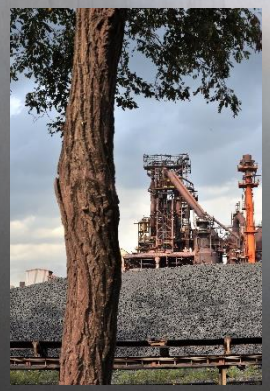
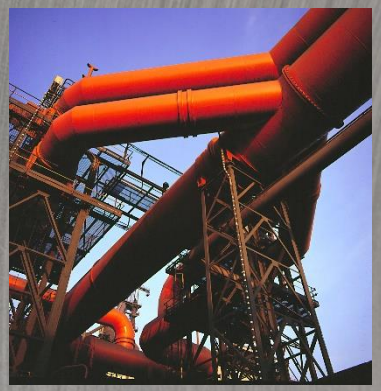
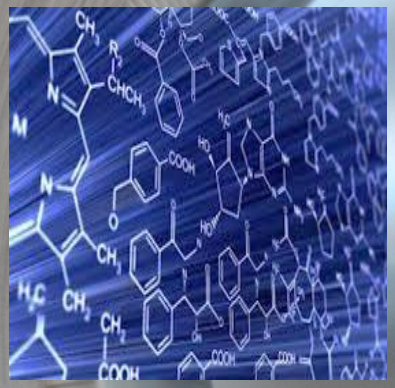
Steelanol

Fueling a sustainable future

This project is co-funded by the European Union




Making Steel

Why carbon emissions? And how much?

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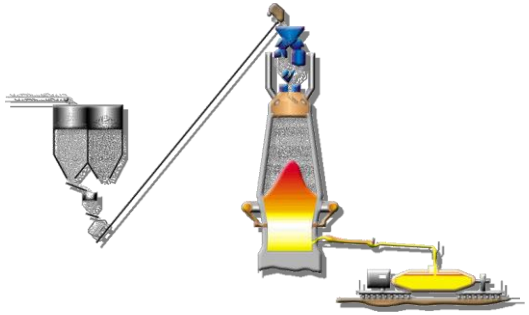


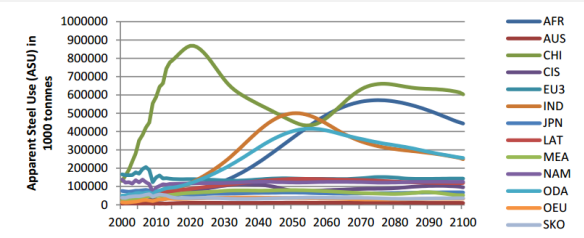
Chemical reaction

$$Fe_2O_3 + 2C = 2\,Fe + CO + CO_2$$

iron ore + carbon = iron + gas

CO_2 is unavoidably created during iron reduction in blast furnace!

We need still increase steel stock in use over this century to create standard of living for 9 billion people.

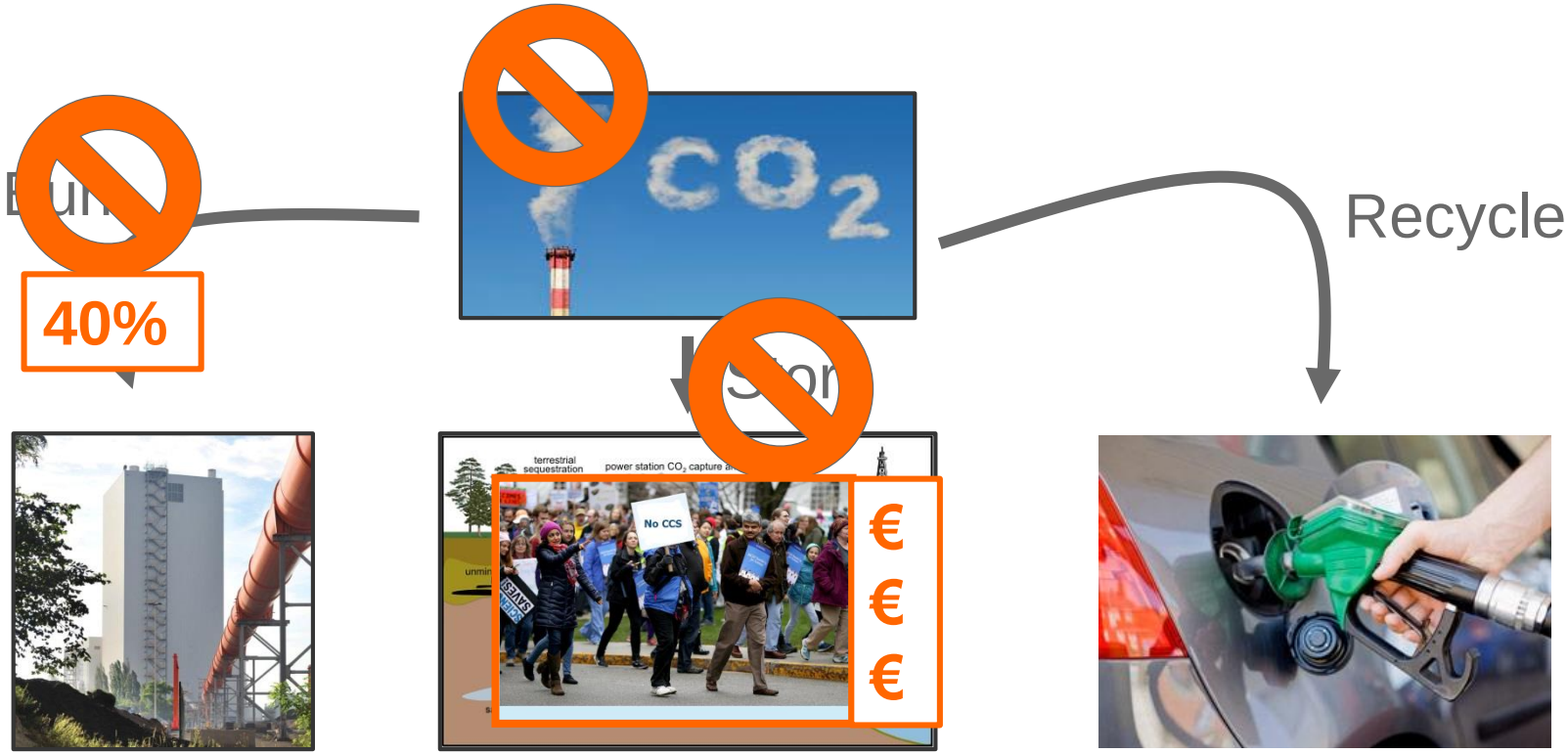


1 kg steel /day.person

20 x

0.05 kg steel /day.person

What to do with the carbon emissions?



Steelanol: AM Gent demonstration project
Objective

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Objective

Construction of **Europe's first-ever** commercial scale production facility to create bioethanol from waste gases produced during steelmaking process.

Demonstrate cost-effective **production of low carbon bioethanol** using unavoidable steel production gases as a resource for a novel gas fermentation technology, finally assessing the valorisation of this biofuel for diverse applications, mostly in the transport sector.

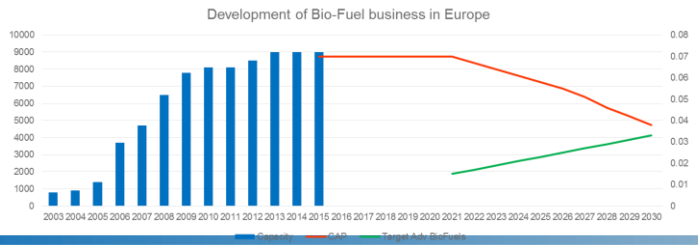
Keyfigures

Investment cost is 120 Meuro

90 000 Nm^3 waste gas/h from blast and basic oxygen furnace

Production of 65 000 ton/year ethanol

Steelanol is eliminating the GHG emissions of 80 million liter of gasoline over the total chain.



Use of biofuel

Blend ethanol with 'Super 95 E10 ' (10%)

EU will limit food-based biofuels in 2030

Making bio-ethanol from steel waste gas

Method

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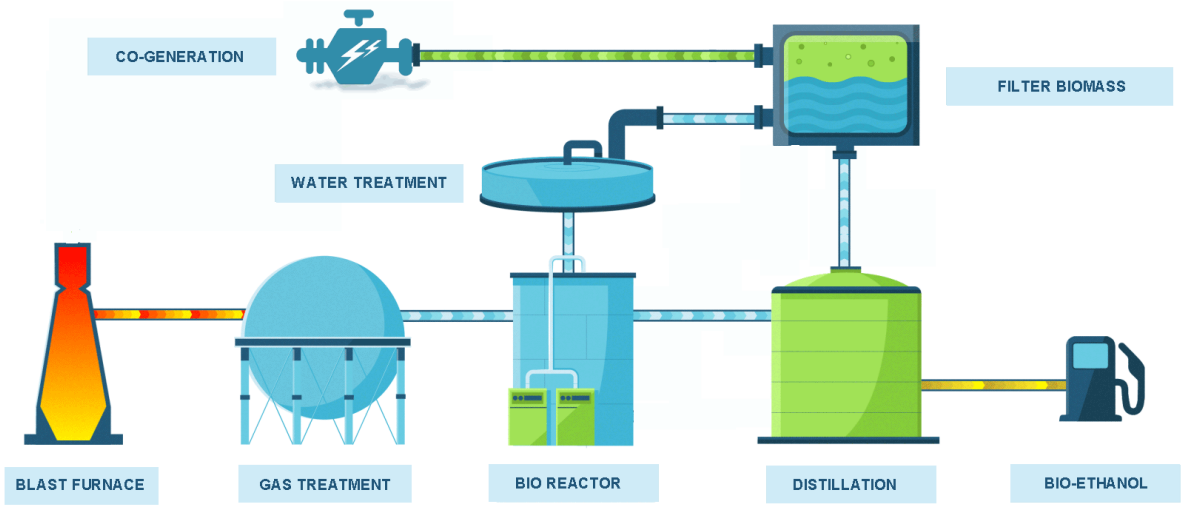
The Lanzatech process: Gas fermentation is an innovative option for further valorization of steel process gases, complementary to the current power plant use and use of the gases for internal thermal energy production.



ArcelorMittal

LanzaTech

PRIMETALS TECHNOLOGIES

E4tech

Steelanol: AM Gent demonstration project
Impact: Green House Gas savings

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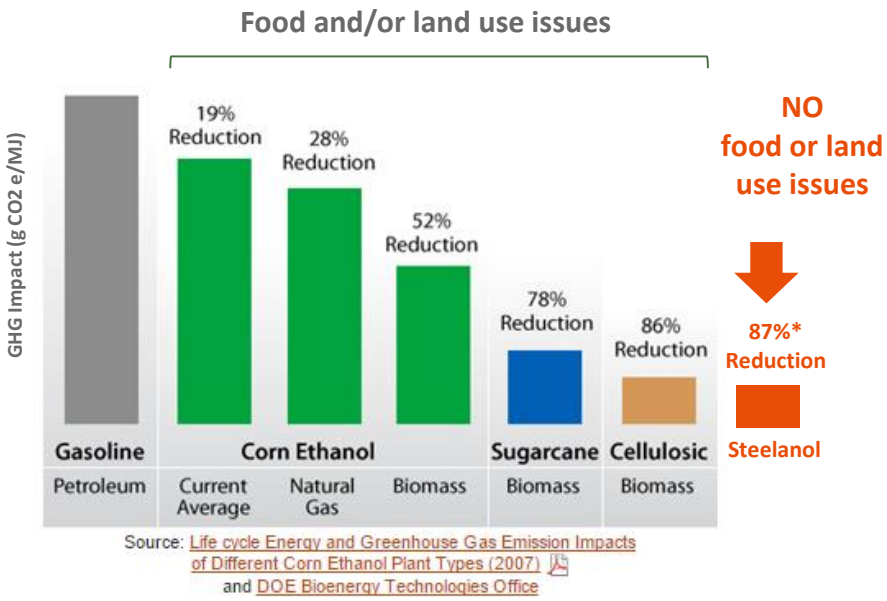
Based on Life Cycle Assessment studies conducted by the Roundtable on Sustainable Biomaterials, E4Tech and Ecofys specifically on the Gent project, the process realizes GHG savings > 80%, as required by RED, and without any food or land use issues.



Car Transport
Steelanol fuel production: 80 000 000 l/y
Steelanol = 100 000 electrical cars (13 500 km/y)

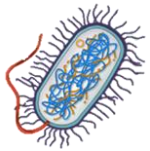
Aviation transport
Steelanol : 40 000 000 liter jet fuel/y
Boeing 747 uses 12 liter/km
600 Boeing 747 flights from London to New York

Renewable power
Steelanol capacity 80 000 000 l/y ethanol = 60 MW (th) x 2 = 120 MW (th)
Wind mill of 3 MW capacity in average = 1 MW (el)
Steelanol renewable power → 120 wind mills

** Base on GHG calculation by Ecofys for the Gent plant*

Steelanol: AM Gent demonstration project
Technical challenges

Main technological challenge is upscaling the technology from demonstration to commercial scale

Implementation	X 50	X 32	X 33	Scope of the investment opportunity
Strain Development	**Lab Scale Reactor**	**Pilot**	**Demonstration**	**Commercial**
				
	2005	2008	2012	NOW

Production Rate	0.5 – 1 kg EtOH/day	50 – 100 kg EtOH/day	± 1,500 kg EtOH/day	± 178,000 kg EtOH/day
Reactor Size	1 – 10 l	2 x 500 l	16,000 l	533,000 l
Location	LT lab	Blue Scope Steel Mill Glenbrook, New Zealand	Baosteel (Shanghai, China) + Shougang (Bejing, China)	AM Ghent Belgium

Project status

- AM Gent has concluded the engineering of the plant concept with selection of best available technology
- Early investment done at the gas pipeline during the powerplant stop of april 2016
- Mobile lab testing on real steel waste gases: positive results
- Certification as biofuel obtained
- Order of main equipment in Q2/2018

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The Director

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Directorate C
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The Director

Brussels,
03 FEV. 2017
BK/abd ener.c.1(2017) 370177

Marie Donnelly

Artur Runge-Metzger

Virtual tour of the Steelanol Plant

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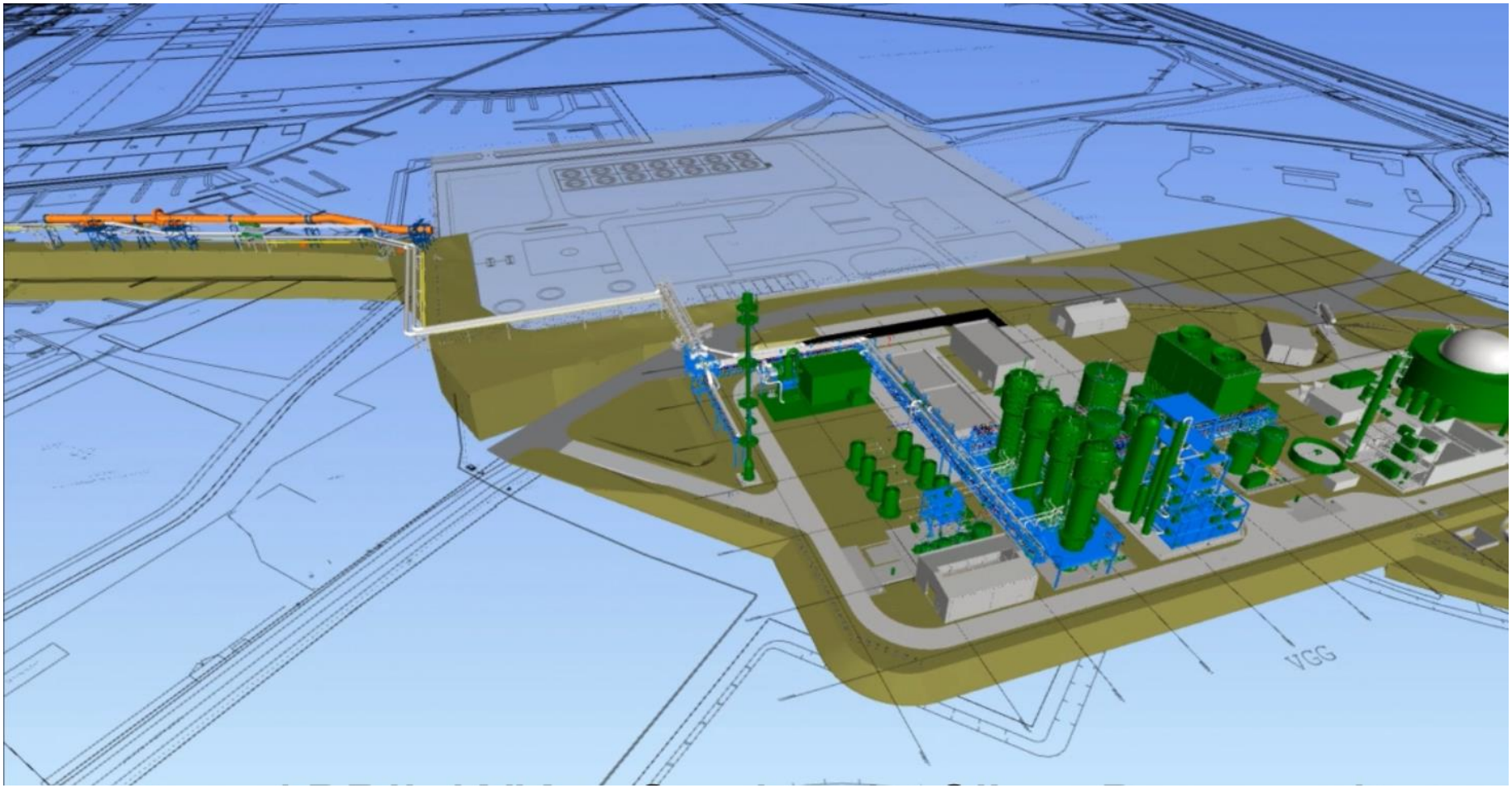

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Thank you for your attention!