EUROPEAN COMMISSION
Community Research

ESTEP

Resource Efficiency for the European steel industry

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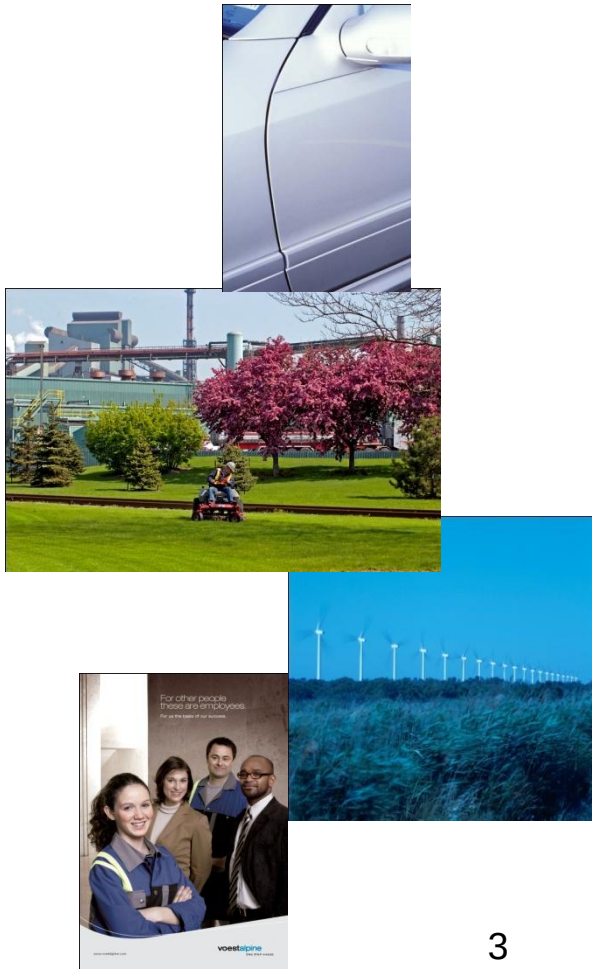
EESC-CCMI- Sustainable EII , July 6, 2011

ESTEP: European Steel Technology Platform

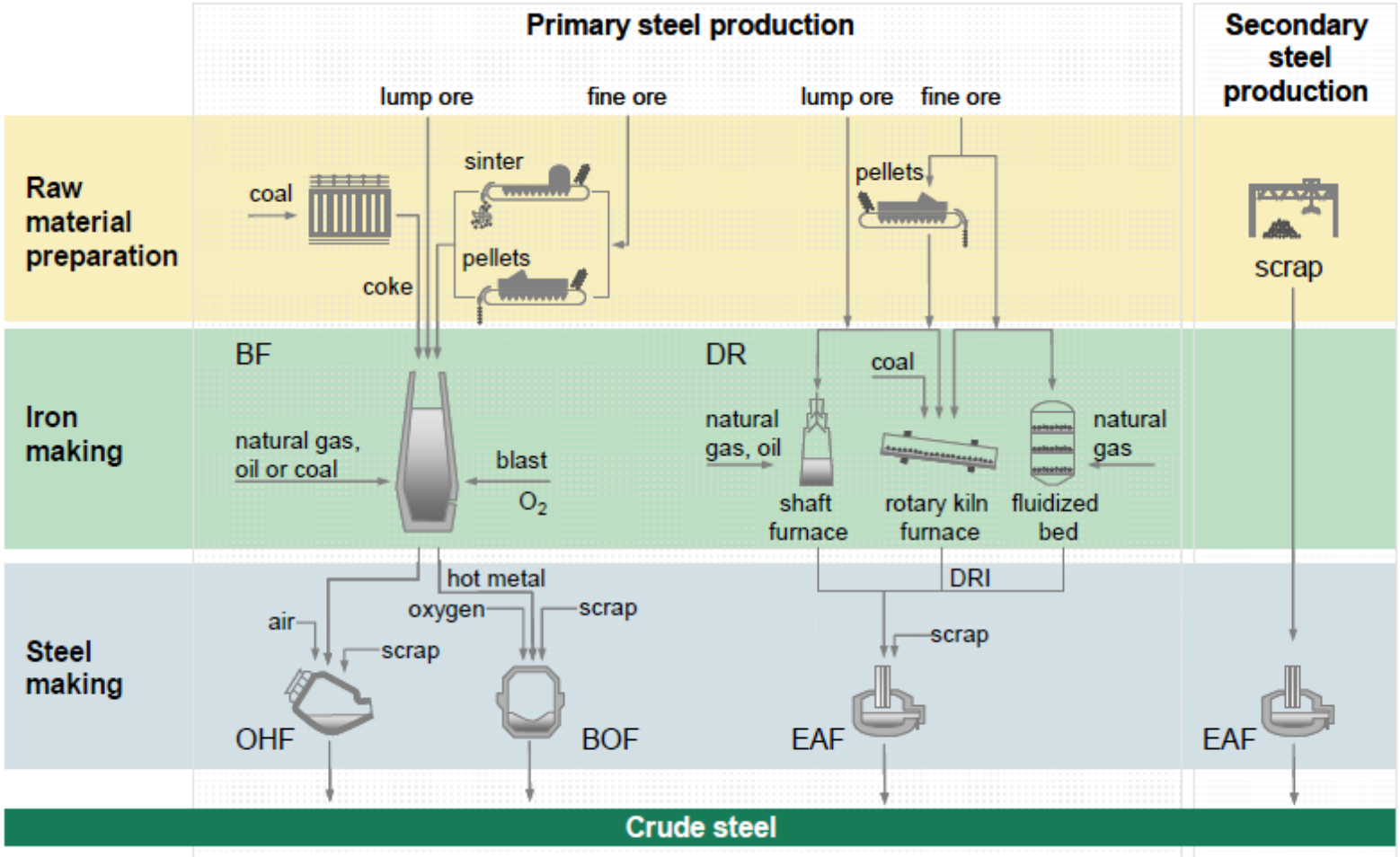
- Among the first ETPs created in Europe
- Financially supported by the EU steel industry only
- Focused on topics linked with Societal Challenges for Europe
- Living Strategic Research Agenda(SRA)
- Wide panel of stakeholders (Academia, Research and Technology centers, E .Commission, Member States representatives, suppliers, clients...)
- Strong involvement in People activities

The SRA of ESTEP answers the following challenges

- Development of Safe, clean, energy-efficient and cost-effective technologies
- Reducing the CO_2 emissions directly in steelmaking and indirectly by offering suitable steel solutions
- Promoting conservation of resources, recovery of wastes and societal value of materials (SOVAMAT)
- Contributing to the development of Energy sources for the future
- Attracting and securing highly skilled people



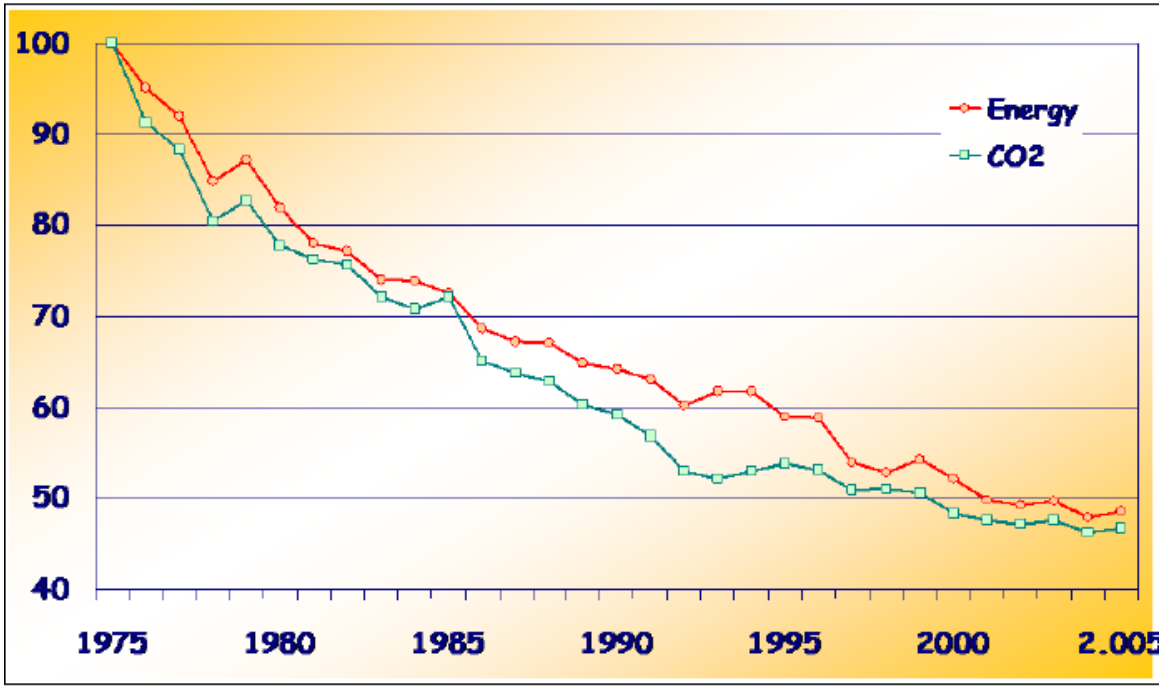
Steel production process(1)



Steel production process(2)

- The EU27 crude steel production is around 200mt/year, with 60% produced through the BF/BOF route and 40% through scrap recycling and EAF.
- The production of primary steel, using iron ore (BF/BOF) is more energy intensive than the production using recycled scrap due to the chemical energy required to reduce iron ore.
- Taking into account the CO2 emissions linked to the electricity consumed from the grid, the CO2 emission factor is 4.5 times higher for primary steel vs scrap. It is nearly the same ratio for energy net consumption.

Steel EU27: CO2 emissions and energy consumption



Over the last forty years, the EU steel industry has reduced its emissions by 50% per ton of steel produced, driven by process improvements, material efficiency and scrap recycling. For primary steel production, the best plants are closed to the thermodynamic and physical limits, and residual margin for energy savings is at the level of less than 10%.

Challenges for Resource Efficiency in the steel industry

- Reduce Energy consumption and CO2 emissions for each tonne of steel produced
  - Maximizing steel recycling
  - Improving steelmaking technologies and share best practices
  - Energy & waste gas management
  - Implementing breakthrough technologies (ULCOS)
- Conservation of other resources by process optimisation
  - Water efficiency and water management
  - Waste and by –products optimisation
  - Biomass and biofuels
- Maximise the efficiency of resources offered by steel products over their life cycle: positive energy & CO2 balance
  - Energy sector, including renewables
  - Transports
  - Construction

Maximizing steel recycling

- Optimising scrap recycling
  - In Europe, more than 90% of used steel products are recycled to produce new steel
  - Today 40% of crude steel within EU27 is produced by the scrap + EAF route
  - Still a potential to increase gradually this rate up to 50% in the next 20 years thanks to larger available quantities and better control of scrap qualities
  - Steel is infinitely recycled without loss of quality
- Recovering Fe units from in-plant residues in dedicated tools(field for R&D and demo projects)
  - BF and BOF dusts and sludges
  - Electric Arc Furnace (EAF) dusts, oily mill scales

Improving steelmaking technologies and share best practices

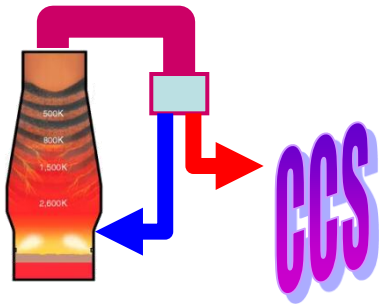
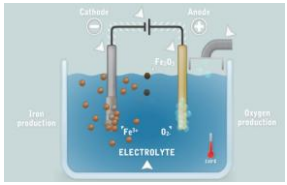
- Energy efficiency in the steel industry
  - Sharing best practices within the European steel companies
  - Evaluation of potential gains within EU27 at the level of 10%
    - Carbon needs for reduction
    - Energy efficiency of the equipments and processes
    - Energy recovery , including waste heat & low temperature heat
    - Maximizing the use of scrap
    - Process yield improvement
    - Integration of renewable energy
    - Overall energy management at plant level

ULCOS: breakthrough technologies for reduction of CO2 emissions

- ULCOS (Ultra Low CO2 Steelmaking) has been running in the EU since 2004 in order to investigate breakthroughs
- 4 families of process routes have been selected for further investigations including pilots and demonstrators:
  - Blast Furnace with TGR(Top Gas Recycling) and CCS.
  - Hisarna, a smelting reduction process with combination of a hot cyclone and a bath smelter.
  - ULCORED, a direct reduction (DR) process, producing DR Iron in a shaft furnace, either from natural gas or from coal gasification.
  - 2 electrolysis variants Ulcowin and Ulcolys with laboratory pilots.

ulcos process solutions…

identified by 2006
fleshed out by 2010

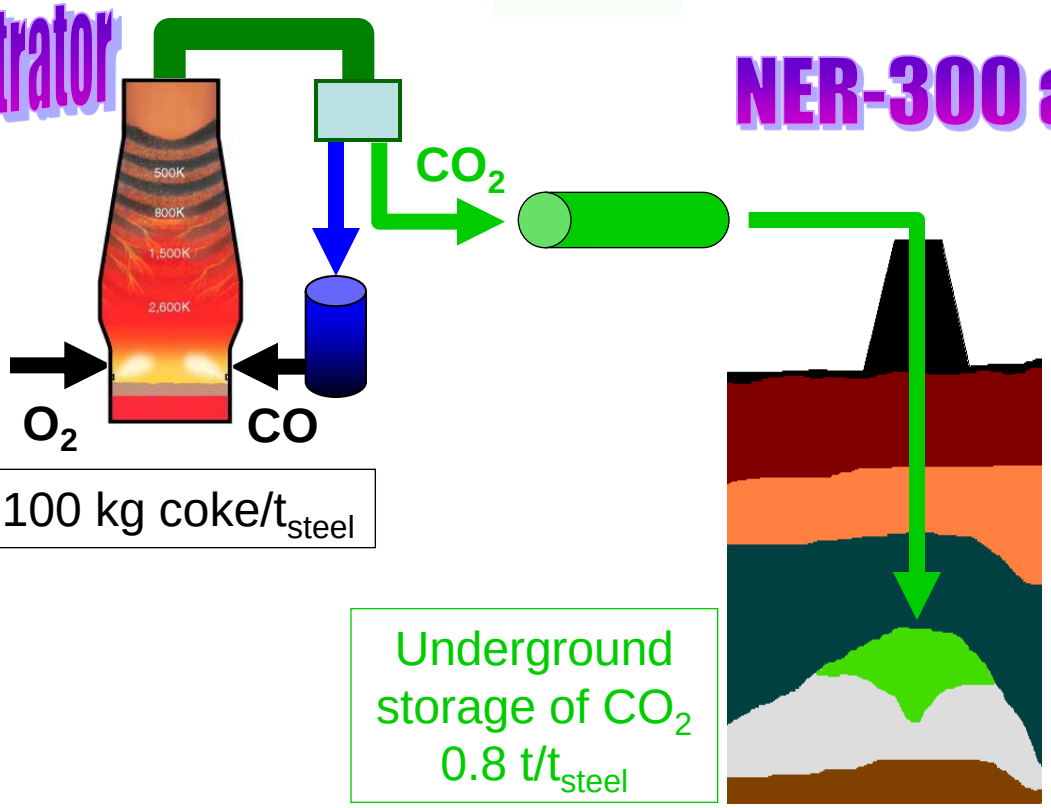
Coal & sustainable biomass		Natural gas	Electricity
Revamped BF	Greenfield	Revamped DR	Greenfield
ULCOS-BF 	HIsarna 	ULCORED 	ULCOWIN ULCOLYSIS 
Pilot tests (1.5 t/h) Demo. under way Submission 02/11	Pilot plant (8 t/h) start-up 2011	Pilot plant (1 t/h) to be erected in 2012 ?	Laboratory.

ULCOS-BF : TGR and CCS

CO_2 emissions of the steel plant: **- 60%**

ULCOS-BF demonstrator

NER-300 allowances



-100 kg coke/t_{steel}

Underground storage of CO_2 0.8 t/t_{steel}

ULCOS-BF reduces CO2 emissions by 60% **and** overall energy consumption by 10%

Steel Products contribute to CO2 reduction in key sectors

- Steel products offer CO2 savings over the life cycle that are greater than the CO2 emitted during their production
  - Energy Sector
    - Efficient fossil fuel power plants (high T° resistant alloyed steels) ; ratio between CO2 reduction/emission over 100:1
    - Efficient transformers (electrical steel sheets) ; ratio 14:1
    - Wind power plants(tower, gearbox, offshore foundations..); ratio 30:1
  - Automotive
    - Advanced high-strength steels for lightweighting ; ratio 1.3 :1
    - Efficient electrical motors ; ratio 3:1
  - Construction
    - Innovative steel solutions for envelope retrofitting
    - Holistic building approach for energy-efficient new steel constructions
- Total Life Cycle Assessment (LCA) for steel applications
  - Ongoing studies of GHG emissions resulting from all steel life phases.

Conservation of other resources

- By-products and wastes
  - Implement solutions based on the 3R: Reduce / Reuse / Recycle
  - Reuse and recycling of nearly 100% of by-products (mainly slags from Blast Furnace and BOF)
  - New technologies : areas for research & demonstrators for the recycling and valorization of dusts , sludges and slags
  - Synergy with other process industries
  - On the long term, towards zero- waste .
- Water management
  - ESTEP is working with WssTP
  - Improvement of water intake, water discharge, water treatment
- Integration of renewable sources: biofuels, biomass…

Resource & Energy efficiency Partnership

"REP" is a group of European associations , ETPs, and organisations motivated to promote resource and energy efficiency in process industries .

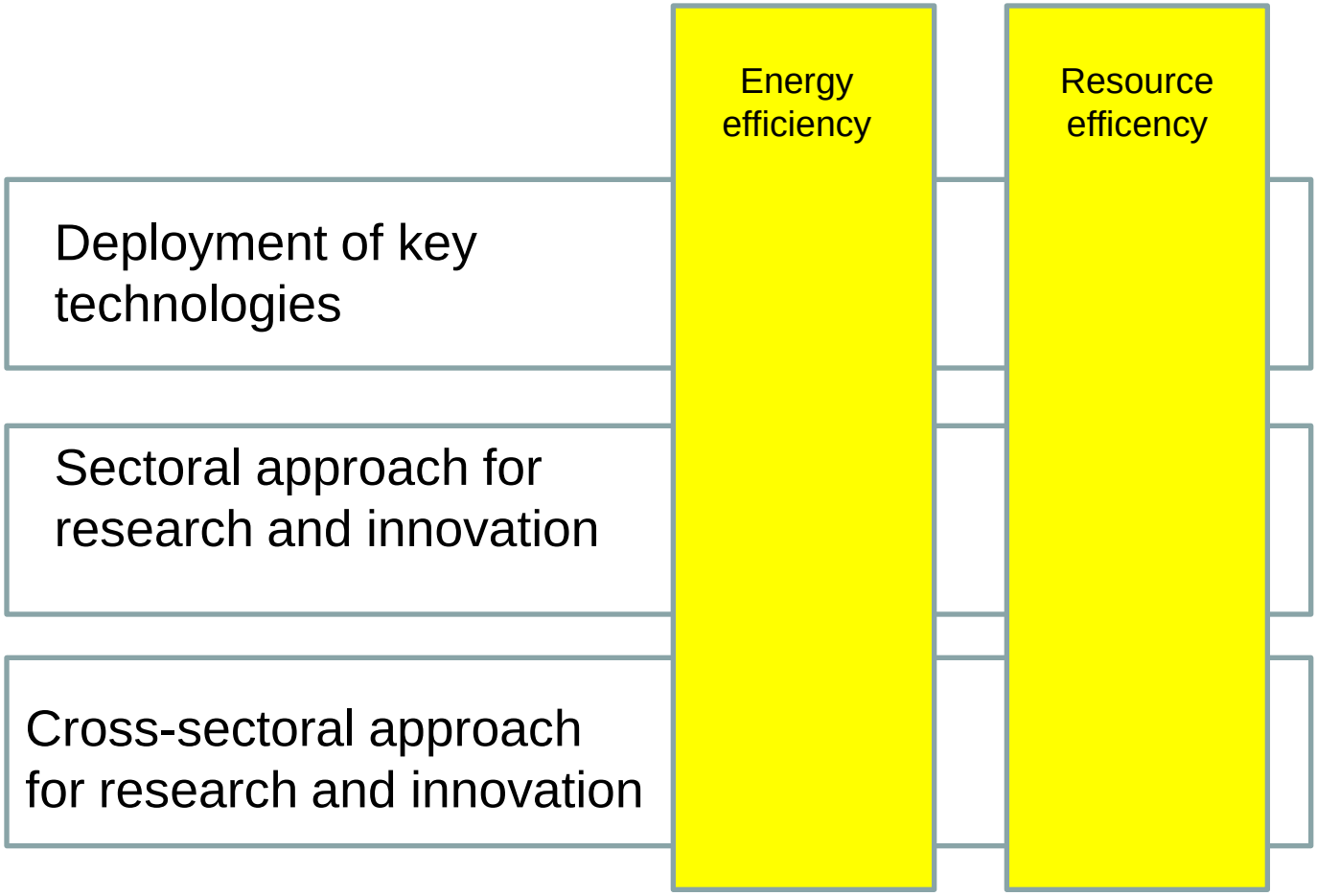
"REP" covers the domain of the process industries, producing materials, with a view on the whole supply chain of value creation.

REP offers support through the development of adequate strategies & via a proposed public private partnership (PPP) dedicated to resource & energy efficiency for these process industries.

Resource & Energy efficiency Partnership

- Main objectives of the proposed PPP:
  - To develop , via research, innovation & knowledge exchange , new solutions to improve resource and energy efficiency in the process industries
  - To develop solutions that demonstrate the advantages of industrial cooperation
  - To explain and promote the current and future potential of industry in addressing the current challenges of employment creation , sustainable production, and energy policy.
  - To provide a channel for a broad coalition of industry interests to dialogue with the EU institutions on methods of improving resource and energy use.

REP: Research & Innovation areas



Resource & Energy efficiency Partnership

- Recommendations from REP :
  - Appropriate framework conditions for the deployment of research &innovation
  - Deployment of key advanced processes & technologies in the field of resource and energy efficient use
  - Sustainable R&D approach and demonstration projects . R&D and innovation driven by industry and the market needs. Exploit the potential of industry in European research Area.
  - Skills development, training, mobility
  - Access to finance for dissemination of existing technologies and new pilot and demonstrators.

Recommendations from the Steel industry

- **Life Cycle Assessment** : to be encouraged , with harmonisation of the methodologies for the different sectors. We agree to develop the 3R, Reduce-Reuse- Recycle, but promoting sustainable solutions , taking into account the social, environmental and economical dimensions .
- **BATs** : no double regulation between ETS (CO2) directive and energy efficiency measures , for example mandatory BATs for industrial installations on top of ETS.
- **Energy audits :** no mandatory energy audits for the steel industry , as this only increases the administrative costs without added value
- **Energy Efficiency obligation schemes:** the steel industry should not be burdened with this provision , both as distributor of electricity (from waste gases) and as final consumer.
  - as distributor, electricity coming from waste gases is used by only a limited number of clients why are usally directly connected to steel production (eg oxygen plants..)
  - As final customer , because double regulation with ETS and moreover impossible to achieve -1.5%/y , when we are close to technological limits.

Conclusions

- Steel industry offers a set of solutions to meet the long term needs of Resource Efficiency .
- For steel production huge progresses have been done during the last 40 years, and we are now close to the thermodynamic efficiency with existing technologies.
- ULCOS investigates breakthroughs with pilots and demonstrators for CO2 emissions reduction
- ESTEP is now implementing roadmaps for energy and resource efficiency within the steel production. We agree to make technological improvements through R&I, but preserving the competitiveness of the European Steel industry.
- Steel products contribute to resource efficiency in key sectors with energy & CO2 savings over the life cycle .
- ESTEP promotes transversal actions in Resource Efficiency with other materials industries.