Interreg
EUROPEAN UNION
North-West Europe
RIVER
European Regional Development Fund

Welcome

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YNCREA Hauts de France/HEI
Lille-France
Lead Partner

RIVER Kick Off Meeting
February 8th 2018

yncréa HAUTS-DE-FRANCE
University of Bedfordshire
STC GROUP LEADING IN LEARNING
cleancarb
Canal & River Trust
UNIVERSITÉ de Picardie Jules Verne
critt Transport & Logistique
ECE
DST

CONTEXT

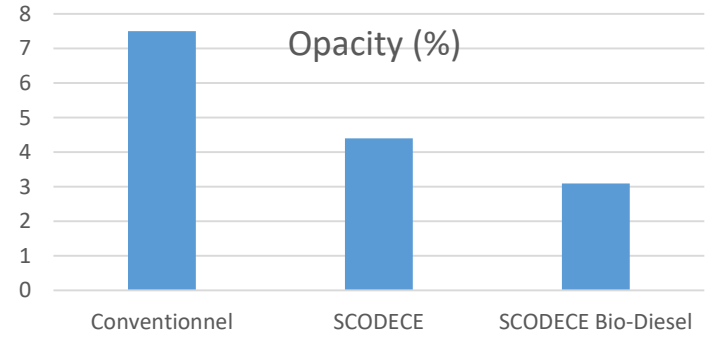
Road transportation remains so important to European energy policy and must now be considered as a problematic of sustainable development.

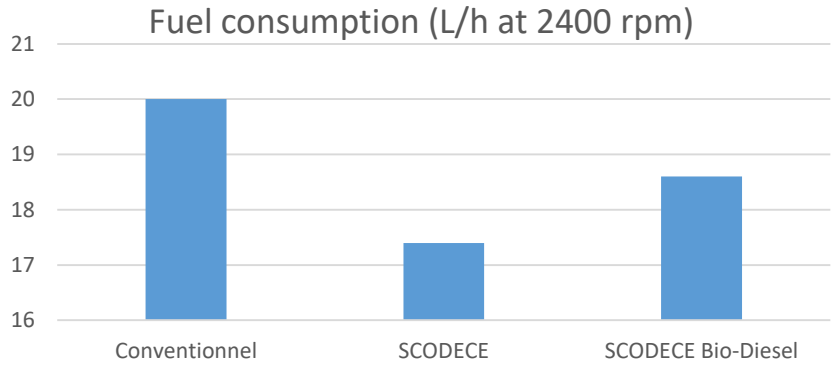
Road transportation is responsible for more than 20% of CO2 emissions in Europe, against only 3% for other modes of transportation (maritime, aviation, rail, river). Diesel engines share around 90% of maritime market.

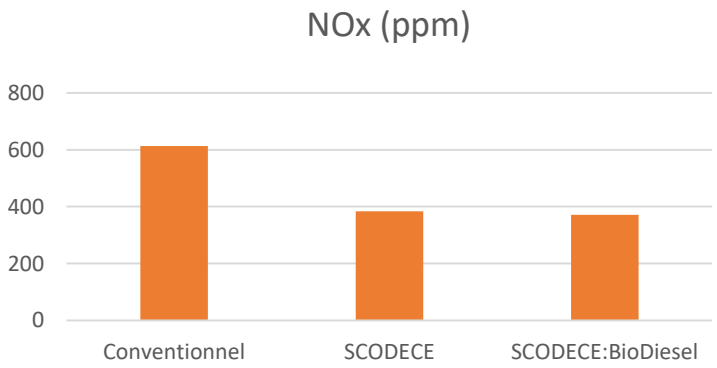
According to the White Paper on Transport, existing Inland Waterways (IW) have to play a bigger role in linking the European seas, in particular in moving goods to the hinterland which is an unused potential to date.

The EU has noted interest in using IW as an important part of transport that has a great potential in achieving a sustainable European transport network.

Project Idea: Learn from SCODECE 05-25 FR INTERREG 2 SEAS





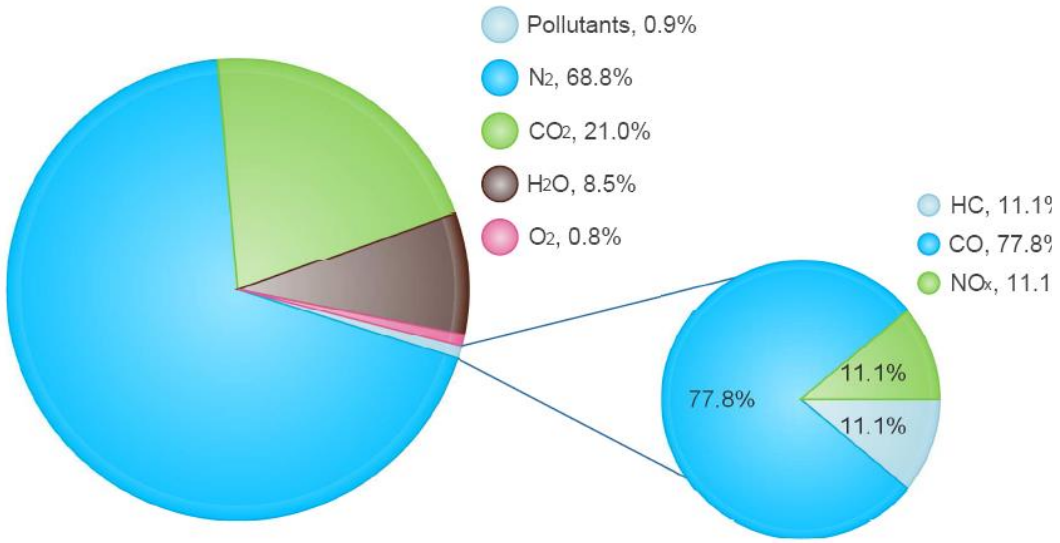


Caterpillar 3126B Tesbed : 6 cylindres 300CV

- How to reduce or eliminate the Dioxide of Nitrogen , the opacity and then the CO2.

- Supply the Diesel Engine by pure oxygen
- Control at high temperature the oxyfuel ratio
- Heat recovery system (10 à 15%) and improve Diesel efficiency up 45%
- Capture and Stocke the CO2
- Transform the CO2

MAJOR EMISSIONS IN DIESEL ENGINES



Evolution de la norme Euro

g/kWh	Euro 1 (1.10.93)	Euro 2 (1.10.96)	Euro 3 (1.10.01)	Euro 4 (1.10.06)	Euro 5 (1.10.09)	Euro 6 (1.01.2014)
NOx Oxydes d'azote	9	7	5	3,5	2	0,4
CO Monoxyde de carbone	4,9	4	2,1	1,5	1,5	1,5
HC Hydrocarbures	1,23	1,1	0,66	0,46	0,46	0,13
PM Particules	0,36	0,15	0,13	0,02	0,02	0,01

Composition of exhaust gas	AFR = 76.9	AFR = 50	AFR = 34.5	AFR = 25.6	AFR = 17.9	AFR = 14.3	AFR = 11.9	AFR = 10.6
CO2, % by volume	2.74	4.19	6.22	8.36	12.40	13.8	12.1	10.2
O2, % by volume	17.14	15.13	12.20	9.26	3.44	0.8	0.3	0.3
CO, % by volume	0.041	0.028	0.024	0.027	0.058	0.7	3.3	6.0
H2, % by volume	-	-	-	-	-	0.1	1.3	3.0
CH4, % by volume	-	-	-	-	0.03	0.1	0.3	0.4
N2, % by volume	80.08	80.65	81.56	82.35	84.07	84.5	82.7	80.1
NOx, ppm by volume	167	267	378	448	364	346	277	186
Aldehydes, ppm by volume	4	1	1	1	4	1	2	0

CHALLENGES

1. European goals for 2050 include minimization of truck access to cities. Inland waterway vessels have the capacity to carry the load of 100 trucks at once by a single vessel (i.e. 2000 tons @ 20 ton per truck).

2. The fossil fuel price has gone down recently the resources are still limited. A 15 % fuel consumption reduction will bring about an economic gain of the same order. (€1500 saving per every € 10,000 spent).

3. Congestion in cities will be significantly reduced by reducing the truck transport in cities. Some of the passenger transport can also be diverted to transport via waterways that will also reduce travel time.

4. Goods manufacturers can benefit heavily from waterway transport.

OBJECTIVES

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Focus: RIVER aims to increase the use of this technology based on oxyfuel CCS (Carbon Capture & Storage) Engine combustion in the inland waterway vessels and the conversion of Carbon in materials bio-solvent products.

What: Integrate oxyfuel CCS combustion technology in inland waterway navigation by facilitating the market uptake of the technologies developed

For Whom: SMEs constructing engines, inland water vessels

Where: Across the NWE Europe.

BASELINE

A small boat equipped with 28 KW engine produces per year 27t CO_2 (assume averagely 6h operation/day with 60% engine load).NOx:194 kg, Fuel consumption:10000l. Modern Diesel Engine with Water Emulsion produces 6t CO_2, 118 kg NOx, Fuel consumption: 9500l

Project Ends : CO_2 emissions avoided pear year 27 tons – NOx emissions avoided pear year 194Kg –Saving fuel consumption 1500l/year- Stored CO_2 is transformed to obtain bio-solvent- 1 feasibility study of this technology for large vessels (110m).

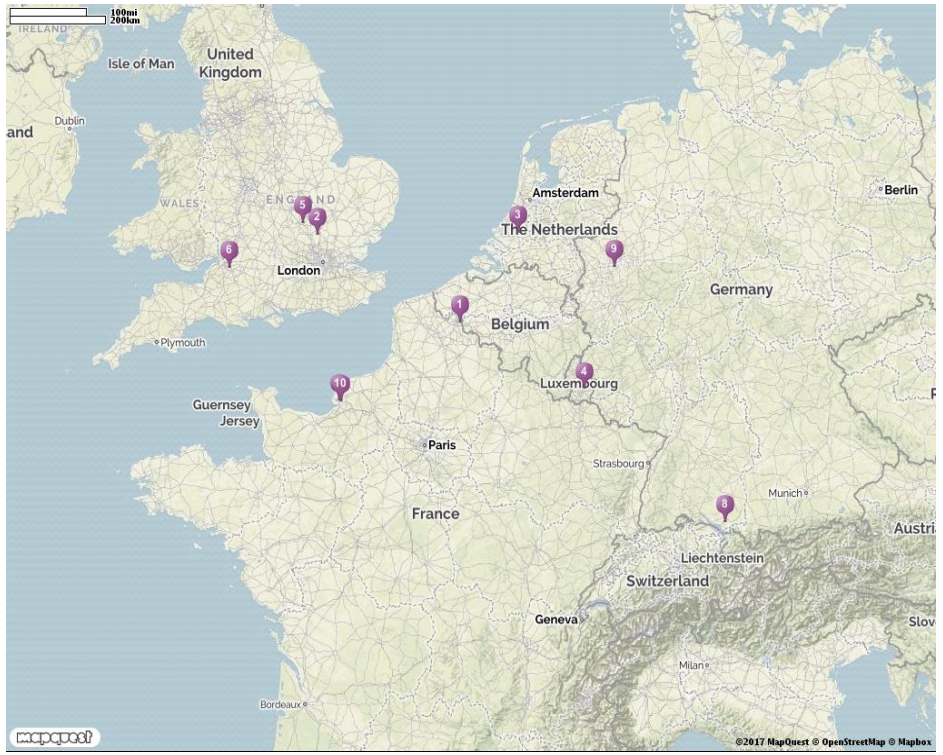
5 years after : 15-25 medium size river boats (71 tons of CO_2/year, 513 kg NOx/year) which will be powered by this technology will save 1062-1770 tons of CO_2 emissions per year, with similar engine efficiency.- NOx emissions avoided pear year 8-13 tons -15-25
direct and indirect jobs: retrofitting the boats.

10 years after the project ends (long-term effects)
300 various size ships/boats will be equipped with the technology, then saving up to 20000 tons CO_2 emissions annually.

Technology applied to other sectors: heavy duty vehicles, with appropriate space for a tank and oxyfuel combustion for power generation plants.

PARTNERS AND ASSOCIATED PARTNERS

Nr	NAME OF ORGANISATION	ABBREVIATION		COUNTRY
1	YNCREA HAUTS DE France-HEI	YNCREA-HEI	LP	FRANCE
2	UNIVERSITY OF BEDFORDSHIRE	UoB	PP	UK
3	Stiching STC group	STC	PP	NETHERLANDS
4	CLEANCARB	CC	PP	LUXEMBURG
5	CANAL&RIVER TRUST	CRT	PP	UK
6	UNIVERSITY PICARDIE JULES VERNE	UPJV	PP	FRANCE
7	Centre de Conseil et d'Innovation en Logistique-Transport &Logistique	CRITT-TL	PP	FRANCE
8	ECE Engine Control Electronics GmbH	ECE	PP	GERMANY
9	DST Entwicklungszentrum für Schiffstechnik und Transportsysteme	DST	PP	GERMANY
10	Compagnie Fluviale de Transport	CFT	SB	FRANCE
11	Lafei GmbH	Lafei	AP	SWIZERLAND
12	HAROPA	HAROPA	AF	FRANCE
13	Voies Navigables de France	VNF	AP	FRANCE
14	Verein für europäische Binnenschifffahrt und Wasserstraßen	VBW	AP	GERMANY
15	De Vlaamse Waterweg NV	DVW	AP	BELGIUM
16	AIR LIQUIDE & FRANCE INDUSTRIE	AIR LIQUIDE	AP	FRANCE
17	SATT NORD	SATT NORD	AP	FRANCE



STRUCTURE OF THE PROJECT

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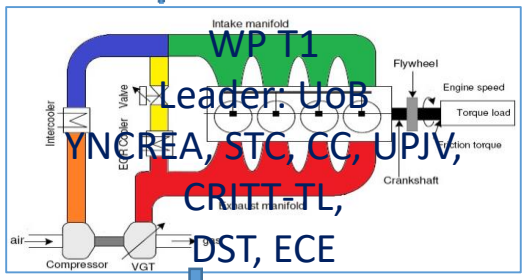
Interreg NWE - JTS

Lead Partner: YNCREA
Project Management

Steering Committee
LP+PPs+PSB+APs

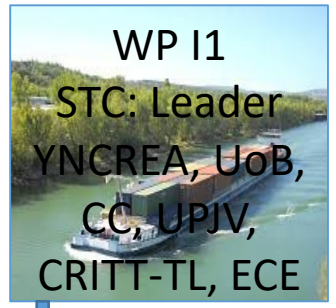
WP LT
Leader: CRT
YNCREA, UoB,
STC, CRITT-TL

WP C
Leader: CRITT-TL
LP + all PPs

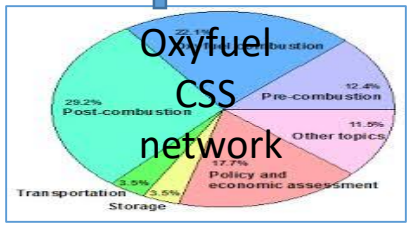


WP T1
Leader: UoB
YNCREA, STC, CC, UPJV,
CRITT-TL,
DST, ECE

WP T2
STC: Leader
YNCREA, UoB,
CRITT-TL, DST



WP I1
STC: Leader
YNCREA, UoB,
CC, UPJV,
CRITT-TL, ECE



Oxyfuel
CSS
network

WP Science & Technology Committee
LP+PPs+PSB+APs+Invited experts

MAIN OUTPUTS

Main Ouput	Main output description	Output indicator
Carbon Capture Storage Technology	Today, many existing technologies are technically ready for deployment for CCS: capture, storage and transport. CCS involves separation of CO2 from mixtures of gases and compression of this CO2 to a liquid-like state; transport of CO2 to a suitable storage site (in our case tank). The developed oxyfuel combustion engine system will enable powered vessels having CO2 capture and storage. This will enable powered vessels having zero CO2 emissions.	Low carbon Solutions in transport (1)
Carbon transformation	Strategy, based on circular economy principles, is to use CO2 in the synthesis of high-value added chemicals. A demonstrator based on continuous flow chemistry will be implemented in Lille and will use CO2 as low-cost raw material in the synthesis of pharmaceuticals, plastics, synthetic materials or plant defense stimulators.	Low carbon Solutions in transport (1)
Roadmap for utilisation of new engine technology with zero Carbon emissions for IWT	Description and analysis of actions needed to accelerate the utilisation of new engine technology to levels that would allow it to fulfill its CO2 emissions reduction in IWT. Promote this technology that spurs economic growth and environmental protection particularly in terms of reducing GHG that contribute to climate change.	20 enterprises co-operating with research institutions

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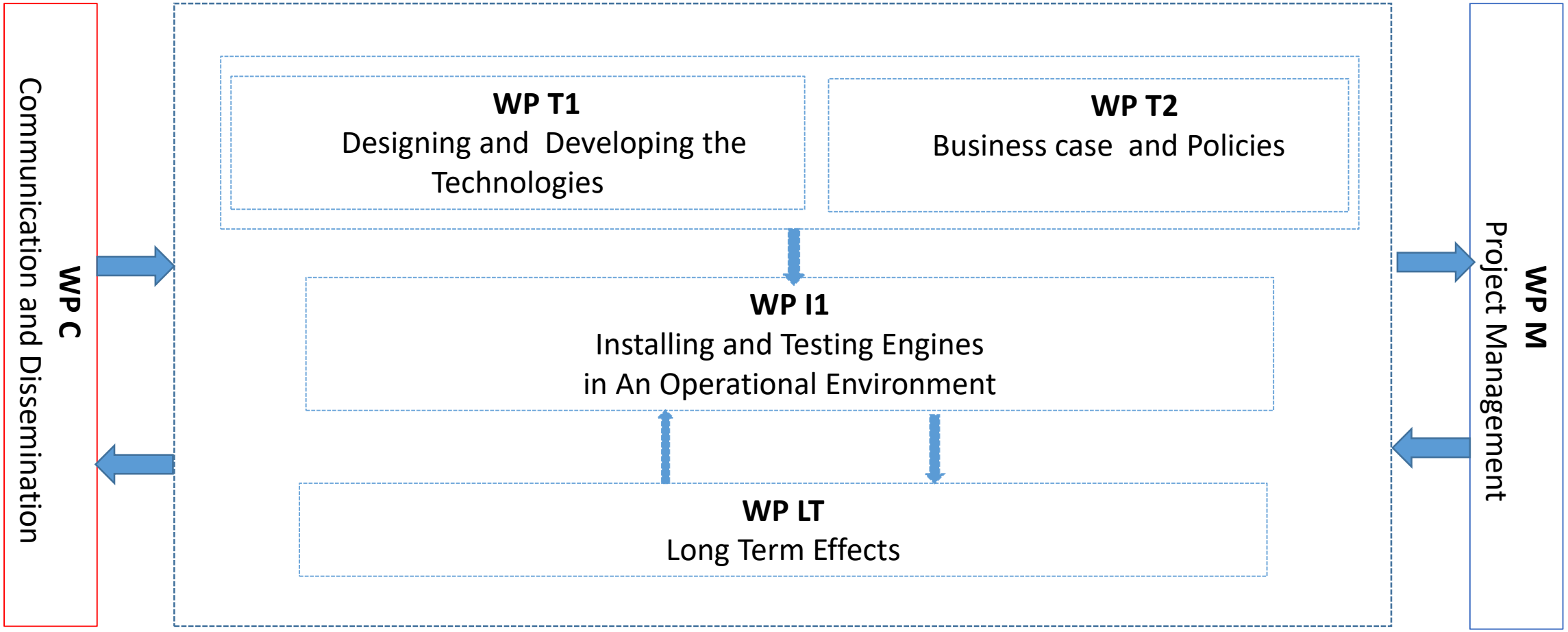
TARGET GROUPS

- Local, regional and national authority
- Higher Education and Researche
- SME
- Enterprise, excluding SME
- Business support organisation
- Interest groups including NGOs
- Infrastructure and service provider
- Other : Engineering offices, Companies of transport, ….

WORK PACKAGES



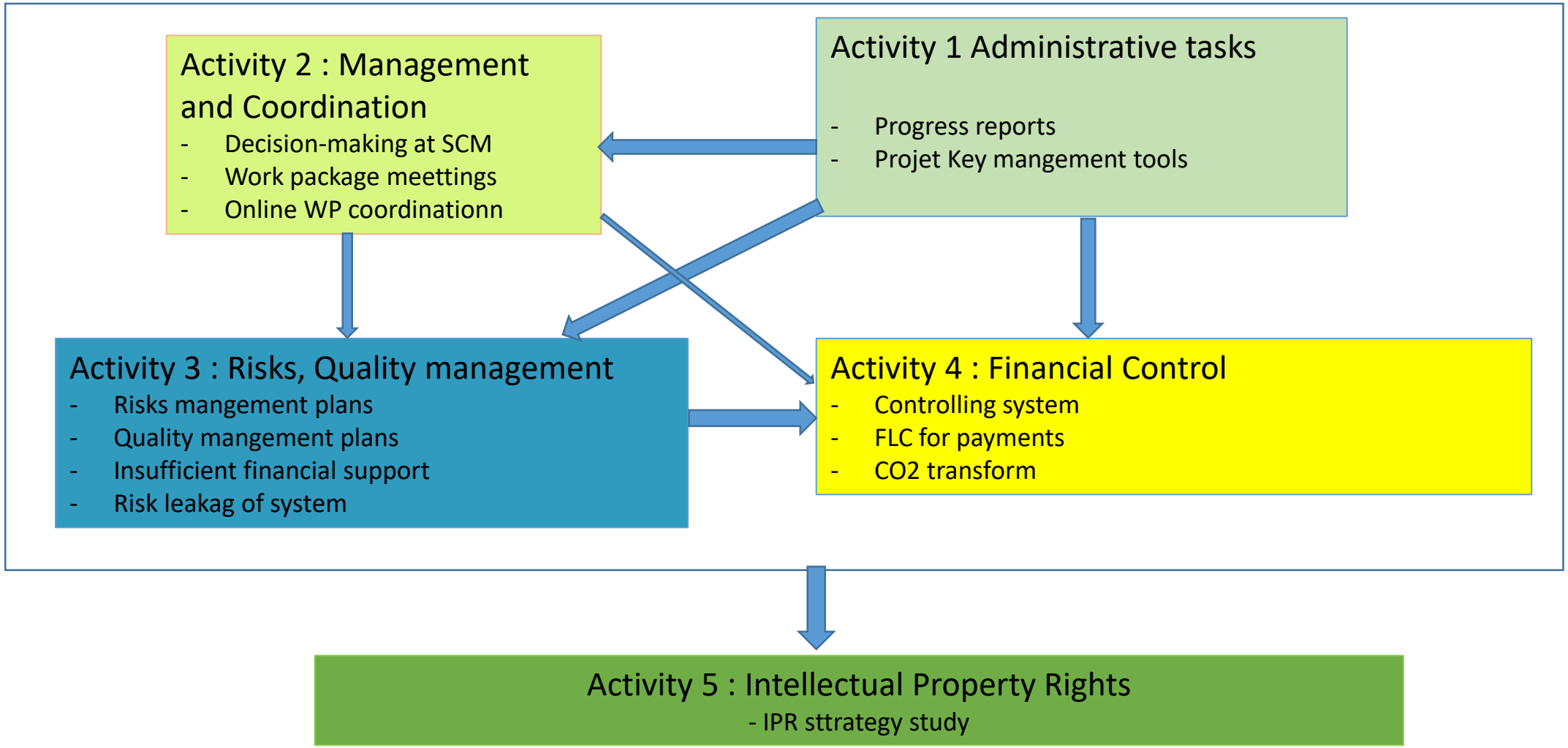
WP LT: Long Terms Effects Objectives

- Promote awareness of RIVER's technology across the rest of NWE and roll out Outputs to stakeholders in other regions.
- Inform Environmental org's about the green benefits and encourage them to champion the project.
- Create a partnership between NWE regions focusing on technology that ensures the project's LTE. Two 1-day visits to UK to witness demonstrations of RIVER technologies will be available to EU companies interested in developing their involvement in IWT and CCS.
- Ensure RIVER's training material encourages Marine engine manufacturers to adopt, assimilate and embed technologies and helps boat builders and technicians to fit/retrofit engines
- Ensure RIVER's technology continuously evolves through research of trends in green technology and regulations
- Ensure RIVER's technology remains aligned with NRMM reg's manufacturers need to meet to obtain type-approval of their engines (a prerequisite for placing their engines on the EU market)
- Maintain a measurement methodology in a format that stakeholders can also adopt which proves the project's results, and predicts them for 5 and 10 years ahead.

WPC: Communication Objectives

Project sub-objectives	Types of communication objectives - What can communications do to reach a project sub-objective?	Communication objectives
Create a network with other regions for the development of this technology in IWT	Change behaviour	To change the behaviour of stakeholders who are opposite for the development of clean and economic Diesel Engines and prefer to develop electrical or Hydrogen solutions. This will be supported by the European platform
	Raise awareness	Relevant stakeholders are informed about the outcomes of the analysis related to the quality of their regional input material.
Stimulate oxyfuel CCS technology in IWT and market development around this technology in NWE.	Raise awareness	To raise awareness at the level of end users and authorities on oxyfuel CCS (Carbon Capture and Storage) technology and market development
	Increase knowledge	There is a lack of knowledge about market opportunities dealing with oxyfuel Carbon Capture and Storage. Actions will be done to increase this knowledge.
Deliver proof of the readiness of oxyfuel CCS technology for vessels	Increase knowledge	Collaborative learning and development will be promoting in order to increase the knowledge at the level of institutions, end-users on oxyfuel CCS technology
	Raise awareness	A comparison study with other future alternatives technologies such as LNG, Hybrid, Biofuels, Electric,etc.. will be developed. Communication materials will be developed to raise ship owners and managing IWT awareness. Materials will be jointly developed taking into account good practice within the partners. Communication to raise awareness in order to reach the ship owners and engine manufactories through website, exhibitions, newsletters , meetings, workshops, contact, open days, etc..). Associated partners will use their own networks to reach this kind of population.

WP M: Management



WPT1: Designing and Developing the Technologies

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Activity 1 : System Configuration, Control, Integration, Simulation

- Design System configuration
- System simulation
- Control, Diagnostics strategies
- Various control models
- Oxy-biofuel study

Activity 2 : Oxygen, Fuel Supply System

- Oxygen supply system with CO2
- Fuel injection system
- On board oxygen production
- Study of Energy consumption

Activity 3 : Operating oxyfuel production

- Simulation platform
- Engine combustion control
- Study of Energy consumption

Activity 4 : Energy recovery, CCS, CO2 transform

- Energy recovery
- CO2 capture, storage
- CO2 transform

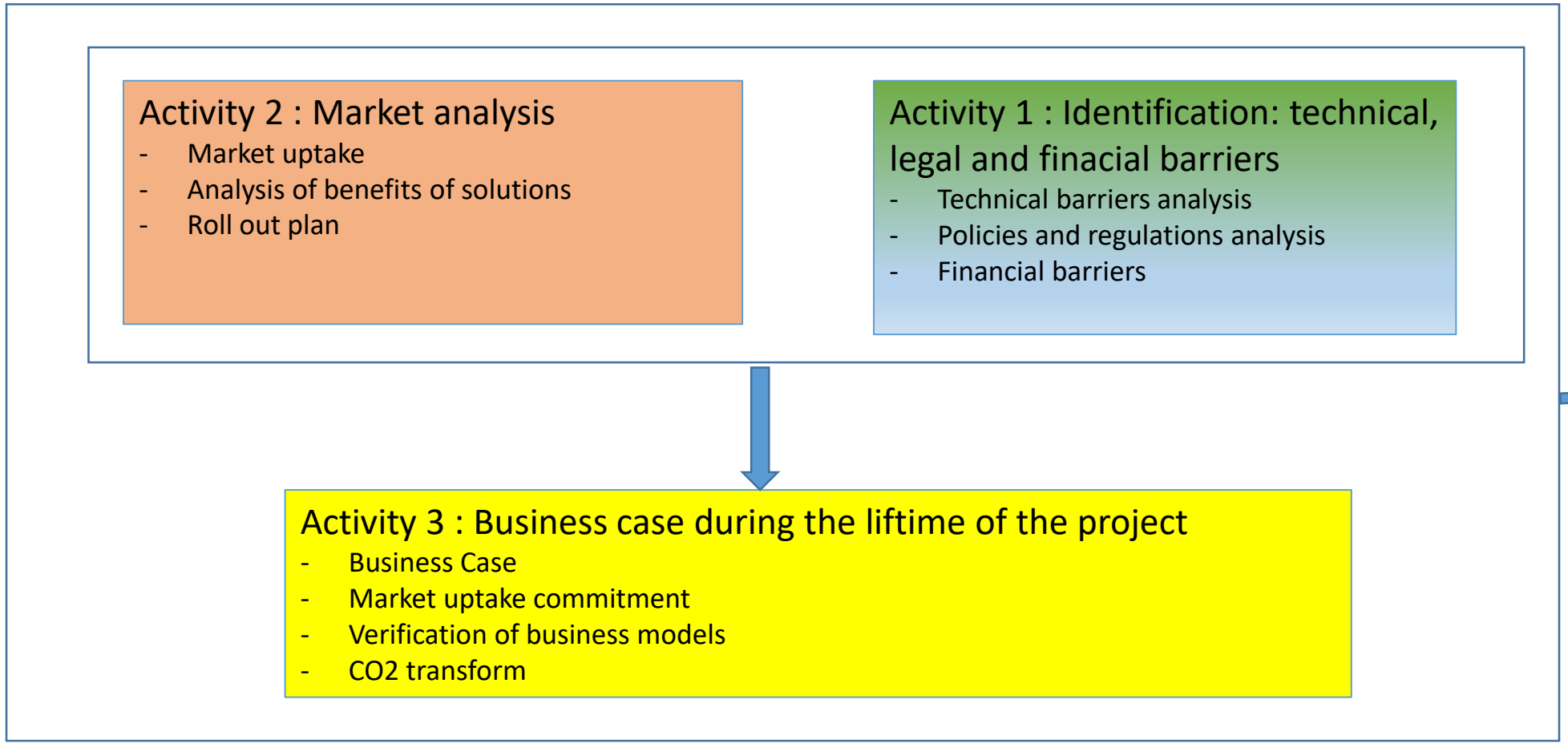
OUTPUTS

- CCS
- CO2 transform

Activity 5 : Integration Oxyfuel Combustion Engine CSS to vessels

- Integration engine sytem with light duty boats
- Integration engine system with heavy duty ships

WPT2: Business Case and Policies



Learn from PROMINENT H2020 Project leaded by STC

OUTPUT

Roadmap for utilisation of new engine technology with zero carbon emissions for IWT

WPI1: Installing and Testing Engines in An Operational Environment

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Thank you!