

Urbanization, infrastructure development, and climate change mitigation

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Cities, energy use, and infrastructure



Cities are concentrated centers of people, economy, production, consumption, and waste disposal; thus they present both the **problems and solutions** to sustainability challenges.



The infrastructure stocks...

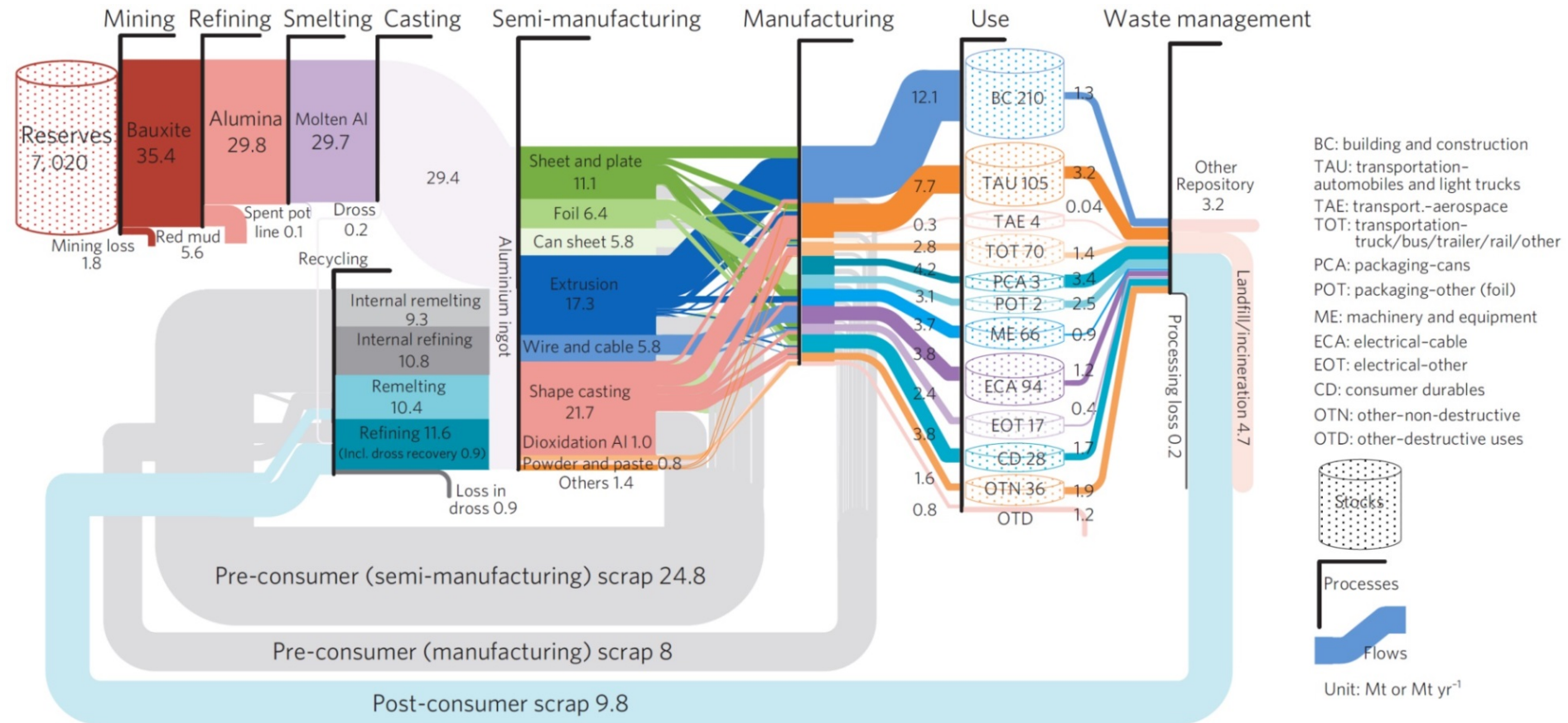


...drive resource and waste flows

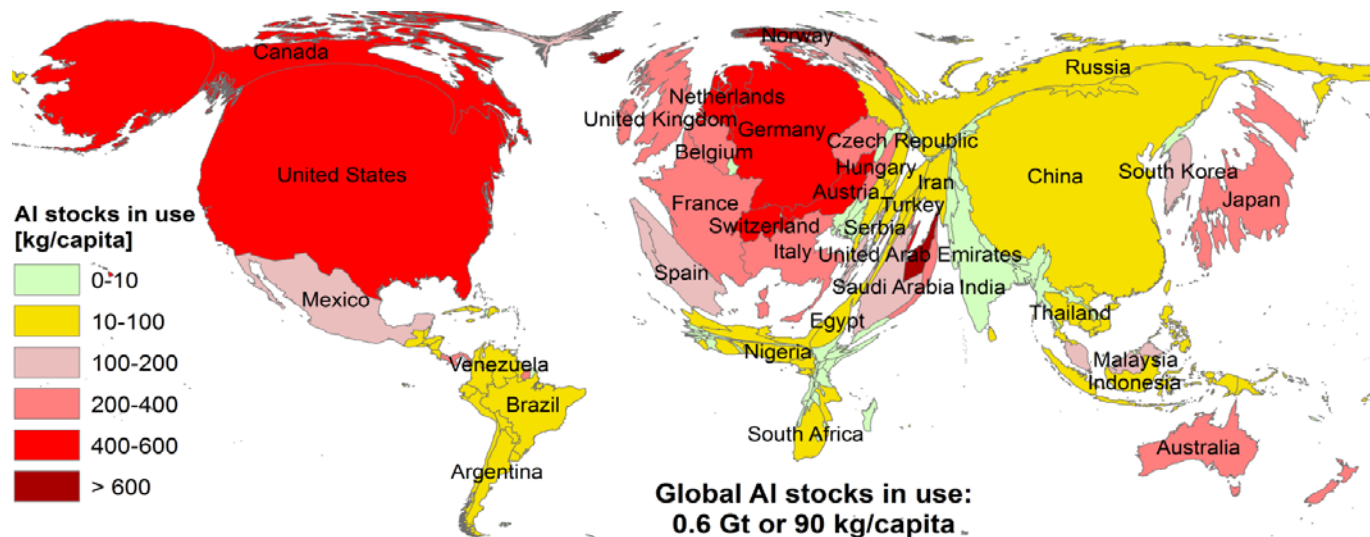
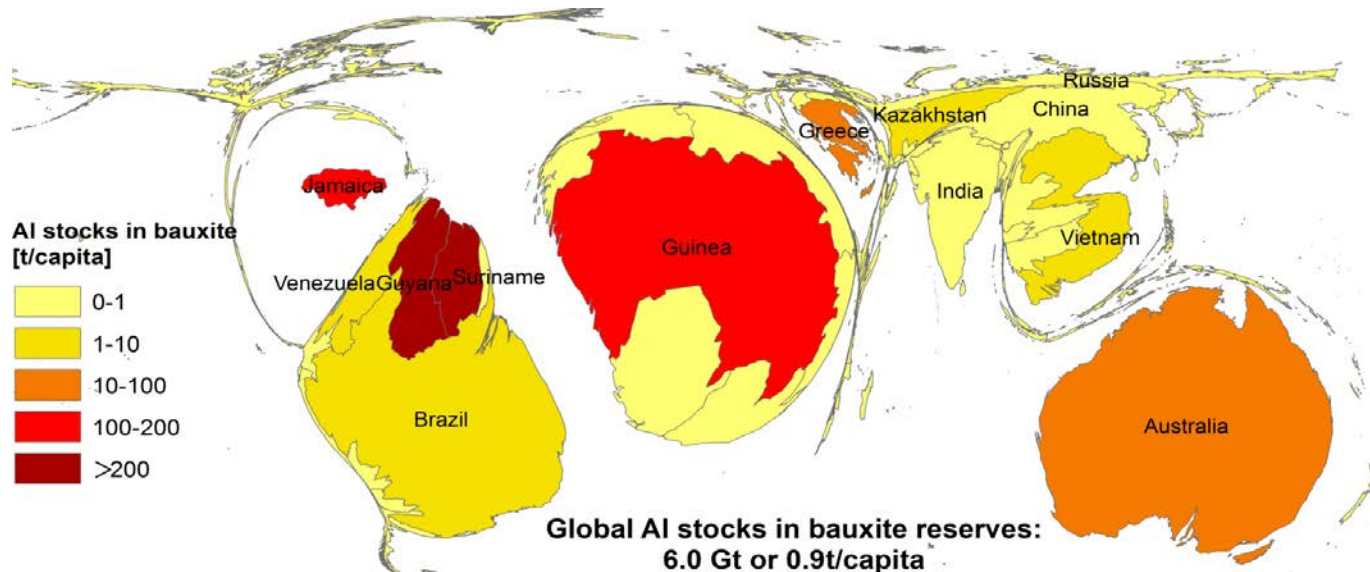
...which together defines the **societal metabolism**



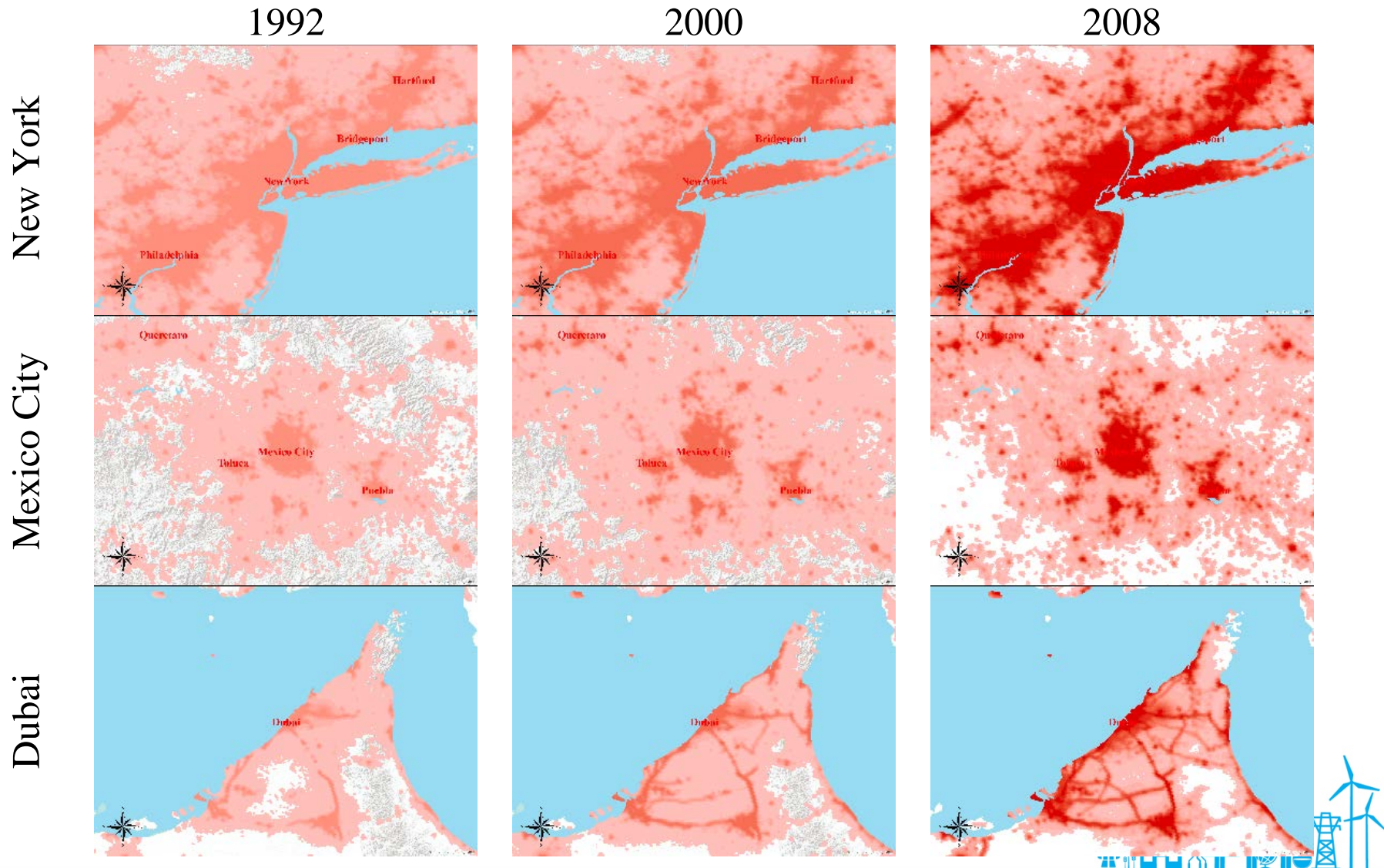
Global anthropogenic aluminium cycle in 2009



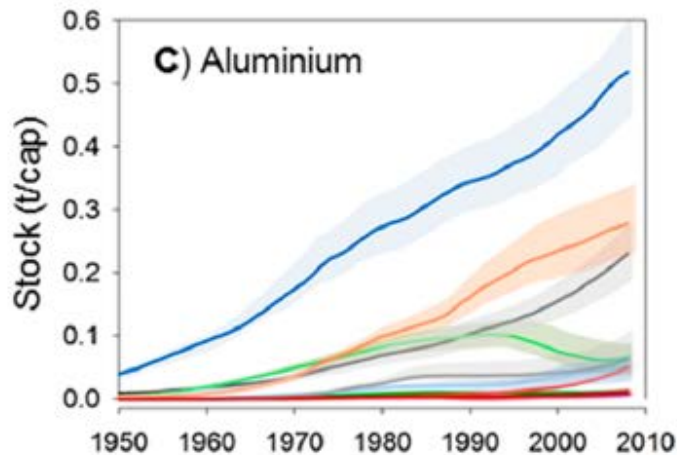
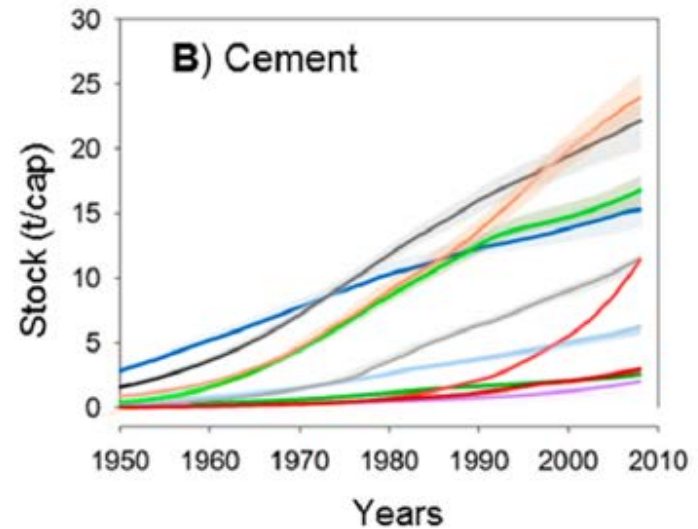
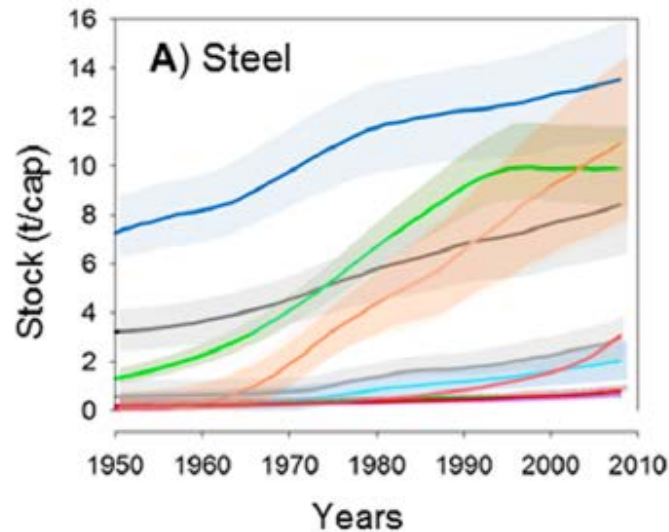
Al stocks under and above ground in 2010



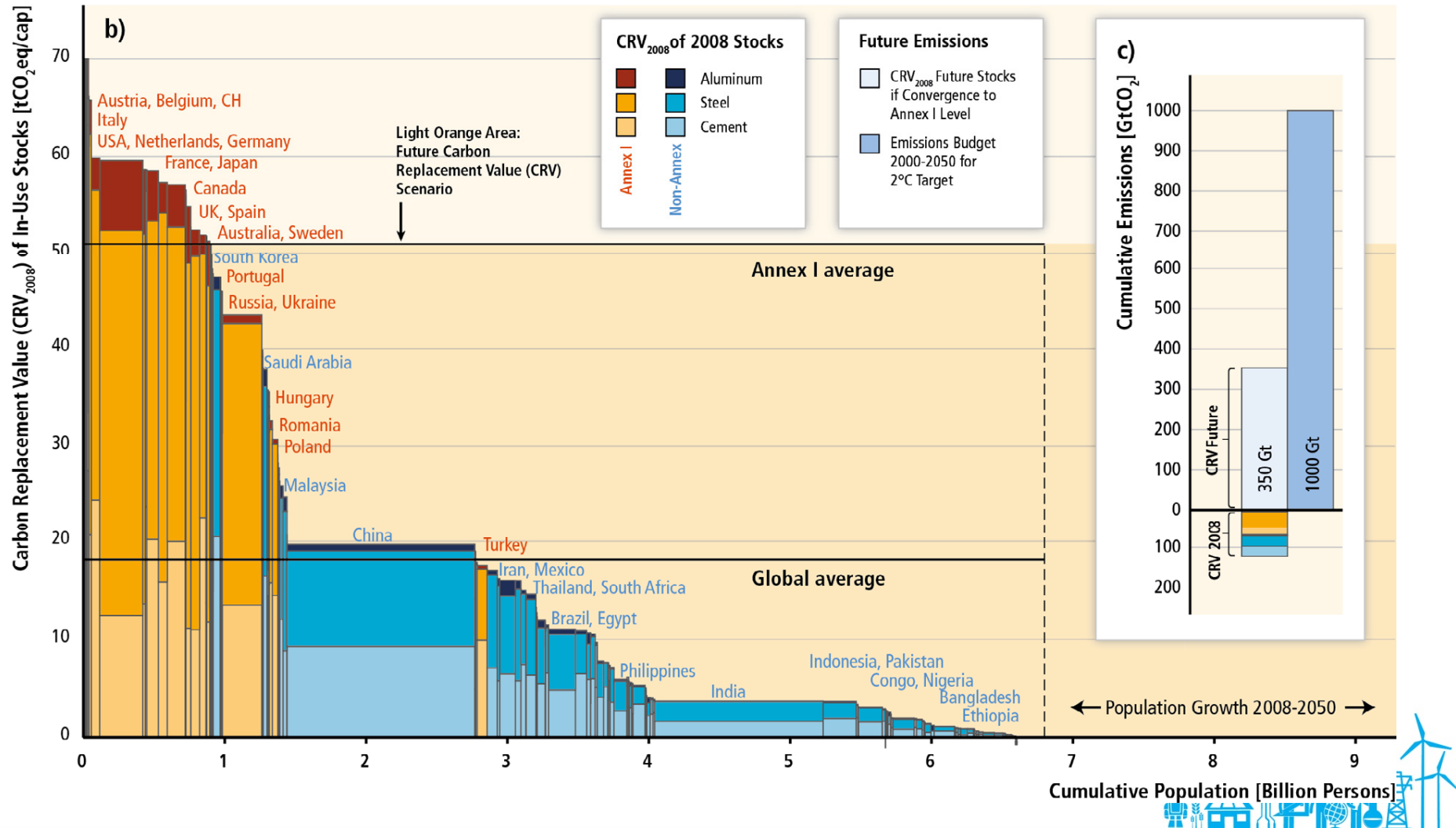
Fe stocks refined by satellite image data, 1X1 km



Infrastructure stocks on a country level - Fe, cement, and Al as a proxy



Carbon footprint of infrastructure stocks (Carbon Replacement Value, CRV 2008)



Mitigation strategies beyond energy/emissions efficiency ...

$$F = P * \frac{S}{P} * \frac{M}{S} * \frac{F}{M}$$

P - population

S/P - service level per capita

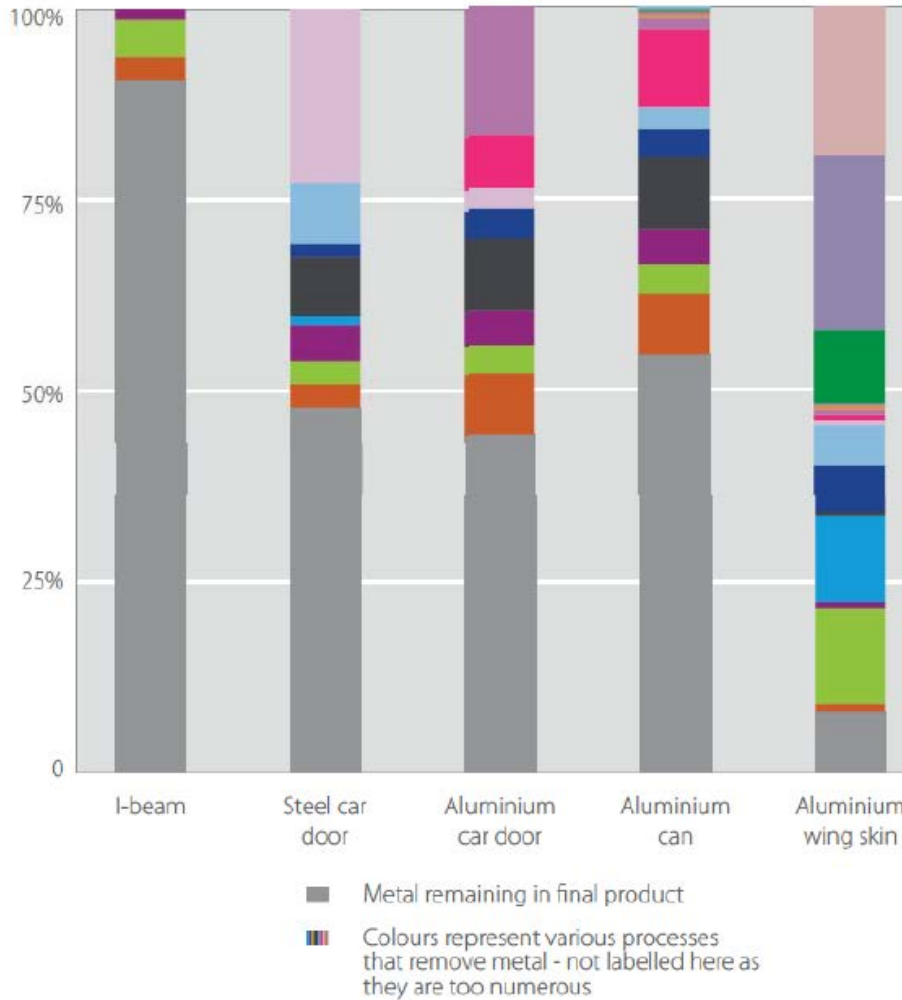
F/M - emission intensity of the materials

M/S - material stock per service unit

Think Big...



Material efficiency - more with less?



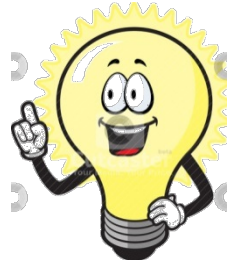
With both eyes open – reducing the metal yield loss



Product lifetime - dealing with planned obsolescence?



Livermore's Centennial Light Bulb, since 1901
<http://www.centennialbulb.org/photos.htm>

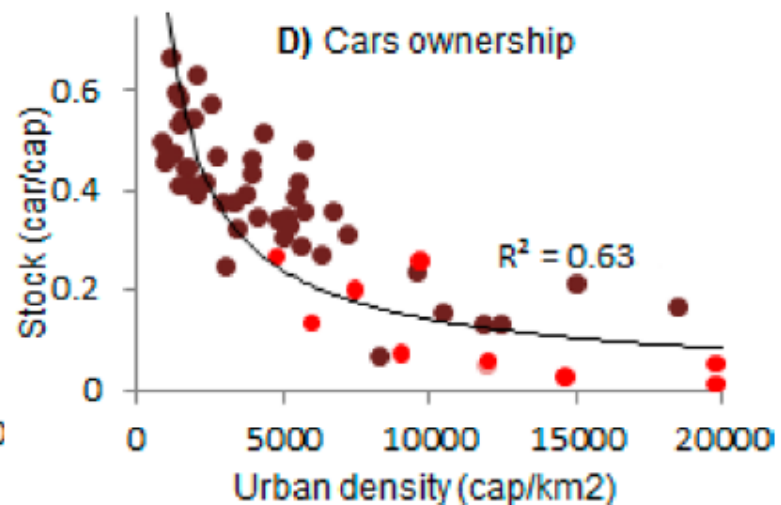
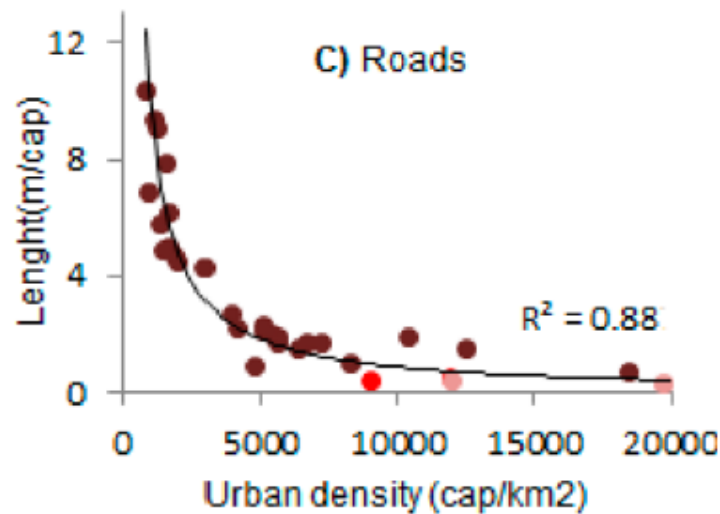
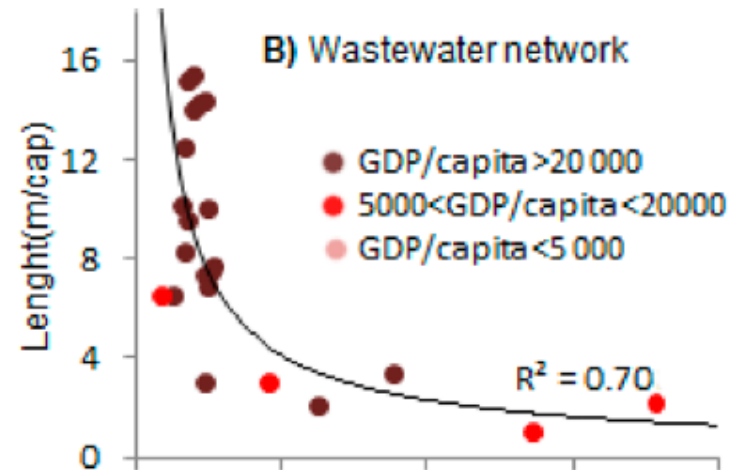
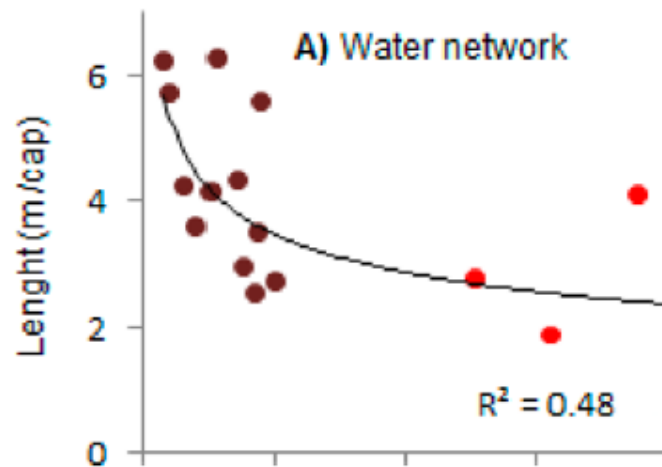


Idea?
Innovation?

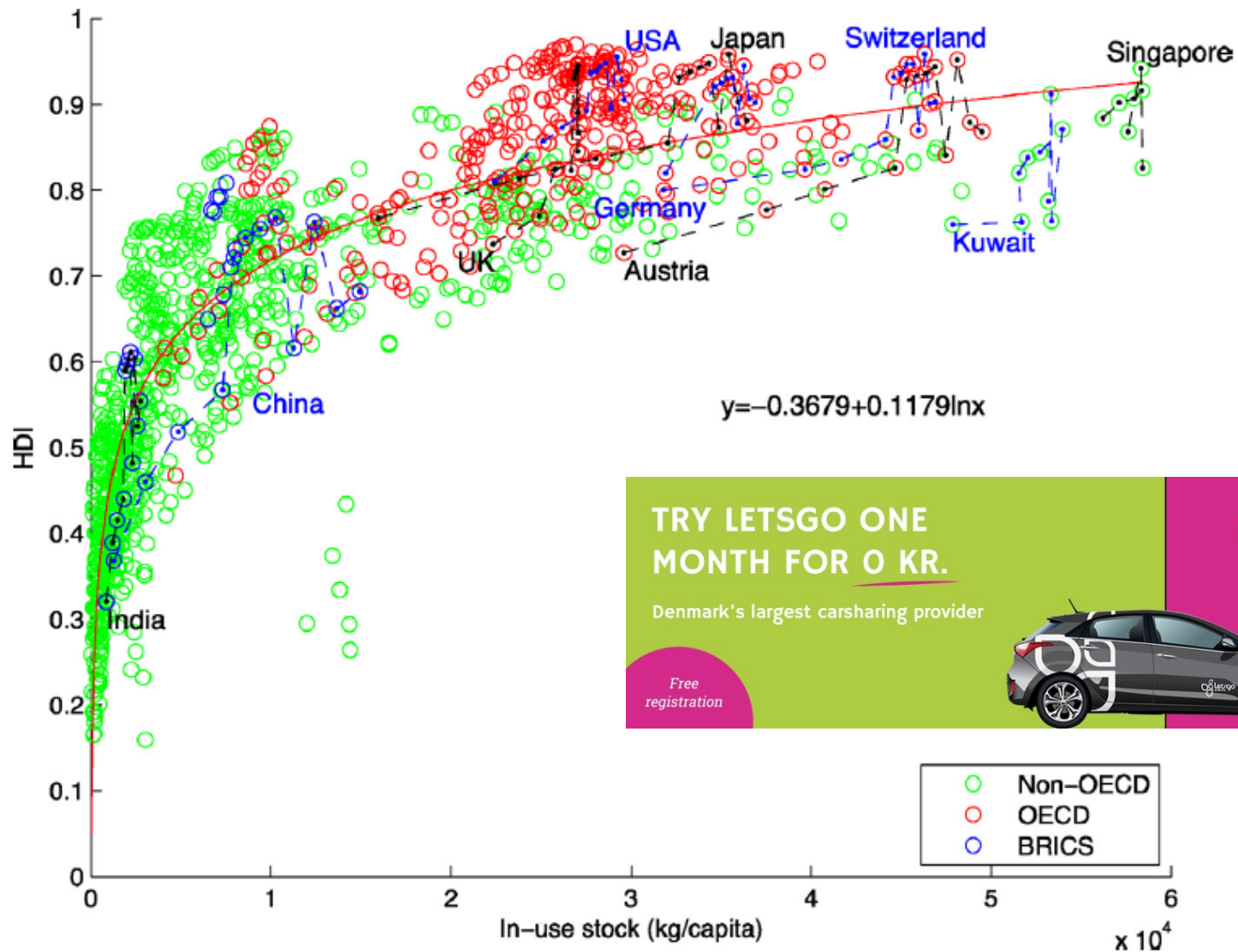
A sign of "Planned obsolescence"
Lifetime: 2500 hrs \rightarrow \leq 1000 hrs



Urban planning – the denser, the better?



Services ≠ stocks: a shared economy?



A new project

The weight of cities and decarbonization and dematerialization implications (2016.09-2019.08)



DET FRIE FORSKNINGSRÅD
DANISH COUNCIL FOR
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Thanks

Questions?

