ETH zürich

La performance des biosourcés à croissance rapide

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Chaire de construction soutenable

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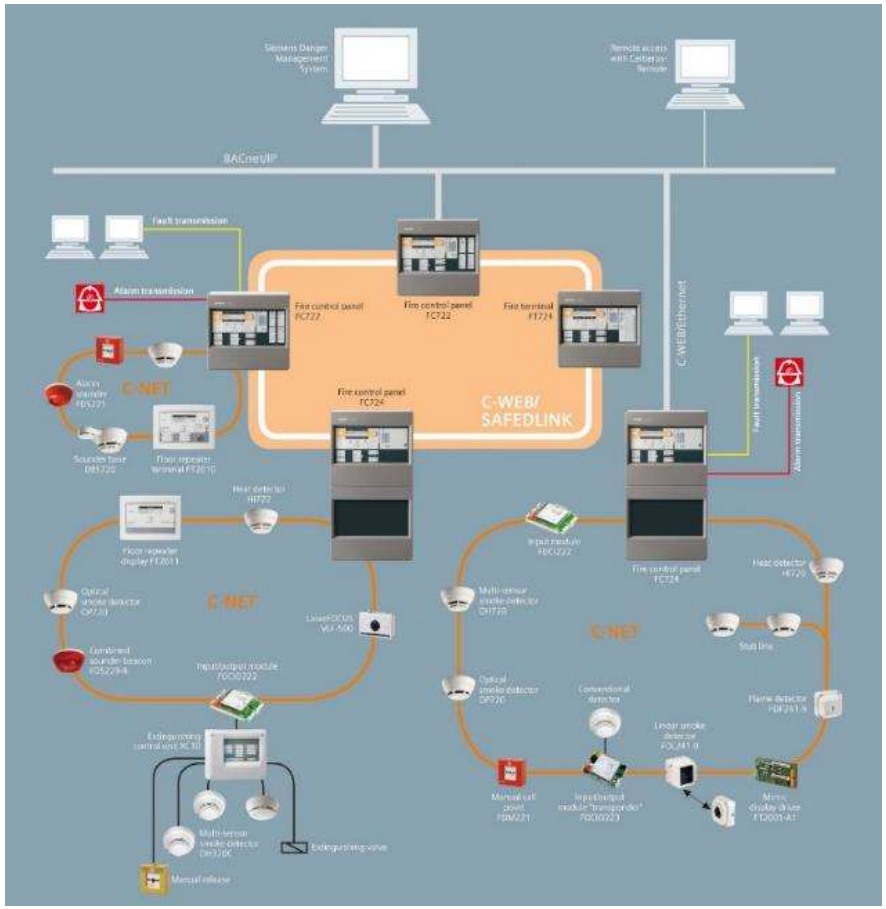
Insulation, double glazing…

Monte Rosa Hütte, Zermat, Switzerland

Fully autonomous mountain hut

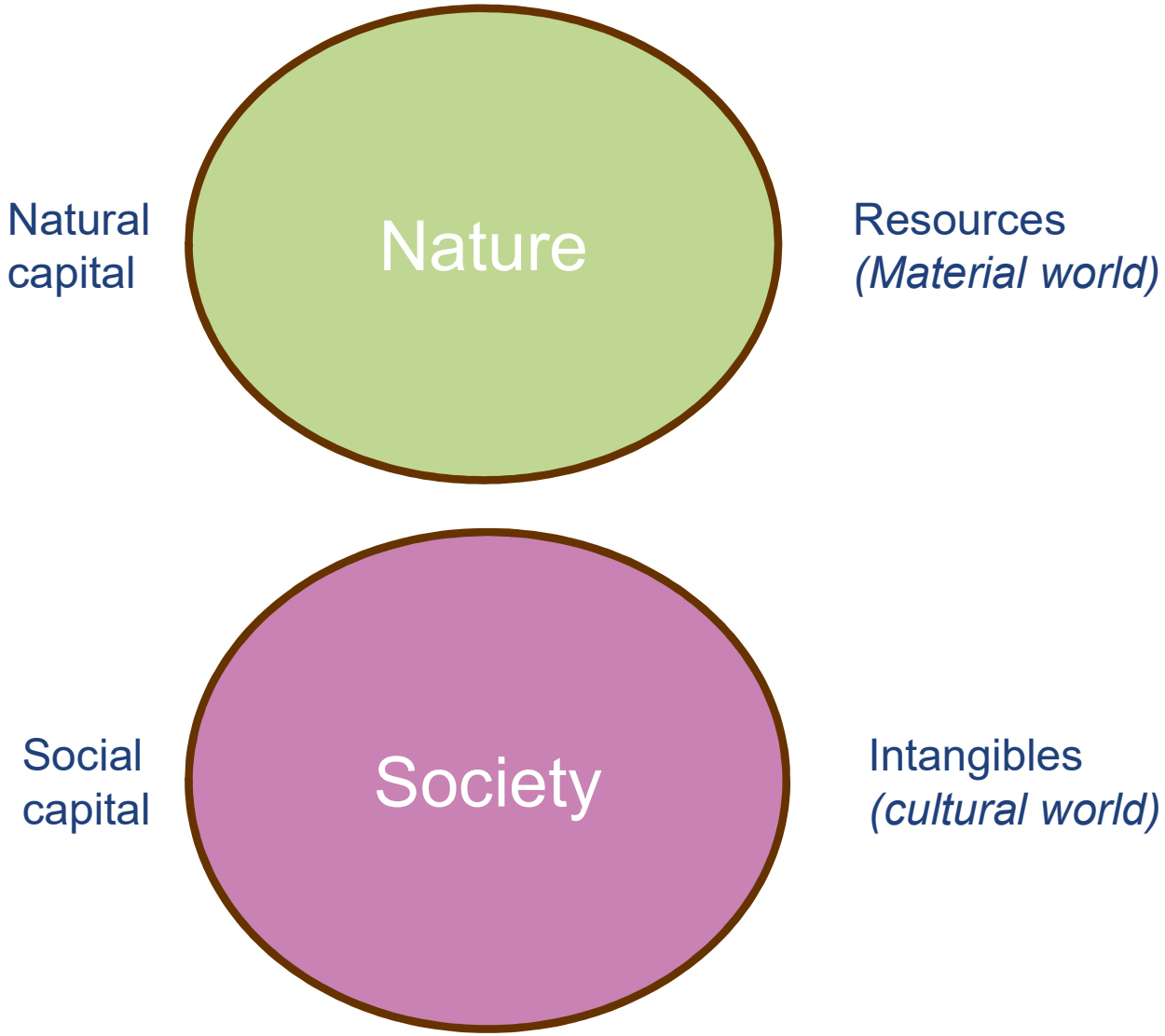
Monte Rosa Hütte, Zermat, Switzerland



Extreme complexity of building systems

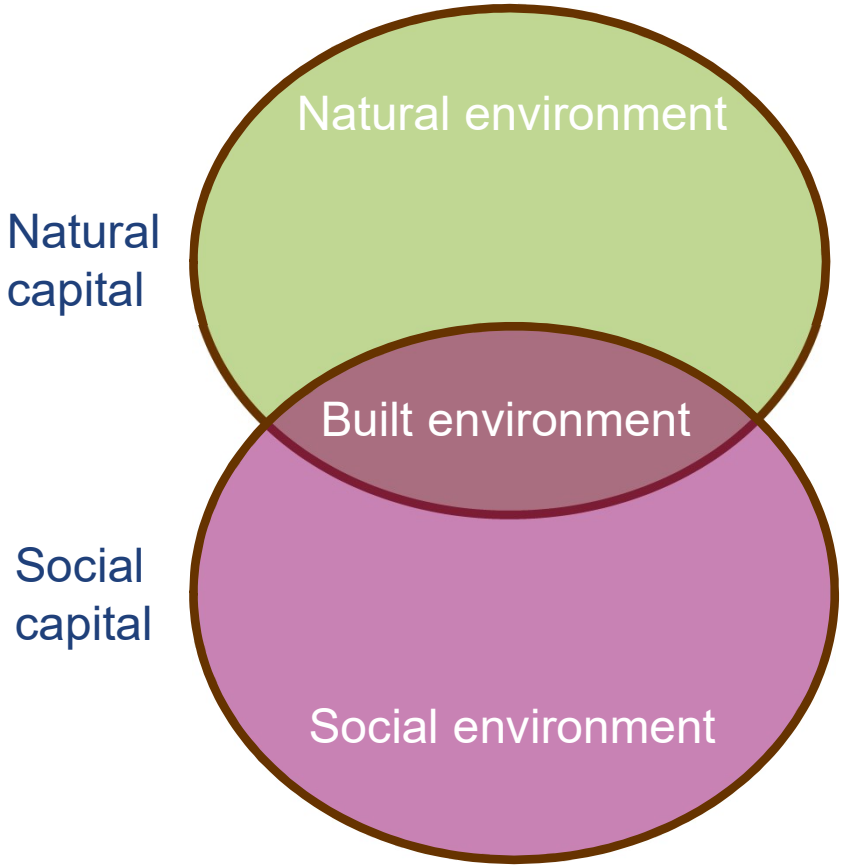
Change narratives

The built environment



Sce: S. Moffatt & N. Kohler. 2008 Conceptualizing the built environment as a social–ecological system, *Building Research & Information.*

The built environment as an interface



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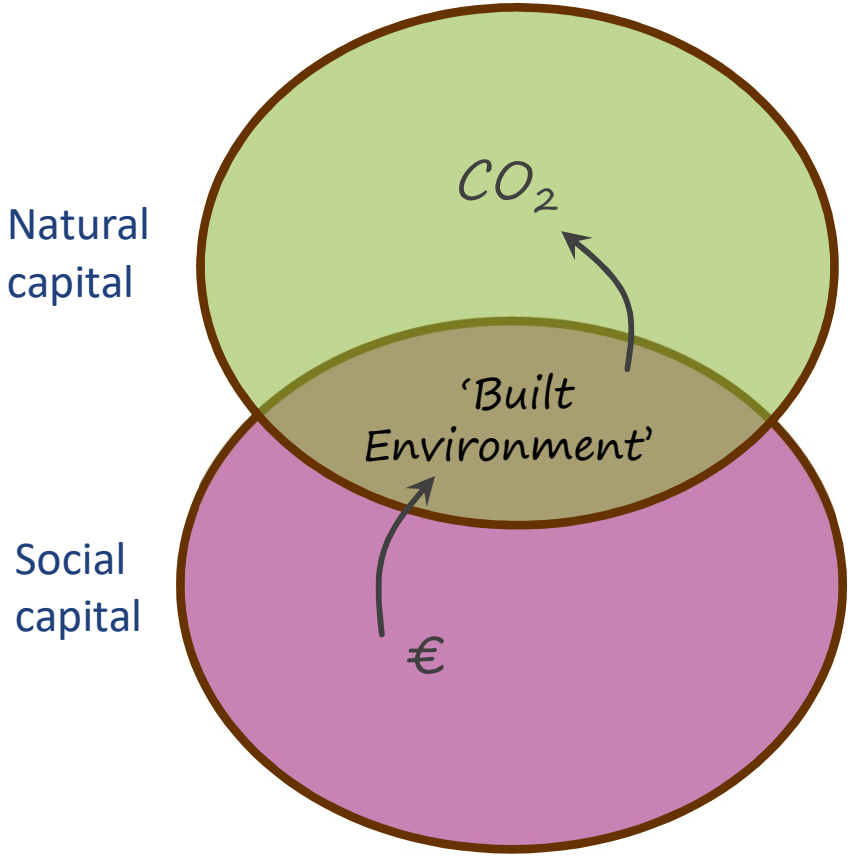
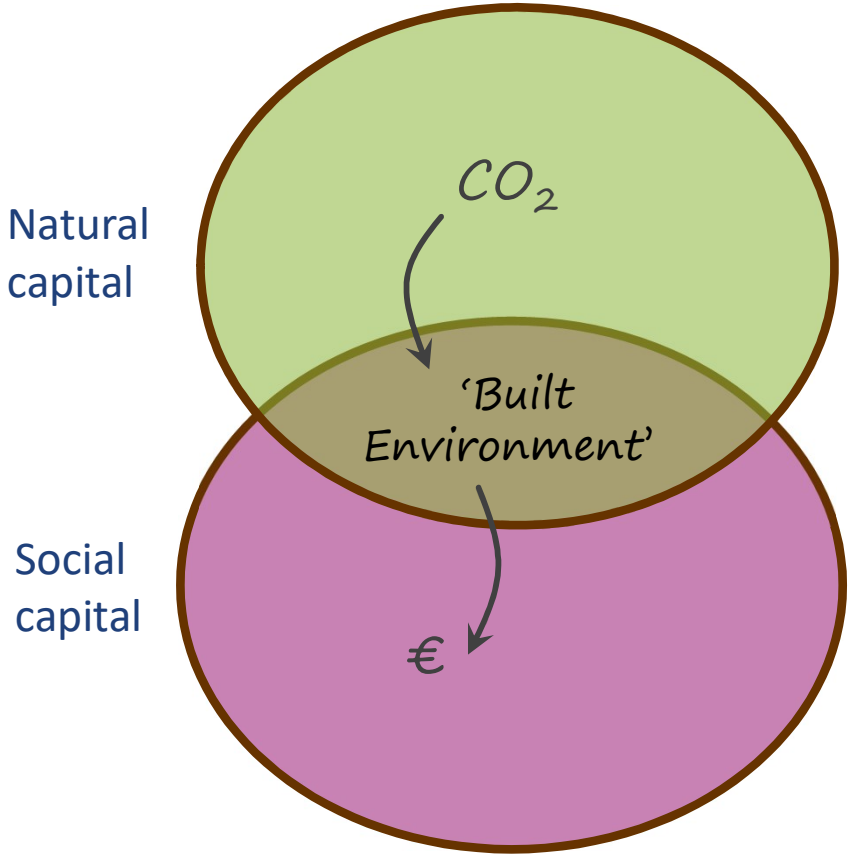
The built environment as an interface



Until now,
we used to promote products that **minimize** environmental and economic costs

Sce: S. Moffatt & N. Kohler. 2008 Conceptualizing the built environment as a social–ecological system, *Building Research & Information.*

The built environment as an interface



Let's promote products that **maximize** environmental and economic benefits

Sce: S. Moffatt & N. Kohler. 2008 Conceptualizing the built environment as a social–ecological system, *Building Research & Information.*

Shifting our views: From problem to potentials

Regenerative approach

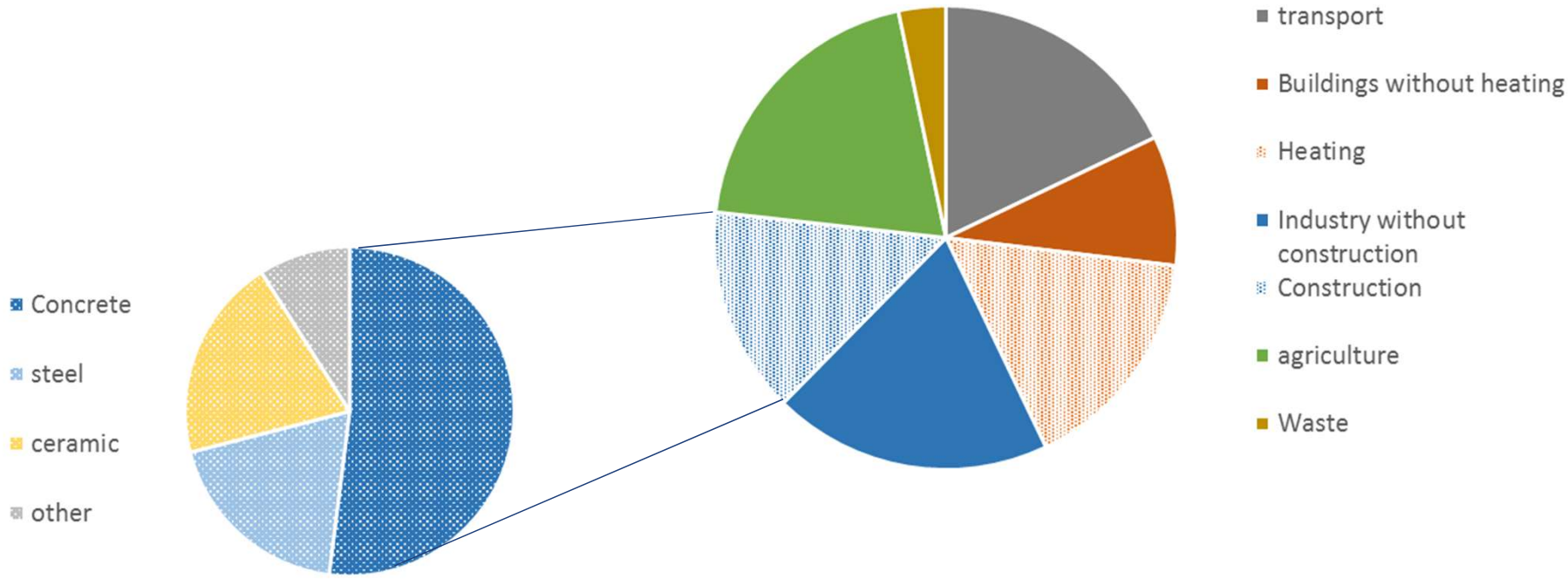
"Doing more good, not just less bad"

	GOAL	APPROACH
Regenerative	Increase positive impact	Regenerative Restorative/net-positive
Regenerative	Adapt & transform	General Resilience
Neutral	Sustainability	Net-zero
Degenerative	Bounce back	Specific Resilience
Degenerative	Reduce negative impact	Green High performance Conservation
Degenerative	Follow code	Conventional building

Step change

Developed from Reed, B. (2007) Shifting from 'sustainability' to regeneration. *Building Research & Information*, 35(6), 674–680.

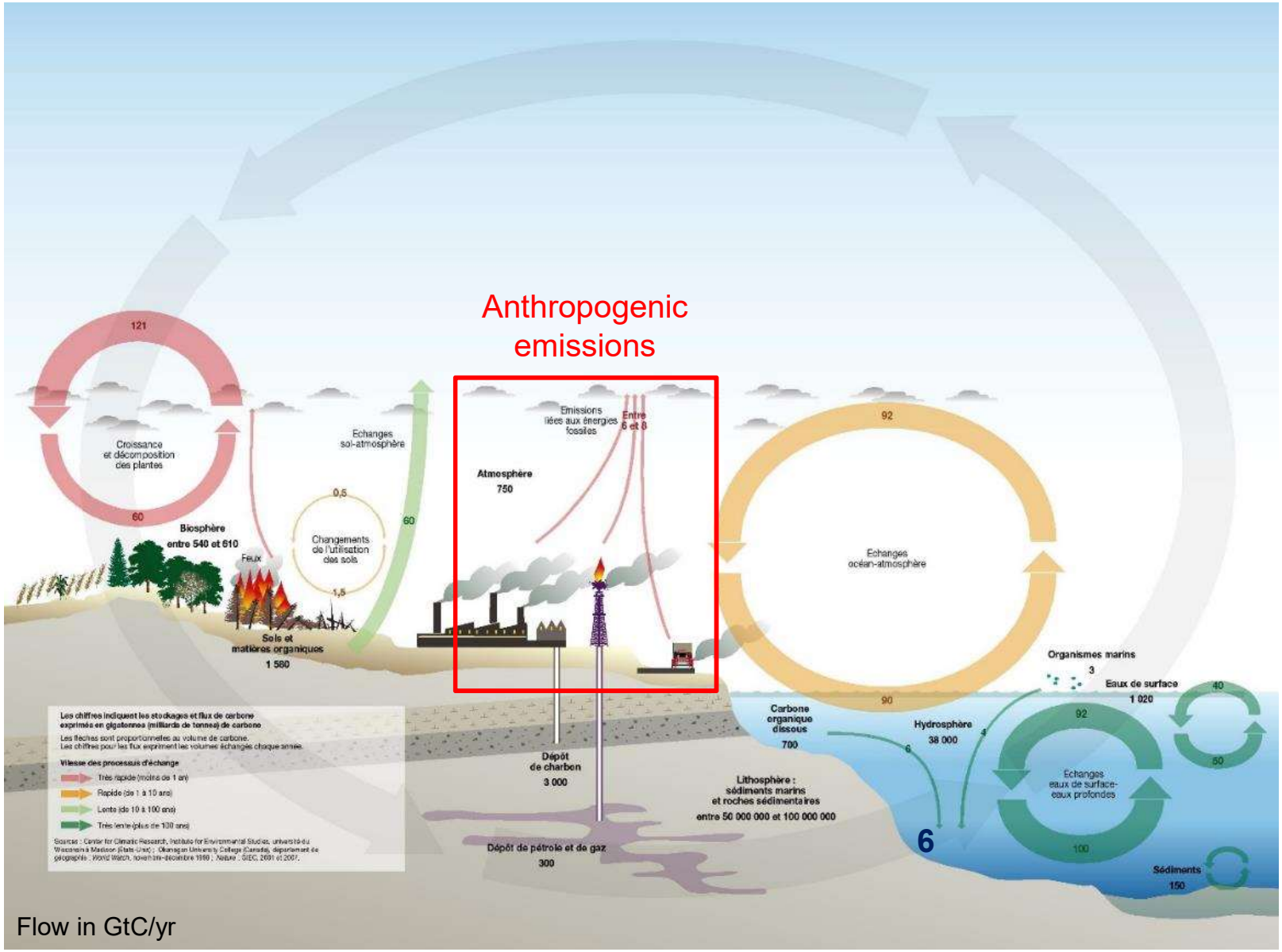
Materials matter



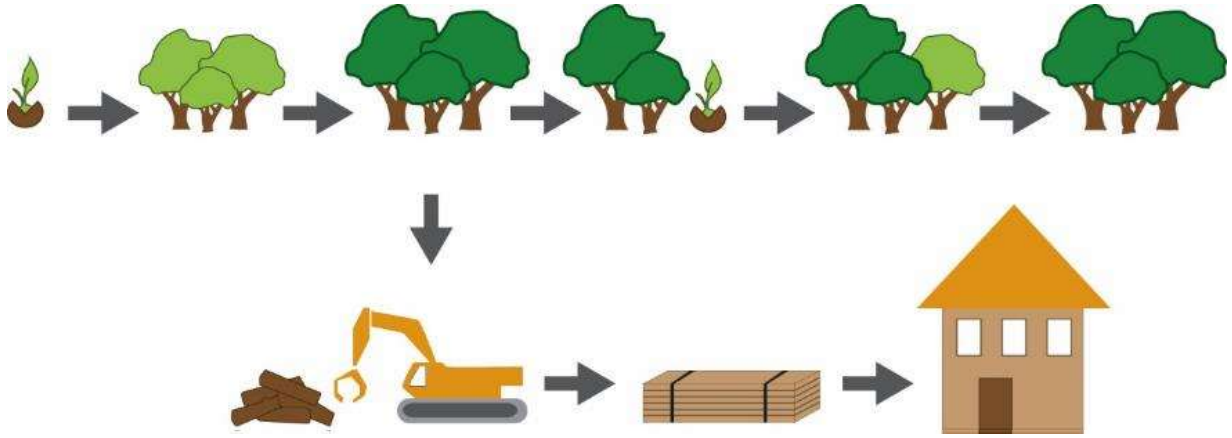
Sce: Bribián et al. 2011. *Building and environment*, 46, 1133-1140.

Sce: Bajželj et al. 2013. *Environmental Science & Technology*, 47, 8062 – 8069.

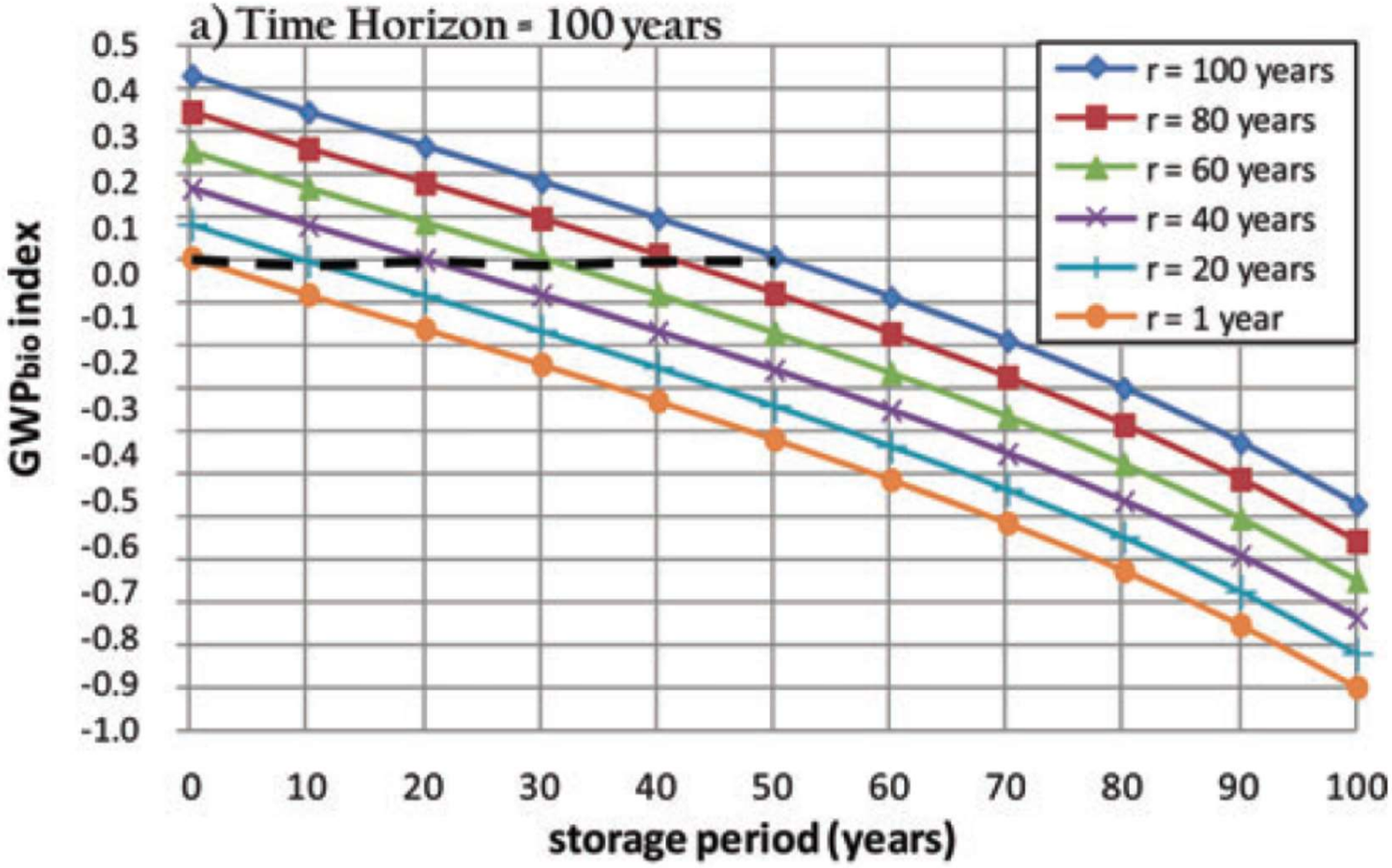
Biobased materials as a regenerative materials



Carbon neutral vs climate neutral



Carbon neutral vs climate neutral



Sce: Guest et al., 2012. GWP of CO2 emissions from biomass stored in the anthroposphere and used for bioenergy at end of life. Journal of Industrial ecology, 17, 20-30

Carbon neutral vs climate neutral

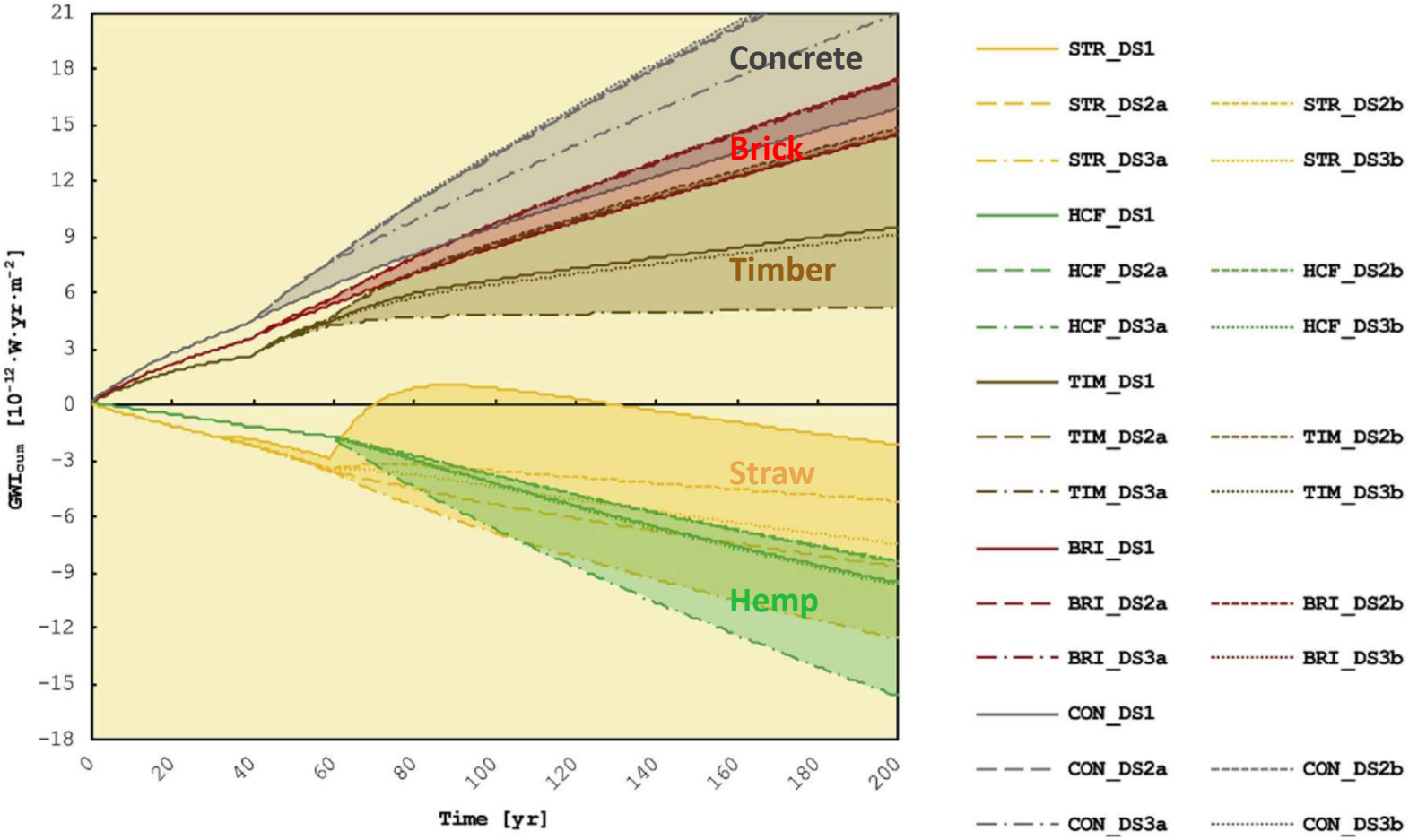


Fig. 7. Cumulative radiative forcing for all scenarios. DS1, 2, 3 stands for disposal scenario with landfill, energy recovery and material recycling respectively. DSa stands for disposal scenario with module D and DSb for disposal scenario without module D.

Sce: Pittau et al., 2018. Fast growing bio-based materials as an opportunity for storing carbon in exterior walls. Building and environment

Materials matter

Time	GDP (trillion 2012 USD)	Population (billion)	Households (million)	Average persons per household	Residential floor area (billion m^2)	Average m^2 per person
2011	80.8	6.95	1894	3.6	164	24
2030	161.4	8.36	2840	2.9	266	30
2050	272.7	9.48	3518	2.7	354	37

From now to 2050:

We need to double the building stock and refurbish the existing one!

Sce: International Energy Agency. John Dulac. 2016

Two possibilities:

The official sustainable construction
The biobased constructive system

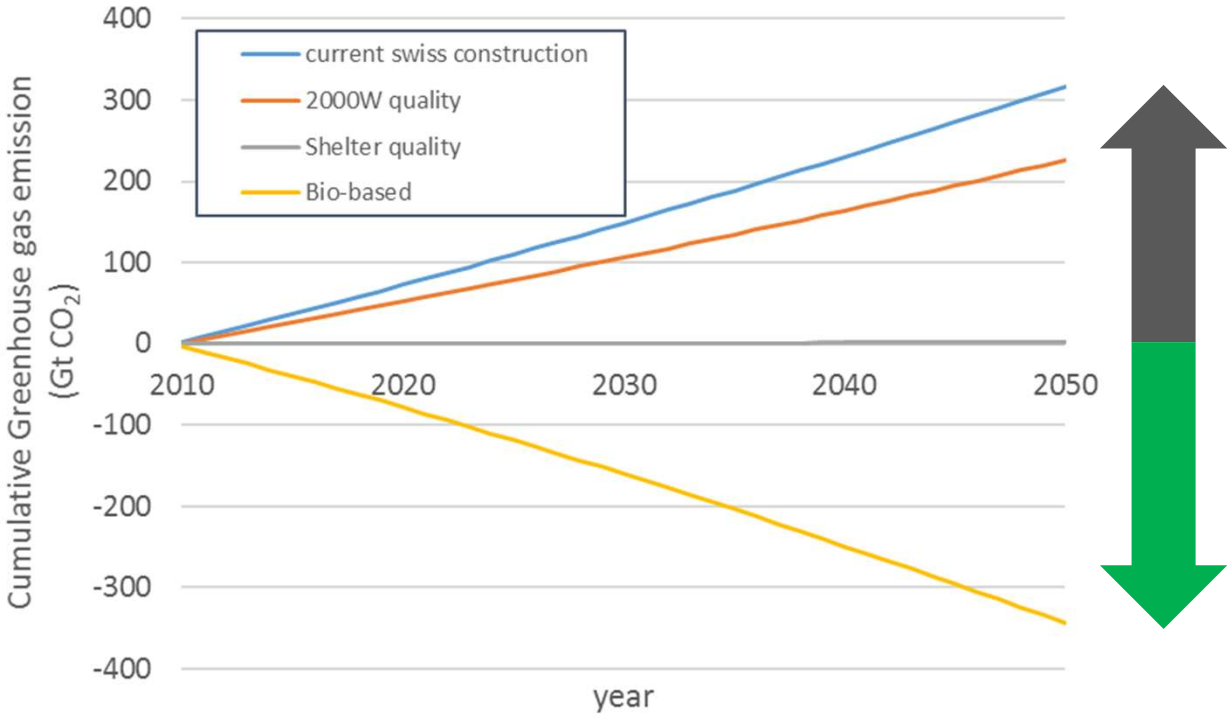
2000 W Society standard

	Construction	Operation
For new buildings		
Guidance value (kg $CO_2/m^2.a$)	8.5	2.5
Service life of the building (yr)	60	60
Total (kg CO_2/m^2)	510	150
For renovation		
Guidance value (kg $CO_2/m^2.a$)	5	5
Service life of the building (yr)	60	60
Total (kg CO_2/m^2)	300	300

For Bamboo House

	Average
Construction (kgCO2/m2)	37.1
Stored biogenic CO2 (kgCO2/m2)	614.9
Surface (m^2)	20
TOTAL CO_2 emissions (ton/m2)	**-0.6**
TOTAL CO_2 emissions (ton/cap)	**-11.6**

The ~~challenge~~ opportunity of urbanisation:



Consume 40% of global budget only for construction

Gain 45% additional budget thanks to construction

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Thank you for your attention