

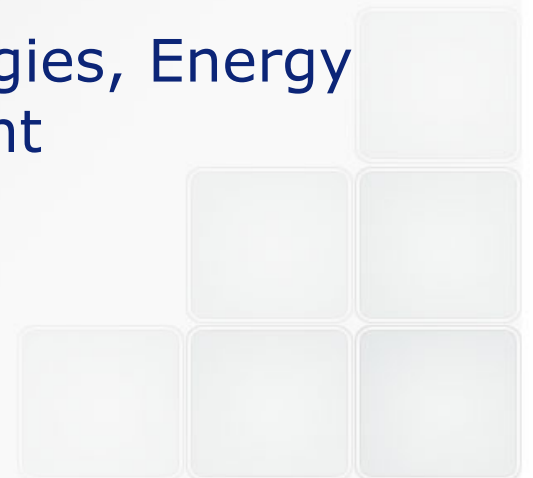


ENEA experiences in R&D of eco-innovation in Italy

Dr Grazia Barberio
Senior researcher

ENEA - Italian National Agency for New Technologies, Energy
and Sustainable Economic Development

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From crises to opportunity



New economic paradigm in which the economic growth is delivered without expenses of environmental quality, human well-being, social disparities.

Eco-innovation is the tool for realising Green Economy

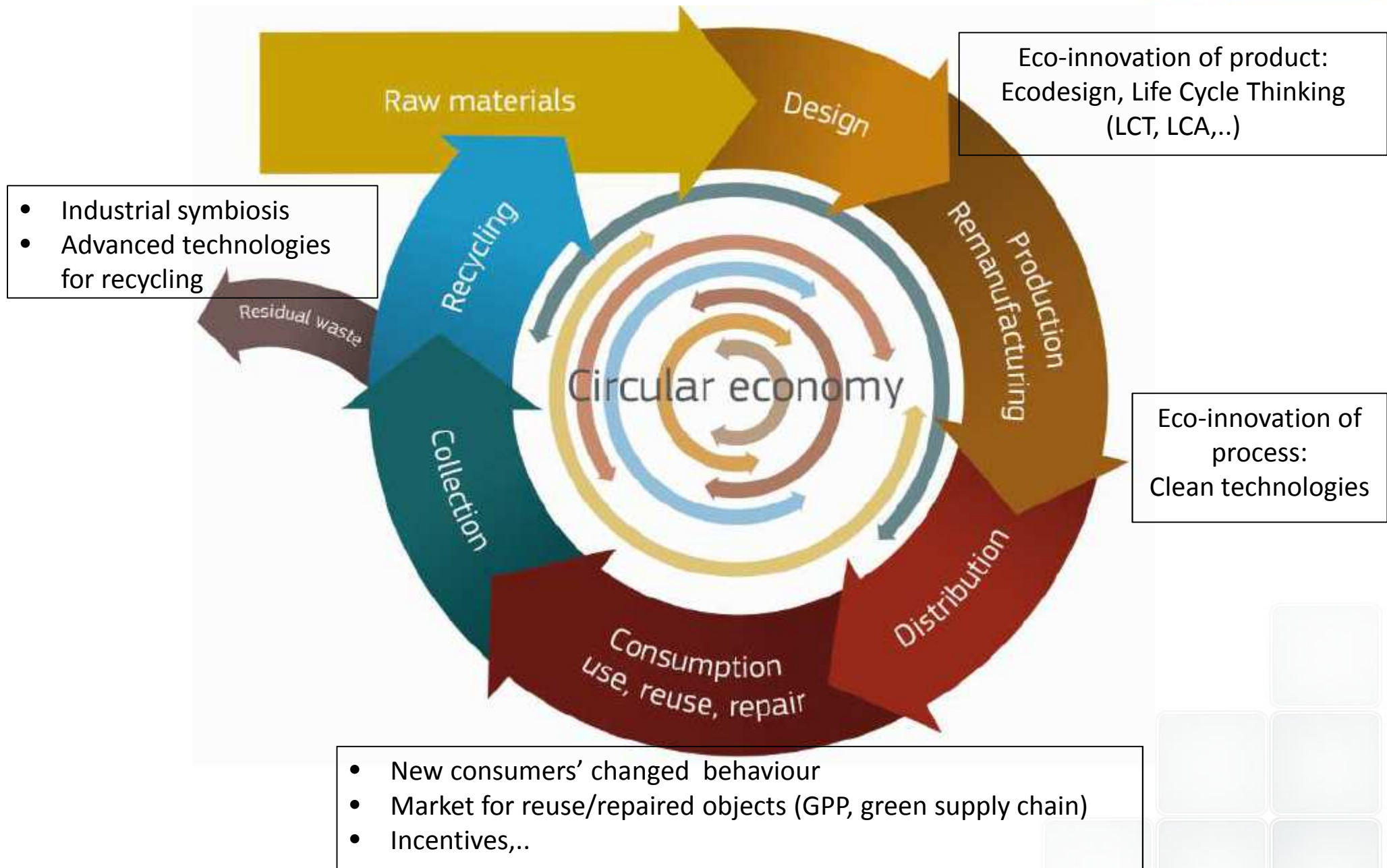
Low carbon society

- Roadmap for moving to a competitive low-carbon economy in 2050
- Conference of the Parties (COP21, Paris 2015)

Recycling society (resource efficiency)

- Resource Efficient Europe flagship initiative and Roadmap for a Resource Efficient Europe
- Integrated strategy on Raw Materials (RM)
- Knowledge Innovation Community on RM
- G7 Alliance on Resource Efficiency

From linear economy to circular economy



URBAN MINING: Example of recovery from waste electric and electronic equipments (WEEE)



EoL PCs temporary storage
Collectors



Manual dismantling of single components



Social jobs



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

ENEA patent

Product centric approach

Demonstration plant ROMEO - Recycling Of MEtals by hydrOmetallurgy



On the basis of the patented process, a pilot plant ROMEO (Recycling Of MEtals by hydrOmetallurgy), was designed and will be realized at ENEA Research Center (Rome). The pilot plant, specifically studied for treating up to 150kg of electronic circuit boards per day, will allow checking the process operation and its technical and economic efficiency.

Advantages and Innovations

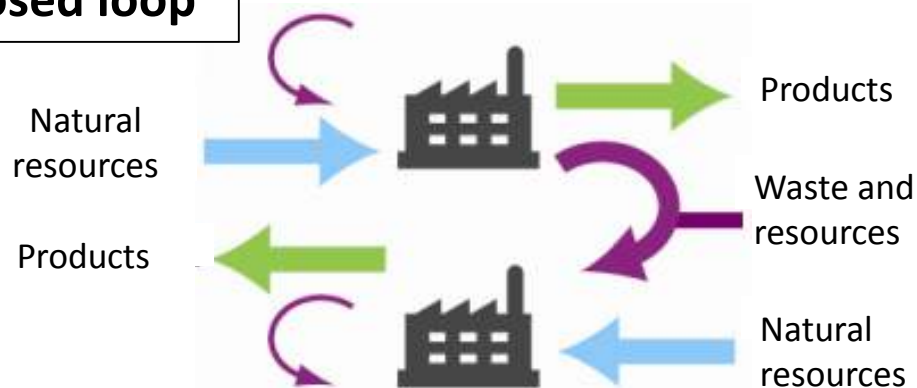
- Possibility to treat the whole circuit board
- Possibility to recover Au and Sn at the first process step
- Possibility to obtain recovered materials at a various purity grade according to the demand (thus being an ideal test-bench for the development of the recovering processes of metals of strategic interest).
- Possibility to be applied on small plants, as a consequence being socially acceptable and bringing a lower environment impact with respect to most common pyrometallurgic plants.
- Possibility to be applied to different waste

Pills of Industrial Symbiosis

Open system



Closed loop



Economic advantages:

- costs reduction for raw materials and energy supply and for landfilling;
- creation of business network and new market opportunity.

Environmental advantages:

- optimizing the use of resources
- mitigation of pressure on environment, saving emissions and landfilling.

Social advantages:

- occupation (green jobs);
- cultural change (sharing economy).

*“Industrial symbiosis engages **traditionally separate** industries and other organisations in a **network** to foster **innovative strategies** for more sustainable resource use (including materials, energy, water, assets, expertise, logistics etc)”*
(Lombardi & Laybourn, 2012)

Waste from one industry can become resource for other industries (“synergy”)

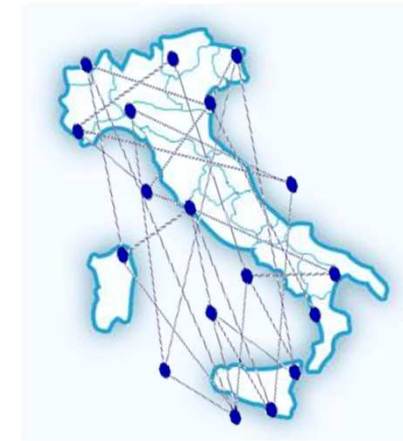
ENEA ongoing activities on Industrial Symbiosis



Industrial Symbiosis **platform**:
www.industrialsymbiosis.it



Symbiosis Users **Network**: Italian network of
Industrial Symbiosis, promoted by ENEA.
www.sunetwork.it



Eur-ISA, launched on November 6th 2013, aims to connect the industrial symbiosis **networks across European** member states.

ENEA is a founding member (with Belgium, Denmark, England, Finland, Hungary, Ireland, Netherlands, Northern Ireland and Turkey). www.eur-isa.org

Thanks for your attention



ENEA – Technical Unit for environmental technologies



grazia.barberio@enea.it



web sites:

www.enea.it

www.sunetwork.it

www.industrialsymbiosis.it



SUN Piattaforma Simbiosi industriale - ***Symbiosis Users Network***

