The steel as backbone of **EU R**esource & **E**nergy **I**ntense **I**ndustry **sustainability**

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19:00 - 22:00
Members' Salon, European Parliament
Brussels, Belgium

EU steel and sustainability

Some facts

Steel made in Europe:

the backbone of sustainability

EU steel and sustainability

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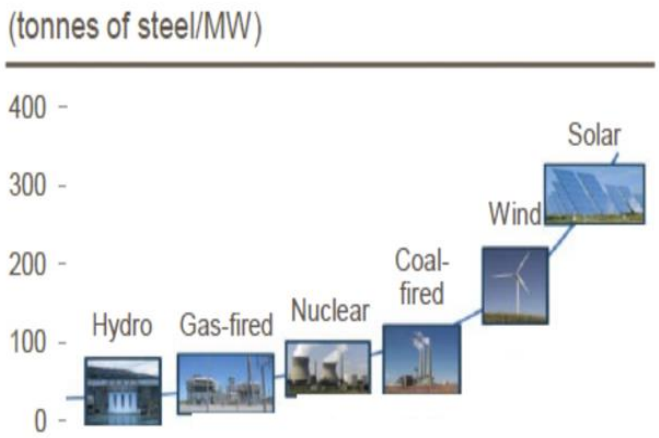
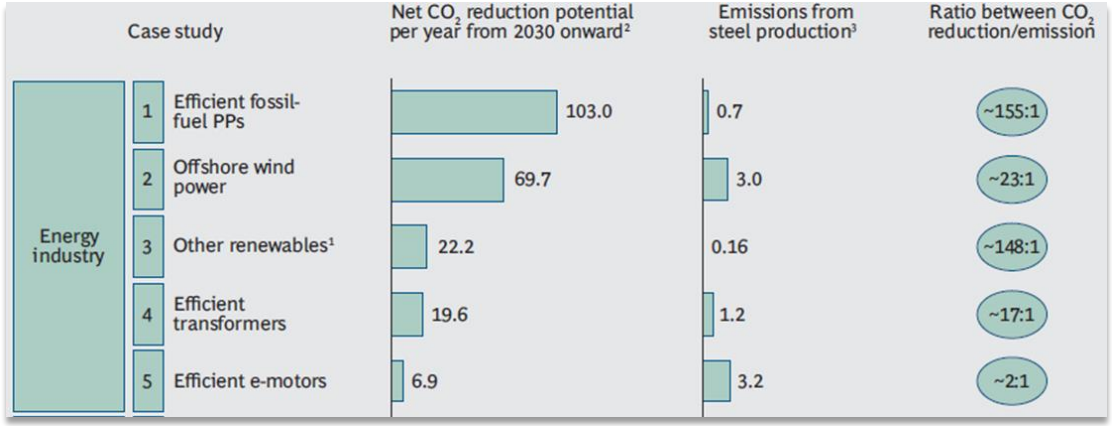
Steel & new EU energy frontiers



The energy generation technologies based on **renewables are** several times **more material intensive, including the steel.**

Innovative use of steel saves much CO_2 as is caused by the production of the steel

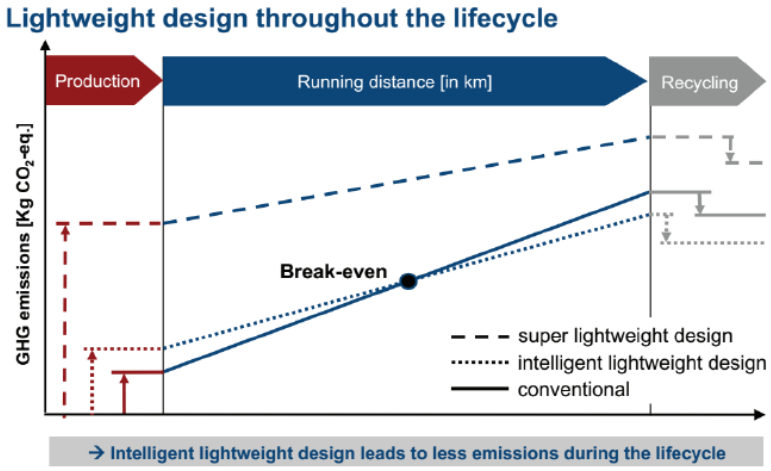


http://www.stahl-online.de//wp-content/uploads/2013/09/Schlussbericht-Studie-Low-carbon-Europe-2050_-Mai-20131.pdf

EU steel and sustainability

Some facts

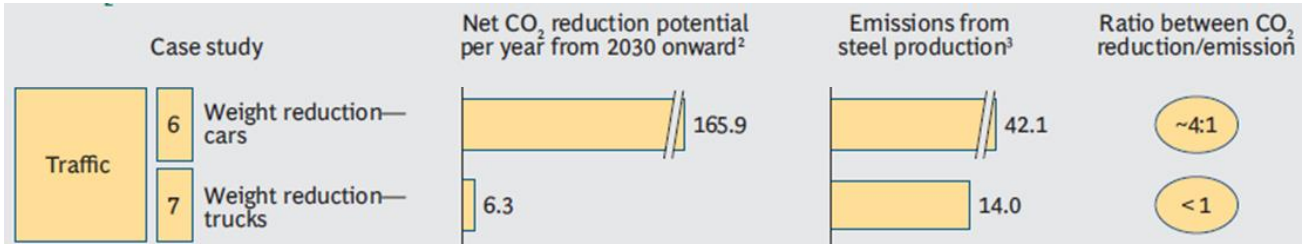
Steel & new transportation era



Source: DG-Research and Innovation "The Future of European Steel, April 2017"

Steel provides sustainable solutions when viewed from a life-cycle perspective:

- new steels provide more "function" (strength/ductility/…) with less material
- new technologies increase the material efficiency over the supply chain.



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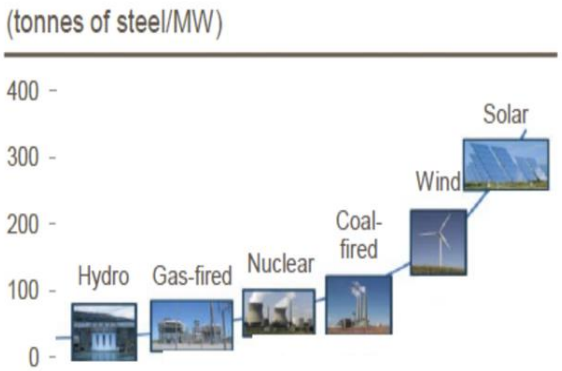

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	Case study	Net CO_2 reduction potential per year[2] from 2030 onward[2]	Emissions from steel production[3]	Ratio between CO_2 reduction/emission
Energy industry	1 Efficient fossil-fuel PPs	103.0	0.7	~155:1
	2 Offshore wind power	69.7	3.0	~23:1
	3 Other renewables[1]	22.2	0.16	~148:1
	4 Efficient transformers	19.6	1.2	~17:1
	5 Efficient e-motors	6.9	3.2	~2:1

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Steel in EU circular economy:

the by-product, a “wealth of glows”

Need to clarify rules on by-products to facilitate industrial symbiosis and help create a level-playing field across the EU

Source: ESTEP-EUROFER WORKSHOP LEGISLATIVE CONSTRAINS AND FUTURE THREATS FOR BY-PRODUCTS AND WASTE Circular Economy Workshop Business 10 November, 2016

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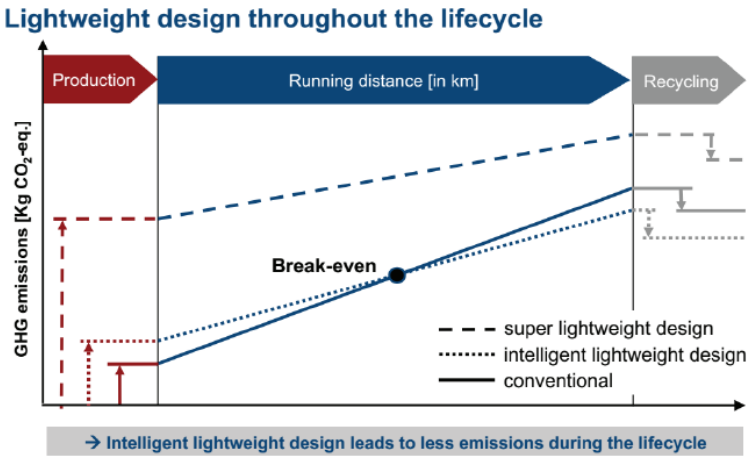

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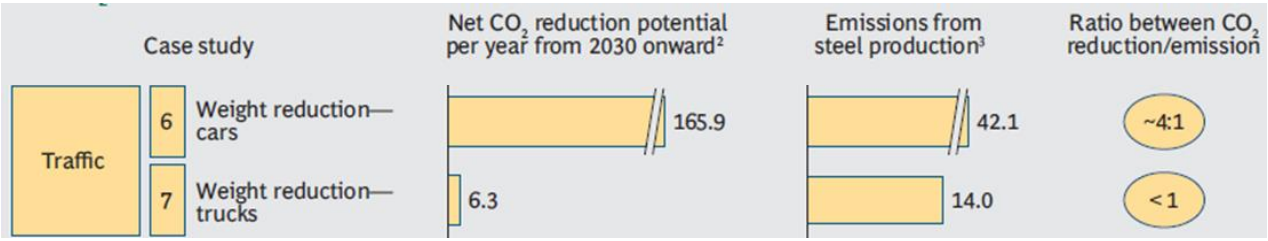

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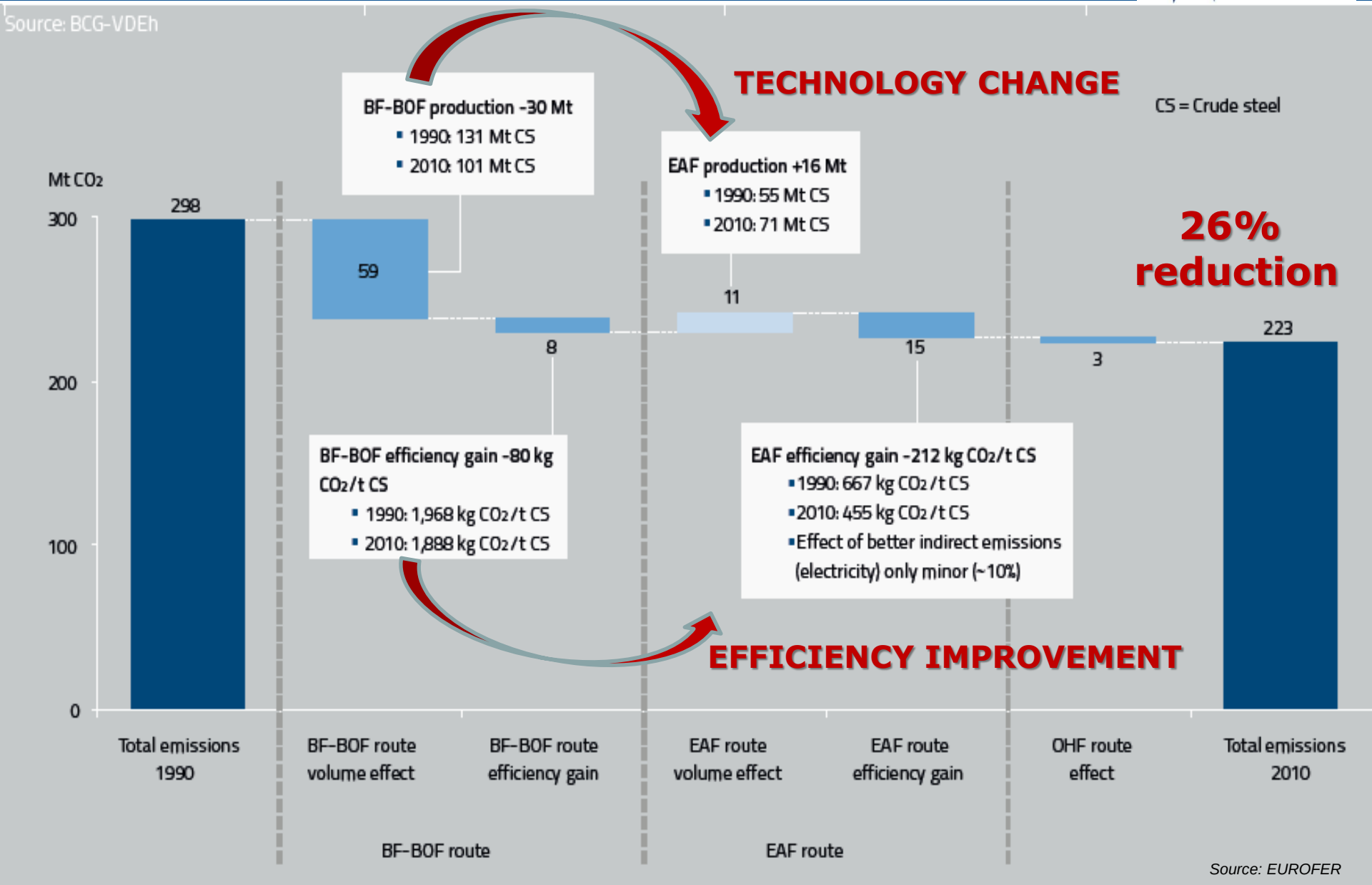
CO_2 reduction in EU steel sector

1990 → 2010



Source: EUROFER

Decarbonisation: the new challenge

ESTEP / EUROFER Technologies pathway

Pathways / Groups	Circular Economy: Enhancing the recycling of steel (eg scrap in BOF/EAF) and its by-products, Resource efficiency (eg SPIRE)		
	Smart Carbon Usage (SCU): Process Integration with reduced use of carbon (+CCS)	Smart Carbon Usage (SCU): Carbon Valorisation/ Carbon Capture and Usage (CCU) (+CCS)	Carbon Direct Avoidance (CDA): Hydrogen; Electricity
Description	Process Integration with reduced use of carbon	Using CO/CO_2 from steel mill as raw material (Chemical conversion of CO/CO_2)	Use of renewable electricity in basic steelmaking, e.g. production of H_2 to replace Carbon
Projects / intiatives	HISARNA, TGR-BF-Plasma (IGAR), PEM, STEPWISE	Steelanol, Carbon2Chem, FReSMe	HYBRIT, H2Future, SuSteel, GrInHy, MACOR/SALCOS, SIDERWIN

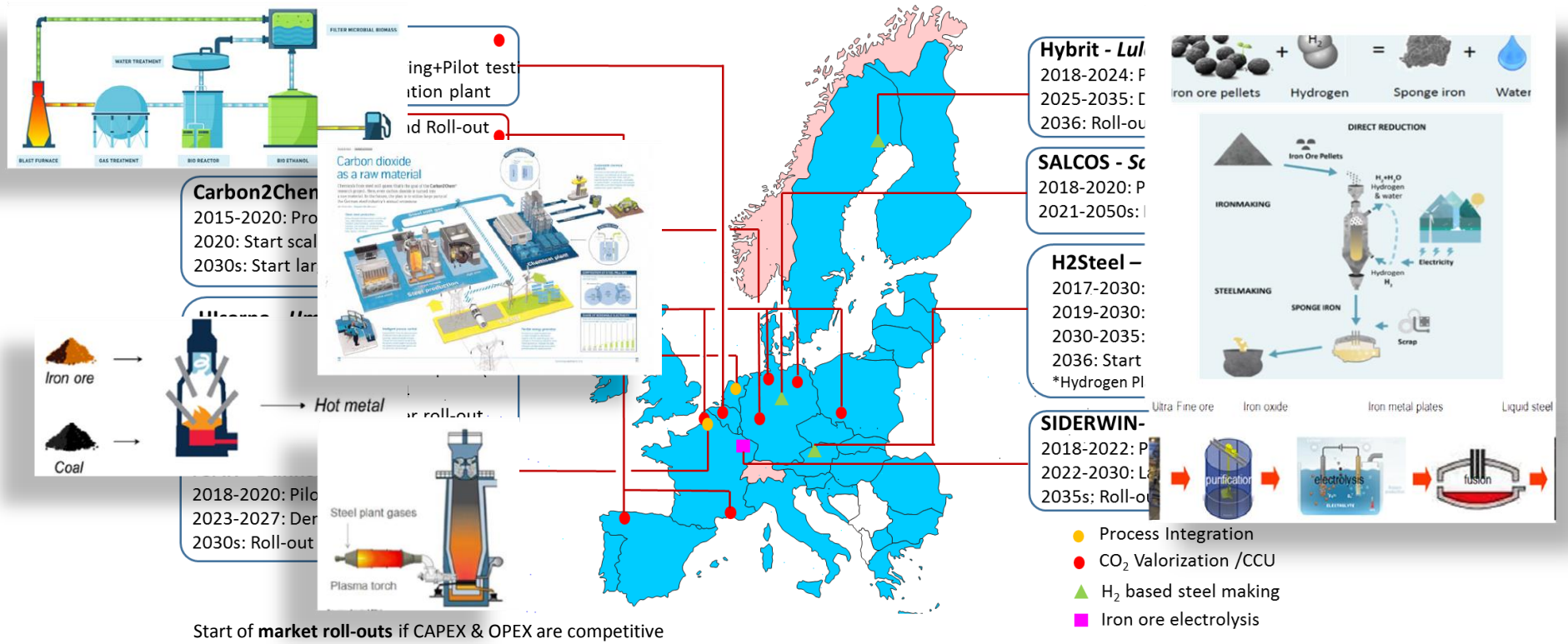
Source: ESTEP Masterplan 2017

All pathways have common challenges:

- International level playing field (affordability of CAPEX and OPEX)
- R&D and risk sharing during upscaling
- Access to renewable energy
- New business models and new synergies for commercial roll-out

MAPPING key innovative

Carbon neutral projects of the EU steel industryy



Start of **market roll-outs** if CAPEX & OPEX are competitive at demonstration phase, & regulatory framework conditions and infrastructures beyond site borders are in place

Source: Publicly available literature, presentations

ESTEP/EUROFER targets:

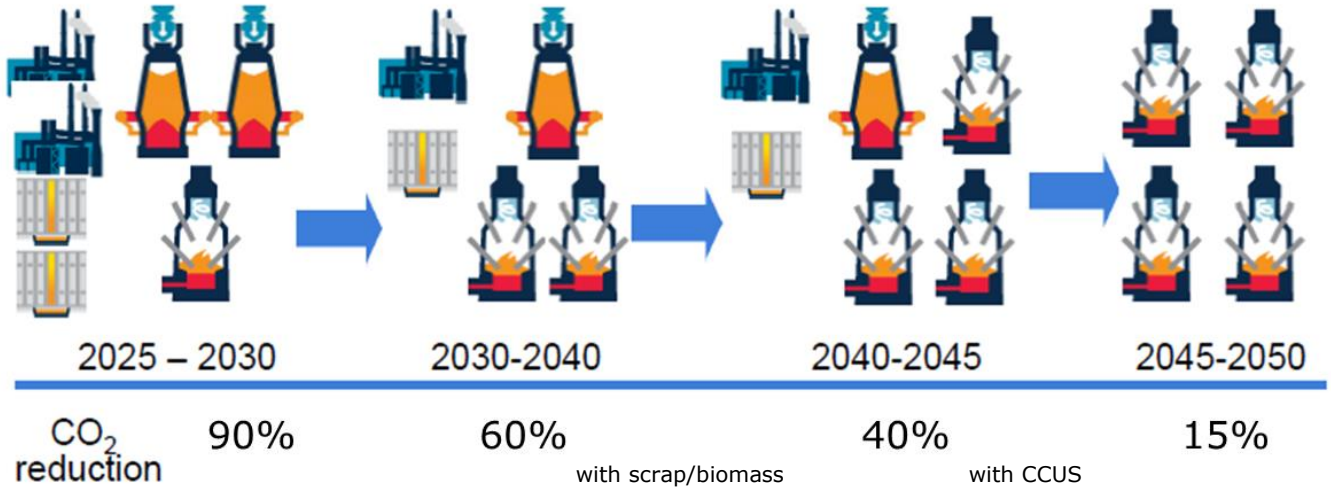
- Bringing at least 4 ongoing projects up to industrial scale (will require financing of up to 11 Billion € in the years 2021-34)
- Launching projects at industrial scale (TRL 6-8) already in the first years of Horizon Europe (2021-27 overall financial support required for research activities is EUR 1.8 Billion €)

EXAMPLEs

Industrial plan for Low Carbon scenario

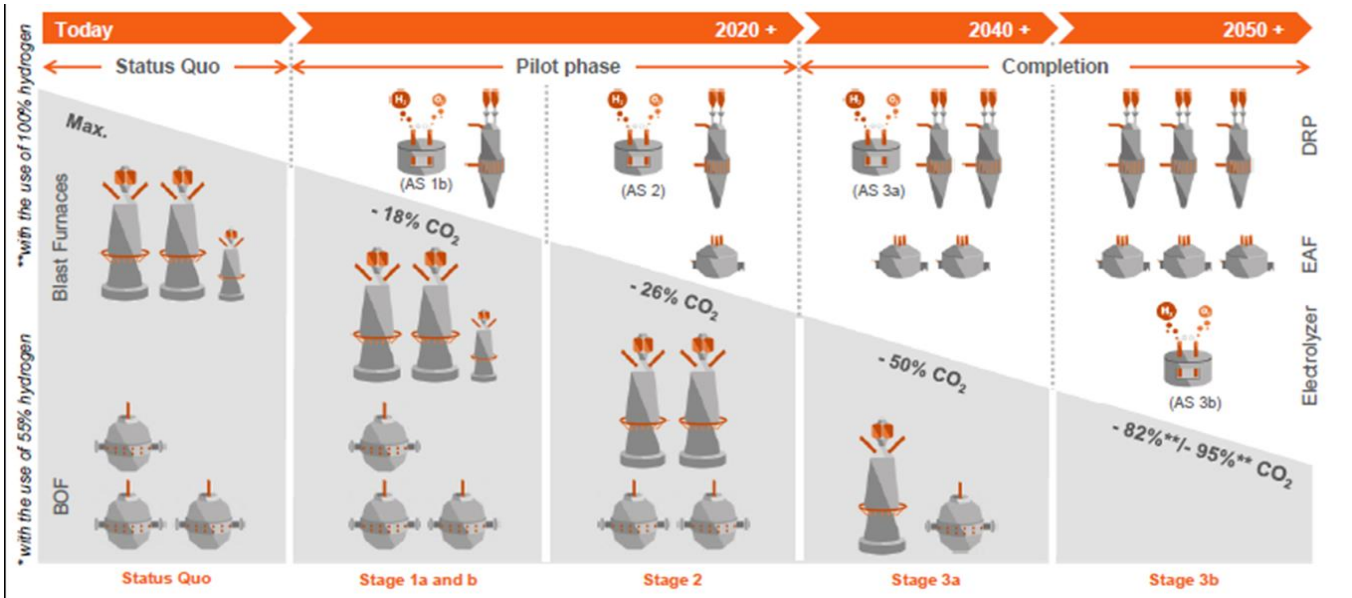
Smart
Carbon
Use

Hisarna
Tata Steel



Carbon
Direct
Avoidance

SALCOS/GreenH_2
SALZGITTER AG



Gradual Decarburization

An example: Direct-Reduced Iron (*DRI*) production

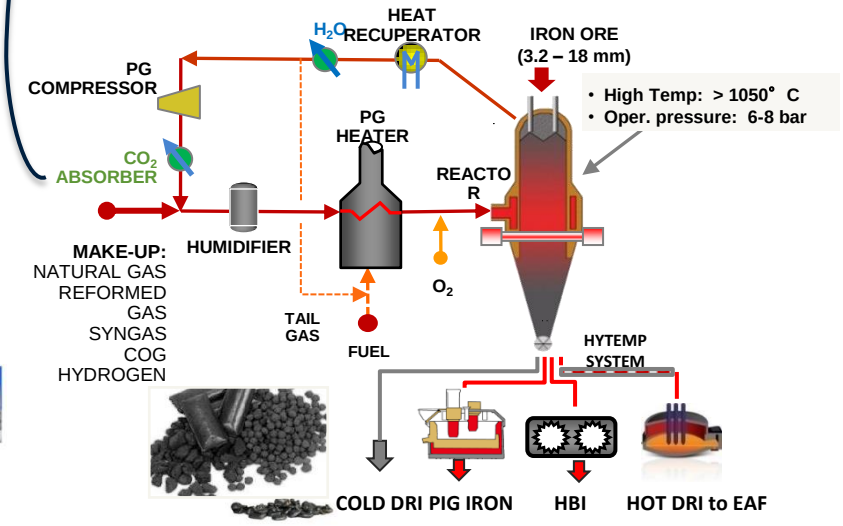
ENERGIRON ZR Scheme

The direct reduction plant uses the **natural gas as a reducing agent** and has the potential for the **gradual introduction of the "green H_2"** generated using renewable sources

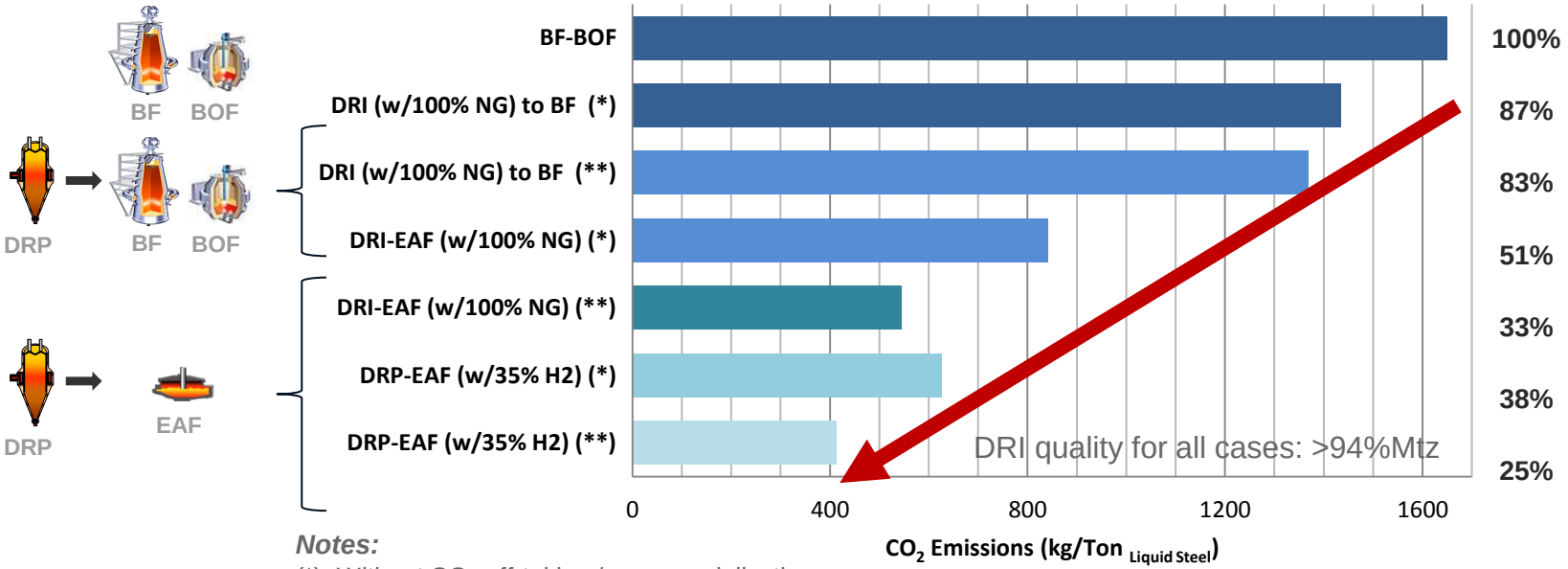
ENERGIRON process inherently includes CO_2 separation (**C**arbon **C**apture)

Utilisation of CO_2 has been also implemented worldwide

Worldwide plants



Potential CO_2 reduction based on DRI and "green H_2"



Notes:

(*) Without CO_2 off-taking / commercialization

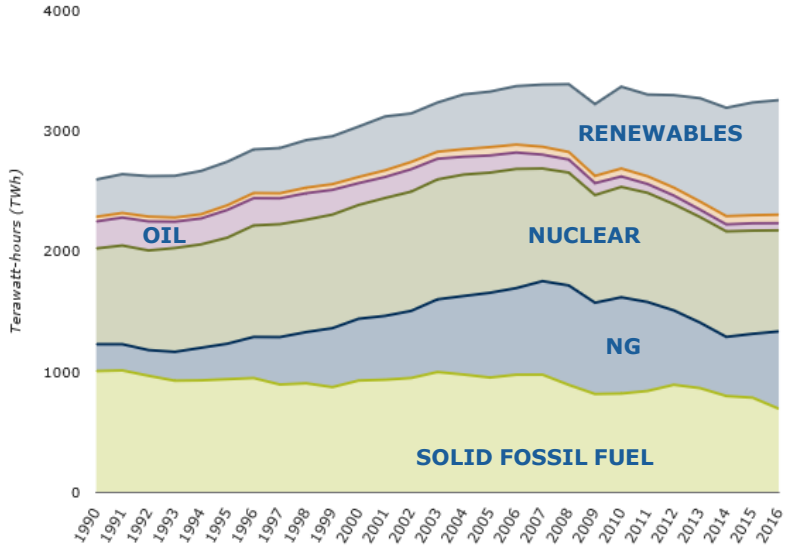
(**) With CO_2 off-taking / commercialization

H_2 in % as energy input

- Use of H_2 concentrations as high as 70% at the inlet of reduction shaft is already well proven in the ENERGIRON-III plants, which involves a steam reformer to produce the reducing gases (H_2 and CO).
- It is possible to keep the 3.5% C even at 35% energy input as H_2 (or about 64% as volume-Nm^3/t_{DRI}).
- For 70% H_2 as energy (~88% as volume-Nm^3/t_{DRI}), the expected C in DRI will be < 2.0%.

Infrastructure need & OPEX

Gross electricity production by fuel, *TWh*, EU-28, 1990-2016 (Eurostat)



EU steel electricity consumption (today): ~ 75 *TWh*

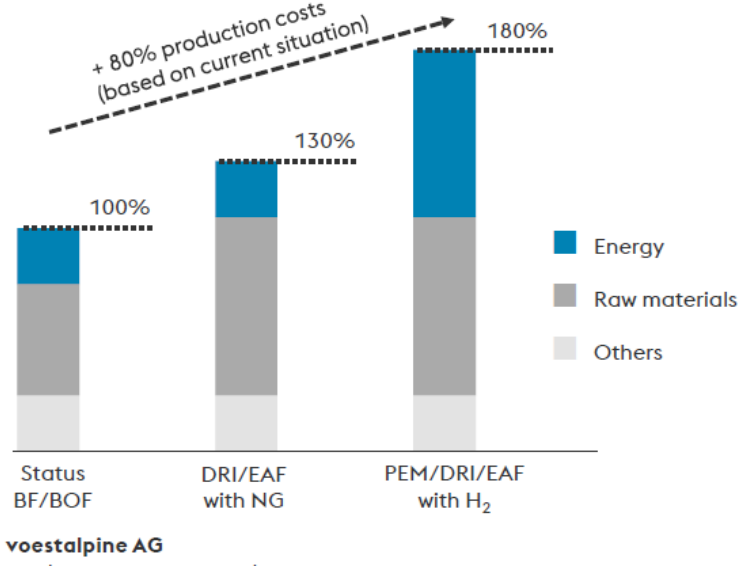
If 100% H_2/electricity/CCUS based: *~ 4-500 TWh**

*with today's efficiency of electrolysers for H_2 production

Additional electricity demand from renewable sources has to be available for steel

How the EU Electricity Market look like in 2030/40 ?

Production Cost (OPEX, Indicative)



Fully renewable transformation results in a relevant increase of steel production costs in EU

Several investments has been done worldwide to move from C to NG where material and energy cost are favorable

To maintain competitiveness on global level low-carbon technologies are not only a challenge of EU steel industry

European Steel Technology Platform – ESTEP

Strategic Research Agenda (SRA)

(This is an electronic version of the SRA, last updated on 5th September 2017)

Thank you for your attention!

www.estep.eu

http://www.eurofer.org/News%26Events/PublicationsLinksList/20160405%20Steel%20the%20Backbone%20of%20Sustainability%20in%20Europe.pdf