



**The one-stop place for
membrane expertise & partnerships!**

About the EMH ...

- ▶ EMH is a international non-profit association (a.i.s.b.l.) , aimed at enhancing industrial implementation of membrane-based technologies
- ▶ Background:



2008: Partners' will for sustainable structure



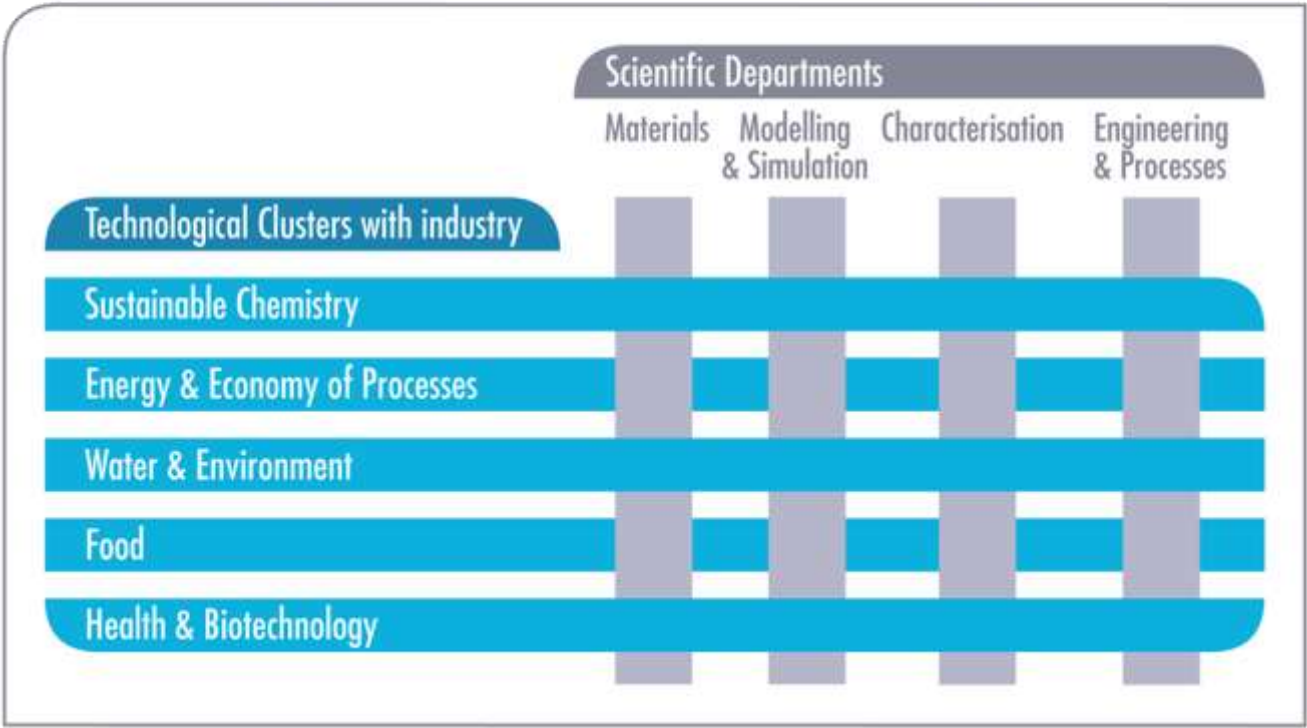
- ▶ Founding members:

European Membrane Society (EU)		
FORTH/ICE HT (EL)	GKSS (DE)	LUT (FL)
ICTP (CZ)	Univ. Twente (NL)	SINTEF (NO)
Univ. Montpellier (FR)	VITO (BE)	IBET (PT)
Univ. Zaragoza (ES)		

EMH Organisation

Missions: Information dissemination
External networking
Lobbying
Support to spin-offs & SMEs
Certification, normalization & labeling

Services: Technical & scientific expertise
Initiating R&D projects
Industry-targeted services
Business opportunity studies
Tailor-made training courses



General Assembly
all EMH partners



Governing Board
5 to 7 EMH persons

The EMH Water Cluster

1st meeting in Brussels, 25.02.2009

■ **Participants**

- **EMH / NanoMemPro / EMS (5p)**
- **WssTP (1p)**
- **EC (3p, DG-RES ENV/NMP)**
- **European projects (3p, MBR-Network, Techneau, Medina)**
- **IWA (1p)**
- **Industry (Veolia, Inge)**
- **R&D (TNO, VITO, GKSS, IBET, LUT, DUT etc)**

■ **Goals**

- **Presentation of networks and coordinated initiatives dealing with membrane and water in Europe
EMH, EMS, WssTP, European projects**
- **Presentation of international context (market, R&D efforts etc)**
- **Introduce EMH Water Cluster as « federating lobby institution »
on water / membrane issues**

Outlook of first meeting

■ Market

- Strong growth for all applications (MF, UF, MBR, NF, RO etc) >10%p.a.
- Increasing water stress / environmental constraints :
« blue oil » of the future ?

■ EU expertise

- Strong but fragmented expertise
- EU constructors well positioned but no supplier champion (except Norit)
- Too few interdisciplinary approach membrane / process
- Needs to build up today the champions of tomorrow

« Innovations are needed to meet new demands: the membrane development story needs new chapters and new champions »

Hervé Buisson, 09.09.2009, Euromembrane 2009

■ R&D efforts in Europe on « Membrane for water »

- Some efforts at national and European level
- « *Negligible* » when compared with other regions (US, Asia, Middle East etc)
- Not organized as « Program »

Conclusion of meeting

- **Support the EC strategy to define joint program between ENV and NMP to strengthen EU industry**
- **EMH Water Cluster has one stop place for the European Membrane / Water industry towards the EC**
- **Increase interdisciplinary approach**
- **Next steps (2009)**
 - **Report on progress at EUROMEMBRANE**
=> Done : 2nd meeting EMH WC
 - **Work on organizational structure of EMH Water Cluster**
with WssTP and existing networks **=> Done : Membr. TF, ChemWater..**
 - **Review Nanomempro road map (2007) by current EU projects on membrane applications from ENV program**
Pierre AIMAR, Inge GENNE, Boris LESJEAN, TorOve LEIKNES,
Jean-Christophe SCHROTTER **=> Next slides**

Update of NanoMemPro Road-Map (water applications)



- **NanoMemPro: NoE program NMP**
- **Road-Map: published end 2007**
(See www.euromemhouse.com)
- **Update of section « environmental applications » with outcomes of FP6 EU projects program ENV**
 - **MBR-Network: MBR technology (done with all 30 partners)**
 - **Techneau: drinking water (done with 10 'membrane' partners)**
 - **Medina: desalination (done by coordinator + core group)**
 - **AquaFit4Use (FP7): industrial applications (done by coordinator)**
 - **But also: Reclaim, Medesol, etc**
- **Goals of update**
 - **Highlight topics covered by EU projects**
 - **Identify needs of further R&D**
 - **Identify new trends or ideas**
 - **Provide joint recommendations to programs NMP and ENV**

Membrane

Modules

Process

Anti-fouling membranes: antibacterial ions in the membrane, teflon, silver coating Nametech	modules operating without pre-treatment Nametech, Carbomembrane	Nametech, Techneau, Reclaim Hybrid processes: - Ion-exchange MBRs - Photocatalysis + membrane - UF/NF and activated carbon
New material and structure (roughness, hydrophobicity, homogeneous pore size etc)	Extensive system designed with low flux / low energy Techneau	Treatment of concentrate streams Techneau, Reclaim
Aquaporin Membrane with carbon nanotubes Membraq, Carbomembrane	New flushing / cleaning methods	Pathogens, micropollutants, viruses, NO ₃ , SO ₄ COV Techneau, Reclaim
Inorganic membrane material Techneau	Compatibility / norming of MF/UF modules	Integrity testing methods for biocontaminants

Fouling: fundamental knowledge (interaction matrix / membrane, models, fouling characterisation methods, biofouling, scaling, adsorption etc) **Techneau, Reclaim**

Fouling: Full-scale feedback

Life cycle analysis of membrane processes: sustainable design and operation
 (Energy + membrane recovery)

✓ Well addressed in EU project ✗ Partly addressed - Hardly or not addressed

Membrane & Fouling

Modules

Process integration

Next generation materials (e.g. disposable membranes, production without solvent, ...) ✗	Optimization of reactor concept to reduce membrane fouling ✗	Better MBR sludge processing ✓
Better membrane chemistry: coating / grafting / pore size... ✗	Novel module geometries (higher mass transfer with high filterability sludge) ✗	Process modeling (biological, hydraulic, fouling) ✗ Model integration
Improved membrane cleaning protocol ✗	MBR ceramic modules ? -	Small MBR systems for decentralized treatment in industry countries ✓
On-line fouling monitor / indicator (input for process control) ✗	Non submerged process ? -	Integrated MBR systems with other physico chemical processes ✗
Foulants analysis in raw wastewater -		Biofilm / MBR Low SRT MBR + digestion - Sludge manipulation in reactor

Advanced knowledge on fouling mechanism

✓ Well addressed in EU project ✗ Partly addressed - Hardly or not addressed

Operation (aerobic MBR)

"New MBR processes" (non conventional MBR)

Reduce concentration of activated sludge	✓
Tool to predict the uncertainties (cost, cleaning, fouling) and lifetime	✗
Real time monitoring and process control for energy optimization	✗
Statistical Process Control (SPC)	✗
Long term fouling / clogging mechanisms in full-scale plants and optimized operation	✓

Textile MBR	✓
CH ₄ /H ₂ Anaerobic MBR (energy recovery)	-
Ion-exchange MBR, NF-MBR (sophisticated ?)	-
Low energy MBR systems for decentralized water treatment and reuse in developing countries AOP (Advanced oxidation process) / MBR	✗
Algal-MBR (polishing + N/P-recovery) Membrane aerated biofilm, osmotic MBR (membranes, modules, processes)	-

Energy optimization / Life cycle analysis of (new) MBR processes

Desalination – proposed in 2007

Membrane	Modules	Process
<p>New thin film composite membranes more stable against chlorine and other disinfectants – Breakthrough material to improve flux and rejection while decreasing energy consumption (carbon nanotubes) – New hydrophobic porous membranes for applications with membrane contactors (distillation / crystallization...)</p>	<p>Progress in ED and NF for converting brackish water into fresh water</p>	
	<p>Multi barrier treatment methods : membranes combined with traditional or advanced water treatment, or a pair of processes in tandem (as an example to protect RO membranes from high fouling in large-scale sea water desalination)- Hybridisation of processes.</p>	
	<p>Development of entirely new integrated membrane plants with new process control and optimisation tools</p>	
<p><i>2009: still needed</i></p>		

2009: these technologies are now more mature – but what/where is the actual market for these technologies?

2009: the concept of multi-barrier treatment is now fully considered by stakeholders: need for process validation on site-specific basis – not to be addressed at the R&D level anymore – has moved to process design validation

2009: still needed, but with a specific target towards process intensification (increasing water recovery)

A huge and ever growing market with new specific problems to consider for the well-being of population and environmental impact

Disposal of huge amounts of waste brines produced by the desalination plants

RO-desalinated deep-seawater for the production of bottled - water

Desalination – 2009 proposal

A huge and ever growing market with new specific problems to consider for the well-being of population and environmental impact – **STILL A REALITY**

Membrane

New RO membranes generation:

- oxidant-resistant RO membrane
- breakthrough material to improve flux and rejection while decreasing energy consumption (carbon nanotubes, biomimetic...)

MEMBAQ, CARBOMEMBANE, NAMETECH

Modules

Process

Design optimisation of RO desalination facilities:

- chemical-free desalination system to minimize environmental impact while maintaining reliability and energy efficiency
- process intensification to increase water recovery at reasonable cost/energy => moving towards zero-liquid discharge, notably for brackish water desalination + identify opportunities for salt valorisation

1st process schemes proposed through MEDINA, but need for viable demonstration of alternative processes (technically and economically)

Alternative technologies to RO (forward osmosis, membrane distillation...)

- need for complete development from the membrane material to process design and optimisation
- objective: power consumption < 1 kWh/m³ (by 2030)

NEED FOR DEDICATED FUNDING

Desalination – 2009 proposal

A huge and ever growing market with new specific problems to consider for the well-being of population and environmental impact – **STILL A REALITY**

Environmental Performance

Need to select the most sustainable and cost-effective **saline water resources in EU** => Is brackish water available ? Is it indeed the best choice (cost, environmental impacts...) - **NEED FOR DEDICATED FUNDING ON INVENTORY OF SALINE WATER RESOURCES**

Improved understanding, monitoring and minimization of **environmental impacts** for BWRO and SWRO facilities:

- development of monitoring and assessment protocols for ecological impacts of concentrate discharge (bio-indicators)
- better design for intake structures to minimize impingement of marine fauna
- better design for concentrate outfalls to optimize dispersion and minimize zone of impact

NEED FOR DEDICATED FUNDING

Coupling renewable energies and desalination utilities: need for a market study to understand/specify the needs so as to identify the optimal technologies based on the specific constraints and expectations (i.e. overall capacity, need for continuous supply or daily/seasonal variations, available renewable resources...)

Next steps of Roadmap update

- **Complete update**
 - **New EU projects: Nano4Water cluster (FP7)**
 - **New information generated by “new large instruments” such as Eureka cluster ACQUEAU, national clusters on water (French,...)**

- **Report**
 - **By end of the year**
 - **State-of-the-art, current trends, project proposals incl. Joint Calls**

- **Ranking of priorities and recommendations to EC**

- **....and also**

EMH Organisation

Missions: Information dissemination
External networking
Lobbying
Support to spin-offs & SMEs
Certification, normalization & labeling

Getting new synergies
by strengthening the links with other application areas
through bridges having membrane technologies as pillars

Industry-targeted
Business opportunity studies
Tailor-made training courses

Scientific Departments

Materials Modelling & Simulation Characterisation Engineering & Processes

Technological Clusters with industry

Sustainable Chemistry

Energy & Economy of Processes

Water & Environment

Food

Health & Biotechnology

??

?

CHEMWATER :

New CA / negotiation

Membrane water & renewable energy

Water & Health

...and all others...