GOOD PRACTICES OF ENERGY EFFICIENCY IN THE EUROPEAN INDUSTRY PROCESSES - Policies of incentivisation and implementation
Energy efficiency in Electric Arc Furnace steel production

EU MERCI
fostering the growth of energy efficiency in the EU industry

GOOD PRACTICES OF ENERGY EFFICIENCY IN THE EUROPEAN INDUSTRY PROCESSES.
Policies of incentivisation and implementation

CSM
Centro Sviluppo Materiali
materials, technology & innovation

Outline of presentation

- Introduction to CSM
- Steelmaking energy demand:
  - A) Data about italian energy production and utilization
  - B) Steel production and energy consumption
  - C) EAF energy demand
- Efficiency improvements
- Technological trends

CSM
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materials, technology & innovation

Diversification and Globalization

Privatization

Corporate R&D
Finsider

2013

Key player in the Technological Transfer, Innovative Solutions for the Industry

2003

1993

Start selling of Know How to New Clients and Markets

1983

1973

1963

Building up of Corporate Know-How for Italian Steel Making Industry

Integration in the RINA GROUP

1963 START UP

2014 ON

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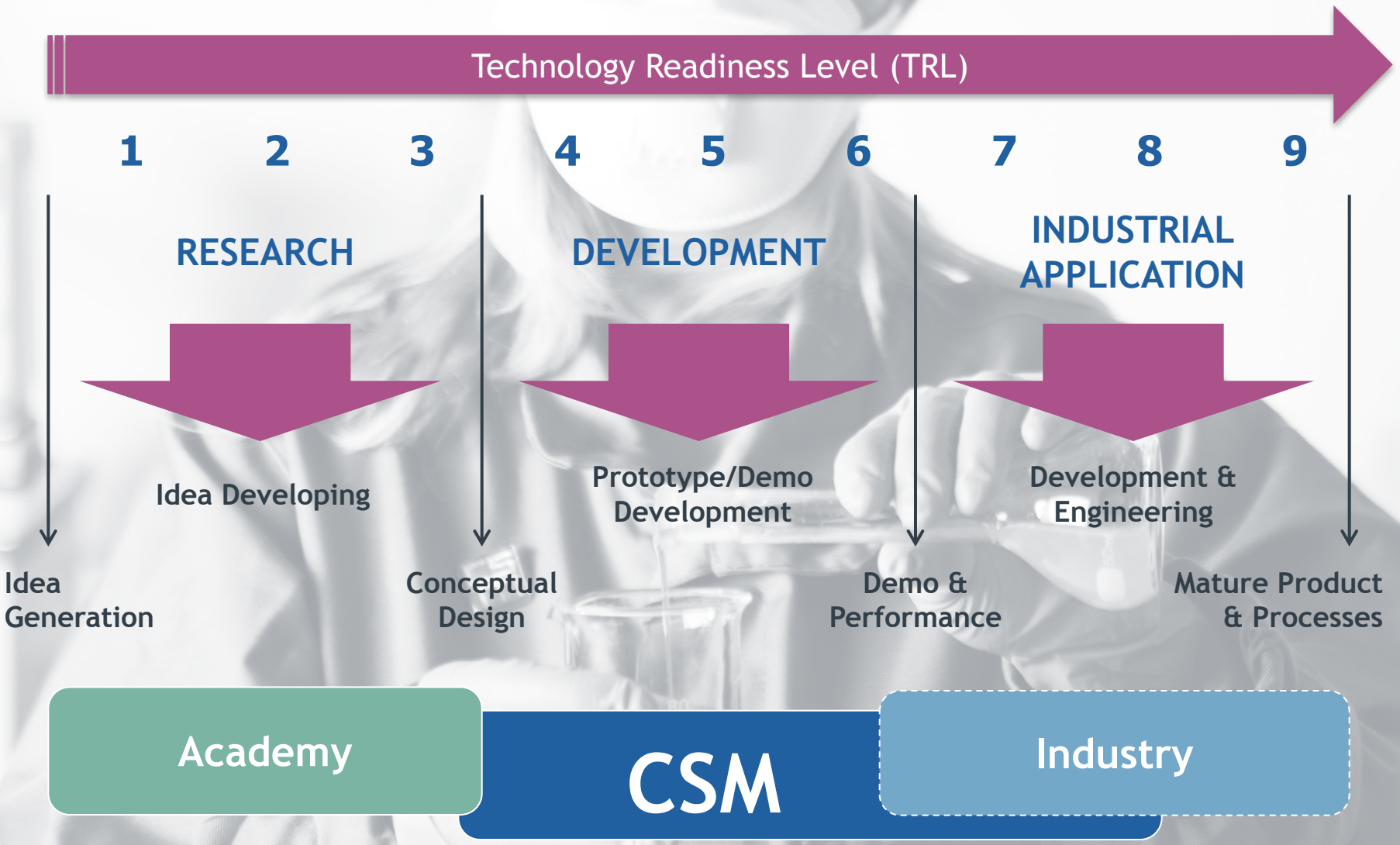
CSM KEY FACTS

- **20** M Euro sales/year
- **100** Researchers
- **100** Laboratory technicians
- **25** Laboratories and Full Scale Pilot Plants
- **160** Patents
- **40** Publications /year
- **300** Running projects
- **6** Policentric Structure Headquarters in Rome (Italy) 5 sites in Italy Offices in China

CSM APPROACH FOR INNOVATION & RESEARCH



CSM APPROACH

CSM has both high level technical skills and state of the art laboratories which allows to assess product/process/plant performances as well as to develop new solutions

ASSESSMENT

- Study of customer needs
- Market benchmarking
- Lab analysis

IDEA

- Complementary technical competences
- Positive experience from similar cases
- New solutions

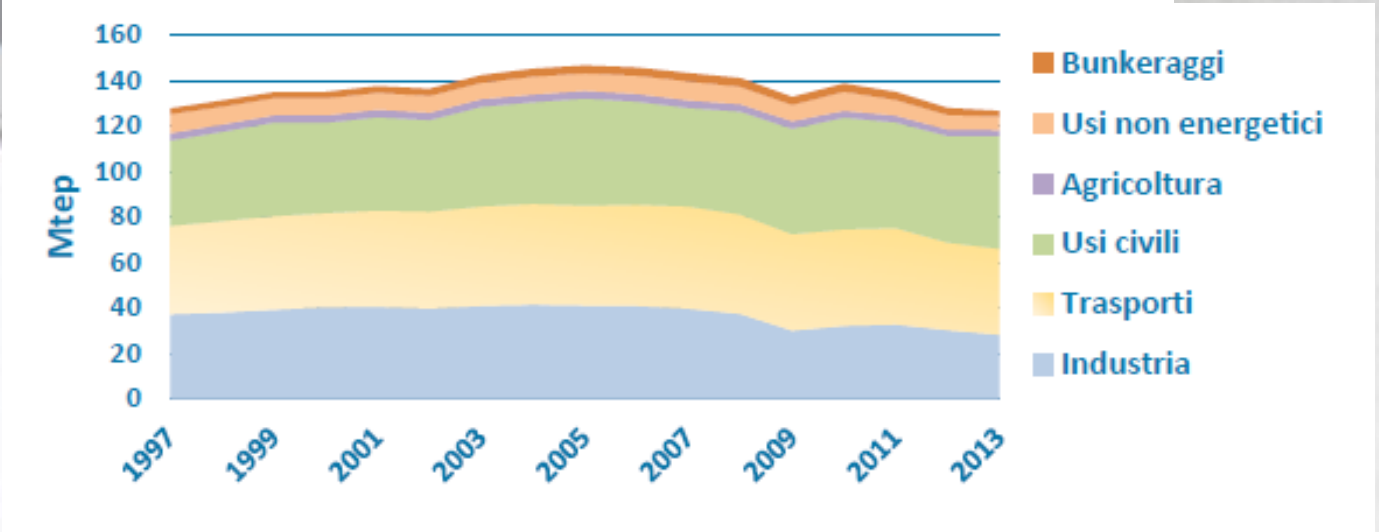
VERIFICATION

- Fit for purpose analysis and lab testing
- Experimental check at real scale

SOLUTION

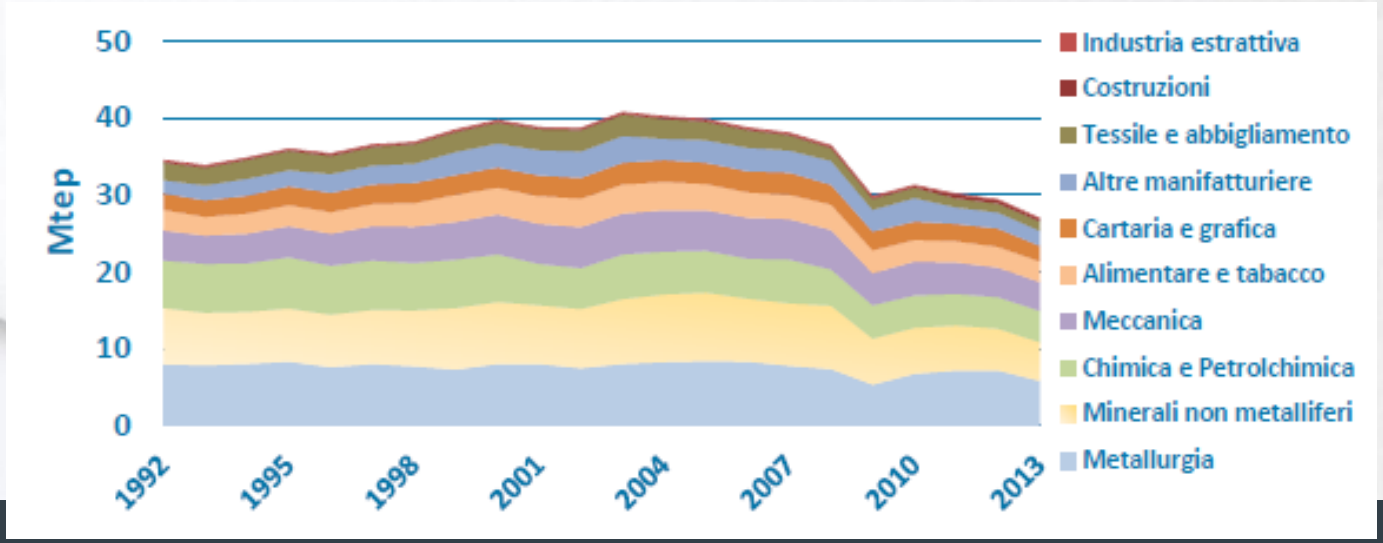
- Product/process suitable for the application/market
- New product/process with better performances/cheaper
- Support to implementation

Italian energy production and utilization



Electricity utilization divided per different sectors

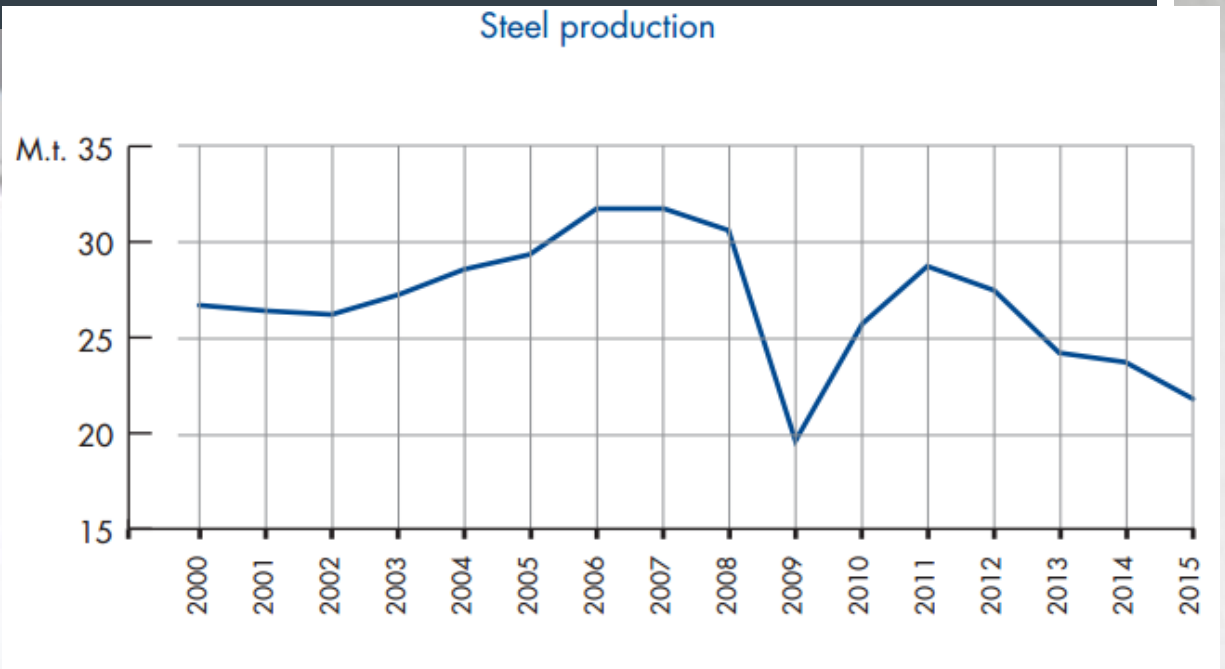
Industry accounts of 20% of energy consumption

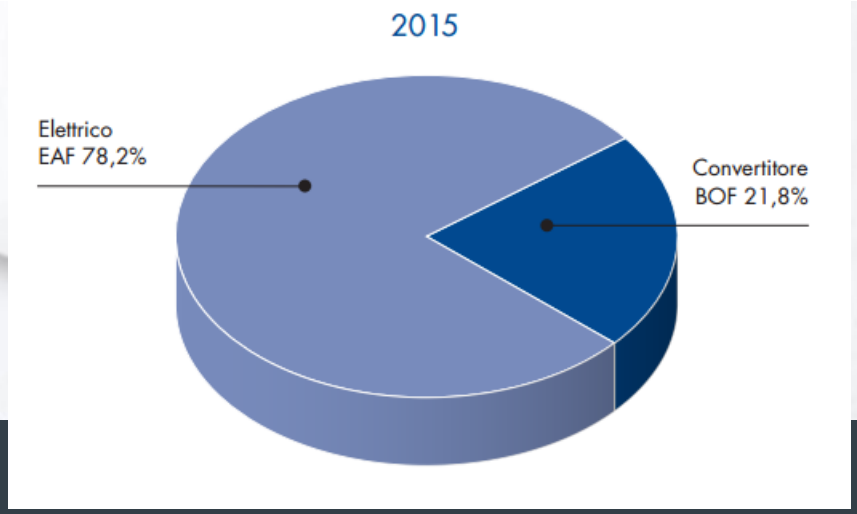


Electricity utilization divided per different industrial sectors

Metal sector is about 25%

Steel production in Italy



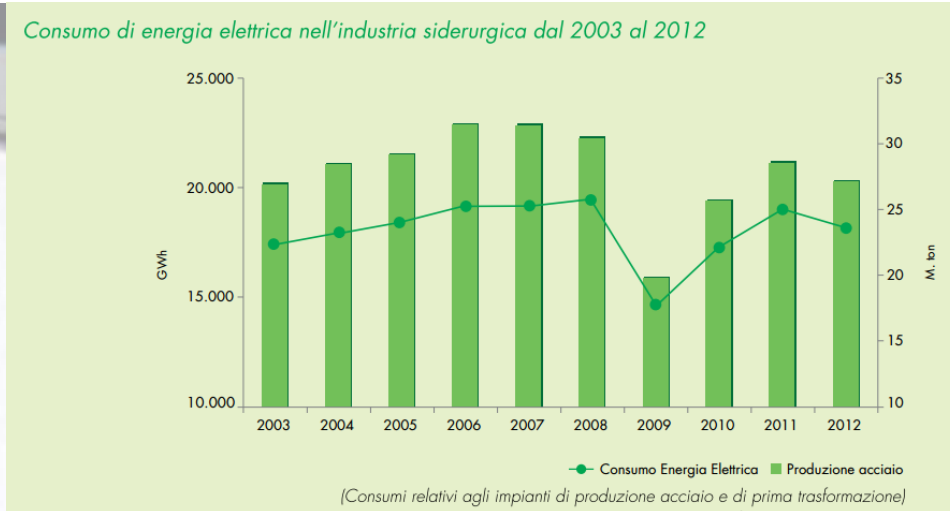


78% of italian steel production is via EAF route

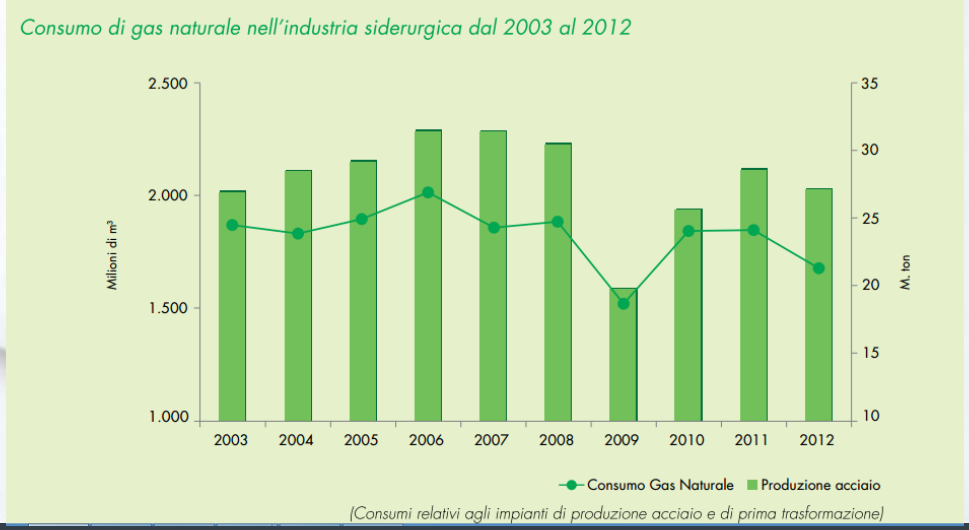
39% of european steel production is via EAF route

Relazione Annuale Federacciai 2015

Steelmaking energy demand



Electrical energy consumption
20,000 GWh annual consumption (2012)
(3 740 000 TOE)
(1GWh=187TOE*)

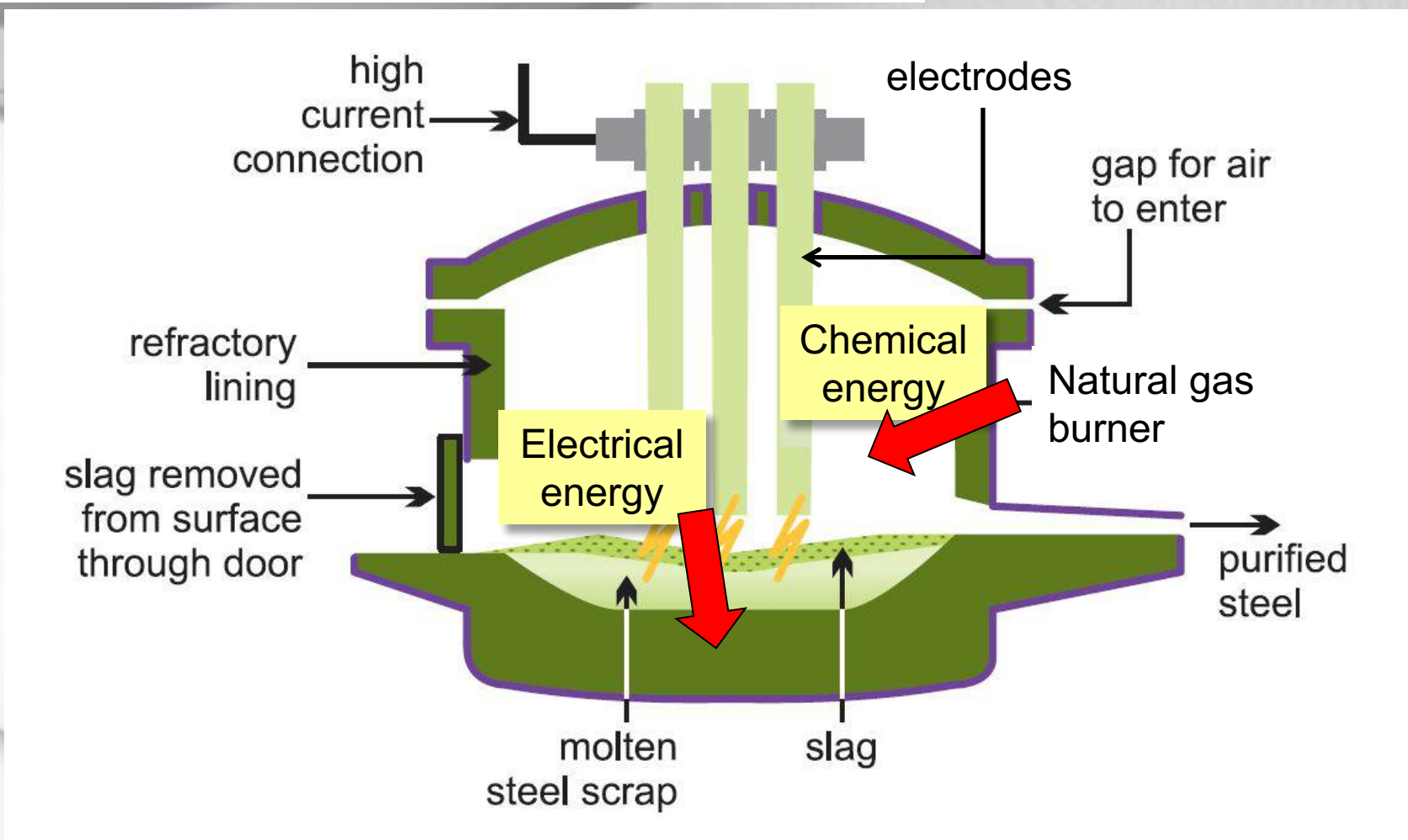


Natural gas consumption
2,000 M m^3 annual consumption (2012)
(1 650 000 TOE)
(1Mm^3=825ToE*)

Delibera
AEEG 9/11 EEN, Allegato A

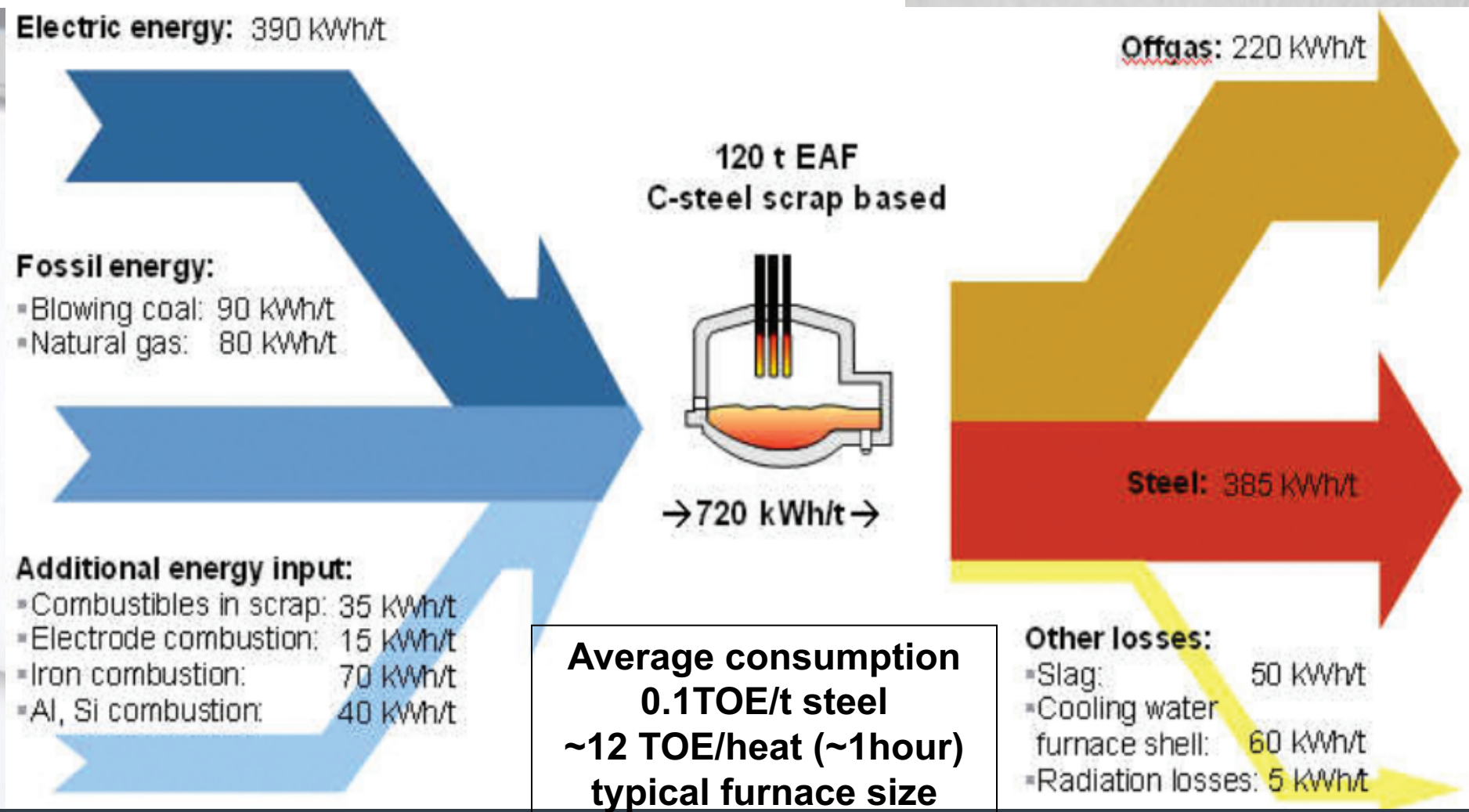
Steelmaking energy demand

Electric arc furnace



Steelmaking energy demand

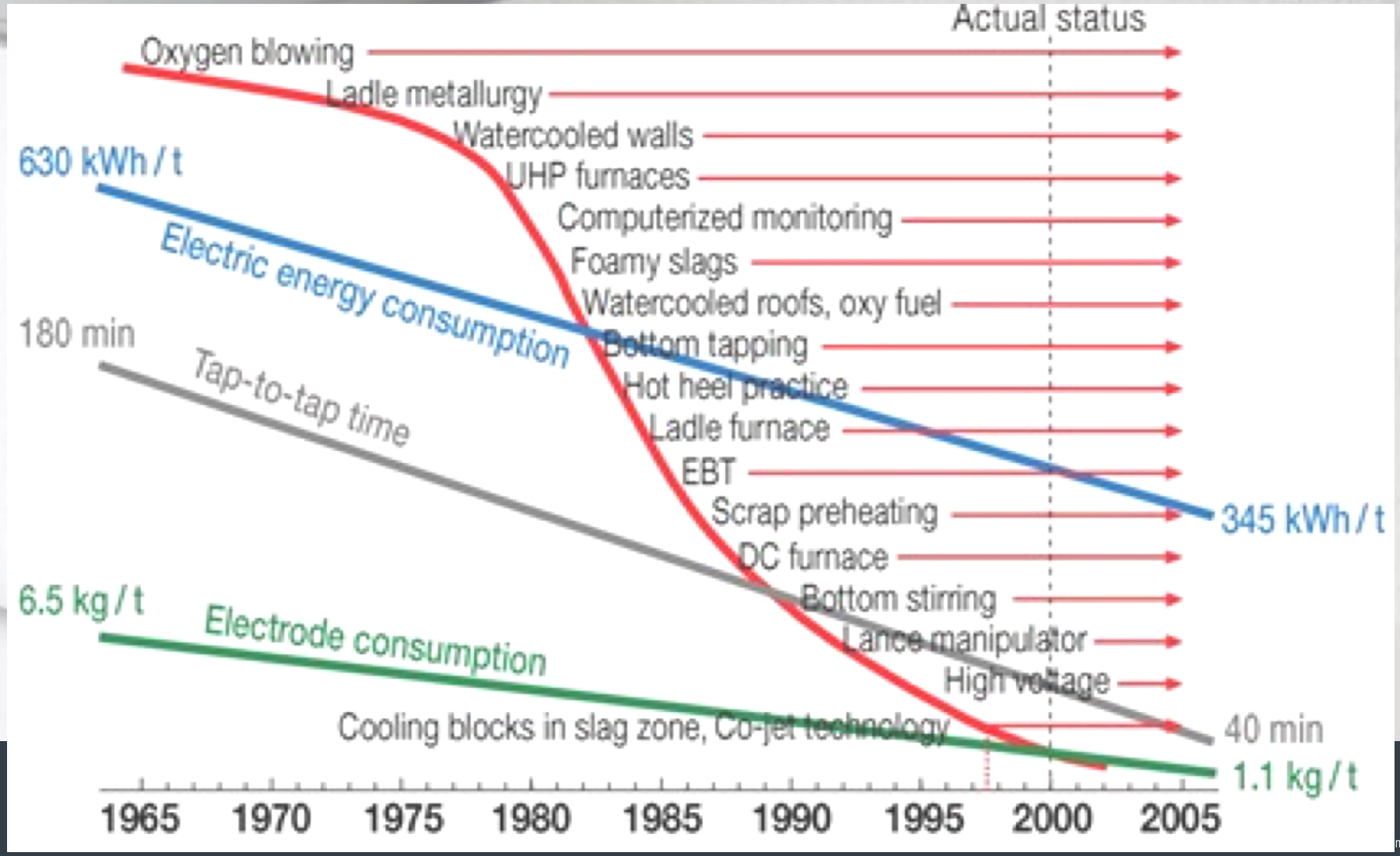
EAF energy balance



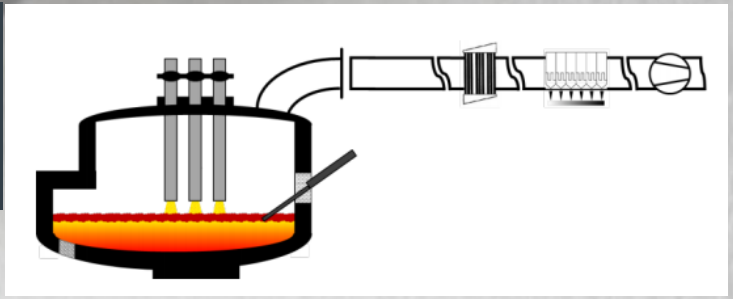
Average consumption
0.1TOE/t steel
~12 TOE/heat (~1hour)
typical furnace size

Steelmaking energy demand

EAF Tehnological evolution and consumption reduction

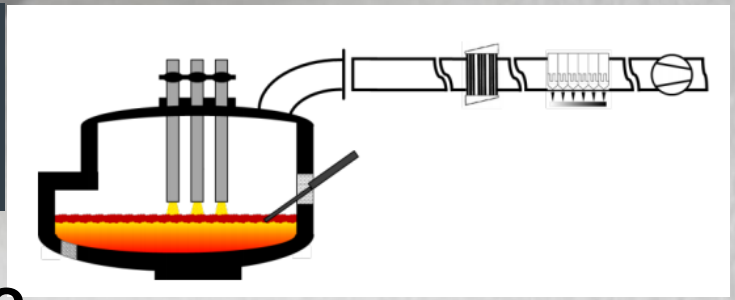


Efficiency improvements



Recent improvements in EAF steel production and future trends

Efficiency improvements



How to increase energy efficiency?

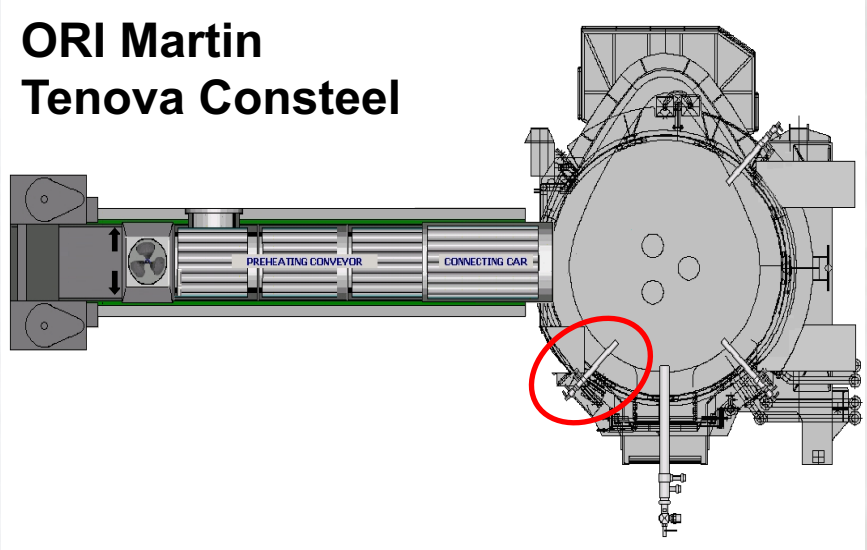
- **Reduction of energy demand**
  - operating practice optimization
  - more flexible use of fuels and materials
- **Increase of steel weight at tap**
  - reduction of metallic losses
- **Reduction of energy losses**
  - higher insulating materials
  - reduction of water cooling
- **Increase the rate of energy recovered**
  - energy recovery from off gas and other hot by-products

Efficiency improvements

Increase the rate of energy recovered
Scrap pre-heating

Scrap pre-heating and scrap continuous charging allows energy reduction

1. **Shaft furnaces, operating with continuous or semi-continuous charging**
2. **Consteel, operating with a tunnel conveyor for continuous charging**



Efficiency improvements

Increase the rate of energy recovered
Scrap pre-heating

Producer Product	Charging technology	Charge	Electrical Energy (kWh/t)	CH4 (m3STP/t)
Reference situation	**Conventional Top charge**	**Bucket**	**~380**	**~8**
Siemens VAI Primetals Quantum	Shaft	3-4 batches	**~280**	**~4**
Fuchs COSS	Shaft	3-4 batches	**~300**	**~2**
CVS EPC	Shaft	3-4 batches	**~300**	**~3**
JPSP EcoArc	Shaft	12-13 batches	**~280**	**~2**
Tenova Consteel	Continuous charging conveyor	continuous	**~350**	**~0**
Tenova Consteel evolution	Consteel	continuous	**~310**	**~8**

Efficiency improvements

Increase the rate of energy recovered
Energy recovery

Energy recovery

Development of systems for maximization of energy transfer from hot gases at 1500-1700 °C with high content of dust <u>without drawback in the micro-pollutant emissions</u>

Development of systems for <u>energy transfer from slag to high temperature fluid</u> with high efficiency not detrimental for slag quality

Intelligent optimization system for <u>energy storing and distribution</u>

From the single plant approach …

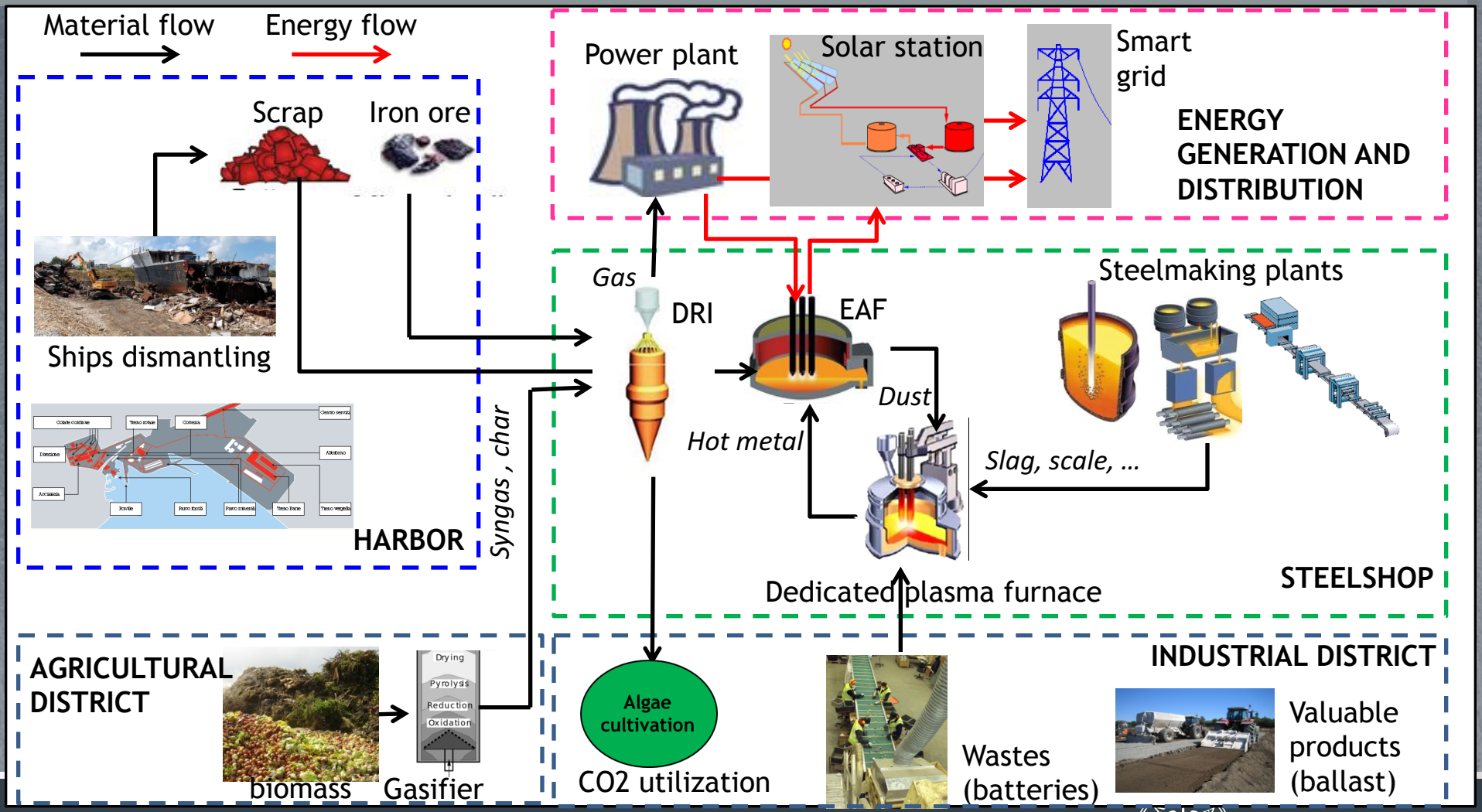
- Up to now the efforts for higher energy efficiency have been focused on the single plant
- The EAF, which represents the 70% of Italian steel production is an emblematic case
- Large efforts of process optimization lead in the last 40 years to a significant reduction of energy consumption (50% of reduction of electrical energy)
- Further savings are still possibile from optimization of operating practice, reduction of losses, utilization of waste heat
- These efforts are bringing to the absolute limits.

… toward a cross-sectorial approach

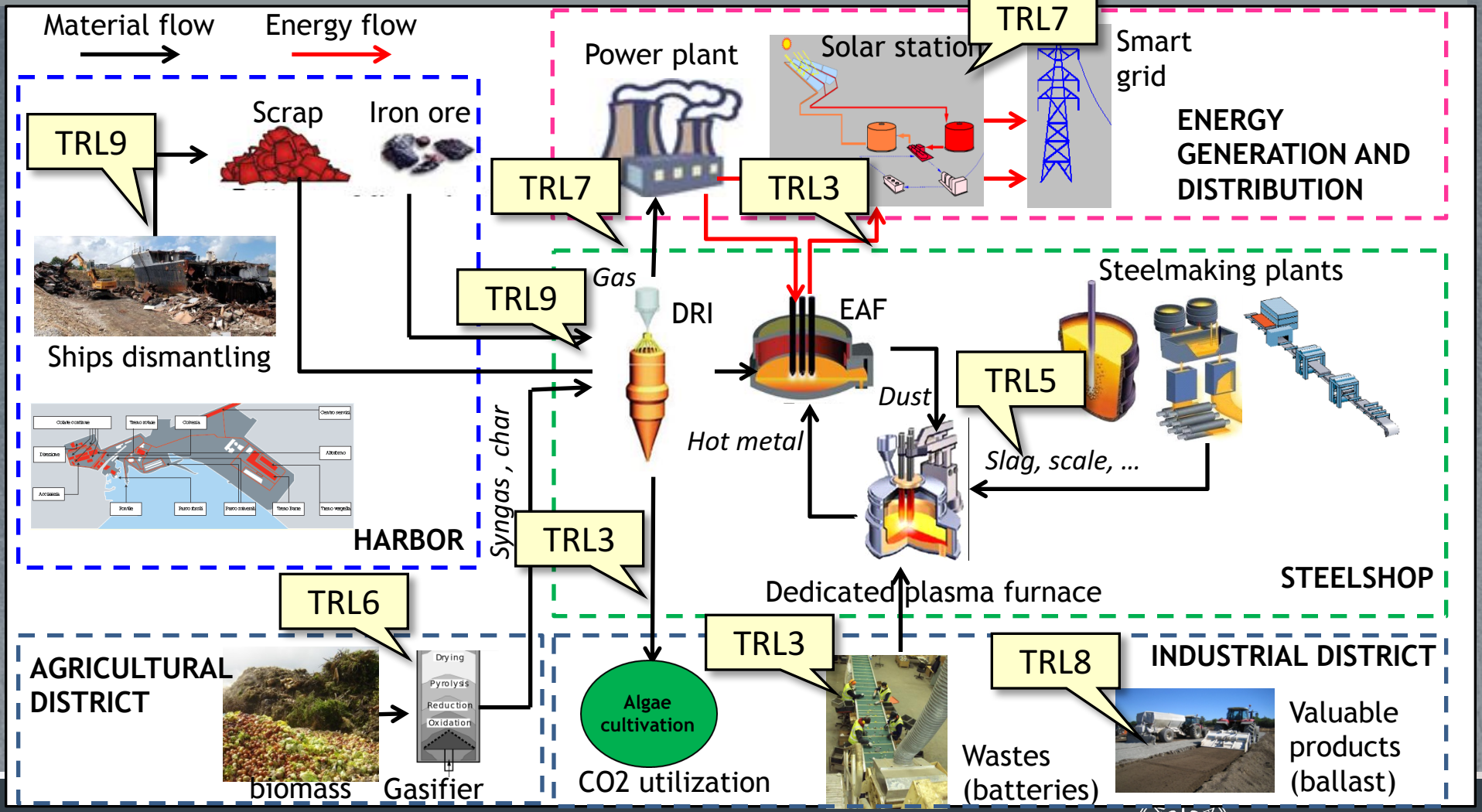
- A further improvement is only possible with a new approach, based a a cross-sectorial vision

- Energy saving can be seen in an integrated view according to the logic of circular economy, where waste heats and waste materials are used inside and outside the steel plant

Conceptual design of steel industry based industrial symbiosis: Piombino case



Conceptual design of steel industry based industrial symbiosis: Piombino case



Thanks for your attention

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