Nordic built challenge

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Publication date:
2014

Citation (APA):
NORDIC BUILT CHALLENGE
TEAM JJW / WITRAZ / RAMBØLL
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phd-studerende CINARK/JJW arkitekter
arkitekt MAA

“Bæredygtige Systemleverancer
ved renovering og nybyggeri” (2010-14)

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Lektor, DTU.Byg
arkitekt MAA, PhD

Bæredygtighed, Klima, Energi,
Dagslys & Designmetoder

AGENDA

Metode
7 koncepter
Konkurrence fase 1 - NBC som case
Nordic Built Charter - to eksempler

Nordic Innovation
“Shearing Layers of Change”\textsuperscript{1} - som design strategy for bæredygtigt byggeri

\textsuperscript{1} Brand, Stewart. How Buildings Learn. 1994
Bæredygtighed i byggeriet - håndtering af kompleksitet

Our design methodology is structured according to Stewart Brand's Shearing Layers. The shearing layers is a description of how buildings change over time, and how the different layers or scales of a building change at different speeds. It is a theoretical model of building metabolism and can be used as a framework to guide resource management by design, since the rate of exchange of each layer has very strong implications on the use of resources in a Life Cycle Analysis.

Recent research has also shown that the Shearing Layers can be used as a framework for environmental design, as the lasting environmental impacts of the larger and slower changing layers have strong accumulated impacts on the environmental performance of a design. Design decisions concerning the bigger and more permanent layers may have bigger environmental benefits and be cheaper than design decisions made at the smaller and rapidly changing layers. The Shearing Layers can be used as a Climate and Environmental Design hierarchy to guide decision making in the design process.

Together, the resource management and environmental design dimensions of the shearing layers, makes it a powerful tool in the design process. Each design decision on every layer can be evaluated according to its relation and impact on other design decisions. This allows the design team to navigate the design process and qualify decisions according to performance and impact in a more transparent way.

At each stage in the design process, - from the conceptual design covered in this competition to later stages such as preliminary and detailed design, - design options are evaluated according to their life-cycle impacts and environmental performance.

**SHEARING LAYERS – THE GEARBOX OF CHANGE IN A BUILDING’S LIFE CYCLE**

The Shearing Layers can metaphorically be called the gearbox of building metabolism. The shorter the life cycle of a layer, the higher the use of resources associated with it.

A building’s **SITE** conditions usually change very slowly over time. It can often be considered permanent.

The **STRUCTURE** of a building is also very permanent, and is usually not altered very much over the entire life-cycle of the building, which may be 50-100+ years.

The **SKIN** of a building changes more often, as the wear and tear of the natural environment inevitably leads to replacement of components, and technological upgrades may become feasible. Modern windows for instance, have a technical life of 20-50 years.

The building **SERVICES** are often replaced due to technical obsolescence. 10-30 years.

The **SPACEPLAN** is also susceptible to change, as the inhabitants change needs and reorganize their lives differently quite often. 5-10 years.

**STUFF** is the most rapidly changing layer. Interior surfaces, furniture and stuff is continuously replaced, often within 1-5 years.

**CONTEXT**

- **SITE**
- **STRUCTURE**
- **SKIN**
- **SERVICE**
- **SPACEPLAN**
- **STUFF**
- **SOCIAL**

**BUILDING**

- **SOCIAL**
- **BUSINESS**
- **ENERGY**
- **LIFE CYCLE**
- **ECOLOGICAL**
- **RENOVATION**
- **DESIGN**

**USER**

- **SOCIAL**
- **BUSINESS**
- **ENERGY**
- **LIFE CYCLE**
- **ECOLOGICAL**
- **RENOVATION**
- **DESIGN**
Bæredygtighed i byggeriet - identificering af vigtigste parameter

STANDARDER / DE FACTO STANDARDER / PRINCIPPER
f.eks. EN15643  f.eks. DGNB, BREEAM  f.eks. C2C, NBC

SOCIAL CONCEPT
BUSINESS CONCEPT
ENERGY CONCEPT
LIFECYCLE CONCEPT
ECOLOGICAL CONCEPT
RENOVATION CONCEPT
DESIGN CONCEPT

Nordic Built debatmøde
Peter Andreas Sattrup / Jan Schipull Kauschen

2014.03.26 5
We, the Nordic building sector, will join forces and capitalise on our common strengths to deliver the sustainable solutions the Nordic region and the world demands. The time is now and the principles of Nordic Built Charter will lead the way.

**OUR COMMITMENT**
We commit to taking leadership and implement the Nordic Built principles in our work and our business plans. We commit to taking the necessary actions to deliver competitive concepts for a sustainable built environment that benefit users, the building sector, our region and the world.

**OUR NORDIC BUILT PRINCIPLES**
**WE WILL CREATE A BUILT ENVIRONMENT THAT:**

| 01 | Is made for people and promotes quality of life |
| 02 | Pushes the limits of sustainable performance, as a result of our innovative mind-set and high level of knowledge |
| 03 | Merges urban living with the qualities of nature |
| 04 | Achieves zero emissions over its lifecycle |
| 05 | Is functional, smart and aesthetically appealing, building on the best of the Nordic design tradition |
| 06 | Is robust, durable, flexible and timeless - built to last |
| 07 | Utilises local resources and is adapted to local conditions |
| 08 | Is produced and maintained through partnerships founded on transparent collaboration across borders and disciplines |
| 09 | Employs concepts that are scalable and used globally |
| 10 | Profits people, business and the environment |

NORDIC BUILT Challenge - som case
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The ten principles in the Nordic Built Charter have been transformed into seven concepts which summarize the most important aspects of sustainable design. The seven concepts provide a multiple solutions space which breaks down the complexity of sustainable design into tangible elements.

**SOCIAL CONCEPT**

**BUSINESS CONCEPT**

**ENERGY CONCEPT**

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NORDIC BUILT Challenge - som case

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- Is produced and maintained through partnerships founded on transparent collaboration across borders and disciplines
- Employs concepts that are scalable and used globally
- Profits people, business and the environment
- Is designed to perform, respecting the qualities of nature

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SOCIAL CONCEPT

BUSINESS CONCEPT

ENERGY CONCEPT

LIFECYCLE CONCEPT

ECOLOGICAL CONCEPT

RENOVATION CONCEPT

DESIGN CONCEPT

PRINCIPLES RELATIONS TO THE PRINCIPLES

Principles 1-2-3-4-6-9-10

Principles 2-6-8-9-10

Principles 2-4-7-9-10

Principles 2-4-6-9-10

Principles 2-4-7-8-9-10

Principles 2-6-8-9-10

Principles 1-2-3-4-5-6-7-8-9-10

Signed by:

Peter Andreas Sattrup / Jan Schipull Kauschen

2014.03.26
**NBChallenge**

**uddrag fra fase 1**

<table>
<thead>
<tr>
<th>Lifecycle Concept</th>
<th>Ecological Concept</th>
<th>Renovation Concept</th>
<th>Design Concept / Landscape and Architecture</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

**The Concept**

We want to address two perspectives: the renovation of the future – as it has been for the last 30 years.

**The Ecological Concept**

Renewable energy technology and energy prices, solar power on site, where this is feasible and can be produced.

**Renovation Concept**

Smaller apartments with lower rents should be retrofitted as the cost of refurbishment and administration costs are transferred into services, promoting their extended use.

**Design Concept / Landscape and Architecture**

Energy efficient building design is currently based on a combination of fossil fuels and renewable energy sources.

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**Source:** Marstal large scale solar heating and Nordic Built Challenge Denmark.
NORDIC BUILT Challenge - Team JJW / WITRAZ / RAMBØLL
Fase 1

Ellebo / Danmark
JJW
med
Habitats (Lise Kloster Bro) - landskab
Novitas Innovation (Tanja Bisgaard) - sparring til økonomisk koncept

ReBootkyrka / Sverige
WITRAZ
We, the Nordic building sector, will join forces and capitalise on our common strengths to deliver the sustainable solutions the Nordic region and the world demands. The time is now and the principles of Nordic Built Charter will lead the way.

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Our invitation
We, the Nordic building sector, invite the Nordic governments and public authorities, investors and financial institutions, end-users and building owners, the energy sector and all others who have a stake in our mission, to join us in our efforts to accelerate the transition to a sustainable built environment.

Signed by:

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Employs concepts that are scalable and used globally
Profits people, business and the environment
NORDIC BUILT Challenge - to eksempler

Achieves zero emissions over its lifecycle

04
NORDIC BUILT Challenge - to eksempler
Embodied Energy + driftsenergi / systemgrænser?

1. livscyklus

2. livscyklus

eller

eén livscyklus


130-180 kwh/m²a

~100 kwh/m²a

30 kwh/m²a

0 kwh/m²a

-15 kwh/m²a

2015-level

1990-level

1960-level

w/o renovation

building code requirements

zero-energy use

accumulated Embodied Energy

GJ

1,8 GJ

16,3 GJ

32,5 GJ

32,5 GJ

17,3 GJ

16,3 GJ

13,2 GJ

16,3 GJ

19,8 GJ

24,8 GJ

26,2 GJ

24,8 GJ

22,6 GJ

17,3 GJ

16,3 GJ

1,8 GJ

13-180 kwh/m²a

~100 kwh/m²a

-100 kwh/m²a

-160 kwh/m²a

1.0 livscyklus

ellera

eén livscyklus
On the SPACEPLAN level, removing app. 7000m² from the existing blocks allows most internal changes, leaving the notion of precast-housing blocks be-

2. How can we make 1960-precast concrete build-

ings fashionable and loved again (as they were in the

ish communities that have a decreasing population)

Strategy E should exemplify the scalability of the con-

cepts and the “silent”, implicit potentials in the exist-

ing buildings are reuses as partition walls and

Built-in (app. 10.000m² in total).

Removing app. 7000m² from the existing blocks al-

2+4, creating larger family apartments spanning over

the existing buildings are reuses as partition walls and

built-in (app. 10.000m² in total).

When exposed on the interior, they can get a vital part of telling the story of re-inventing

bracing elements. When exposed on the interior, they can get a vital part of telling the story of re-inventing

On the SPACEPLAN level,

strategy allows most

in block 2+4, new kitchen / bathroom

combutions of flats in block 2+4, new kitchen / bathroom

combutions of flats in block 2+4, new kitchen / bathroom

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combutions of flats in block 2+4, new kitchen / bathroom

combutions of flats in block 2+4, new kitchen / bathroom

Combutions of flats in block 2+4, new kitchen / bathroom

Strategy B1 new facade (stone) penthouse

Strategy B2 new facade (wood) penthouse

Strategy C re-use facade penthouse

Strategy D re-use facade new buildings

Strategy E reuse facade deconstruction + reuse (new) buildings

Table 1: Relation of the different renovation strategies with respect to environmental footprints and costs

(Presented are based off site conditions and all strategies were in block 2+4; Reductions to the baseline (Strategy A))

<table>
<thead>
<tr>
<th>SITE</th>
<th>CO2eq</th>
<th>WASTE</th>
<th>EMBODIED ENERGY</th>
<th>WATER</th>
<th>RESOURCES</th>
<th>COSTS</th>
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<tbody>
<tr>
<td>Strategy A</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Strategy B1</td>
<td>128%</td>
<td>120%</td>
<td>94%</td>
<td>112%</td>
<td>120%</td>
<td>133%</td>
</tr>
<tr>
<td>Strategy B2</td>
<td>105%</td>
<td>115%</td>
<td>96%</td>
<td>102%</td>
<td>110%</td>
<td>127%</td>
</tr>
<tr>
<td>Strategy C</td>
<td>93%</td>
<td>95%</td>
<td>92%</td>
<td>102%</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>Strategy D</td>
<td>109%</td>
<td>105%</td>
<td>101%</td>
<td>108%</td>
<td>108%</td>
<td>141%</td>
</tr>
<tr>
<td>Strategy E</td>
<td>108%</td>
<td>105%</td>
<td>100%</td>
<td>115%</td>
<td>107%</td>
<td>134%</td>
</tr>
</tbody>
</table>

Table 2: Comparison of the 5 different design strategies.
NORDIC BUILT Challenge - to eksempler

BYSCO-konceptet:

Ellebo bliver til en Produkt-Service-System (PSS)

-> incitament til at spare ressoucer

-> skaber jobs (lokalt)

-> skaber langvarige forretningsperspektiver

-> begrænser (økonomiske) risici for beboerne

-> ingen “point-of-sales” (kun et budget, ansvaret forbliver hos BYSCO)

men: hvem kan gøre dette (tillid)? hvem ejer bygningen? hvad med beboerdemokratiet? store byggeopgaver uden udbud? fungerer systemet kun ved høje materialepriser?
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<td><strong>THE CHARTER</strong></td>
<td><strong>THE CHALLENGE</strong></td>
<td><strong>THE FUNDING</strong></td>
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<td>JJW Arkitekter</td>
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<td>JJW Arkitekter (DK)</td>
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<td>KADK (DK)</td>
<td>Helen &amp; Hard (NO)</td>
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<tr>
<td>KADK / J. Schipull</td>
<td>NTNU (NO)</td>
<td>White Arkitekter (SE)</td>
</tr>
<tr>
<td>DTU / P.A. Sattrup</td>
<td>CTH (SE)</td>
<td>Lassila Hirvilammi (SF)</td>
</tr>
<tr>
<td>Ellebo, Ballerup</td>
<td></td>
<td>Studio Granda (IS)</td>
</tr>
<tr>
<td>Krögarvägen, Stockholm</td>
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<tr>
<td>Metodisk værktøj, -</td>
<td></td>
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<tr>
<td>Begge forslag præmieret</td>
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NORDIC INNOVATION
Innovationsansøgning på baggrund af erfaringerne fra arkitektkonkurrencen. Det designmetodiske værktøj bør komme flere til gode. Udfordringer:

- Bygninger står for størstedelen 40% af energiforbruget. Arkitektur er (også) ressourcestyring
- Helhedssynet udfordres, kompleksiteten stiger, kræver ny ekspertise
- Implementering og udvikling af ny viden i praksis kræver tid og ressourcer
- Rådgivervirksomheder er ofte små og mellemstore virksomheder, ressourcer er begrænset, økonomi og tid er presset
Idé: Nyt Nordisk Netværk for Arkitektvirksomheder: 
*Nordic Built STED – Sustainable Transformation and Environmental Design*

- Kritisk masse: Flere virksomheder kan kollektivt skabe mere viden, accelerere udvikling, og skabe byggede demonstrationsprojekter

- Maksimal udnyttelse af nordiske styrkepositioner indenfor både arkitekt og ingeniørforskning: zero-energy, zero-carbon, zero-waste

- Stærk Nordisk arkitektonisk identitet og ekspertise via mix af etablerede og ny virksomheder med stærke faglige profiler (New Nordic, Louisiana)
Idé: Nyt Nordisk Netværk for Arkitektvirksomheder:
*Nordic Built STED – Sustainable Transformation and Environmental Design*

- Fokus: Bæredygtige designløsninger for renovering og transformation

- Fokus: Forbedret brug af IT: BIM, simuleringsværktøjer og LCA redskaber i designprocessen. Ny tjenesteydelser

- Fokus: Struktureret vidensdeling gennem forsknings- og praksissamarbejde, udvikling af fælles databaser.
Close, - but no cigar! Udfordringer:

- Innovation i tjenesteydelser. EUDP havde et forholdsvist snævert teknologisk sigte mht. innovation, - ikke på IT, - ikke på services/tjenesteydelser

- Uens kriterier mellem Nordisk og de nationale niveauer (EUDP i Danmark), meget svært at navigere i

- Forskningsdimension måtte neddrosles pga krav om meget ‘markedsklare’ innovationer
Anbefalinger:

- Større og tydeligere fokus på designforskning, designinnovation og designløsninger:
  
  Godt design skaber mere værdi i flere dimensioner, sparer mere energi, og har bedre miljøprofil end suboptimerede teknologiske tiltag

- Bredere teknologisk sigte:
  
  Teknologi i designproces, Informationsteknologi til støtte for designkvalitet, teknologisk knowhow
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2014.03.26

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Konkurrence vs forsknings- og udviklingsproces:
Forskellige tempi, omsættes langsomt i praksis

Målsætning Arkitektkonkurrence Innovationspulje

NORDISK Forskning og Innovation

Demonstrationsprojekter

Designmetoder
Bæredygtigt byggeri

Ny tjenesteydelser
systemleverancer
Peter Andreas Sattrup  pans@byg.dtu.dk

Jan Schipull Kauschen  jan.schipull@kadk.dk