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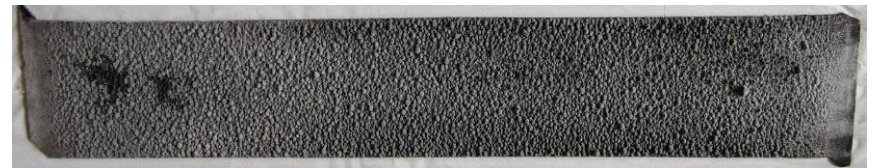


Ultra Low CO<sub>2</sub> Steelmaking

[www.ulcos.org](http://www.ulcos.org)

# Update on the ULCOS program

Jean-Pierre Birat,  
ArcelorMittal, European Coordinator  
of the ULCOS program



"How will employment and labor markets develop in the context of a transition towards a low-carbon economy?", Brussels, 1 March 2011

# Outline

- timeline and perspective
- the ULCOS process solutions
- ULCOS-BF
- Hlsarna
- ULCORED
- ULCOWin & ULCOLysis
- conclusions





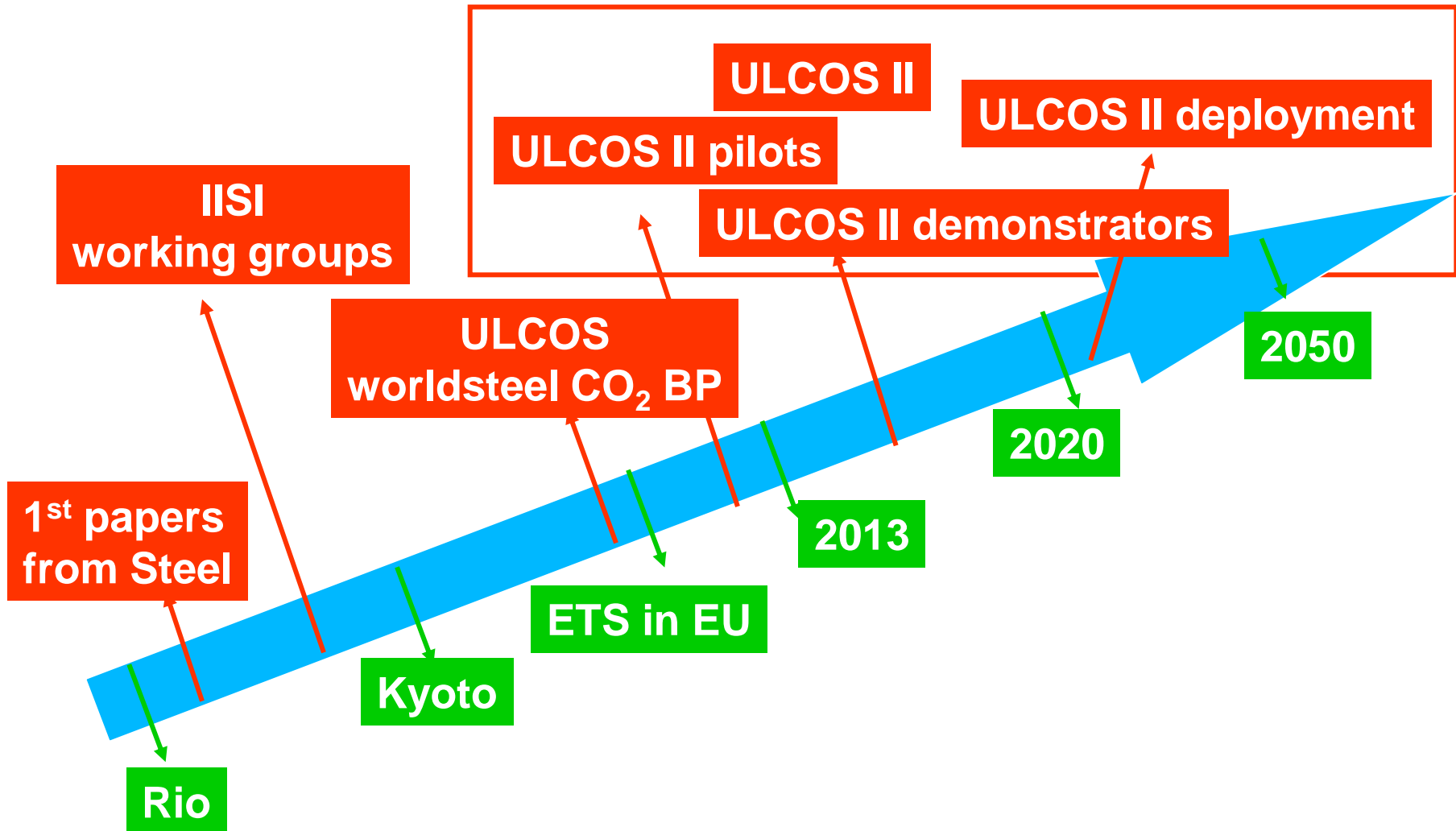
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# Timeline



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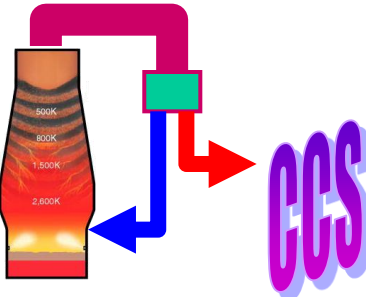


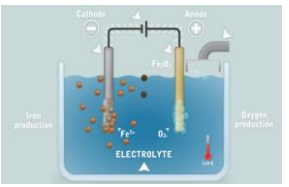
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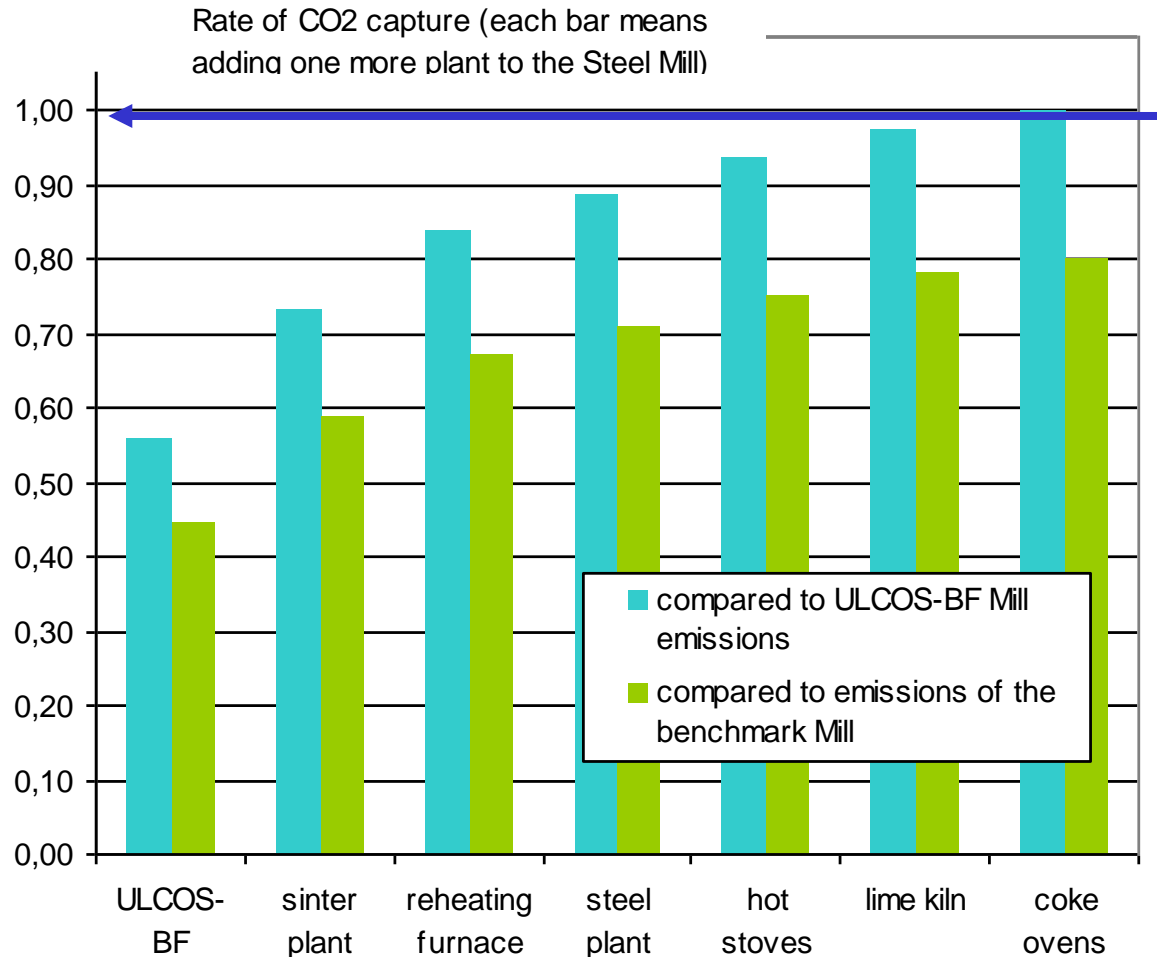
# ulcos process solutions

*identified by 2006  
fleshed out by 2010*

Coal & sustainable biomass		Natural gas	Electricity
Revamped BF	Greenfield	Revamped DR	Greenfield
ULCOS-BF 	Hlsarna 	ULCORED 	ULCOWIN ULCOLYSIS 
Pilot tests (1.5 t/h) Demonstration under way	Pilot plant (8 t/h) start-up 2010	Pilot plant (1 t/h) to be erected in 2011 ?	Laboratory

# ULCOS-BF with >> 50% reduction

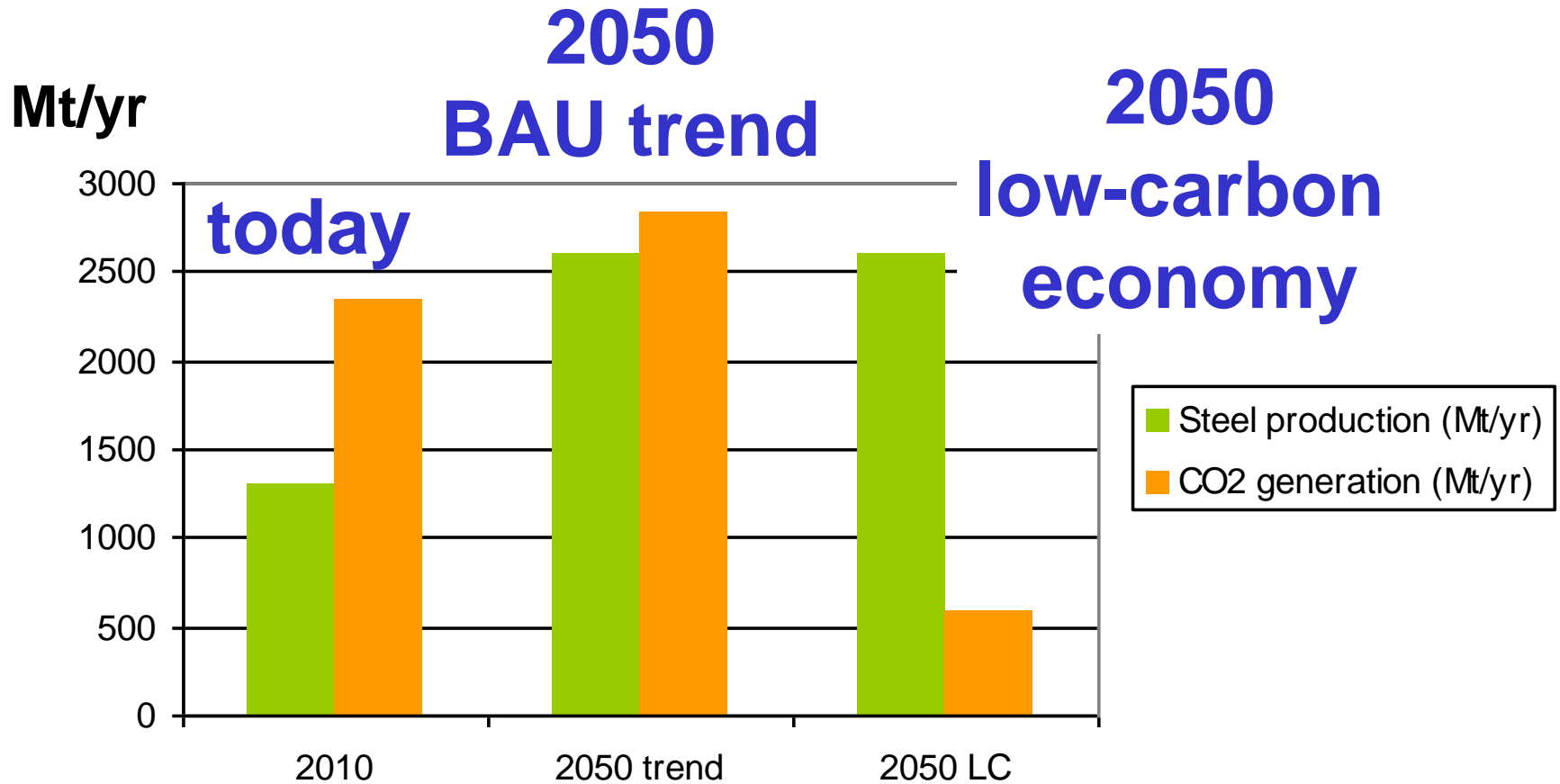
Cumulated capture rate



100% capture



# Virgin & recycling routes...

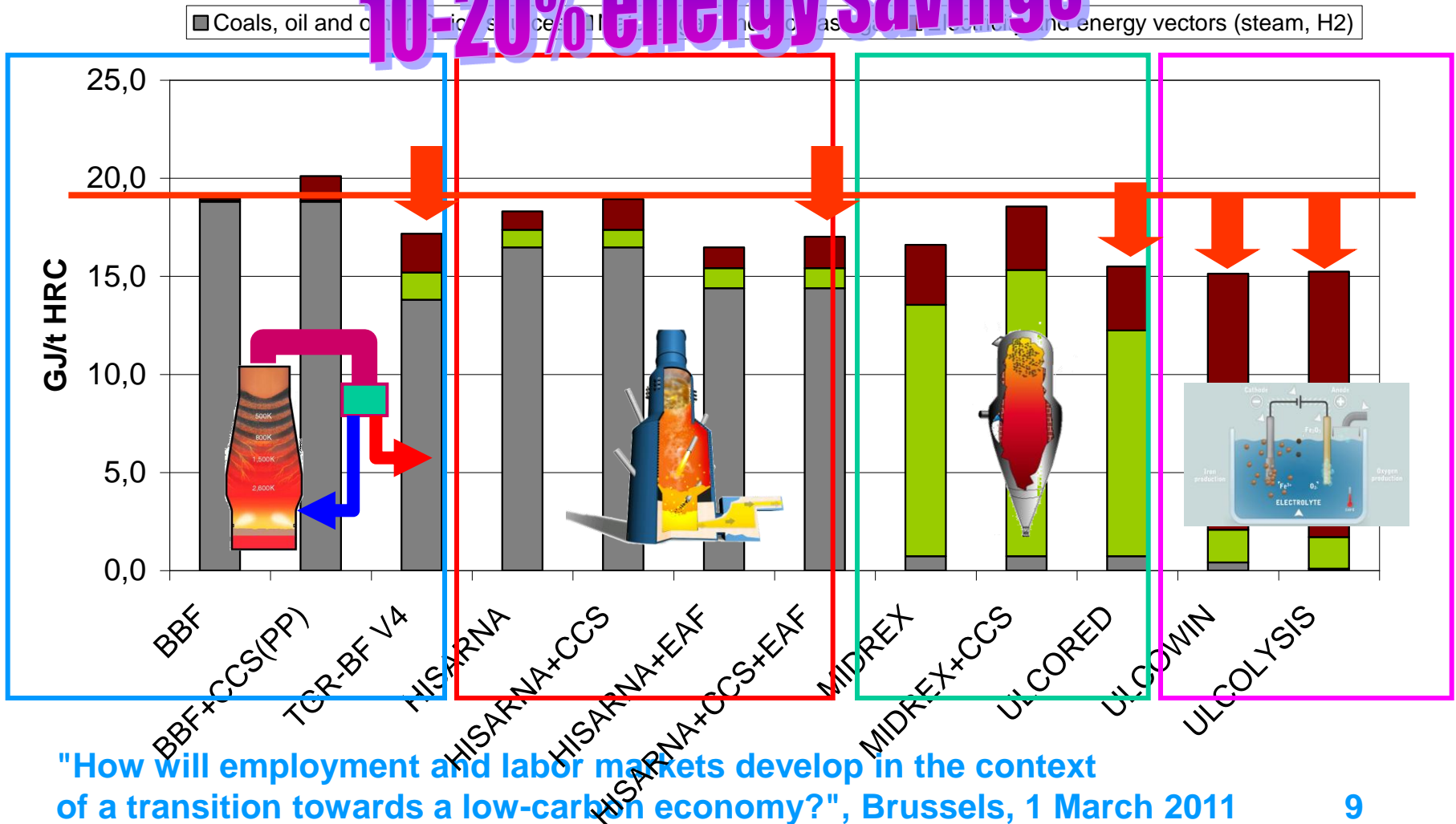


**socio-economic projections**



# Energy (GJ/t<sub>HRC</sub>)

10-20% energy savings

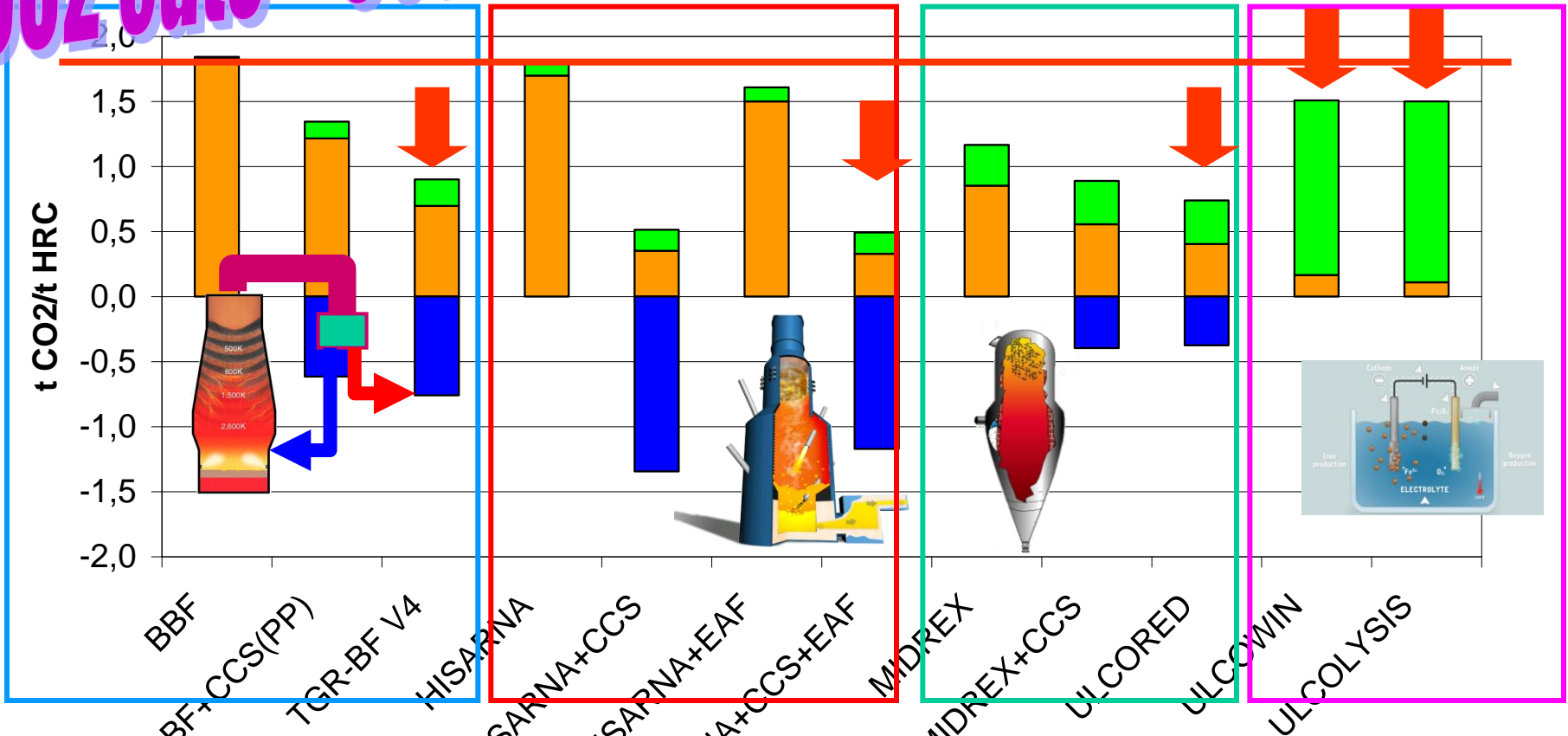




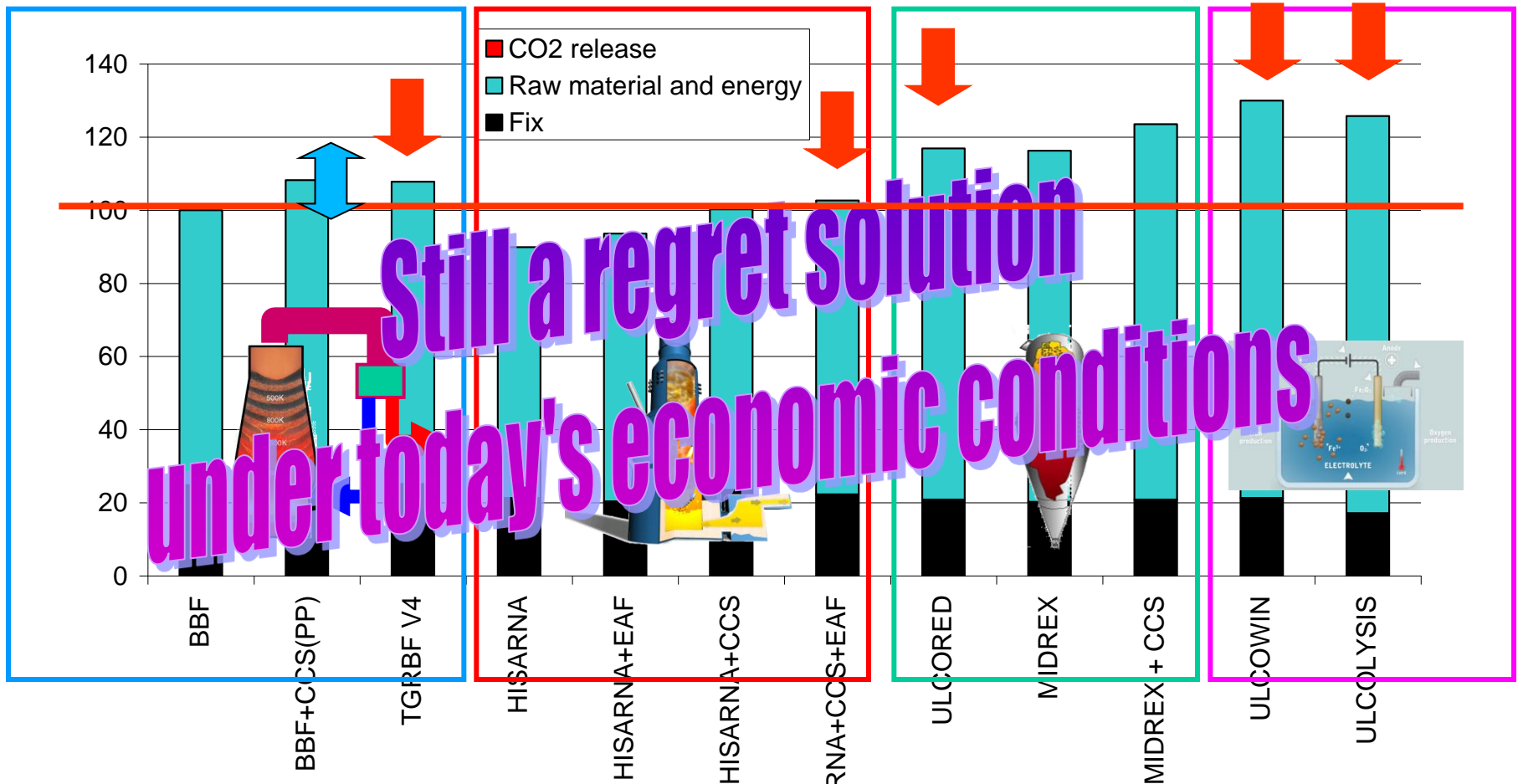
# CO<sub>2</sub> reduction (t<sub>CO2</sub>/t<sub>HRC</sub>)

## CO<sub>2</sub> cuts > 50%

Scope 1 Scope 2 CO<sub>2</sub> captured



# Operating costs (index)



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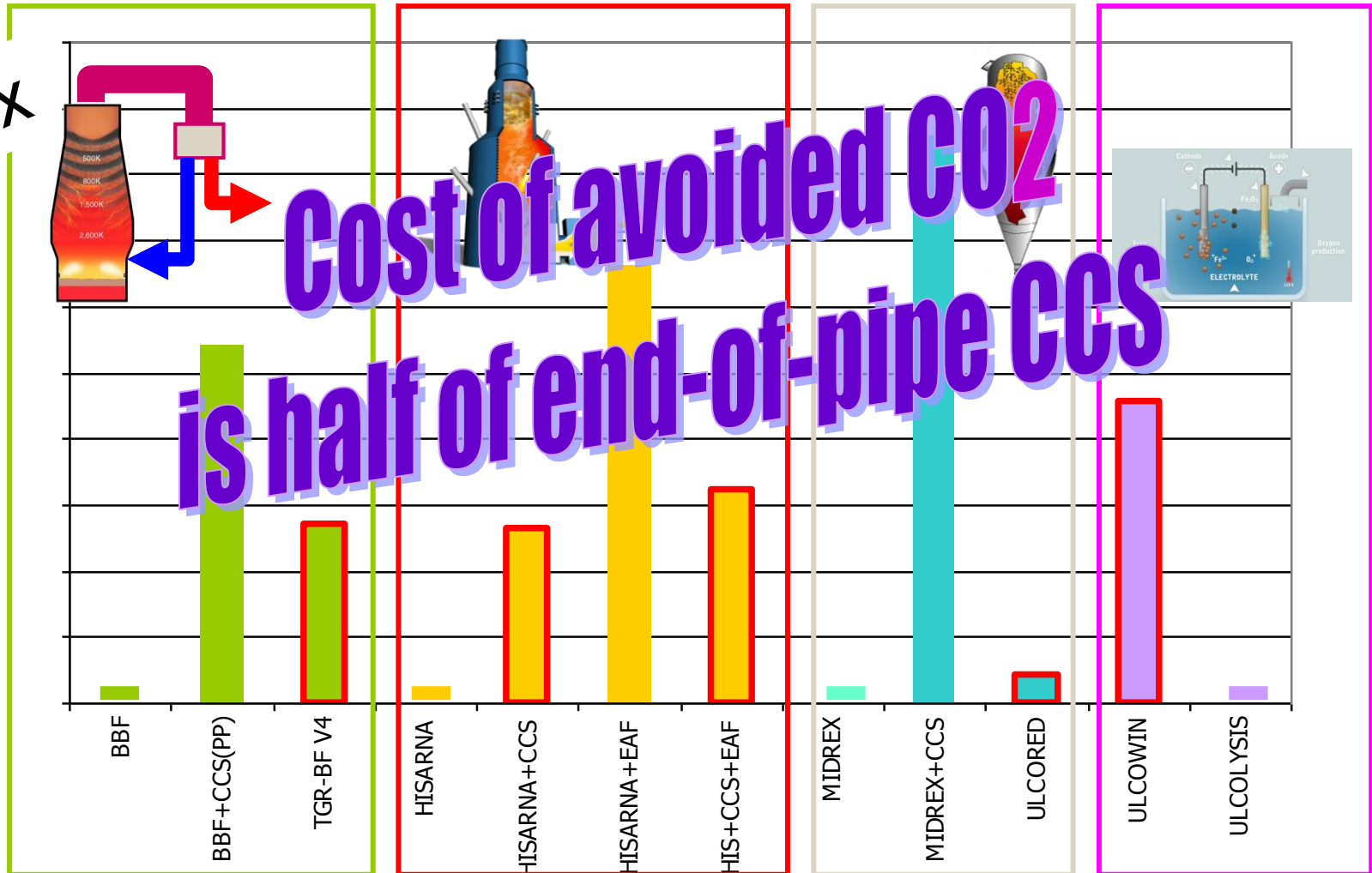


# Cost of avoided CO<sub>2</sub>

2010

index

**Cost of avoided CO<sub>2</sub>  
is half of end-of-pipe CCS**



11



# Productivity

- all ULCOS solutions expected to operate at higher productivity than the conventional process they substitute for, e.g. 30% for ULCOS-BF



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# ulcos II consortium

MoU stage

voestalpine

SSAB

ArcelorMittal

TATA



LKAB





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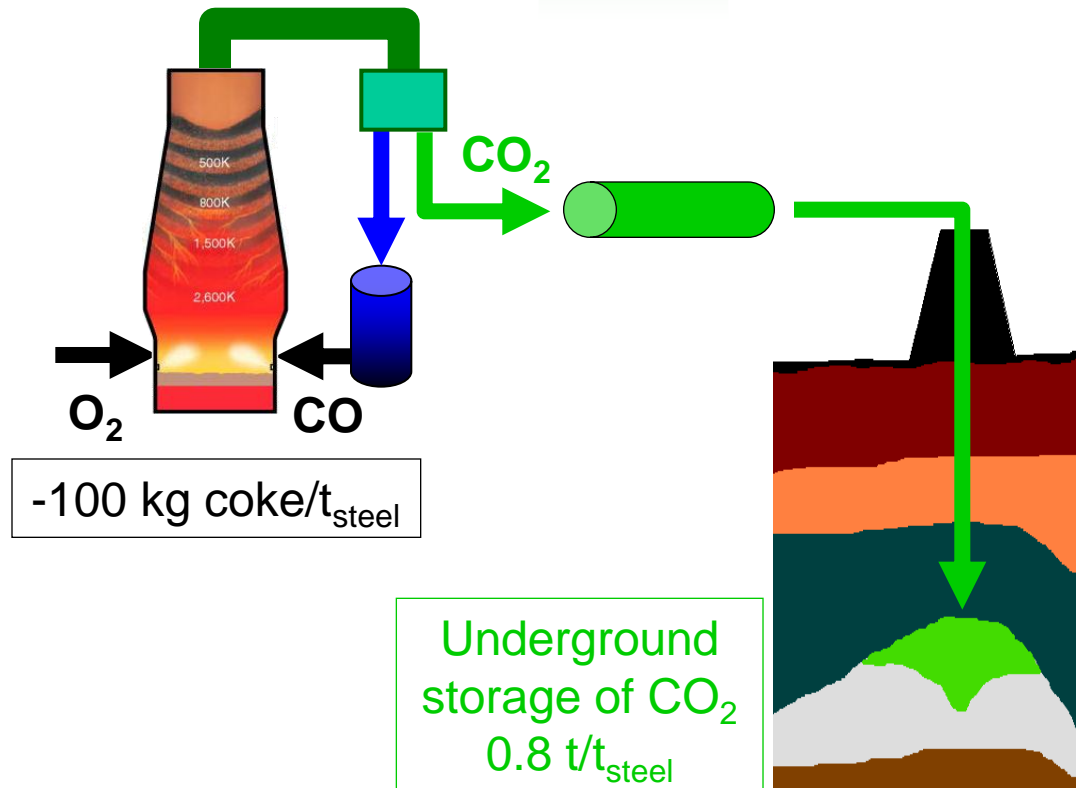
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# ULCOS-BF

stored AND avoided

CO<sub>2</sub> emissions of the steel plant: - 60%

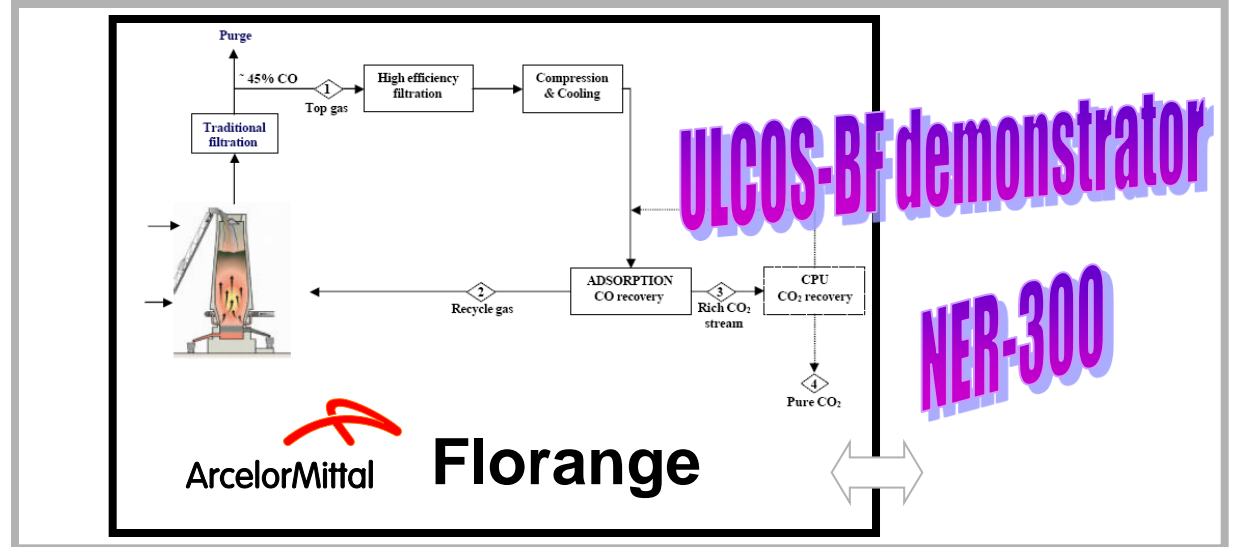
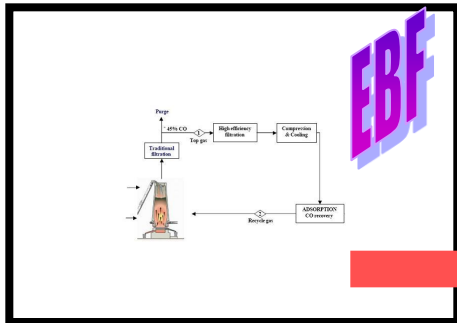




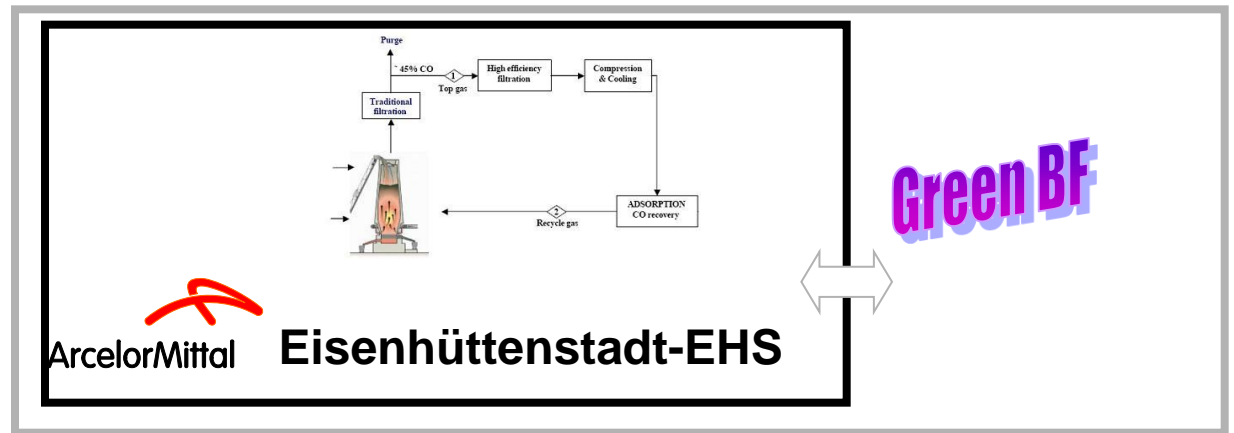


# ULCOS-BF project

CO<sub>2</sub> storage

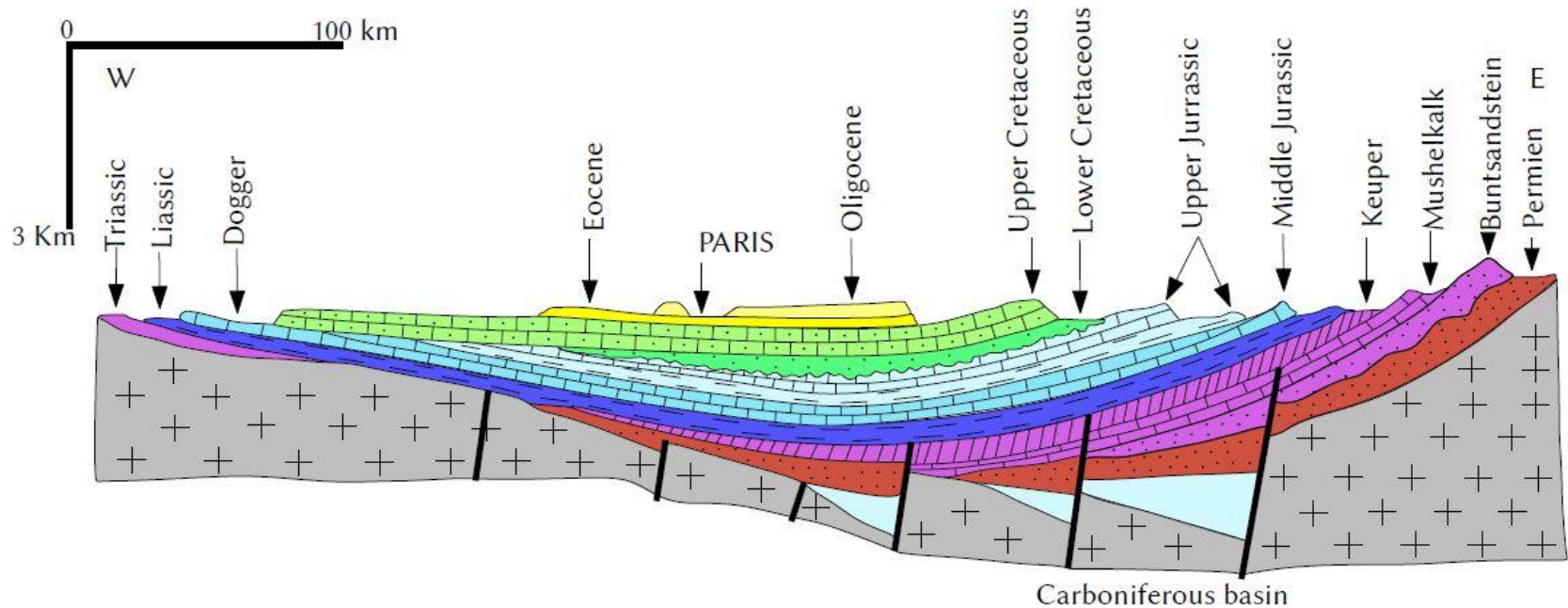


**ULCOS I**  
3 projets RFCS + 1 FP





# CO<sub>2</sub> storage



Storage in a deep saline aquifer, with pipe transport of dense CO<sub>2</sub> from capture site.



# ULCOS-BF: key figures

## Timeline:

- Eisenhüttenstadt project approved December 2010
- NER-300 proposal filed in Paris on 9 February 2011, to cover the Florange demonstrator
- Consortium Agreement under final stage of negotiation among members
- start up 2013 in Germany and 2014 (BF) - 2015 (Storage) in France. 10 years of operation in France planned for 2016-2025
- permitting process launched for storage; FEED studies for the BF

## Important milestones

- exploration permit approved
- start of site geophysical exploration
- FEED studies for BF & pipeline
- filing of NER-300 in Brussels
- answer from the EU, etc.

## Targets (demonstrator):

- 700,000 t/yr stored for 10 years
- 94% capture rate

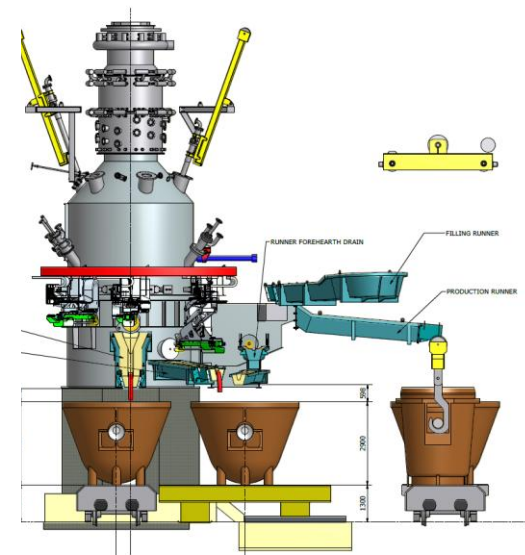
## Budgets:

- still a *regret* solution...



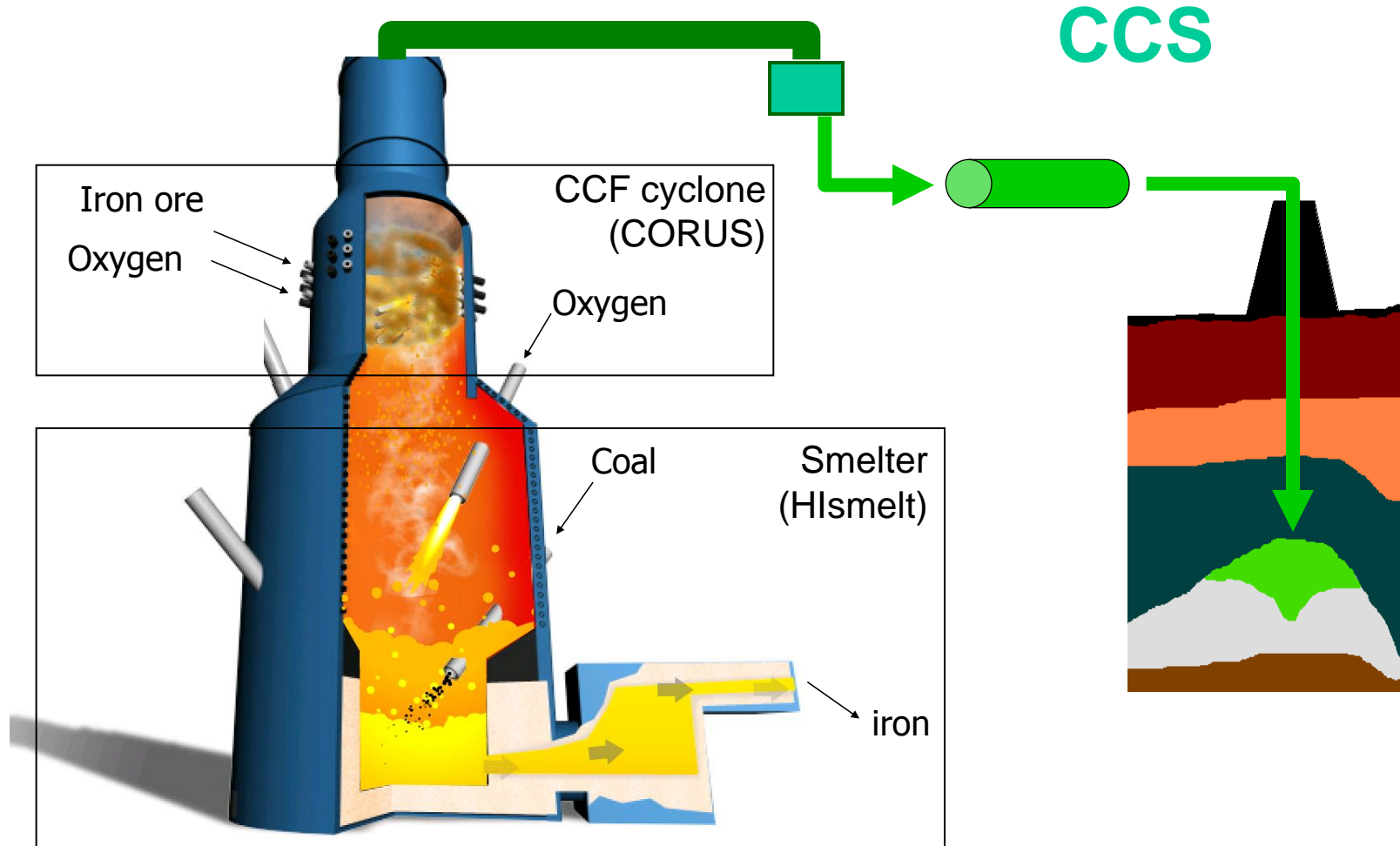
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# Hlsarna





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# Hlsarna



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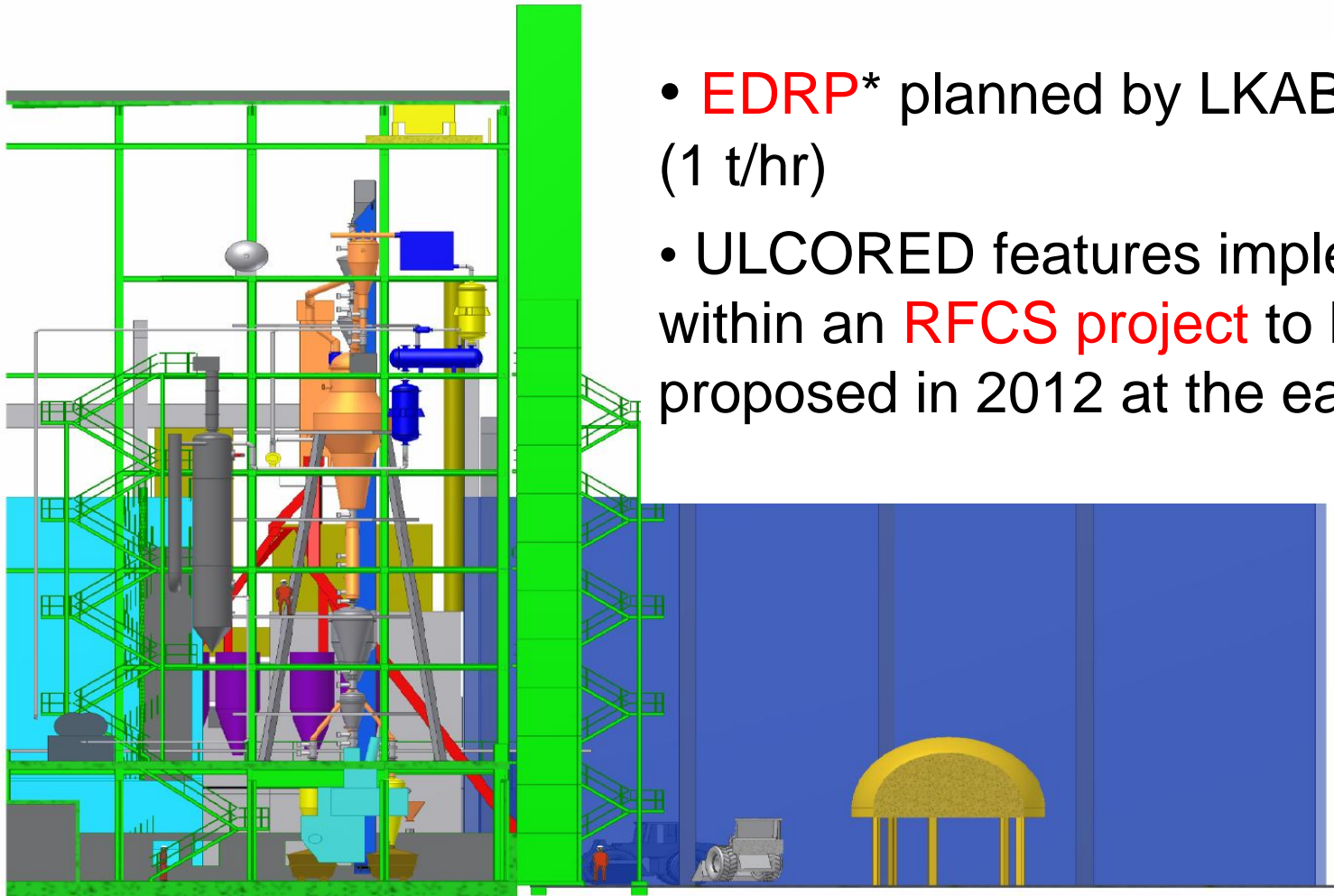
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- ULCOwin & ULCOlysis
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# ULCORED

LKAB



- **EDRP\*** planned by LKAB in Luleå (1 t/hr)
- ULCORED features implemented within an **RFCS project** to be proposed in 2012 at the earliest





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# ULCOwin



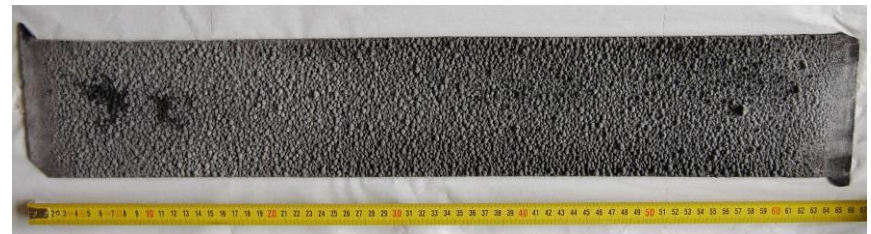
electrowinning cell

- 4 kg samples
- pure Fe + O<sub>2</sub> evolution
- 110 ° C (=room temperature electroreduction)
- water alkaline electrolyte

*inert anode!*



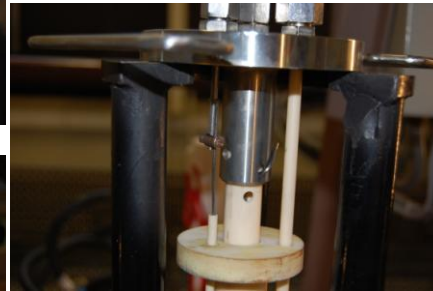
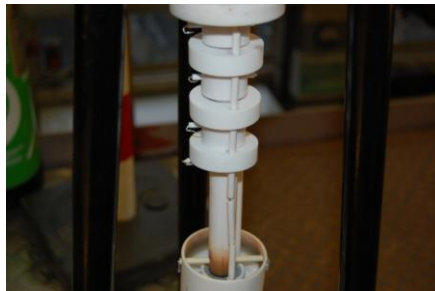
ArcelorMittal





*inert anode!*

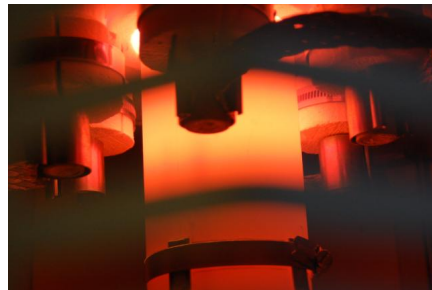
# ULCOlysis



- 1 g samples
- pure Fe + O<sub>2</sub> evolution
- 1550 ° C = pyroelectrolysis
- slag electrolyte



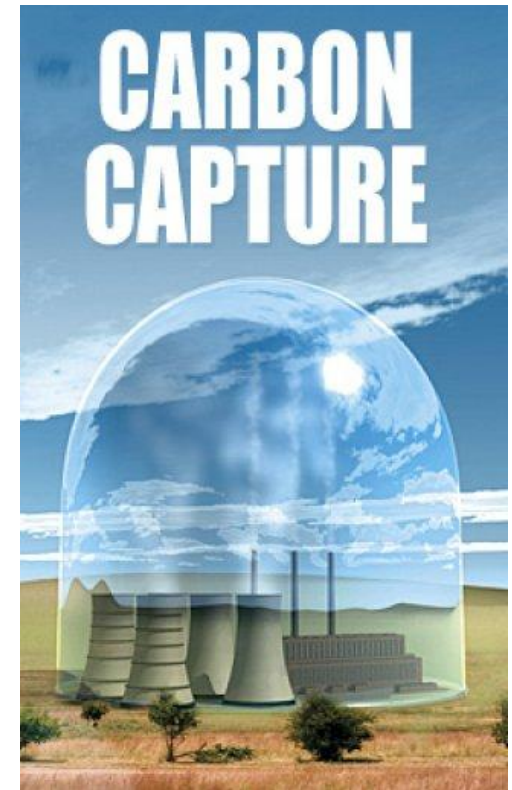
ArcelorMittal





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# Conclusion: innovation & risks

- if the **demonstrators** are **successful**...
- ...and if the **economic conditions** for implementing the ULCOS routes are **right**...
- ... then **deployment** should follow up for most of the Steel Mills in Europe, and, eventually in the world, for the Steel Industry to meet its post-Kyoto targets
- **however, ULCOS was a research initiative, has turned into a demonstration initiative but it IS NOT a plan for reducing the emissions of the Steel sector!**



# Thank you!

