Industrial Ecology

Understanding the synergies of business and the implications for design

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Aim and objectives of this presentation

Aim:

Discuss terminologies, limitations and business opportunities of urban developments responding to global pressures (climate change)

Objectives:

1. Provide background and describe trade-offs to global pressures
2. Give an example of natural resource requirements for mitigation
3. Explain industrial ecology and metabolism of cities
4. Provide business case studies of industrial ecology using adaptation (flooding) and mitigation (recycling)
5. Discuss these issues- engage you in this debate now and later

Background

Various targets and commitments e.g. UK mitigation

- Cut emissions by 80% by 2050,
- 40% electricity from low carbon sources by 2020

Cities (and urban planners!) advocate strategies but may not necessarily consider **resource availability**

Political and commercial debate, but theories such as **industrial ecology** and **urban metabolism** need to enter the debate

There can be conflicts of urban responses to climate change mitigation and adaptation that have **positive** and **negative** impacts

Some examples….

Some responses and possible conflicts

Response	Potential benefit	Potential negative impact
Air conditioning	Reduce heat stress	Increase energy needs and emissions
Densification of cities	Reduce public transport emissions	Increase urban heat island intensity and exposure to noise pollution
Irrigation	Supplying water for food	Salinization of soil, degradation of wetlands
Biofuels	Reduce GHG emissions	Deforestation; replace food crops, raise food prices
Catalytic convertors	Improve air quality	Large scale mining and resource movements
Wind turbine	Reduce air pollution and GHG emissions	Large scale mining and resource movements

Adapted from: Dawson (2011)

Mitigation strategies by 30 UK cities

Cities plan to mitigate climate change (Heidrich et al 2013) using:

- Assessment reports (63%)

- **Solar PV (54%);**

- **Electric vehicles (46%);**

- **Wind farms (50%)……..**

- ……Air source heat pump (7%)

Heidrich et al 2013

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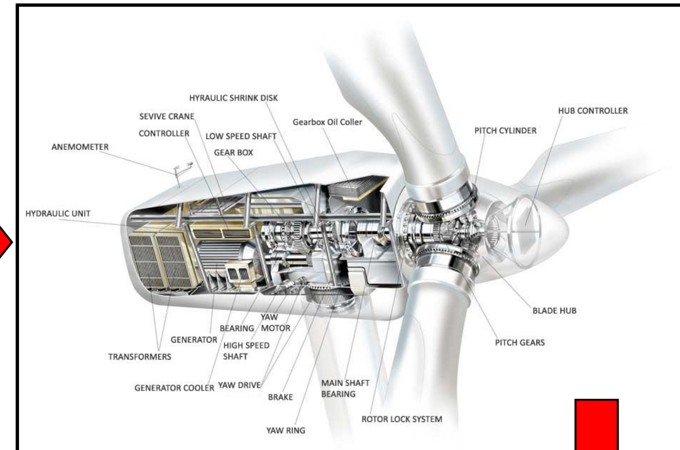
Mitigate Climate Change

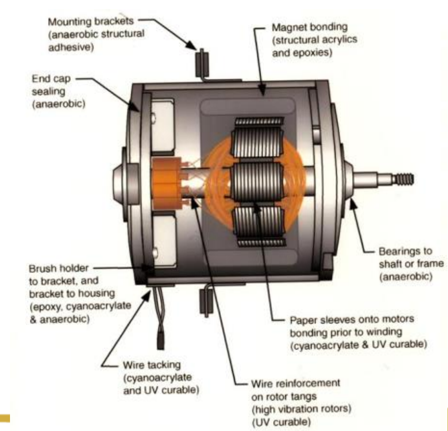
Green Electricity

Installation

Assembly



Manufacture



Production

Mining

Terminologies used

Industrial Ecology- first Evan (1974) now defined: **"the study of material and energy flows through industrial systems"** (Frosch and Gallopoulos 1989)- can be an Urban System

Urban metabolism- Marx and Engels; later Wolman (1965) now defined as "**…technical and socio-economic process that occur in cities, resulting in growth, production of energy and elimination of waste"** (Kennedy et al 2007)

Many other terms **feed** into this- Ecological Footprint, Life Cycle Assessment, Material Flow Analysis, Carbon accounting, CO_2, Societal Accounting, Environmental Impact Assessment, Quality of Life, Certified emission reduction…. **(talk to me!)**

Bottom line: **societal and technological systems are bounded within the biosphere, and cannot exist outside of it.**

Industrial Ecology in cities

Policies,
Planning,
People
Technologies

Equipment,
Materials,
Services &
Businesses

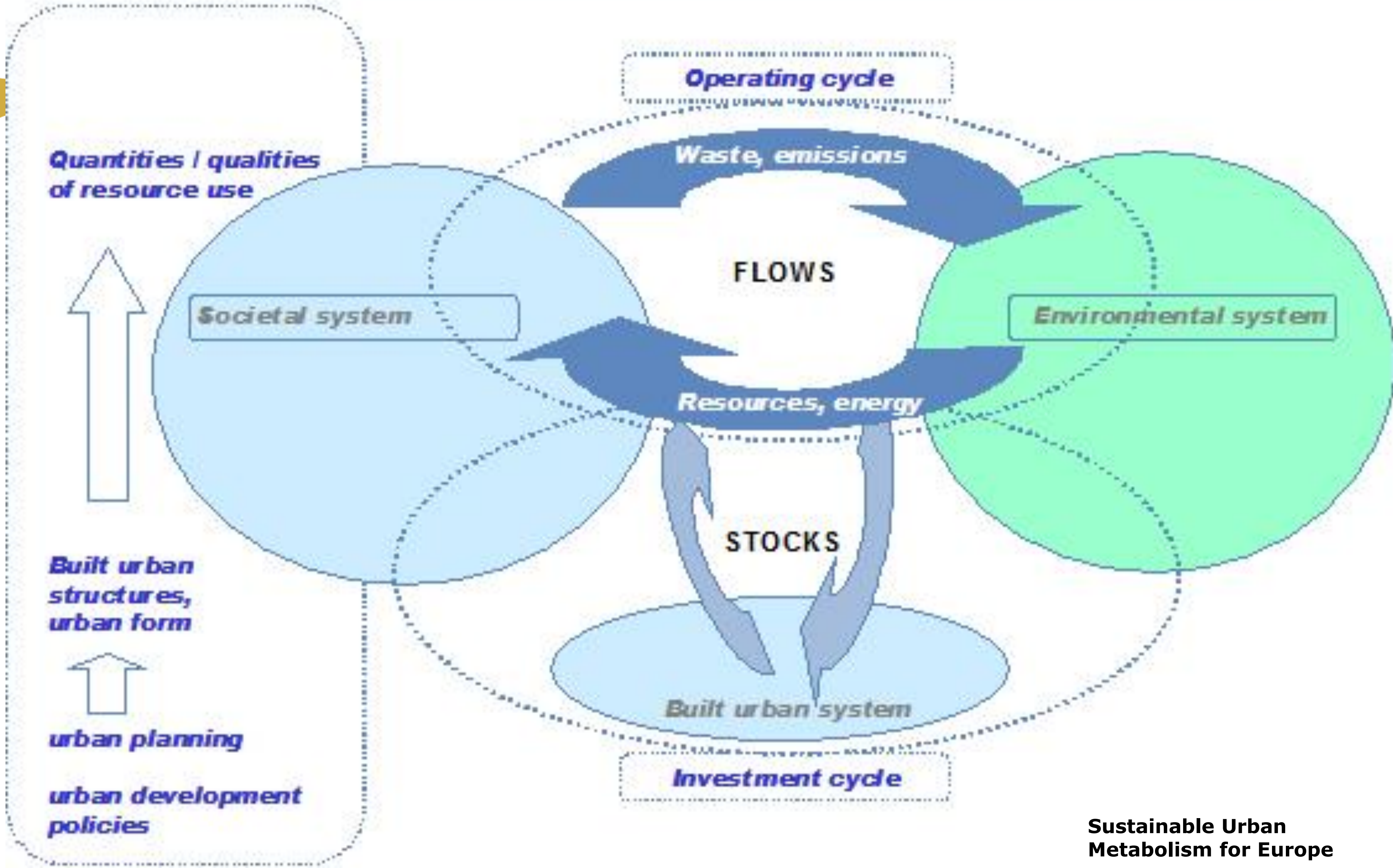
Resource Recovery
Potential; Market
Potential & Profit

Sustainability,
Metabolic, &
Financial
Targets

What goes in goes out

www.cfgnet.org

Urban metabolism: Stocks & flows concept



So what can we do?

Synergies of business and industrial ecology

Whole systems approach

Describe case studies
- internationally,
- national and
- locally

Internationally

WtE Copenhagen

Big Architects

Nationally- Olympic Park

Olympic park- North Side

- Need of sustainable drainage system
- Commitment- Zero Waste games

Adapt- flooding actively managed (1 in 100years rainfall and CC) Protect groundwater, watercourses and surface water

Mitigate- recycled 184 tonnes of mixed plastics- 33,000 metres of Aquadyne; - all plastic waste created by the games- recycled

Part of legacy of the Olympics- still there!

Gateshead- Get Carter

Locally- Gateshead

Above Tesco- waterproofing and operations are paramount

Student accommodation with green and brown roofs (paving, planting and sports pitch)

16,000m^2 of roof; ~24,000m^2 of Aquadyne (double layers)

Adapt- flood attenuation store 46 l/m^2 and transfer water (1 in 180 years storm), slow down peak runoff

Mitigate- recycled 600t of mixed plastic, reduce carbon footprint
use Tesco waste to make Tesco waterproof and operational

To conclude

Industrial ecology and urban metabolism are concepts and theories

Sustainable designs, materials, systems etc. need to be requested by clients and enacted by planners, designers and engineers

I have given you some examples but I have more

So much more to do- talk to me

Appendix

References

and more stuff of interest

References

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Wolman, A. (1965). The metabolism of cities. Scientific American, 213(3),179-190.

Kennedy, C., Cuddihy, J., & Engel-Yan, J. (2007). The changing metabolism of cities. Journal of Industrial Ecology, 11(2), 43-59

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Heidrich, O., Dawson, R.J., Reckien, D. and Walsh, C.L. (2013) 'Assessment of the climate preparedness of 30 urban areas in the UK', Climatic Change, 120(4), pp. 771-784.

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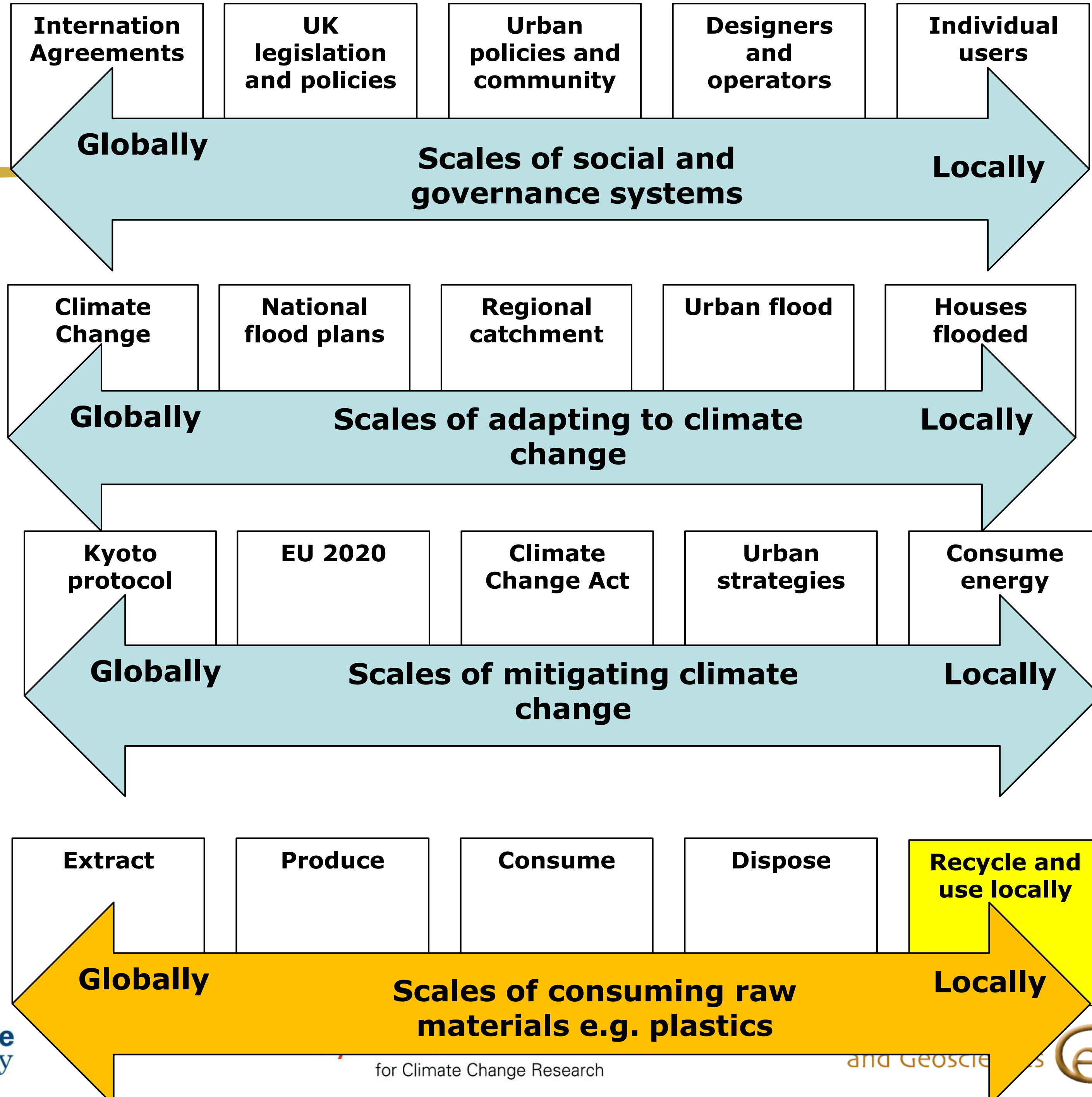

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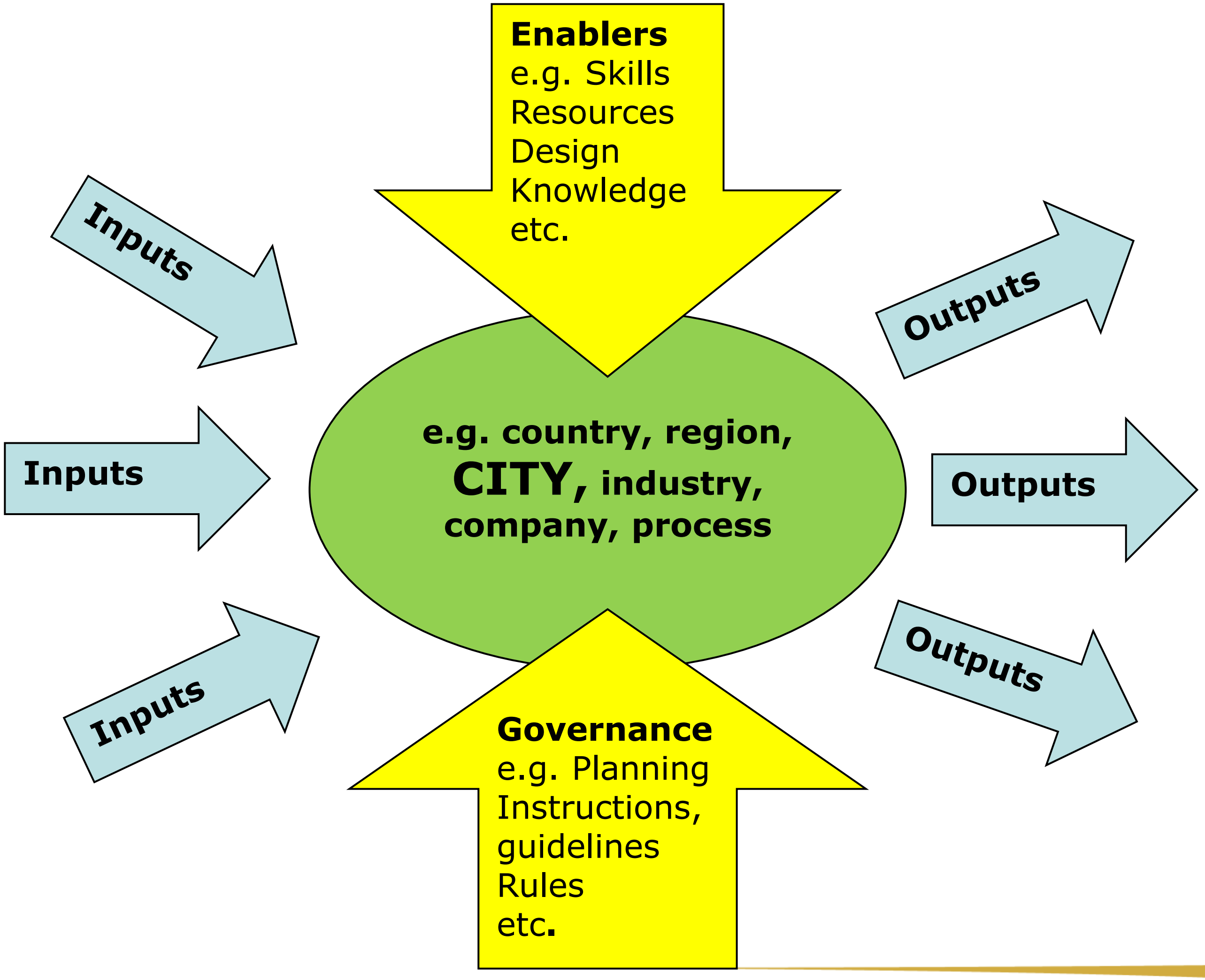
Industrial Ecology and the city



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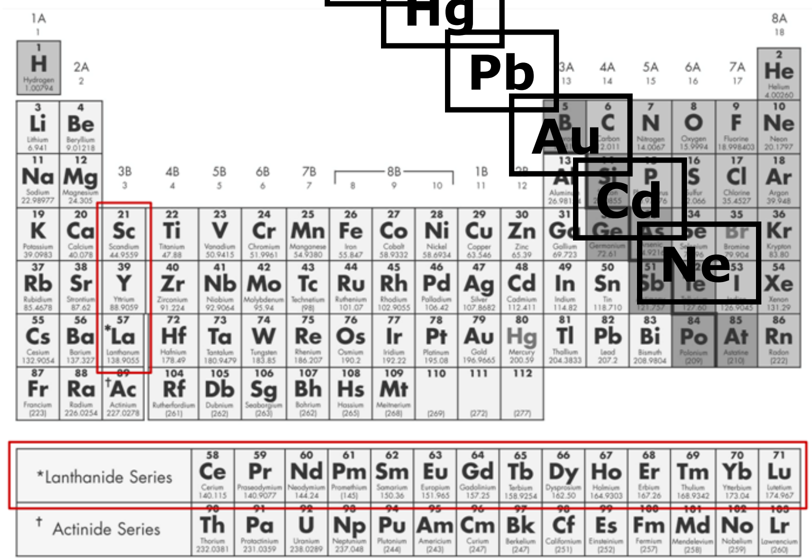
Life cycle of elements

Mining → Refining and Production → Nd / Dy / Li / Cu / Zn / Ca / Hg / Pb / Au / Cd / Ne → Photovoltaic / Magnets / Catalysts / Batteries / Electronics → Disposal or Recycling



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Interesting websites and background

www.ellenmacarthurfoundation.org

Newman, Peter and Isabella Jennings. **Cities as sustainable ecosystems : principles and practices**

www.cfgnet.org

http://www.big.dk/#projects

http://www.sume.at