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Innovations in Global Desalination

Når vannkilden er tom – kan avsalting redde verdens voksende storbyer?

Christian Wee, Business Development Director

Presentation, agenda

What is desalination?

Is desalination the solution to the urban water challenges?

Norwegian desalination technology

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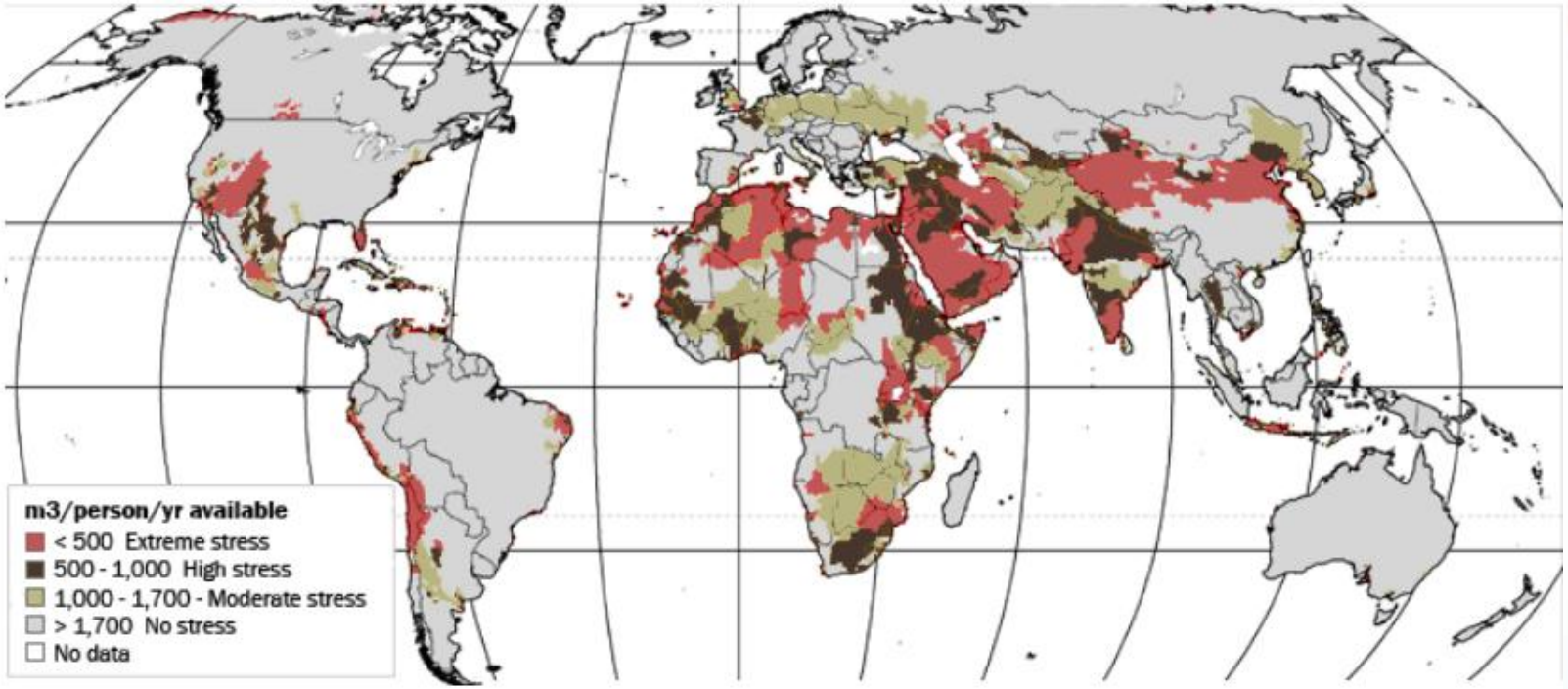
The globe is drying up!



Source: Centre for Environmental Systems Research, University of Kassel

The use of water increased 600 % last century

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About Desalination

- Desalination is the process of removing salt & other minerals from water
- Desalination has been used by seamen since 16th century, but has gained global acceptance only since 1980's
- 3 main technologies for seawater desalination
    - MED – Multi-effect distillation
    - MSF – Multi-stage flash
    - RO – Reverse Osmosis
- Historical main markets for desal are:
    - Mediterranian area – Spain, Morocco, Libya, Israel
    - Middle East – UAE, Saudi, Oman, Qatar
- Emerging markets for desal are:
    - India & South-east Asia
    - China
    - Latin America
    - USA

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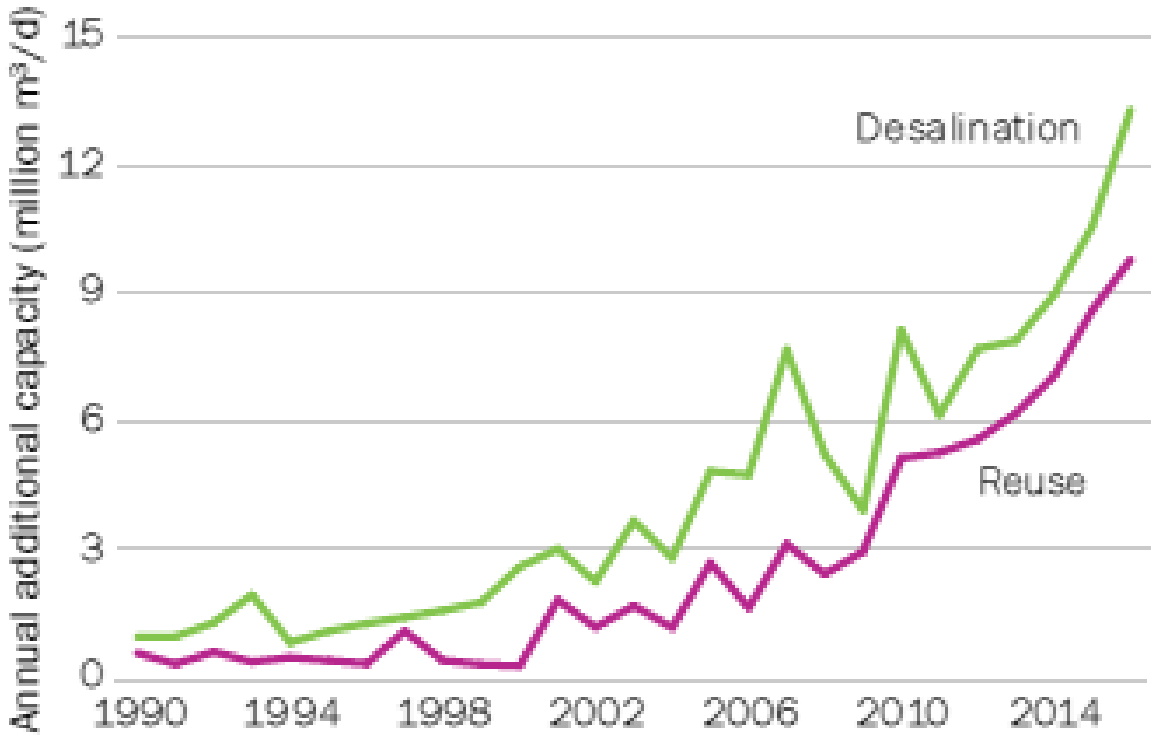
Desalination has grown steadily since mid 90's



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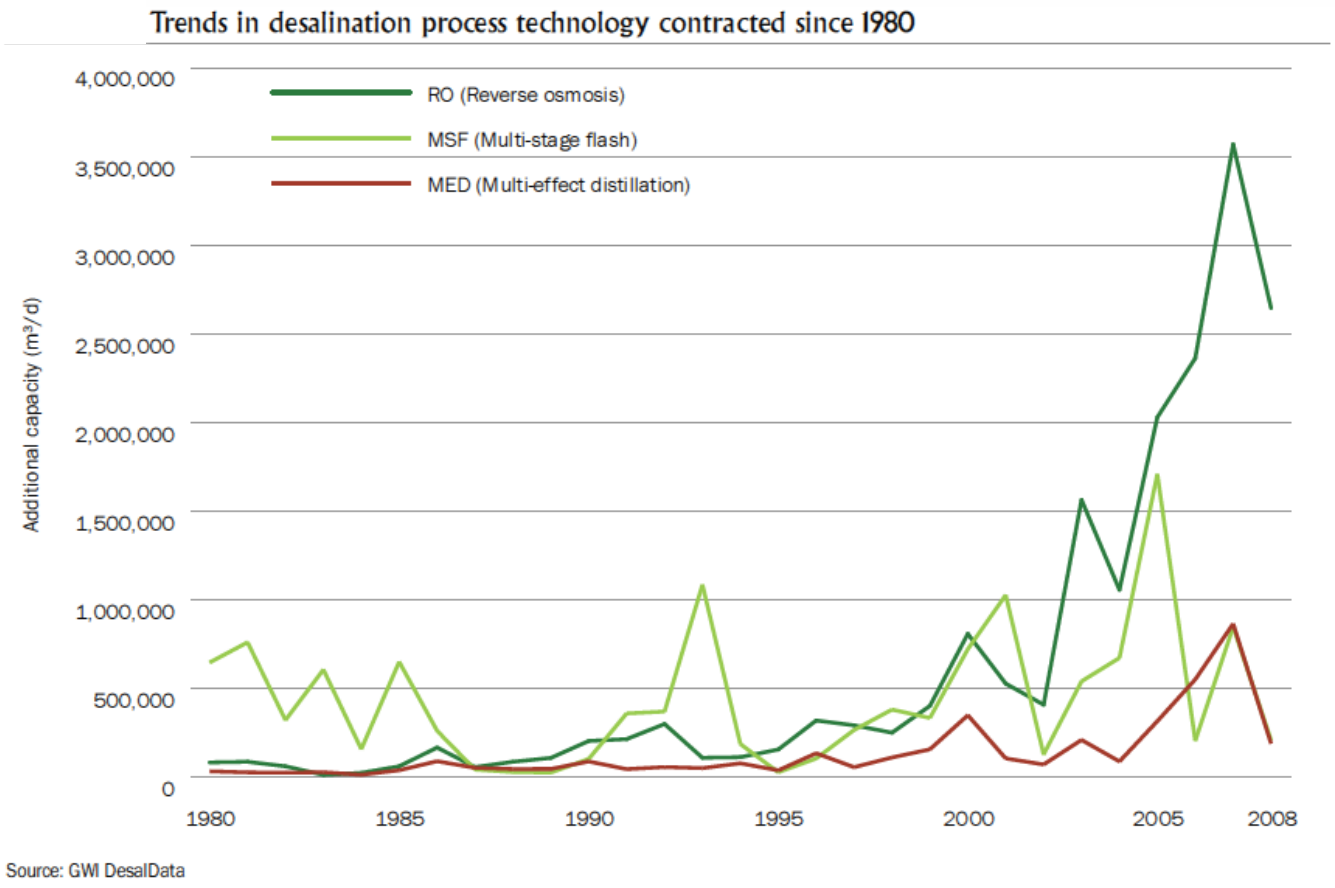
.....and Reverse Osmosis is the preferred technology



Source: GWI DesalData

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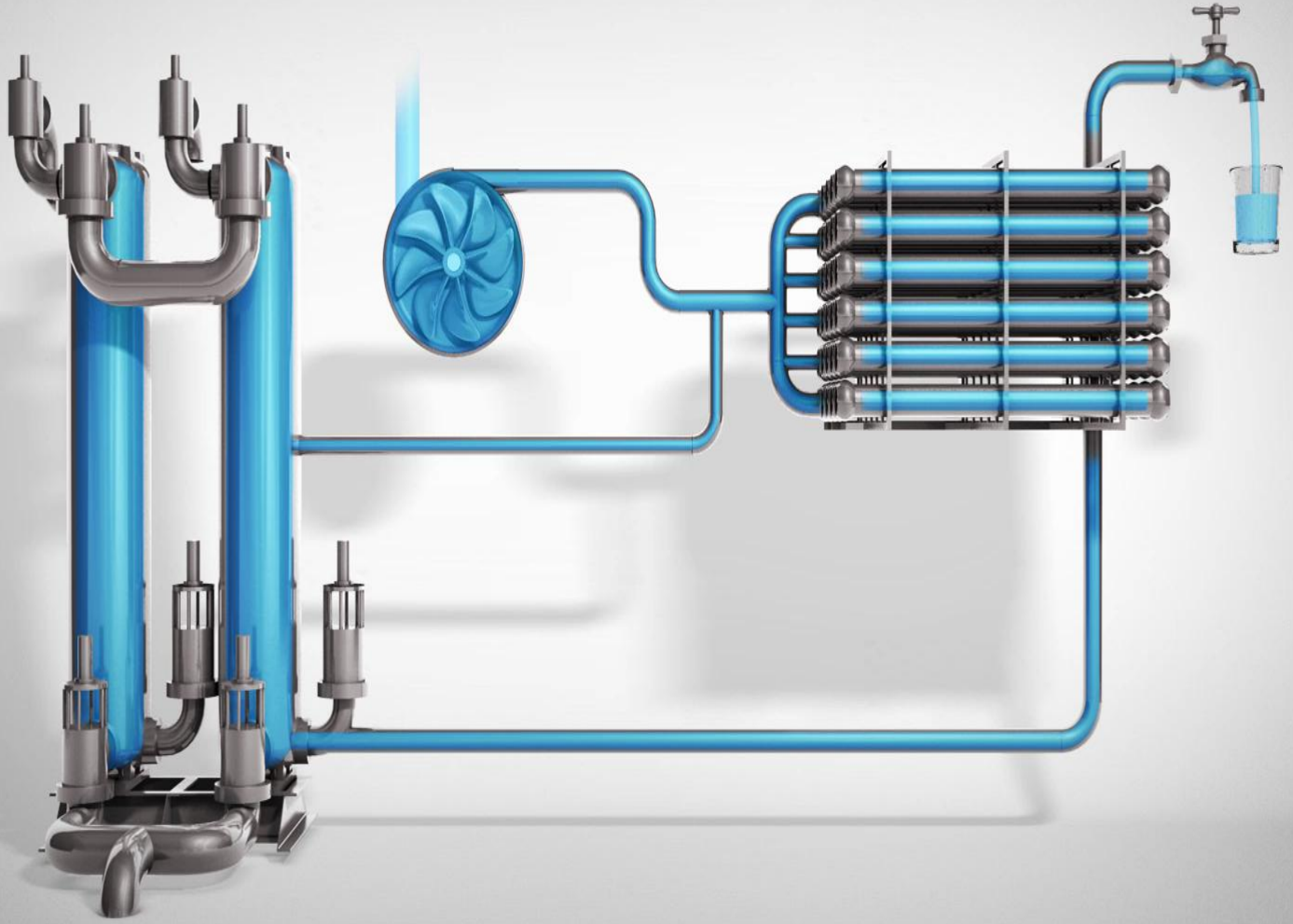


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Aqualyng – a leading player in the internation desalination market

- Developed in a Norwegian industrial environment well known for technology inventions
- Installed Reverse Osmosis(RO) plants since 1998, with references in 8 countries and 3 continents – of which 3 are operated by Aqualyng
- Strong focus on RO technology, with patented Energy Recovery Device, the Recuperator, the most efficient ERD in the market
- Since 2007, focus has been on Build Own Operate projects, recently with China as prime focus market
- Building plants from 20 000-200 000m3/day

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Is desalination THE solution for the water challenges in the growing urban areas?

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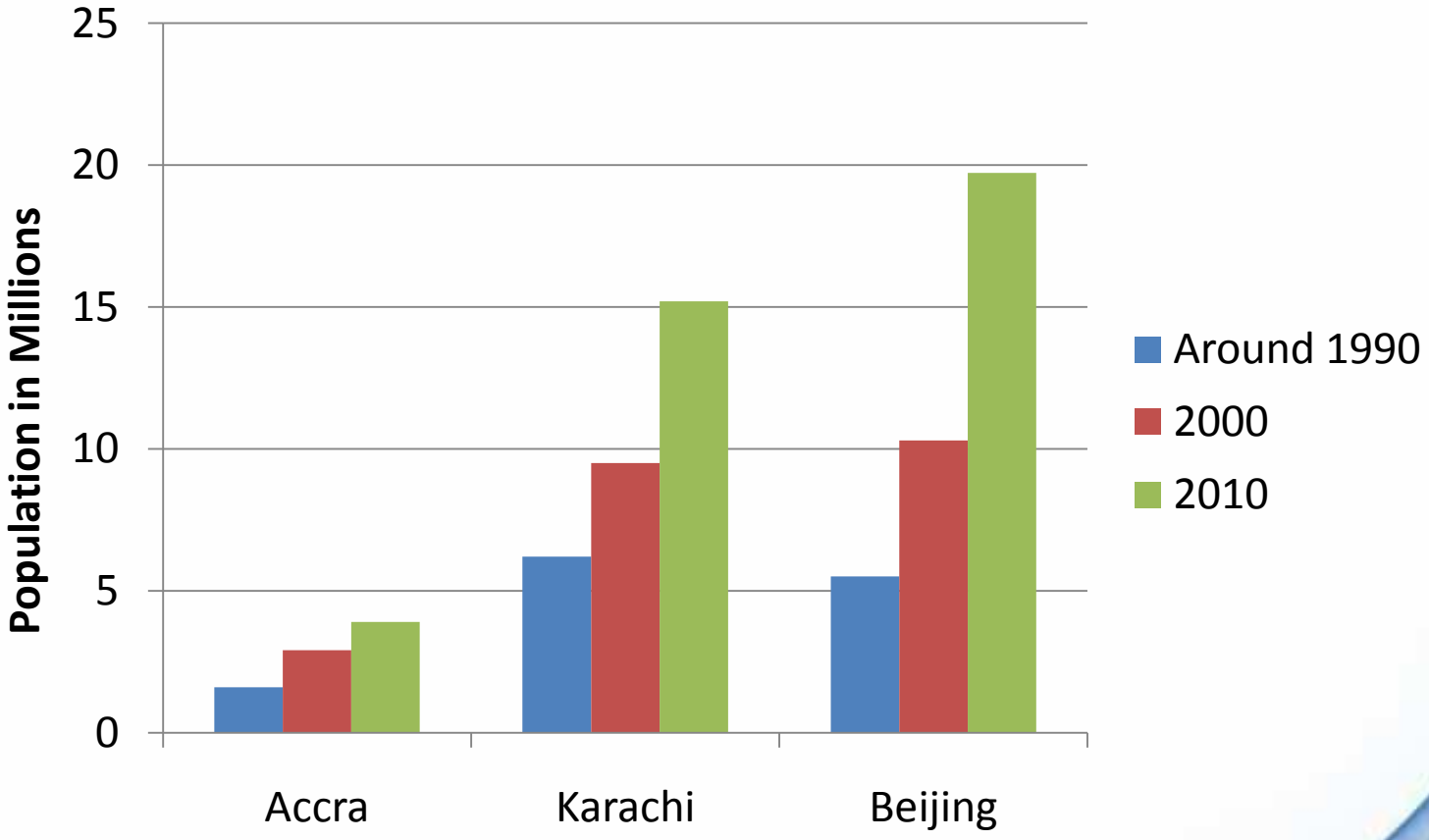
Urbanization in Aqualyng cities



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The River Diversion Program – a possible solution?

•The **South-North Water Transfer Project** is a multi-decade infrastructure project to better utilize water resources available to China
•Originates from an idea of Mao Zedong, and can in total divert 44,8 billion m3 of water from South to North

Western Route	Central Route	Eastern Route
Water from Yangtze river into Yellow river	Water from Danjuangkou reservoir on Han river , crossing the Yellow river and flow to Beijing	Water from Yangtze river along the Grand Canal, through tunnell under Yellow river to reservoirs near Tianjin
To supply western parts of China	To supply Beijing and surroundings	To supply Tianjin and surroundings
Feasibility of project still under study	Recently put on hold by government for 5 years without explanation as to why	Originally planned for completion 2012, has recently been delayed due to water pollution

The River Diversion Program might be a long term part of the solution, however not the short term fix that North China urgently needs

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Is desalination THE solution for the water challenges in the growing urban areas?

Yes, of course...	Obviously not, because....
Seawater is a steady raw water source	Desalination is too costly an alternative.....
Desalination is becoming cheaper year by year	.....and in many cases, where you lack water you also lack the needed energy
Desalinatied water is of excellent & stable quality	One should rather focus on water reuse and proper pipeline systems
There are simply no other options.....	What if you have no coastline?
.....and all human being have a right to a safe freshwater supply	Desalination is no environmental-friendly solution

Desalination is one of many potential solutions to the growing water shortage, in some cases the only one, in other not at all

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Norwegian technology is in the forefront of desalination innovations

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The AQUALYNG Recuperator

- **Turbines**
  - Energy consumption:

    3.5-4.5 kWh/m^3
- **Recuperator**
  - Energy consumption:

    2 kWh/m^3

  - Works like a plunger pump, hydraulically driven by the brine
  - Capacity = brine stream
  - System recovery of 40%
  - Only 40% of feed water delivered by high pressure pump
  - 60% from the Recuperator

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Other Norwegian innovations

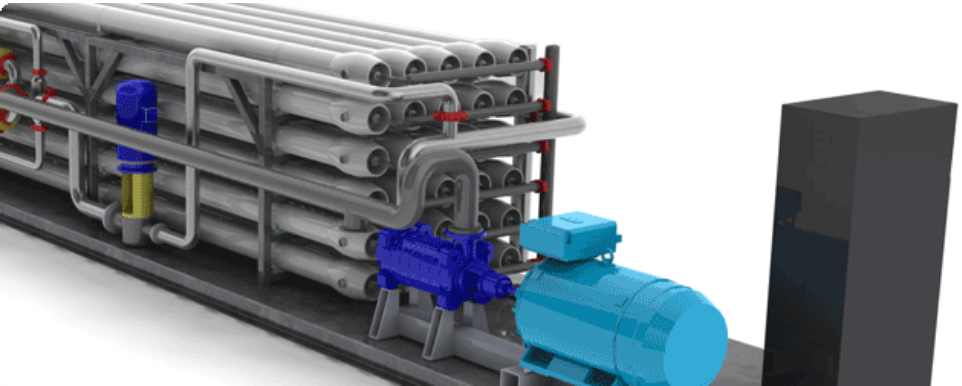
ERI – Energy Recover Inc.

- Listed on the US stock exchange
- Leading Energy recovery system on the market
- Originally invented in Norway

Other Norwegian innovations

RO Solutions

- Norwegian company based in Verdal
- Developing pre-assembled RO skids, ready to install
- Quick delivery time, easy transportation to less mature desalination markets



MPS 100
Reverse Osmosis
Desalination Modules

Thank you for your attention!

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www.aqualyng.com