

# Designing a ZEN campus

## An exploration of ambition levels and system boundaries

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*Environmental advisor*  
*NTNU*

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*Senior engineer*  
*Statsbygg*

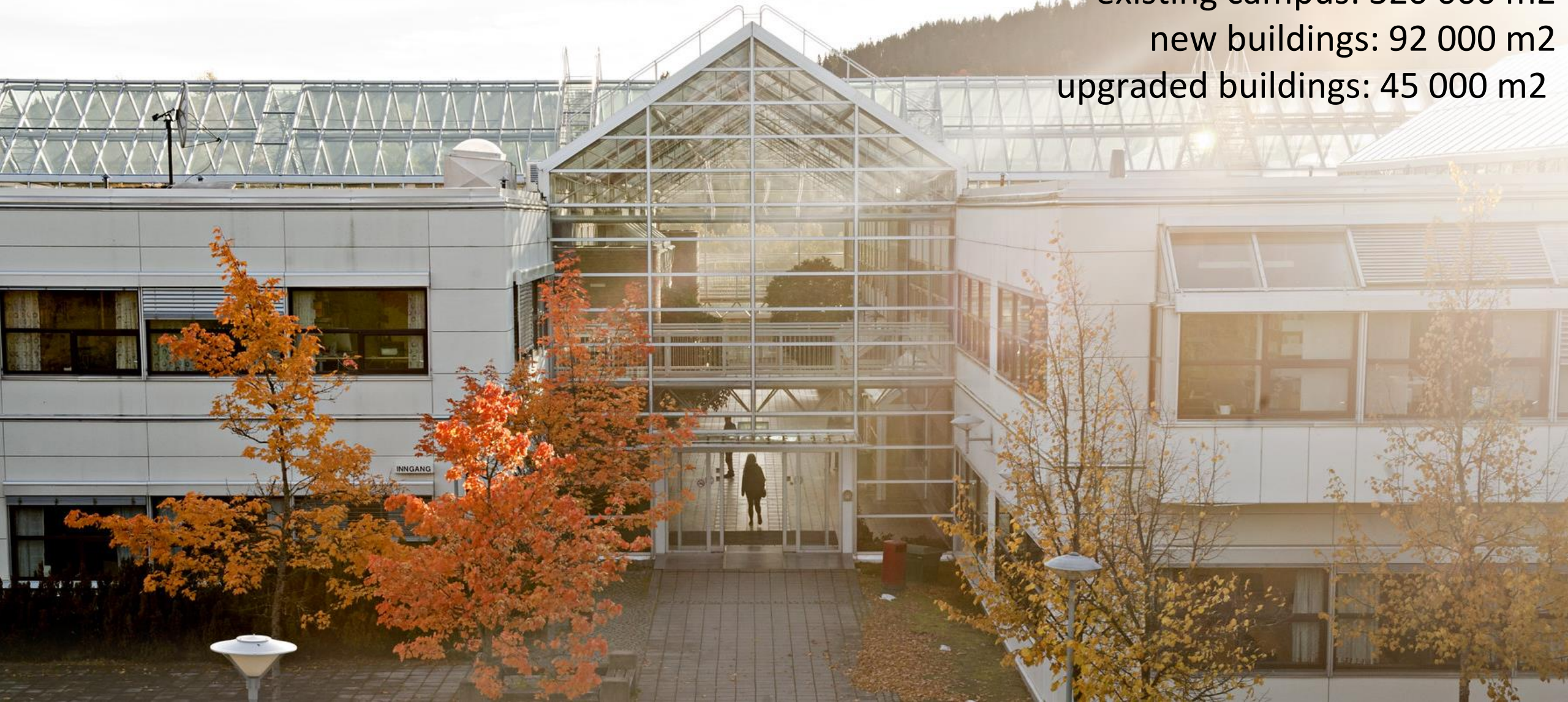


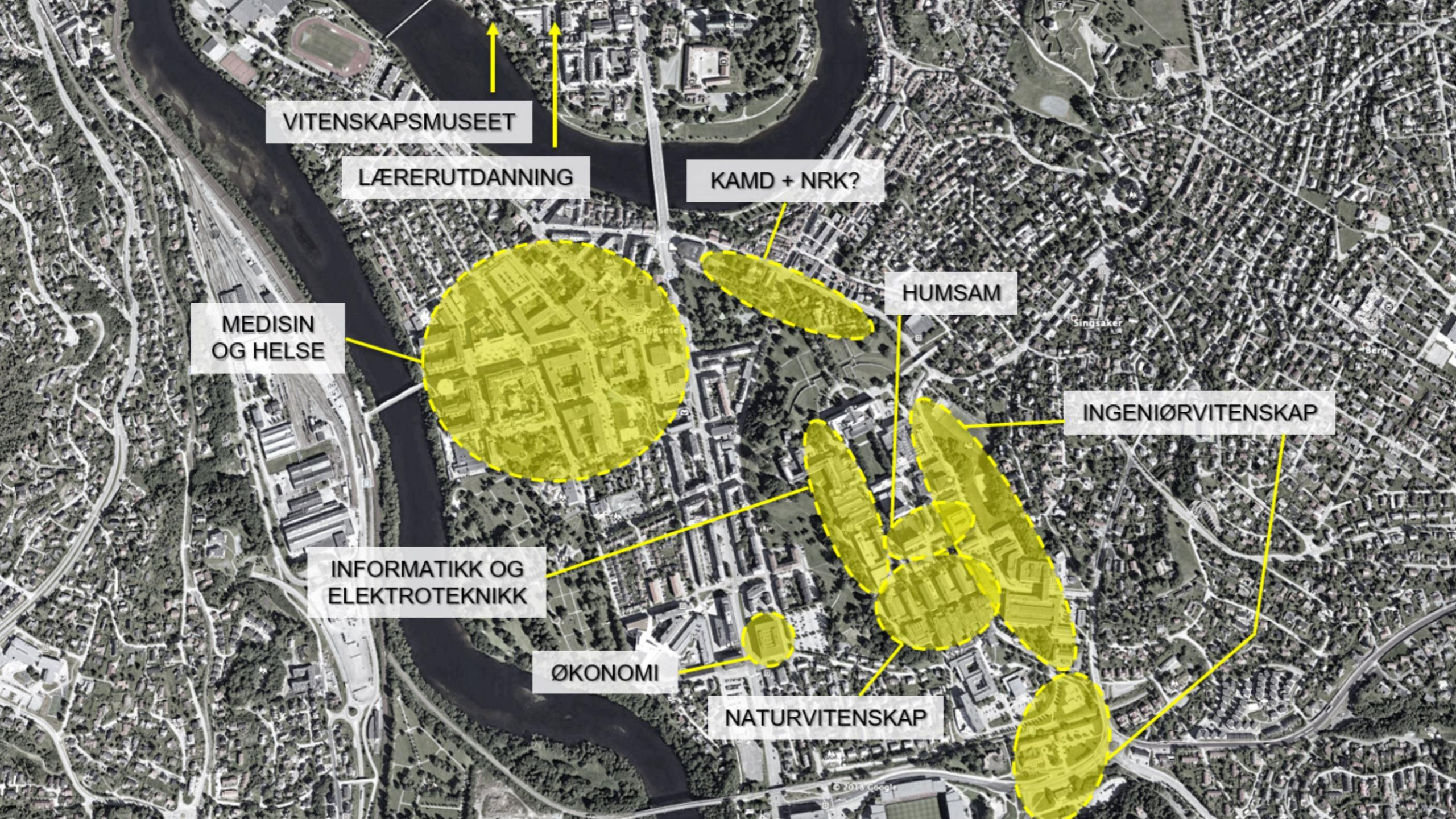
# Campus gathering at Gløshaugen

existing campus: 320 000 m<sup>2</sup>

new buildings: 92 000 m<sup>2</sup>

upgraded buildings: 45 000 m<sup>2</sup>





VITENSKAPSMUSEET

LÆRERUTDANNING

KAMD + NRK?

HUMSAM

INGENIØRVITENSKAP

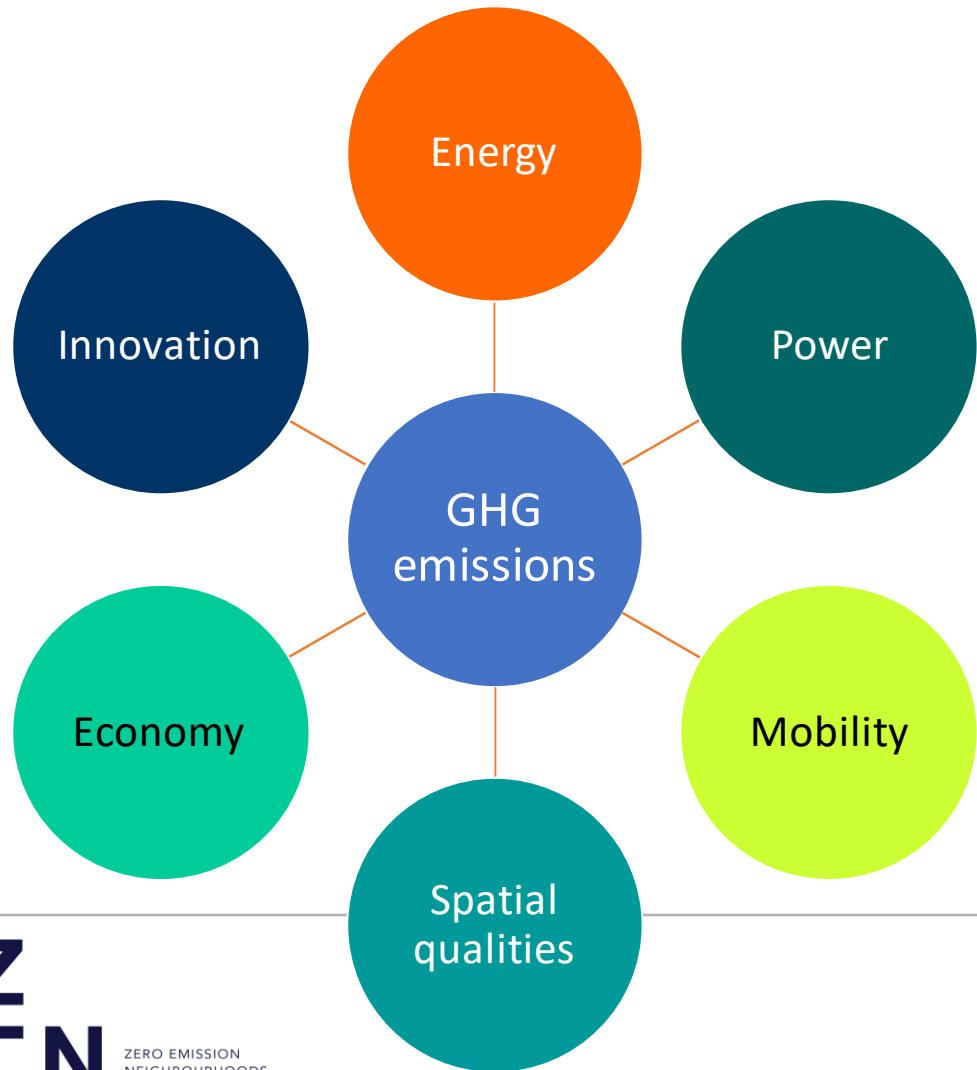
MEDISIN  
OG HELSE

INFORMATIKK OG  
ELEKTROTEKNIKK

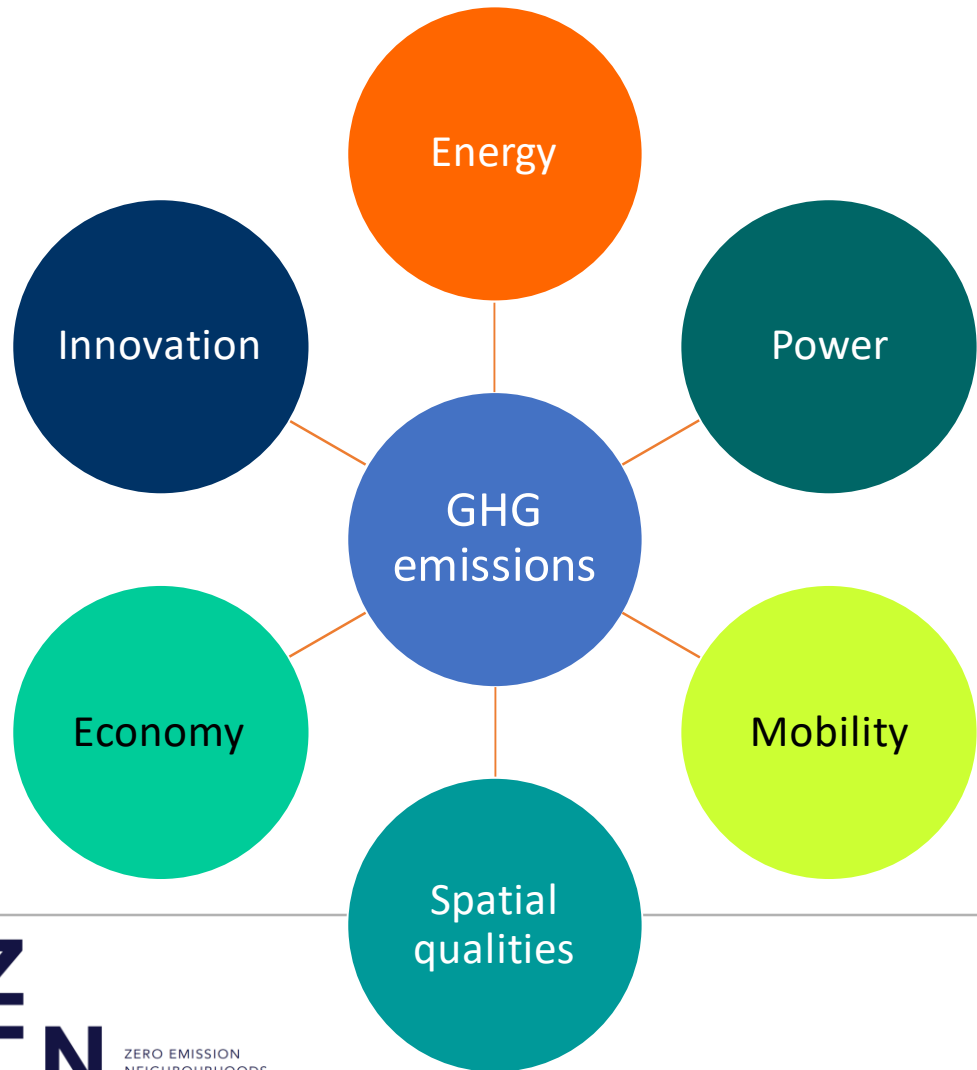
ØKONOMI

NATURVITENSKAP

# Campus: Pilot in Zero Emission Neighbourhoods (ZEN)



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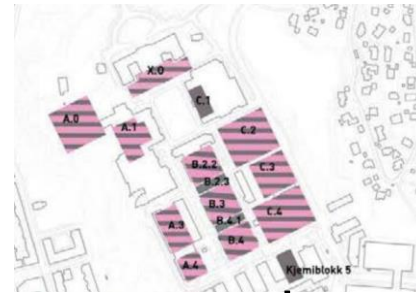
- Energy consumption
  - Existing buildings
  - Renovated buildings
  - New buildings
- Energy production
  - Photovoltaics
  - Heat pumps
  - Wind turbines (*not included here*)
  - Solar thermal (*not included here*)
  - CHP biomass (*not included here*)
- Energy optimisation



# System boundaries and ambition levels



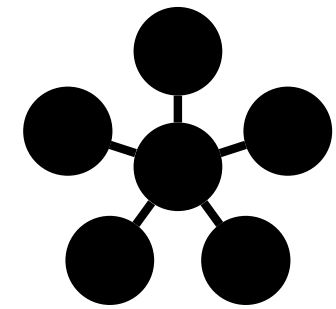
existing



renovation



new



energyhub

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*energy production?*  
*energy consumption?*

# System boundaries and ambition levels

## *energy production*



*new*

*renovation*

*existing*

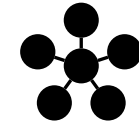
## *energy consumption*



*new*

*renovation*

*existing*



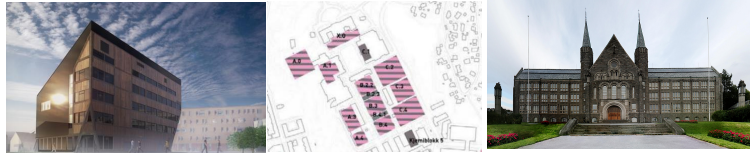
*energyhub*





# System boundaries and ambition levels

## energy production



new

renovation

existing

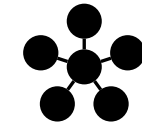
## energy consumption



new

renovation

existing



energyhub



A	X				X				30 %
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# System boundaries and ambition levels

## energy production

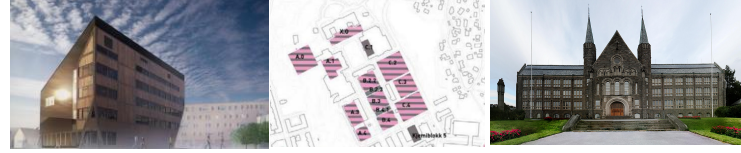


new

renovation

existing

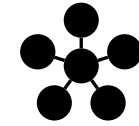
## energy consumption



new

renovation

existing



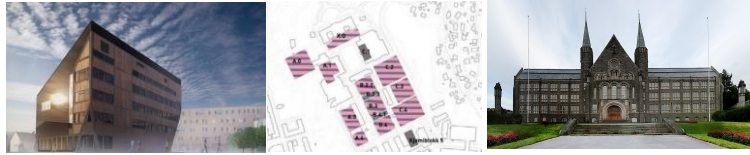
energyhub



A	X				X				30 %
B	X	X			X	X			23 %

# System boundaries and ambition levels

## energy production



*new*

*renovation*

*existing*

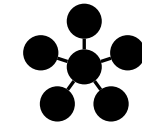
## energy consumption



*new*

*renovation*

*existing*



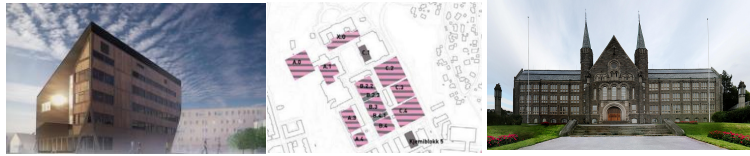
*energyhub*



A	X				X				30 %
B	X	X			X	X			23 %
C	X	X	X		X	X			49 %

# System boundaries and ambition levels

## energy production



*new*

*renovation*

*existing*

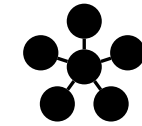
## energy consumption



*new*

*renovation*

*existing*



*energyhub*



A	X				X				30 %
B	X	X			X	X			23 %
C	X	X	X		X	X			49 %
D	X	X			X	X		X	107 %

# System boundaries and ambition levels

## energy production

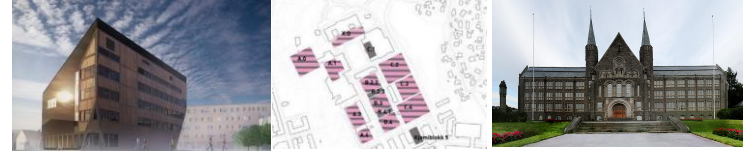


new

renovation

existing

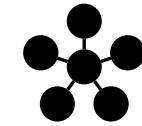
## energy consumption



new

renovation

existing



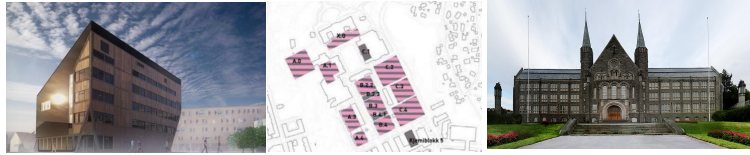
energyhub



A	X				X				30 %
B	X	X			X	X			23 %
C	X	X	X		X	X			49 %
D	X	X			X	X		X	107 %
E	X	X	X		X	X		X	132 %

# System boundaries and ambition levels

## energy production



new

renovation

existing

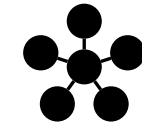
## energy consumption



new

renovation

existing



energyhub



A	X				X				30 %
B	X	X			X	X			23 %
C	X	X	X		X	X			49 %
D	X	X			X	X		X	107 %
E	X	X	X		X	X		X	132 %
F	X	X	X		X	X	X	X	19 %

# System boundaries and ambition levels

## energy production



new

renovation

existing

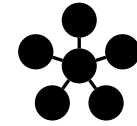
## energy consumption



new

renovation

existing



energyhub



A	X				X				30 %
B	X	X			X	X			23 %
C	X	X	X		X	X			49 %
D	X	X			X	X		X	107 %
E	X	X	X		X	X		X	132 %
F	X	X	X		X	X	X	X	19 %

# System boundaries and ambition levels

## energy production



new

renovation

existing

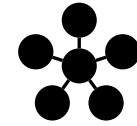
## energy consumption



new

renovation

existing



energyhub



A	X				X				30 %
B	X	X			X	X			23 %
C	X	X	X	?	X	X			49 %
D	X	X		?	X	X		X	107 %
E	X	X	X		X	X		X	132 %
F	X	X	X		X	X	X	X	19 %



# Concluding remarks

- ZEN requires a positive energy campus
- It is possible to realise a positive energy campus – for the new and renovated buildings
- A plus energy campus requires a combination of energy production and storage

# Takk for oppmerksomheten!



<https://fmezen.no>



@ZENcentre



FME ZEN (side)