Session III: ASSESSMENT OF POTENTIAL CUMULATIVE ENVIRONMENTAL IMPACTS OF MEGA DESALINATION PLANTS CONGLOMERATING AROUND THE MEDITERRANEAN.

17-18 October 2012, Brussels

MAIN OUTCOMES OF REGIONAL EXPERT GROUP MEETING

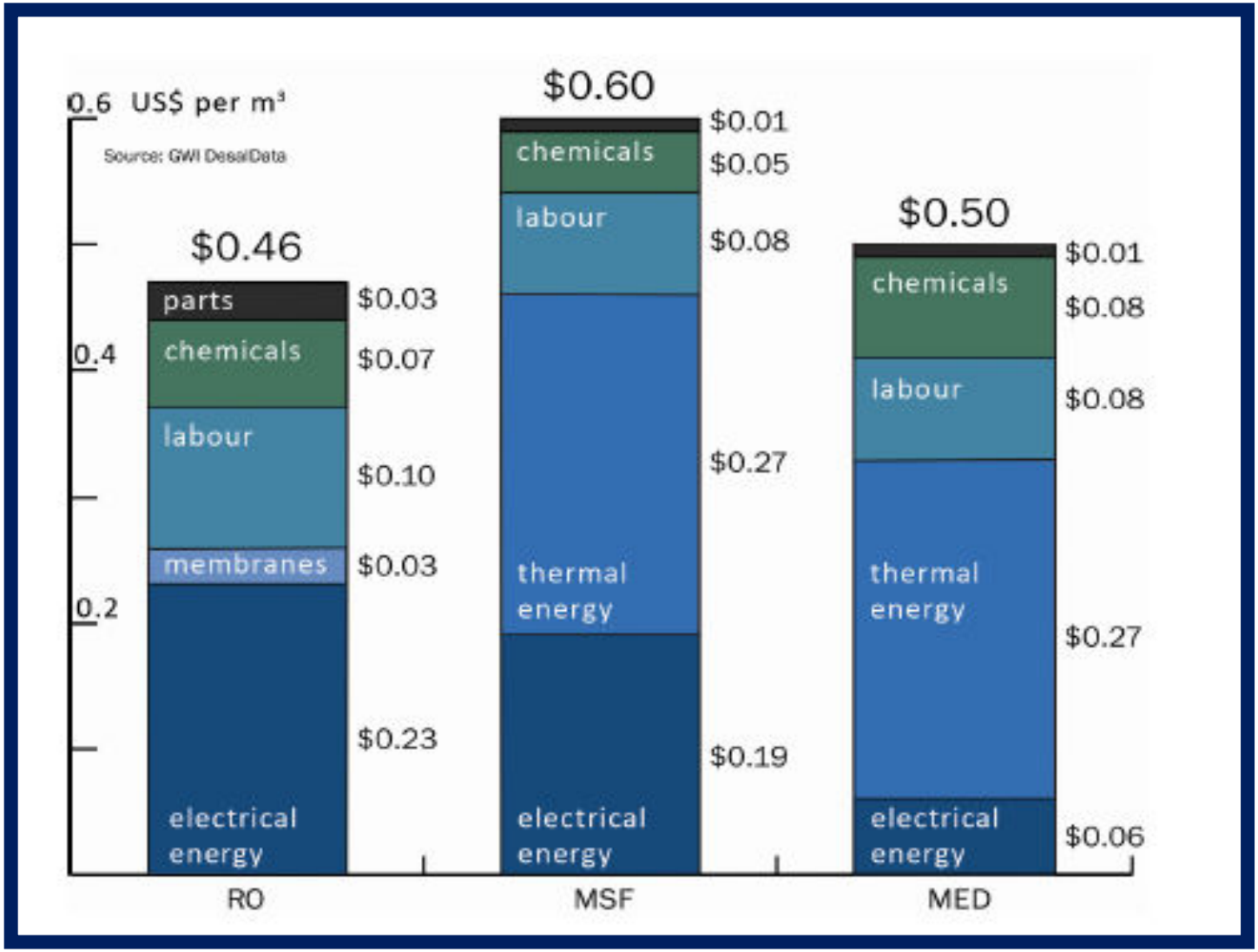
1. Desalination has to be considered as a part of a holistic approach for the overall sustainable development and only after less expensive technical efficiency (demand management interventions) & allocative efficiency (efficiency with which society allocates its water resources among sectors) are totally exhausted.
2. National experts clearly indicated that desalination constitutes a fundamental component of their water resources management and as a main toll to fill future supply-demand gap in water supplies.
3. The potential cumulative environmental impacts of the proliferating mega desalination plants, around the shores lines of the Mediterranean, strongly emerged as a crucial issue that should be given adequate attention from SWIM-SM.

PROSPECTS OF DESALINATION

TWO CONTROLLING FACTORS:

1. Cost of production – Economy of scale
2. Technological development and experience

COST OF DESALINATION



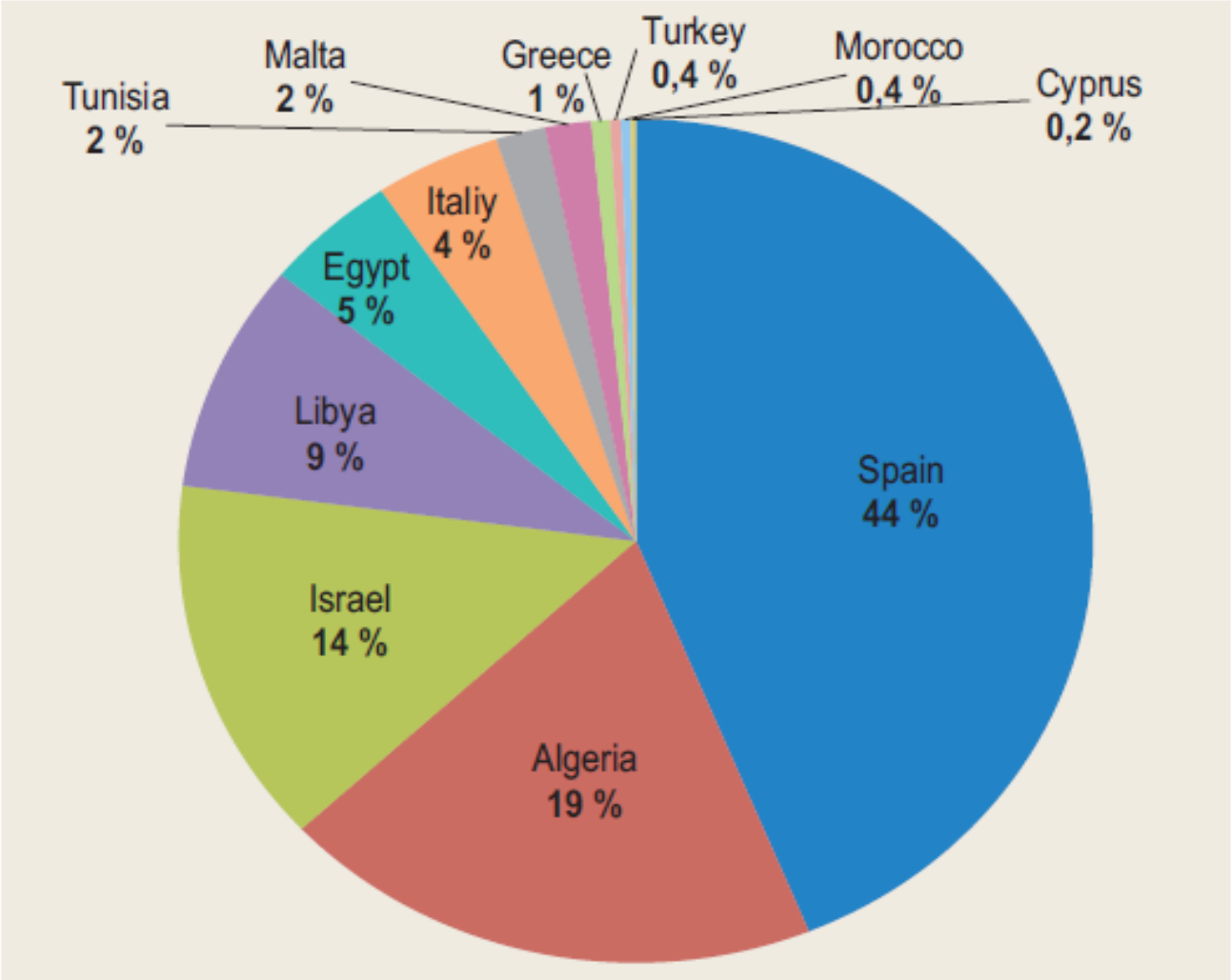
Source: WHO & UNEP Manual 2008

DESALINATION CAPACITIES IN SMCs

COUNTRY	Fossil Fuel Desalination in Bm^3/year
MOROCCO	0.0
ALGERIA	0.5
TUNIS	0.1
EGYPT	0.2
ISRAEL	0.4
JHORDAN	0.2
LEBANON	0.0
SYRIA	0.5
PALESTINE	0.2
TOTAL	2.1

Source: Franz Trieb et al, Concentrating Solar Power for Seawater Desalination AQWA-CSP (2007)

INSTALLED DESALINATION CAPACITY IN THE MEDITERANIAN



Source: H. Boyé, Plan Bleu, 2008

PROSPECTS OF DESALINATION IN THE MED REGION

According to Plan Bleu (2010), by 2030 the Med region is projected to multiply its desalination capacity by three to fourfold, thus reaching 30 to 40 million m^3/day exceeding 12 billion m^3/year.

How about the Environmental Projections?

1. Assuming a 50% recovery (typically between 35% - 60%) the production of such a volume of desalinated water will require pumping of some 24 billion m^3/year of sea water and in turn discharging around 12 billion m^3/year of brine.
2. The cumulative environmental impacts associated with the construction & operation of such a large number of mega desalination facilities around the Med Sea have to be explored, assessed & analyzed.

BUT WHY THE CONCERN ABOUT THE ENVIRONMENT? THE RESIDUAL CHLORINE EXAMPLE

- Assuming the lowest possible level of total residual chlorine for controlling bio-fouling is 0.2 mg/liter (typically between 0.2 and 0.5 mg/l) in 12 billion m^3/year discharged brine water will result in the dumping of 2,400 metric tons/year of extremely toxic residual chlorine in the near-shore marine environment (6.6 tons per day).
- According to US-EPA criteria (1986), "except possibly where a locally important species is very sensitive, saltwater aquatic organisms and their uses should not be affected unacceptably if the 4-day average concentration of chlorine - produced oxidants does not exceed **7.5 ug/L** more than once every 3 years on the average & if the one-hour average concentration does not exceed **13 ug/L** more than once every **3** years on the average.

THREE ENVIRONMENTAL IMPACTS

1. Impacts of plants intakes.
2. Impacts of plants outfalls - Brine discharge.
3. Atmospheric emissions.

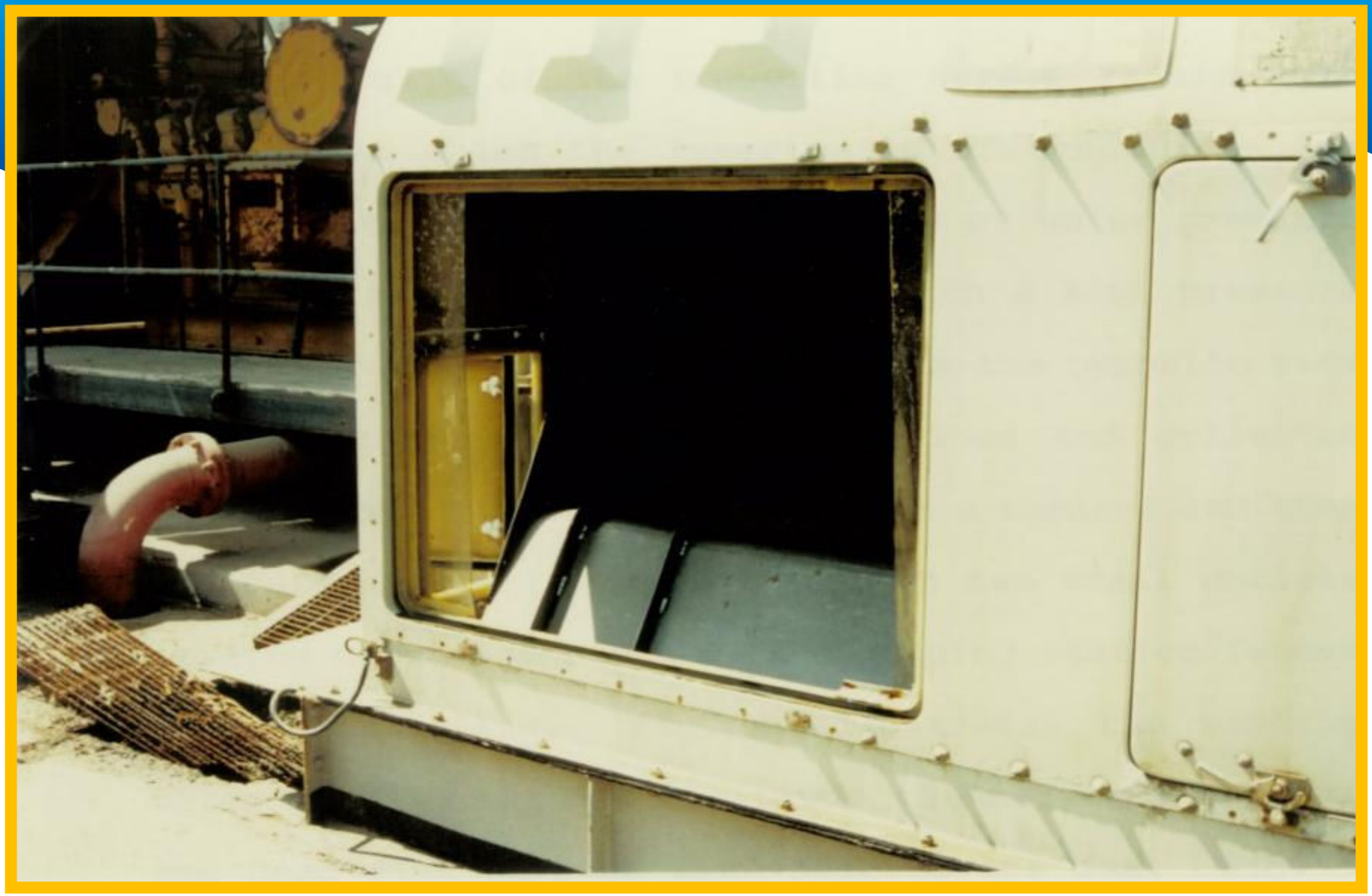
I- Impacts of plants intakes

1. **Impingement:** As the seawater going into desalination plants is screened and filtered, aquatic organisms are removed from water.
2. **Entrainment**: As smaller organisms passing through filters find their way through the process, they get exposed to chemicals, higher temperature or pressure, conditions which are endangering their existence.

Forebay of a desalination plant intake

Screen bar 10cm wide at entrance of forebay

Dead Pelagic fish (Sardinella) in the forebay of desalination plant resulting from chlorination for bio-fouling control



Housing of traveling screen mesh of <1cm^2

II- IMPACTS OF BRINE DISCHARGE

1. Physical Impacts: Results from the discharge of hot brine from thermal desalination.
2. Chemical Impacts: i- Residual chlorine, ii- Corrosion products from thermal desalination, iii- Chemical additives to control scale formation, iv- THM formation, etc.

ENVIRONMENTAL IMPACTS OF TRACE METALS:

- Corrosion products due to water flow, dissolved gases & treatment chemicals (acids) on the alloys utilized in desalination pipes often include harmful heavy metals such as Ni, Cu & Mo & less toxic metals such as Fe & Zn.
- Trace metals will last in different compartments of the marine environment forever.

Environmental Impacts of THMs & Anti-scalants in Brine Water

I. Formation of THMs in finished water.
II. Formation of THMs in brine reject
III. Anti-scalants to hamper carbonate deposition). Phosphates cause eutrification.

III- ATMOSPHERIC EMISSIONS

The products of combustion released by fossil fuel are ash particles, carbon dioxide (CO_2), carbon monoxide (CO), water vapor, Sulfur dioxide (SO_2), & nitrogen oxides (NOx). Except for SO_2, all other gases are GHGs.

- GHGs
- Acid rain

OBJECTIVES OF PROPOSED DESALINATION ACTIVITIES FOR 2013 & 2014

To investigate & conceptually assess the cumulative environmental impacts of mega desalination plants conglomerating around the shores lines of the Mediterranean and to identify their mitigation measures.

FIRST ACTIVITY

The assessment: (2013)

The assessment shall encompass the following:

1. An inventory of the currently operating mega desalination plants including the technical details such as technology used, production capacity, pre-treatment, energy used, chemicals consumed, etc.
2. A survey of mega desalination plants in pipeline or planned until 2030 on the shores of the Mediterranean Basin.
3. An assessment of the brine discharge in terms of volume, pollution load, physical and chemical characteristics, etc.

1. An assessment of atmospheric emissions including SO_2, CO_2, particulates, NOx, etc.
2. A conceptual assessment of the potential fate, transport, bio-accumulation and bio-magnification of desalination related contaminants.
3. A projection of the cumulative impacts of brine discharges on the marine eco-system and assessment of potential impacts on food chain and bio-diversity using variable scenarios.

SECOND ACTIVITY

- To convene a 2 days regional Expert Group Meeting including the members of Desalination Core group in Athens on Potential Cumulative Environmental Impacts of Desalination Plants on the Mediterranean Sea to substantiate and verify the outcomes of the above assessment. This activity will be implemented in synergy with UNEP-MAP, MED-POL, H2020. (**2013**)

THIRD ACTIVITY

- To convene a one-day high-level techno-political policy dialogue in Brussels to develop a vision and debate the prospects of desalination on the Mediterranean Sea in light of expert's opinion on its potential cumulative environmental impacts in collaboration with MED-POL, EDB, UfM. To be implemented during (**2014**).

Thank you

for your kind attention

مع خالص شكري
وامتناني

Merci pour

votre attention

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