



CAalytic membrane **RE**actors
based on
New **m**Aterials for C1-C4 valorization

CARENA is a large-scale integrating project funded by the EC

**Interview with Arend de Groot–
ECN, The Netherlands.**



I obtained a PhD Mechanical Engineering at the Technical University of Delft in 2004, almost 8 years after starting work at ECN in 1996. Making the classical mistake in thinking I could easily finish my thesis in the evening hours, I jumped at the job opportunity at ECN and never regretted it. Of course within a few weeks I was enthusiastically going about my work at ECN and the stack of papers related to my thesis moved gradually towards the corner of my desk and out of sight. Happily I did finish the thesis many years (and evenings) later.

I started at ECN as part of the fuel cell program, carrying out process analysis. Through the application studies for PEM fuel cells, I became involved in different studies on the use of hydrogen as an energy carrier. For a number of years I worked on the implementation scenario's looking at the technical and economic barriers to wide-scale use of hydrogen. One of the most interesting projects was a large European project on scenarios for the introduction of hydrogen in the EU transport sector involving the main European car manufacturers and gas suppliers. I also had the opportunity to represent the Netherlands in different Annexes on hydrogen of the International Energy Agency.

In 2005 I moved into the area of energy efficiency in the Chemical Industry. The focus of my activities was on Process Intensification. I co-authored the European Roadmap of Process Intensification and lead a group developing different PI technologies. In particular we worked on structured reactors, advanced distillation concepts and membrane reactors. The track-record of our group was an important factor in the becoming coordinator of the CARENA project in 2009/2010.





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As a coordinator you have the last word. How do you look back on the CARENA project?

We have been lucky to work with a wonderful team. First of all the work package leaders, which have organized their part of the work very well. And all the partners in general, which have shown great willingness to adapt their work to the needs of the project. **This is always a challenge in European projects, where you have to plan ahead for 4 years.** Or even 5 years if you take into account the proposal phase. Often this leads to conflicts of interest when the resources and people committed originally to the project do not match the needs of the project. Therefore it is a good sign if you see that partners agree on new roles and activities during the project to address the most urgent challenges. **In the CARENA project I have seen many times this flexibility of the partners to deviate from the original plan if necessary. I think this characterizes a good project.**

The cooperation between the different nationalities is what I enjoyed above all! In the CARENA project about 30% of the people working in the project live abroad. **Working outside of your own country broadens your perspectives. I think one of the important benefits of the EU projects lies in the opportunity given to widen your horizons of working in such project. On a personal level and also professionally.**

What has not gone as planned in the project?

Undoubtedly, you face technical issues which you are sometimes not able to address within the frame work of the project. It is research, so you never achieve all you goals. **However, overall I am quite impressed with the progress we have made.**

Of course the world around us has changed since we started on the project. The economic crisis, the shale gas in US, the renewable generation starting to impact the electricity prices, the rapid expansion of the Asian chemical industry, **all these factors have impacted the outlook.** At the start of the project there was a general expectation of further increasing oil prices and a corresponding increase in prices for feedstocks for the chemical industry. Today's world is very different from what we thought at the beginning of the project. Therefore economic boundary conditions have changed for the processes we develop. That requires reorientation of the business cases.

“Working with the cooperation between the different nationalities is what I enjoyed above all”



Pd Membrane's Workshop in 2014



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What were the most rewarding aspects of the project?

I think the interactions we had within the project and externally have been very successful. At our first annual meeting for example we organized a poster session for our PhD students and post-docs to present their work. I remember this as a very lively event which was helpful to involve the PhD's in the project and generate interest for their work from the partners.

The project also organized a series of very successful workshops and seminars. Especially the membrane workshop in Montpellier (2012), the two workshops on palladium membranes in Rome (2012) and Petten (2014) and the catalytic membrane reactor (2015) have been very successful.

For me personally the interaction with our Strategic Advisory Board has been very rewarding. An opportunity for me to make use of the great experience of the members of the board and their stimulating views.

"wonderful team inside CARENA"



Arend de Groot at the workshop in 2015

And finally...the famous last words?

Not a single regret having taken on the task of coordinating the CARENA project. Of course it is sometimes hard work, but on a personal level I thoroughly enjoyed the opportunity to work together and interact with so many people. I am truly going to miss that!

Thank you Arend for answering my questions, and all the best for CARENA and the other projects you are involved in.

Interviewed by Laurence Bosch



CARENA in brief

Starting date: 1st June 2011
Project duration: 2011 – 2015
Number of partners: 19
Coordinator: Arend de Groot, ECN, the Netherlands
Programme: FP7-NMP-2010-LARGE- 4
Project Reference: GA 263007

