Agenda

• About Entra Eiendom and strategi
• About Powerhouse
• A active house (building)
• How to buildt active house and use of IED/ID
About Entra Eiendom

• Entra is a leading Norwegian real estate company
• Creates value by developing, letting and operating attractive and environmentally leading premises
• Owns 120 properties - 1,2 million m2
• Property value about 25 billion NOK
• Owned by the Norwegian government
Main strategic choices

- Profitable growth
- Leading in Customer relations
- Industry leader environment
POWERHOUSE "ONE"
Powerhouse Kjørbo
Powerhouse Kjørbo, Sandvika
The project of Powerhouse Kjørbo

- Existing buildings from the 1980s
- Area about 5500 m²
- Current regulation plan
- Today’s facades expression to be retained
  Rehabilitate to energy-positive buildings
- BREEAM Outstanding
- Creating attractive premises
- Economy
Environmental goals in Powerhouse Kjørbo

Active house

Creadle to Creadle

POWEPHOUSE

BREEAM OUTSTANDING

Future-Built
Active House/ energy-plus house/ zero-energy building

An energy-plus-house produces more energy from renewable energy sources, over the course of a year, than it imports from external sources.

An energy-positive building is a building which during its operational phase generates more energy than what was used for the production of building materials, its construction, operation and disposal.
Energy for the operation

+ 

Embodied energy

<

Production of renewable energy

Diagrammer: SNØHETTA / Andreas Eggertsen
IED/ID and Powerhouse Kjørbo

Definition from ID process guideline

ID is defined as a combination of;

1. Integration or cooperation between stakeholders (client, architect and other consultants, and eventually users) from early on in the design process.
2. In achieving high energy/environmental ambitions, the implementation of integrated architectural solutions or passive qualities are prioritized before active systems.
Facade
Energy efficiency – Ventilation strategy
Ventilation principle in the floors
Optimal energy use
- Heat distribution
Thermal energy supply

Figur 5: Forenklet skisse med hovedkomponenter for varmesystem basert på grunnvarme og varmegis.

1. Energibronner 10 x 200 m
2. Kjøling datarom 10 kW
3. 2 x 30 kW varmegis
4. Akkumulatortank varmt tappevann
5. Akkumulatortank oppvarming
6. Lavtemperatur varmedistribusjon (for eksempel veggvarme)
7. Varmt tappevann
8. Ventilasjonsvarme
Calculated solarpower production: 40.7 kWh/m²/y

Renewable energy

SOLARPANEL PRODUCTION

Illustrations: HYDRO – finalreport Powerhouse Kjørbo
Diagram: SNØHETTA / Andreas Eggertsen
Calculated embodied primary energy divided over 60 år: 22,1 kWh/m²/y

Primary Energy vs electrical energy over a lifetime:
1 kWh el ~1,46 kWh primary energy
### Calculated energy for operation

<table>
<thead>
<tr>
<th></th>
<th>Energimerke C kontorbygg</th>
<th>Powerhouse Kjørbo</th>
<th>Reduksjon vs energimerke C</th>
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<tbody>
<tr>
<td>Romoppvarming</td>
<td>43,4</td>
<td>5,5</td>
<td>87,4 %</td>
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<td>Ventilasjonsvarme</td>
<td>27,6</td>
<td>0,9</td>
<td>96,9 %</td>
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<td>Tappevannsoppvarming</td>
<td>6,6</td>
<td>2,1</td>
<td>67,8 %</td>
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<td>Vifter og pumper</td>
<td>22,0</td>
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<td>Belysning</td>
<td>25,0</td>
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<td>69,4 %</td>
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<td>Utstyr- generelt</td>
<td>34,0</td>
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<td>Utstyr - datarom (serveranlegg)</td>
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<td>Romkjøling/komfortkjøling</td>
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<td>Ventilasjonskjøling</td>
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<td><strong>Totalt</strong></td>
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<td>49,3</td>
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<td>171,5</td>
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<td>137,5</td>
<td>20,4</td>
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<td>85,1 %</td>
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# Energy-budget powerhouse kjørbo

<table>
<thead>
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<th>Description</th>
<th>KwH/m²/Year</th>
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<tr>
<td>Need for delivered energy</td>
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<tr>
<td>Embodied energy over 60 år</td>
<td>- 22,1</td>
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<tr>
<td>Production of renewable Energy “PV”</td>
<td>+ 40,7</td>
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<tr>
<td>Resultat</td>
<td>- 1,8 ??</td>
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<tr>
<th>Description</th>
<th>KwH/m²/year</th>
<th>Primary energy factor</th>
<th>Primary energy KwH/m²/year</th>
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<td>Embodied energy over 60 år</td>
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<td>PV 2010-2040</td>
<td>40,7</td>
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Thank you