Desalination Status In Egypt

Presented by : Prof. Dr./ Ahmed Moawad
HCWW Vice Chairman

Holding Company for Water and Wastewater

1. Water Status in Egypt:
   (Current & Future Status).
2. Desalination in Egypt
   (Current & Future Status)
3. TOTEX Reduction
4. Alliance

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94.8 million Egyptians live in:

253
Cities

4740 villages

According To CAPMASS 2017

Drinking Water Production from Different Sources in Egypt

Surface Water

- WTPs
- 87.9% from total amount

Groundwater

- 11.7 % from total amount

Sea Water

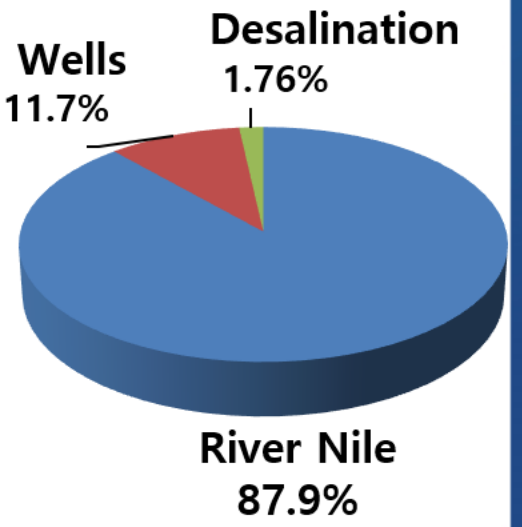
- Desalination
- Total amount 0.43 million m^3/day
- 1.76 % from total amount

Water Current Status

Water Production (Millions m3/day)	29.05
Number of Water Treatment Plants	2726 233 Filtration + 828 Compact + 1607 Well Plants + 58 Desalination
Water Distribution Networks (km)	166,000
Number of Subscribers (Millions)	15.6

Coverage Percentage

98%



Wastewater Current Status

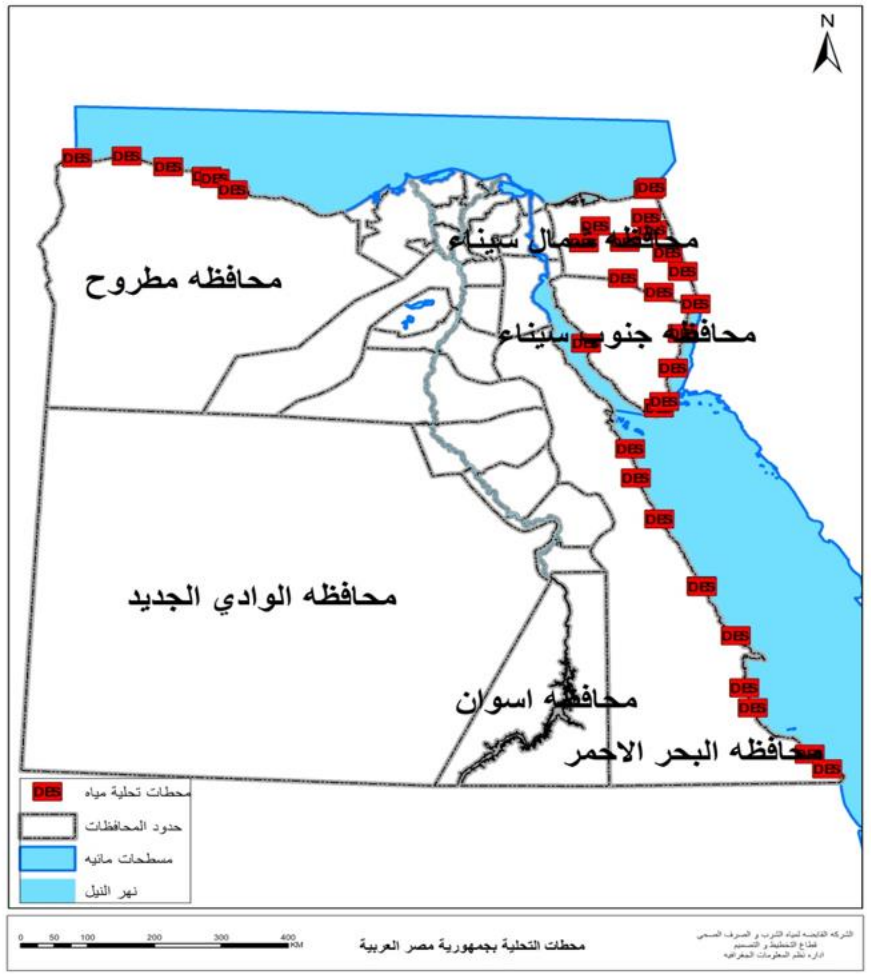
Wastewater Capacity (Millions m3/day)	12.3
Number of Wastewater Treatment Plants	409
Wastewater Networks (km)	53,000
Number of Subscribers (Millions)	8.2

Coverage Percentage

59.7% (Population)

- 94% Urban (Population)
- 34% Rural (Population)

Desalination Plants Locations



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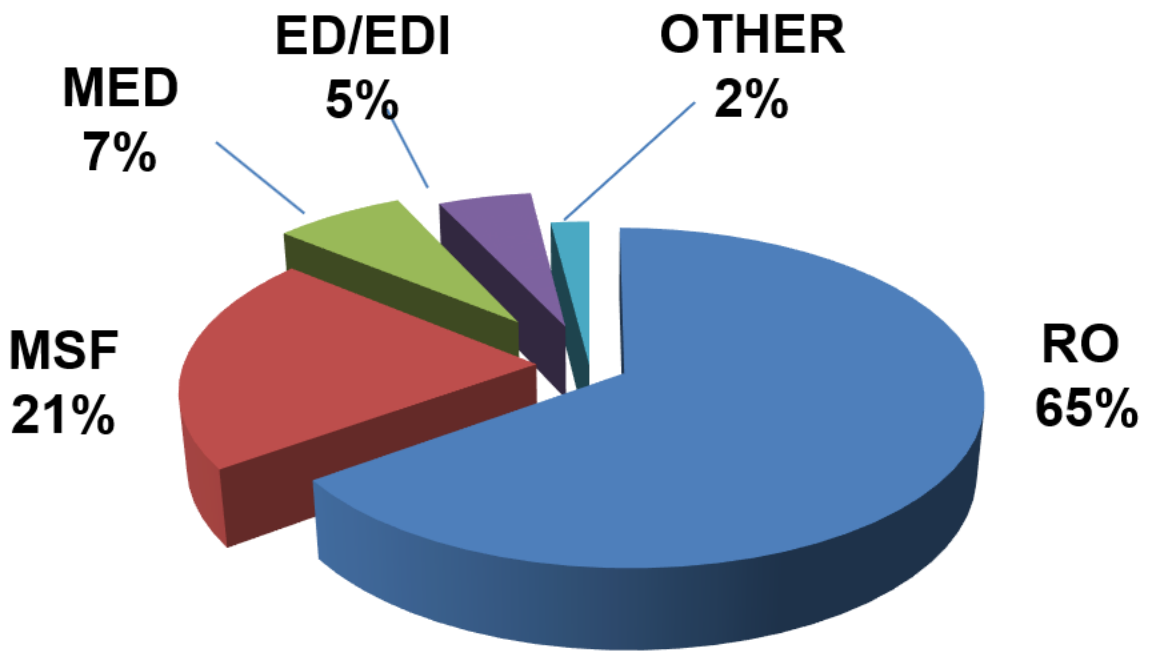
Use of different technologies for desalination all over the world



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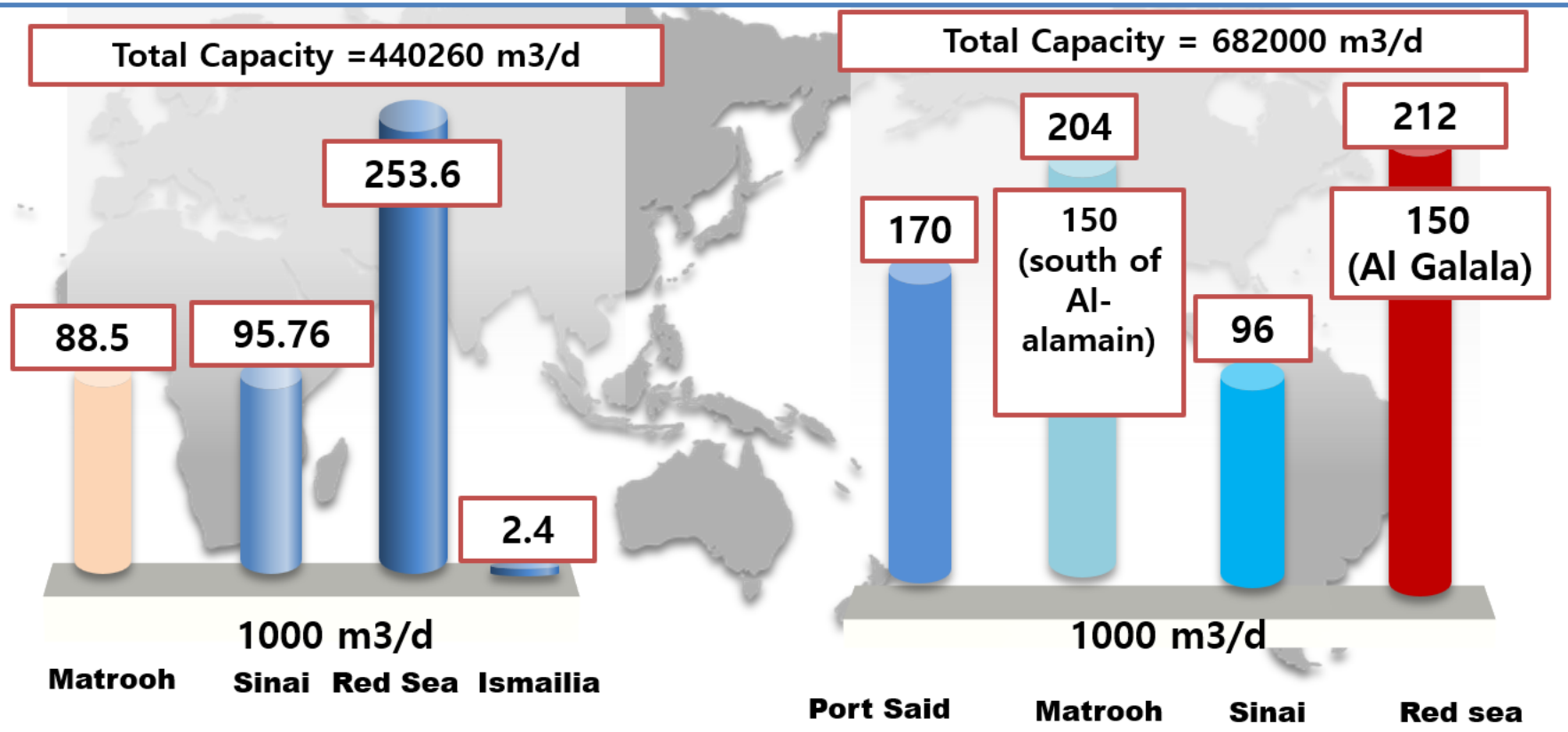
Design Capacity For Existing & ongoing Desalination Plants



Existing Plants

Ongoing desalination plants

Water supply in Red sea Governorate, (existing plants, ongoing & planned projects)

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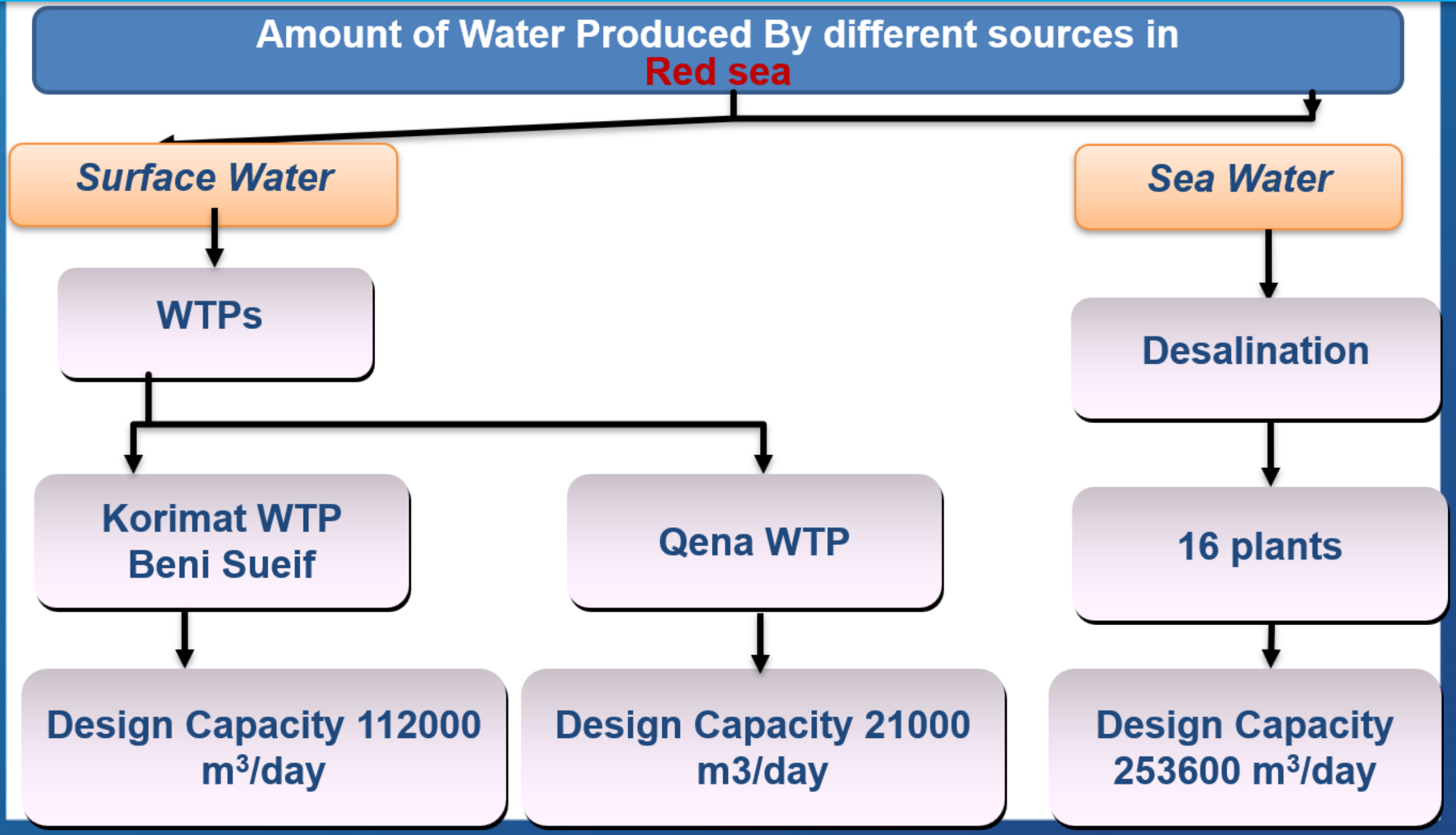

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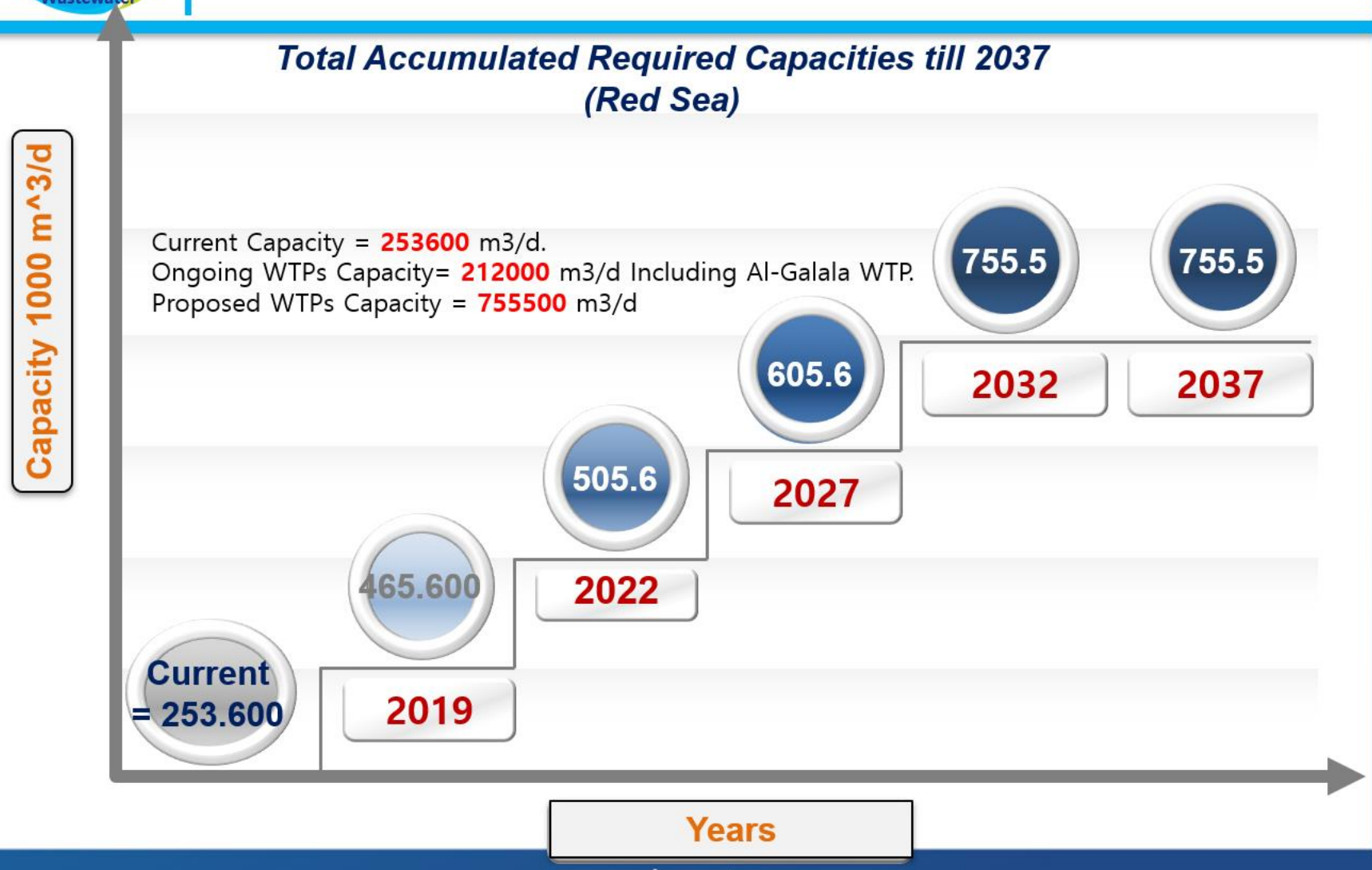
Total Accumulated Required Capacities till 2037 (Red Sea)



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Desalination Plant Hurghada (Elyosr) 80,000 m3/day

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Safaga Desalination Plant

Existing capacity 6000 m3/day

El - Qussair 7500 m3/day Desalination Plants

Future capacity 60000 m3/day

Water supply in Matrouh Governorate, (existing plants, ongoing & planned projects)

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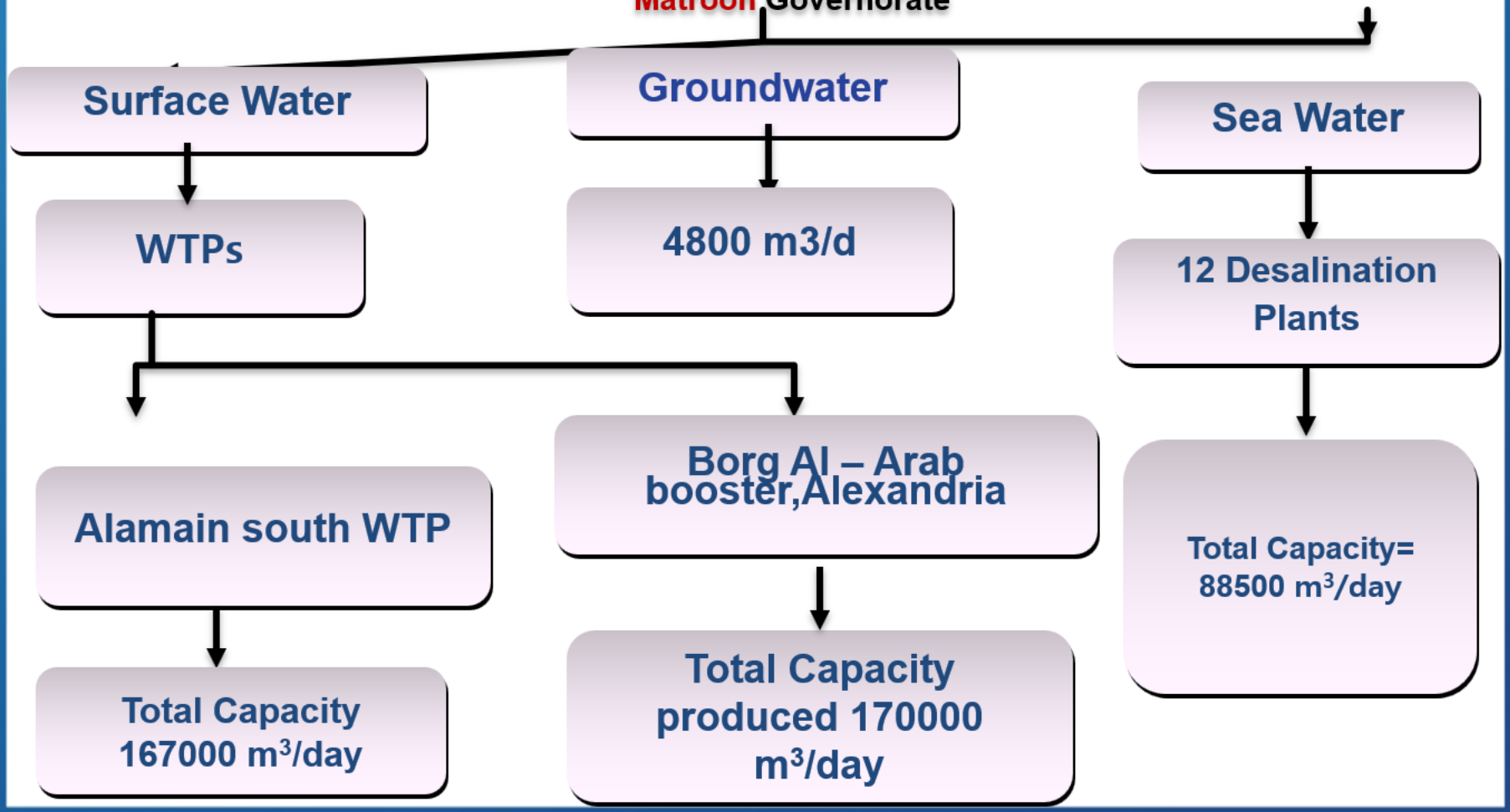
Amount of Actual Water Produced By different sources in Matrooh Governorate



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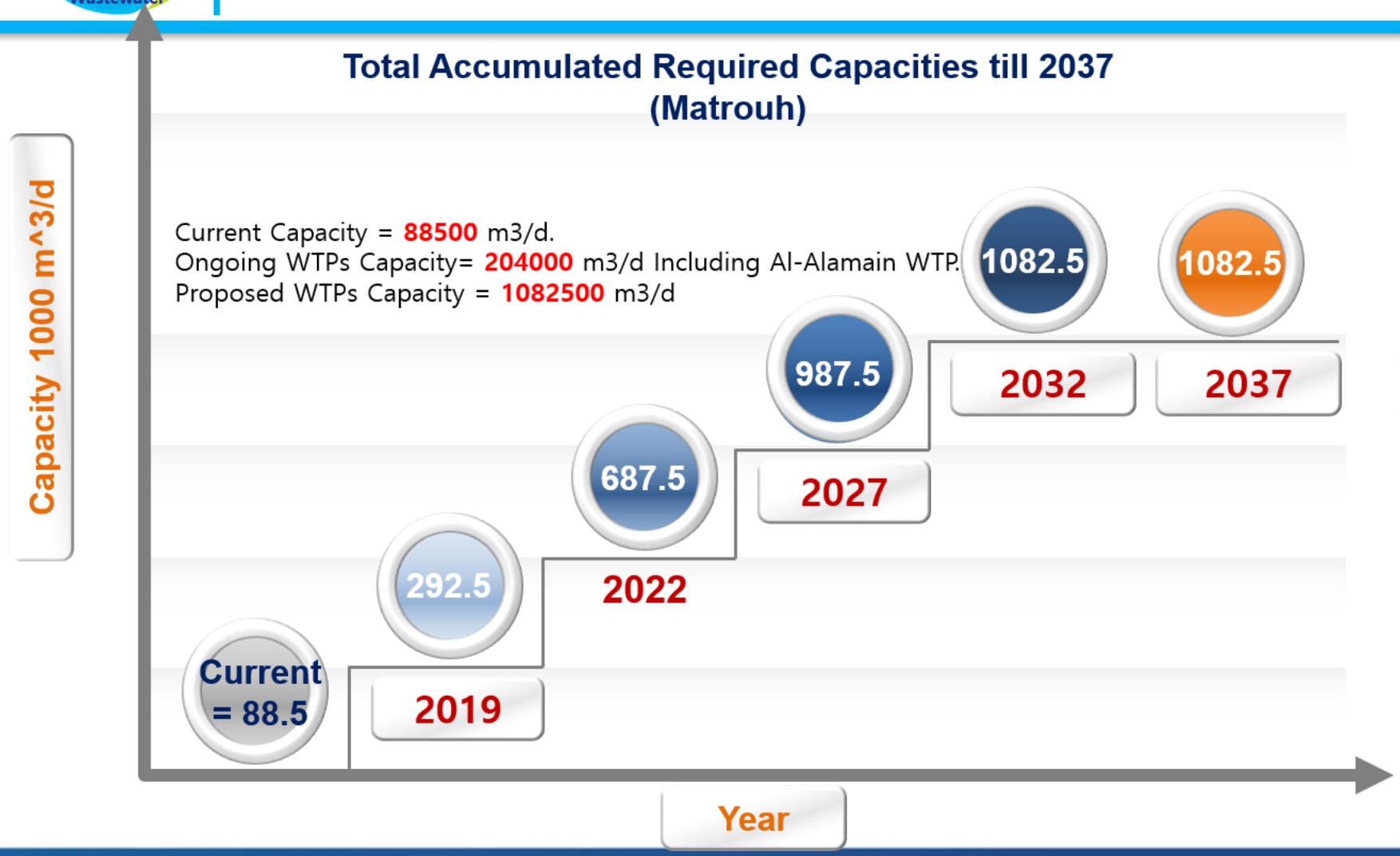
Total Accumulated Required Capacities till 2037 (Matrouh)



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Al-Remaila First Stage Desalination Plant

Existing capacity 24000 m3/day

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Al-Remaila second Stage Desalination Plant

ongoing capacity 24000 m3/day

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Cleopatra 4500 m3/d Desalination Plant TSM

Future capacity 60000 m3/day

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Water supply in South & North Sinai Governorate,
(existing plants, ongoing & planned projects)

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Amount of Water Produced By different sources in North Sinai

- **Surface Water**
  - WTPs
    - Total Capacity 160000 m^3/day
- **Artesian Plants**
  - Total Capacity 58800 m^3/day
- **Sea Water**
  - 21 Desalination Plants
    - Total Capacity = 20760 m3/d

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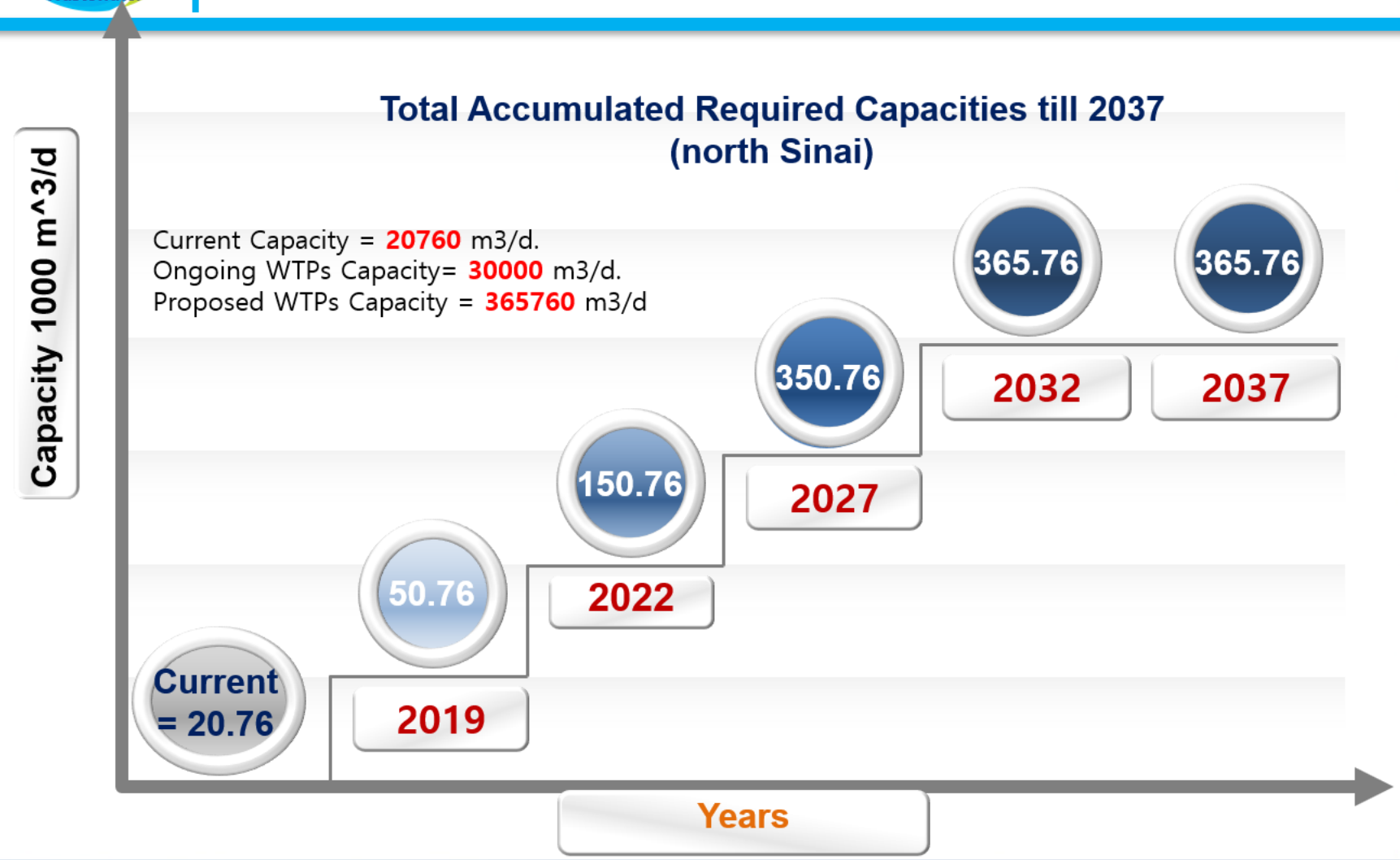
Total Accumulated Required Capacities till 2037 (north Sinai)

Current Capacity = **20760** m3/d.
Ongoing WTPs Capacity= **30000** m3/d.
Proposed WTPs Capacity = **365760** m3/d



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Arish Desalination Plants

ongoing capacity 25,000 m3/day

future capacity 325,000 m3/day

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Rafah Desalination Plant

Existing capacity 5000 m3/day

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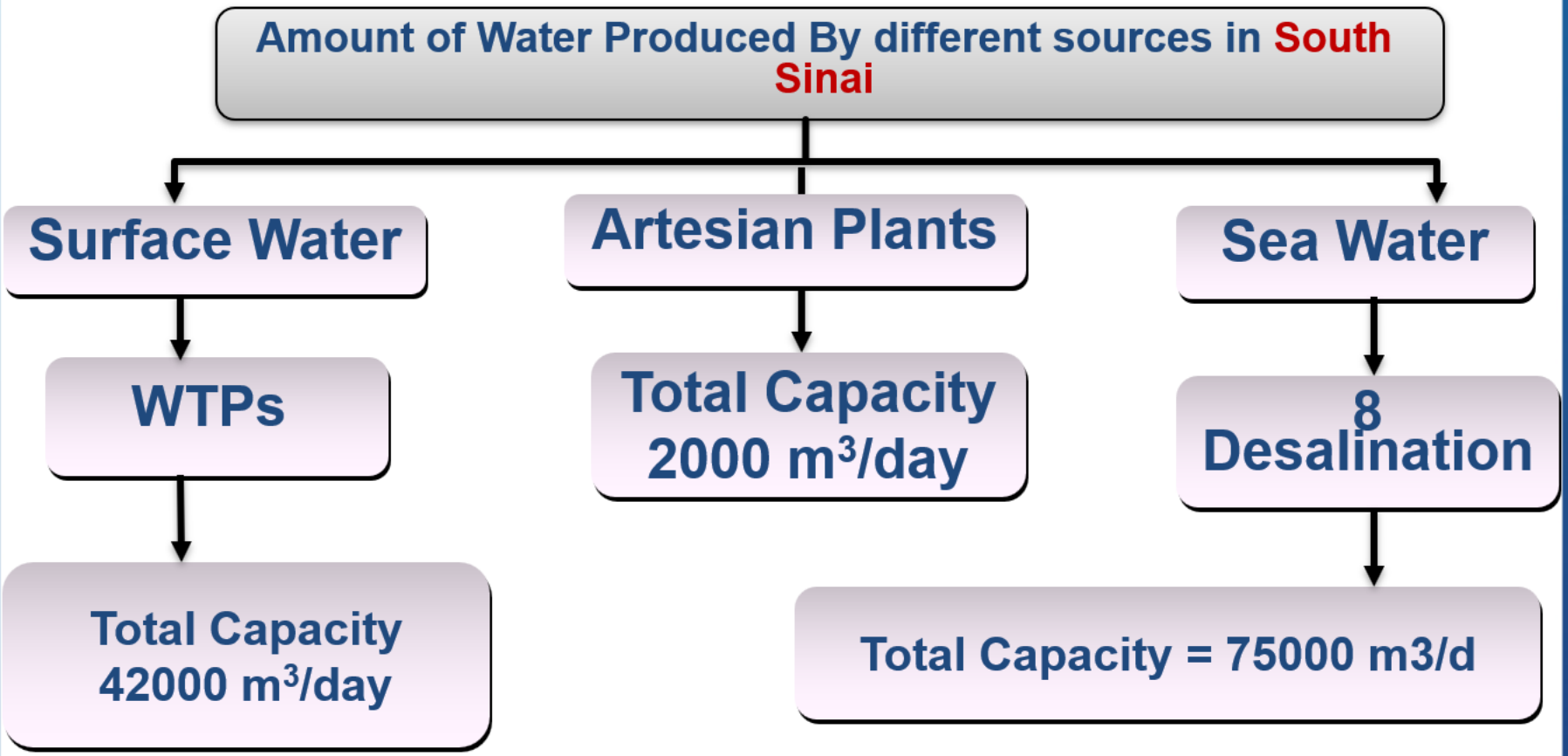

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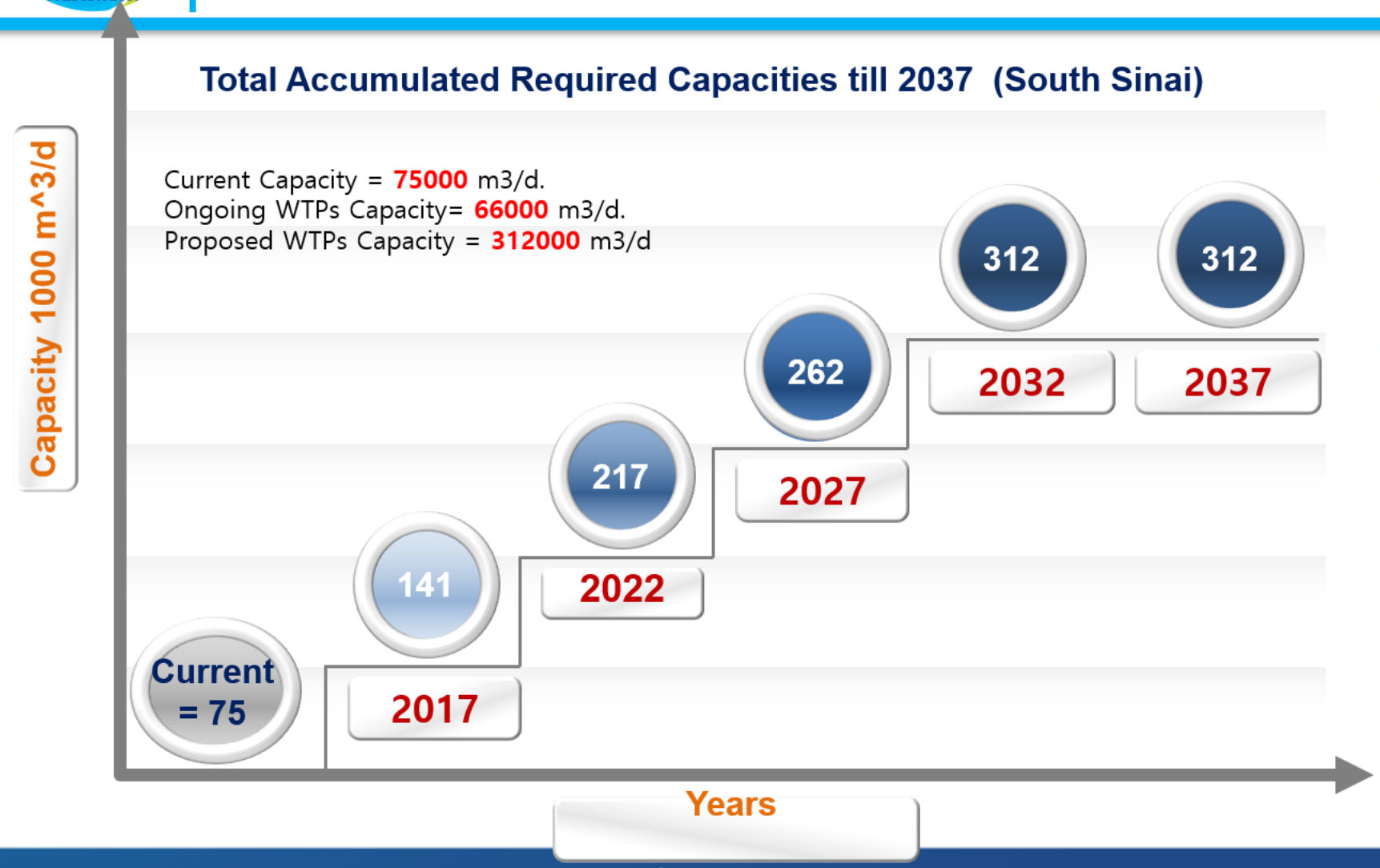
Total Accumulated Required Capacities till 2037 (South Sinai)



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AlShabab Desalination Plant

Existing capacity 8000 m3/day

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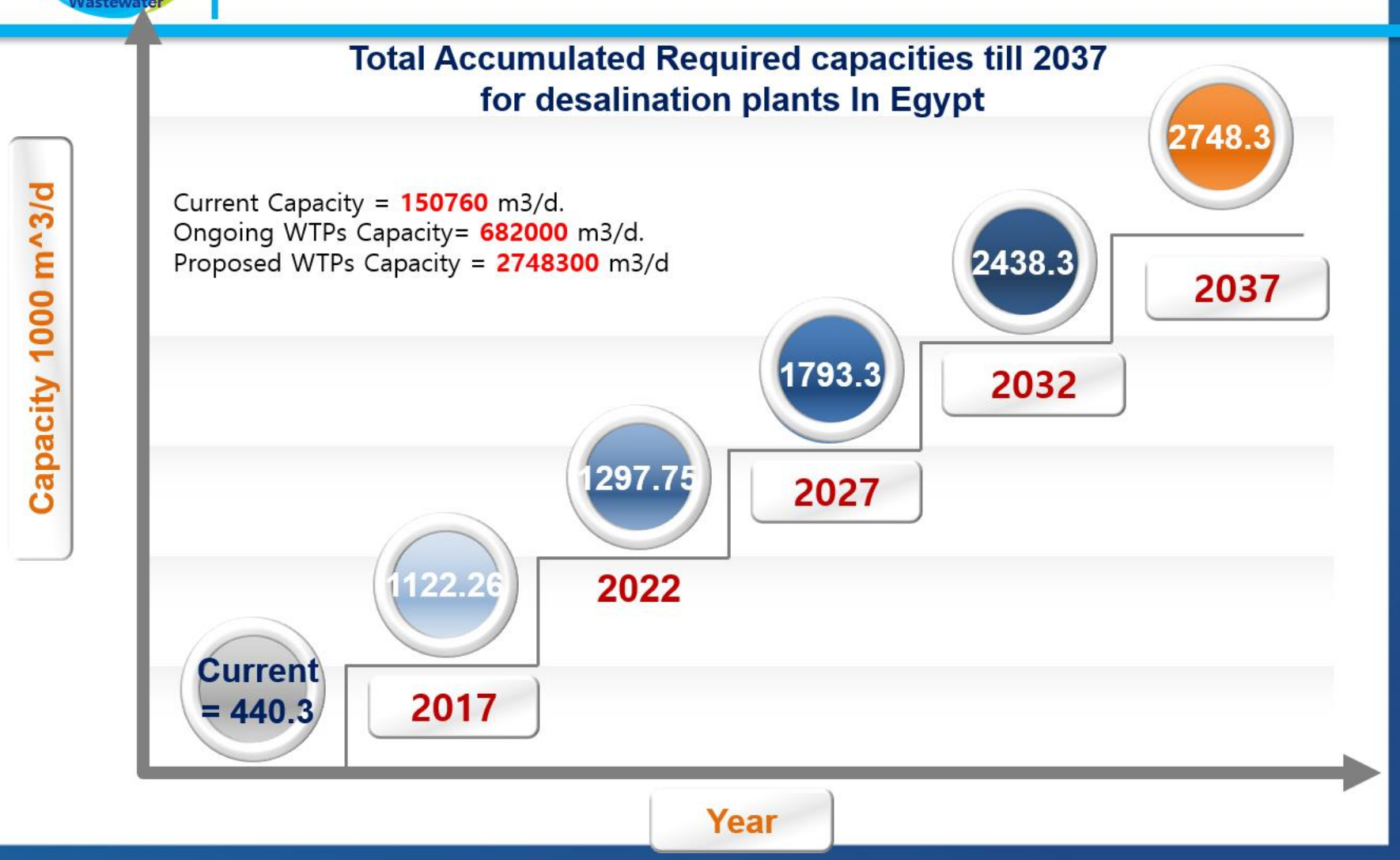
Total Accumulated Required capacities till 2037 for desalination plants In Egypt

Current Capacity = **150760** m3/d.
Ongoing WTPs Capacity= **682000** m3/d.
Proposed WTPs Capacity = **2748300** m3/d



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Total Area Required For The Construction Of Desalination Plants For all Governorates

Governorate	Total Area Needed (1000 m^2)			Total Area (1000m^2)
	2020-2022	2022-2027	2027-2037	
Red Sea	190	145	45	380
Matrooh	20	48	72	140
North Sinai	48	96	8	152
South Sinai	37	22	24	83
Kafr El sheikh	30	-	-	30
Total Area (1000m^2)	325	311	149	785

How to reduce TOTEX (Cost: $0.5 →$0.4)

- 90's= $0.7 – $1.2 , Now = $0.51 -$0.53
- Renewable Energy.
- Specifications.
- Front End Engineering & Design (FEED).
- Risks.
- Intakes & Outfalls.
- Brine Disposal.
- R&D.

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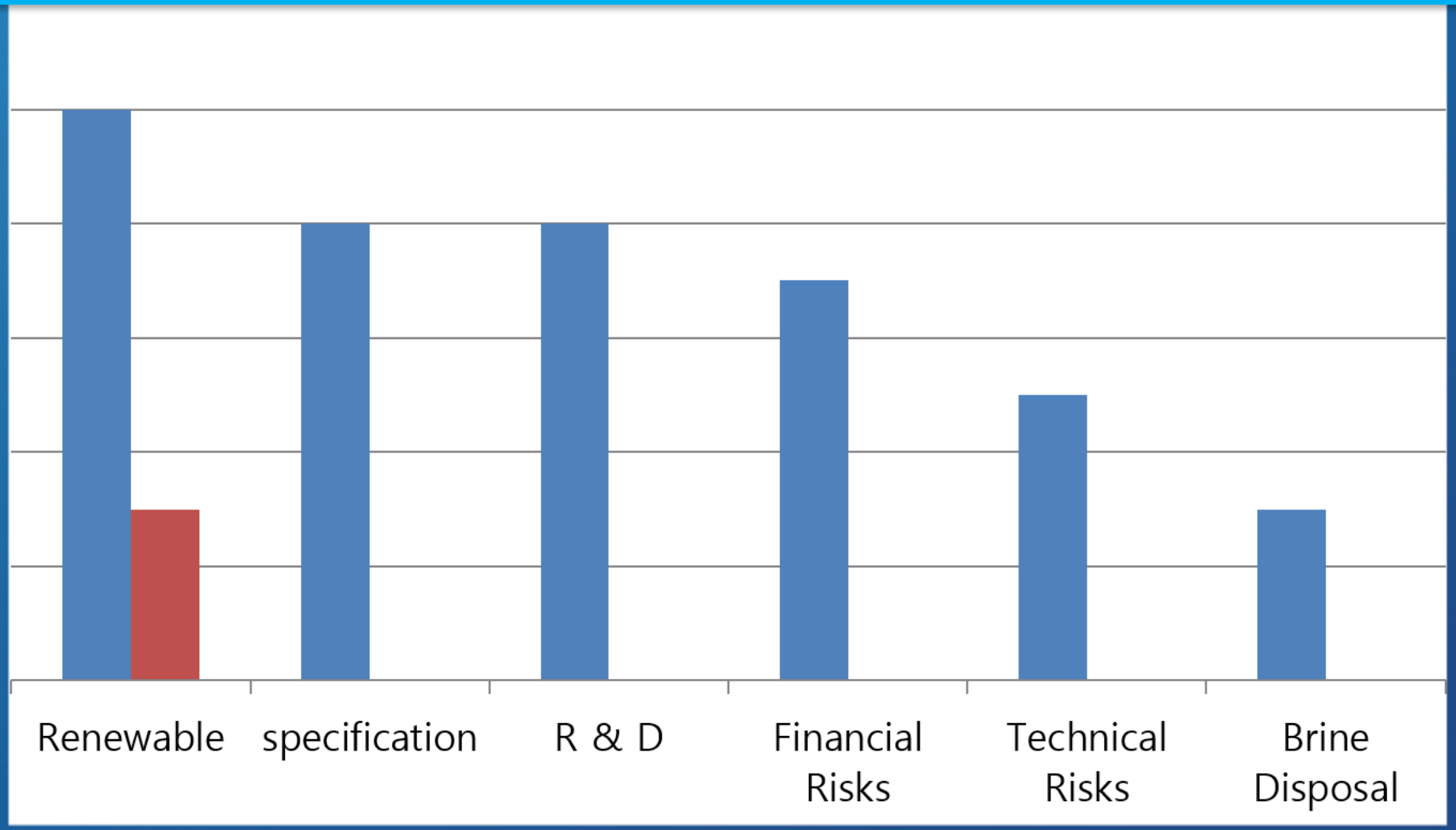

Desalination Energy Consumption & The Need For Expansion in Using Renewable Energy

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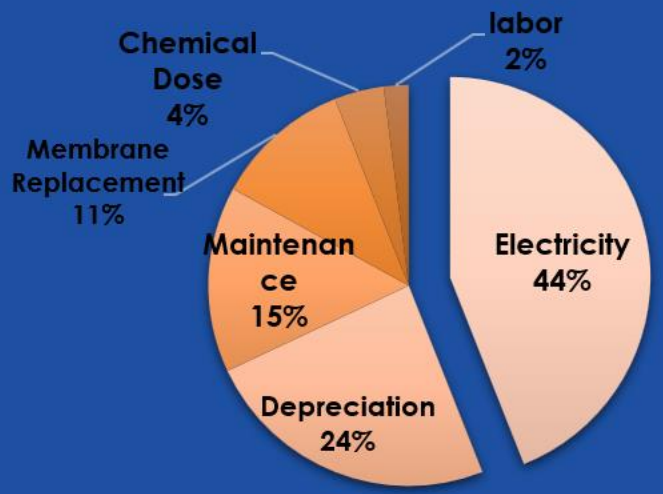
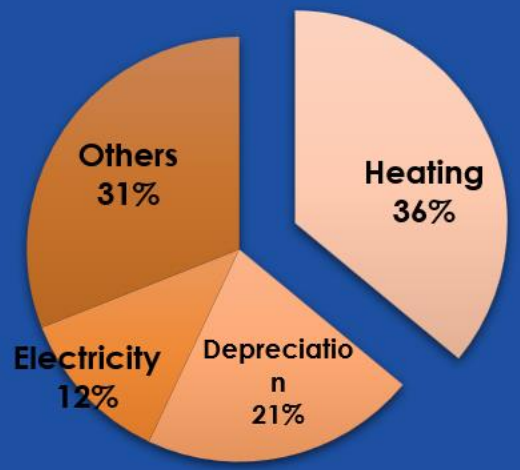
Average TOTEX of Domestic Seawater Desalination

RO Cost Structure (tons of water)



Low Temperature MED Cost Structure (tons of water)



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Stages of Power Recovery Systems

1960	1980	1990	2000	2010
				
Without Recovery System	**Francis Turbine**	**Pelton Turbine**	**Turbocharger**	**Pressure exchanger**
9 - 10 KW.h /1m^3 produced	7.5 - 8 KW.h / 1m^3 produced	6.5 KW.h /1m^3 produced	5 - 5.6 KW.h/1m^3 produced	2.5 - 3.5 KW.h/1m^3 produced

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Turbo charger

Pressure exchanger

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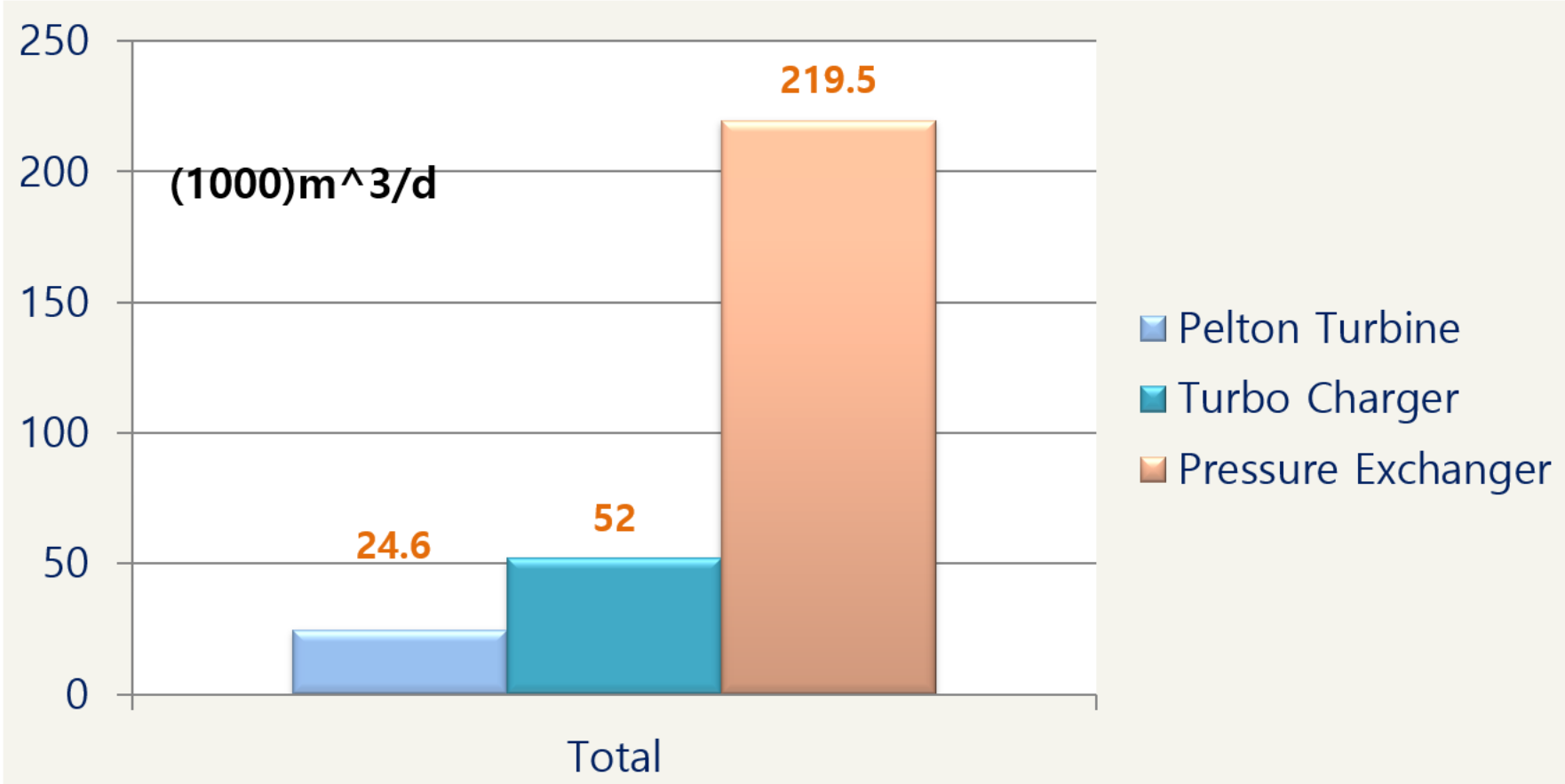
Energy Recovery Systems



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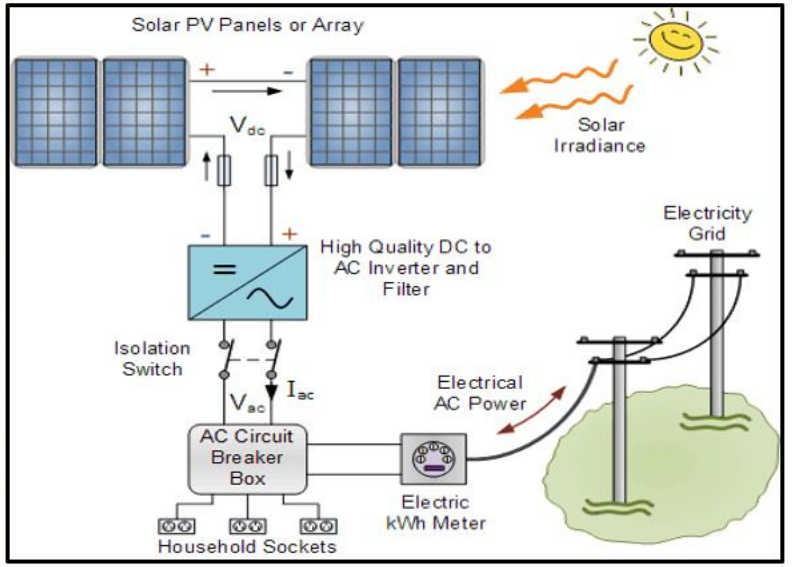
Total Amount Of Electricity Required For Desalination Plants For all Governorates

Governorate	Amount Of Electricity Required Mwatt/h			Total electricity Needed (M.watt/h)
	2020-2022	2022-2027	2027-2037	
Matrooh	115	90	30	235
Red Sea	13	30	45	88
North Sinai	30	60	5	95
South Sinai	22	14	15	51
Kafr Elshiekh	18	-	-	18
Total (Mwatt/h)	198	194	95	487

Renewable Energy

- Direct Supply → CSPs , PV , …
- Indirect Supply

Through grid



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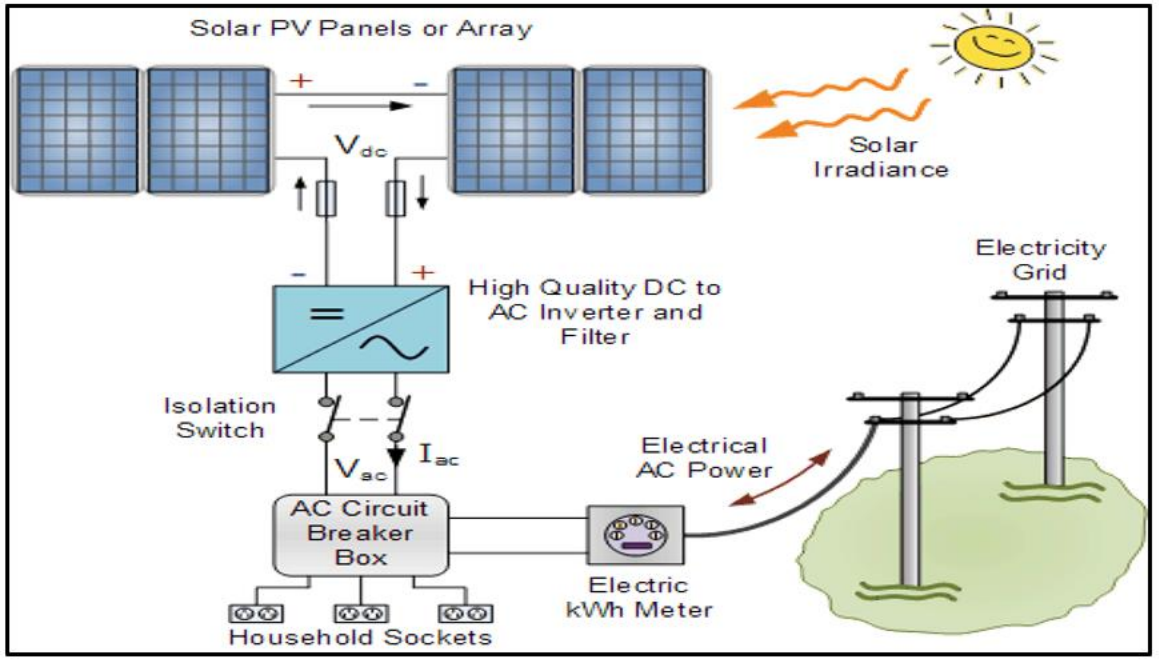
On going desalination projects by on grid solar energy (Sinai)



- Location : Well desalination At Reed Village & Sadr Alhitan with 200m3/d each.
- Project Objective : On grid solar energy technology.
- Capacity : 500 KWH for each plant.
- Total Cost: 18.73 Million L.E.

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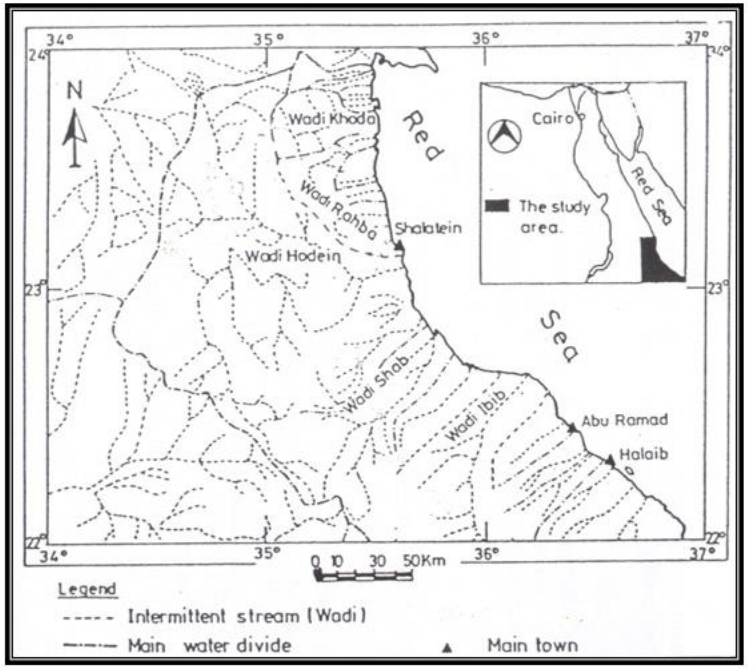
On going desalination projects by off grid solar energy (Shalateen)



- **Location :** DRC – Shalateen.
- **Project Objective :** the integration of saline water/seawater RO desalination and solar photovoltaic (PV) technology.
- **Capacity :** 21 m^3/day of All mechanical as well electronic components were manufactured at the Arab Organization for Industrialization (AOI).

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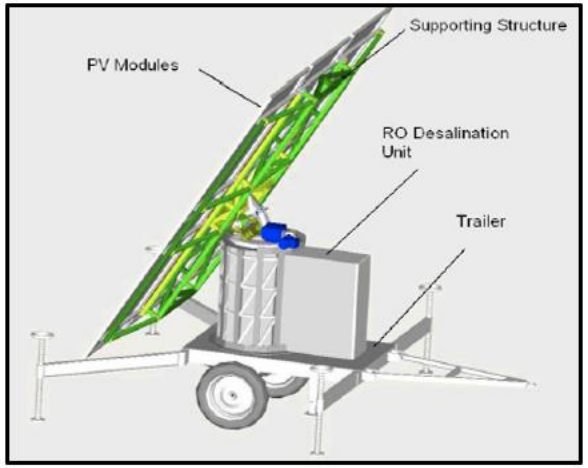
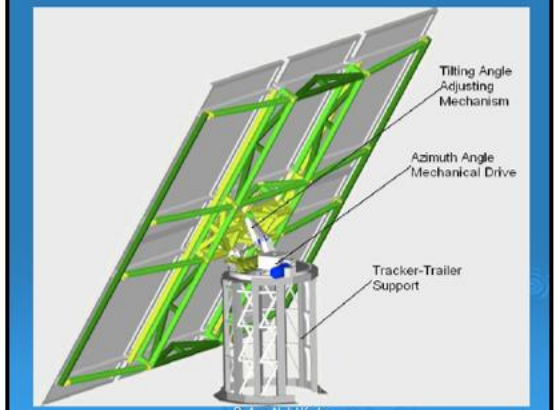
On going desalination projects by off grid solar energy

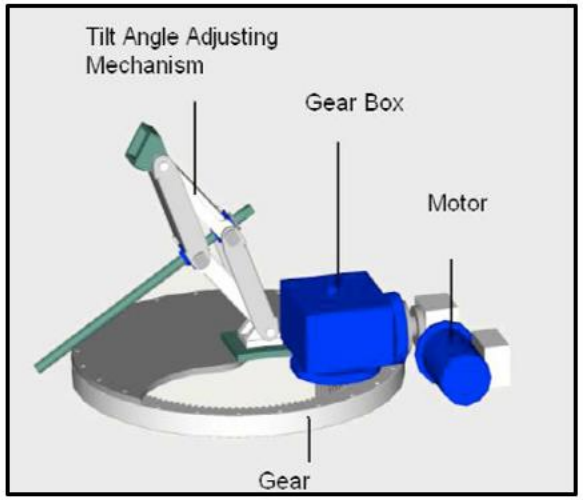
At Northwest coast of Egypt

Transportation Mode



Main Structure





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On going desalination projects by off grid solar energy

Target area: Northwest coast of Egypt (Matrooh)

Location : Sustainable development Center For Matrouh resources.

Project Objective : Designing, implementing and testing of an efficient cost effective battery less Mobile (PV-RO) desalinating unit.

Capacity: 11 m^3/day.

Developer : Desert Research System

Specifications

Professional minimum functional specification:

- **Some Developers make poor technology choices, but they can be over prescriptive, which adds unnecessary cost to projects. Recent tenders have specified systems without the option to use alternative proven technologies.**
- **Decisions should be made by the engineer, and which can be left to the developer would give more scope for cost savings.**

➢ Specifications

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Water Quality

(Impact of Pre-treatment on energy, chemical and membrane costs)

Figure 6 – Typical SWRO desalination plant CAPEX breakdown (Source: Advisian)

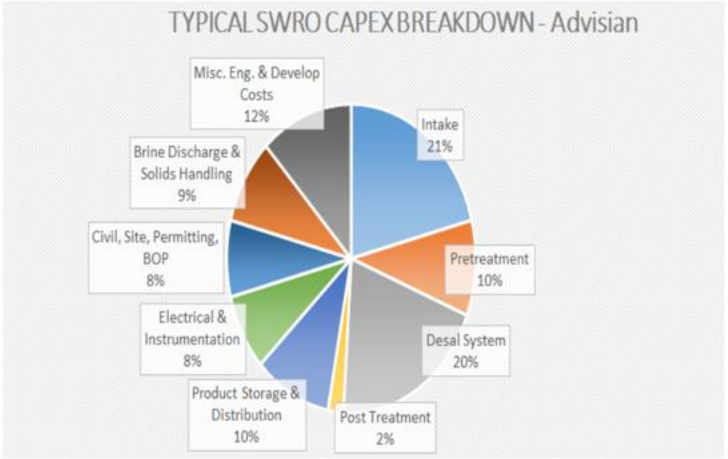
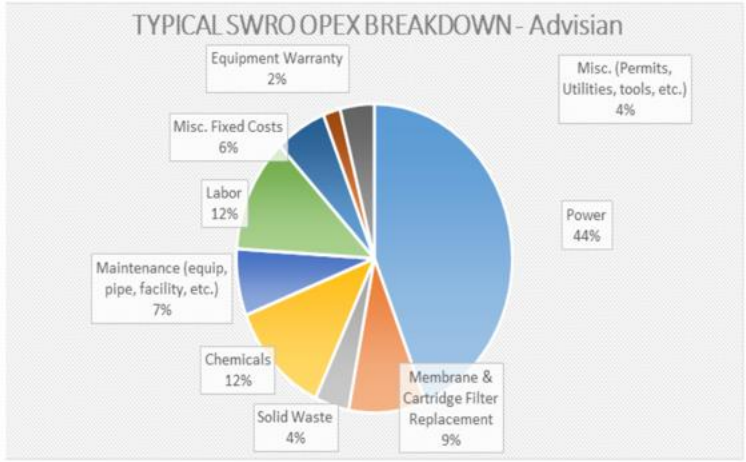


Figure 8 – Typical SWRO desalination plant OPEX breakdown (Source: Advisian)



>20% saving in Pretreatment CAPEX (2% Total CAPEX)

- Ensuring that systems are designed based on actual and accurate predictive data.
- Improvement in materials of construction costs.
- Careful and effective management of local suppliers.

Pretreatment - >10% saving in Total OPEX

- Technology selection could provide 50% reduction in membrane and cartridge replacement (4.5% Total OPEX)
- Process efficiency – 10% energy reduction (4.4% Total OPEX)
- Fouling reduction – 20% reduction in chemicals (2.4% Total OPEX)

➢ FEED Stage

- As a general approach redefining the development process, similarly to the way they are implemented in other industries, through the inclusion of FEED stage in which the engineering is agreed and defined in detail will minimize the risk for all parties, align interest and therefore will allow Developers, EPC and O&M to reduce the level of contingencies while sharpening pencils, since there will be higher clarity on conditions, supplies and equipment .

Risks

- Financial Risks.
  - Currency
  - Balanced risk in contracts
- Environmental Risks.(ZLD)
- Technical Risks.

➢ Intakes & Outfalls

Old Brine Outfalls

New technology of Brine Outfalls

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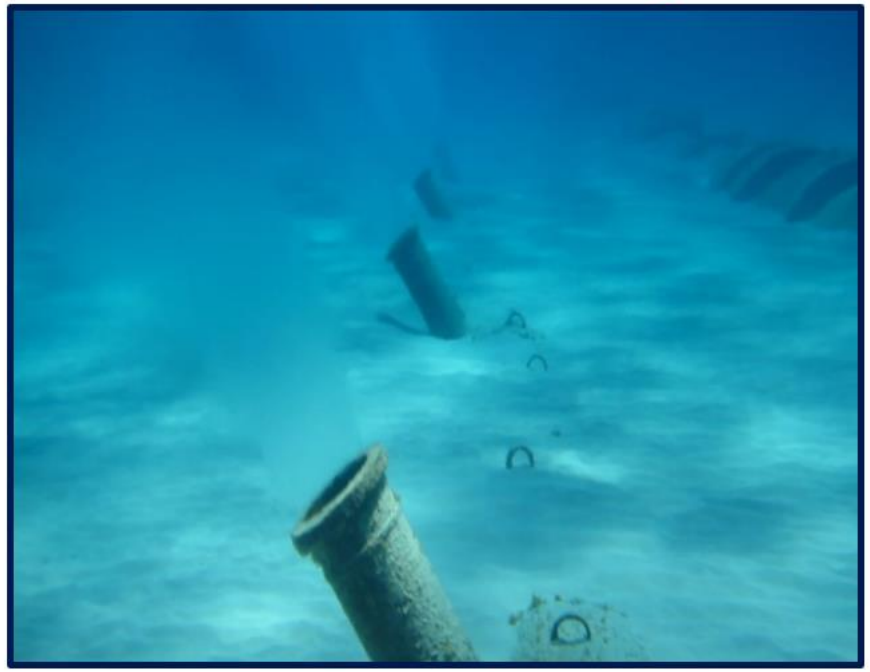
Hurgada Desalination Plant Old Outfalls Design

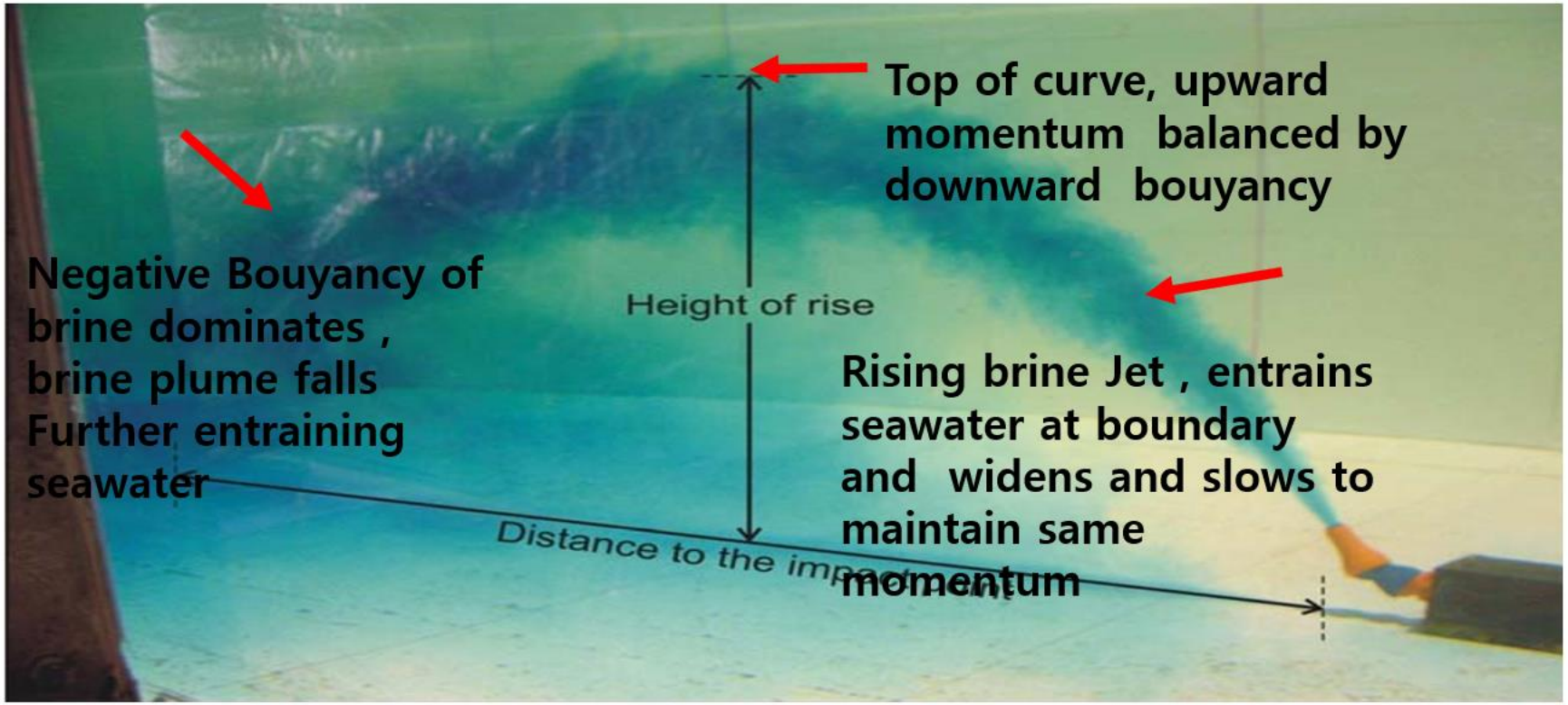
Hurghada Old Outfall, no diffusers, badly secured

Hurgada Desalination Plant (El YOSR) Outfalls design



Outfall Diffusers Ensure Rapid Brine Dilution

Hurgada Outfalls Design Modelling



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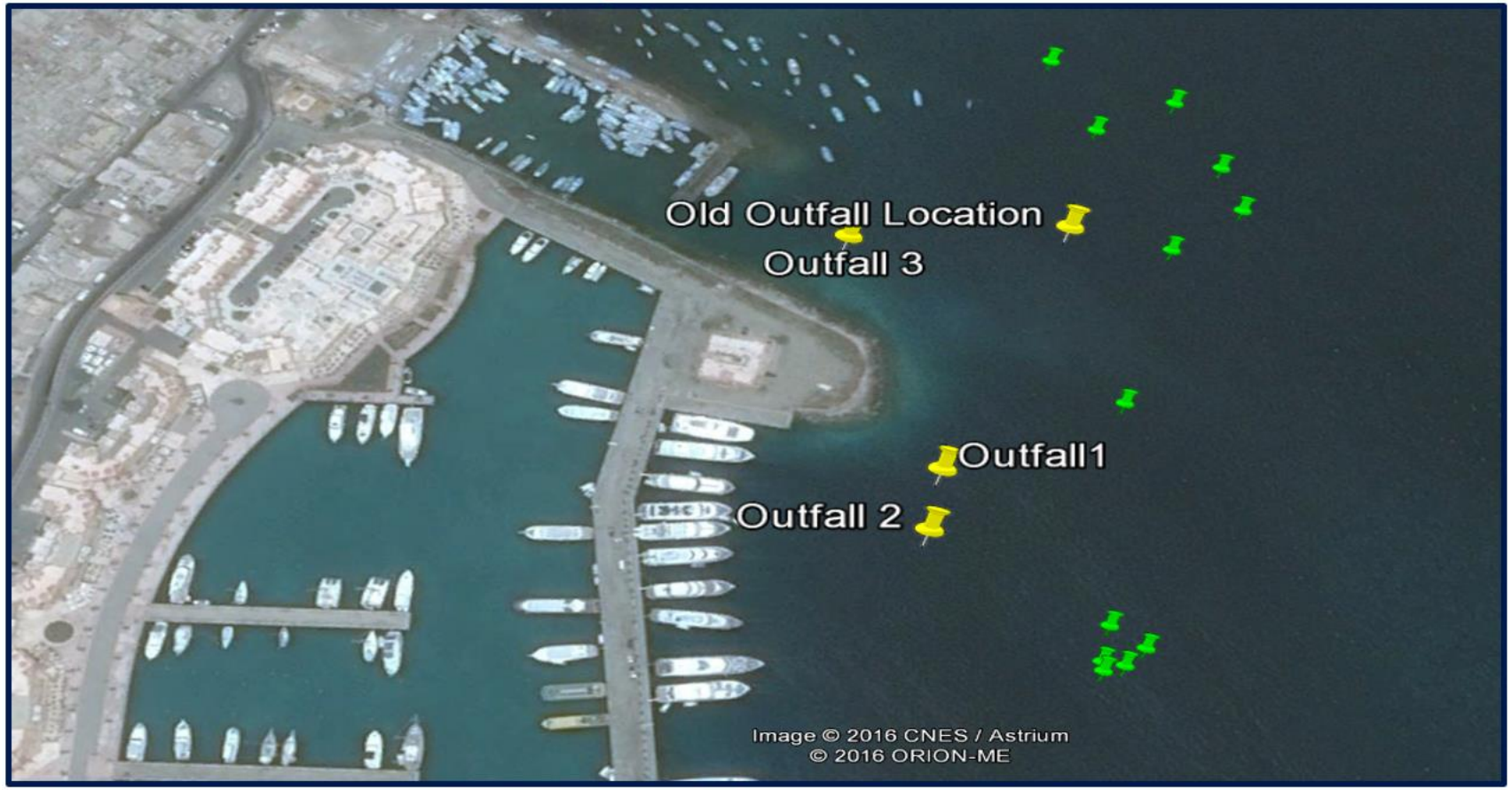
Hurgada Desalination Plant
Design For New Outfalls



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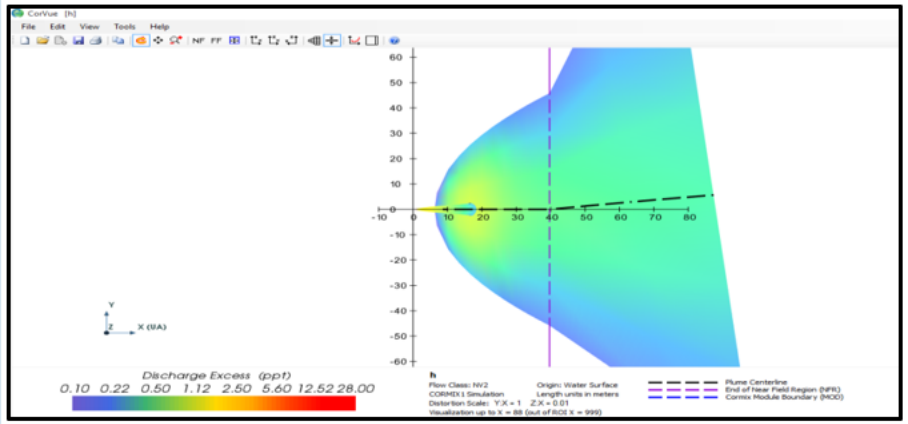
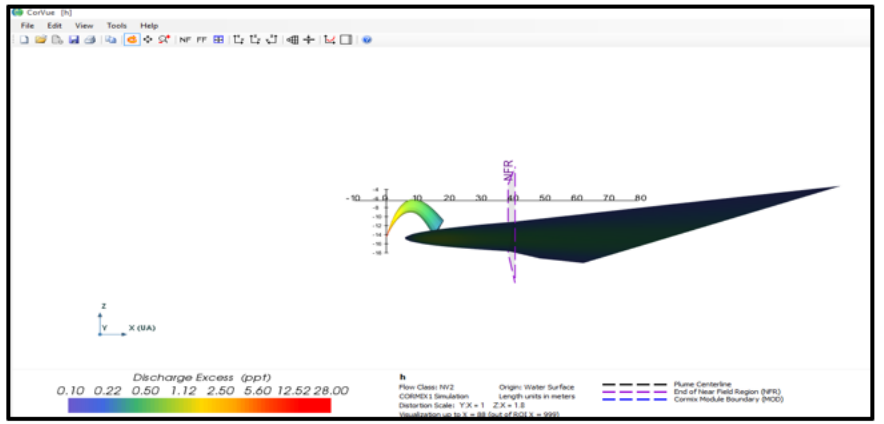
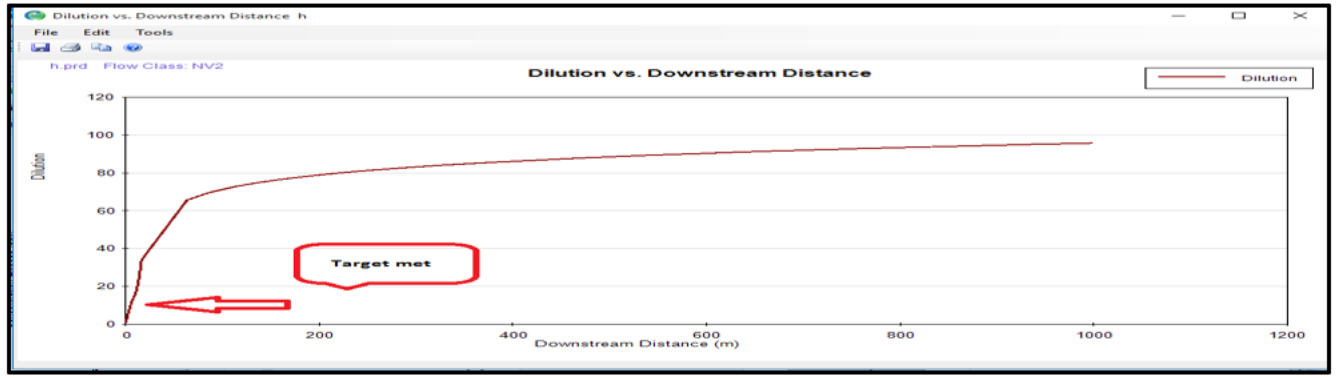
Discharge Excess vs. Downstream Distance







Cormix indicates the 13.33 Dilution needed can be achieved at approx. 7.48 m from the Diffusers.

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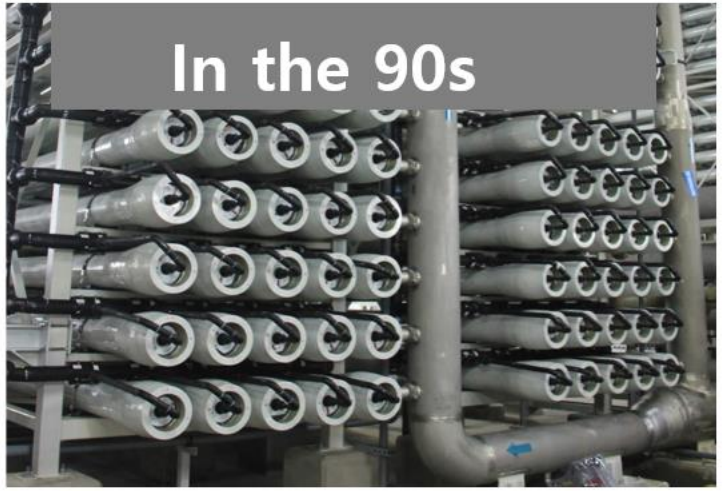
➢ R & D

- No disruptive technologies
- Incremental improvements
- Membranes (flux, range of salinity, pressure, cleaning resistance ...)
- Extremely low investment in R & D



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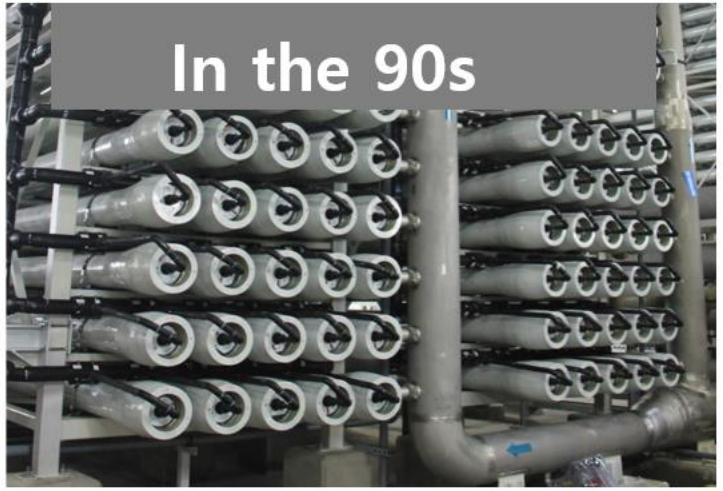
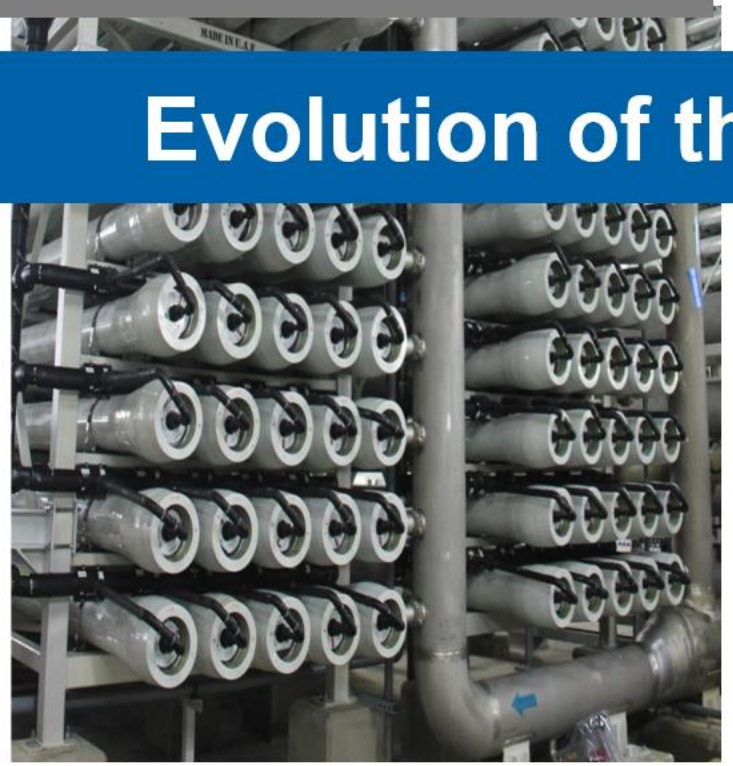


Discovering more disruptive technologies: More R&D Investment

In the 90s



Evolution of the RO core system

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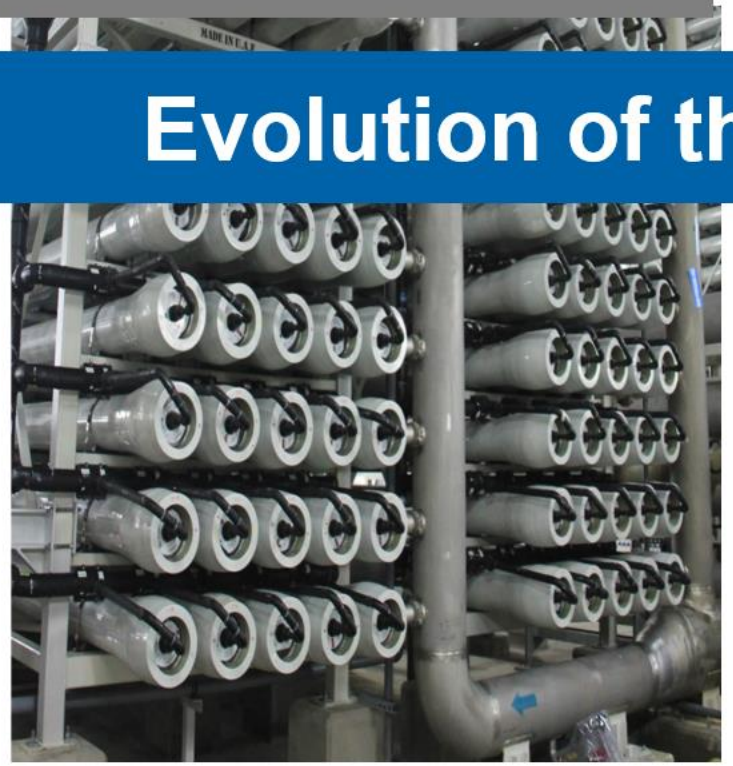
Discovering more disruptive technologies: More R&D Investment

In the 90s	Today

Evolution of the RO core system



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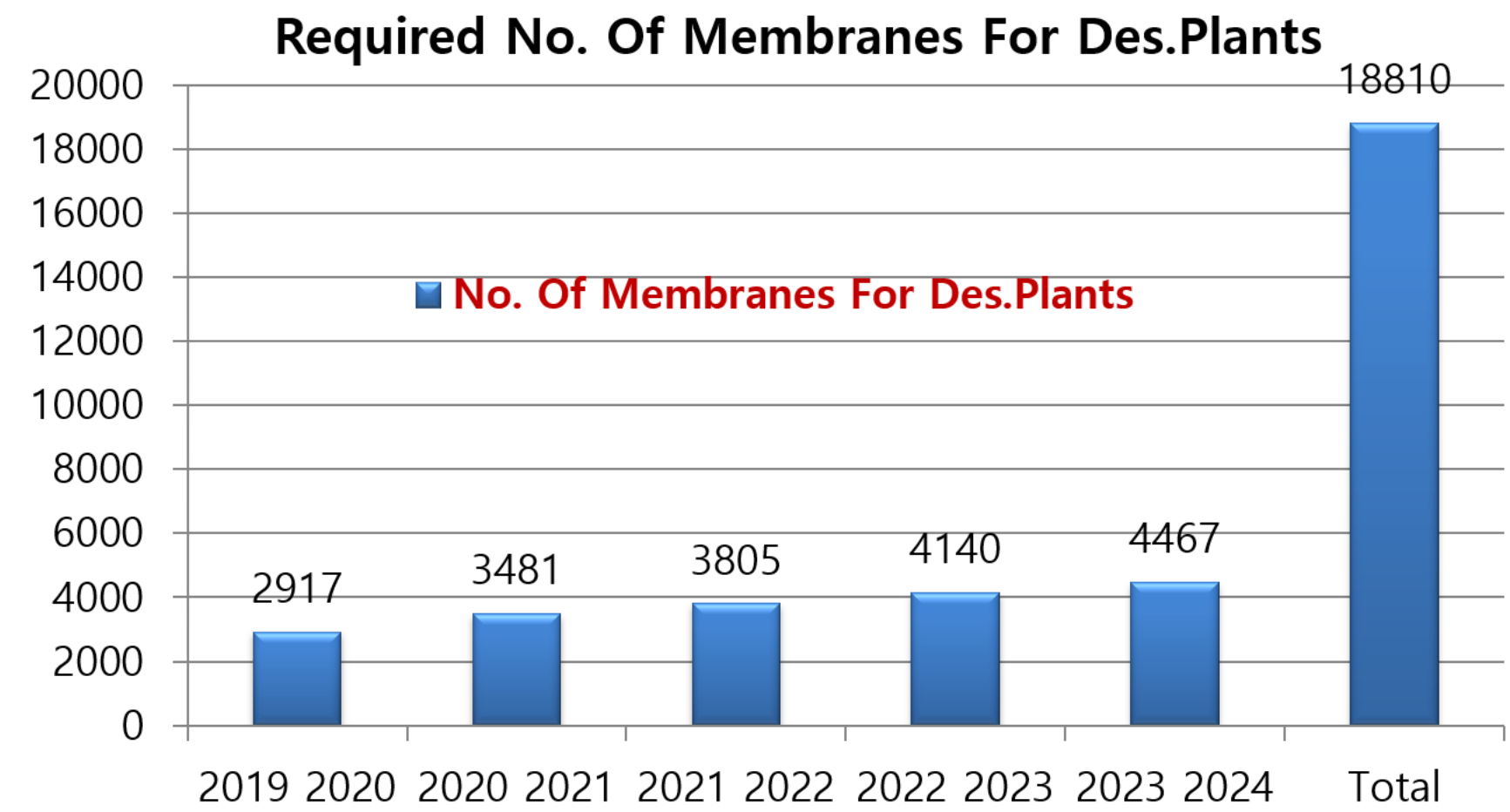

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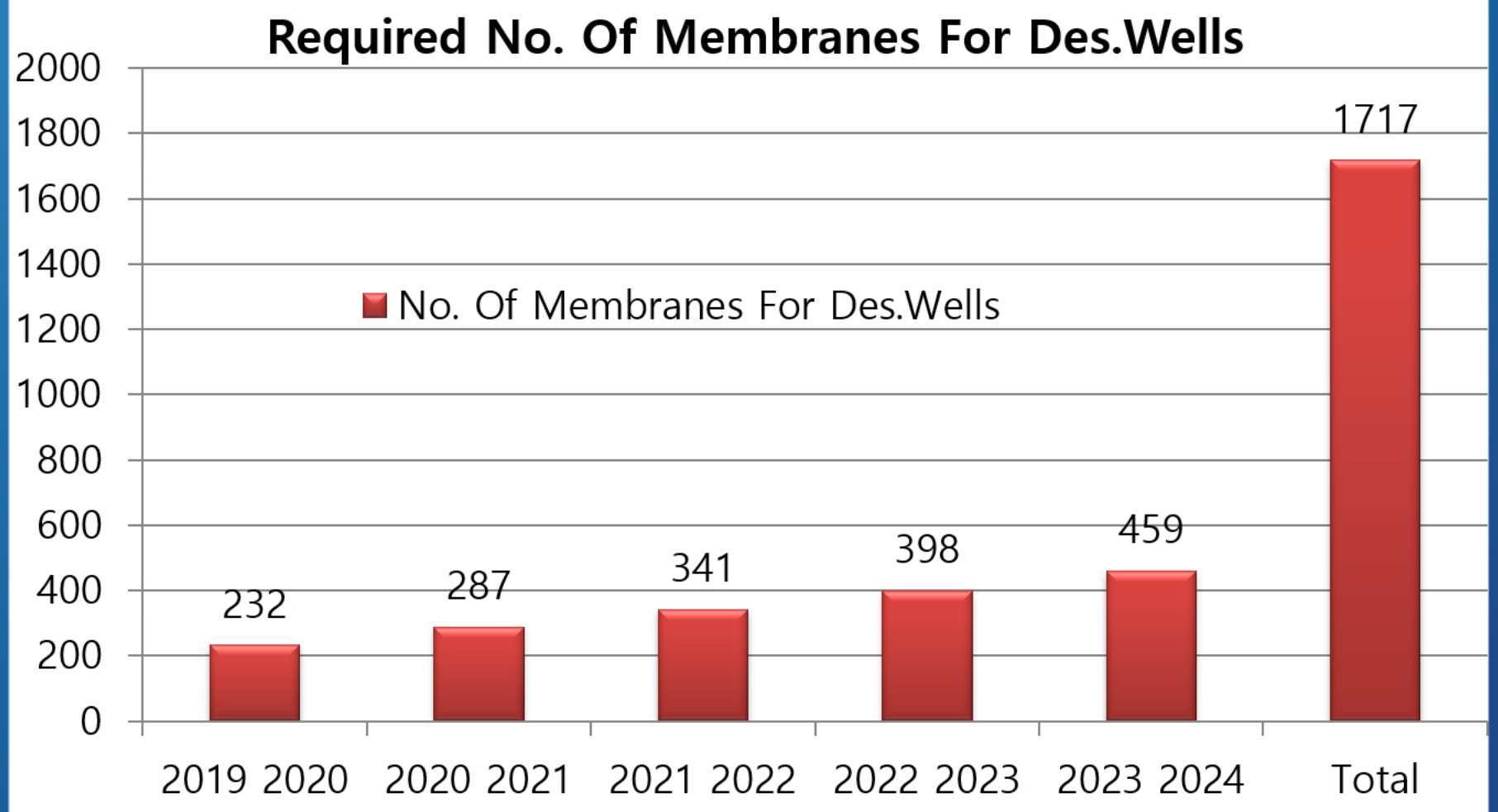
Holding Company for Water and Wastewater



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Water desalination alliance

	NAME	
1	Holding company for water and waste water	HCWW
2	Academy Of Scientific Research & Technology	
3	Faculty of engineering- Assiut universty	
4	Faculty of engineering- Alexandria universty	
5	ADST	
6	British universty	
7	Desert research center	DRC
8	Science and technology center of excellence	STCE
9	Arab renewable energy company	ARECO
10	Sakr factory for developed industries	
11	Kaha company for chemical industries	Factory 2 70
12	Misr elkheir foundation	


Thank you
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Questions

R.O. Desalination plants From Various Countries

Saudi Arabia : Al sho-aiba

Produced capacity :150000 m3/d Start up : during 2009

Perth - Australia

Capacity : 160000 m3/ day

Start up : during 2006

Barcelona,Spain

Capacity : 200000 m3/ day

Start up : during 2009

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Hurghada (Elyosr) - Egypt

Capacity : 80000 m3/ day

Start up : during 2017