

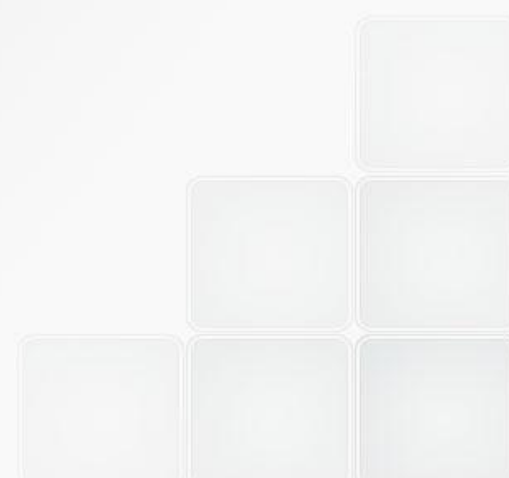


High added value materials from waste tyre gasification residues

Sustainability assessment and analysis of future scenarios for waste tyres

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Ecomondo - Rimini, 10/11/2011

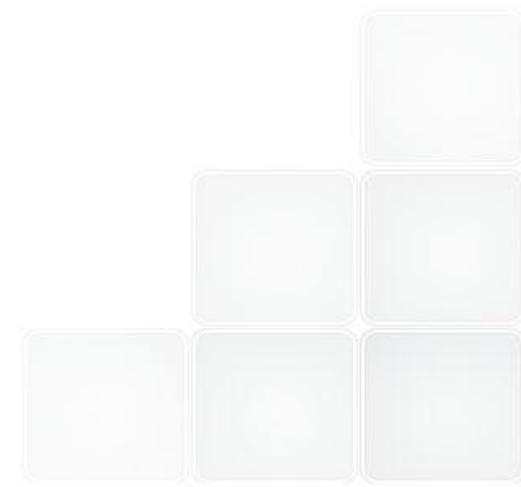


WP7-Sustainability assessment



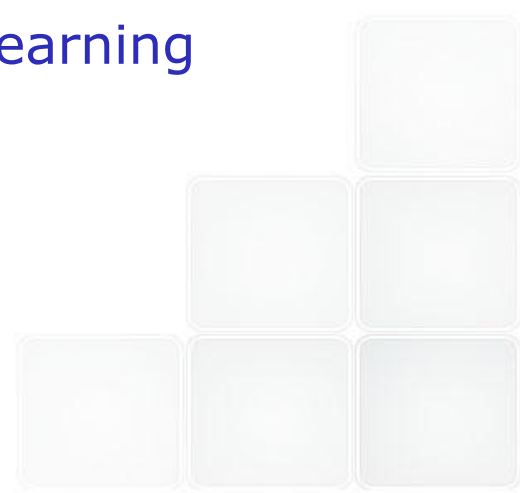
Objective: Sustainability assessment of TyGRe technology and analysis of future scenarios

Partners: ENEA UTVALAMB-LCA (Technical Unit Models, Methods and Technologies for the Environmental Assessment - Laboratory of Life Cycle Assessment and Eco-design)
FEBE ECOLOGIC
ETRA



UTVALAMB-LCA Activities

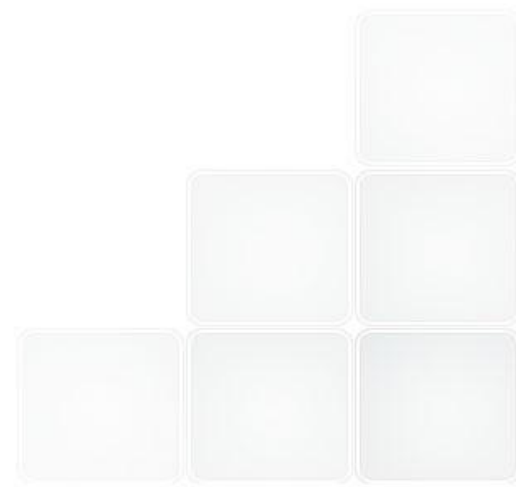
- Sustainability Assessment based on the Life Cycle approach:
 - Methodological development (CALCAS project)
 - Assessment of new technologies: besides TyGRe, the Lab is now involved in two projects funded by FP7, NanoHex and LAMP, on applications of nanomaterials, and a project on solutions for the production of electricity and heat from the car-fluff, financed by a private-public partnership initiative (Tekné projects)
 - Assessment of product/services (agrifood, biofuels, building and construction etc.)
- Products eco-innovation: development of methodologies and tools, especially for SMEs (ecosmes.net, LAIPP, ACTCLEAN, GENESI, LECOP/Emilia-Romagna High Technology Network)
- Training and dissemination (Italian LCA Network, e-learning courses, training for enterprises, etc.)



- FEBE ECOLOGIC was founded as a "spin-off" of ENEA in 2000
- For 12 years FEBE ECOLOGIC has been supporting organizations in strengthening and valorising their products and corporate sustainability thanks to experienced consulting and training services, and powerful software solutions.
- By the quantification of life cycle impacts related to products and technologies FEBE ECOLOGIC helps to assess, manage, improve and communicate environmental performance.
- Since 2001 FEBE ECOLOGIC has been collaborating with PE INTERNATIONAL, a global leader in sustainability consultancy with subsidiaries and activities in several countries in the world (www.pe-international.com)
- FEBE ECOLOGIC is active in the Italian and Hungarian market, and participates in international projects (see www.febe-ecologic.it for more information)

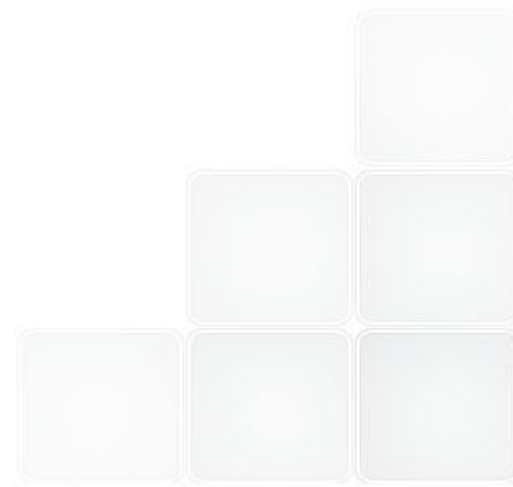


Next presentation (WP8)



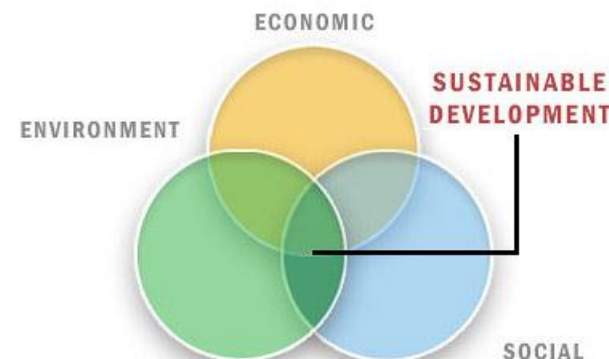
Outline

- What's sustainability assessment of technologies (SAT)?
- The framework for SAT in TyGRe: Life Cycle Thinking and operative tools
- The case study
- Expected results and conclusions



What's Sustainable Technology?

- **Sustainable development** is development that meets present and future generations needs. Its challenges are located in the domains of **social, economic and ecological concerns**.
- Technologies, which have played a significant role in creating the problems that we have to face, can also play a relevant role in solving them, but...
 - How can we **know in advance** that changes brought by new technologies will make our society more sustainable?
 - Is it enough to assess the **inherent sustainability** of a technology or do we need to take into account **other aspects** related to the management of the technology, its pervasiveness and interaction with other technological systems?

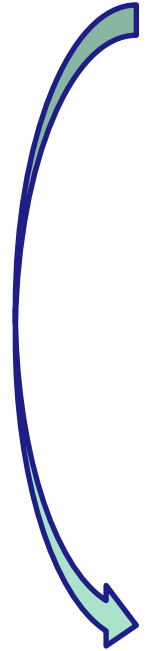


A contribution of the EU FP7

(Theme 6-Environment/Environmental Technologies)

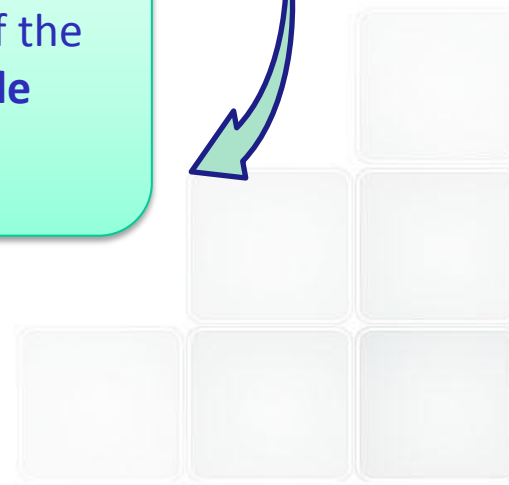
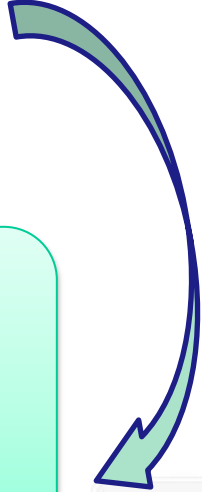
Research can give a contribution to:

- develop **harmonised methods**, including environmental, economic and social indicators, for the assessment of the degree of sustainability of the existing and the future technologies.
- **verify** the suitability of the assessment methods



PROSUITE project aims to develop a framework methodology, operational methods and tools for the **Sustainability Assessment of technologies** over their **life cycle**.

TyGRe project includes the Sustainability assessment of the technology by using **life cycle based operative tools**.



The Life Cycle Thinking approach

LCT avoids potential shift of burdens

- from one stage of the life cycle to another
- from one environmental medium to another
- from one location to another
- across different impacts (economic, environmental, social)
- from the present to the future



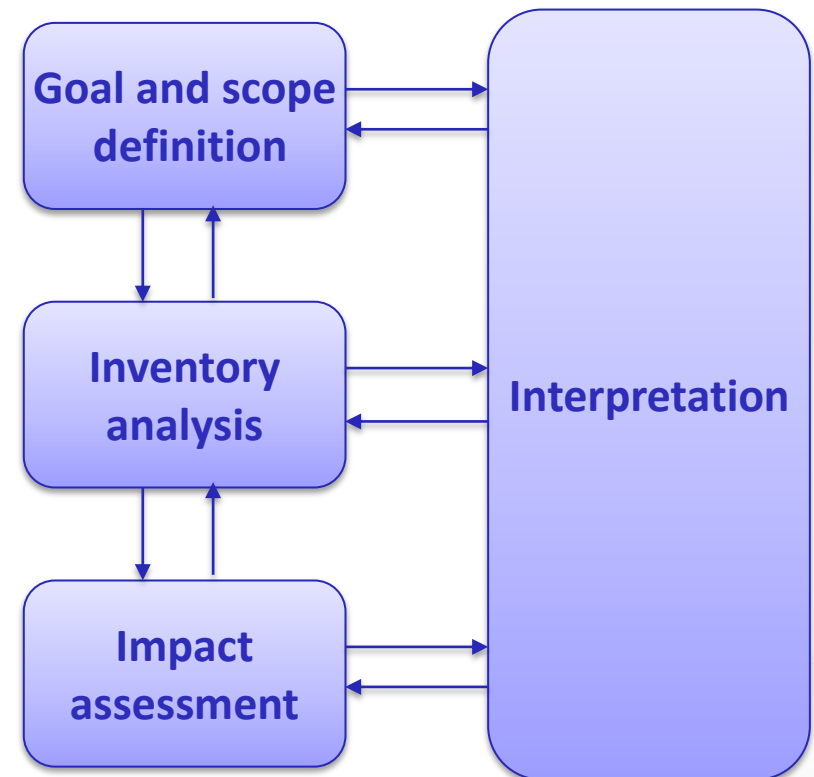
Source: National Institute of Standards and Technology

Operative tools (three dimensions of sustainability and the same methodological framework):

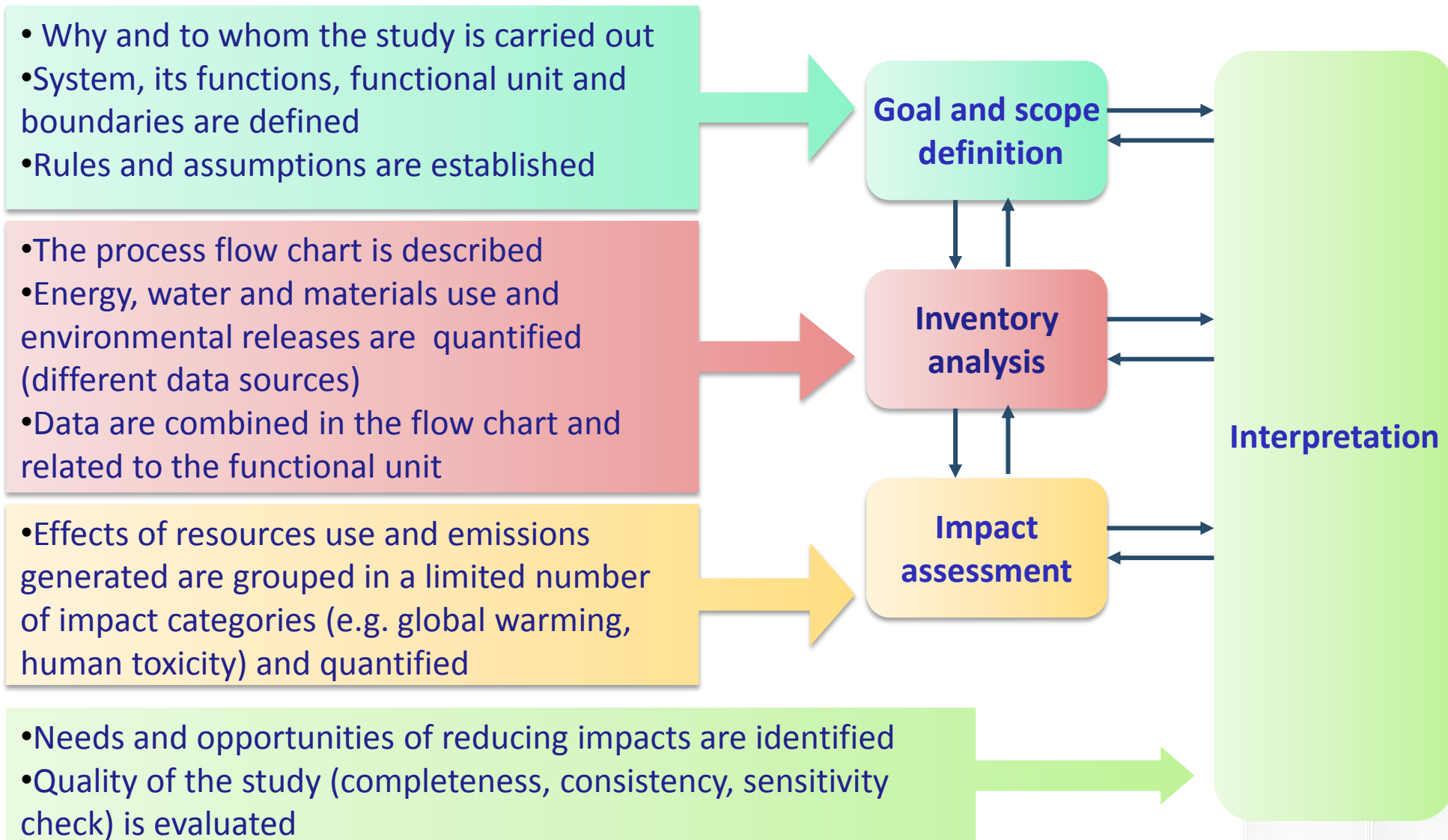
- Life Cycle Assessment (**LCA**)
- Life Cycle Costing (**LCC**) and
- Social Life Cycle Assessment (**S-LCA**)

Life Cycle Assessment

- LCA is a tool for the systematic evaluation of the **environmental** aspects of a product or service system through **all stages of its life cycle**.
- LCA provides scientific and quantitative information to **identify/prevent environmental burdens**.
- **ISO 14040** and **14044** provide the general framework for LCA
- The **ILCD Handbook** gives comprehensive guidance for LCA studies
(<http://lct.jrc.ec.europa.eu>)

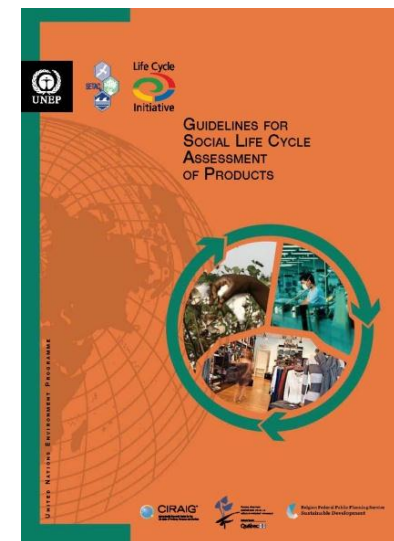
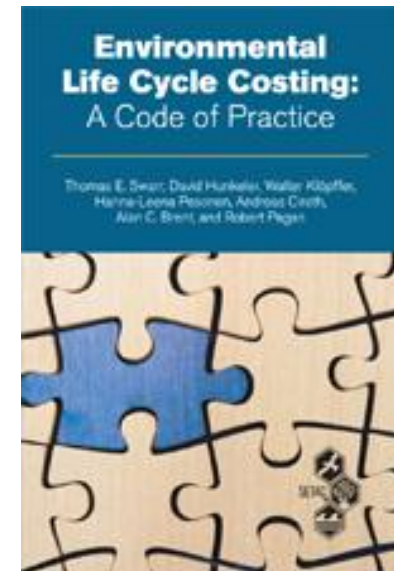


Main steps of an LCA study



LCC and Social LCA

- Life Cycle Costing is a compilation and assessment of all costs related to a product. **Environmental LCC** is applied in parallel to an LCA and is defined as *"assessment of all costs associated with the life cycle of a product that are directly covered by one or more of the actors of the life cycle, including externalities that will be internalised in the near future"*.
- Social LCA (S-LCA) is a systematic process of collecting and reporting about **social impacts** (positive and negative) in **product's life cycle**.



The TyGRe case study

- LCA, LCC and S-LCA are applied to assess **TyGRe** in comparison with a **reference situation** of scrap tyres treatment:
 - Combustion with coal in cement kilns
- Functions performed by TyGRe plant:
 - End of life treatment of scrap tyres
 - Production of energy via gasification
 - SiC production

LCA enables the comparison of products/services performing the same functions.

Scenarios to be compared

Current Scenario

Tyres shredding and scraps production
Co-combustion of tyres in cement kilns
SiC synthesis (e.g. Acheson process)
Electricity production

New Scenario

Tyres shredding and scraps production
TyGRe (SiC and electricity production)
Combustion of coal in cement kilns



The approach adopted (1)

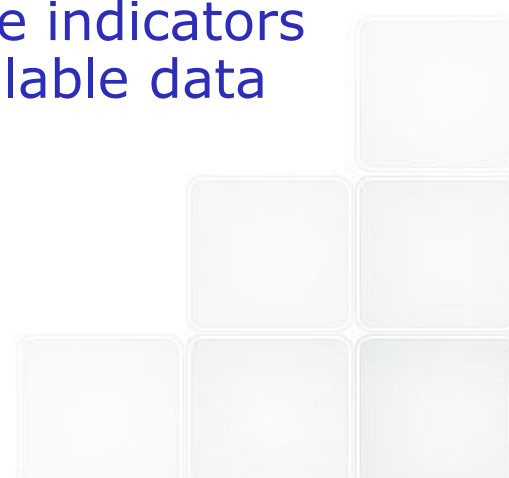
1. **Screening LCA** study of *New Scenario*:

- focus on the methodological issues
- definition of the system model and implementation in GaBi (software for LCA)
- inventory based on **laboratory data** (energy, materials, transport, main emissions)
- main environmental critical issues

2. **LCA and LCC studies** of *Current Scenario* mainly based on literature data and expert judgment.

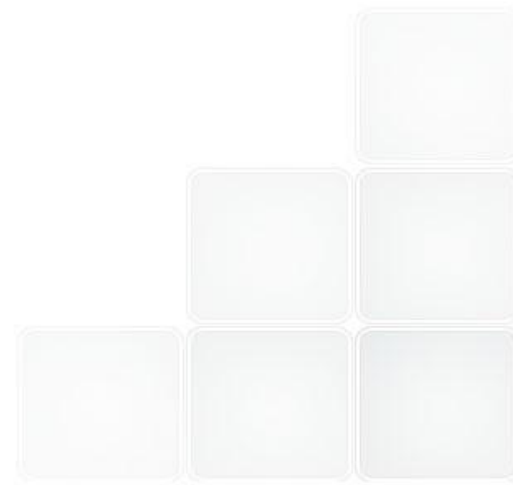
3. Assessment of the **social dimension** according to the UNEP-SETAC framework:

- definition of the most relevant social aspects, the indicators for the comparison of the scenarios and the available data sources
- S-LCA study



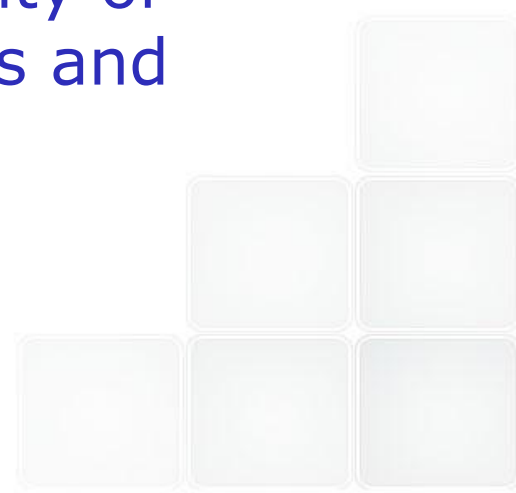
The approach adopted (2)

4. **Scale-up** and LCA and LCC studies of *New Scenario*:
 - Data collection on **pilot scale**
 - Definition of scaling-up criteria
5. **Comparison** between scenarios using the results of LCA, LCC and S-LCA
6. Assessment of **future scenarios**. Analysis will include future probable changes both in society and in technology and different degrees of pervasiveness of TyGRe technology.



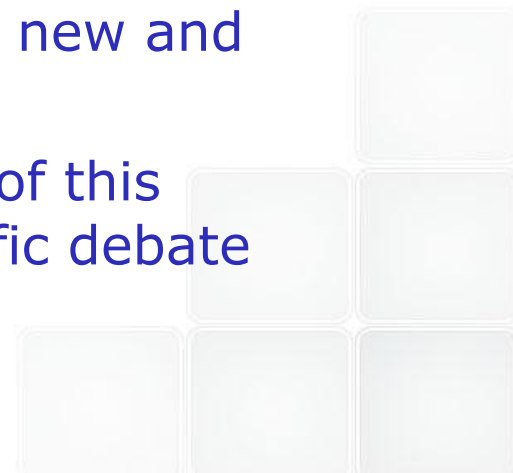
Main expected benefits

- The hot spots analysis and the assessment *ex-ante* of different options contribute to avoid shifting of burdens and to **anticipate the potential risks** of the technology investigated;
- The **systematic and comprehensive approach** contributes to analyse the opportunities for new markets and future scenarios;
- The study gives a contribution to the debate about the use of LCA+LCC+S-LCA for the sustainability assessment of technologies. It is an opportunity of **testing the approach**, assessing the benefits and identifying the limits.



Conclusions

- Sustainability is a **learning process** and there is no single way of defining what a sustainable technology should be.
- Key challenges are the development and validation of **methods and tools** able to capture the basic sustainability features of a technology under a **life cycle perspective**.
- Social, economic and environmental aspects need to be assessed. In **TyGRe** the use of the following tools is tested:
 - **LCA**, which offers a well-defined basis for the environmental assessment
 - **LCC**, which allows assessing the costs of a technology
 - **S-LCA**: the methodology is still in its infancy and quantitative information is seldom available
- Main result will be the **comparative assessment** of new and current scenarios of scrap tyres treatment
- A critical analysis of the **suitability and feasibility** of this methodological approach will contribute to the scientific debate about Life Cycle Sustainability Assessment.



Acknowledgements



- Working team: Porta P.L. ^a, Zamagni A. ^a, Amerighi O. ^b, Scimia E. ^c, Benveniste G. ^c
- Contributions of ETRA (European Tyre Recycling Association) for market analysis
- Contributions of all partners of TyGRe for data collection

^a ENEA-LCA and Eco-design Laboratory

^b ENEA-Research and Study Unit

^c FEBE ECOLOGIC www.febe-ecologic.it

Thank you for your attention!

