Reuse and recovery of raw materials, material flow (industrial symbiosis)

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LCS-RNet
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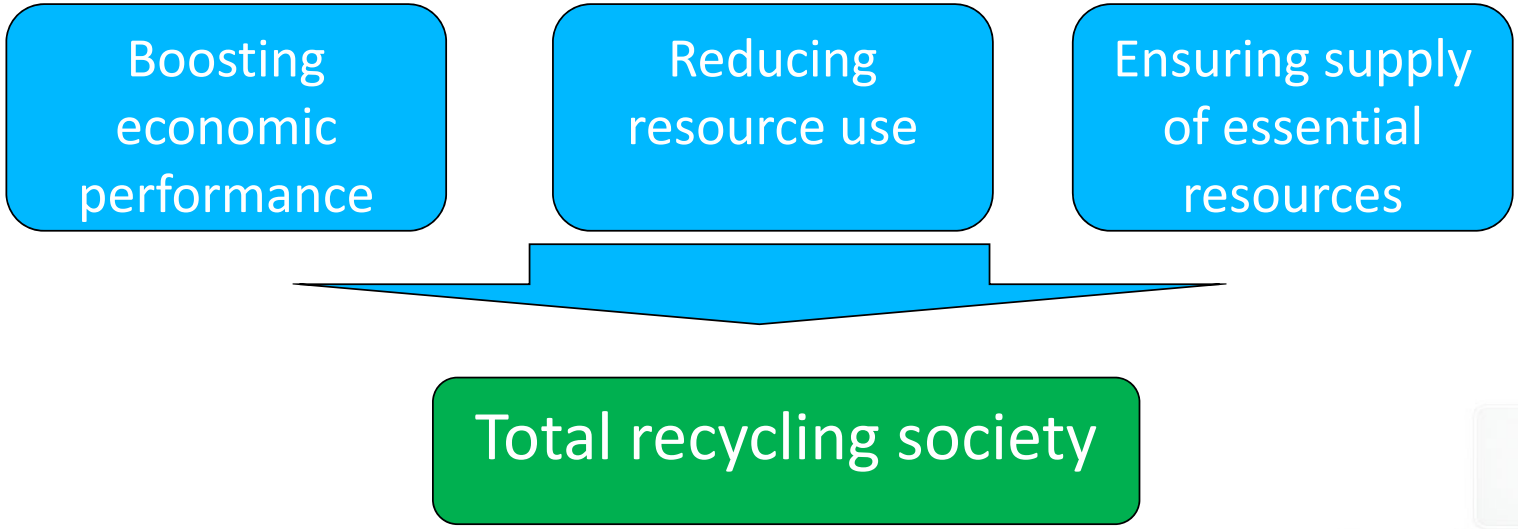
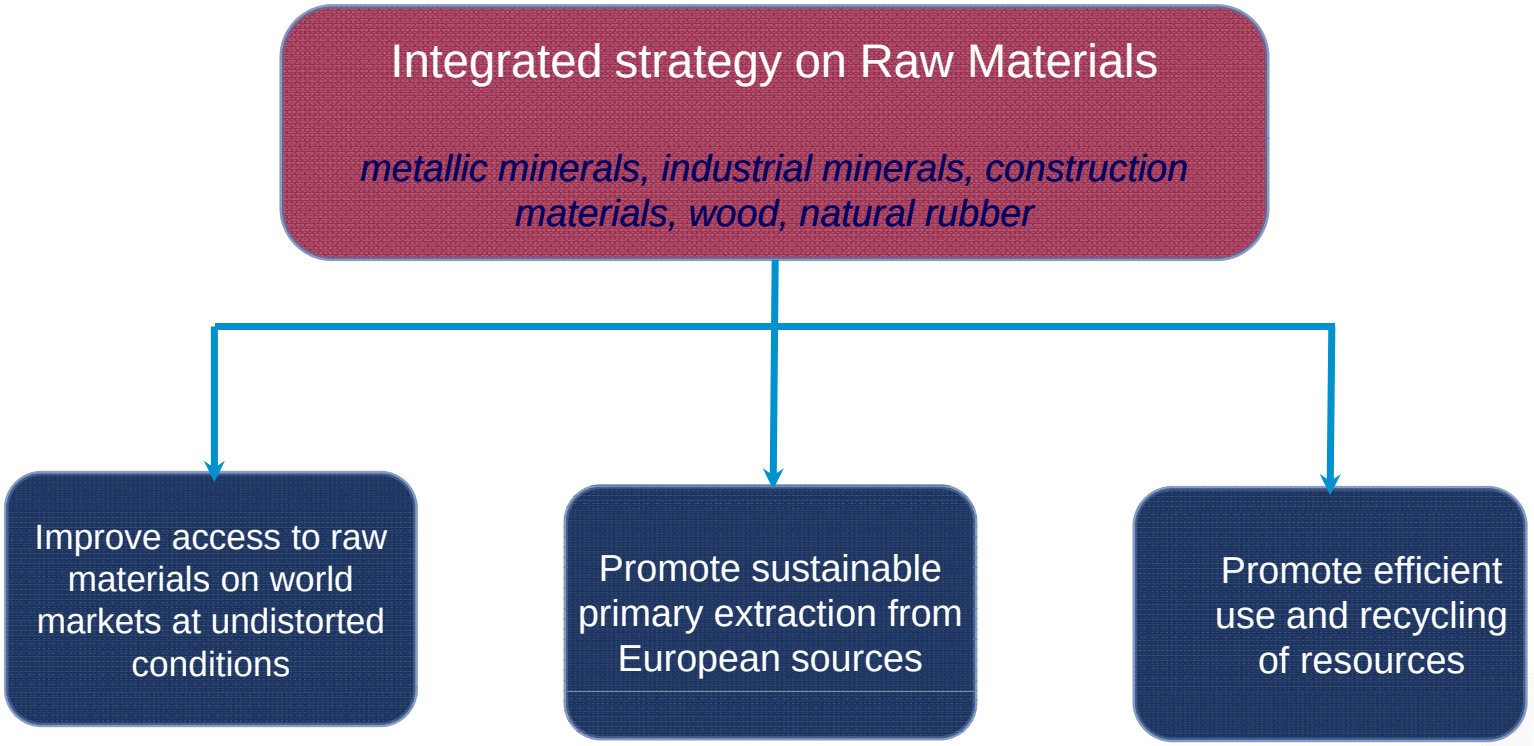
Resource efficiency

Resource efficiency has become priority for both environmental and economic reasons



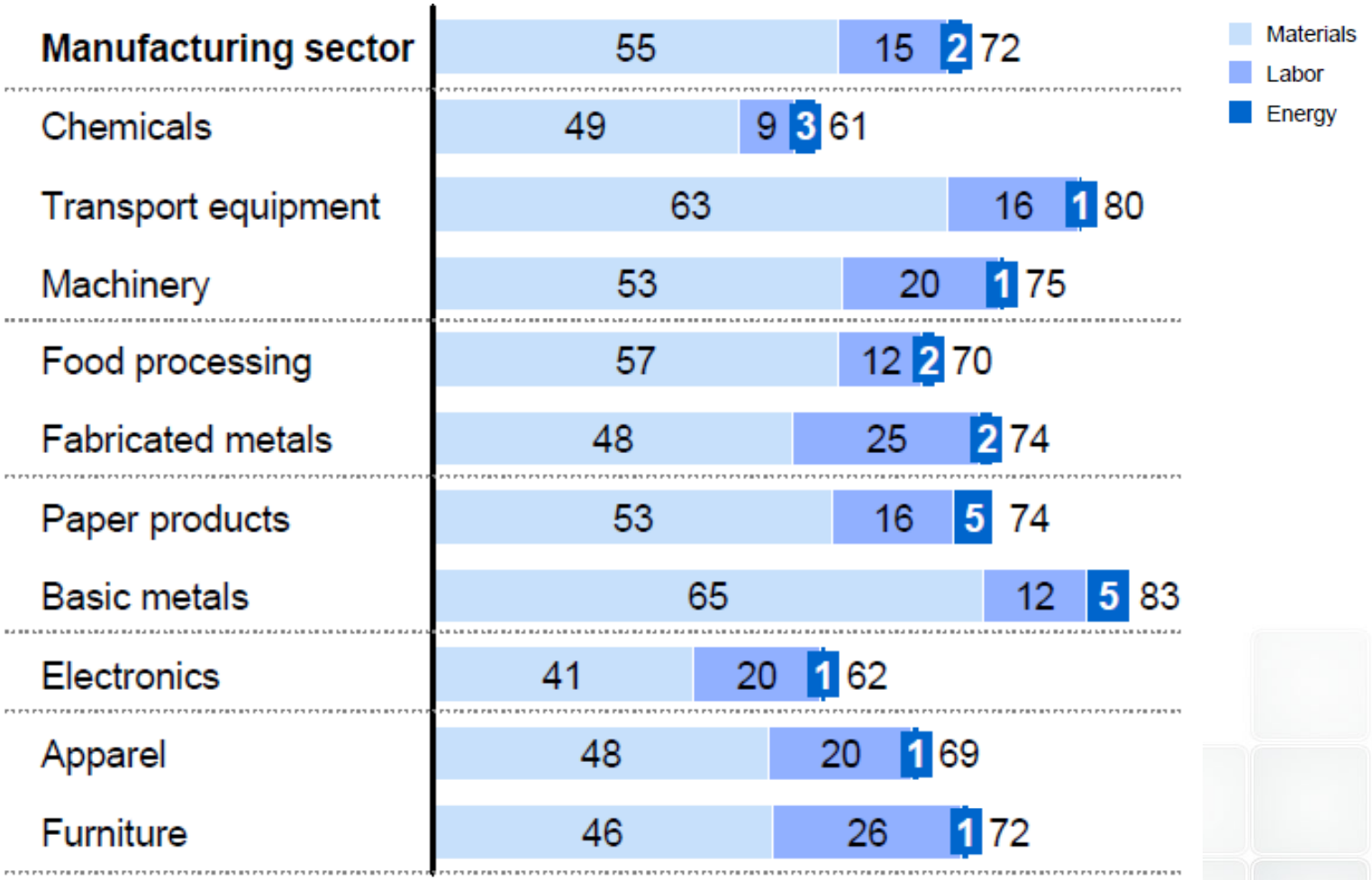
European Initiative for Raw Materials



Main objective: contribute to the mid- and long-term **security of a sustainable supply of the raw materials** that are required to meet the fundamental needs of a modern, resource efficient European society

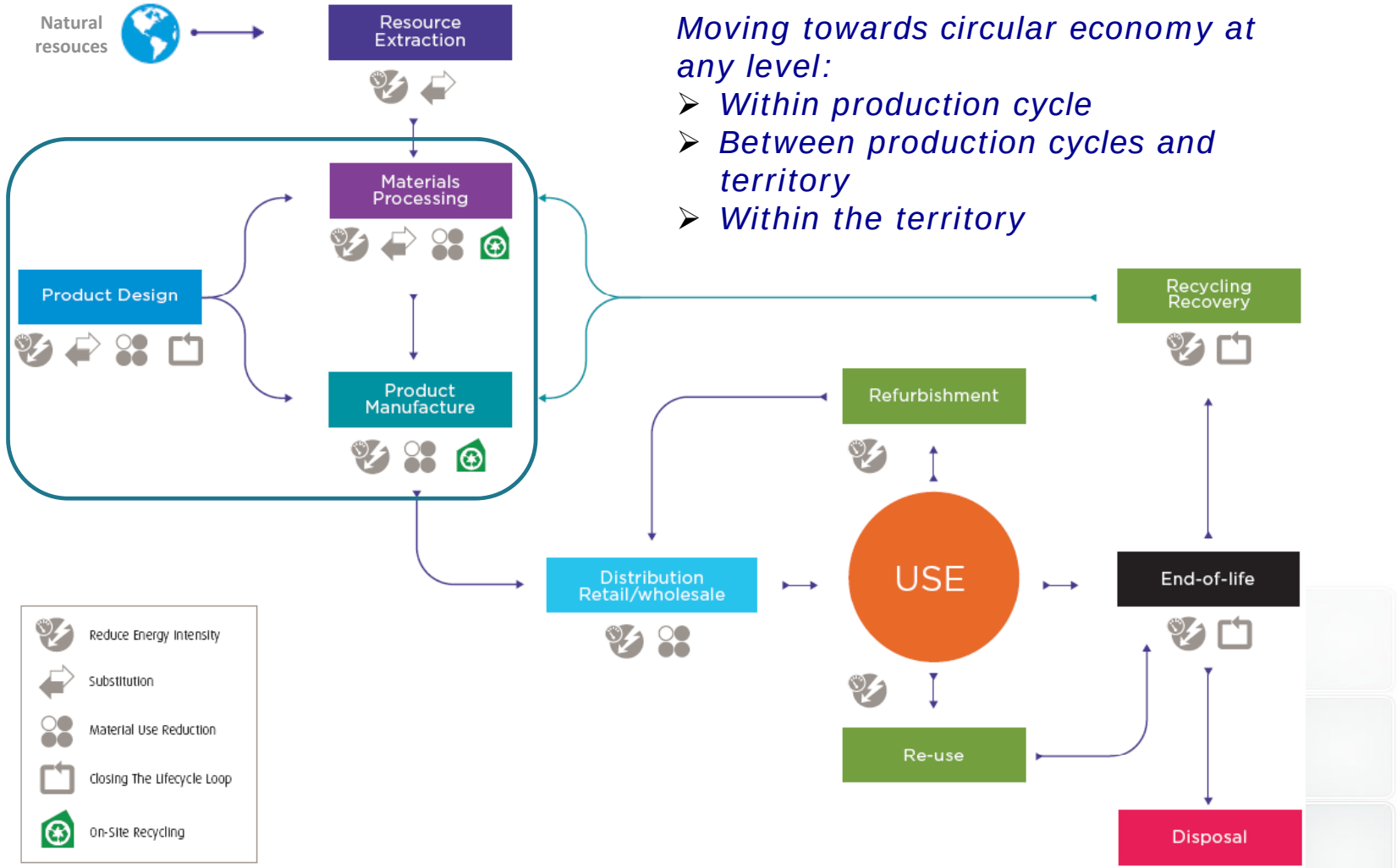
Raw Materials Alternate Recycle Extract

Costs over Sale price (%)



Source: McKinsey Global Institute (2012), Operations Practice Manufacturing the future: The next era of global growth and innovation (2006 data)

From linear economy to circular economy



Moving towards circular economy at any level:

- *Within production cycle*
- *Between production cycles and territory*
- *Within the territory*

Eco-innovation

Definition

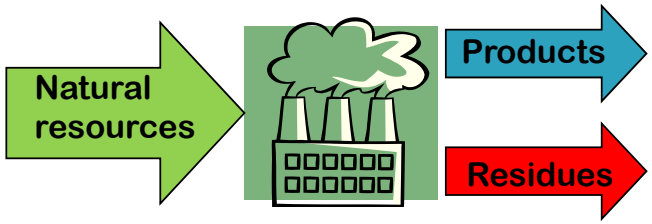
[..] the use of a new product, process, management system, service or procedure, aimed at a reduction in the flow of materials, energy consumption, pollution and other factors of pressure on 'environment and society with respect to the relevant alternatives, all along the life cycle. Such kind of activity has the capacity to create value and meet the needs of consumers in respect of social and environmental standards.

- **Green Economy essential tool**
  - Objective: radical change towards a systems of production and consumption based on a sustainable supply and use of resources and on a reduction / elimination of emissions aiming to a full decoupling among economic growth, environmental impacts and resources consumption.
  - Path: a tool to be applied not only to the field of so-called "eco-industries" but to the entire production of goods and services and lifestyles.
  - Effects: on the environment, economy and society.

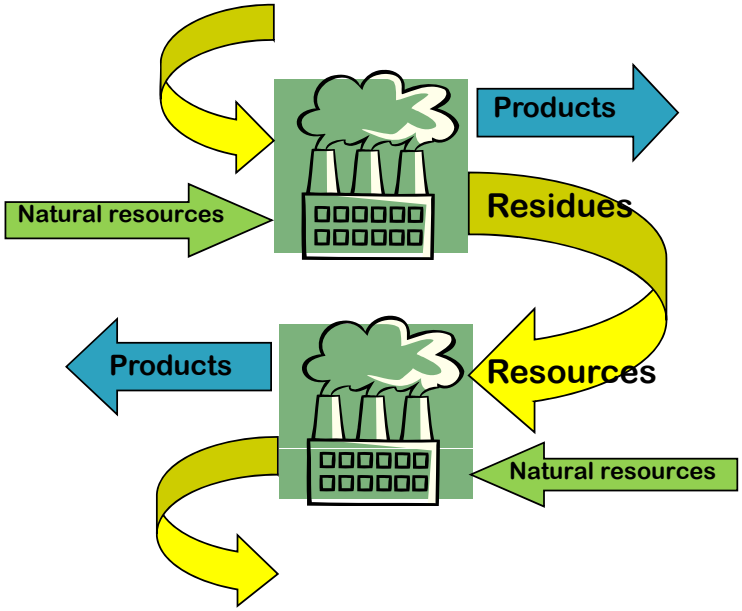
Industrial symbiosis

"…the set of resources exchanges between two or more dissimilar industries…"

Linear system



Transition to a circular system



Economic benefits

- Decreasing raw materials and energy supply costs
- Reducing industrial waste management costs
- Business opportunities between companies

Environmental benefits

- Reducing resources consumption, pollutant emissions, waste production and landfilling

Results of the National Industrial Symbiosis Programme (NISP – UK) 2005 - 2012

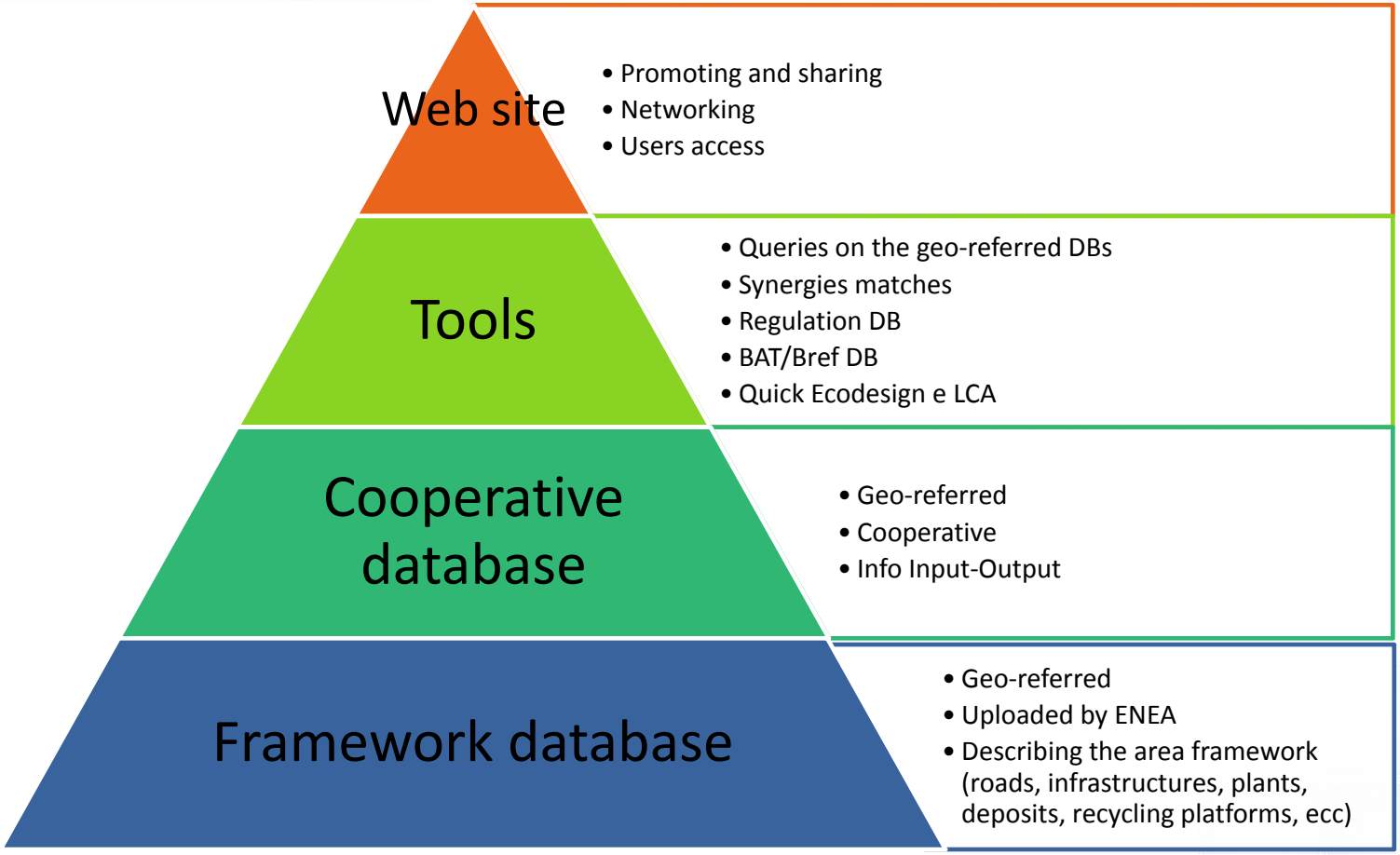
International Synergies
industrial ecology solutions

METRICS	In Year Benefits*	Lifetime Impact (Max 5 year)
Landfill diversion	9 million tonnes	45 million tonnes
CO_2 reduction	8 million tonnes	39 million tonnes
Virgin material savings	12 million tonnes	58 million tonnes
Hazardous waste eliminated	0.4 million tonnes	2 million tonnes
Water savings	14 million tonnes	71 million tonnes
Cost savings	€243 million	€1.21 billion
Additional sales	€234 million	€1.71 billion
Jobs	10,000+	???
Private investment	€374 million	???

€40 million investment since 2005
*all outputs independently verified

Rate Euro £1 = €1.18

The Industrial Symbiosis Platform



SYMBIOSIS
Piattaforma di simbiosi industriale

www.industrialsymbiosis.it

Urban waste: problem or resource?

Urban mining potential from WEEE

	Primary extraction in 2011 [t]	Estimated world reserves [t]	Potential secondary recovery from WEEE [t]	Average content in medium grade ore [g/t]	Average content in printed circuit boards [g/t]
Gold	2.700	51.000	4.000	5 - 10	80 - 1000
Silver	23.800	530.000	10.000	200 - 400	200 – 3.300
Platinum	192	66.000 (PGMs)	1.000	4 - 6	20 - 40
Palladium	207	66.000 (PGMs)	2.500	4 - 12	50 - 120
Copper	16.100.000	690.000.000	8.000.000	6.000 – 45.000	160.000 – 345.000

Source: E Waste Lab, Remedia, PoliMI, 2012; Effective electronic waste management and recycling process involving formal and non-formal sectors, 2009

Materials and energy recovery from waste electric and electronic equipments (WEEE) – An example

EoL PCs temporary storage → Manual dismantling of single components → Social jobs

Collectors

Batteries
Li, Co

LCD flat screens
In, Sn, Y, Eu, La, Ce, Tb, Ga

Printed Circuit Boards
Au, Ag, Sn, Cu, Pb, Fe, Ta, Pd, plastic

Loud speakers
Nd, Pr

Hard disks
Nd, Pr, Dy, Au, Pd, Pt, Rh, Ru, Ta, plastic

Plastic Case
Materials: Syngas, chemicals, active carbons

Energy: heat, electric energy

Product centric approach

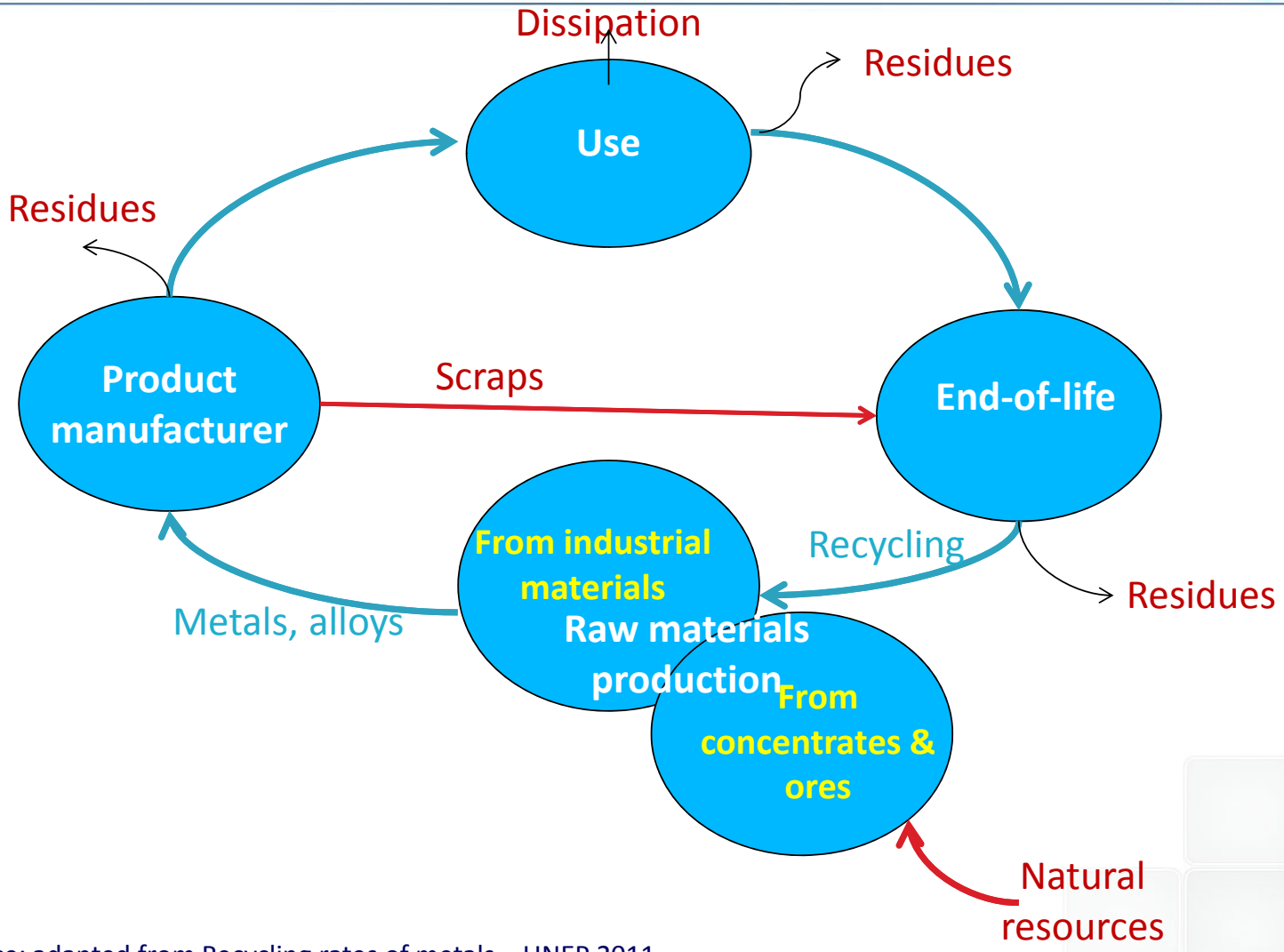
Ecological footprint: mining vs recycling

Emissions per metal in ton of CO_2

Metal	Scenario 1 primary mining	Scenario 2a Manual dismantling/ smelting India	Scenario 2b Mechanical dismantling /smelting India	Scenario 2c Manual dismantling /smelting Europe	Scenario 2d Mechanical dismantling/ smelting Europe
Aluminium	10	0,87	0,94	0,75	0,82
Nickel	20	4,8	6,7	4,7	6,6
Copper	3,4	1,2	1,5	0,98	1,2
Gold	17.000	710	1.330	690	1.300
Silver	140	20	40	20	40
Palladium	9.400	210	730	200	720

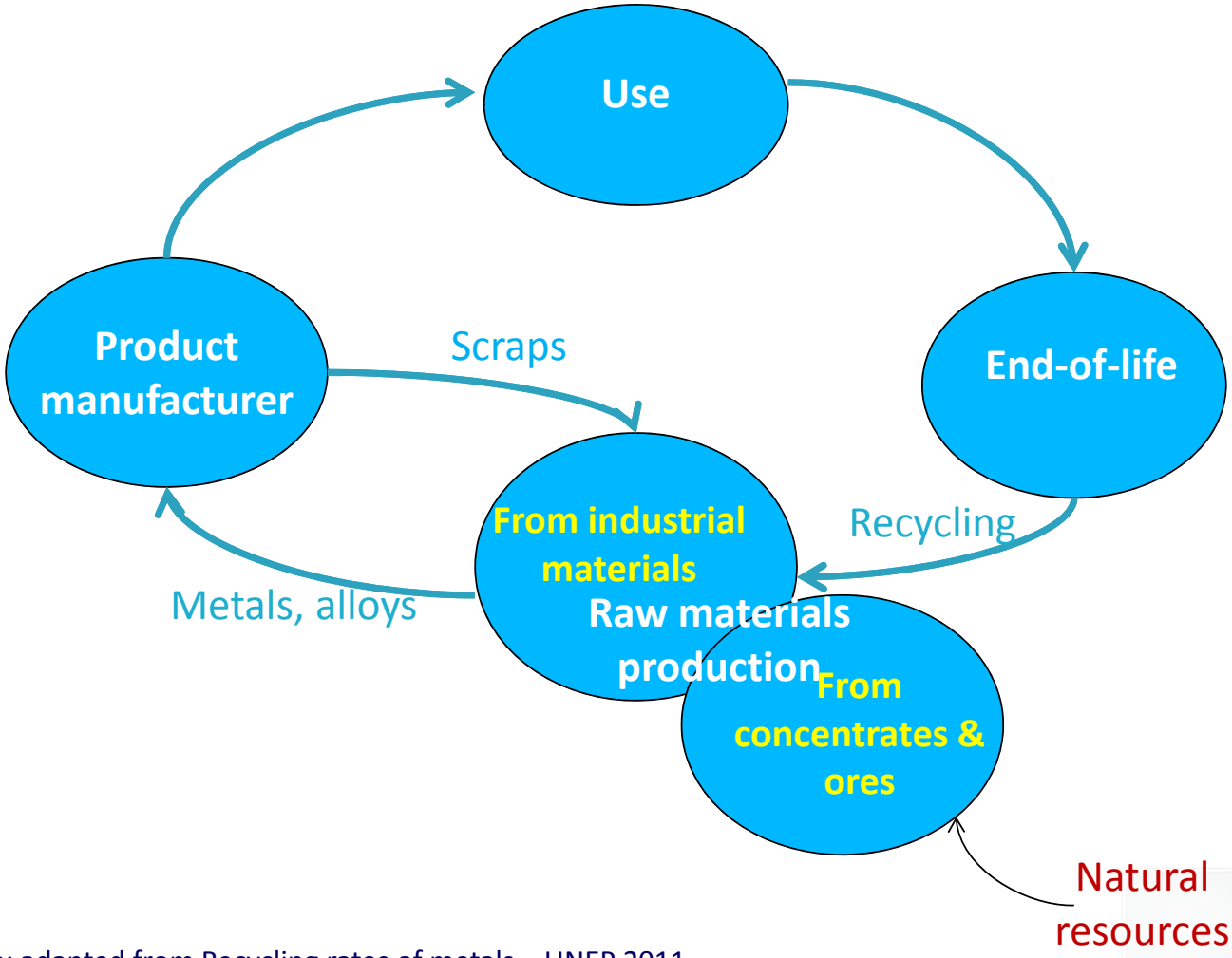
Source: Carbon Footprint of E-waste Recycling Scenarios in India: Frederik Eisinger Ronjon Chakrabarti, Christine Kruger, Johannes Alexeew; 2011

Life cycle of materials



Source: adapted from Recycling rates of metals – UNEP 2011

Closed cycle of materials



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