

nx

filtration

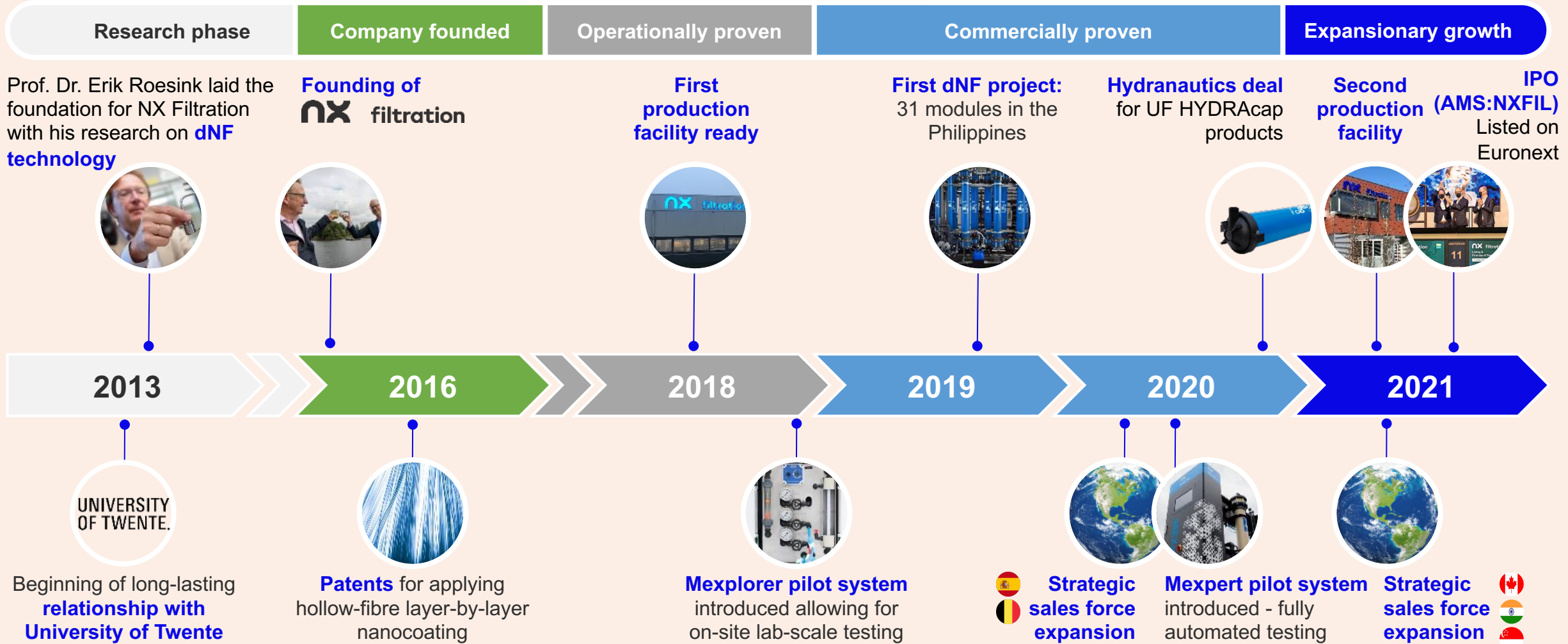
Proven break-through membrane technology

Hollow fiber nanofiltration

Robert Gerard, AIWW 2021



NX Filtration: The journey so far



Sustainability & Low OpEx

Green chemistry

Our coating process for NF membranes applies water-based chemistry, in contrast to conventional solvent-based coating processes. Our membrane spinning process is highly energy efficient thanks to our unique in-line polymer mixing concept.

Chemical free operation

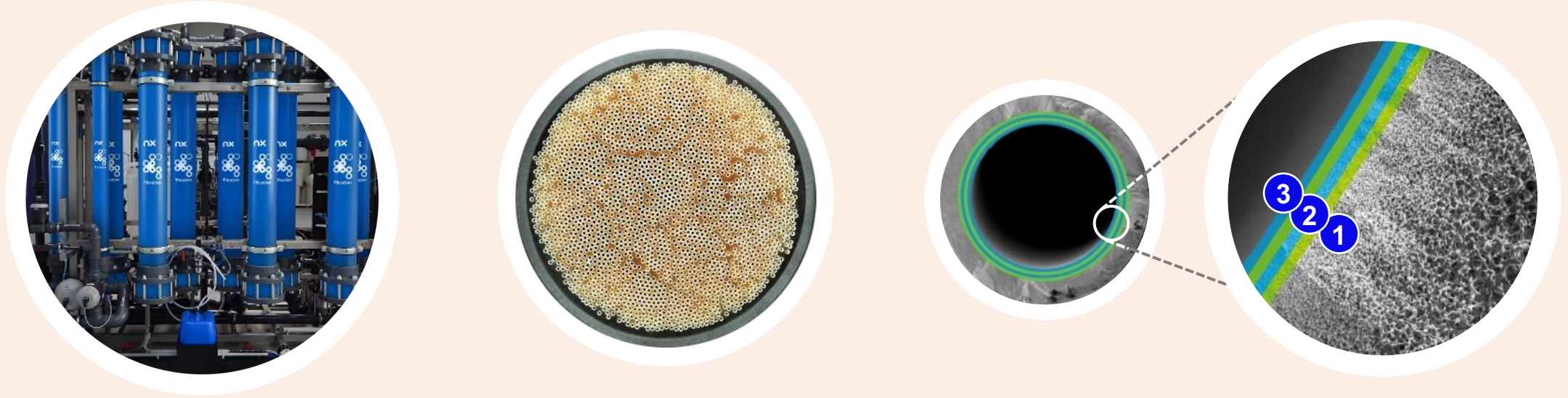
Our solution avoids the use of flocculants and coagulants in pre-treatment and requires a very low chemical cleaning frequency.

Energy efficient

Our membranes realise significant CO₂ footprint reduction during operation compared to conventional technologies such as RO, adsorption (activated carbon) and oxidation processes.

Patented Technology Layer-by Layer (LbL)

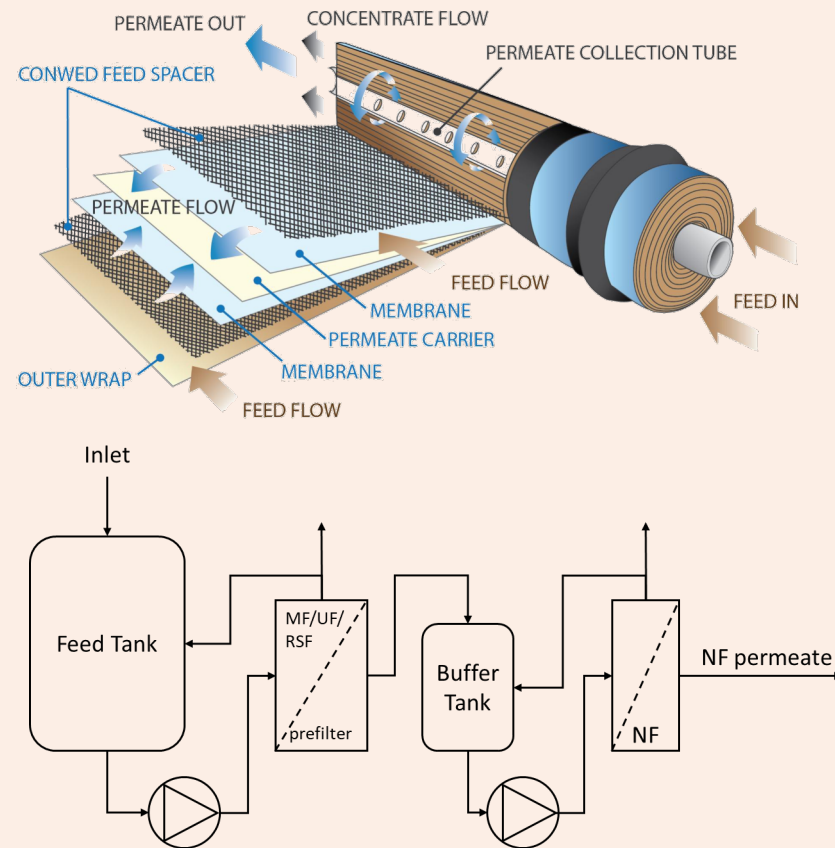
Direct nanofiltration (dNF) patent protected technology



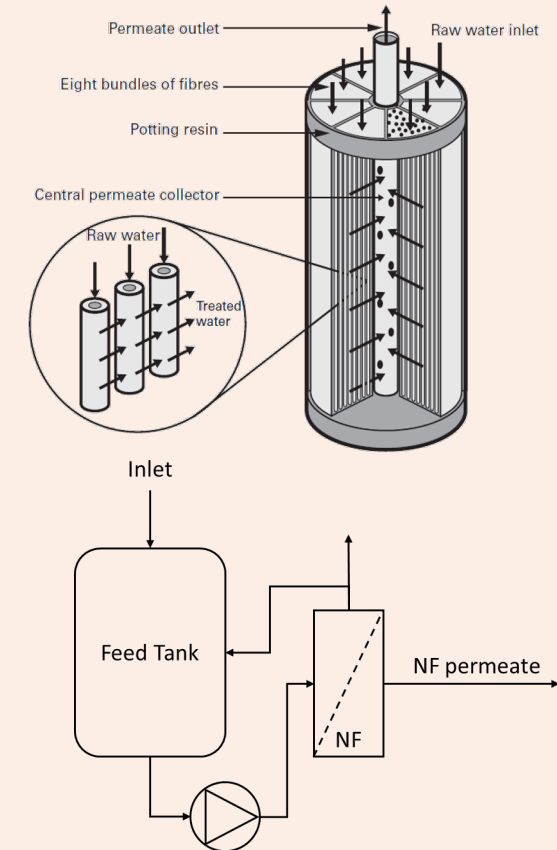
- 1 Family of patents around **dense membrane support structure** to ensure optimal selective layer adhesion
- 2 Family of patents around the in-line application of a **first selective charged layer**
- 3 Family of patents around the **layer-by-layer** application of positively and negatively charged nanolayers, offering precise control of the membrane selectivity properties. *Ongoing nanolayer innovations aim to enable new applications, such as further penetrating RO markets*

Direct nanofiltration – Innovative coating creates robust materials and enables simple process

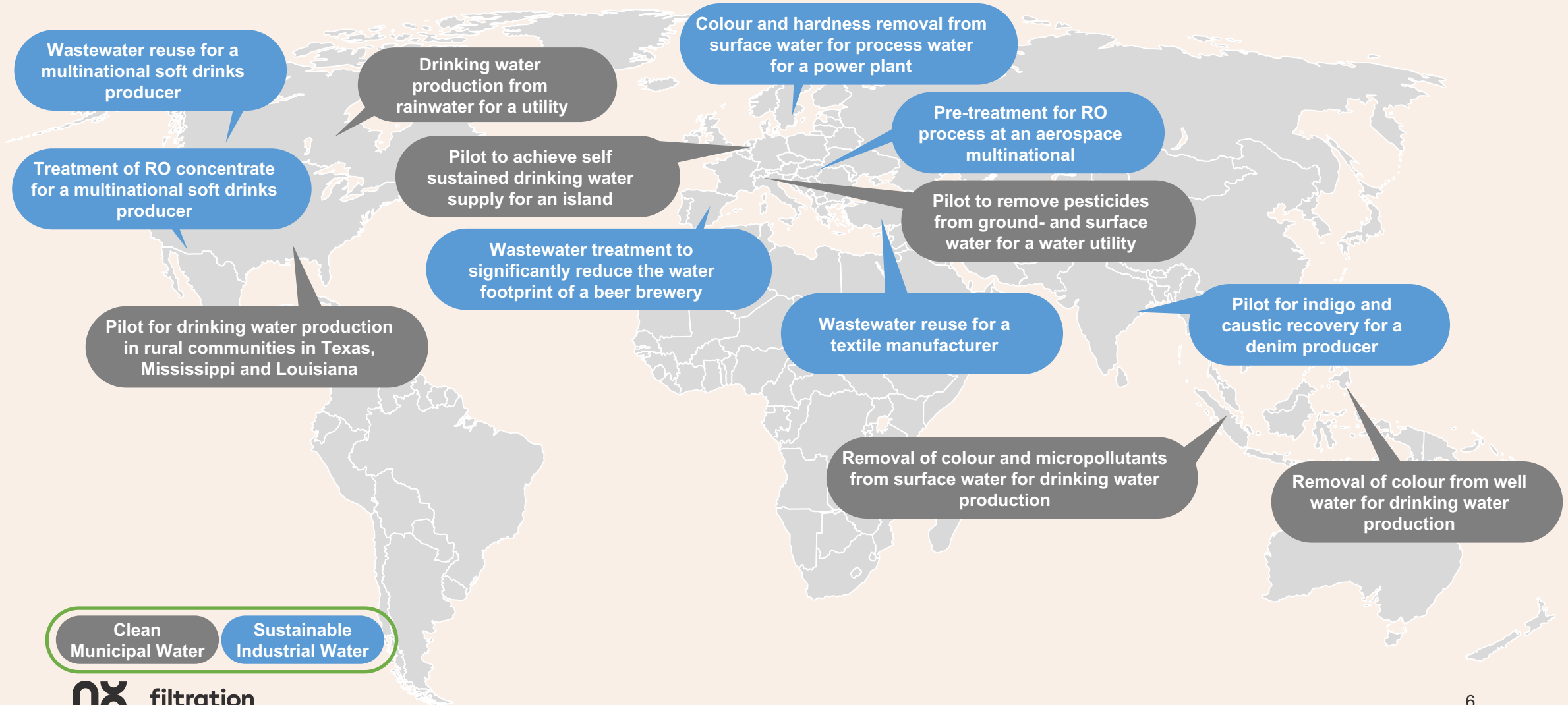
Traditional spiral wound NF scheme



Hollow fiber dNF scheme



Our technology has already proven successful across applications around the world – *selected examples*



Removal of micropollutants from municipal wastewater after biological treatment (1/2)

The customer's query

The customer, a wastewater treatment plant in the Netherlands, was looking for a solution to remove micropollutants from the wastewater effluent prior to discharge into an environmentally sensitive local water stream.

Our approach

We applied our dNF40 nanofiltration membranes directly on the wastewater after biological treatment and settling tanks. Contrary to conventional membrane processes, our process only required a strainer as pre-treatment.

Results

Stable operation since early 2019 with a crossflow design.

CEF every two weeks with 250 ppm NaOCl @ pH>10



20

LMH flux

>97%

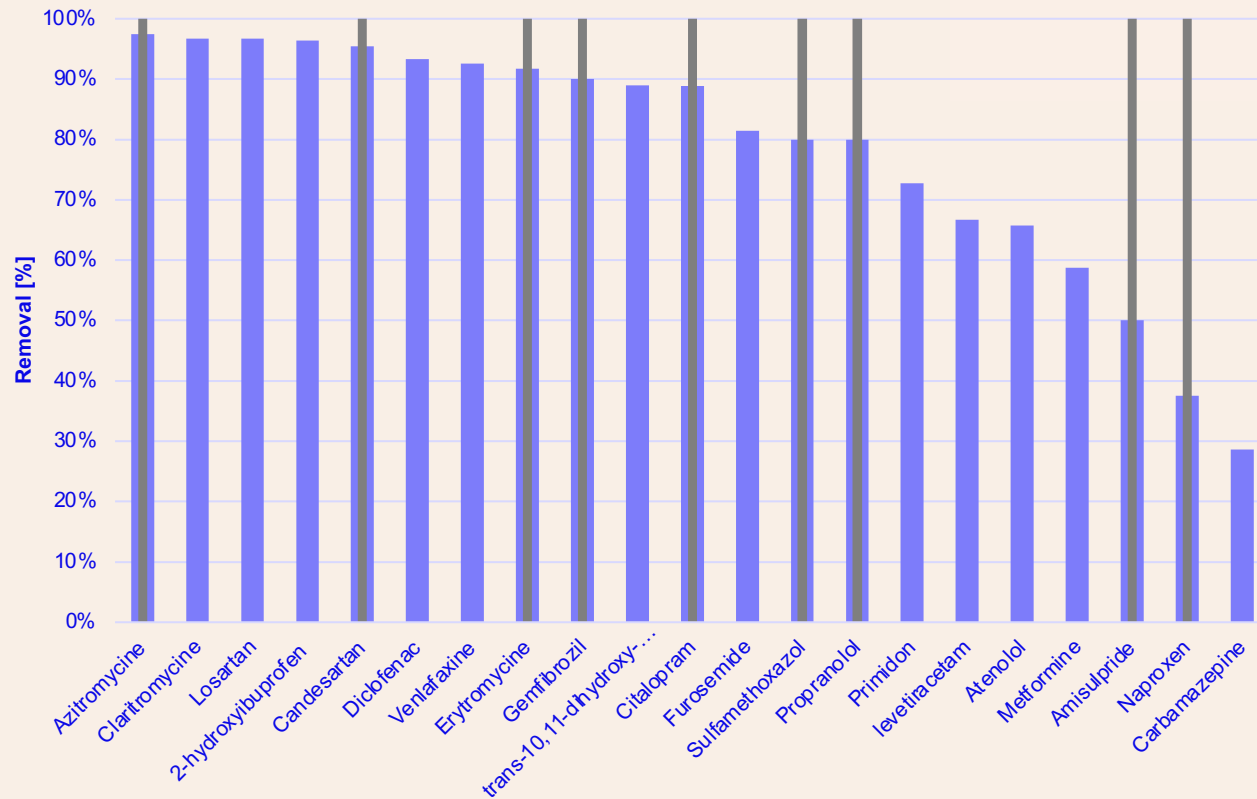
rejection of Total Organic Carbon

>80%

rejection for a cocktail of micropollutants, mainly pharmaceuticals, see next slide

Removal of micropollutants from municipal wastewater after biological treatment (2/2)

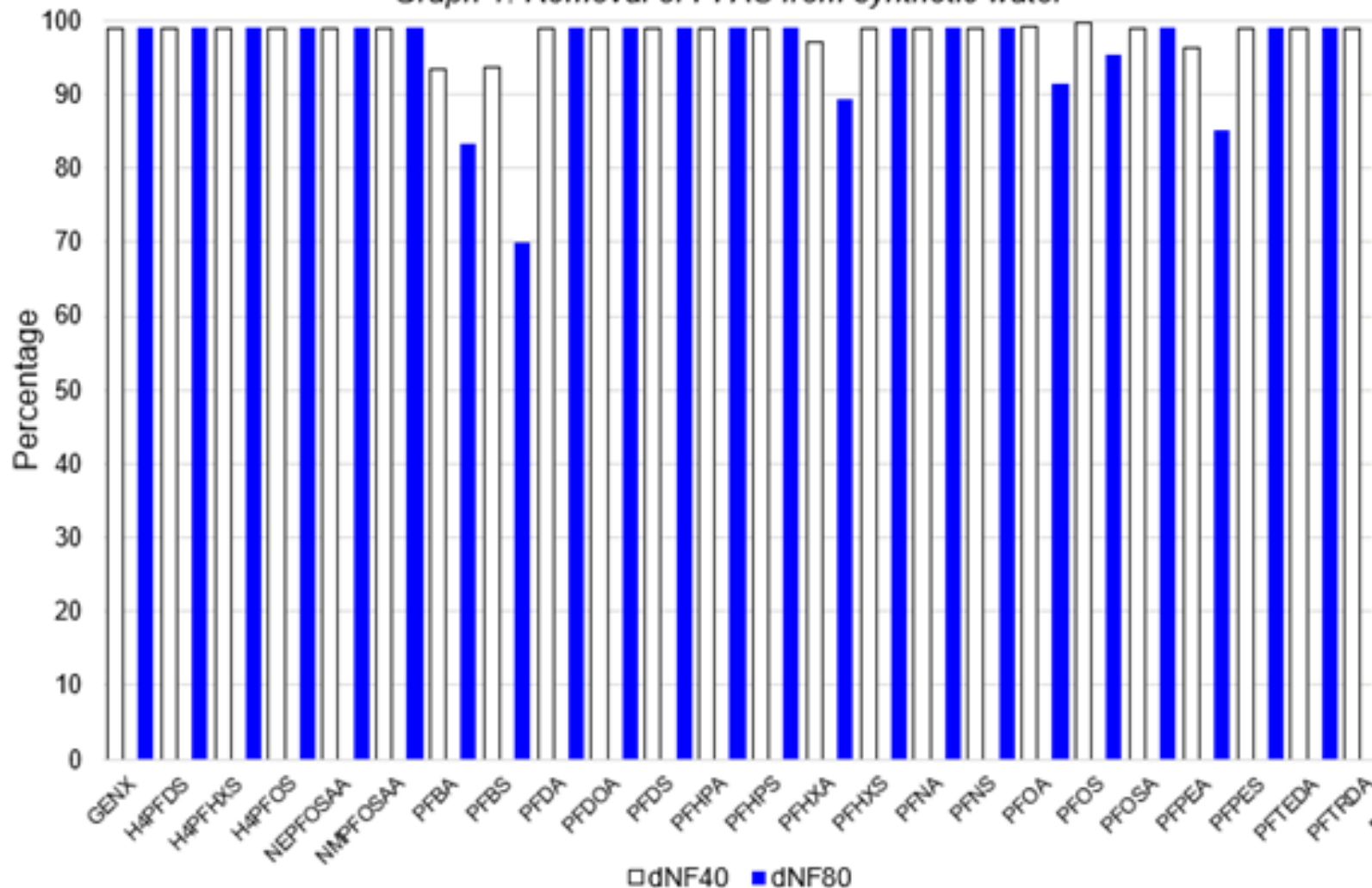
Removal of micropollutants



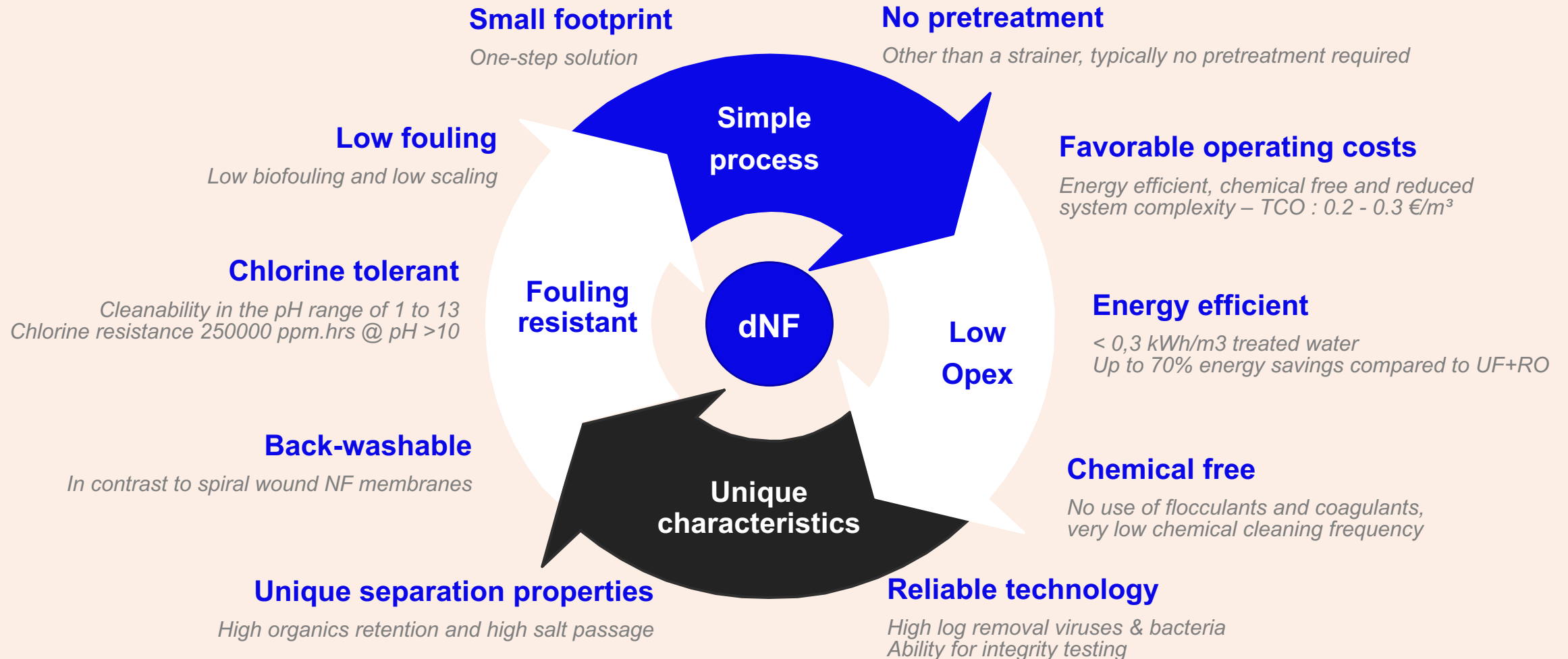
Removal of various PFAS compounds

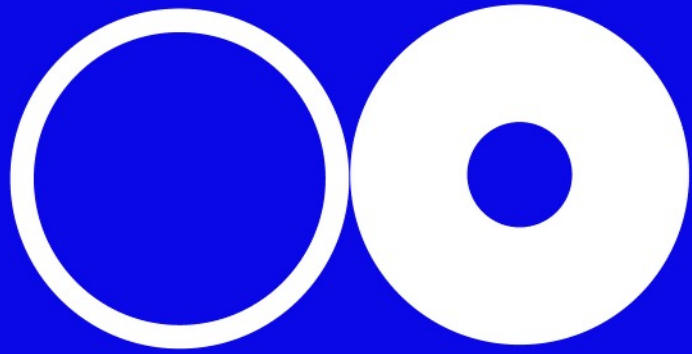
| PFAS | dNF40 | | dNF80 | |
|----------|-----------------------------|---------------------------|-----------------------------|---------------------------|
| | Feed water μl | Permeate μl | Feed water μl | Permeate μl |
| GENX | 250 | 2.5 | 250 | 2.5 |
| H4PFDS | 500 | 5 | 500 | 5 |
| H4PFHXS | 250 | 2.5 | 250 | 2.5 |
| H4PFOS | 250 | 2.5 | 250 | 2.5 |
| NEPFOSAA | 500 | 5 | 500 | 5 |
| NMPFOSAA | 250 | 2.5 | 250 | 2.5 |
| PFBA | 1500 | 100 | 1500 | 250 |
| PFBS | 300 | 19 | 250 | 75 |
| PFDA | 250 | 2.5 | 250 | 2.5 |
| PFDOA | 500 | 5 | 500 | 5 |
| PFDS | 250 | 2.5 | 250 | 2.5 |
| PFHPA | 250 | 2.5 | 250 | 2.5 |
| PFHPS | 250 | 2.5 | 250 | 2.5 |
| PFHXA | 1250 | 36.5 | 1300 | 140 |
| PFHXS | 250 | 2.5 | 250 | 2.5 |
| PFNA | 250 | 2.5 | 250 | 2.5 |
| PFNS | 250 | 2.5 | 250 | 2.5 |
| PFOA | 1050 | 8 | 1050 | 90 |
| PFOS | 1200 | 2.5 | 1300 | 60 |
| PFOSA | 250 | 2.5 | 250 | 2.5 |
| PFPEA | 1300 | 49.5 | 1250 | 185 |
| PFPEs | 250 | 2.5 | 250 | 2.5 |
| PFTEDA | 1000 | 10 | 1000 | 10 |
| PFTRDA | 1000 | 10 | 1000 | 10 |
| PFUDA | 250 | 2.5 | 250 | 2.5 |

Graph 1: Removal of PFAS from synthetic water



Wrap-up: Unique features of our dNF nanofiltration membrane





Thank you

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