

# The Water Issue in Greek Islands: Existing Situation and Challenges

Christopher J. Koroneos  
Mayor of Nisyros Island  
Unit of Environmental Science and Technology  
School of Chemical Engineering  
National Technical University of Athens  
[www.nisyros.gr](http://www.nisyros.gr)  
koroneos@chemeng.ntua.gr

# Introduction

- What is the Water situation of the Greek islands within the context of sustainable development?
- What has caused this situation? Insularity and lack of resources
- What policies could be applied to resolve the water supply problem?

# Greek Islands are a characteristic region

Islands have **specific characteristics**:

- Small size (limited population, area, natural resources)
- Remoteness and isolation
- Particular, rich and vulnerable natural and cultural environment

**Insularity** influences negatively **production and living cost**. Islands –compared to the mainland- cannot have:

- economies of scale due to limited variety and quantity of resources
- good accessibility and low transport cost
- agglomeration externalities

# Greek Islands are a characteristic region

- The **performance of the islands is generally lagging behind EU-27** considering most of the key development indicators; this low performance may be attribute to lack of resources
- **Islands' Attractiveness is directly influenced by insularity:** low Accessibility, low quality and high cost Public Interest Services, low external economies
- **Lisbon's strategy goals are by far not met in islands** (% of employment, R&D expenditure, education attainment, ITC penetration, resource efficiency etc). Obstacle for development

# Greek Islands are a characteristic region

- **Vulnerability** is a characteristic of islands' economy (monoactivity/tourism – public intervention) and environment (low availability of resources - fragility);
- Attractiveness and performance is even lower for **small islands**; vulnerability is higher
- **Natural and cultural assets** constitute a prominent potential for a significant number of islands.

# **Greek Islands are a characteristic region**

**Insularity** of the small islands has to be considered as a **permanent, natural feature that affects negatively, directly and indirectly, islands' attractiveness.**

**Insularity** may place **obstacles for the achievement of the goal of sustainable development.**

**Insularity creates unequal opportunities** between the small Greek Islands and the rest of the European Union.

**EU and the Greek government must apply different policies to the Islands based on their insularity in order to address the different characteristics the different costs of insularity by a differentiated policy**

# SWOT Analysis

## Strengths

- Quality of life
- Natural and Cultural Assets
- Security (not in very big islands)

## Weaknesses

- Attractiveness parameters due to:
  - (a) insularity
  - (b) “under-development”

## Opportunities

- Livability – Quality of life
- Sustainability – Environmental Management
- Accruing demand for quality and secure food
- Accruing demand for specific interest tourism
- Cultural and creative economy
- Residential Economy
- Renewable energies

## Threats

- Climate change
- Economic crisis / diminution of public transfers
- Globalization / growing competition for products and services incorporating low Added Value (low skilled labour)
- Energy price's raise

# Greek Islands are a characteristic region

- The major problems that the Greek Islands face because of their insularity are:
- difficulty in transportation
- lack of fresh water
- Access to energy sources
- Waste water treatment
- Solid Waste management
- High environmental costs

# Greek Islands are a characteristic region

- I will concentrate on the issue of fresh water supply.
- Most of the islands do not have natural water. This problem was resolved until recently with the transportation of water. This was a very expensive method. In the past few years desalination has been used. This is an extremely energy intensive method for the production of water.
- Most of the small Greek Islands today use desalination for their water needs. However, the water produced using desalination has a very high concentration of Total Dissolved Solids (TDS) so it can not be used for drinking.

# Greek Islands are a characteristic region

- This leads to the consumption of bottled water which is imported mainly from the Greek mainland.
- The production and transportation of the bottled water has a very big environmental impact.
- This also creates a big solid waste problem from the plastic bottles that are used.

# Greek Islands are a characteristic region

- It is very important that the policy of the federal government and the local authorities must be to interconnect the production of fresh water with the
- Access to energy sources
- Waste water treatment
- Solid Waste management
- Environmental costs

# **Greek Islands are a characteristic region**

Lets look at the water needs issue

# Fresh Water Needs

- Quality of life
- Economic expansion
- Agriculture and food
- Public health

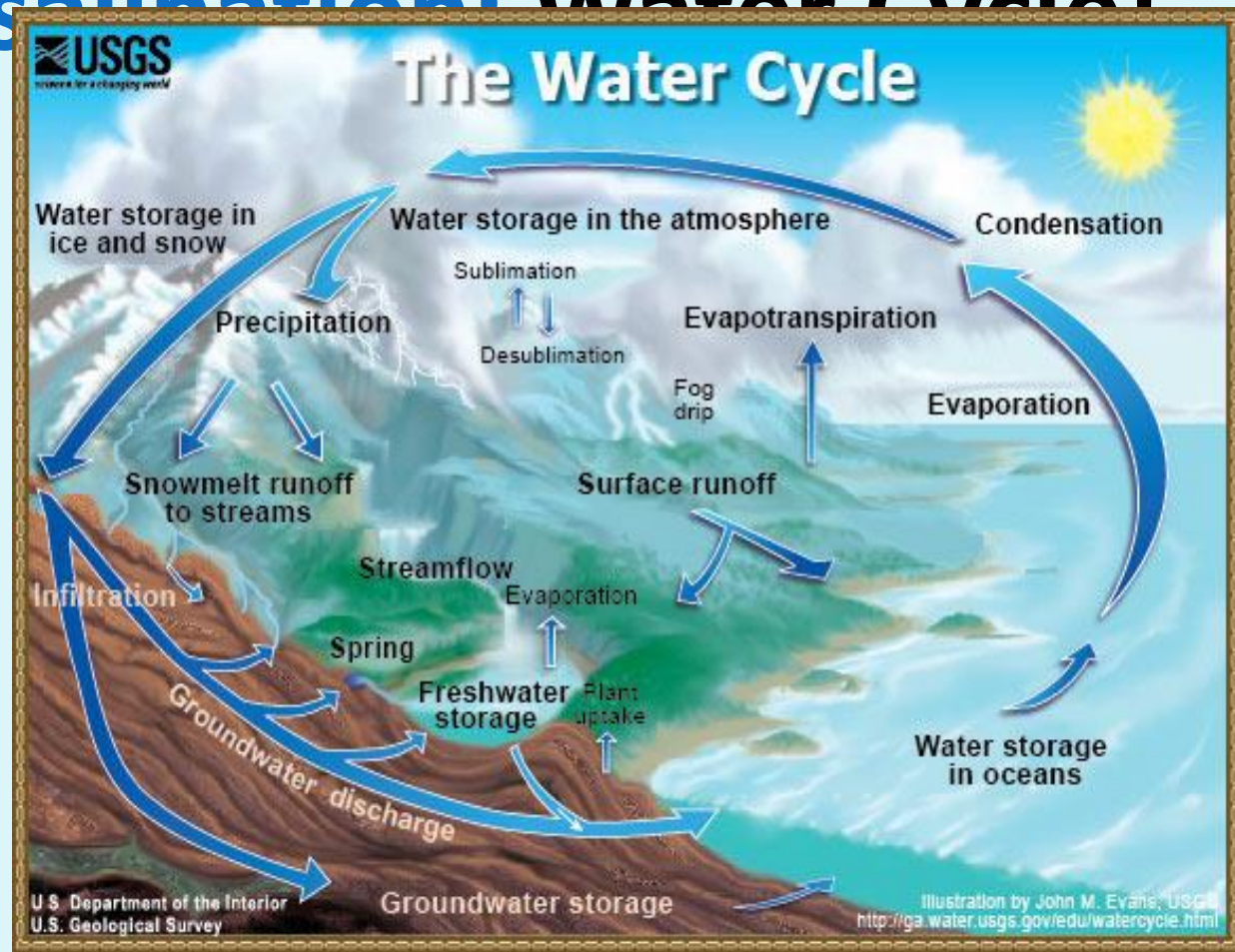
# Why Desalination?

- 75% of the Earth's surface is covered by water
- 97.5% of that water is oceans
- Only 1% is available for drinking
- There is no other means to produce fresh water except desalination

# Natural Desalination: Water Cycle

- Major Stages

- 1. Evaporation
- 2. Condensation
- 3. Precipitation
- 4. Collection



# Desalination Technologies

- **Mechanical Operations (Reverse Osmosis)**
- **Thermal Operations**
  - Distillation
    - Multistage flash (MSF)
    - Multiple effect distillation (MED)
    - Vapor compression
- Electro dialysis
- Vacuum freezing

# **Desalination barriers**

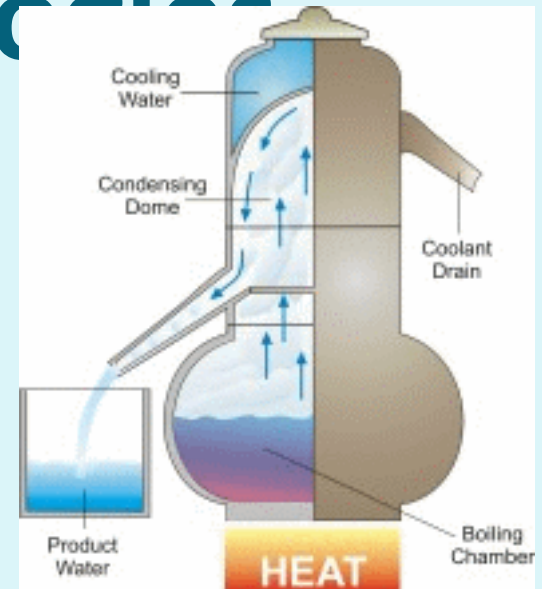
## **n barriers**

- **Advanced processes need a considerable know-how**
- **Construction and running of the plant have a significant impact on the environment**
- **A vast initial investment is required**
- **Water production cost is markedly higher than traditional provisioning value in ordinary conditions**
- **Energy must be available in large amounts and at a reasonable price**

# Desalination Technologies

## 1. Thermal Desalination Processes

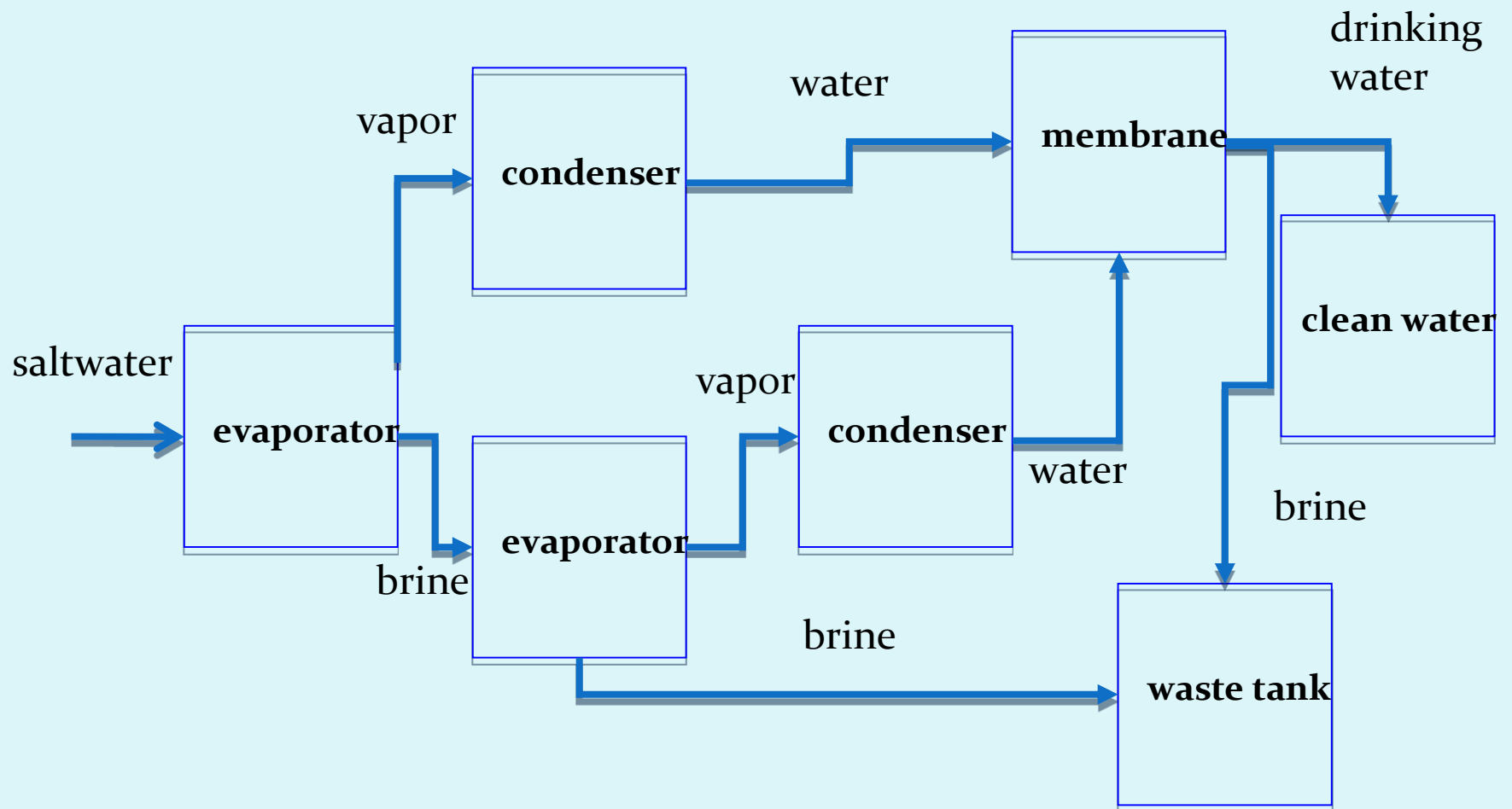
- Similar to the Earth's natural water cycle
- Water is heated, evaporated and collected
- Produces clean water and brine



### *Example: Multi-Stage Flash Desalination*

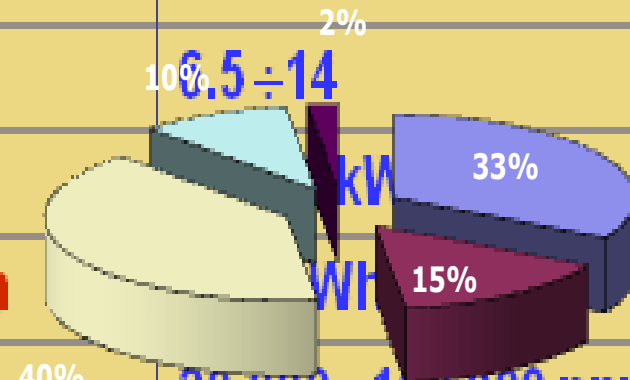
- Process uses multiple boiling chambers kept at different atmospheric pressures
- Saltwater enters the system and is boiled and evaporated in each chamber
- Process produces clean water and brine

# Thermal Desalination Processes



# Multiple Effect operation

Form of energy required	steam
Operating temperature	< 70 °C
Number of effects	8 ÷ 18
Gain Output Ratio	6.5 ÷ 14
Thermal energy consumption	100 kWh
Electrical energy consumption	2 kWh
TDS content of feed water	30,000 ÷ 100,000 ppm
Product water quality	< 10 ppm
Single-unit capacity	500 ÷ 12,000 m <sup>3</sup> /d



steam

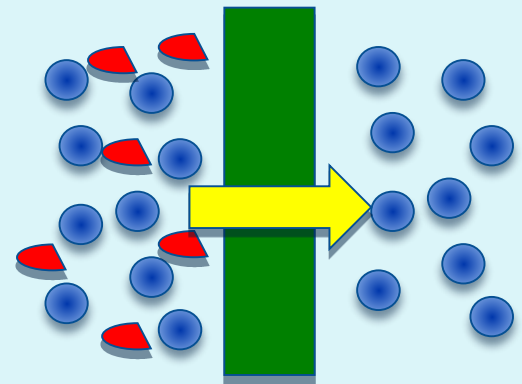
# Desalination Technologies

## 2. Membrane Desalination Processes

- Saltwater is forced through membrane sheets at high pressures
- Membrane sheets are designed to catch salt ions
- Process produces clean water and brine

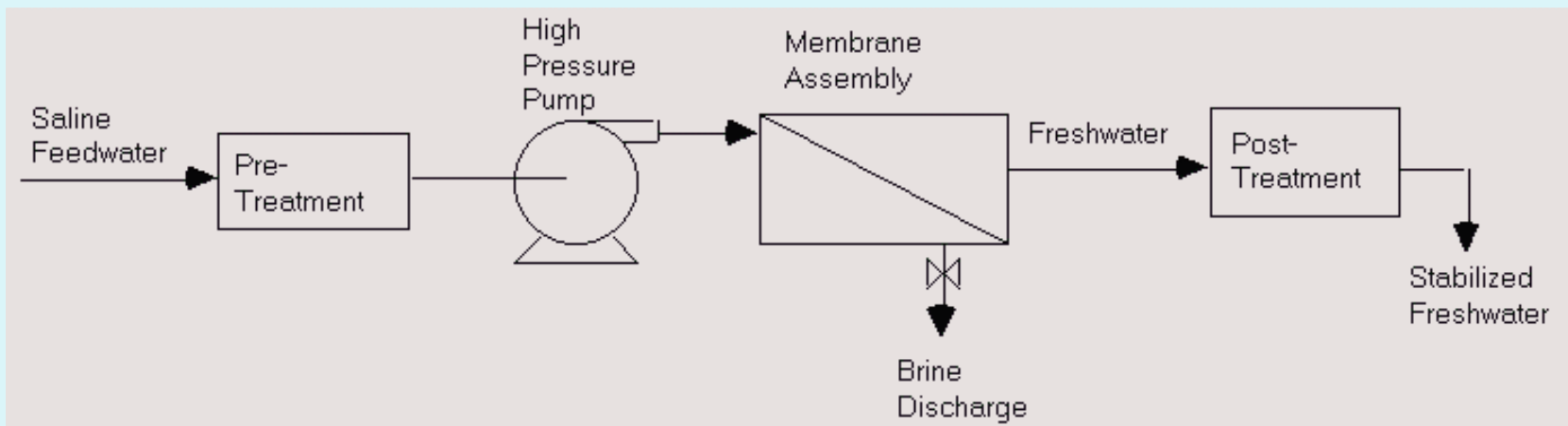
### Example: Reverse Osmosis

- Saltwater is forced through a membrane at 600 to 1000 psi
- Multiple layers of membranes remove as many of the salt ions as possible



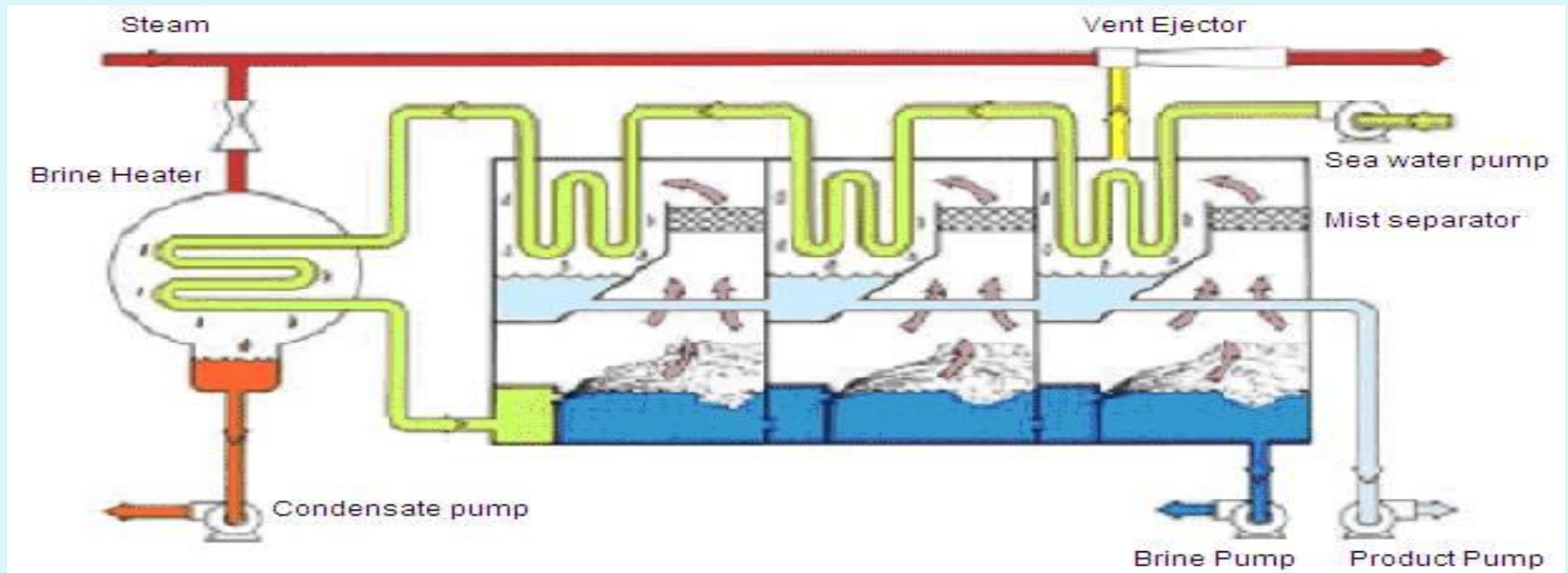
# Reverse Osmosis

- Water pressure increased
- Pumped through permeable membranes
- Salts separated from water due to membranes
- Most desalination plants utilize this technology



# Multi Stage flash

- Steam is used to heat tubes of saline water
- Heated water flows into “stages” that are at lower pressure



# Multi Stage flash (cont...)

- Generally, only a small amount converts to steam since rapid vaporization results in cooling of water
- Thus water is flashed multiple times in different stages at lower pressures, requiring no extra heat
- But, multi stage flashing reduces thermal efficiency
- 85% of world's desalinated water is generated through MSF
- Recently the equipment has become cheaper

# Conclusions

All Desalination processes need vast amounts of energy ranging between 4 to 7 kwh /m<sup>3</sup> of fresh water.

Renewable energy sources such as solar energy, wind energy and Geothermal Energy must be utilized to reduce the cost and the environmental impact of the production of fresh water using desalination.

# Conclusions

- It is very important that the policy of the federal government and the local authorities must be to interconnect the production of fresh water with the
- Access to energy sources
- Waste water treatment
- Solid Waste management
- Environmental costs