Istituto di Tecnologie Industriali e Automazione
Consiglio Nazionale delle Ricerche

Interreg Mediterranean
EUROPEAN UNION
GREENOMED

from research …. to market

Companies' challenges for green manufacturing

Golboo Pourabdollahian (CNR-ITIA)

First GREENOMED conference
07 March 2018
Thessaloniki, Greece

About ITIA-CNR

MILANO HEADQUARTER

STRATEGIC DIRECTION, ADMINISTRATION, RESEARCH ACTIVITIES PLANNING & MANAGEMENT, RTD&I LABORATORIES.

Personnel: 60 - Surface: 1.400 m²

VIGEVANO

RESEARCH AND DEVELOPMENT FOR THE ADAPTATION OF DESIGN AND PRODUCTION CONCERNS TO THE "MASS CUSTOMIZATION" PARADIGM.

Personnel: 12 - Surface: 1.000 m²

ROMA

STUDIES FOR THE MANAGEMENT OF PRODUCTION SYSTEM WITH EMPHASYS ON INTERNAL AND EXTERNAL LOGISTICS.

Personnel: 11 - Surface: 200 m²

BARI

INDUSTRIAL DEVELOPMENT ACTIVITIES OF NEW MANUFACTURING EQUIPMENTS ADDRESSED TO MECHATRONICS, MICRO MANUFACTURING AND AUGMENTED REALITY.

Personnel: 12 - Surface: 300 m²

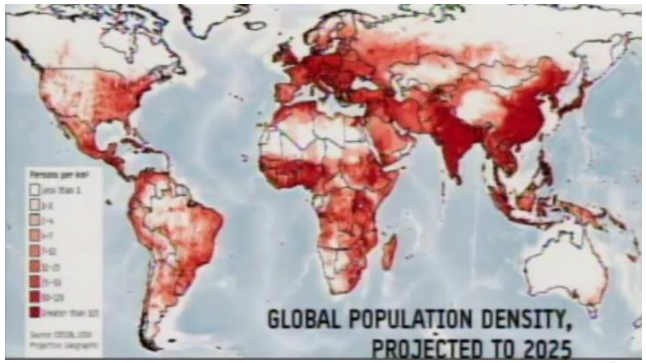
Why do we need Circular Economy?

- We use the natural resources of **1.6 planets** annually

- In 2016 we have used up our annual budget of planet's resources in **less than 8 months**

- With this consumption:
  - ~**46 years** to the end of oil
  - ~**161 years** to the end of natural gas
  - ~ **410 years** to the end of coal
  - We need from **5 to 10 planets**.

- Now, we are 7 billion but it is excepted to increase up to 9 billion in 2050

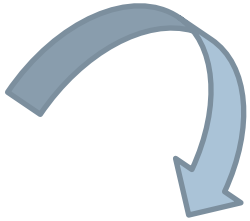


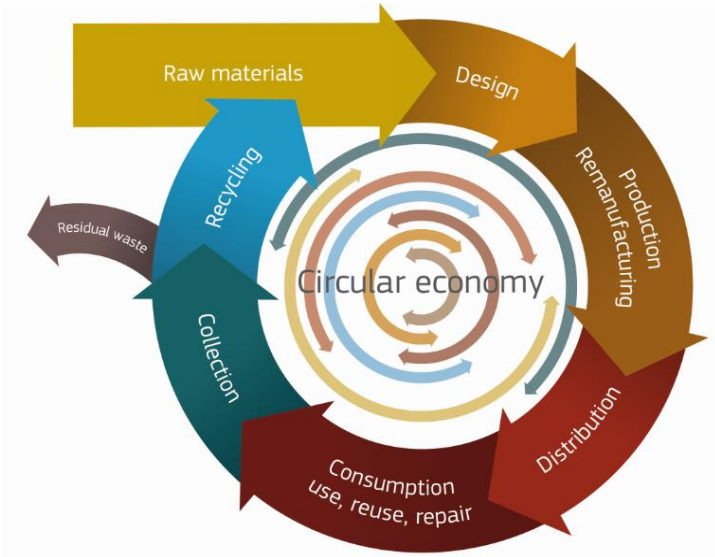
Why do we need Circular Economy in Europe?

- Europe **imports much more natural resources** that it exports
- Europe is vulnerable to **volatile raw material prices**
- Europe still generate about **five tonnes of waste per person per year** on average, and little more than a third of that is effectively recycled
- Europe has to secure **competitive, affordable and sustainable** sources of energy

The concept of Circular Economy

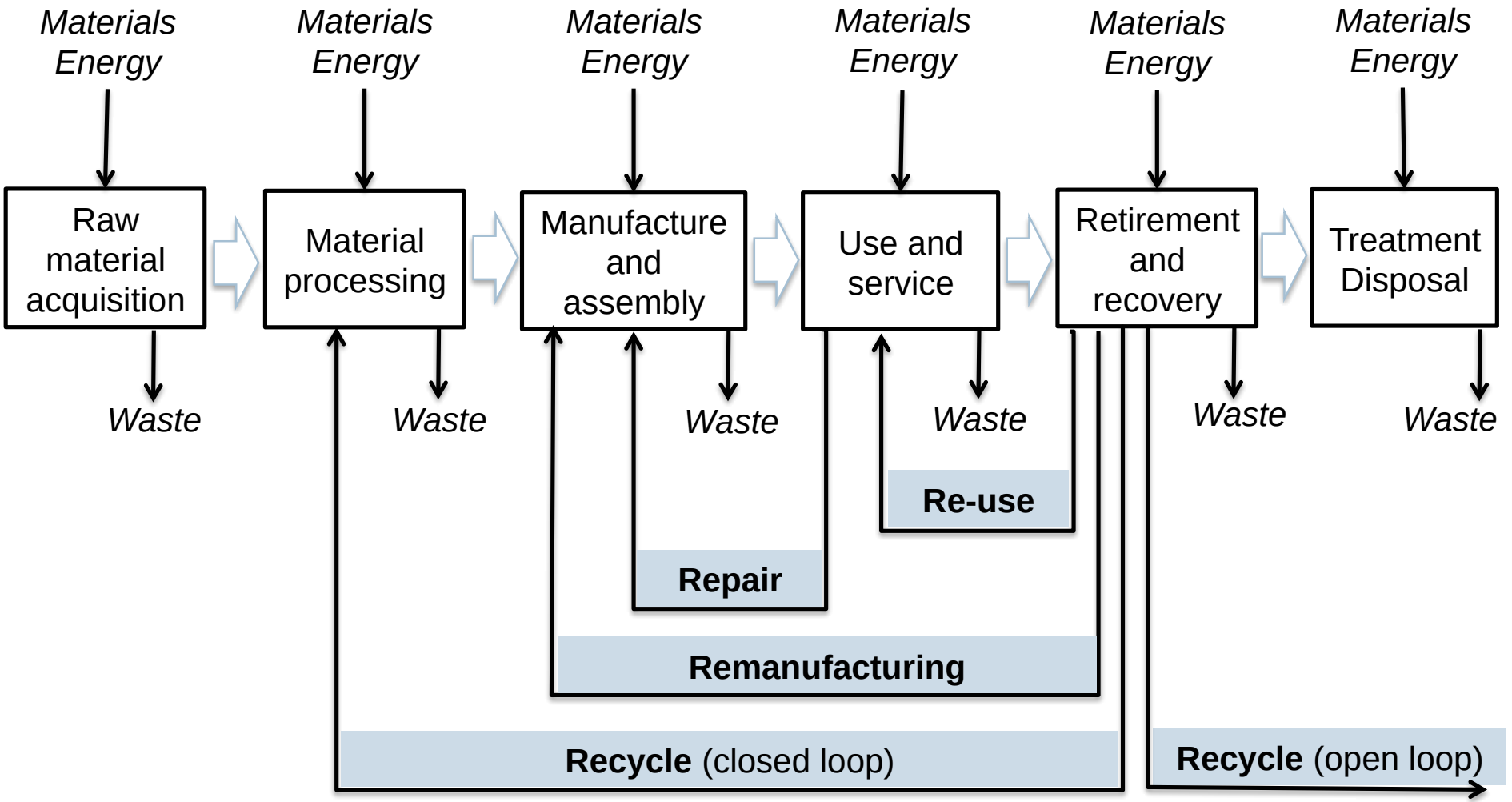
A circular economy is an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life.





EU – Towards a circular economy, a zero waste programme for Europe, COM (2014) 398 final

Processes of Circular Economy



Benefits of Circular Economy

ENVIRONMENTAL advantages

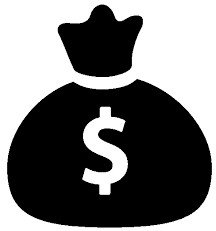
- Reduced emissions in the production processes
- Less material and energy usage
- Less waste production

But.... the value of Circular Economy is NOT ONLY environmental

Benefits of Circular Economy

FINANCIALS

- Increase profits through reduction of production costs (e.g. less material/energy)
- Leveling incomes in low-turn economy periods (for example, when customers do not have money to buy products, they would be able to buy products with recycled/reused material)



MARKETING

- Offer differentiation
- New and emerging markets

STRATEGIC

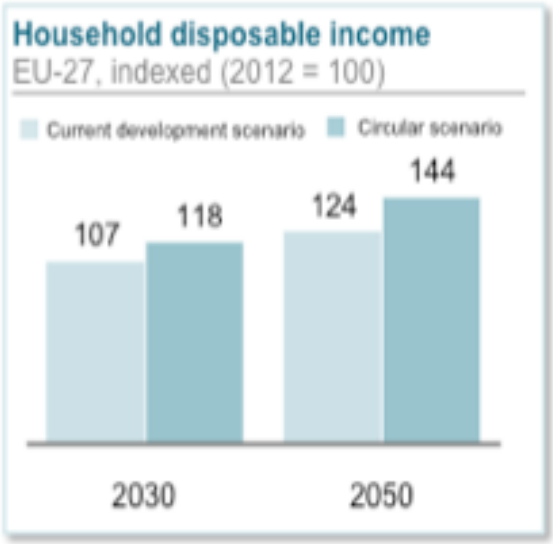
- Put strategic barriers to low-cost competitors by shifting competition from virgin materials to reused/recycled materials (design and use of products)

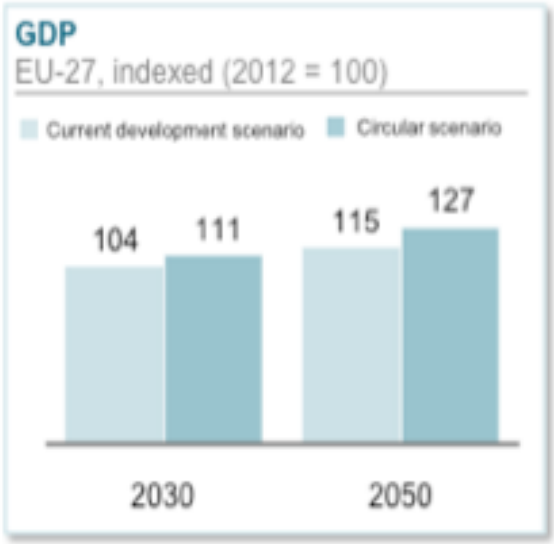
SOCIAL

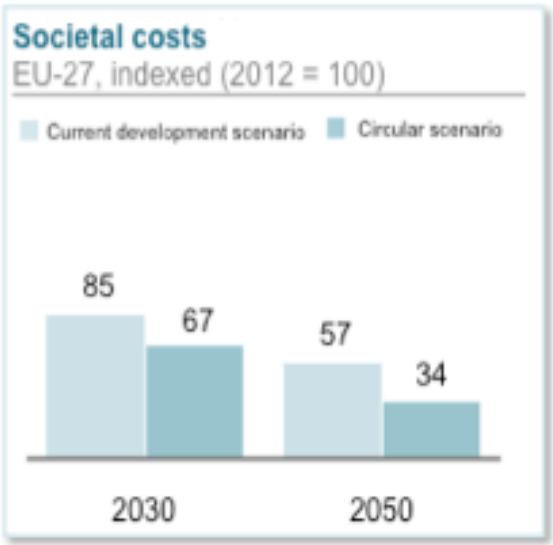
- Allow more customers to have access to complex and/or expensive products
- Promotion of environmental friendly behavior and consumption

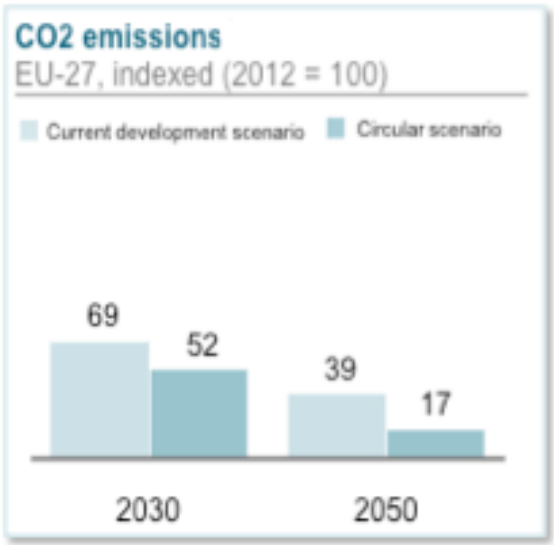
Comparison of potential development paths

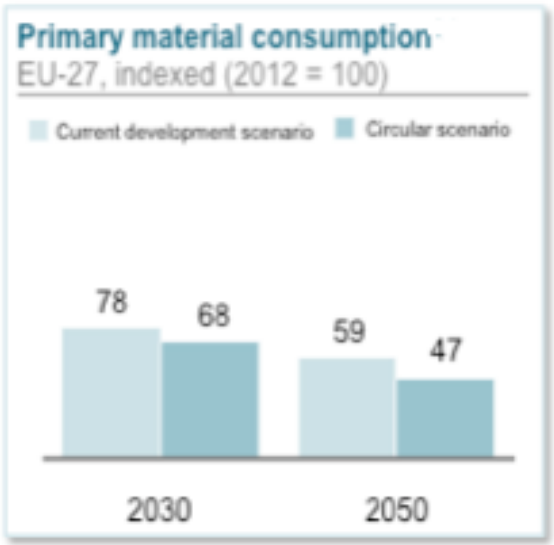
EU-27, indexed (2012 = 100)











Ellen Macarthur foundation

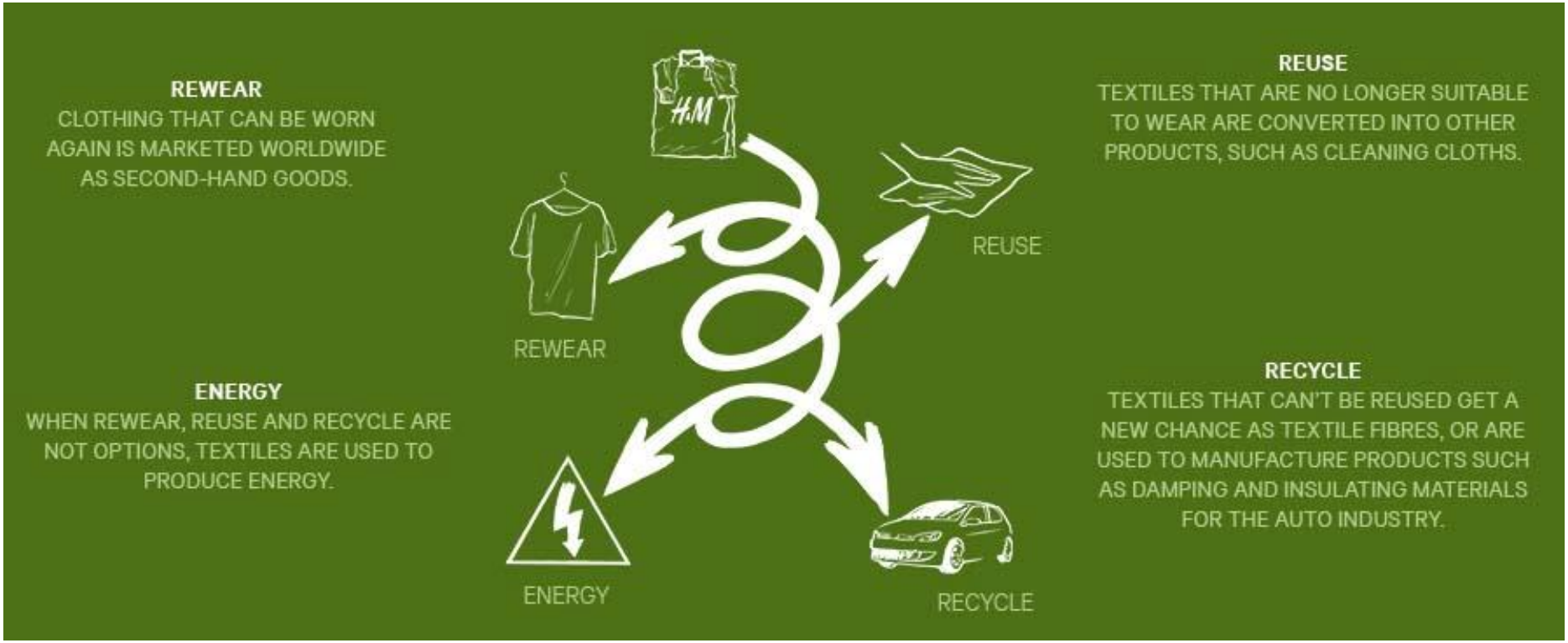
Example of pioneers: KYOCERA

The Japanese electronics firm Kyocera was an early pioneer of refillable toner cartridges.

KYOCERA Document Solutions has established a **resource recycling system**. Under this system, all collected used products are transported to **recycling centers** operated by KYOCERA Document Solutions **and carefully disassembled by hand**. After that, an inspection identical to that conducted on newly manufactured parts is conducted on the disassembled parts; **reusable parts are reused while any parts not reusable are recycled to the utmost extent**.

https://www.kyoceradocumentsolutions.co.za/index/environment/recycle_and_reuse.html

Example of pioneers: H&M



- Since the start in 2013, collecting **over 22,000 tonnes** of old garments.
- Most of the fibers are **REUSED** as second hand clothes, or cleaning cloths or into the first new yarn to make new clothes.

According to the customer surveys:

- the **awareness of the garment collecting** program increased significantly amongst H&M customers.

Implementation of circular economy and green manufacturing technologies is challenging for companies

Largely unexploited potential

Largely unexploited potential

The case of Printed Circuit Boards

70-80% of PCBs globally disposed are treated in China

- **Very low recycle** rate (about 50%)
- **Low purity** of recycled materials
- **No reuse/remanufacturing**
- **Dramatic environmental impact**

Source: UNU report 2012

Challenges of circular economy

Why?

- **Extreme variability and uncertainty of input** in terms of typology and conditions
- **Shorter life-cycle** of products
- **Intrinsic complexity** of disassembly, inspection, repair and recycling operations

No automatic flexible technologies are currently available (at sustainable cost)

Furthermore:

- **Process fragmentation** and **no optimization at system level**
- **No reference business models** of proven success, especially for SMEs

Source: Duflou et al., 2008

Challenges of circular economy

- **Lack of skills and knowledge**→ Companies have traditional knowledge in design and manufacturing of new products
- Complexity of **regulation**
- **Lack of cultural readiness** of companies and end-users
- **Cannibalization**

Challenges of circular economy

Impact on the organization

Pilot Plants

Promote the development of joint pilot plants and demonstrators

Open Facilities where companies (including SMEs) can find:

- Innovative technologies
- Multi-disciplinary competences (technology, business, innovation)
- A network of innovative technology and service suppliers

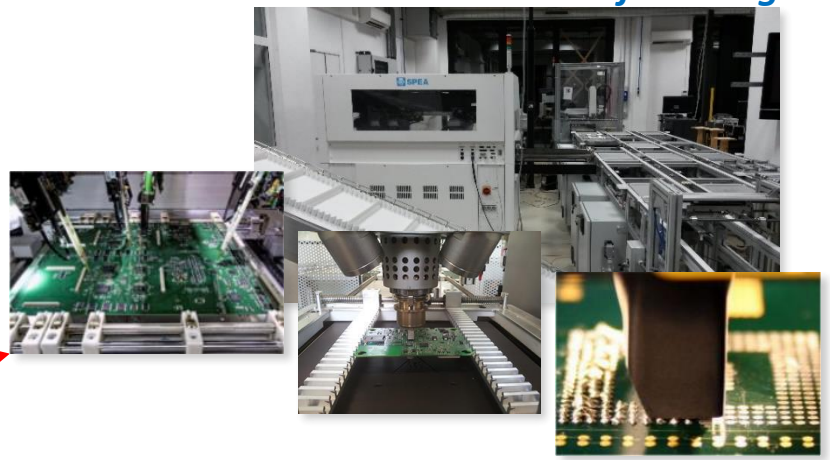
To understand, test, set-up and uptake innovative technologies and methods

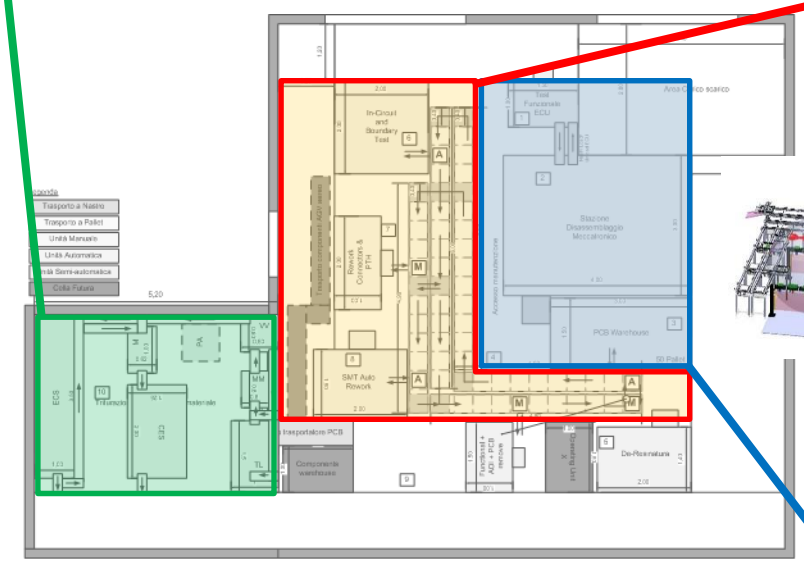
De-and remanufacturing Plant: Research/ Teaching Factory

An integrated Pilot Plant for the remanufacturing and recycling of mechatronic components (automotive, large machinery, electronics, white goods), is being designed and installed at ITIA-CNR (January 2013). The pilot project was funded by Regione Lombardia with a grant of 1.5 Million Euro.

Cell 3: Recycling

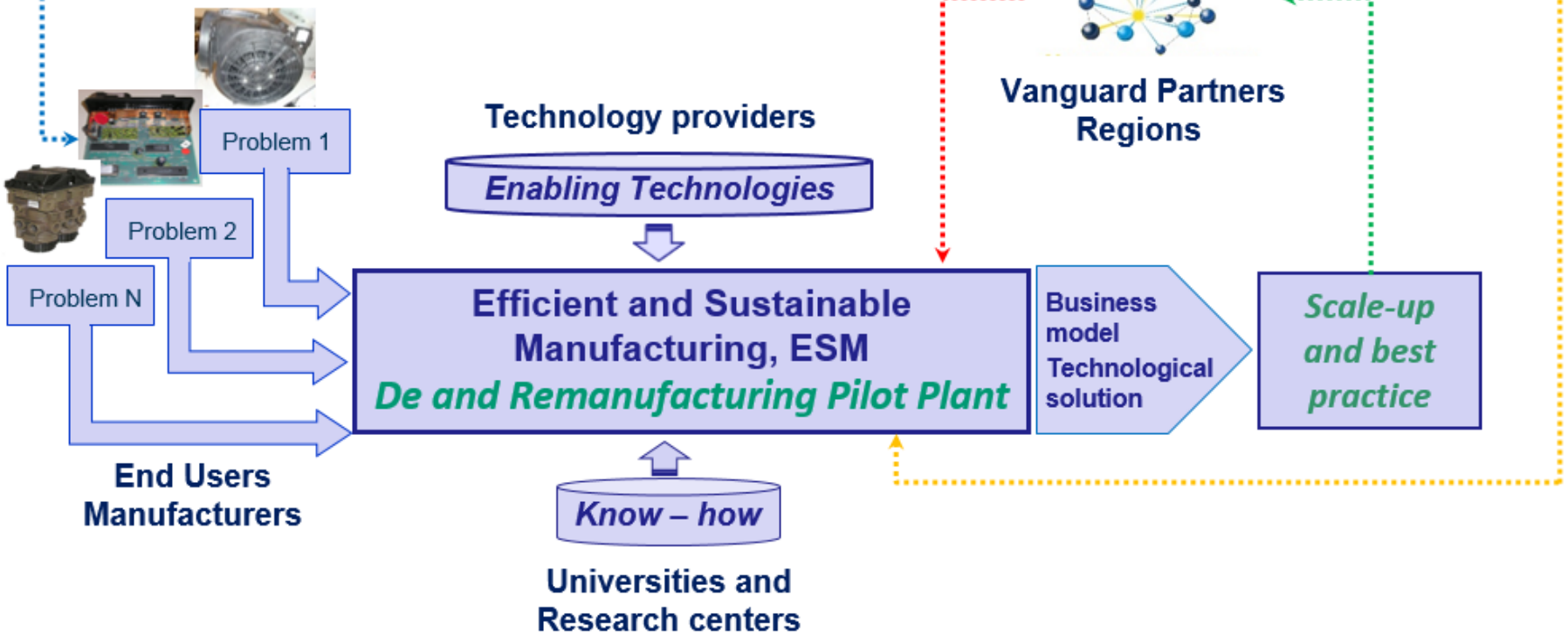
Cell 2: Remanufacturing





Cell 1: Disassembly

Pilot Plants



Pilot Plants

Investigate innovative de- and re-manufacturing process-chains to recover functions and materials (e.g. key metals, rare earths) from high value post-use electronics.

An Italian TLC company which design, develops and implements, electronic products and solutions for Next-Generation Networks services.

- 24 millions of telephone lines installed worldwide and 8 millions of hardware units (boards, shelves, cabinets).
- 80% of them are still working and expected to be dismissed in the next years.

Goal:

•Re-use components.

•Recover high-value materials

Expected Impacts:

•8M€ increase in revenues per year for the company.

•Pay back time of the investment is 2 years.

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Thank you for your attention!

For further information:

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