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Healthy Cities – Integrated Waste Management

CHRISTIAN STIGLITZ
President
European Institute of Environmental Economics (EIEE)
Austria

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- **In 2050 more than 66 % of the world‘s population will live in cities**

- **In India the population of cities will increase by 400 Mio people in 2050**

Cities must become places with high quality of life and sustainable economic development

Cities must develop into „smart cities“

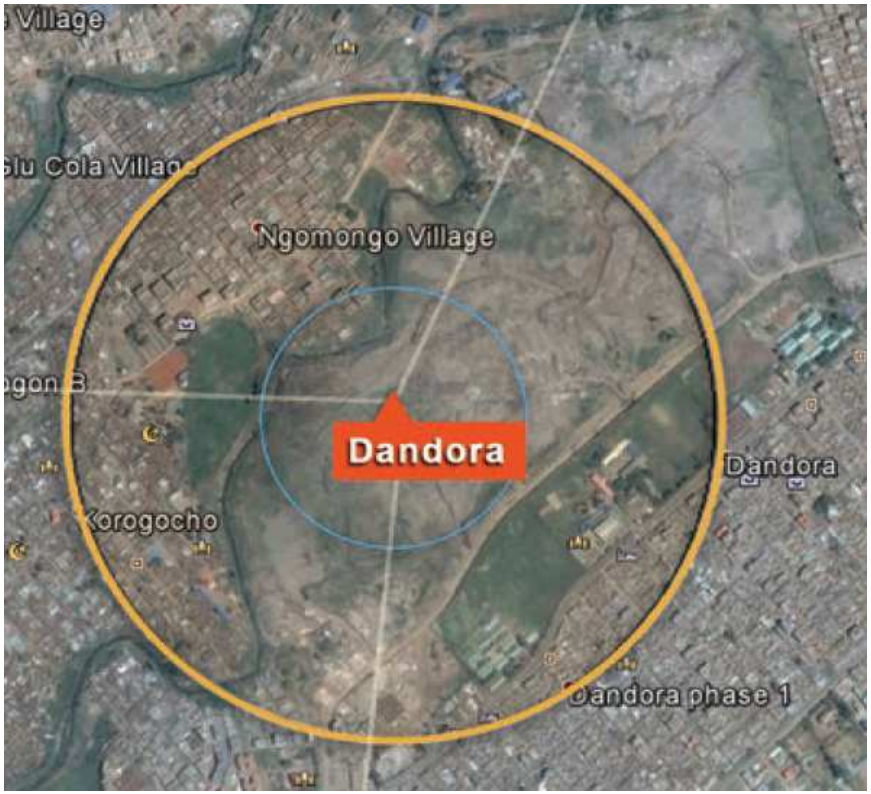
Source: UN Department of Economic and Social Affairs)

: "A city can be defined as ‘smart’ when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement of the citizens”(*)

Integrated sustainable Waste Management is essential to maintain a healthy environment and manage resources efficiently

(*) Source: Caragliu and Nijkamp 2009, University of Amsterdam

Waste Dump in Urban Area (Dandora, Nairobi)



Waste in place:	ca 25 Mio t
Waste added:	ca 0,7 Mio t pa
Size:	ca 53 ha
Distance to nearest house:	200 m
Population within 10 km	2,4 Mio inh
Content:	MSW, haz waste

Ca 3000 people working on landfill for material recovery (informal sector)

Source: ISWA Waste Atlas 2014

Integrated Waste Management

- Manages all types of waste
- Minimizes impact of waste on the environment
- Maximizes recovery of resources from waste

Integrated Waste Management - the EU waste hierarchy

Source: ETC/SCP.

Source: European Commission (DG ENV) Use Of Economic Instruments And Waste Management Performances 2012

Integrated Waste Management
- Waste reduction

Qualitative Waste reduction

Avoid hazardous substances in the construction process and in the product (eg. Cadmium, mercury, POP etc)

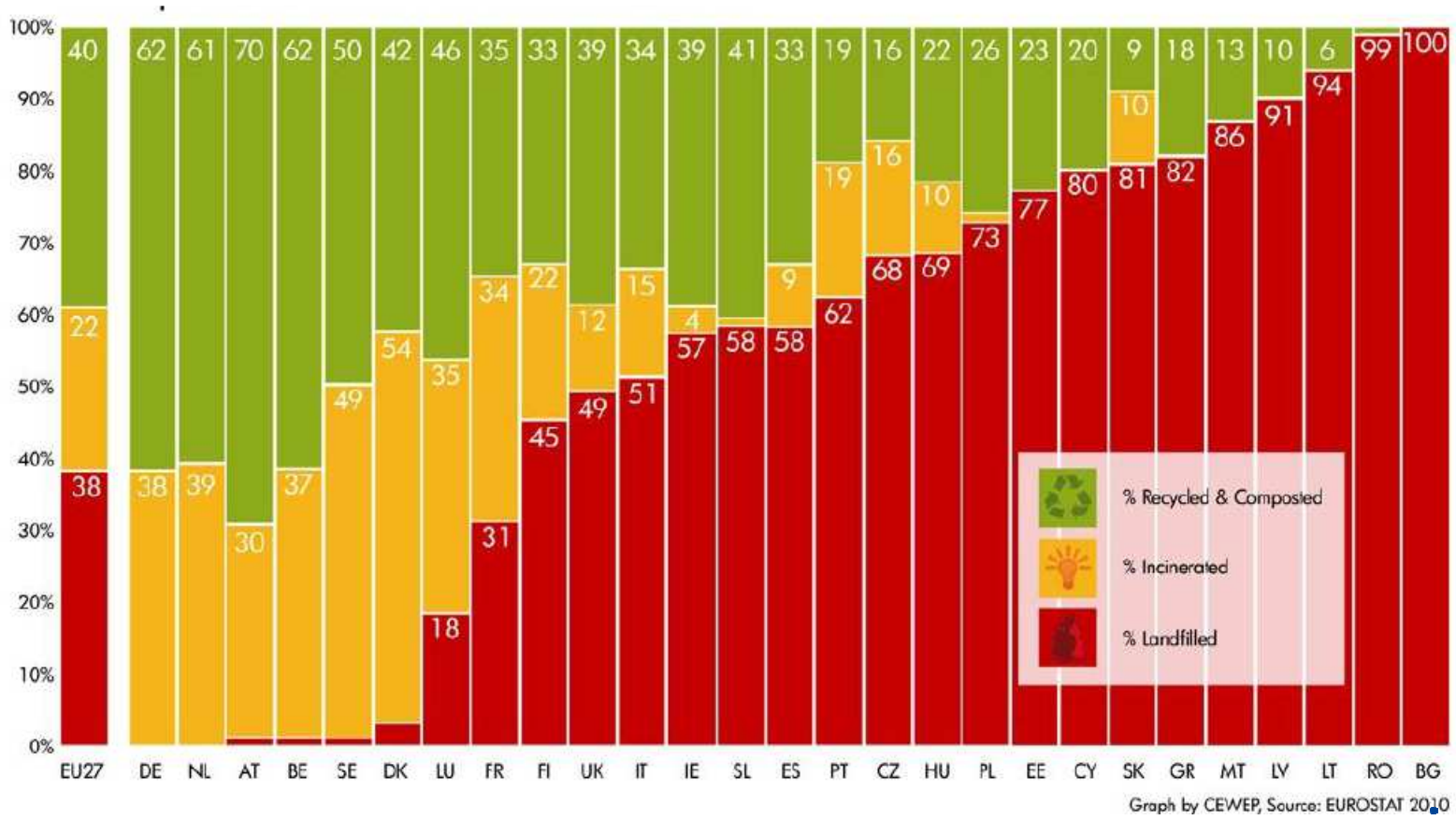
Quantitative Waste reduction

- Clean production
- Ecodesign
- Design for recycling
- (through the EPR =Extended Producer Responsibility concept)
- Cradle to cradle concepts
- Repair and Reuse
- Separate collection and recycling

Integrated Waste Management
- Waste treatment

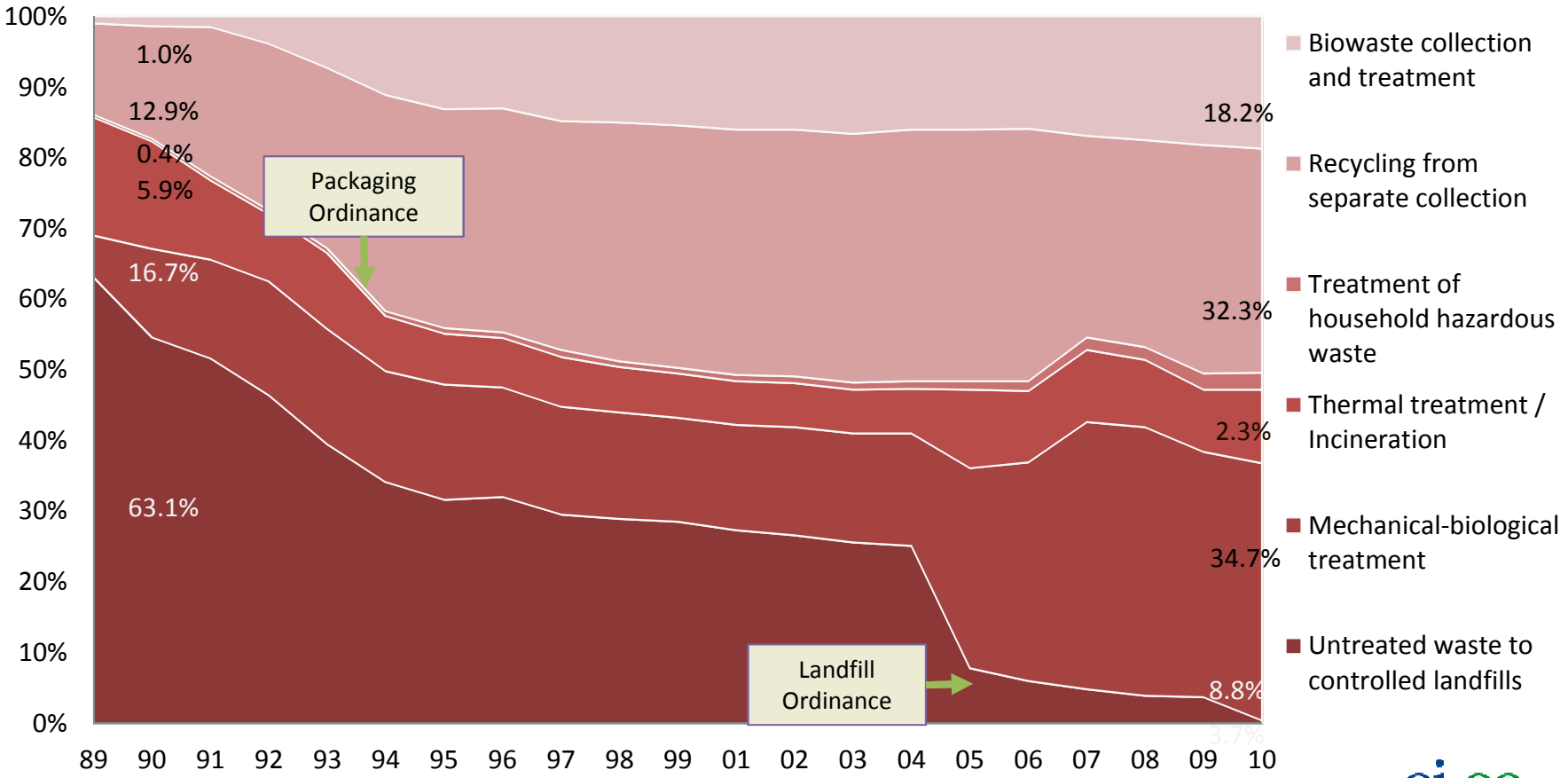
- Biological and Mechanical treatment for composting and recycling
- Biogas production
- Collection at source, Recovery, treatment and recycling of materials (packaging, WEEE, vehicles, lamps, batteries, vehicles etc)
- Waste Derived Fuel (WDF) cement kiln, cellulose/pulp production
- Incineration with maximum energy recovery (district heating, cooling)
- Recovery of materials from incineration slags
- Treatment of hazardous substances (special treatments, underground landfills, high temperature incineration in rotary furnaces etc.)
- etc
- Final disposition in sanitary landfills

Municipal Waste treatment in the 27 EU member states 2010



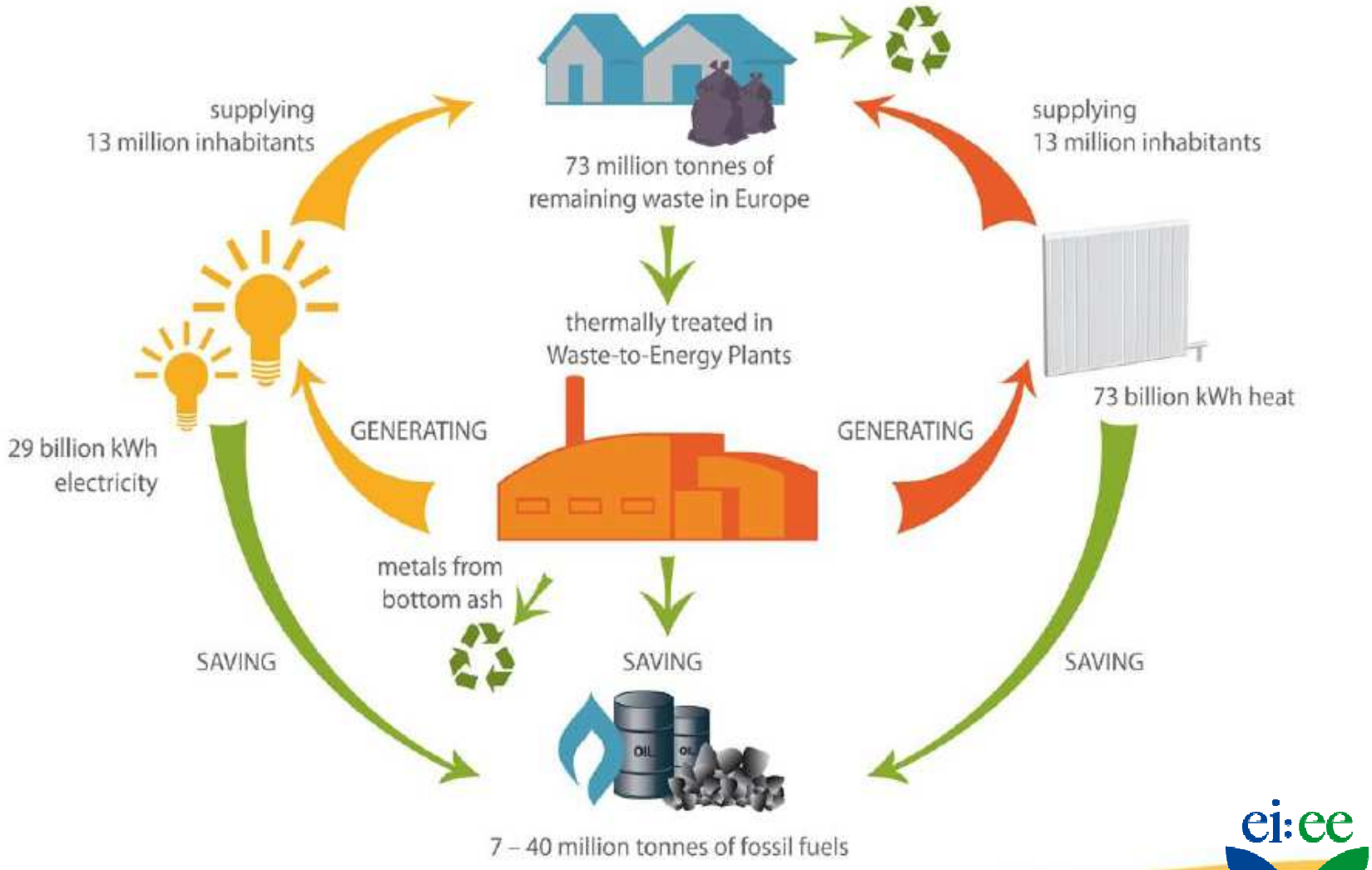
Source: CEWEP, eurostat

Treatment of MSW in Austria: One Step Ahead



Source: Environment Agency Austria, 2011.

Waste to Energy Cycle



Source: CEWEP

Thermal Treatment of Waste

- Incineration of MSW with energy recovery (district heating/cooling
- WDF sorting of MSW produces fuel to replace fossile fuels
- Gasification (produces combustible gas, hydrogen, synthetic fuels)
- Thermal depolymerization (produces synthetic crude oil, which can be further refined)
- Pyrolysis (produces combustible tar/biooil and chars)
- Plasma arc gasification or plasma gasification process (PGP) (produces rich_syngas_including hydrogen)

Thermal Treatment of Waste (cont)

Cost efficiency depends on:

- Costs of MSW management
- Cost of deposit in sanitary landfill
- Cost of primary energy, fossil fuels etc

Gate fees for MSW Incinerators in EU ca 60 – 100 €/t

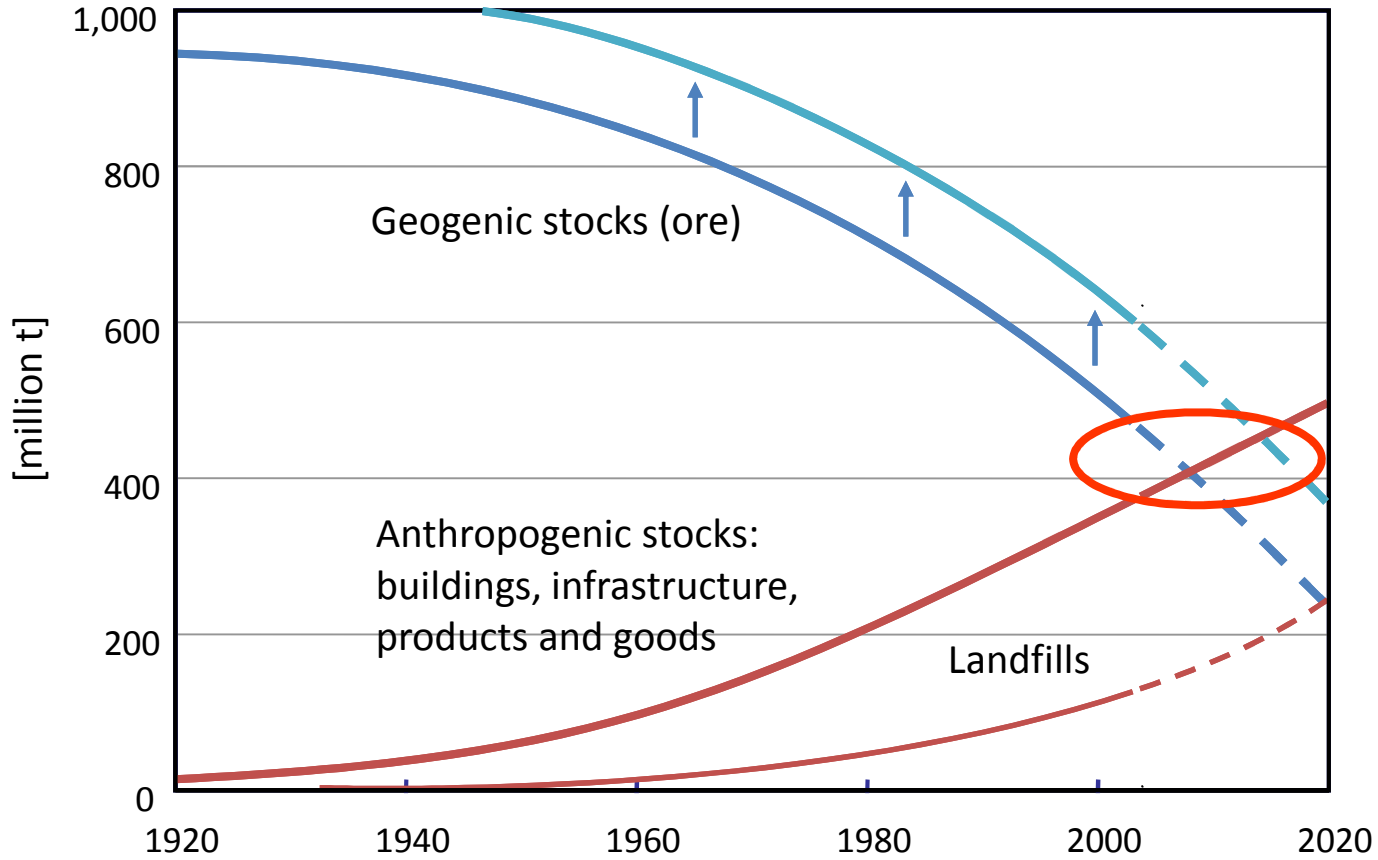
Urban Mining

- Cities are a huge resource of secondary raw materials built into infrastructure, buildings, etc since centuries
- Most have high value, e.g.copper, steel, iron, plastics
- Volume are huge: in Austria alone (8 Mio inhab)
  - 3.800 Mio t materials used in existing buidings in Austria
  - 2 Mio t Copper contained in built-up area
  - 40-80 Mio t Steel etc

Urban Mining (cont)

- With increasing raw material prices secondary raw material recovered from existing buiding cites will play a growing role in material sourcing.

Anthropogenic Stocks and Urban Mining: copper



Source: Rechberger, 2004, ARA AG.

Urban Mining (cont)

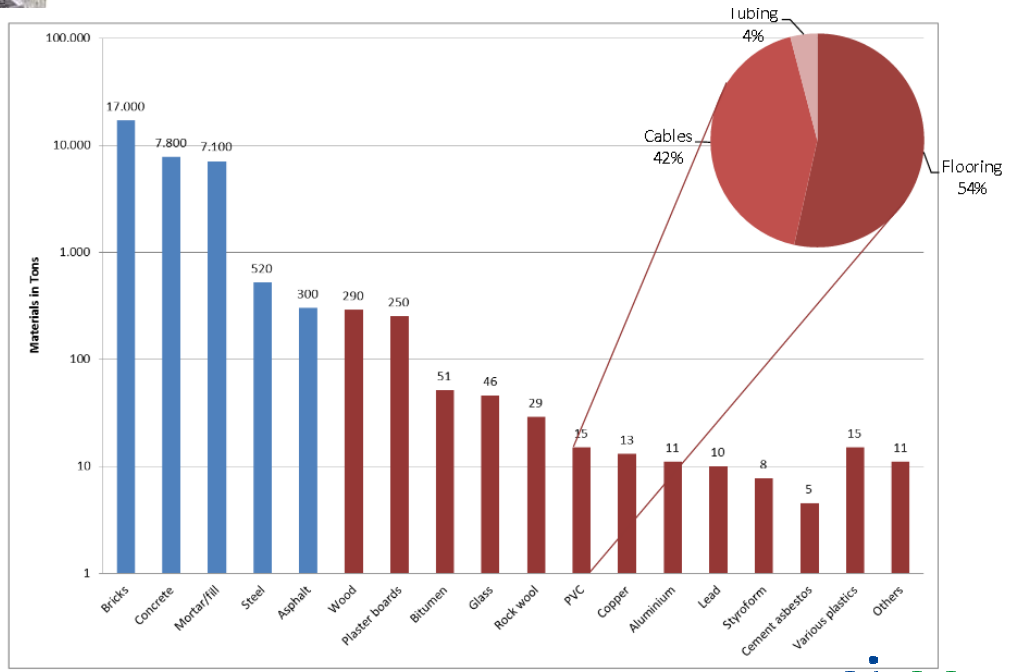
Research is going on in many countries to estimate the txpe and volumes of these materials,

The Christian Doppler Institute for Anthropogenic Resources at the **Technical University Vienna** is developing tools to evaluate those resources regarding quality, quantity and accessability.

Urban Mining (cont)

Kaiserin Elisabeth Hospital, Vienna

Contained resources per material



Source: F. Kleemann et al, Resource potential of built infrastructure, TU Vienna 2013

Integrated Sustainable Waste Management- A possible strategic map

- Map all material streams in and out of anthropogenic space
- Reduce waste at source
- Recover and recycle resources in waste including energy at economic optimum
- Minimize impact on the environment
- Move to sanitary landfill

Key to a Healthy, Happy and Smart City