

Peter Andreas Sattrup

Architect MAA PhD Senior Adviser - Sustainability

**Architecture: Towards a Step-Change in Building Performance
VALUE CREATION, WELL-BEING and LIFE CYCLES**

**DANISH ASSOCIATION OF
ARCHITECTURAL FIRMS**

VALUE, WELL-BEING and LIFE CYCLES



Danish Association of Architectural Firms

Mission: To strengthen the business framework of Danish architectural firms position, quality of work and professionalism

650 member companies

5000 member employees, architects, landscape architects, building constructors, technical and administrative staff



Kindergarten, Kerteminde
CEBRA architecture
Foto: Mikkel Frost

Sustainability @ the Danish Association of Architectural Firms

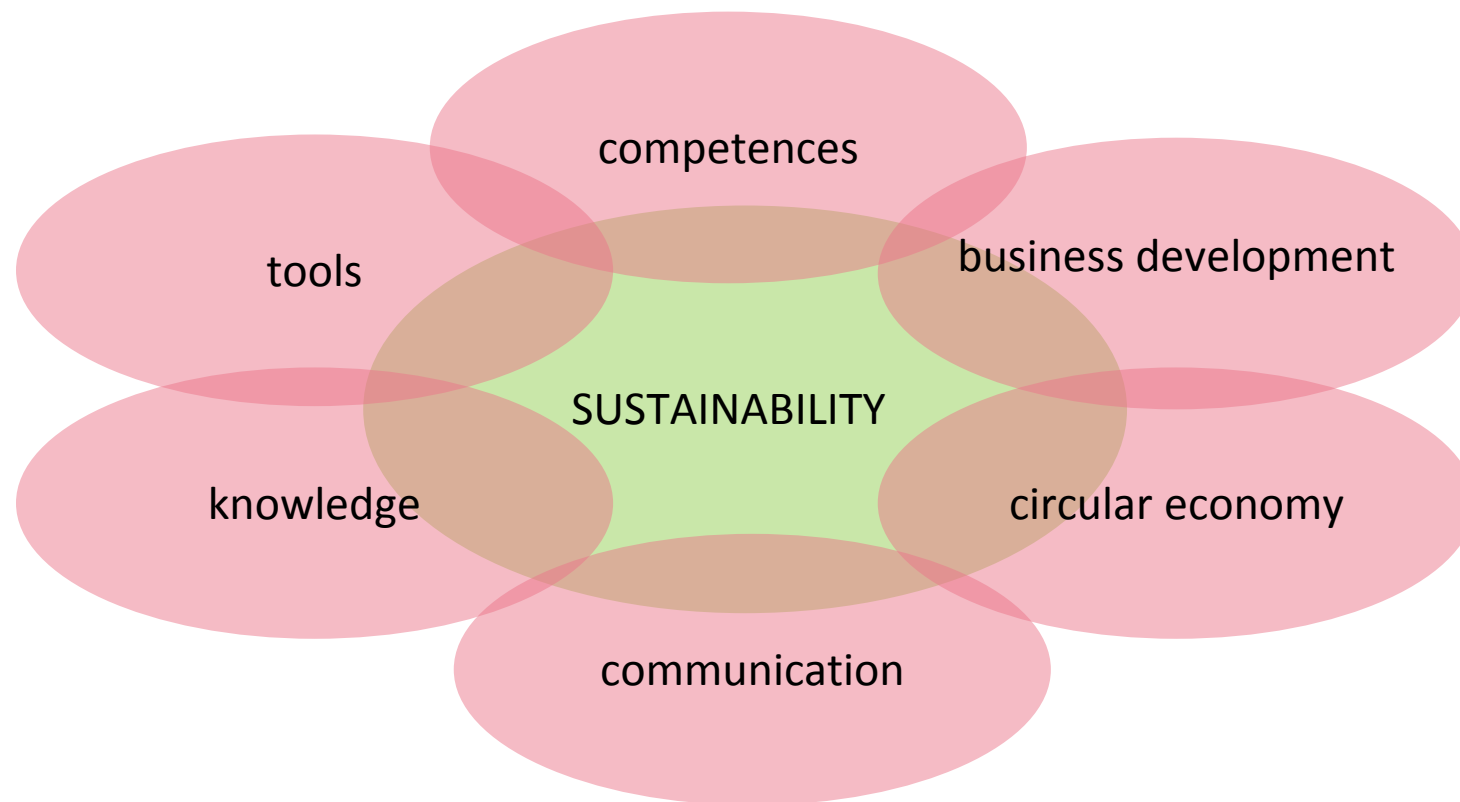
4 Focus Areas:

Business Development

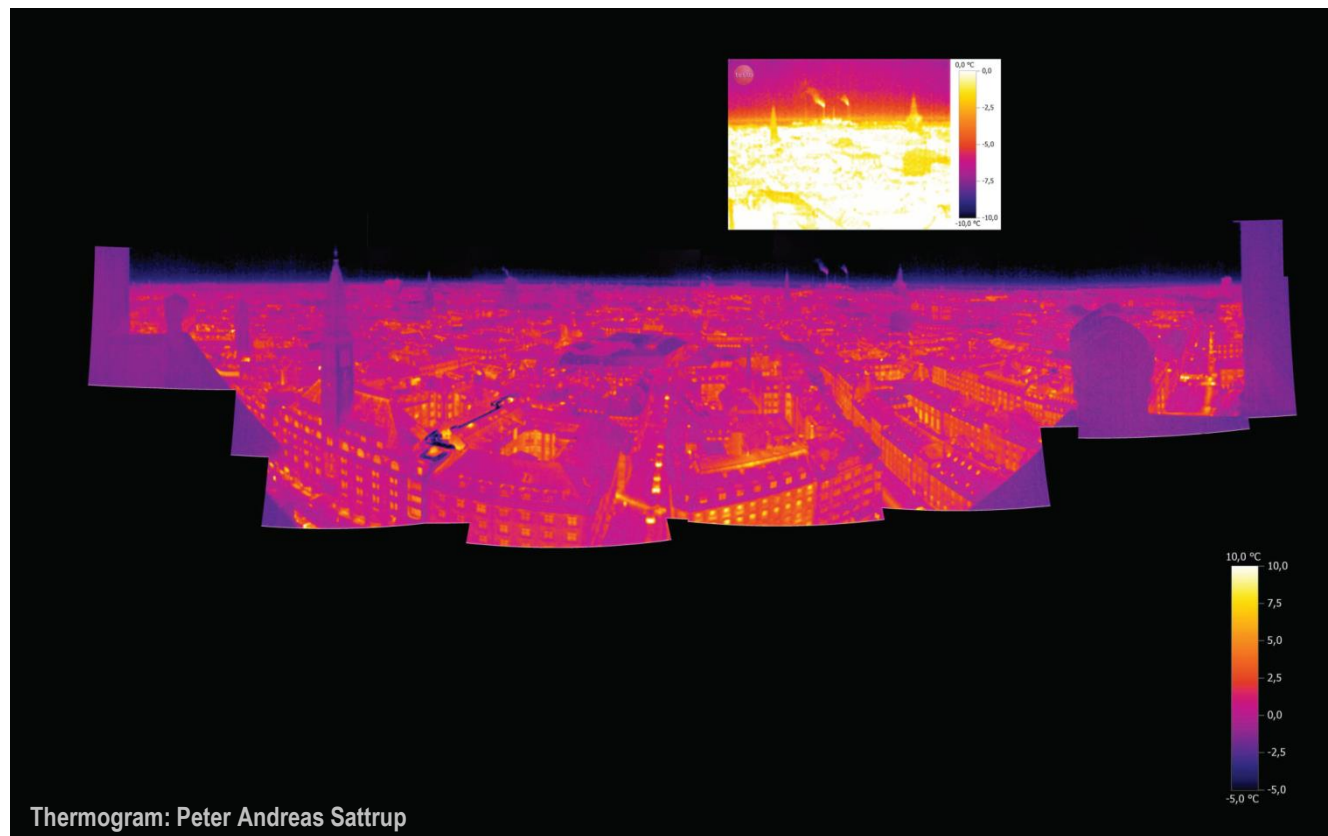
Law and Insurance

Politics

Sustainability



Fundamentals: Body – Health – Energy – Architecture – Climate



Political vision – Denmark as a pioneering nation

Regulatory			
Year	housing*	workplace**	
2010	~50	~70	
2015	~35	~50	<i>low-energy 2015</i>
2020	~20	~25	~ passivhaus
	0	0	zero energy
	> 0	> 0	active house / energy+
			Voluntary

Gradual increase of technical performance standards beyond EU norms

Pushing innovation in architectural design services and solutions

Pushing innovation in high performance components

Danish Energy classification systems: regulatory, proposed and voluntary
Simplified performance requirements.

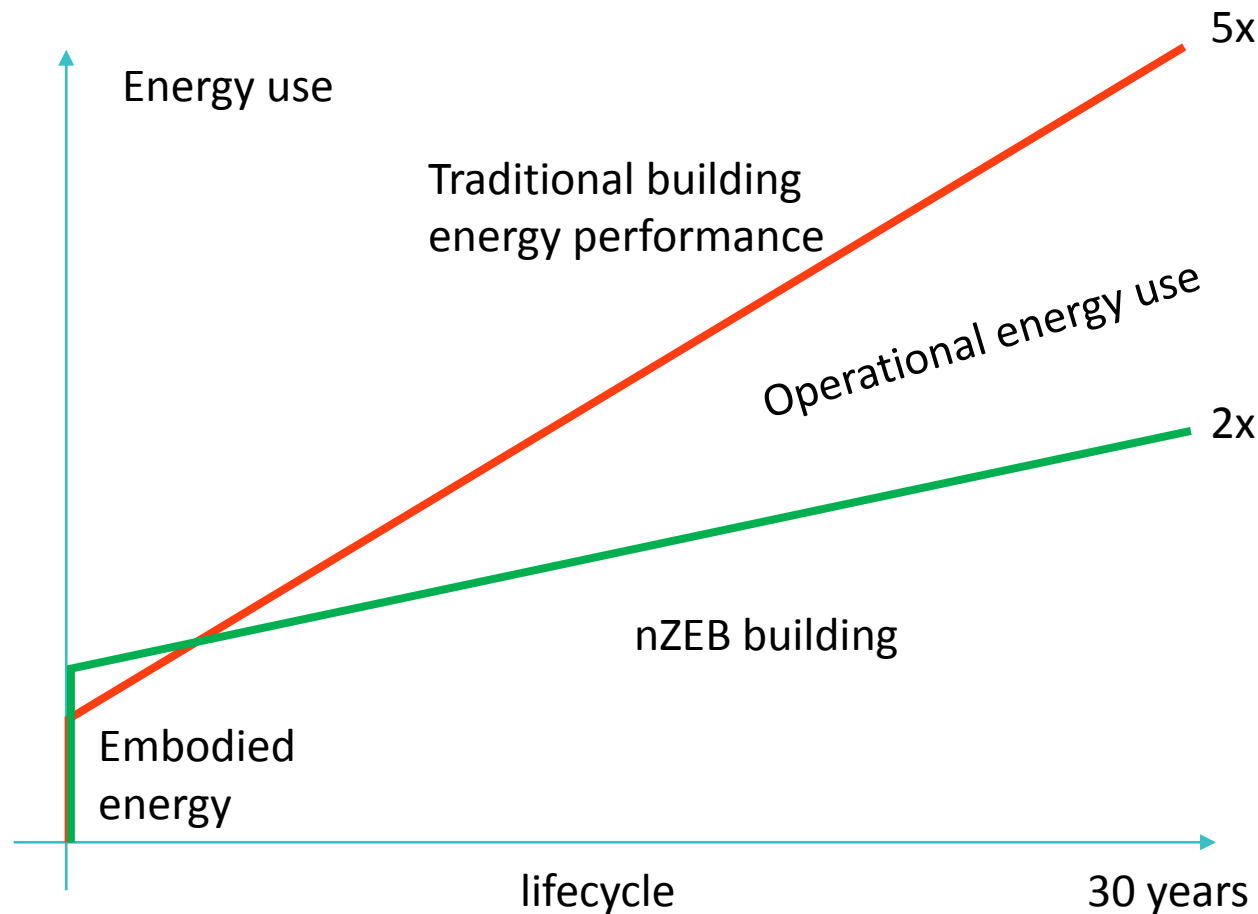
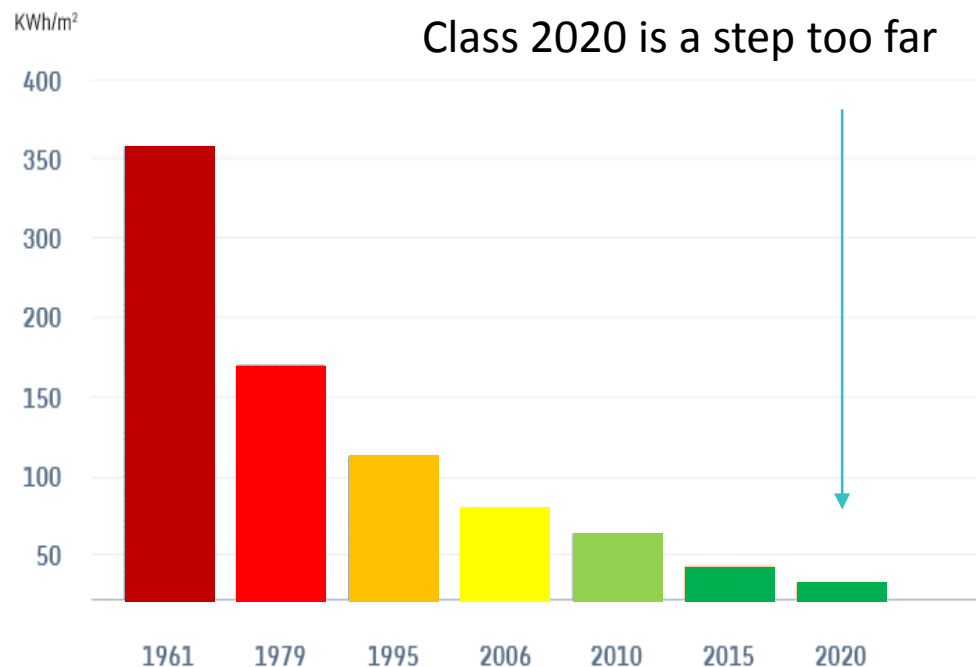
Yearly primary energy use: unit kWh/msqyear gross area

* heating, cooling, ventilation, DHW

** heating, cooling, ventilation, DHW, artificial light

Sources: (Erhvervs- og Byggestyrelsen 2010)(Dansk Byggeri 2011)

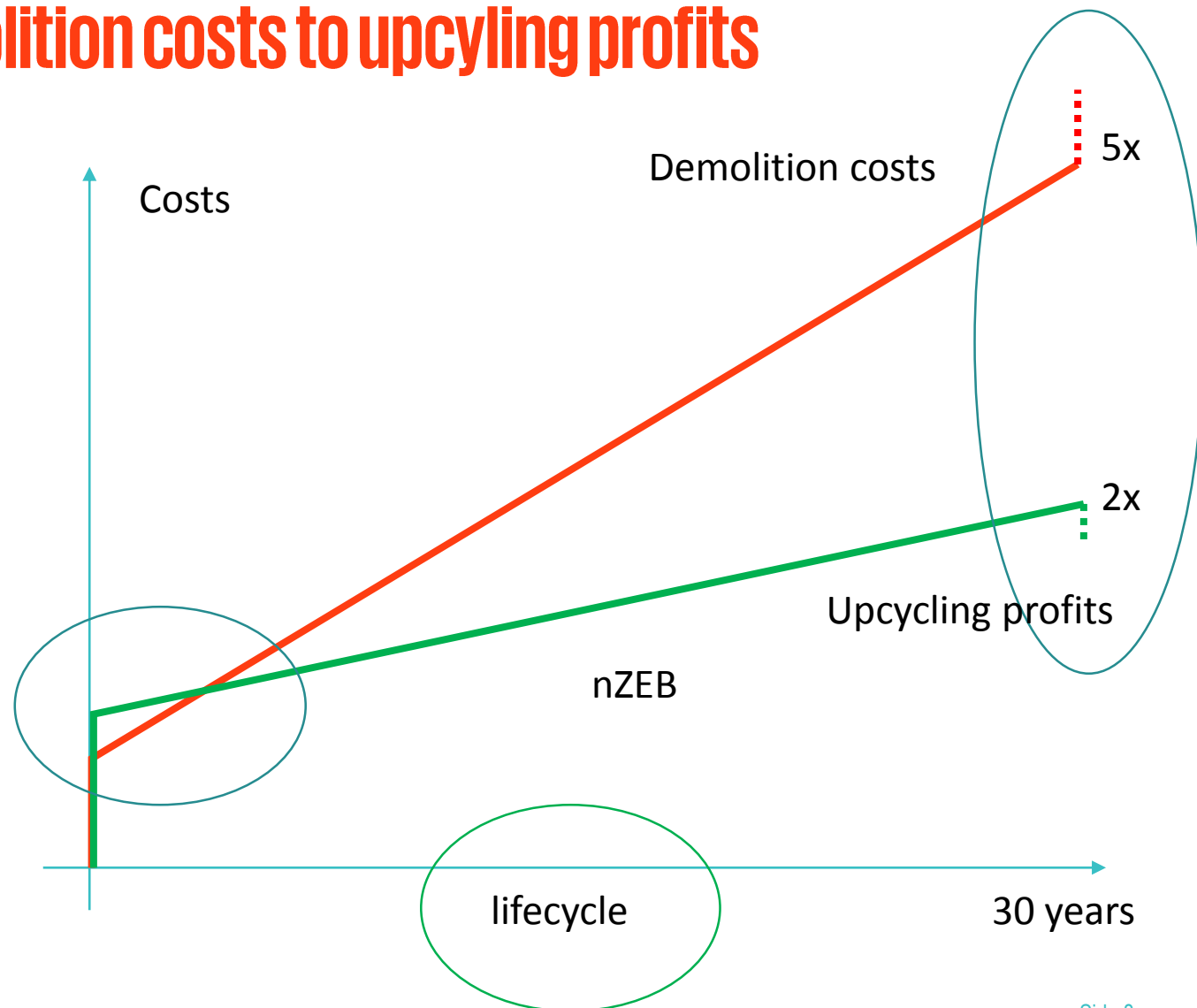
Experiences with NZEB in Denmark



Circular economy can turn demolition costs to upcycling profits

Danish experience with compulsory nZEB building classes show that it is now easier to find energy savings focussing on embodied energy and circular economy recycling strategies than by focussing on operational energy use

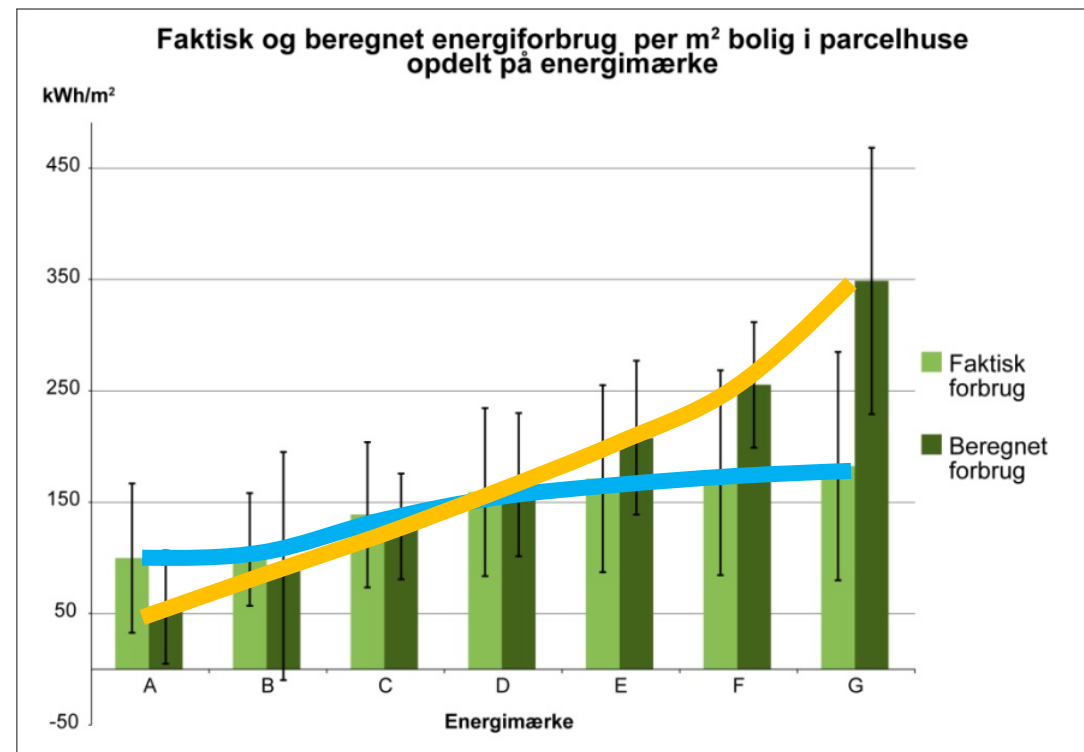
Design is key to succesful solutions



Behaviour – a major challenge

Incorporate the validation of calculated EPCs with measured operational performance data. Only validated EPCs should be used to underpin any financial instruments or performance contracting

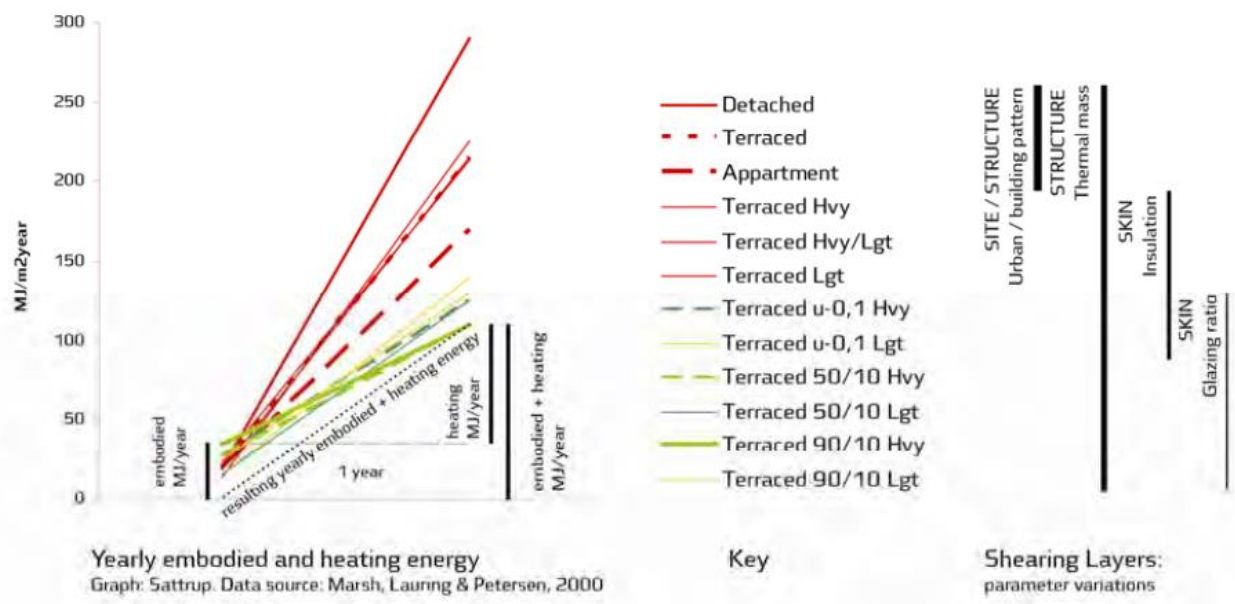
Difference between calculated and measured energy performance of Danish single family homes. (SBI 2016)



Figur 3: Sammenligning af gennemsnitligt faktisk forbrug og gennemsnitligt beregnet forbrug for hver type energimærke med spredningen indtegnet på hver søjle. I denne figur er der i modsætning til figur 1 kun medtaget de huse hvor vi både har beregnet og faktisk forbrug for hvert enkelt hus. Der indgår 135.311 huse i denne sammenstilling. (NB: denne figur indgår ikke i de tidligere udgaver af rapporten)

We need data access – to enhance performance

Open Big Data – Harmonise reporting metrics across nation states and between calculated and achieved performance and put in place disclosure requirements to ensure the rapid and continuous improvement of energy efficiency measures and technologies.

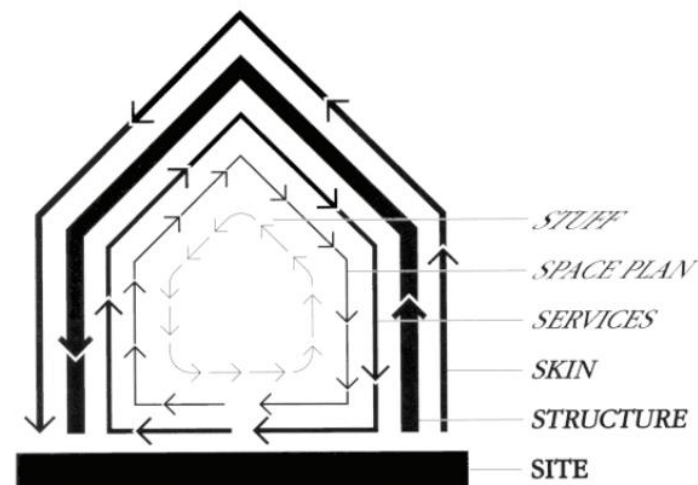


Life cycles – the next dimension

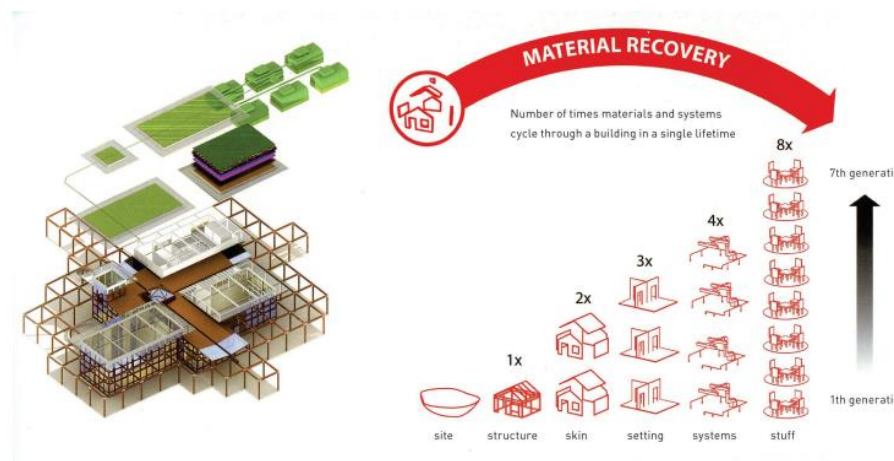
Understanding the lifecycles of buildings is key to successful retrofits and circular economy:

Some layers of buildings change more often than others: The Structure of a building changes very little while the building's Skin and Services are upgraded more often.

The patterns of change open up opportunities for performance upgrades and up-cycling of materials.

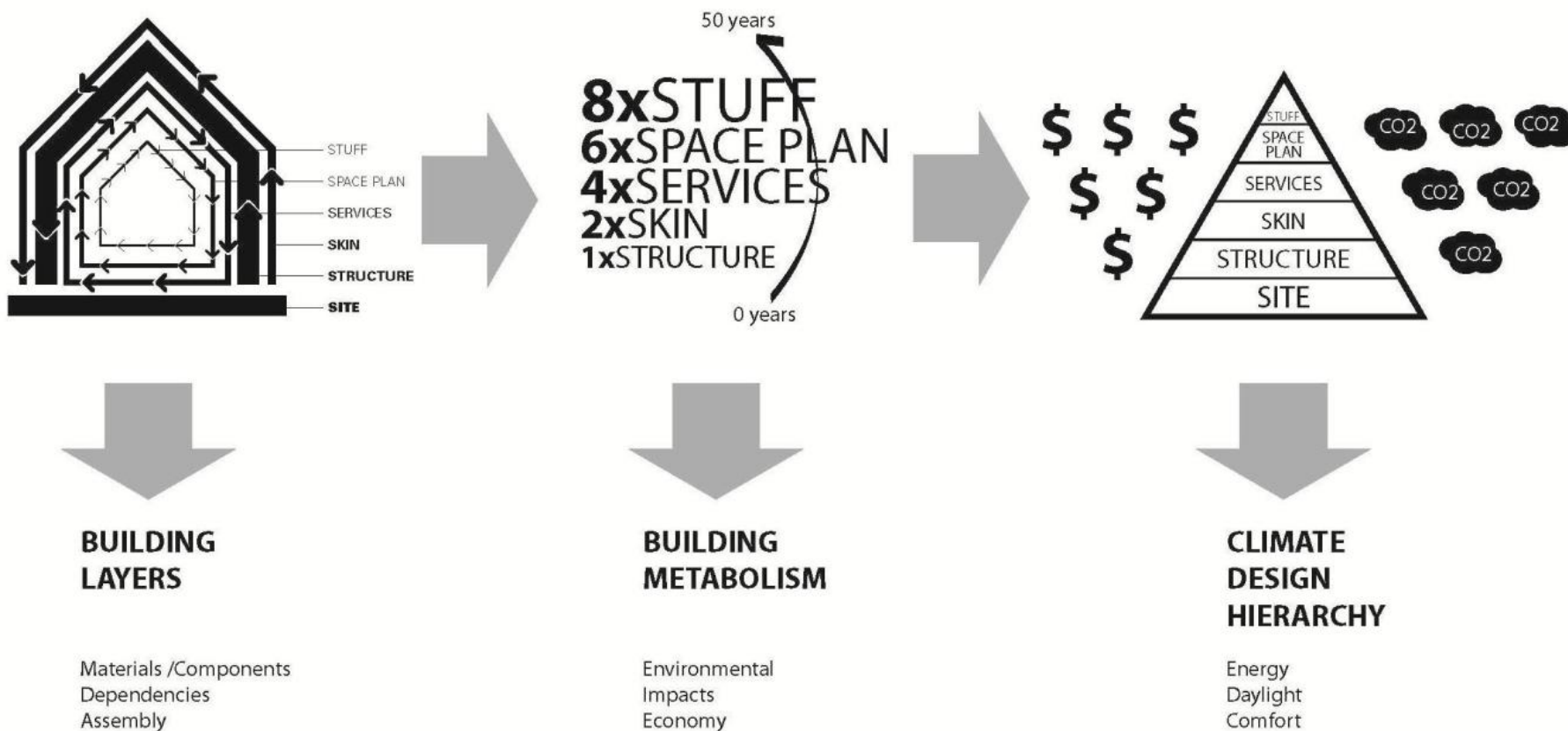


Brand 1994



McDonough 2009

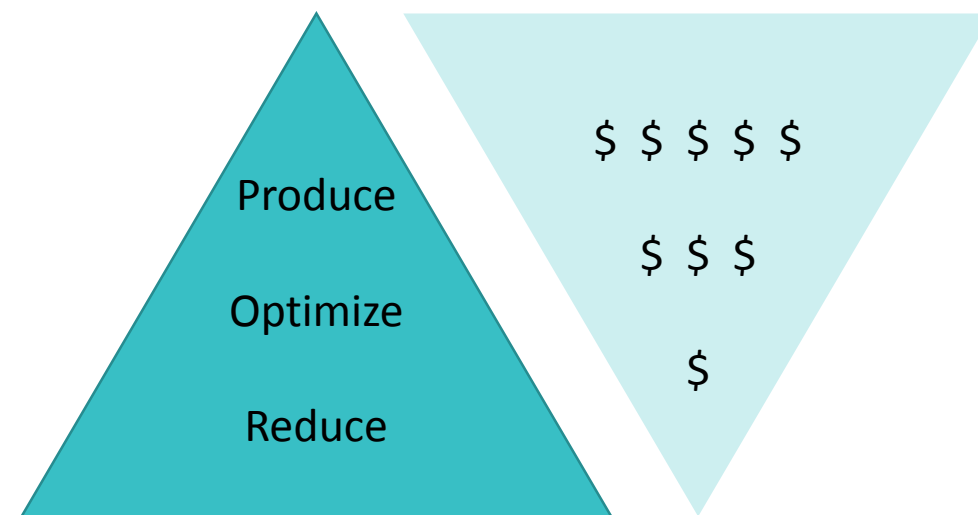
Life cycles – the next dimension



Smart buildings – require intelligent design

Recognise the need to target improvements across all four pillars of building performance: consumption of natural resources, indoor environmental quality, occupant satisfaction and value over the life-cycle of a building;

Systems
Controls
Configuration





CASE: Rambøll Hq – Mikkelsen arkitekter

Climate, resources urban life, economy

“There’s focus on sustainability and reduced energy use – but also on the daily operation and how the building stimulates collaboration across departments and disciplines”

– Lars Ostenfeld Riemann, Client

Meaning

Measurement

CASE: Esbjerg Psykiatri – Arkitema



Forced fixation reduced 69%
61% reduction in use of tranquilizers

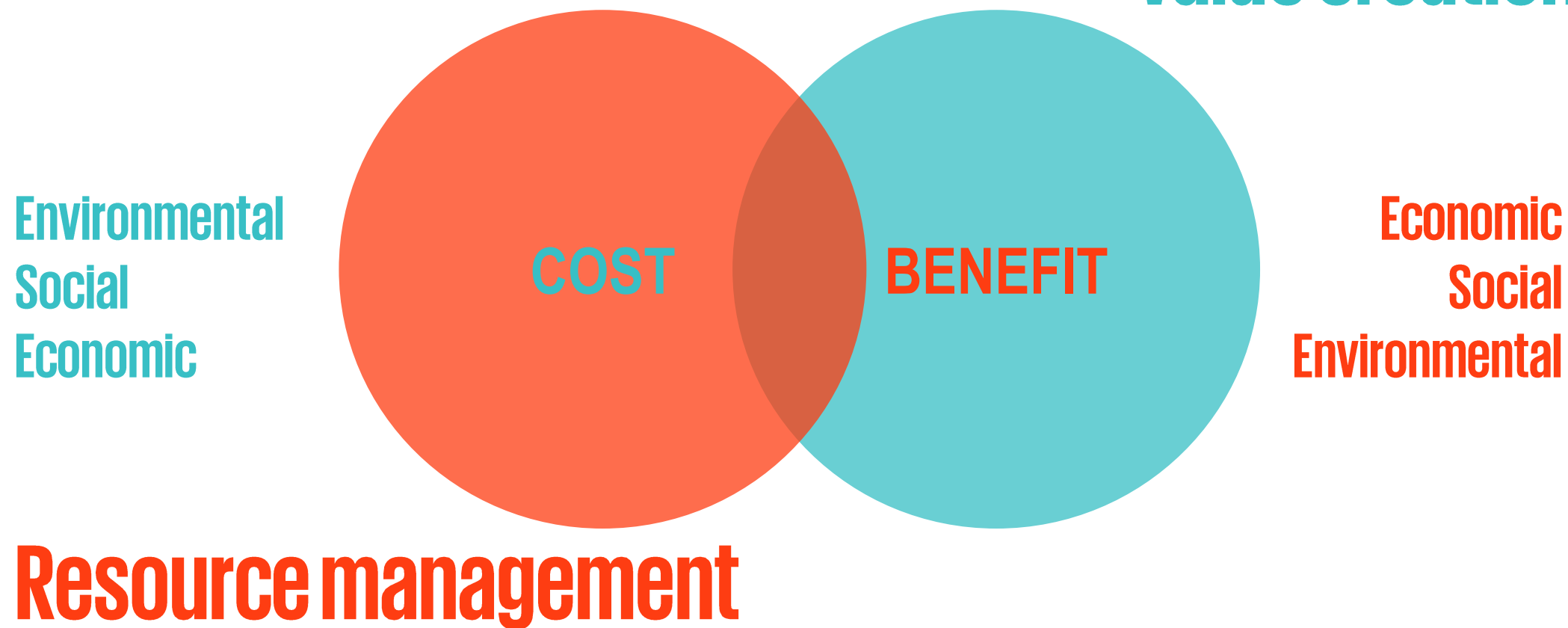
Photo by Arkitema

CASE: Aabenraa Psykiatri – White Arkitekter



Photos by Adam Mørk

Value creation



CASE: Jaegers – Vandkunsten



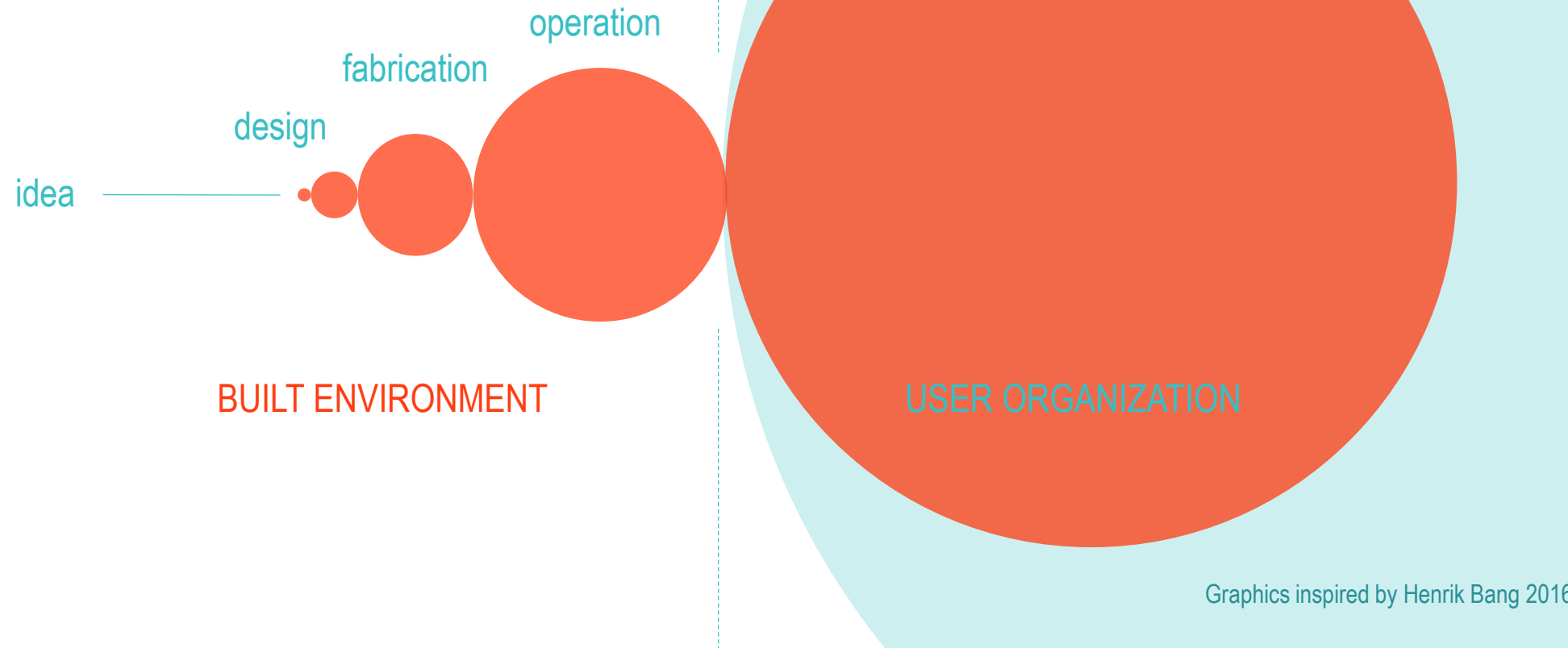
CASE: Up-cycle house – Lendager Group



CASE: Rymsgade 30 – Krydsrum arkitekter



Value



Cost

Graphics inspired by Henrik Bang 2016

CASE: VUC Haderslev – AART architects



Photo by Jens Markus Lindhe

CASE: VUC Haderslev – AART architects

Productivity & learning, urban liveability

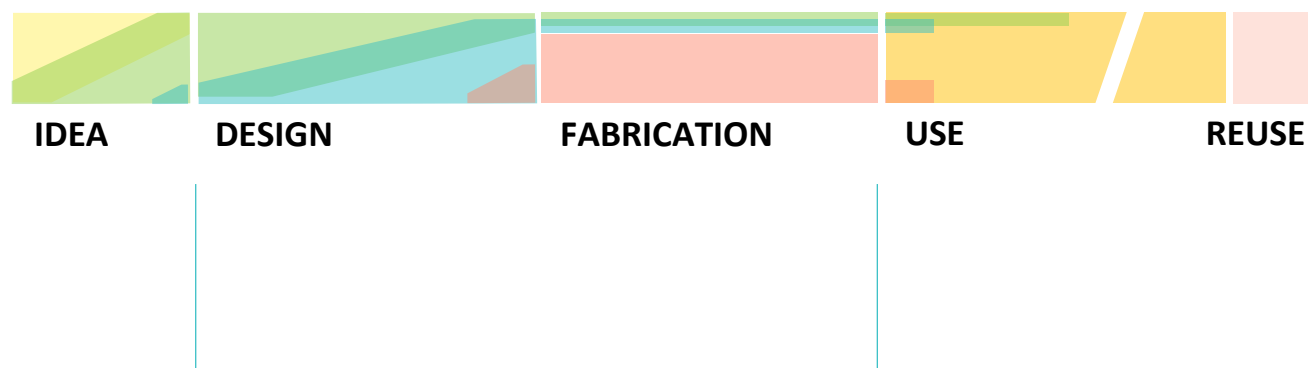
Students and teachers very satisfied with study environment

2x students continue to further education

Statistic: An unemployed person getting a job is worth DKK 200.000/yr

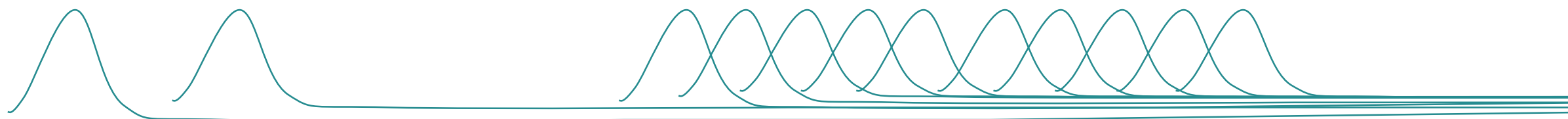
- Building paid back in 3 years?

PERSPECTIVES: TOOLS and METHODS



BEFORE DURING

AFTER



KPIs

PERFORMANCE ESTIMATES

PERFORMANCE MONITORING

PERSPECTIVES: TOOLS and METHODS

ENVIRONMENT

Indeklima Bymiljø
Bokvalitet Arbejdsmiljø
Friareal Naturindvinding

Simulations
Measurements
Life Cycle Assessment

Resource forbrug
Cirkulær økonomi
Miljøindkninger – CO2

SOCIAL

Trivsel, Sundhed
Produktivitet, Læring
Sammenhængskraft i Byliv

Dialogue processes
Co-creation
User evaluations

Kerter, Arbejdsulykker
Social ansvarlighed
Gentrifisering, ulighed

ECONOMY

Samfundsøkonomi
Investeringseffekt
Afledte økonomiske effekter

Financing
Business Models
Life Cycle Cost

Arbejdsøkonomi
Transitionenkostninger
Totaløkonomi

More cases & background information:

www.danskeark.dk

Authors: Peter Andreas Sattrup, Nanna Rose Broch, Karen Sejr, Cathrine Filia Trakossas, Mia Winther-Queen

Editor: Peter Andreas Sattrup

Advisory board: Mette Skjold, Torben Juul & Søren Nielsen.

Thanks to all the architectural firms and their collaboration partners who contributed!

Danske Arkitektvirksomheder – Danish Association of Architectural Firms 2017