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European research in nanotechnologies for water treatment

"Nanotechnology meets water treatment"
Dissemination workshop of the **nano4water** cluster
Aachen (DE), 26/10/2010

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Content

- **European research context**
in the field of water technologies
- **Community research strategy**
- **Examples of FP7 cooperation projects**
- **Conclusions**

EUROPE 2020

(3 March 2010: EC Communication)
(17 June 2010: EU Council adoption)

Three mutually reinforcing priorities:

1. Smart growth: developing an economy based on knowledge and innovation
2. Sustainable growth: promoting a more resource efficient, greener and more competitive economy
3. Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion

Several flagship initiatives including:

- "Innovation Union"
to improve framework conditions and access to finance for research and innovation





Mrs Maire GÖGHEGAN-QUINN
EU Commissioner with responsibility
for Research and Innovation and for
leading a cross-cutting approach to
innovation.

...Turning a *European Union* into an *Innovation Union*"

"Investment in research and innovation is the only smart and lasting way out of crisis and towards sustainable and socially equitable growth"

- **EC communication « Innovation Union »** on 6 October 2010
 - The « Innovation Union » plan aims to boosting investment in research and making Europe an attractive place to develop new products
- Calls for **"European Innovation Partnerships"**
 - to link up the innovation chain to get products through to market faster
 - to streamline programmes, instruments, funds in Europe
 - Being worked out: **"Water efficiency"** as a possible candidate

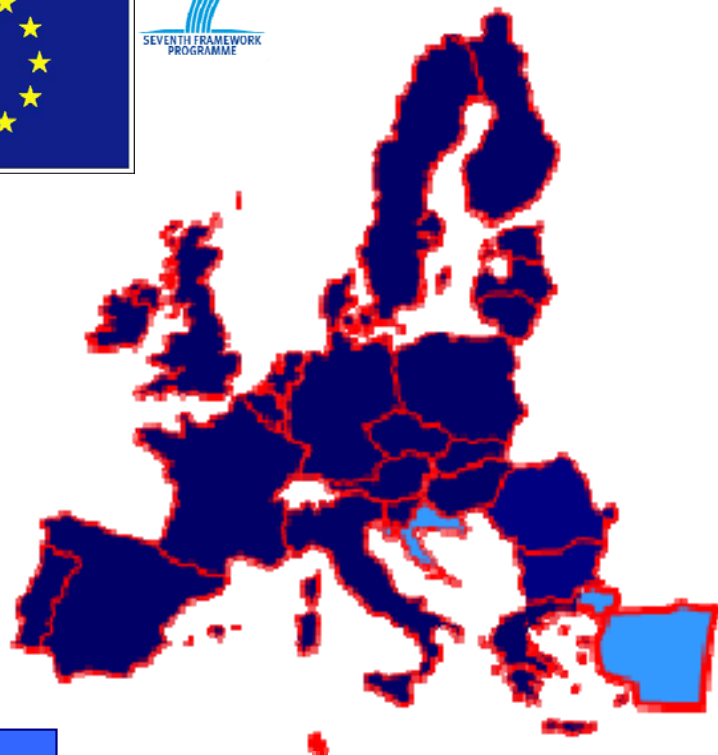




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Water research Networking examples in Europe



Water JPI
Joint
Programming
Initiative

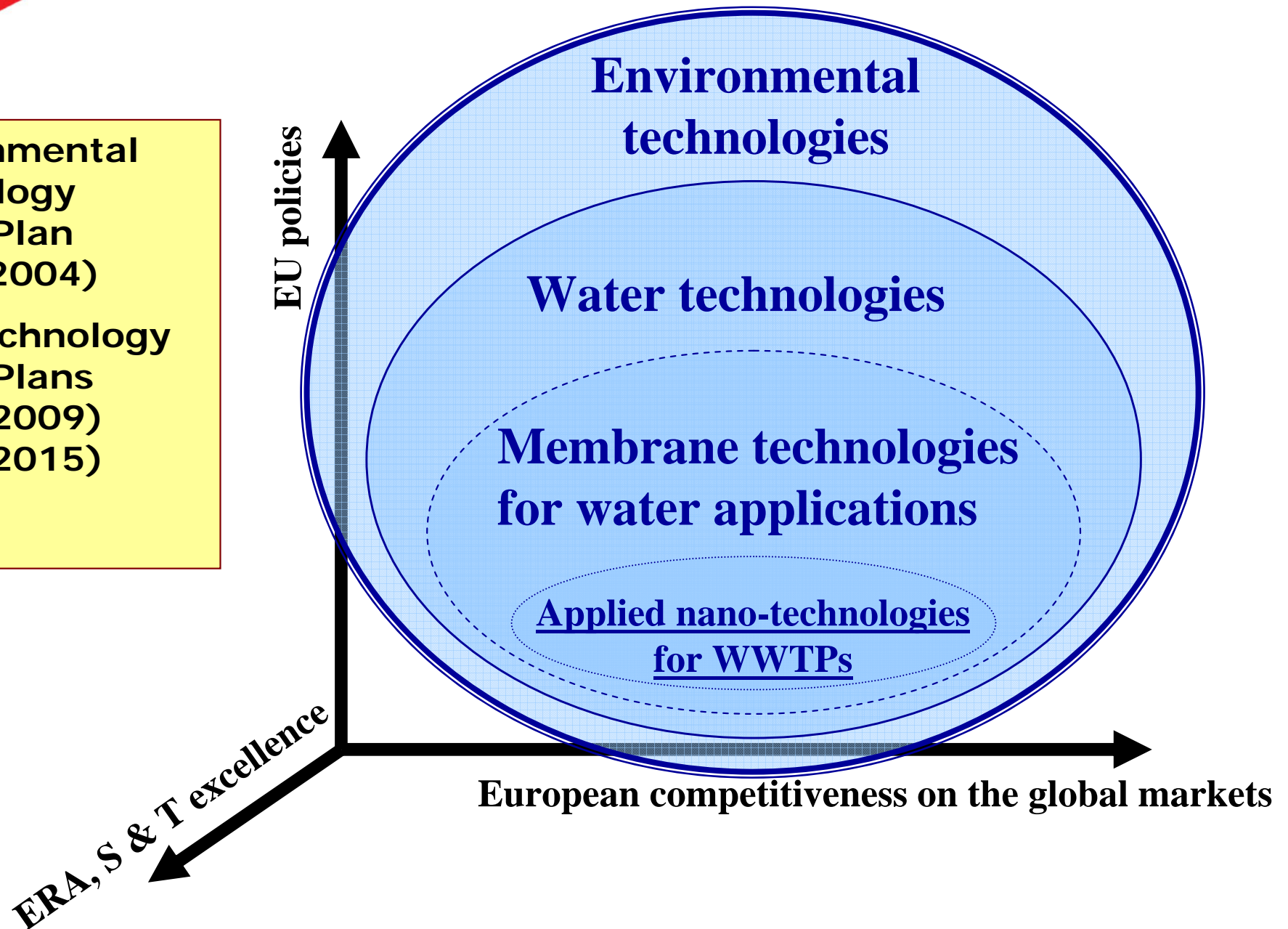
Water ERA-NETs





Environmental technologies: three axes for a research strategy

- ✓ Environmental Technology Action Plan ETAP (2004)
- ✓ Nanotechnology Action Plans (2005-2009) (2011-2015)





Call FP7.ENV-NMP.2008 “Environment Theme”

- **Environmental technologies for water**

- Nanotechnologies for water treatment (Area 3.1.1-2)

- To support research and technological development in the field of water treatment by applying developed or adapted nano-engineered materials to promising separation, purification and/ or detoxification technologies.

- Proposals should focus on process intensification aiming at improving selectivity, robustness, stability and performance while reducing energy requirements and by-product generation.

- Specific monitoring issues, as well as safety, environmental and health aspects, should be included

- Funding scheme: Collaborative projects (small or medium-scale focused research projects).

- Impact: Step-change advances in water treatment technologies

The European cluster "nano4water"

- A recent initiative for joint dissemination
- A joint web platform
- 50+ academic and industrial partners in 6+ collaborative projects
- One common aim: the use of nano-technology for advanced water filtration
 - Nano-membranes
 - Nano-materials in catalytic reactors

The nano4water cluster logo is displayed at the top left. Below it is a navigation menu with the following items: Home, Projects, Partners, News, Joint Workshop, Links, Contact, Disclaimer, and Logo. The main content area features a section titled "The nano4water cluster" with a description: "The nano4water cluster is a coalition of research projects, funded by the European Commission following a Joint Call on nanotechnologies for water treatment (FP7-ENV-NMP-2008-2). The aim of this action is to support research and technological development in the field of water treatment by applying developed or adapted nano-engineered materials to promising separation, purification and detoxification technologies. The approved projects address these challenges focusing on different approaches [more]". Below this are six project cards, each with a small image and a title: "Clean Water" (Water detoxification using innovative vi-nanocatalysts), "MONACAT" (Monolithic reactors structured at the nano and micro levels for catalytic water purification), "Nanotech" (Development of intensified water treatment concepts by integrating nano- and membrane technologies), "New ED" (Advanced bipolar membrane processes for remediation of highly saline waste water streams), "WATERMIM" (Water treatment by molecularly imprinted materials), and "MEMBAQ" (Incorporation of aquaporins in membranes for industrial applications). On the right side, there is a "News & Events" section with three items: "Autumn Event Joint Dissemination Workshop of the nano4water cluster on 26 October 2010, Aachen (DE) [more]", "Call for Papers IWA Specialist Conference on Nano ar Water, 15-16 May 2011 Monte Verita, CH [more]", and "Open call on membran technology ACQUEAU calls for projects aiming at reducing energy demand of membrane processes. Deadline for outline proposals 20 August 2010 [more]". At the bottom right, there are three dates with corresponding events: "11.03.2010 Short Course on 'Nanotechnology for Water and Wastewater Treatment', 6-9 April 2010, Unesco-IHE, Delft (NL) [more]", "05.03.2010 NanoMemCourse on 'Nanostructured materials and membranes for food processing' [more]", and "02.03.2010 WATERMIM dissemination activities [more]".

Home

The nano4water cluster

The nano4water cluster is a coalition of research projects, funded by the European Commission following a Joint Call on nanotechnologies for water treatment (FP7-ENV-NMP-2008-2).

The aim of this action is to support research and technological development in the field of water treatment by applying developed or adapted nano-engineered materials to promising separation, purification and detoxification technologies.

The approved projects address these challenges focusing on different approaches [more]

Clean Water
Water detoxification using innovative vi-nanocatalysts

MONACAT
Monolithic reactors structured at the nano and micro levels for catalytic water purification

Nanotech
Development of intensified water treatment concepts by integrating nano- and membrane technologies

New ED
Advanced bipolar membrane processes for remediation of highly saline waste water streams

WATERMIM
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MEMBAQ
Incorporation of aquaporins in membranes for industrial applications

News & Events

Autumn Event
Joint Dissemination Workshop of the nano4water cluster on 26 October 2010, Aachen (DE) [more]

Call for Papers
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02.03.2010
WATERMIM dissemination activities [more]

The nano4water cluster comprises six Collaborative Projects on nanotechnology in water treatment co-funded by the Research DG of the European Commission within the joint RTD activities of the Environment and NMP Thematic Priorities

SEVENTH FRAMEWORK PROGRAMME



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Nametech
nano 4 water cluster

NAMETECH:

Development of intensified water treatment concepts by integrating nano- and membrane technologies

- Opportunity: By combining nanotechnology with membrane technology, antifouling or micropollutant removing properties can be given to membranes leading to better performance in advanced water treatment.
- Methodology for preparing nano-activated membranes (NAMs).
 - Ag and TiO₂ particles will be incorporated in a microfiltration membrane structure. These nanoparticles have anti-bacterial properties and will reduce fouling, which will result in an enhanced flux.
 - Various nanoparticles will be used for the removal of micro-pollutants and for detoxification.
 - All developed NAMs will be tested on laboratory scale before selecting the most promising concept for testing at pilot scale. These activities will be complemented by a toxicological study and the application of LCA to assess all environmental impacts.



Duration: 36 months

Start Date: 1/06/2009

Project Coordinator: VITO (Belgium)

Project Web Site: <http://www.nametech.eu>

Project Partners	
Vlaamse Instelling voor Technologisch Onderzoek N.V., BE	Rheinisch-Westfälische Technische Hochschule Aachen, DE
Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, NL	The University of Manchester, UK
Norit Process Technology B.V., NL	AGFA-GEVAERT N.V., BE
Consorzio Venezia Ricerche, IT	Technical University of Liberec, CZ
Aquatest AS, CZ	Suez Environnement – CIRSEE, FR
Fachhochschule Nordwestschweiz, CH	



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NEW-ED:

Advanced bipolar membrane processes for remediation of highly saline waste water streams

- Challenge: to overcome current limitations of bipolar membrane technology which prevent its application to large scale industrial brines to recover valuable materials and minimize saline effluents. NEW ED aims at closing industrial water cycles and reducing the amount of waste water streams with highly concentrated salt loads stemming from a broad range of industrial production processes.
- Methodology for preparing nano-activated membranes (NAMs).
 - new type of bipolar membranes with a revolutionary water transport concept aiming at operation at elevated current densities and high product purities
 - a new membrane module concept will be developed adapted to the new membrane type and the New ED technology will be integrated into relevant production processes
- Targets end-users from the chemical industry to recover valuable raw materials from waste water and at the same time minimize emissions to make their processes more resource efficient.



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Duration: 44 months

Start Date: 01/05/2009

Project Coordinator: RWTH Aachen University, DE

Project Web Site: <http://www.new-ed.eu>

Project Partners	
RWTH Aachen University, DE	Fumatech GmbH, DE
University of Twente, NL	Ben Gurion University, IS
Prayon S.A., BE	Bayer Material Science, BE



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CleanWater

nano 4 water cluster

CLEAN WATER: Water Detoxification Using Innovative vi-Nanocatalysts

- Development of advanced water detoxification technology exploiting solar energy and recent progress in nano-engineered titania photocatalysts and nanofiltration membranes
 - Preparation of nanostructured UV-Vis light-activated photocatalysts
 - Development of composite carbon nanotubes/titania nanostructures
 - Development of photocatalytic nanofiltration membranes with tailored pore size and retention efficiency for target water pollutants
 - Evaluation of the materials activity for the photodegradation of water pollutants: MC-LR cyanobacterial toxins, geosmin, endocrine disrupting compounds and their interference with classical water pollutants such as phenols, pesticides and azo-dyes.
 - Analysis and quantification of degradation products to ensure the effectiveness and environmental impact of the engineered nanomaterials
 - Development of a laboratory-scale continuous flow photocatalytic-disinfection-membrane reactor.
 - Up-scaling of Materials and Processes



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CleanWater

nano 4 water cluster

Duration: 36 months

Start Date: 1/06/2009

Coordinator: National Center for Scientific Research “Demokritos”

Project Web Site: <http://www.photocleanwater.eu>

Project Partners

National Center for Scientific Research
“Demokritos”, GR

Osmosistemi, IT

Innovative Research and Technology Ltd,
UK


University of Las Palmas de Gran Canaria,
ES

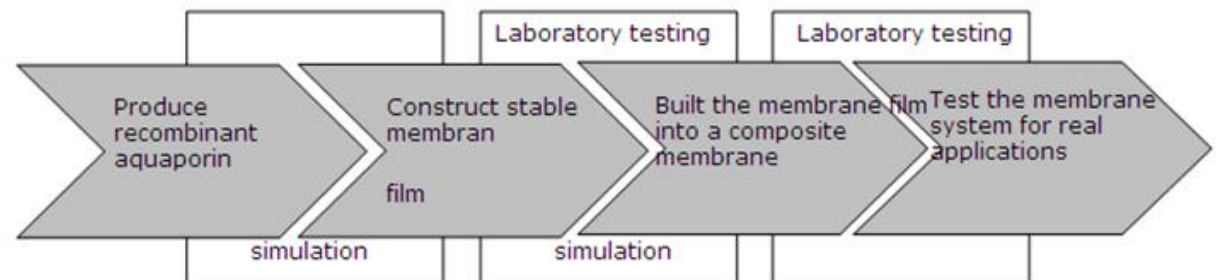
Faculdade de Engenharia da
Universidade do Porto, PT

ARMINES (GEPEA-Universite de Nantes-
Ecole Des Mines de Nantes), FR

University of Cincinnati, USA

Nano4water also includes additional FP6/FP7 projects funded by the NMP Theme

-  - Intensification of catalytic water treatment by coating structured reactors with nanocarbon materials
 - More selectivity, robustness, stability, performance
 - Less energy, by-products
- **WATERMIM Project** - Production of functional materials by using Molecular Imprinting Material technology to come to molecular selective water purification processes
- **MEMBAQ** - Using natural processes (aquaporin) to improve separation and filtration techniques



NanoSafety Cluster

About the NanoSafety Cluster

EU NanoSafety Cluster Projects

EU-US Modelling Cluster

News and Events

Contact

Intranet

EU NanoSafety Cluster Projects

European NanoSafety Cluster Compendium

Sixth Framework Programme Projects

Seventh Framework Programme Projects

National Projects

European NanoSafety Cluster Compendium

For several years now, the research community has responded by launching very valuable projects under the Sixth Framework Programme. Significant technological progress both in the technology and in its safety management. Thirty projects are either complete NMP and other programmes, under FP6 (11 projects, €30M) and FP7 (19 projects, €52.5M). These projects together with a number of other projects addressing safety as side objective, represent the progress.

Please click on the link below to view the recently published European NanoSafety Cluster Compendium, which contains information on the Sixth Framework Programme FP6 and Seventh Framework Programme FP7.

 [European NanoSafety Cluster Compendium](#)

For further information on FP6 and FP7 programmes please link on the <http://cordis.europa.eu/>





Conclusions

- **Several motivations orient our research strategy:**
 - To strengthen the European water industry
 - To strengthen the European Research Area
 - To help implementing EU environmental policies
 - To provide cost-effective solutions to water treatment operators
- **Driven by what markets will deliver in 2020**
 - 10+ years to go from labs to markets
 - Particular attention to up-scaling issues (from molecules to pilot plants and market)
- **Case-study approach**
 - With public and private end users' involvement
 - Cost-effective in various operational water treatment contexts
- **Life cycle assessment**
 - Greenhouse gases emissions (such as NO, NO₂, CH₄ and CO₂)
 - Energy consumption
 - Routes of involved toxicants in water and sludge
 - Toxicity of by-products
- **Use of a panoply of RTD & innovation instruments**
 - Upstream/downstream research, demonstration, benchmarking, training, awareness raising, standardisation, innovation and up-take, coordination...
- **Interface with other public and/or private initiatives in Europe**



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Thank you for your attention

