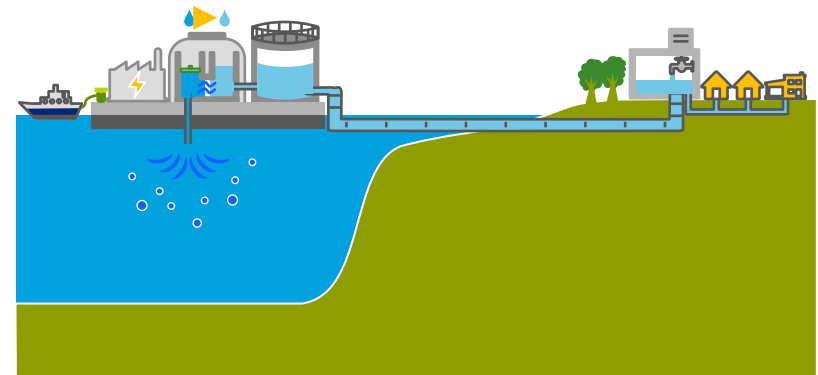


## Shift to Floating Seawater Desalination

In order to reduce environmental issues  
and supply timely to meet demand

Toshifumi Kokubun  
Deloitte Tohmatsu Consulting Co., Ltd.

November 24<sup>th</sup>, 2014

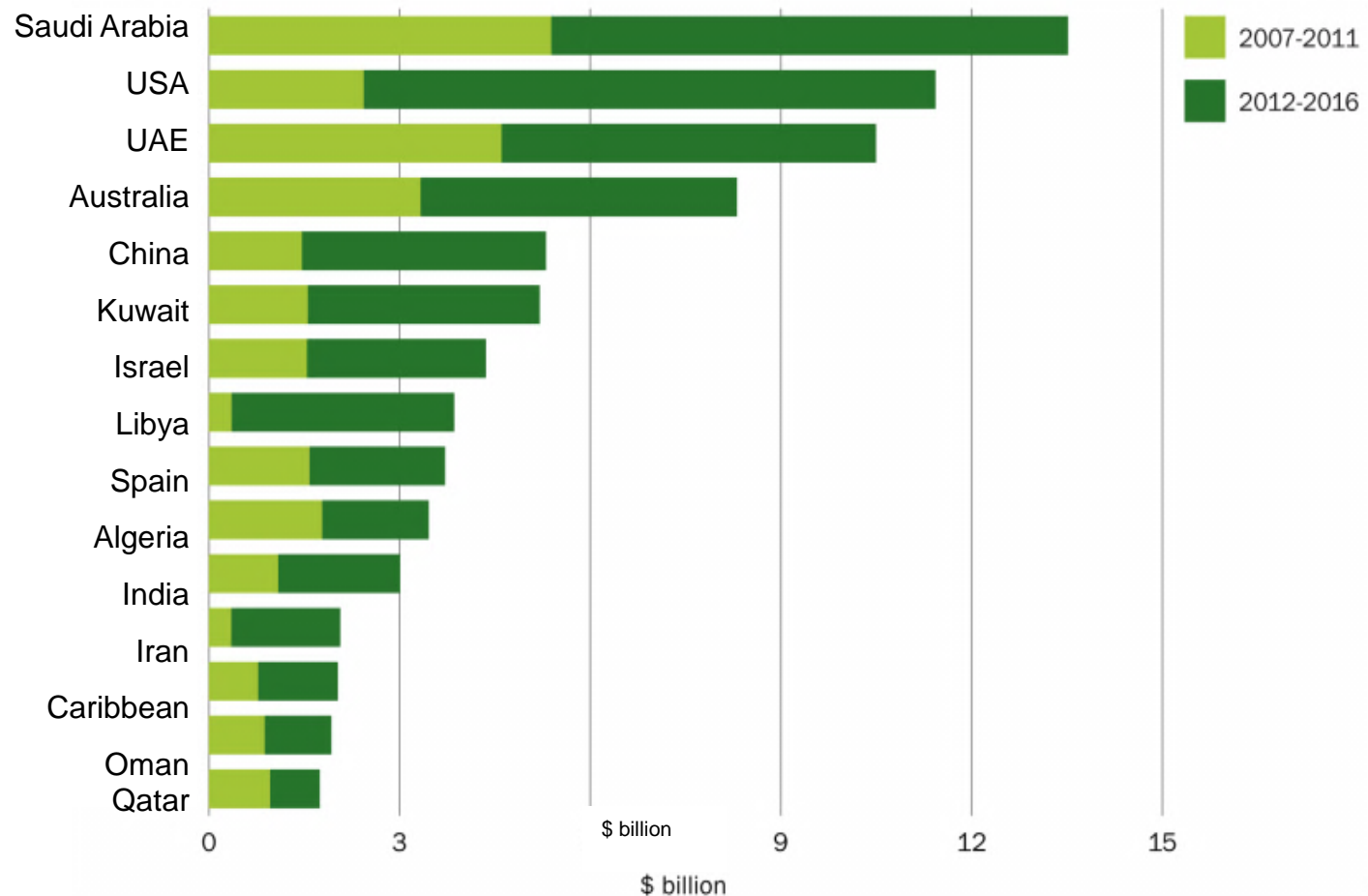


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# Floating desalination plants

# Current situation of desalination market

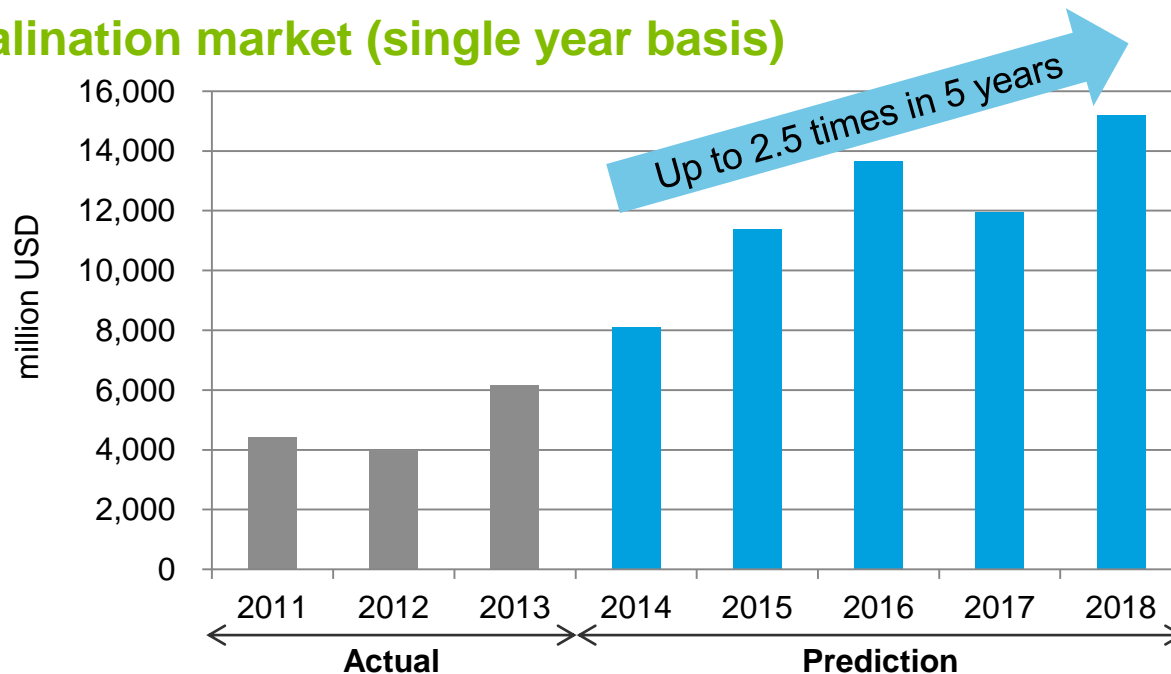
- Global desalination market has been expanding dramatically from 2000s and already formed big market especially on North America and Middle East.
- Its market is expected to grow up to more than 13 billion USD in Saudi Arabia, 10 billion USD in UAE and 11 billion USD in United States (2007-2016).



# Future trend of desalination construction market

- Desalination plant construction market is expected to increase significantly both on in terms of monetary amounts and of capacity.
- Global desalination market is expected to reach 15 ~ 20 million m<sup>3</sup>/day every year in capacity-basis after 2026
- In terms of monetary amounts, developing market of the desalination plant is predicted to reach over 14 billion USD in 2018 and will continue at, at least , the same amount year after year.

## Global desalination market (single year basis)



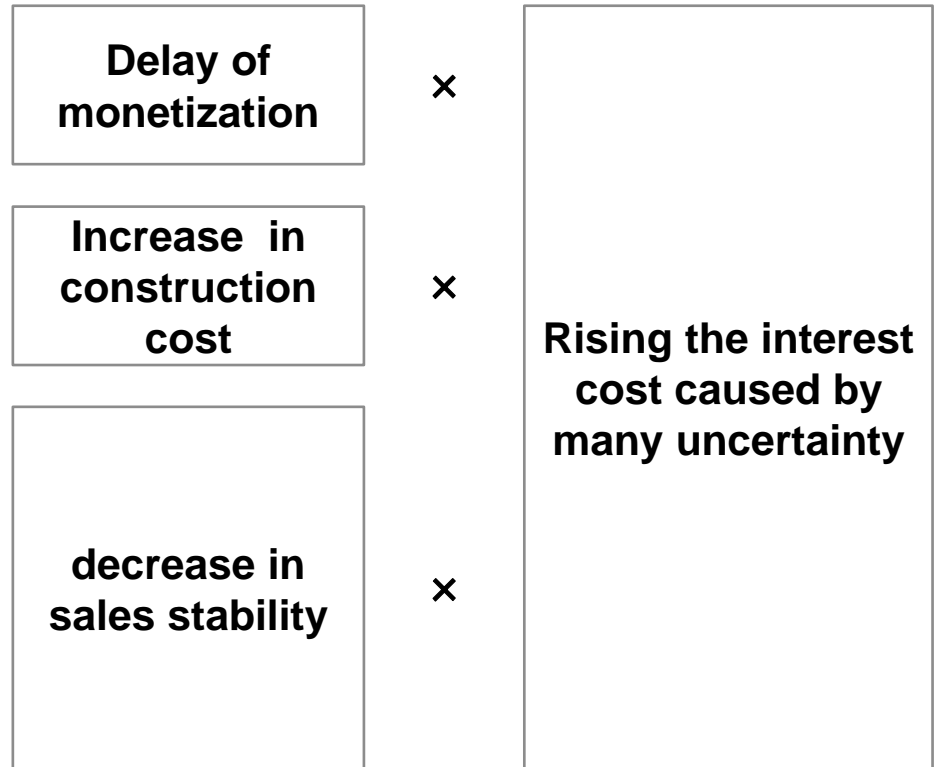
Source: DesalData.com “GWI DesalData’s long-range desalination market forecast”, Global Water Intelligence “Global Water Market 2014”

# The desalination industry is facing crucial issues and is in need of a drastic solution to stable growth

## Risk factor

- I** Extension of time for completion with the environmental assessment
- II** Unexpected additional construction cost of the environmental facility
- III** Declining demand due to climate change
- IV** Alteration of the contract due to political uncertainty

## Reduce profitability

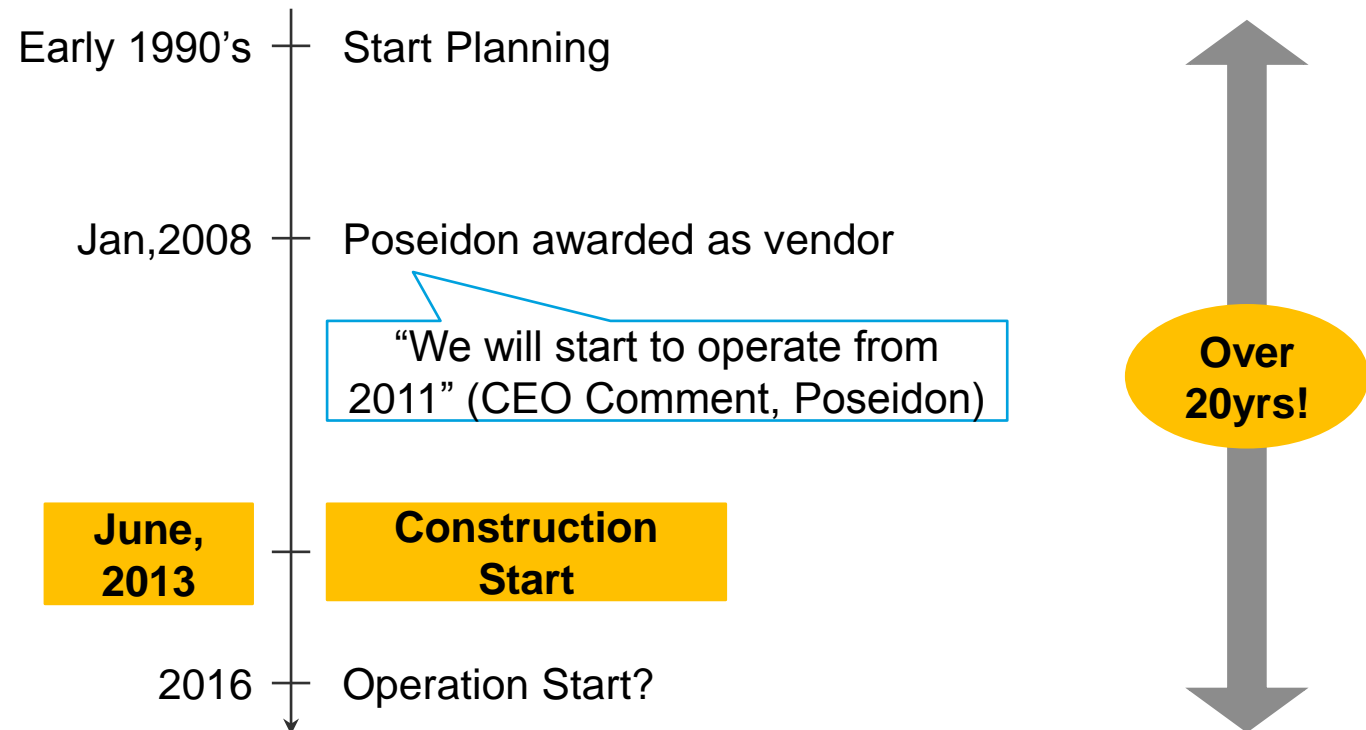


**Drastic solution to improve profitability is necessary**

# I Problems of land-based facility 1: Prolonged project

## Background of desalination plant in Carlsbad, California

- In early 1990s, since Southern California was suffered from continuous drought for 5 years, and the amount of water provision was limited to one third of the standard level, they began to plan the building of a desalination facility.
- However, it took over 10 years to carry out the bid, and the construction was finally started in 2013 and operation is supposed to start in 2016, although it was originally planned to begin in 2011.

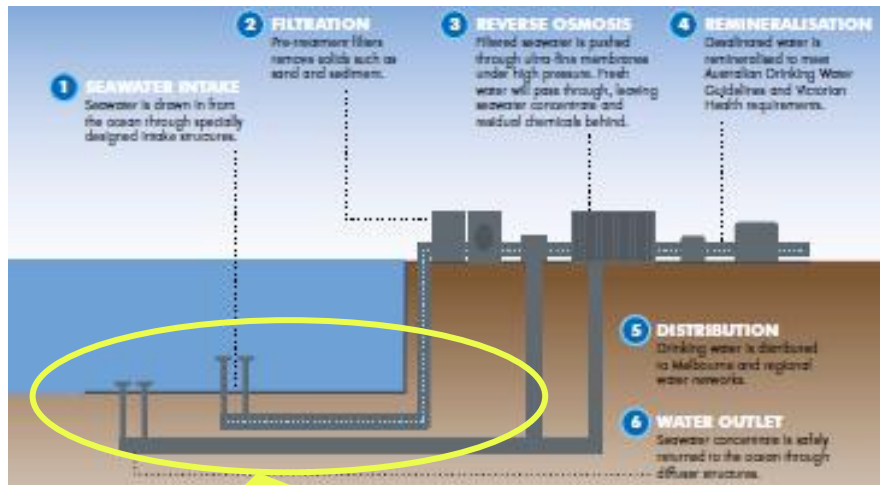


Source: The Wall Street Journal (June 21, 2013 & January 17, 2008)

## II Resolving case of the damage by seawater collection of floating desalination plant

- The environmental damage by seawater collection has been increasingly focused on the construction of a land-based facility, and a large cost is now paid to collect the water from the bottom of the sea offshore.

### The case of a desalination plant in Victoria, Australia



The feed-water pipeline is implemented on the bottom of sea to avoid intake small species.

### Relatively expensive cost of plant construction in Victoria, Australia

- Desalination plant in Victoria costs 5.9 billion USD is much expensive than that of in Saudi Arabia which costs 1 billion with same desalination amount.



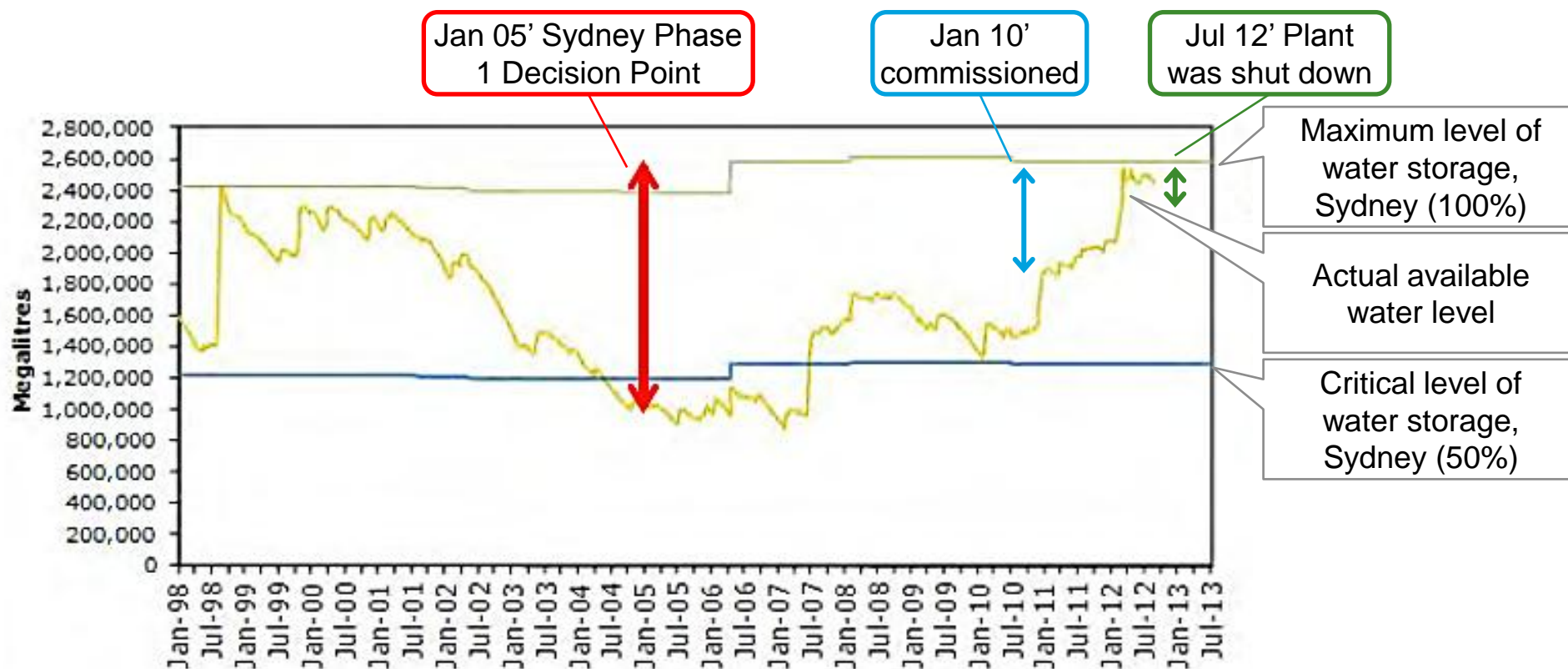
Rich green remains landscape.

Source: ASPECT Studio & DesalData.com

### III Problems of land-based facility 2: Low utilization

- The Sydney plant was commissioned when water reached below the critical level.
- After a few years water availability improved considerably because of good weather condition in Sydney and the plant forced to shut down in 2012.

#### The case of Sydney Desalination Plant



Source: Australian Bureau of Metrology



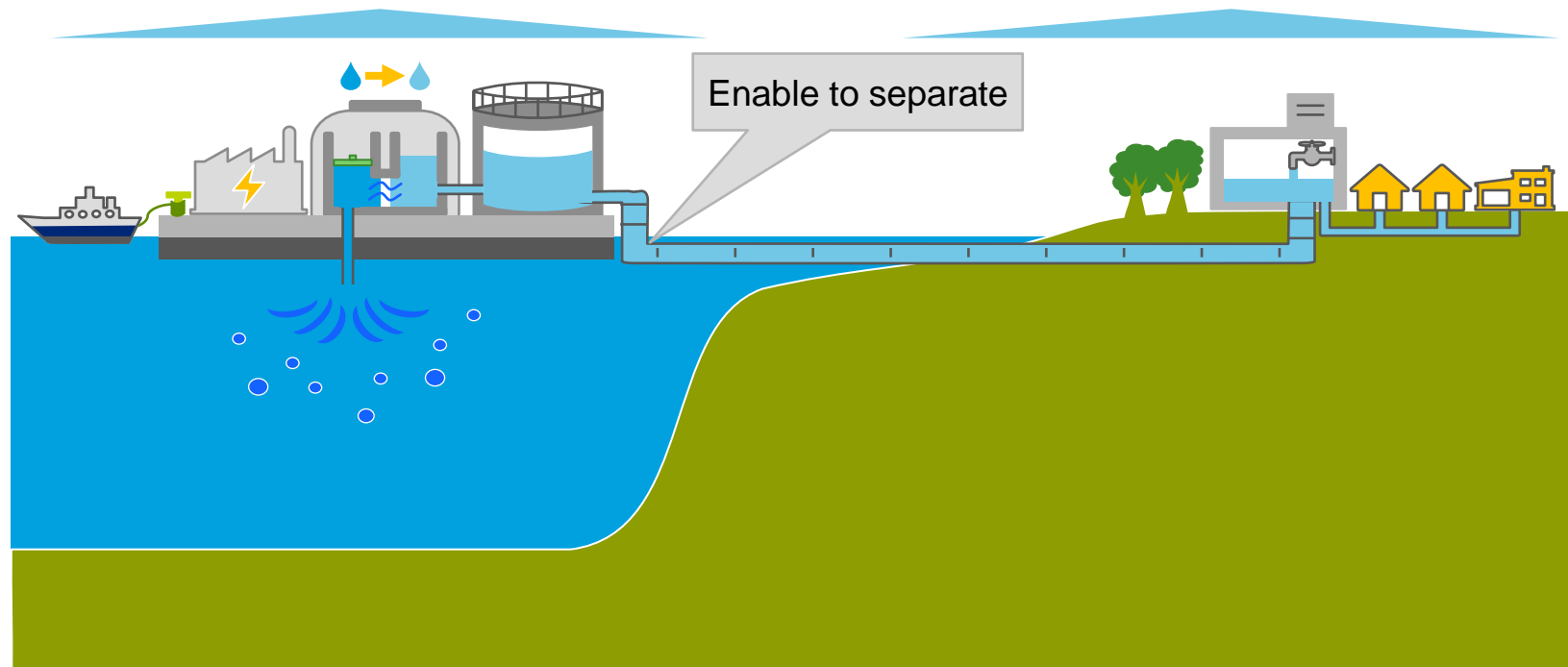
# The floating desalination plant will be an effective solution for the stable growth in the desalination business

## Reduce the uncertainty

- Move somewhere else when demand and country risk changed.
- Production will be made prior to obtaining the order based on demand prediction.

## Reduce opposition campaign

- Minimize harmful effect on the environment costal area.
- Preserve diversification of the shallow sea.



# **Actual performance of the Floating Desalination Plants and generating huge business opportunity by top company's strategy**

# Actual performance of the floating desalination plant



- Floating desalination plant has been utilized as a temporary solution and already demonstrated many cases in several area.
- Floating desalination plant can be quickly implemented, incrementally add its capability, and can easily moved to other area upon request after finishing its expected role.

## Saudi Arabia

- A floating desalination facility was introduced in 2008 until a permanent land-based facility was built in 2009.
- 52,000m<sup>3</sup>/day
- USD2.27/m<sup>3</sup>

## Cypriot

- The Cypriot government decided to build a floating desalination as a temporary solution from 2008 to 2013.
- 20,000m<sup>3</sup>/day
- EUR1.38/m<sup>3</sup>

## Thailand

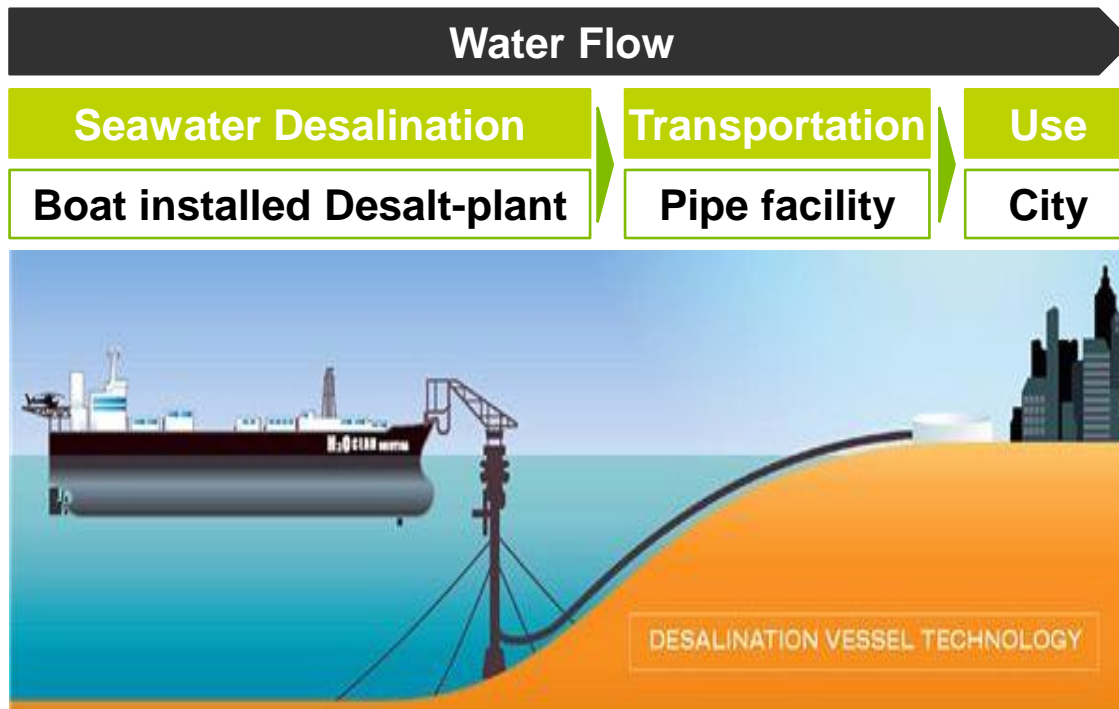
- In 2006, A desalination facility was quickly introduced upon the request within 2 months.
- 4000m<sup>3</sup>/day

# Case 1: Water Standard

- American water-related engineering company, Water Standard Company (WSC), has launched the business of a floating desalination plant, called “Seawater Desalination Vessel (SDV),” from 2008.

## SDV system by Water Standard

### WATER STANDARD



Source: Water Standard, Houston, IEEE spectrum, TX (PRWEB) June 28, 2011

Compared with a land-based desalination facility, our SDV is superior economically as well as in environmentally.

- The cost of collecting seawater is smaller, because the plant is located on the sea.
- The cost of protecting the coastal environment is smaller, because seawater can be used for the process of diluting waste liquid.
- The damage to the ecosystem is smaller when seawater is taken.



**WSC CEO**  
**Amanda Brock**

## Case 2: IDE and Hyflux

### IDE

Global top tire

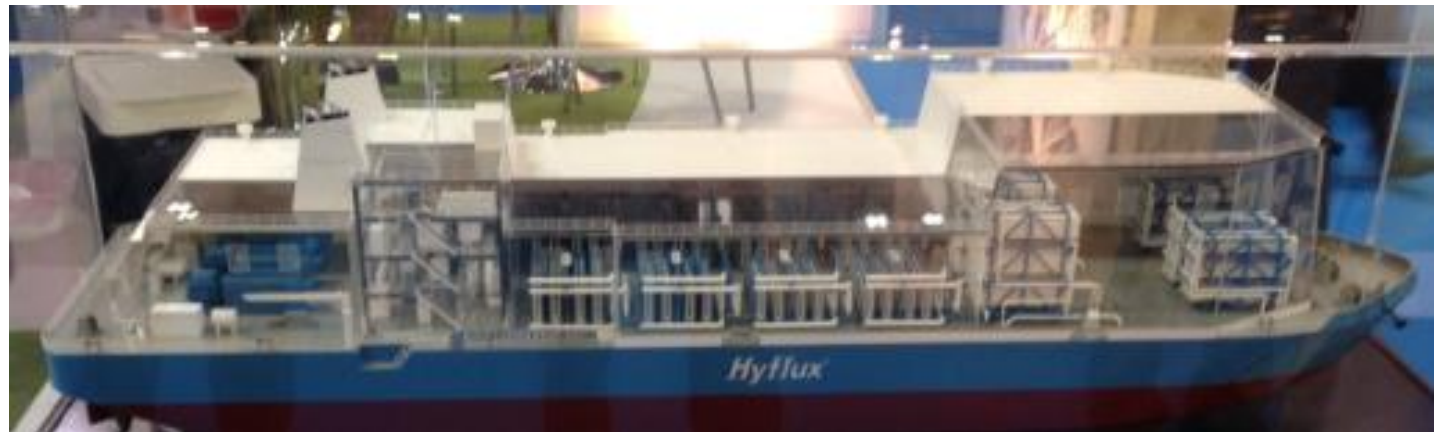
We will raise sales portion of the floating desalination in the future. Approximately **15% to 20% of the new desalination plants will be floating model.**

### Hyflux

ASEAN  
leading  
company

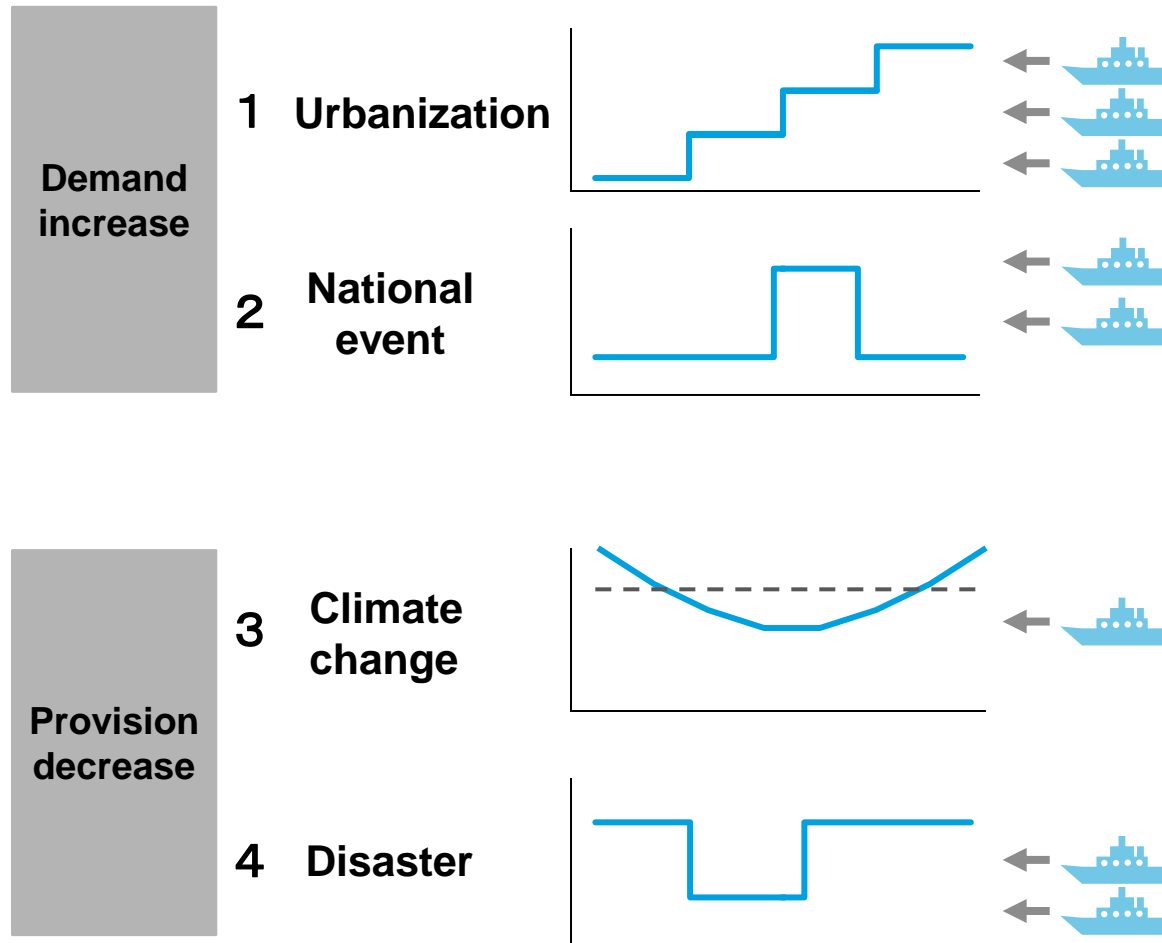
Hyflux used Singapore International Water Week to demonstrate a model of its floating desalination production vessel that will be able **to produce 30,000m<sup>3</sup>/day at maximum capacity.**

The first full-scale vessel **could be produced in six months' time** and its likely destination is the Middle East, Hyflux has suggested.



# The effectiveness and opportunity for the ship based floating desalination plant

## Type of water demand



**Incremental, Sudden,  
Unpredictable events**

**The size of Ship Based floating desalination plant can adjusted by adding or reducing the number of ship upon demand fluctuation.**

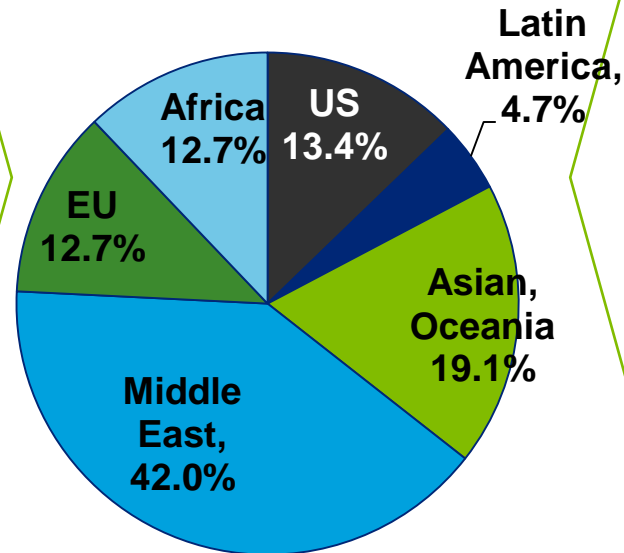
# Potential market of the floating desalination plant manufacturing

- 15% to 20% of the whole new desalination plant demand is the floating model and being strategically implemented in top tier company's mid term plan.
- Assuming the realization of this plan, market will generate at least \$1.5billion to 4billion every year until 2025.

## Driver 1 Adverse wind to land based plant

- ① Strict environmental regulation on onshore plant
- ② Difficulty to accept the increasing cost for municipality is causing delay in construction schedule
- ③ Request from investor to raise the number of floating model in order to reduce project risk

The size of floating desalination plant manufacturing market will be at least \$1.5billion to 4billion until 2025



## Driver 2 Increase demand suitable for floating plant

- ④ Incrementally expand the gap between population growth and capacity of the water utility
- ⑤ Intensifying water shortage in the advanced country
- ⑥ Increase in natural disaster

# Floating business other opportunities



# New other opportunities for floating solution in the near future

## New opportunities for creating floating demand

1

**Raising awareness of the limited damage to our infrastructure from Tsunami**

Effectiveness of offshore location of the LNG based electric power plant against Tsunami will become more commonsense.

2

**Accelerating hydrogen society around the world**

Hydrogen transportation will increase drastically as a newly electric power source.

Offshore hydrogen storage will be needed in order to accumulate the byproduct hydrogen at nearby offshore rig.

The floating wind power generation from distant seas will increase by utilizing hydrogen transportation technology.

**Japan seeks an opportunity to make the first case of floating desalination plant and expand these models in global market as an effective solution**

# Floating LNG electric power plants might be the new standard Post-Fukushima

## Floating LNG electric power plant



Developed and introduced to Japan by Sevan marine.

- Smooth generating efficiency in load, range from 70 to 700 MW.
- Unaffected by earth quakes and subsequent catastrophic impacts.

Sevan proposed it to Japan as a Post-Fukushima LNG electric power plant.

## Power Plants Heading Out to Sea in Post-Fukushima Japan

**Bloomberg**  
9/9/2014

By Masumi Suga and Chisaki Watanabe | Sep 9, 2014 4:51 PM GMT+0900 |

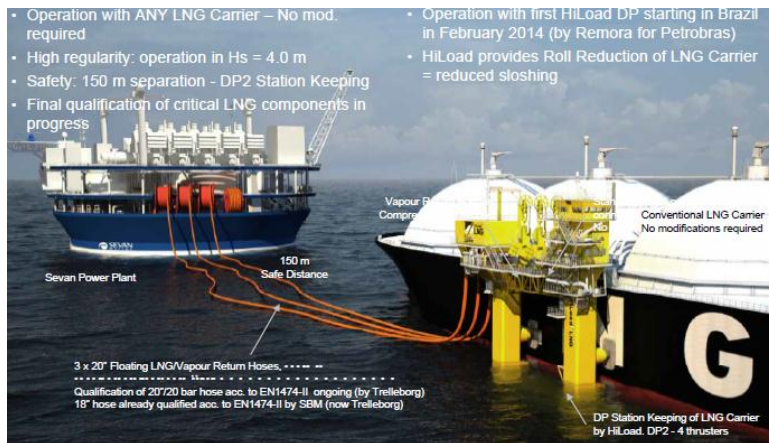
[44 Comments](#) [Email](#) [Print](#)

One of the biggest hurdles to building new power plants in Japan is finding a place that's safe from earthquakes and tsunamis. That place may turn out to be 30 miles at sea.



**Sevan Marine ASA**, a

Source: Sevan Marine ASA via Bloomberg

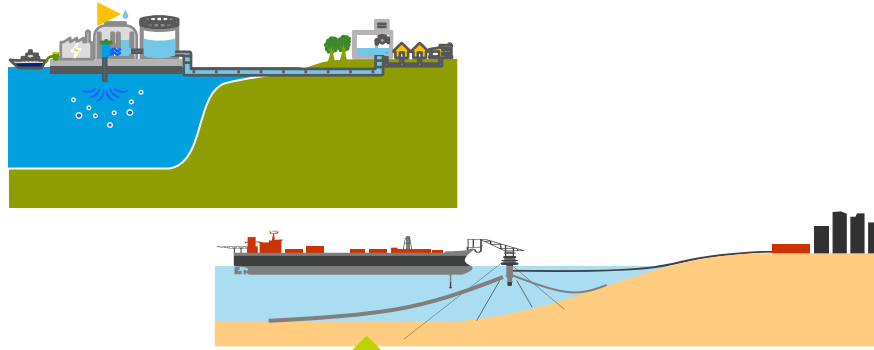


# Anticipated additional opportunities in the near future

## Expanding business opportunities

## Implementation time line

**Floating desalination plant**



**Within 3 years**

**Robust electric power**



Hydrogen gas turbine will be implemented in the near future

**Within 5 years**

**Hydrogen society**



**Within 10 years**

# Proposal to solve environmental issues and reduce the business risks of the desalination plant

## Global issues

- It drastically increases the worldwide risk of the damage to the marine ecosystem if we rely on land-based plants to cover all exploding demands of sea-desalination in the future.
- It also increases the business risks for desalination plant company to invest the additional cost for the facility to avoid environmental risks or the consensus building with residential group, which raises the risk of slowing down the private investment for ensuring adequate supply.

## Solutions by governments and international organizations

- To solve these global issues above, we suggest;
  1. Promote the shift to the floating desalination plant and accelerate the technology development.
  2. Establish new environmental regulation for accelerating the shift desalination plant location from land to seaborne.
  3. Raise general awareness of the effectiveness to the floating LNG electric power plant and obtain the hydrogen business opportunity proactively.



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