

Kristina Mjörnell

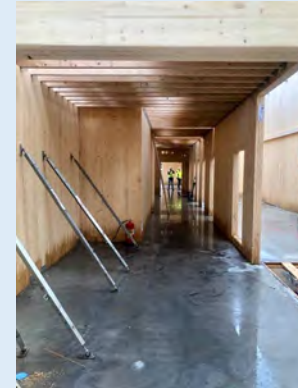
Affiliation

RISE VP Business and Innovation area Sustainable Cities and Communities

Adjunct Professor, Lund University for 11 years

Research

- Moisture safety in the building process, ByggaF
- Moisture safety in wooden buildings
- Sustainable renovation and energy efficiency
- Effective use of building space, overcrowded apartments
- Applied AI for estimating renovation and energy saving potential and for predicting hazardous materials in buildings
- Renovation of second homes
- Adaptive reuse of existing buildings to new use



Efficient use and adaptive reuse of buildings

Kristina Mjörnell, RISE and LTH



Mega challenges

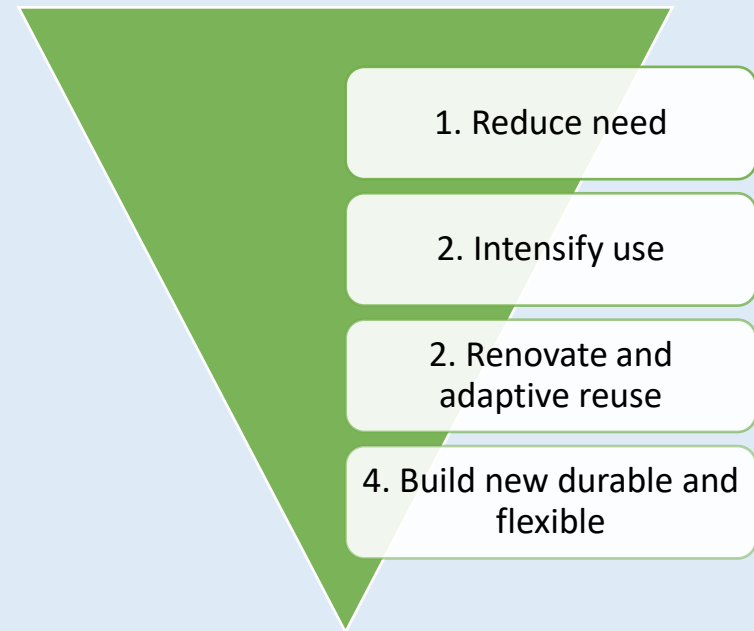


Meet goals from society



Four-step principle for buildings

1. Reduce the need for space for existing activities
2. Intensify the use of space/share
3. Renovate and rebuild to adapt to new needs, new uses
4. Build new with high flexibility, with design and materials that last a long time and can be repaired and reused



Reduce need for space



KRY Login

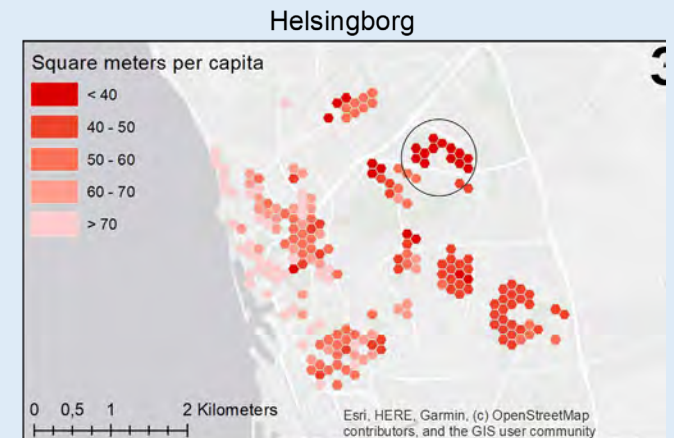
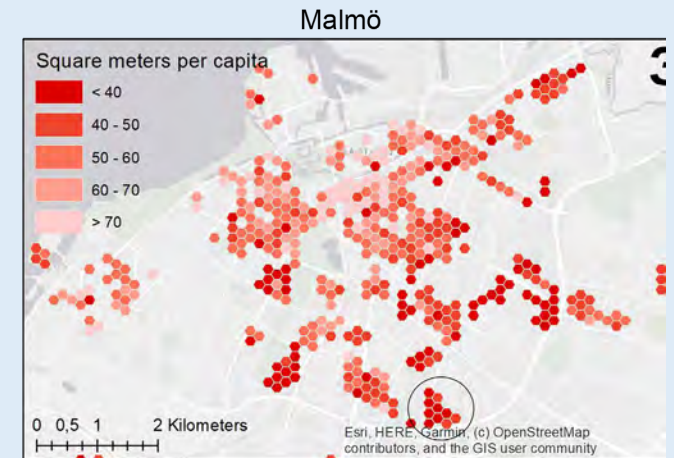
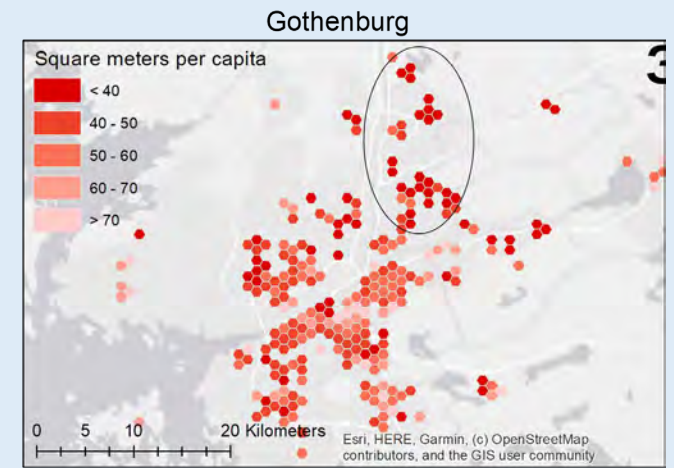
Meet a doctor online

- ✓ Receive advice, prescriptions or referrals
- ✓ Over 30,000 satisfied users
- ✓ Home delivery of medicines
- ✓ First meeting free

Download on the **App Store** or Get it on **Google Play**

A white smartphone is shown in the foreground, displaying a video call with a male doctor wearing glasses and a white lab coat.

But avoid overcrowded apartments



Abdul Hamid, A.; von Platten, J.; Mjörnell, K.; Johansson, D.; Bagge, H. Determining the Impact of High Residential Density on Indoor Environment, Energy Use, and Moisture Loads in Swedish Apartments-and Measures for Mitigation. *Sustainability* **2021**, *13*, 5446. <https://doi.org/10.3390/su13105446>

How is residential space used today?

- Buildings from the 1970-ties have high energy use and are the target for energy renovation.
- Many are located in low-income areas with large families in small apartments.
- The residential density differs a lot in cities.
- kWh/m² is not fair, use kWh/capita instead?
- We need new metrics and goals for energy and resources used for living space.

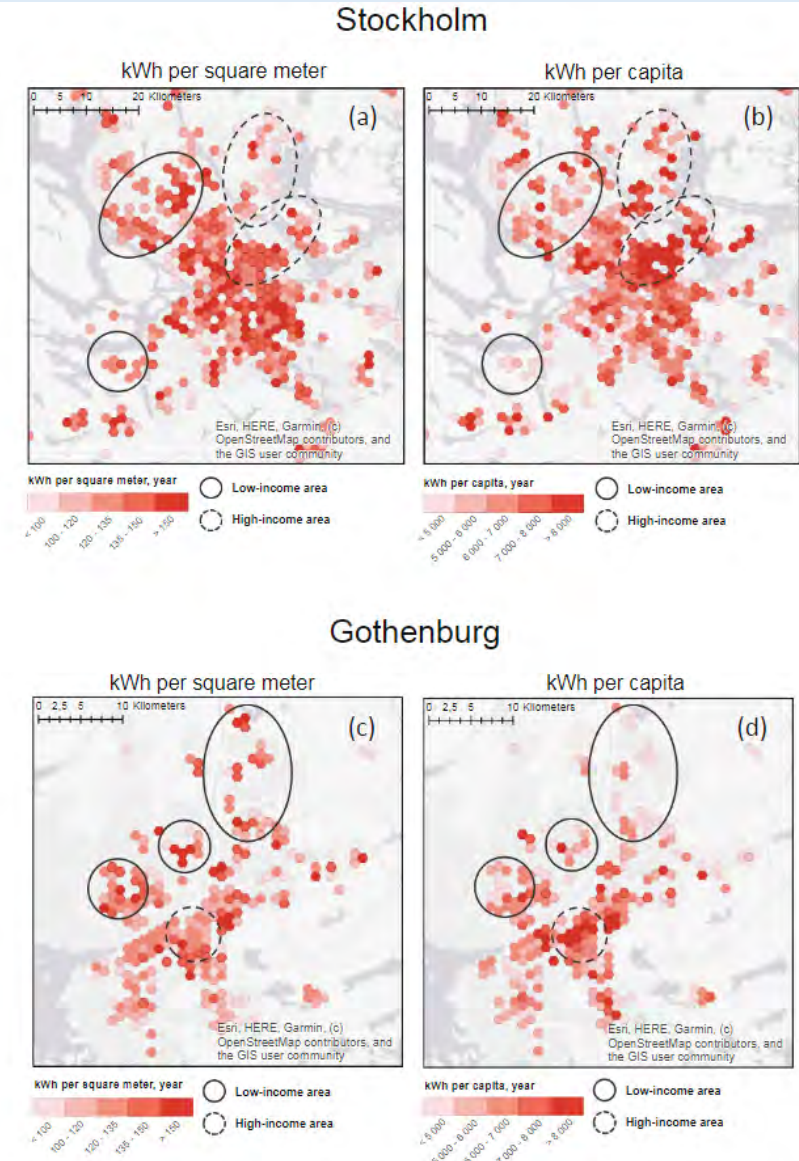


Fig. 3.3. Thematic maps showing energy use in multifamily buildings in Stockholm (a and b) and Gothenburg (c and d) in 2018, normalised to floor area (a and c) and to number of capita (b and d).

ARKUS- PROJEKT



SMÅHUS I VRETA, 3 personer SMÅHUS I VRETA, 4 personer

SMÅHUS

FLERBOSTADSHUS



HEMLINGBY, Färre boende HEMLINGBY, Fler boende

kg CO₂e/kvm BTA

329 kg
CO₂e/kvm BTA

329 kg
CO₂e/kvm BTA

266 kg
CO₂e/kvm BTA

266 kg
CO₂e/kvm BTA

ton CO₂e/person

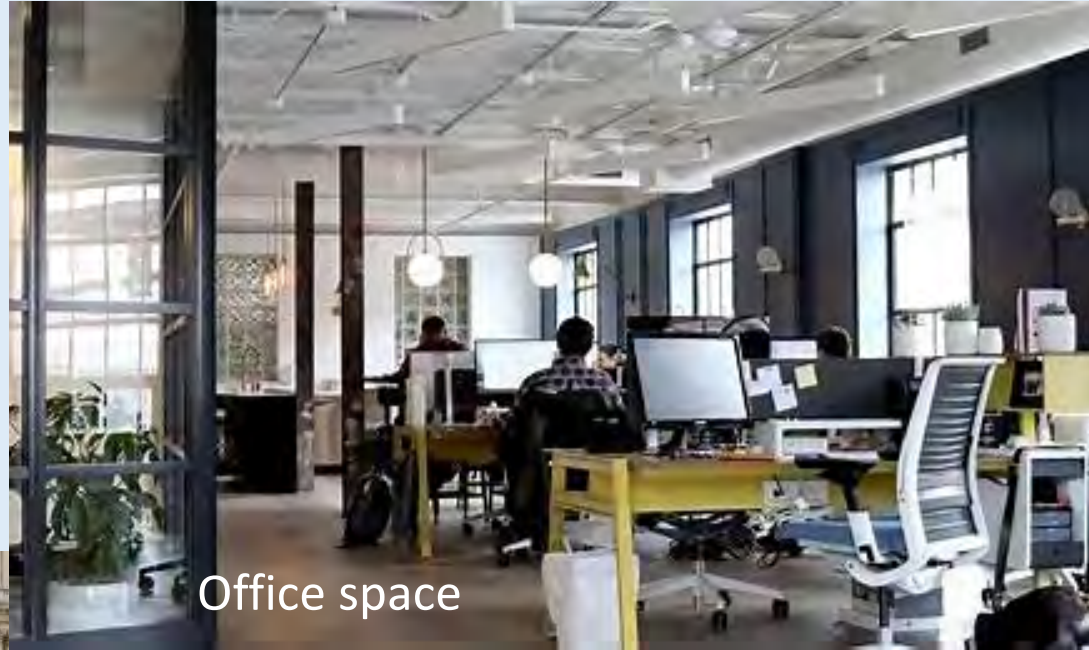
~ 16,7 ton
CO₂e/person

~ 12,5 ton
CO₂e/person

~ 15,1 ton
CO₂e/person

~ 12,9 ton
CO₂e/person

2. Intensify the use of space



Office space



Educational/lecture rooms



Outdoor space/street

Reduced office space with digital solutions

Krook&Tjäder, Göteborg



K
&
T



Sharing street space

Street Moves i Göteborg

K
& T

2. Intensify the use of living space

Rent out part of the house

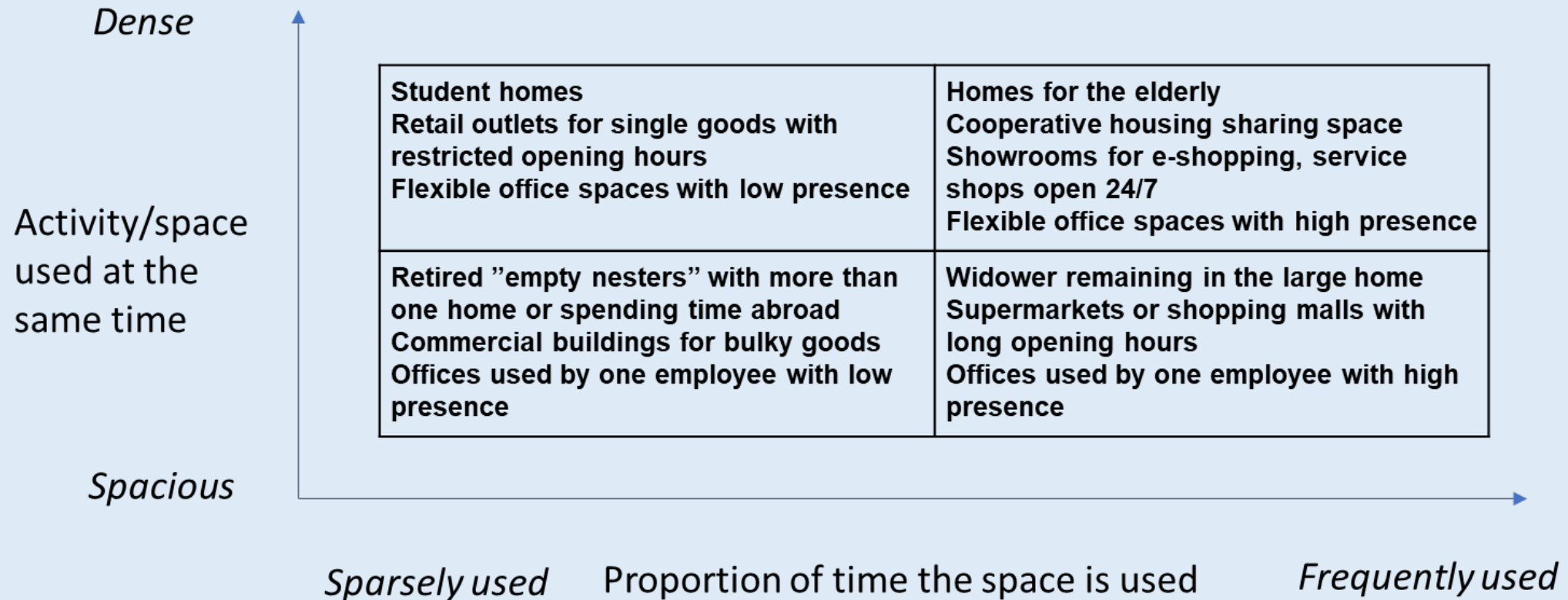


Generational living

Cohousing



Two ways to intensify the use of space



3. Renovation and adaptive reuse of buildings



Many buildings are in urgent need of renovation



Deep renovation with rational renovation process using prefabricated elements





Result: Low energy use, good indoor environment, accessible...
but expensive for building owners and tenants...

Mini, midi, maxi eller "0"



Careful renovation



Renovation with reuse

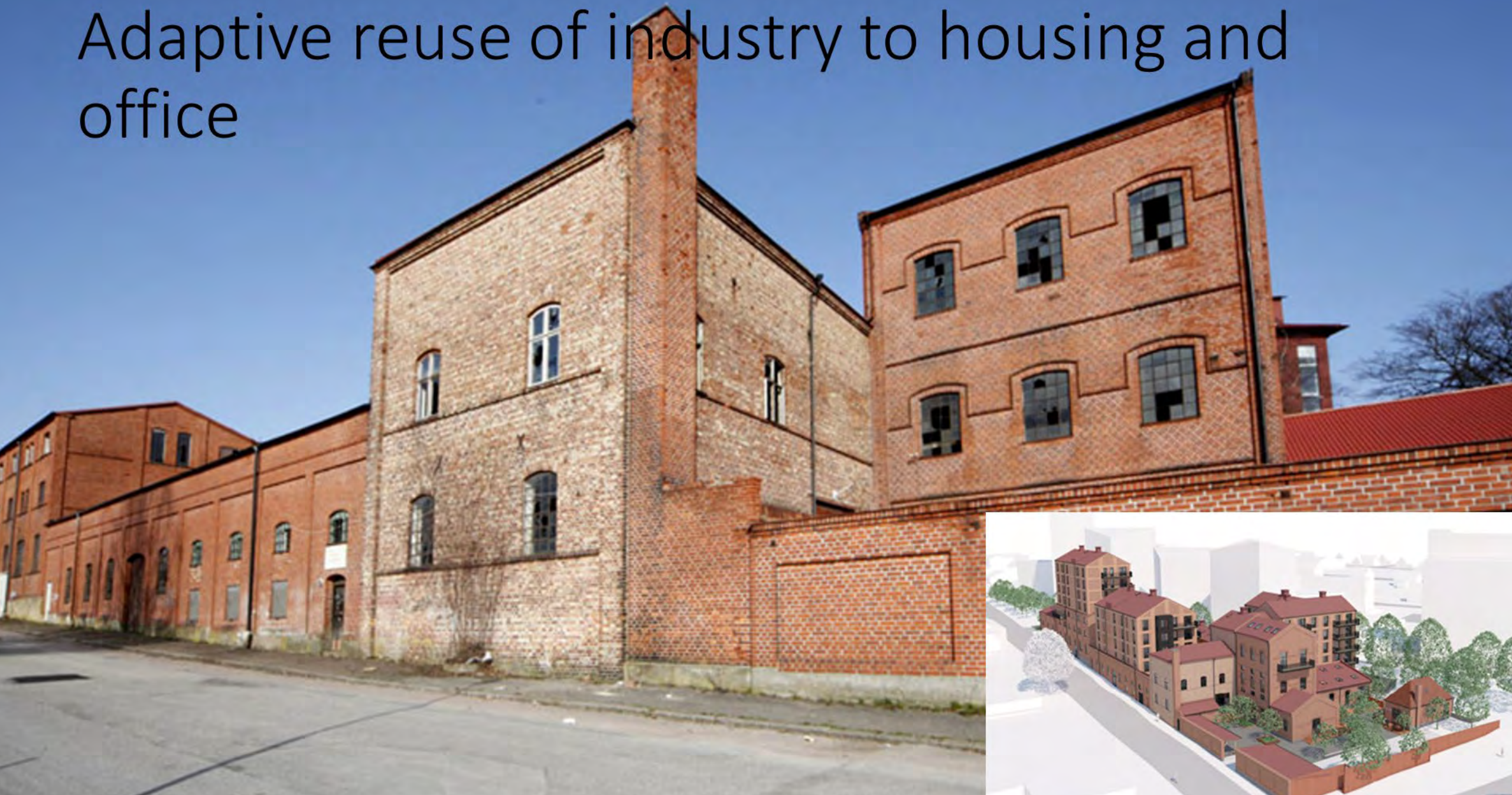
Kustgatan, Göteborg



Renovation with reused material



Adaptive reuse of industry to housing and office



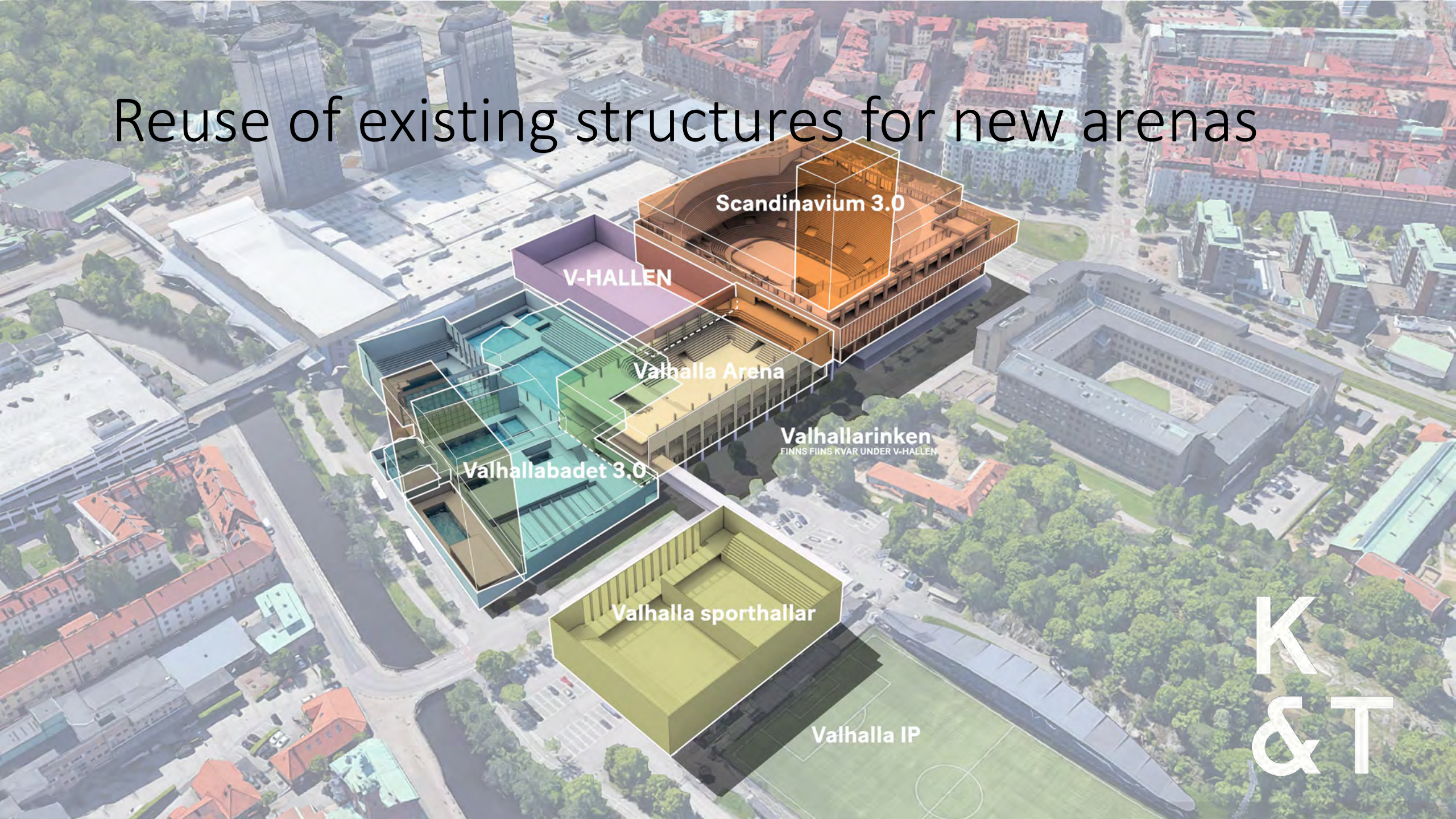
Adaptive reuse of warehouse to office

Corem, Göteborg



K
&T

Reuse of existing structures for new arenas



Scandinavium 3.0

V-HALLEN

Valhalla Arena

Valhallabadet 3.0

Valhallarinken
FINNS FIINS KVAR UNDER V-HALLEN

Valhalla sporthallar

Valhalla IP

K
&T

A lot of empty office space in cities today that might be converted to housing...



A survey of 1000 empty offices in 2 cities

City	Close to services, public transport, recreation and possible as housing with small measures		Close to service, public transport, recreation and possible as housing after reconstruction		Total space of 500 empty premises in each city
	No of premises	Space (sqm)	No of premises	Space (sqm)	Space (sqm)
Gothenburg	39	6 334	94	33 796	276 479
Stockholm	22	2 049	104	24 984	319 241



Kontorslokaler i Segeltorp – Valvia Fastigheter



Kontorslokaler i Segeltorp – Valvia Fastigheter



Ekstrands nya kontorslokaler - EKSTRANDS



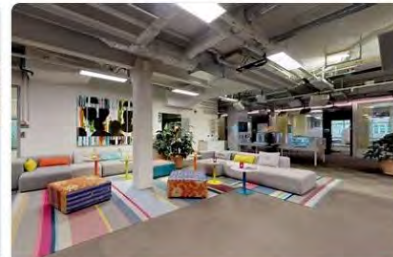
Ekstrands nya kontorslokaler - EKSTRANDS



Kontorslokaler helt i återbruk – kom inte och ...



Intro Inred skapar RSM:s nya kontorslokaler - Intro Inred | Interiör ...



Kontorslokaler i Stockholm city - Vasakronan



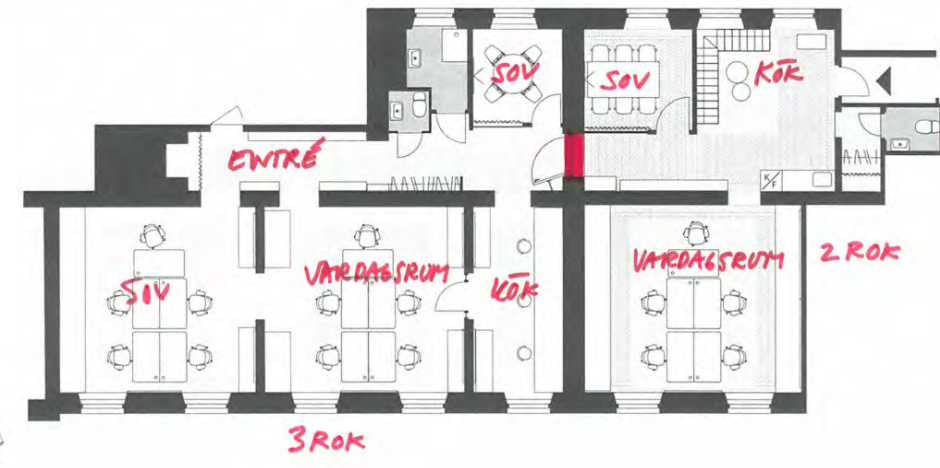
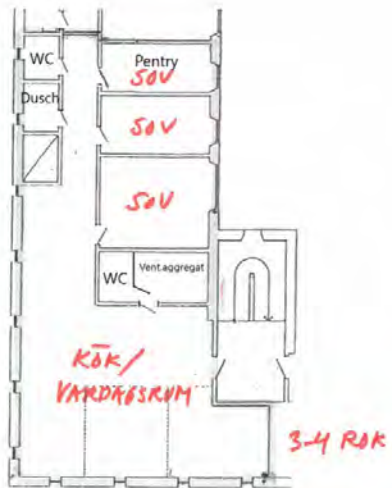
Ommålning Kontorslokaler SACO. Johanneshov | An...



Kontorslokaler i Stockholm city - Vasakronan

[Feedback](#)

Possible conversions



Barriers for conversion

Political

- Conflicts between political goals

Economical

- Lower rent for housing, cost for conversion

Social

- Disturbing existing tenants, accessibility issues

Technical

- Regulations for light, noise, fire, energy use...

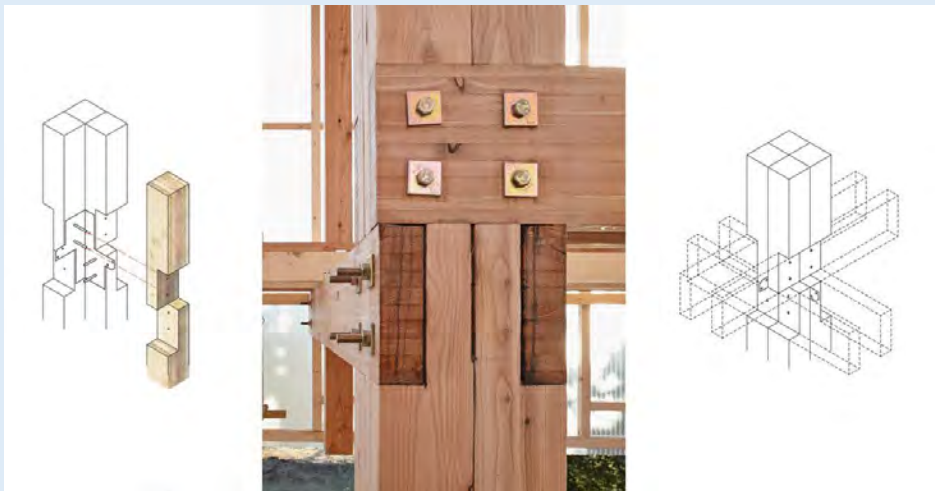
Environmental

- Quality issues, lack of life cycle perspective

Legal

- Regulations in city zoning plans, CE-labelling

4. New construction, flexible, durable, reuse...



TÄVLING OBOS

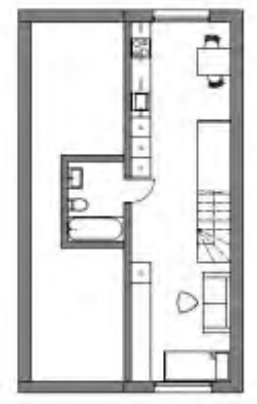
K &T

KROOK & TJÄDER

*Flexibelt
cityradhus*



För att skapa bostadshus som kan vara flexibla över tid föreslås ett tredje våningsplan som både kan integreras med de två nedre eller hyras ut separat.



A new wall made of old windows

GLA

The use of glass in architecture is a long and varied history. From the simple windows of the past to the complex glass facades of the modern world, glass has played a significant role in the evolution of building design. This section explores the various ways in which glass has been used in architecture, from its early applications to its most recent and innovative uses.

The use of glass in architecture is a long and varied history. From the simple windows of the past to the complex glass facades of the modern world, glass has played a significant role in the evolution of building design. This section explores the various ways in which glass has been used in architecture, from its early applications to its most recent and innovative uses.

THE HISTORY OF GLASS



The history of glass is a long and varied one, spanning thousands of years. From the simple windows of the past to the complex glass facades of the modern world, glass has played a significant role in the evolution of building design. This section explores the various ways in which glass has been used in architecture, from its early applications to its most recent and innovative uses.

RI
SE

What is the status and quality of reused materials/products?

Area of use and function



Quality assessment



Experts opinion or suggested testing method based on standards

Functions →

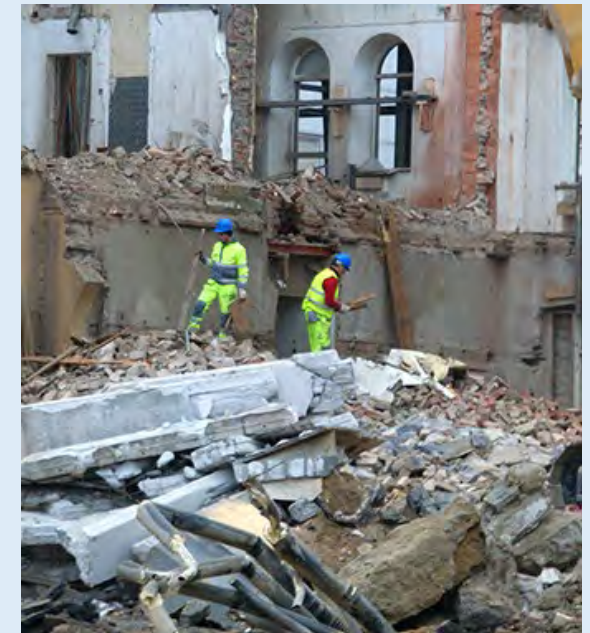
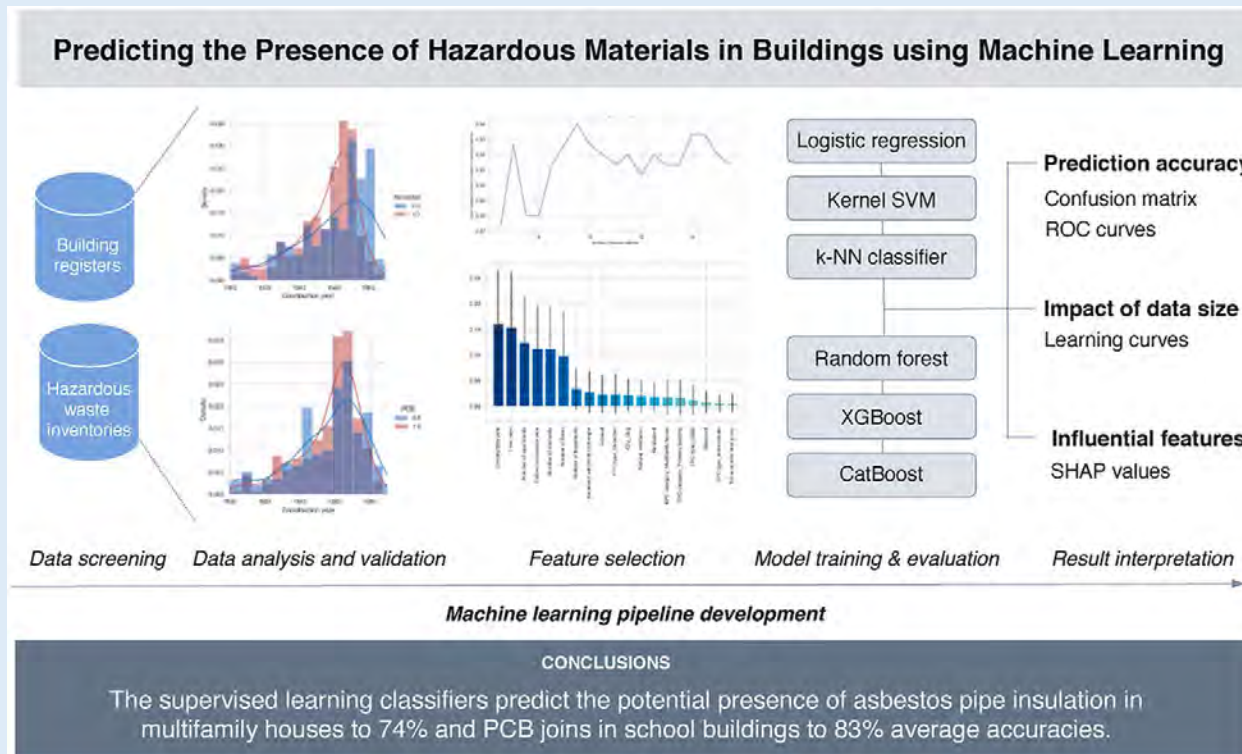
Moisture Thermal Acoustic Dimension and density Strength Fire Aesthetic



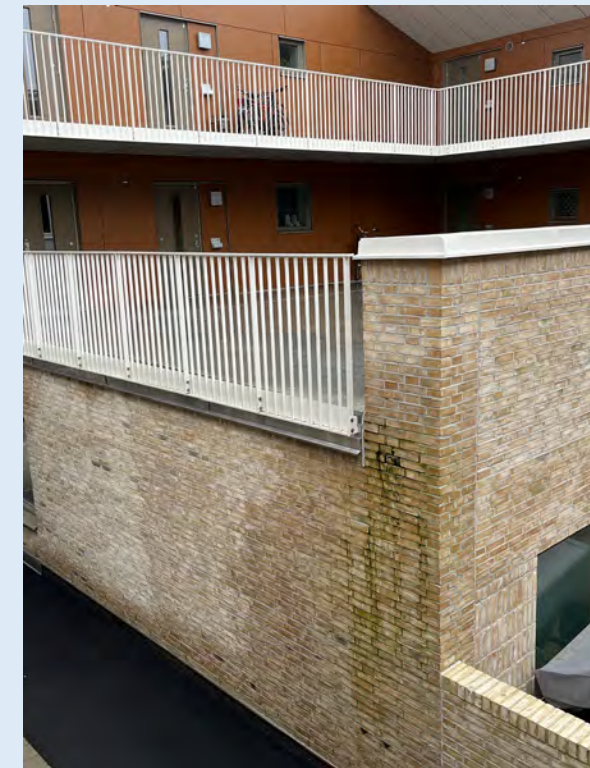
Material/byggprodukt	Fukt	Termiska egenskaper	Akustik	Dimension och densitet	Hållfasthet	Brandsäkerhet
Trä konstruktionsvirke (reglar)	-	-	-	mått vid 17% fuktkvot	Hållfasthetsklassen C14	-
Isoleringsmaterial (glasull & stenull)	vattenabsorbtion, ångnomgångsmotstånd	Lamдавärke	-	mått	-	Euroclasses A1&A2
takpannor (tegel/betong)	vattentäthet, frostbeständighet	-	-	mått	böjhållfasthet	A1
mursten tegel	vattenabsorption, frostbeständighet (porvolymförhållande)	-	-	mått/torrdensitet	tryckhållfasthet	A1
Innerdörrar	-	-	ljudreduktion	mått	-	inget eller EI30-EI60
Undertakskivor	Ja, kopplat till hållfasthet	lambdavärke	ljudabsorption	mått	Draghållfasthet	A1/brandtest

Circularity – detect hazardous substances

- Hazardous substances are typically observed during renovation and can increase the cost and time for renovation and decontamination. So, knowing if these substances exist beforehand is an advantage when deciding on appropriate measures.



Design and adapt buildings to be resilient to climate change



Conclusions

- The four-step principle could be used as a mean to reach the goals of decreased carbon footprint, increased robustness to climate change, reduce segregation and provide affordable housing and attractive living environments.
- There is a huge potential for efficient use of space, sharing of space, renovation and adaptive reuse of empty premises to other use even though there are several challenges, both technical, financial and legal to be solved to implement this on a large scale.

What is the way forward?

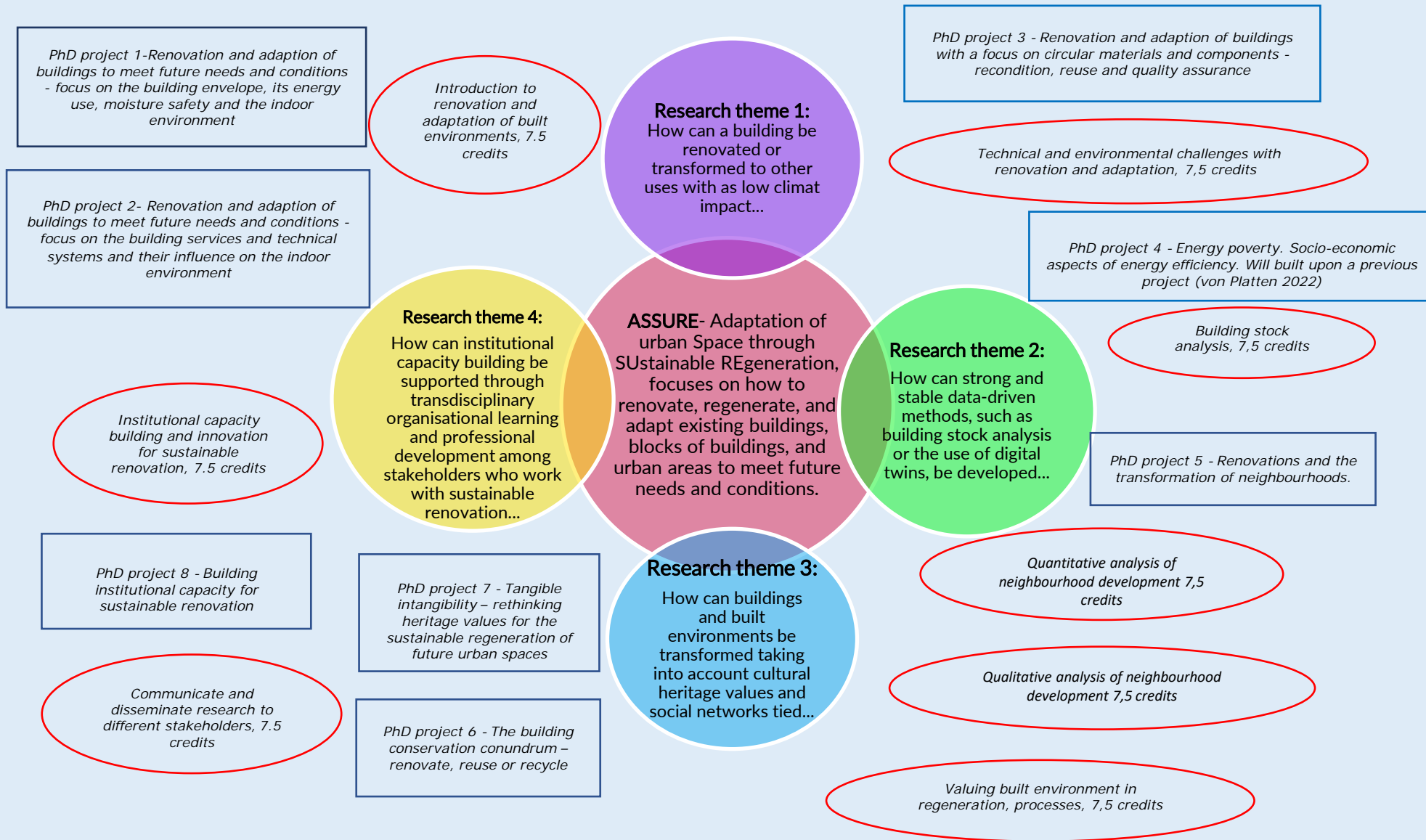
- Data is collected, compiled, available and used for design, operation, predictions
- Energy use (reduced, flexible, efficient use and shared space)
- We use less space/activity, but still ensure a good indoor environment
- Existing buildings and neighbourhoods are adapted to new needs och conditions
- Circularity – detection of hazardous substances, plastics, flame retardants, moisture damages,..., quality assurance of reused material (moisture, mould, U-values, bearing capacity, fire resistance...)
- Cultural heritage – protected, preserved, adapted... to assure values
- Buildings are designed and adapted to become more resilient to climate change
- No/very few (moisture)damages (new designs and materials, sensors, AI, control)


ASSURE- Adaptation of urban Space through SUsustainable REgeneration

National PhD research school 2023-2027



Lunds universitet/LTH – Malmö universitet – Uppsala universitet/Campus Gotland - RISE



A multi-story brick building with a light-colored brick facade and dark brown accents. The building features several arched windows with dark red frames. Three balconies with ornate black wrought-iron railings are visible, extending from the second, third, and fourth floors. The balconies have concrete bases. The building is set against a clear blue sky.

Thanks!
Questions?