ASPLAN VIAK AS:

ARCHITECTURE AND CONSULTING COMPANY
Approx. 1000 employees with expertise in:

• Architecture
• City and Area Planning
• Building and Construction
• Energy and Environment
• Communication and Transport Engineering
• Landscape Architecture
Asplan Viak - Department Energy and Environment
Buildings account for approx. 40% of the global energy consumption and represent a major contribution to the global greenhouse gas emissions.
The beginning - 2010

Zero Emission Conference November 2010
Definition of a Powerhouse

In its operational phase, an energy-positive Powerhouse should generate more renewable energy than it consumes during its lifetime through the production of building materials, construction, operation

as well as deconstruction and disposal

The Powerhouse collaboration:
Definition of a Powerhouse

Operational Energy Demand

+ 

Embodied Energy
(materials, construction, demolition)

<

Production of Renewable Energy
(on site)
Powerhouse Kjørbo (Sandvika)

Trinn 1:
- Ca. 5200 m² BRA
- Byggestart: 2012
- Ferdigstillelse: 2014

Trinn 2:
- Ca. 10 000 m² BRA
- Byggestart: 2015
- Ferdigstillelse: 2018
The first Powerhouse – Kjørbo, Sandvika

Renovation of two office buildings

➢ Originally built: 1980
➢ Heated floor area: 5,180 m²
➢ Project start: January 2012
➢ Completed: April 2014

Objectives

➢ Renovate to an energy positive building
➢ Commercial market conditions
➢ BREEAM-NOR «Outstanding»
➢ Keep the expression of the building
Building 4 and 5 before the refurbishment ...
.... and after.
Office landscape before ...
...and after.

Activity Based Workspace (ABW)
Energy concept

- Consequent reduction of energy demand
- Exposed concrete in ceiling for heat storage
- Energy wells supply heat and free cooling.
- Two heat pumps operating at different temperatures.
- Local production of electricity
Energy efficient ventilation concept

- Efficient heat recovery (85%)
- Displacement ventilation
- Use of the building staircases, (reduced duct lengths, low speed)
- Demand controlled
- Very low pressure drop (SFP 0,10-0,25)
- Openable windows
Energy efficient heating concept

Heat pump system

- 10 energy wells (200 meter)
- 2 heat pumps with different working temperatures (80 kW for space heating and 8 kW for DHW)
- Free cooling in summer
- COP better than expected (3,9 / 4,2 => 4,1)
- District heating only as reserve – not necessary for peak load
Heating and cooling concept

➢ No need for radiators along the outer wall.
➢ Just five radiators in the core of each floor.
➢ Free cooling in summer
➢ Exposed concrete.
High efficient PV-system

Solar system

- 1550 m² on the roof of building 4, building 5 and the roof of the garage.
- Efficiency solar panels: 20.4%
- Installed power: $312 \text{ kW}_p$
- Electricity production: 220,000 kWh/year
Minimize embodied energy – reuse

➢ The buildings’ structural systems remained
➢ Materials such as old glass façades have been reused
➢ All new materials were carefully chosen to ensure that the materials had low embodied energy.

Reuse:

Low carbon footprint
The solar system => approx. 30%.
Energy Dashboard

Total Electricity Production
Kilowatt-hours of electricity produced last year

Solar Production
222,431 Kilowatt-hours

Total Consumption
227,730 Kilowatt-hours

Energy performance

Totalt energiforbruk [kWh/m²] med punkter for hver måleravlesning

- ET-Kurve 2014
- Avvikslinjer ± 10%
- Kjørbo ABP
- Powerhouse
Energy balance during 60 years of operation
How is Powerhouse commercial?

**Owner**
Higher rent
Higher valuation and exit value
Lower finance cost

**Tenant**
Lower sick leave
Increased productivity

**Owner/tenant**
Lower operating/common costs
Branding / CSR

Sources:
- Entra ASA
Sustainable Transport

Charging station for electric cars
➢ Dedicated parking for electric cars is available.
➢ Surplus energy from the solar system is used to charge electric cars.

Bicycle parking
➢ Safe and weather protected parking for bicycles.
Energibalanse for Norge, 2014  
Energibalansen følger energiflyten på norsk territorium.

**Produksjon av primær energi**
- Naturgass: 48.5 %
- Råolje: 37.9 %
- Vann- og vindenergi: 6.1 %
- Annet: 7.6 %
- Inkludertes NGL: 4.2 %
- Kondensat: 2.2 %
- Biotrømmel og avfall: 0.6 %
- Kull: 0.4 %

**Tilgang**
- Netto innenlands tilgang: 315 TWh
- 10 TWh International bunkers (sjøfart og luftfart)
- 7 TWh Lagerendringer, nedgang (+) og oppgang (-)

**Netto innenlands energibruk**
- 231 TWh
- 26 TWh sikrer (10 TWh) og statistiske avvik (16 TWh)
- Energi brukt i transformasjon (5 TWh) og forbruk i energiproduserende næringer (63 TWh)

**Eksport**
- 2 042 TWh

**Import**
- 76 TWh

**Netto innenlands energibruk**
- Med råolje: 231 TWh
- Uten råolje: 209 TWh

**Etter forbrukergruppe**
- Industri og bergverk: 67 TWh (+ 0.4 % siste år)
- Transport: 56 TWh (- 1.8 % siste år)
- Andre aktiviteter: 86 TWh (- 8.4 % siste år)

**Fordeling av energibruk på energiprodukter**
- Industri og bergverk
- Transport
- Andre aktiviteter

**Hvor mye er egentlig 1 TWh?**
1 terrawatttime (TWh) er en milliard kilowattiner (kWh). En gjennomsnittlig norsk husholdning bruker rundt 20 100 kWh per år. (2012).

Kilde: http://www.ssb.no/energibalanse
New Powerhouse Definisjon

-A Powerhouse definition based on global warming potential
New Powerhouse definition

This is defined by two criteria

1. Plus energy building

   The building must comply with FutureBuilt plus house standard (2018) with project specific and documented values for ventilation air volumes, heated tap water and lighting. Project specific and documented values for plug loads shall be used if they are lower than the standard values in NS 3031. If the plug loads are higher than defined in NS 3031, the standard values will be used.

2. 1,5ºC-proof according to the IPCC SR 1.5 P1 Scenario

   The total greenhouse gas emissions over a 60 year lifecycle for the function of a m² of building space, should be lower than the budget defined as the sum of the annual emissions occurring from processes related to materials, construction processes, operational energy and end-of-life as it would have been in an equivalent 2010 building space multiplied by the factor for the given year defined by a reference scenario documented to be in line with the 1,5ºC-target.

   To ensure communicability, the suggested label is: Powerhouse Paris-proof
Paris-proof buildings:

- Reduce operational energy and plus energy buildings.
- Use low-carbon materials and construction processes.
- Refurbish existing buildings and reuse building materials.
- Design smart buildings and maximize use.
Powerhouse Telemark
Thank you for your attention

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https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2486604