# Best practice in RFCS projects STEEL

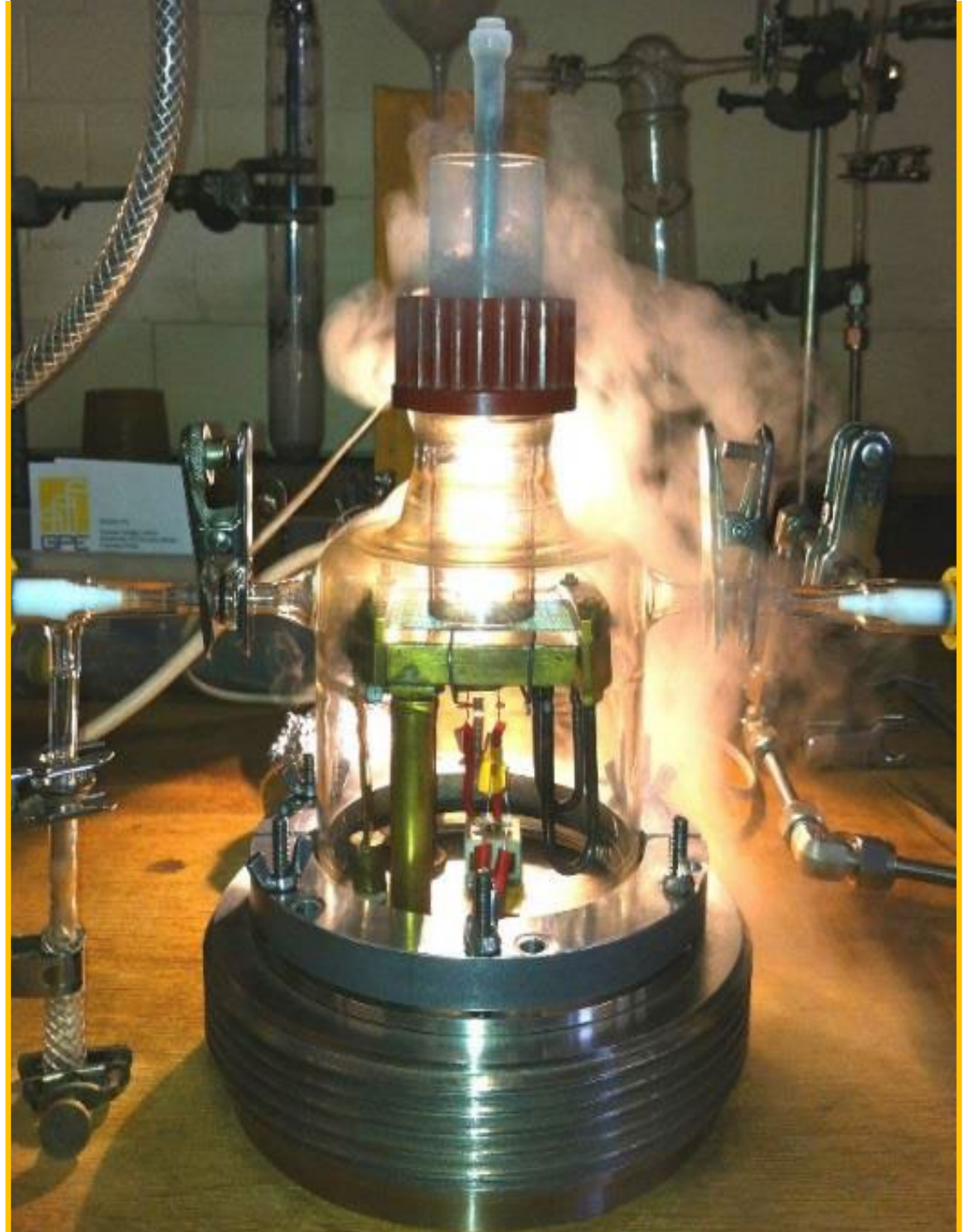
RFCS Summit 2022

*Brussels 21-22 March 2022*

# GREENEAF2 - Biochar for a sustainable EAF steel production - 00003

The project undertook further R&D of using biomass char instead of coal in electric arc steel furnaces, especially the field validation of char injection & the effects on productivity.

European Commission



# GreenEAF2 History

The previous GREENEAF project (RFSR-CT-2009-00004) has demonstrated the feasibility of utilization of char, from biomass, as substitute of coal into the EAF.

The present project objective was to make the char use a standard practice.

Therefore, the following activities have been carried out:

- char laboratory characterizations to check the capability of the material to replace coal in industrial trials, both for charging and injection procedures,
- identification of most suitable injections systems
- analysis of EAF behaviour in case of char and biomass use during long-time industrial trials
- Life Cycle Assessment study, as regard to inventory issues.

European Commission

# GreenEAF2 main objectives

Industrial trials of EAF charging confirmed the feasibility of coal substitution and outlined the relevant process aspects: basket preparation to avoid material burning before dissolution into molten steel and EAF post combustion to recovery the energy content of the char volatile matter.

In case of injection trials, a wide range of possibilities has been exploited: biochar, biochar mixed with fossil coal and virgin ligneous biomass. The best slag foaming, comparable with the pulverised fossil coal injection has been obtained with virgin biomass.

Outlined energy saving with EAF equipped for post combustion and tailored char production form low grade biomass showed that char utilization is economically sustainable.

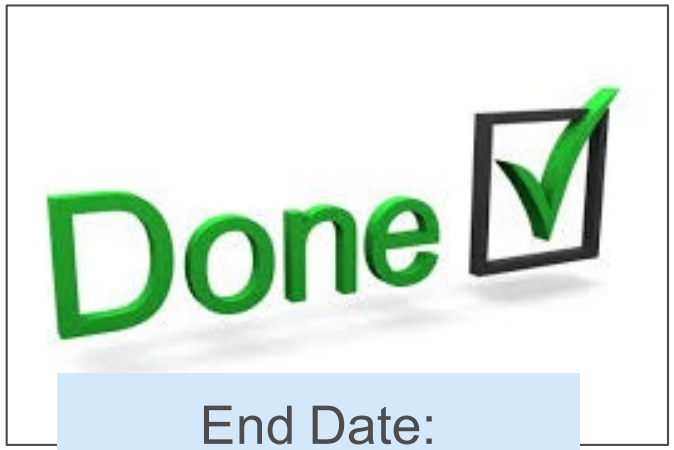
# Data sheet GreenEAF2


Start Date:

1/07/2014


EU Grant

€1,001,182

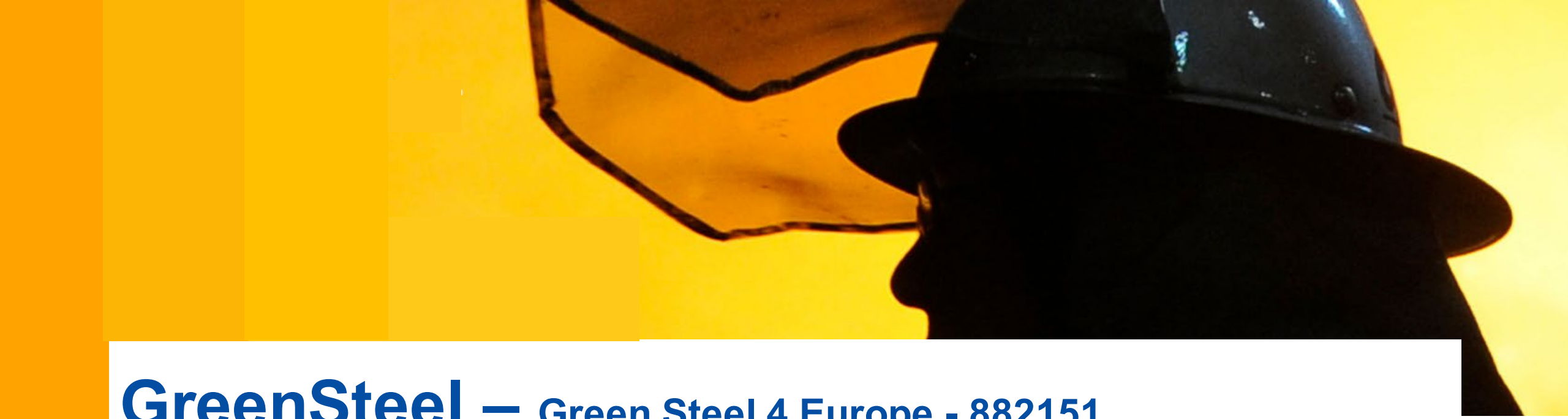



End Date:

30/06/2016

[Biochar for a sustainable EAF steel production (GREENEAF2) - Publications Office of the EU (europa.eu)]

European Commission



# GreenSteel – Green Steel 4 Europe - 882151

"*The GREENSTEEL project has significantly contributed to identifying the challenges and proposing solutions towards reducing greenhouse gas emissions in the steel industry*" Jonas Fernandez, Member of the European Parliament - Socialists and Democrats, at the conference "Climate-neutral steelmaking in Europe: Technology, financing and policy conditions".

European Commission

GREEN STEEL FOR EUROPE

# Project history

The Green Steel for Europe (GREENSTEEL) project provides insights and recommendations for effective solutions for clean steelmaking suitable for the EU to achieve the 2030 climate and energy targets and the 2050 long-term strategy for a climate-neutral Europe.

Ten partners including a think tank, eight research and technology organisations and a European industrial association participated in the project, ensuring excellent research quality.

Throughout its research and dissemination activities, GREENSTEEL also engaged relevant stakeholders representing the steel and non-steel industries, public authorities, academics, research institutions and civil society organisations who provided inputs and validated the project findings.

European Commission

# The key outcomes of GREENSTEEL include

- Identification of different categories of barriers impinging on the decarbonisation of the steel industry.
- Enhancement of the evidence base to decarbonising the EU steel industry and providing state-of-the-art knowledge on key decarbonisation technologies and technology routes, roadmaps for deploying these technologies and the decarbonisation scenarios for 2030 and 2050.
- Estimates of the investment needs to support the decarbonisation process and identification of the funding programmes most relevant to the decarbonisation of the EU steel sector.
- Proposed mechanisms for blending and sequencing of existing and forthcoming funding opportunities to maximise their impacts.
- Identification and assessment of the policy options under six areas that support the decarbonisation of the steel industry (funding, renewable energy, green hydrogen, carbon pricing, carbon capture and use or storage, and steel scrap).

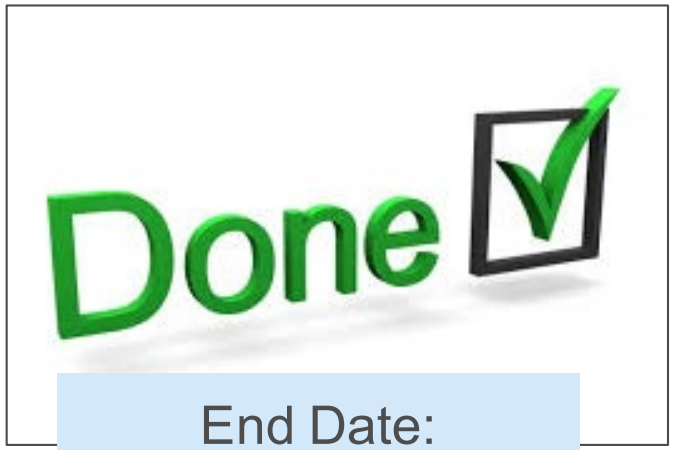
# Data sheet GREENSTEEL


Start Date:

01/01/2020


EU Grant

€ 1,247,612




End Date:

31/10/2021

[Green Steel for Europe - ESTEP]

European Commission

# MACOPilot - Optimisation of the mixed-acid online monitoring and control in stainless steel pickling plants - 709694

The project sought to increase the EU's steel industry production flexibility whilst maintaining highest quality. This pilot project aims to optimise the innovative online concentration measuring technique concerning set-up, long-term reliability and operative range.

European Commission

# Short history of MACO Pilot project:

- The project started in July 2016 and finished in December 2019. In the beginning a characterisation and determination of measurement requirements at the pickling plant applications was carried out. Subsequently the measuring technique set-up and concentration calculation model were optimised.
- In summer 2017 the installation of three measuring systems could be performed successfully at a new strip pickling line and regenerated acid tank system of Outokumpu Nirosta. Beside comprehensive operational testing and optimisation of the measuring technique investigations with an advanced closed-loop concentration control model based on high-rate concentration data were carried out until the end of the project.
- From the end of 2017 a further measuring system in combination with a mixed acid sample stream pre-filtration technique was established and tested at a wire-rod dip-tank pickling plant of Deutsche Edelstahlwerke. Furthermore, an innovative pickling process management model for this plant was developed and operationally tested. Taking into account all the project results and experience, concepts for improvement of existing European mixed acid pickling plants by online monitoring and control were development.

European Commission

# Main objectives of the MACO Pilot project

Within the RFCS research project FLEXPROMUS (2010-2013) an innovative method for continuous HF-HNO3-mixed-acid online analysis was successfully developed. First tests at two stainless steel strip pickling lines showed very promising results.

However, further measuring technique optimisations concentration measuring technique concerning set-up, long-term reliability and operative range for different mixed acid pickling plant applications was necessary to reach TRL 7.

Furthermore, the development of advanced control models is required for improvement of the stainless-steel mixed acid pickling plant process operation and working conditions.

These were the main objectives of the MACO Pilot project, that was finally accepted for funding within RFCS Call 2015.

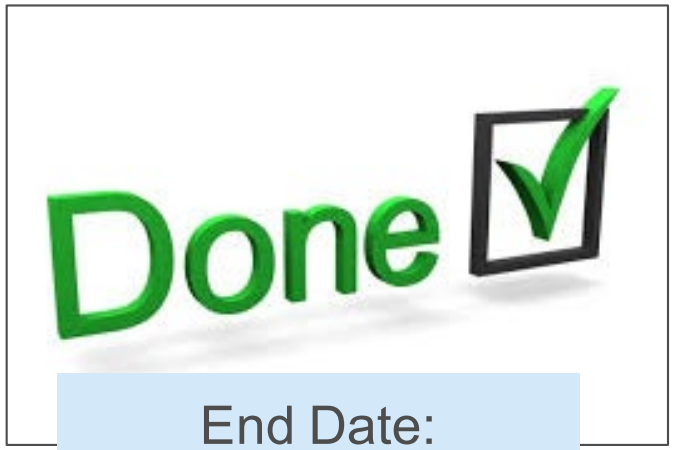
# Data sheet - MACOPilot


Start Date:

01/07/2016


EU Grant

€ 960,181

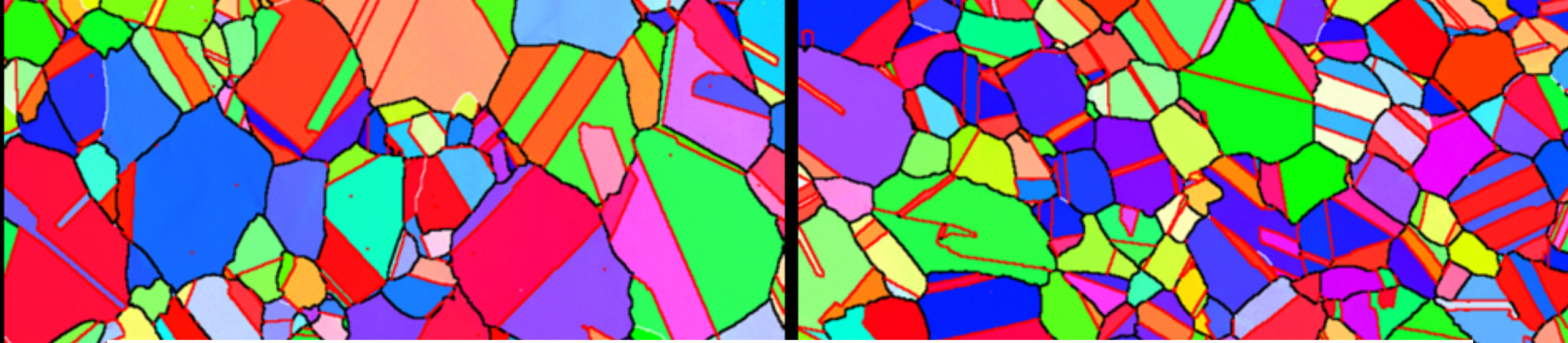



End Date:

31/12/2019

[MACOPilot_Funding & tenders (europa.eu)]

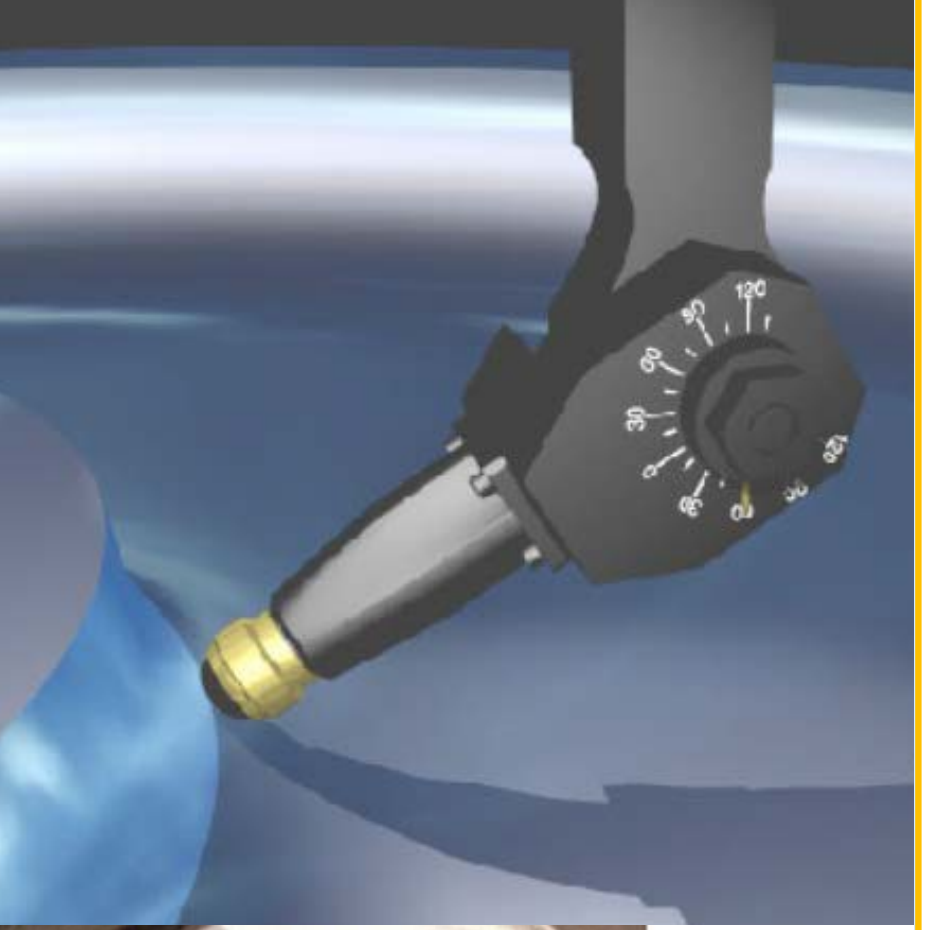
European Commission

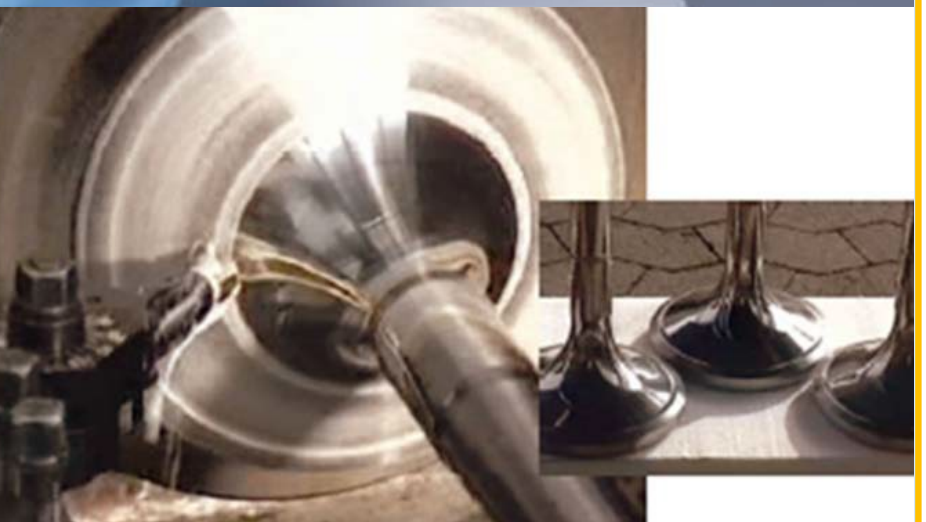


# SteelWind - Design and development of a new high nitrogen bearing STEEL for offshore WIND turbines with improved surface fatigue, wear and corrosion properties for in service life increment - 14018

The project explored the design and development of a new high nitrogen bearing steel for offshore wind turbines with improved surface fatigue, wear and corrosion properties for increased lifespan.

European Commission





# SteelWind history

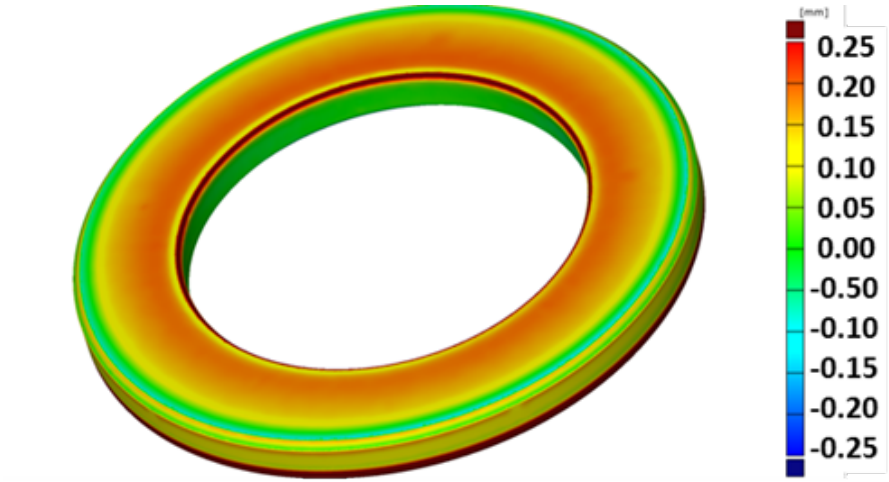
- The general aim of STEELWIND was the increase of the reliability of wind turbines (offshore in particular), by improving the properties of steel bearings for the operations in harsh environment.
- The work finally focused on the design and application of a High Interstitial Austenitic Steel (Carnit 90) expected to withstand both dynamic loads – achieving high levels of strength - and corrosion attack of water, especially sea water when used in offshore applications.
- With the developed steel, it has been possible to manufacture bars characterized by a good quality (absence of porosity, steel cleanliness and the required level of strength for the bulk (300 HV, 900-1000 MPa) with an excellent level of toughness in comparison with the reference materials (high carbon chromium steel 100Cr6). The operations of surface strengthening (as deep rolling) were investigated and optimized in order to approach the required surface hardness.
- Component testing included full-scale testing and the development of functional testing equipment aimed at creating in the conventional steel the typical features of bearing damage as butterfly defects, which are often found coupled to WEC damage

European Commission

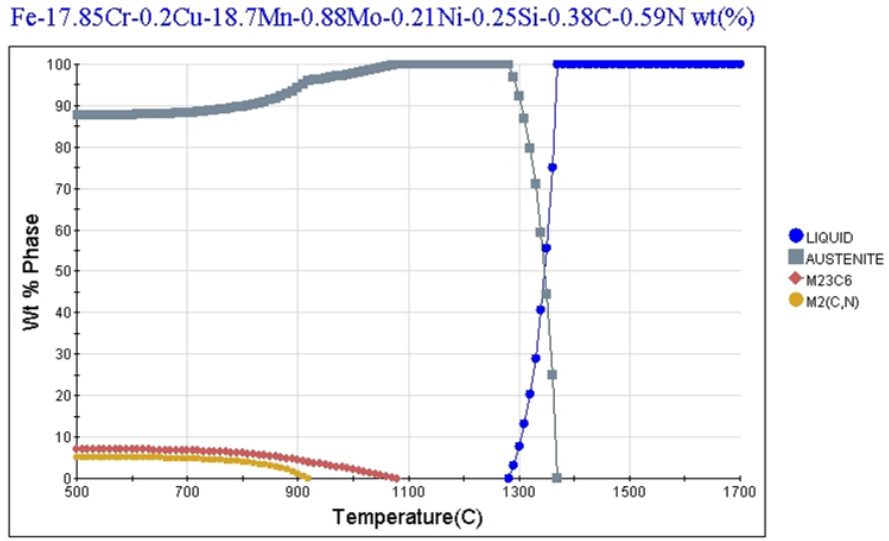
# Main objective of SteelWind project

- The general aim of STEELWIND was the increase of the reliability of wind turbines (offshore in particular), by improving the properties of steel bearings for the operations in harsh environment.

Component




Component deviation




Carnit_thermodynamics

European Commission

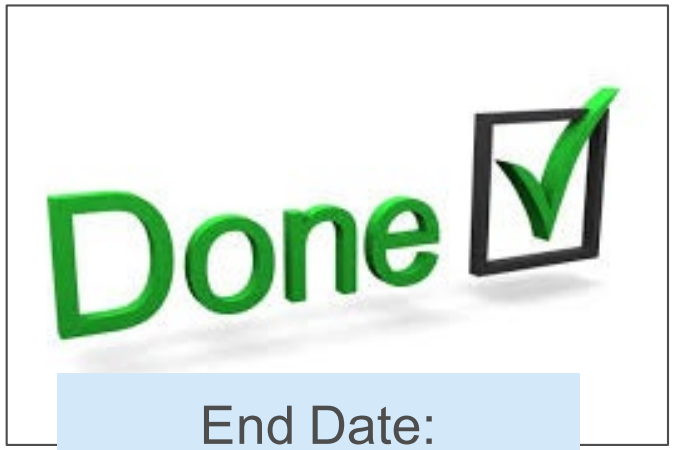
# Data sheet - SteelWind


Start Date:

1/07/2014


EU Grant

€ 1,135,317




End Date:

31/12/2017

# CrashTough - Towards high crashworthiness parts through the investigation of microstructural effects on fracture toughness of 3rd generation AHSS - 800693

The project sought to understand and optimise the micro-structures of third generation advanced high-strength steels for use as lightweight automotive parts for increased vehicle efficiency.

European Commission


# Project history

Crash&Tough was focused on the development of high crash-resistant slutions based on 3rd generation Advances High Strenght Steels (AHSS), by investigating the effect of microstructural constituents on fracture toughness and crash resistance of TRIP-assisted steel.

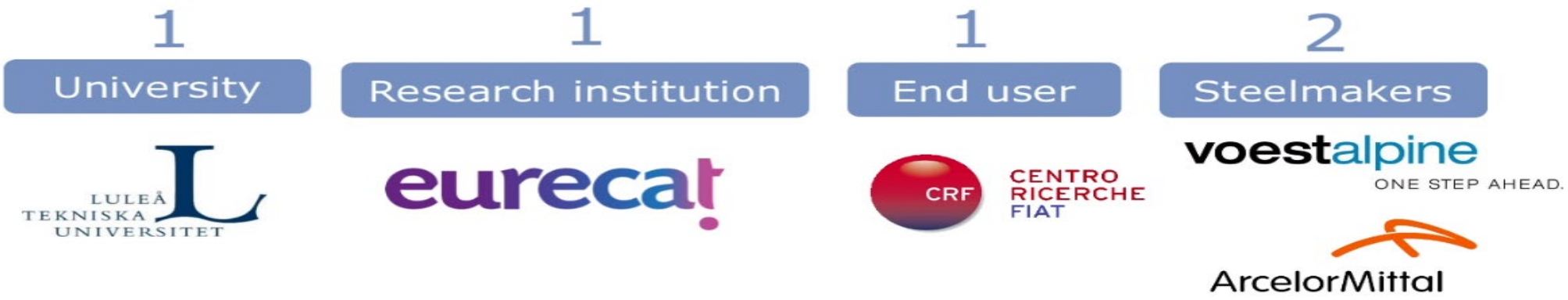
The project provided relevant information on the relationship microstructure-fracture toughness-crash resistance and proposed new advanced characterization and modelling techniques to predict the crash behavious of 3rd generation AHSS.

Crash&Toyugh validated the applicability of 3rd Gen AHSS for manufacturing crash-relevant automotive components withpotential weight saving up to 20% with respect to first generation AHSS.

European Commission

# Main objectives of Crashtough

- The project sought to understand and optimise the micro-structures of third generation advanced high-strength steels for use as lightweight automotive parts for increased vehicle efficiency.



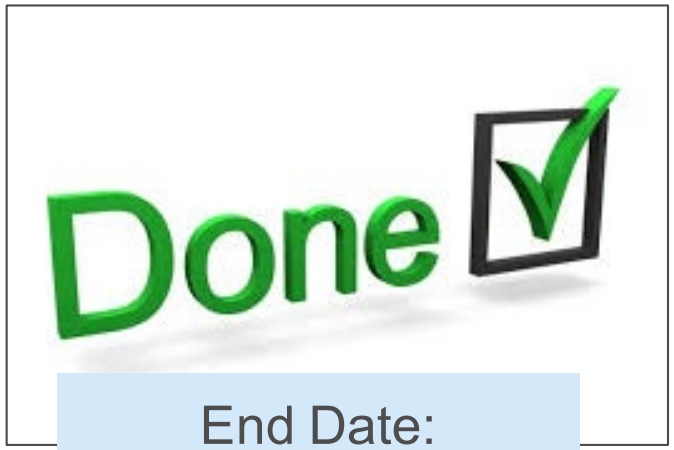
# Data sheet - Cashtrough


Start Date:

01/07/2018


EU Grant

€ 1,138,162




End Date:

31/12/2021

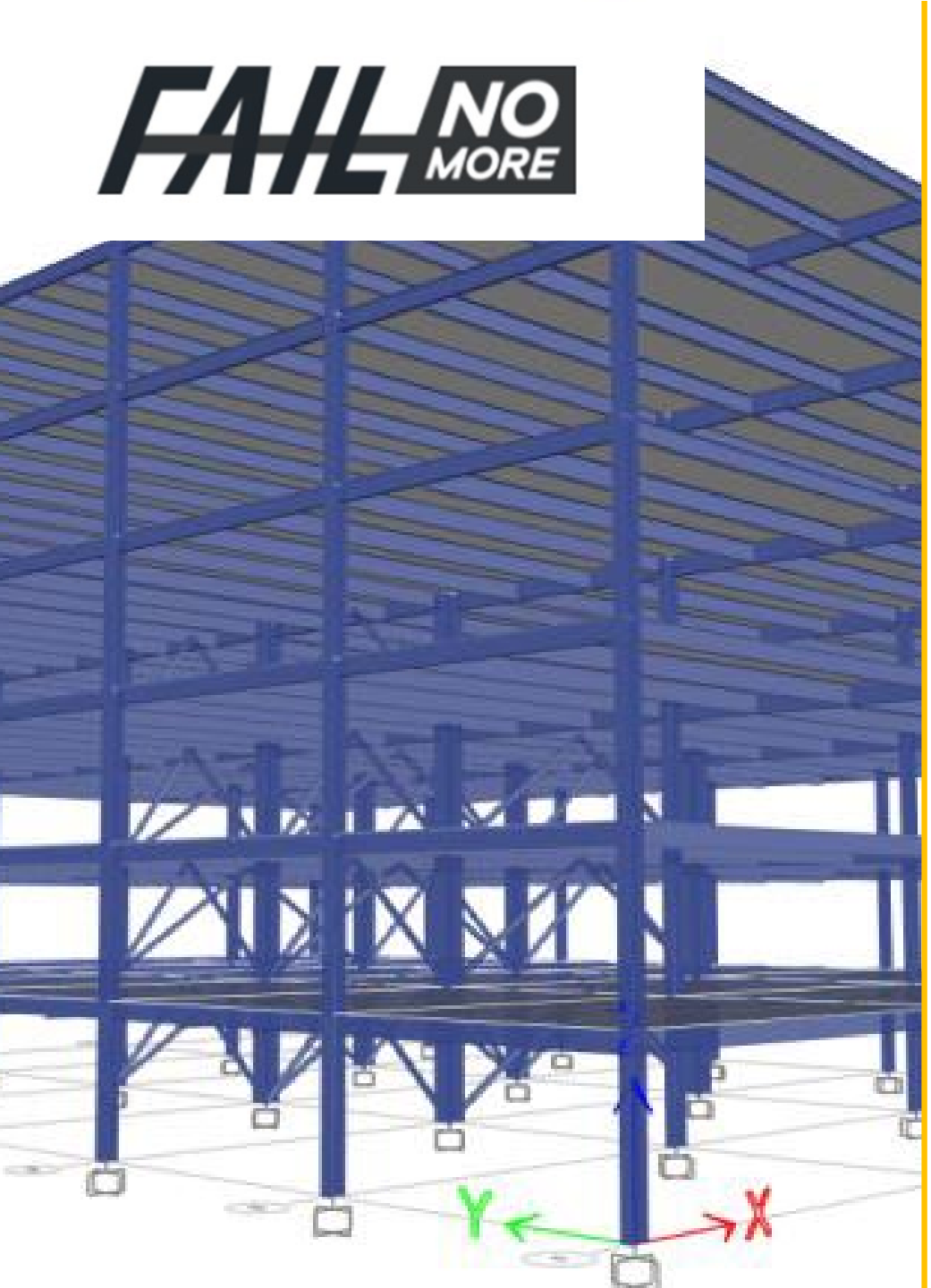
[Crash&Tough- Investigació de la resistència a fractura 3rd Gen AHSS (eurecat.org)]

European Commission

# FAILNOMORE - Mitigation of the risk of progressive collapse in steel and composite building frames under exceptional events - 899371

The project will produce design guidelines for mitigating the risk of progressive collapse of steel and composite structures subjected to exceptional events such as impact and explosions.

European Commission



# FAINOMORE history

The purpose of the project was to consolidate the knowledge developed in the aforementioned research and transform it into practical recommendations and guidelines.

The set of practical and user-friendly design guidelines considered in the project focuses on steel and composite structures subjected to unidentified threats and identified threats such as impacts, explosions, fires and earthquakes; it refers also to the available normative documents so as to form in itself a commonly agreed European design methodology.

The project was funded for 24 months (starting from July 2020) by the Research Fund for Coal and Steel (RFCS).

European Commission

# FAILNOMORE main objective

- The main aim of the project is to produce a set of practical and user-friendly design guidelines for mitigating the risk of progressive collapse of steel and composite structures subjected to exceptional events such as impact and explosions.
- This will be based on recent research projects and available normative documents in order to propose a common design methodology to be implemented in the European practice.
- The main dissemination will be through a design manual including worked examples, which will be drafted in various national languages, as well as a series of training workshops in 11 European countries.

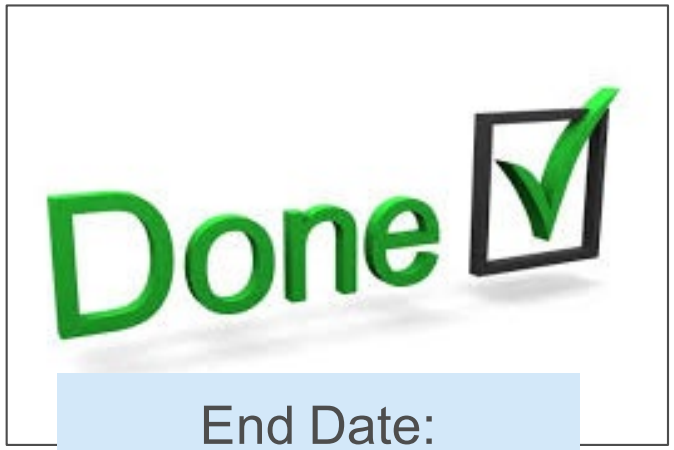
# Data sheet - FAILNOMORE


Start Date:

01/07/2020


EU Grant

€ 958,413

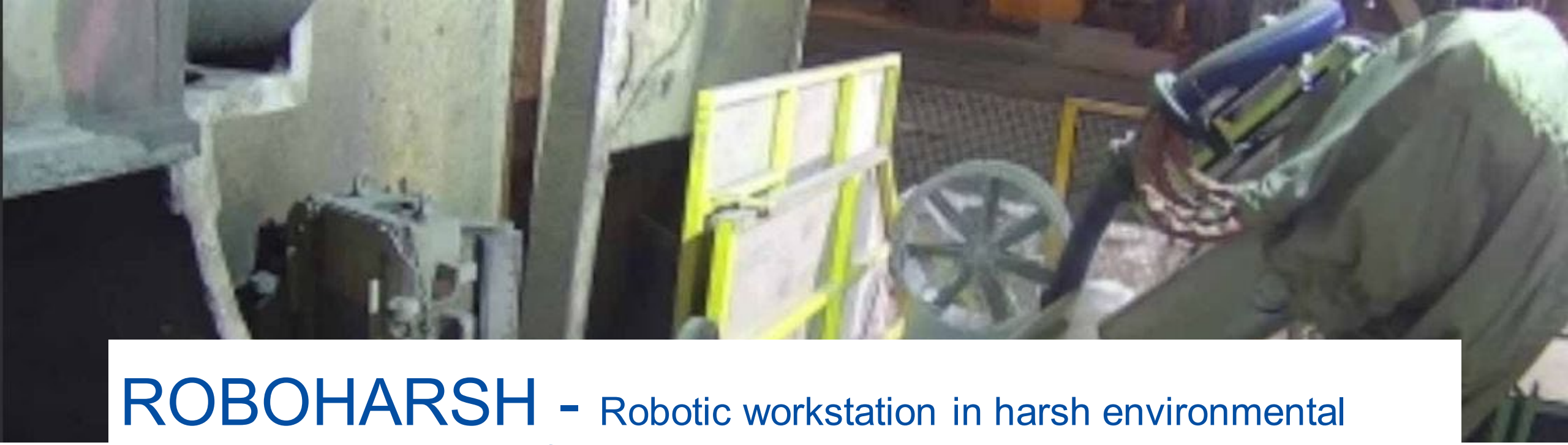



End Date:

30/06/2022

[Crash&Tough- Investigació de la resistència a fractura 3rd Gen AHSS (eurecat.org)]

European Commission



# ROBOHARSH - Robotic workstation in harsh environmental conditions to improve safety in the steel industry - 709553

The project wished to increase steel workers' health and safety by using robots for potentially dangerous ladle sliding gate maintenance.

European Commission

# ROBOHARSH main objectives

The overall goal of installing a suitably adapted robotic cell in the steel shop will be reached by achieving the following intermediate objectives:

- definition of the requirements of the system and of the list of operations that can be performed by the robot
- design and adaptation of the robotic cell to the special needs of this particular application
- design of a vision system to support the control of the robot and the monitoring of the whole cell
- integration and installation of the system on the plant
- extensive evaluation and test of the system during the operations
- integration of the technological development within a social innovation process, implementing technological innovation within a social innovation process right from the beginning involving all the relevant actors and parties effected, concerning impact right from the beginning (production process, management, organisation, personnel development, and societal challenges like qualification and environment)final evaluation and assessment of the performance of the system in terms of preservation of the workers' health and safety and operations reliability.

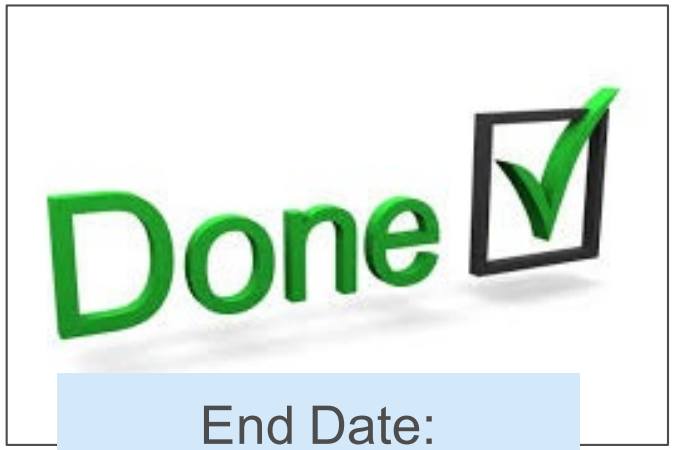
# Data sheet - ROBOHARSH


Start Date:

01/07/2016


EU Grant

€ 962,339




End Date:

30/06/2019

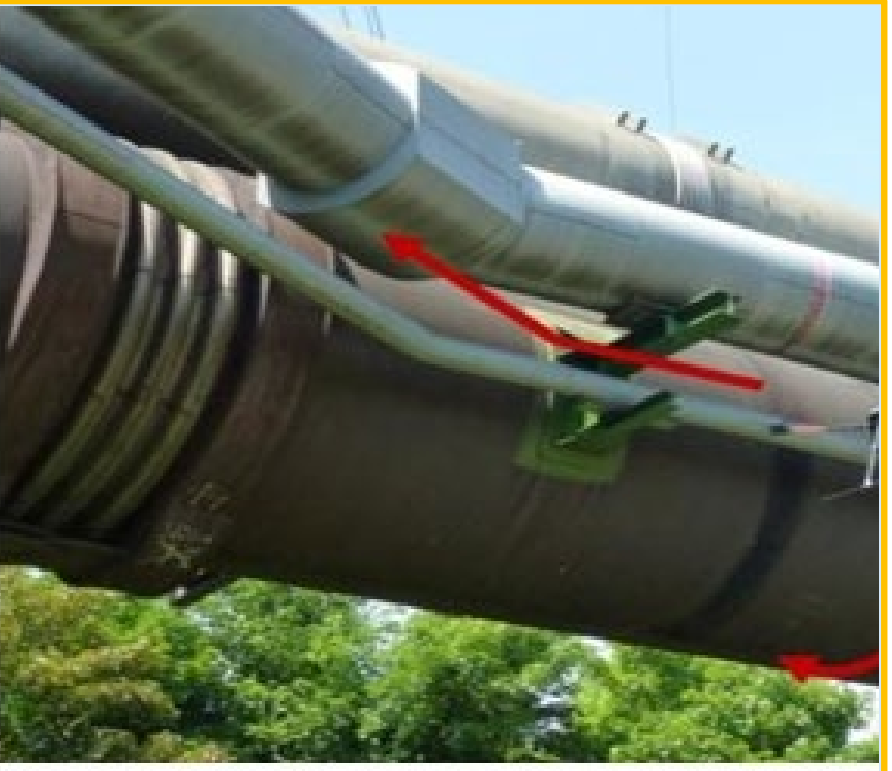
[ROBOHARSH _ Funding & tenders (europa.eu)]

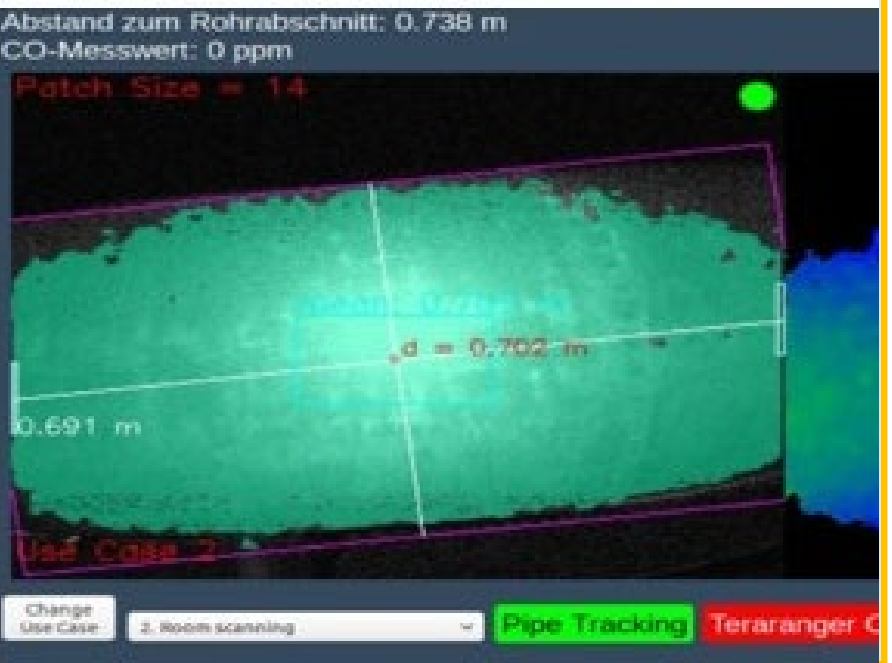
European Commission

# Dromosplan - Drones for autonomous monitoring of steel plants -**710066**

The project is an important milestone in industrial drone application. A greater understanding of the technological, social and organizational challenges associated with drone operation on a commercial level was achieved.

European Commission






# Dromosplan history

As part of understanding the application of drones in these areas the implications for work and workers was assessed – in terms of occupational safety as noted above, but also on the work routines, the organisation of work, skill and training needs and the broader 'effects' of the application of the technology.

The onsite tests, performed in two industrial site (tkSE plant at Duisburg, Germany and ADI-Acciaierie d'Italia Italia plant at Taranto, Italy), demonstrated the feasibility of the solutions developed that can be used to perform activities within a steel plant compliant with the objective of the project. Although mature, the drone technology still require time for integration and development to make it fully usable in the plant. However, this process must be accompanied by the gradual creation of a suitable organization composed of personnel with specific skills. Therefore, technological integration and staff awareness still require further study and experimentation.

European Commission

# Dromosplan main objective

- The civilian and often private use of drones is state-of-the-art since some years and is still expanding rapidly. It includes environmental, agricultural, disaster response, border control and many other activities. For an industrial application, especially in steel industry, they are not suitable because of missing robustness regarding the harsh industrial environment and because of the necessity of a long-term usage.
- The aim of the DroMoSPlan project was to evaluate the benefits arising from the application of Unmanned Aerial Vehicles (UAVs) in steelworks The overall objective of the proposal is the significant reduction of maintenance costs by monitoring and inspecting steel manufacturing equipment with a new type of autonomous flying drones.
- For this purpose, the project activities were carried out in order to design, develop, validate and implement the concept of a remotely controlled drone, equipped with multiple sensors, for its use in monitoring and inspection of internal and external areas of steel production sites.

# Fields of application in steel industry

Exist a lot and the use cases defined and performed in this project are an example of a such wide possibility of applications:

- Maintenance (inspection of roofs and chimneys)
- Environment (monitoring and detection of chemical leak)
- Safety (surveillance of high voltage areas and CO detection)
- Security (anti intrusion surveillance)

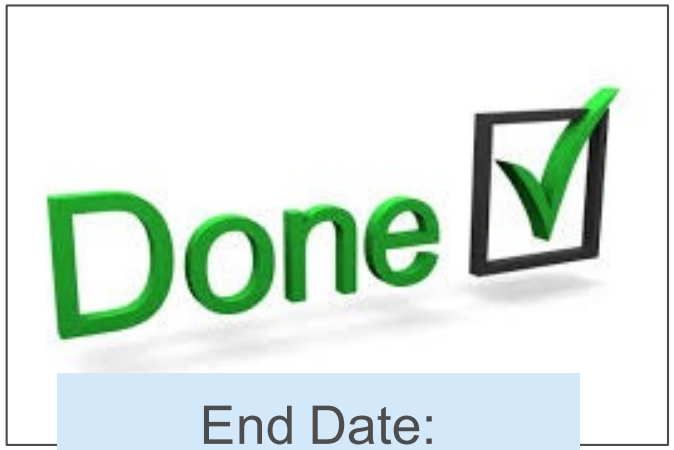
# Data sheet - ROBOHARSH


Start Date:

01/07/2016


EU Grant

€ 962,338




End Date:

31/12/2020

[Dromosplan_Funding & tenders (europa.eu)]

[DroMoSplan]

[DroMoSPlan – Drones for autonomous Monitoring of Steel Plants | BFI EN]

European Commission

# Thank you



European Commission