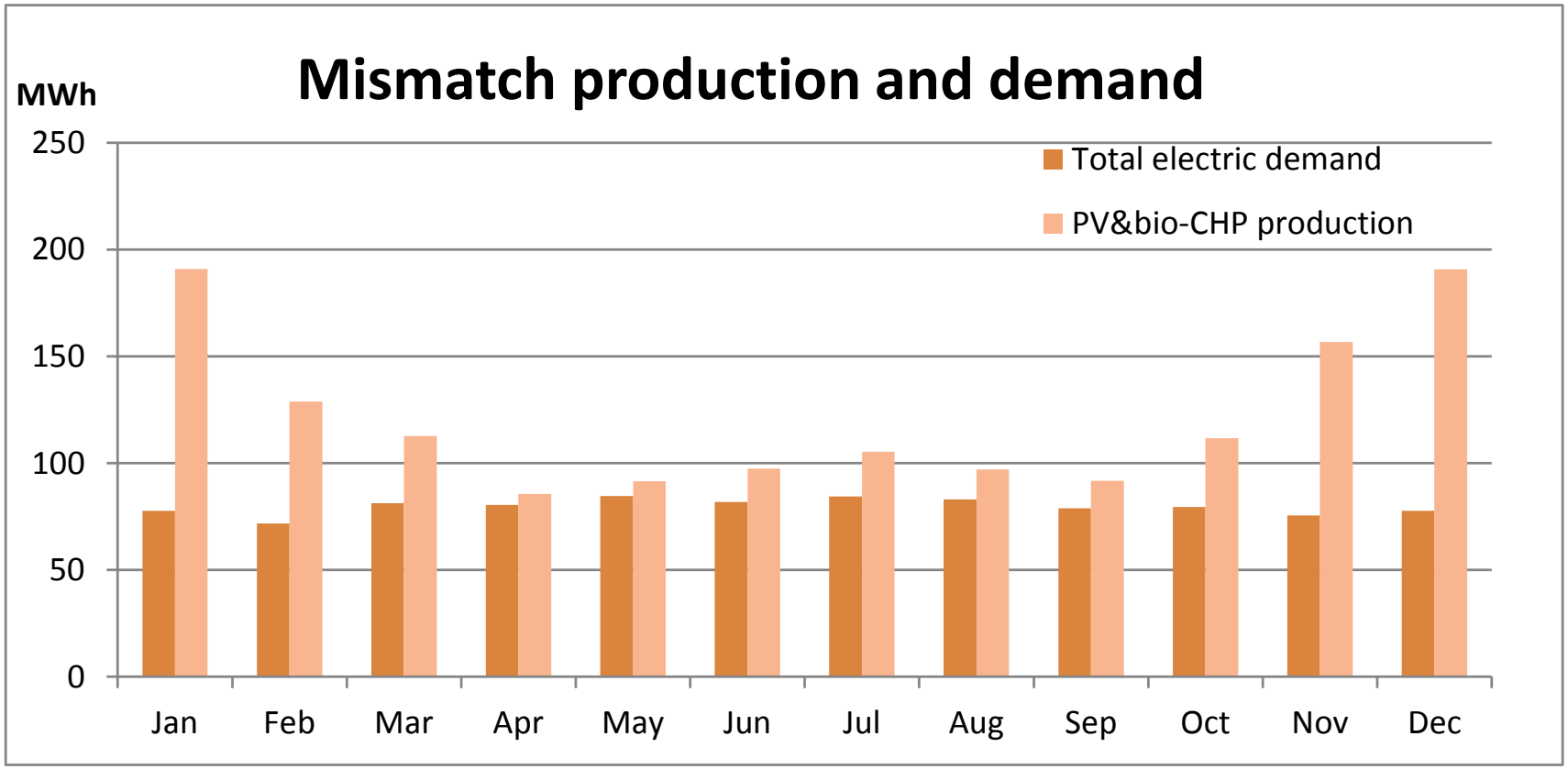


Monthly calculation: 35% electricity exported/imported from grid

Larger if hourly calculations

Videre analyser

Energibruk

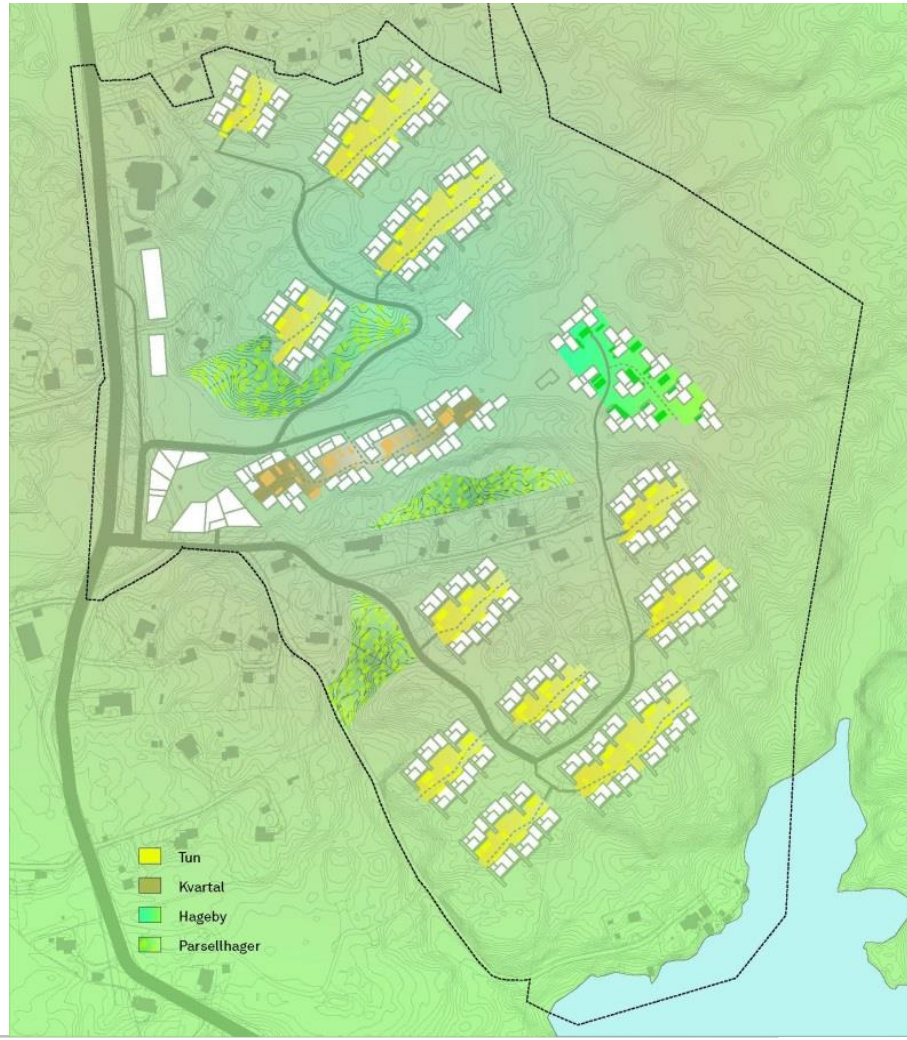
- scenarier for bygg og transport

Utforming av bygg

- materialvalg, bygningskropp, takareal, buffersoner
- trebaserte parkeringskjellere

Energiforsyning

- sol, vind, grunnvarme, bio-chp
- utveksling mellom bygg, nett og transport



Illustrasjon: Snøhetta