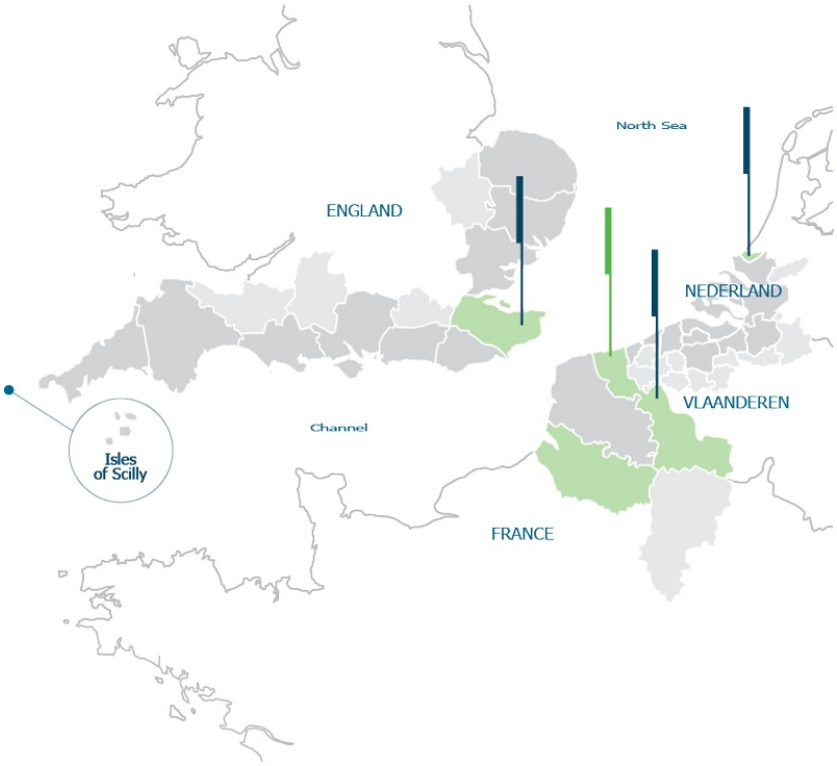
CleanTech

2-Seas Technology Centre for Clean Environment

■ Project summary



The goal of CleanTech is to help decrease the discharge of air pollutants in the cross-border area. The partners will look at the role of nitrogen and sulfur oxides in atmospheric pollution. These pollutants – the general oxides of nitrogen (NOx) and the general oxides of sulfur (Sox) – are often the result of direct combustions formed in industrial processes. Building on previously developed methods and tools, with the support of the public sector and industry itself, and thanks to collaborations between different research laboratories, the partnership will now develop models to validate their findings. Crossborder cooperation is essential to trace and study the contaminants which can affect a zone larger than 100 km from the source of the transmission. Initially modelling and developing a pilot procedure, partners will also detect and measure the chemicals present during the combustion process and finally, they will develop advanced sensors which can be used during the industrial process to control emissions.

■ Activities

What was the project trying to achieve?

The four eligible states to the INTERREG IVA Programme are directly concerned by their own emissions of pollutants, but equally by the other states since the pollutants can travel more than 100 km from the source of the transmission. The goal of CleanTech is to help decrease the discharge of NOx and SOx according to the levels quoted in report n°6 by IIASA, ""National Emission Ceilings for 2020 based on the 2008 Climate & Energy Package"" dating back to July 2008. In this report, it is recommended that the NOx levels in France are reduced from 1323 kT (year 2000) to 507 kT in year 2020. The numbers reported for the United Kingdom are from 1855 to 554 kT, Belgium from 351 to 135 kT and the Netherlands from 410 to 177 kT. It will be impossible for the individual states to meet their goal without cross-border cooperation between the concerned states. Further, if one focuses in detail on the data directly linked to the

pollution from the maritime transports in the English channel and the North Sea, one notes that the amounts of NOx and SOx pollution levels were estimated at 720 kT and 516 kT, respectively in year 2000 (Source: IIASA Contract No. 06-107, April 2007). These figures shows that the emission associated with the maritime transport are far from negligible when considering the figures from the individual countries during the same time. In addition, 20% of the NOx and SOx emission in the region around Rotterdam in 2007 originated from maritime transport. The maritime aspect of the CleanTech project is indeed demonstrated by these figures. The aim of our project is to contribute to a joint effort of the member-states to reduce the NOx and SOx polluting emissions.

What were the activities implemented?

Preparation activities The preparation of the project has already initiated a large number of contacts between the various partners to establish the scientific program. We chose to split the project into 3 activities: - Activity 1: ""Modelling and developing a pilot procedure"" / ULCO, Kent and CNRS - Activity 2: ""Sensors and detection techniques"" / ULCO, Delft and CNRS - Activity 3: ""Materials: synthesizing, structural characterization and development of advanced sensors"" / 4 partners Opening meeting has taken place in Dunkerque, September 22nd, 2009. Two PhD students are started to work on the project within first 6 months after the official start of the project. Project management and coordination - The Subsidy Contract has been prepared and signed. - The Partnership Agreement has been prepared and signed. - The Project Management Committee was adopted. - Every six months the partners have discussed the results on a project meeting (6 in total). - 4 additional PhD students, 4 post-docs and an administrative assistant have worked on the project. Project communication - A WEB site is launched and updated systematically - Communications, publications, project results dissemination, press realise for 380 journals and organisations have been done - Arcelor Mittal Dunkerque has started to co-finance the project since September 2009. - 64 sintering processes have been realized at the pilot plant. Two new classes of promising additives have been discovered allowing the NOx emissions to be decreased by a factor of 3. - An improved laboratory reactor has been developed and used to study the reduction mechanism; 18 additives have been studied in 65 experiments. - Computer modelling has been used to identify and optimise experimental work. - Structural studies have been carried out to identify industrial atmospheric pollutants, their chemical nature and the quality of the industrial products prepared using the additives; 204 sintering samples.

■ Results

What were the key results of the project?

Activity 1. New promising additives for ‘In-bed deNOx’ industrial procedure allow polluting NOx emissions to be decreased by a factor of 3. To achieve this very promising result, 64 experiments using industrial pilot plant have been carried out, 204 samples of industrial sinter have been analysed using advanced laboratory methods as Mössbauer spectroscopy and experiments at large facilities as 3G synchrotron photon sources. A specific laboratory reactor was designed and largely improved during the experiments to study the mechanism of NOx reduction using additives. In total, 18 additives of 5 different classes have been investigated and two classes of promising additives have been found. One class of promising additives

reduces also SOx emissions in industrial process by 30%. The reaction modelling and calculations of stability of sinter phases have been helpful for experimental research. The analysis and modelling of promising additives allow new pollution reduction routes to be explored, i.e. NOx transport emissions, one of the main and unresolved atmospheric pollution. Activities 2 and 3. Efficient detection techniques and sensors for NOx, SOx and secondary pollutant monitoring have been developed based on synthesis of new materials, their characterisation and modelling using advanced methods. In particular, a transportable THz spectrometer has been developed, tested using real industrial samples and showed a low detection limit of 10ppm SOx, of 58-560ppm NOx, and of 2ppm NH3 as well as for many other gas pollutants. Chalcogenide glass chemical sensors for detection of cadmium have been developed and reveal an excellent sensitivity, selectivity and response stability compared to commercially available devices.

Did all partners and territories benefit from the results?

The beneficiaries for each territory of this project are manifold since atmospheric pollution does not have borders. In fact, any reduction of pollution can only have positive effects. In fact, the reduction of NOx and SOx, which may cause serious lung problems, is in the right direction for the general health of the population. The other main beneficiary of this reduction is the environment because these pollutants are responsible for the phenomenon of acid rain that disrupt the ecosystem, and specifically in relation to NOx, which contribute to photochemical pollution and tropospheric ozone formation and indirectly to accentuate the greenhouse effect. In other words, the population in all territories involved (Nord – Pas de Calais, Kent and Delft-en-Westland) is the main beneficiary of the project results. Universities of all territories benefit also from the results obtained both on the laboratory/research group level as well as the entire institution. The main beneficiary from local industry is Arcelor Mittal. However, this industrial group has steel production activity worldwide including many European countries. Therefore, indirectly local industry of Kent and Delft-en-Westland could benefit from the project results. Local and regional authorities have been informed of the project through multiple communication and dissemination actions, i.e. seminars in all territories involved, press release for 380 journals and organisations prepared in collaboration with the Communauté Urbaine de Dunkerque and IRENI, publications in local newspapers.

What were the effects / outcomes for the territories involved?

More safe, sustainable and healthy environment for each territory involved is the main effect/outcome of the project. A possibility to reduce the polluting industrial NOx emissions by a factor of 3 will concern all neighbouring population and far beyond the territories involved (Nord – Pas de Calais, Kent and Delft-en-Westland). In addition, the promising additives found in the project could help to solve a major EU environmental concern related to NOx transport pollution, for which no satisfactory solution has yet been found. Reduction of NOx pollution in local industry (Arcelor Mittal), as well as a possible in future NOx reduction for ground and maritime transport (all territories involved) are the concrete examples of the project outcomes.

■ Distinctiveness

What was the real added-value of doing this cross-border project?

The CleanTech project was heavily dependent on cross-border cooperation. There is evidence that developments associated with this project are possible only through the skills of each partner as each of them can be regarded as an international leader in its own area of research. Particularly for the scientific part, we have addressed by collaboration the problems associated with reducing the emissions of NOx and pollutant detection. The University of Kent (UK) was able, through modelling, to identify chemical reactions that occur following the addition of additives during combustion and calculate stability of iron oxide, critically important for quality of final sinter products. The ULCO has implemented the processes, which have theoretically shown to give the best results. The CNRS, TU Delft (the Netherlands) and ULCO successfully collaborated to support the detection of intermediate chemical compounds, identified by the modelling, by measuring the emissions with sensors. The University of Kent was a key partner for TU Delft to elucidate the sensing mechanism of WO3 sensors for NOx detections realised via joint research proposal and collaborative work using XANES spectroscopy at ESRF (Grenoble).

Have any synergies been developed with other projects or networks?

The project partners have worked with IRENI (Institut Regional de l'Environnement Industriel) during the life time of the project. We have also worked with Arcelor Mittal Dunkerque to develop a semi-industrial procedure of NOx reduction. We do not work with other EU-funded projects (FP7, INTERREG) or national/regional projects during the course of the project.

What are the key messages , key lessons learned you would like to share?

The communication objectives were essentially achieved. The only exception was a periodic (every 6 months) information letter for public institutions. It was done several times but not on periodic basis. The communication actions most useful have been realised for industrial partners (Arcelor Mittal DK), scientific (conferences and workshops) and student (seminars) community. The essential problem in communication activities is to inform general public and administration since no specific and systematic actions are available. We have used the IRENI (Institut Regional de l'Environnement Industriel) to promote and disseminate the project results. No specific lessons have been learned except that communication and project result dissemination for general public needs a specific expertise which is normally absent in a research laboratory. This is true for national and cross-border cooperation. In summary, close contacts and intense discussions between the partners are key elements to effectively achieve the project's objectives.

Project Information

Title	2-Seas Technology Centre for Clean Environment
Total project budget	€ 1 788 807
ERDF	€ 894 403
Priority & objective	Priority 2 b. Develop activities to prevent and cope with natural, technological and human risks and to guarantee the quality of the environment
Timeframe	2009-07-01 - 2012-12-31
Lead partner	Université du Littoral Côte d'Opale (ULCO)
Project Coordinator	Helène PIHEN(pihen@univ-littoral.fr)