



The Role of Oil and Gas Industry in Ground Water Conservation

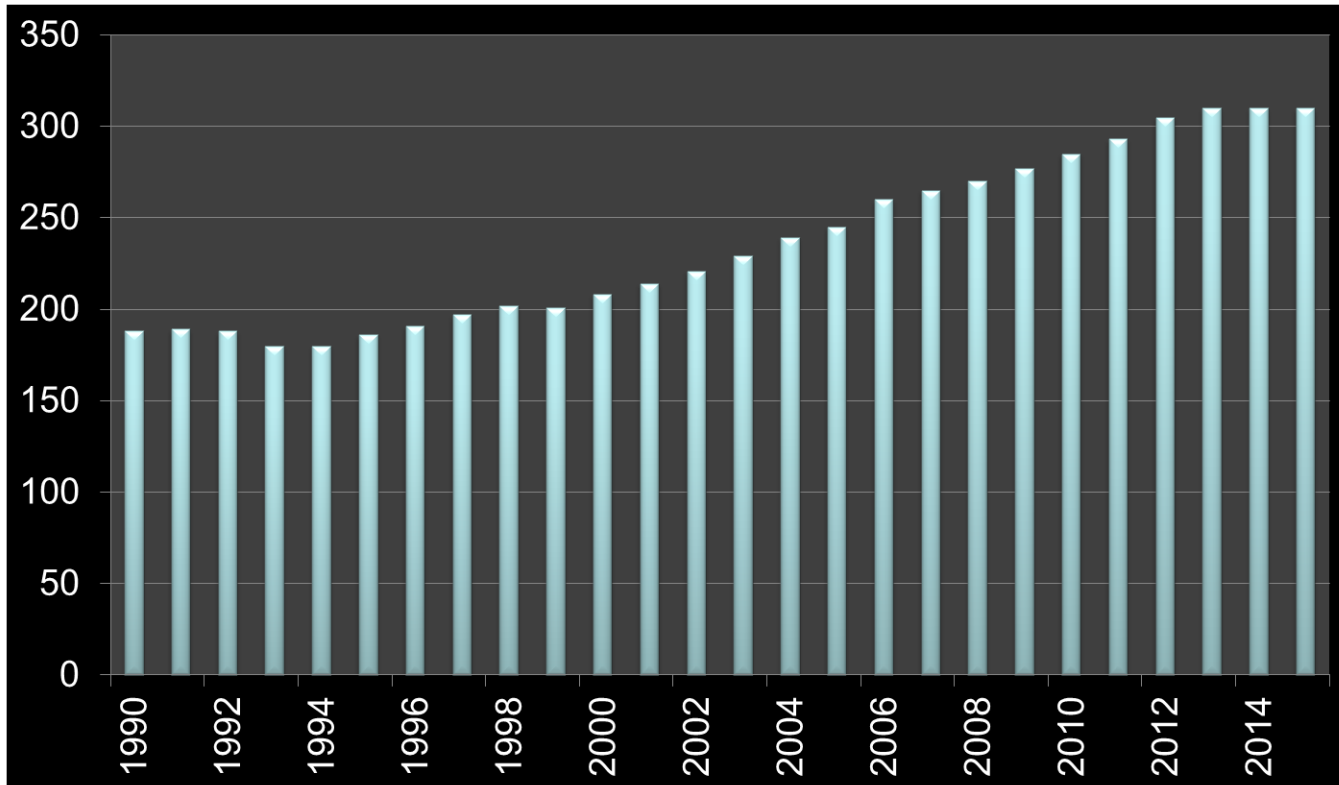
Hani AlKhalifa
President Produced Water Society
Middle East Chapter

- How much water was produced with oil and gas worldwide?

115,000,000,000 BBLs
In GCC

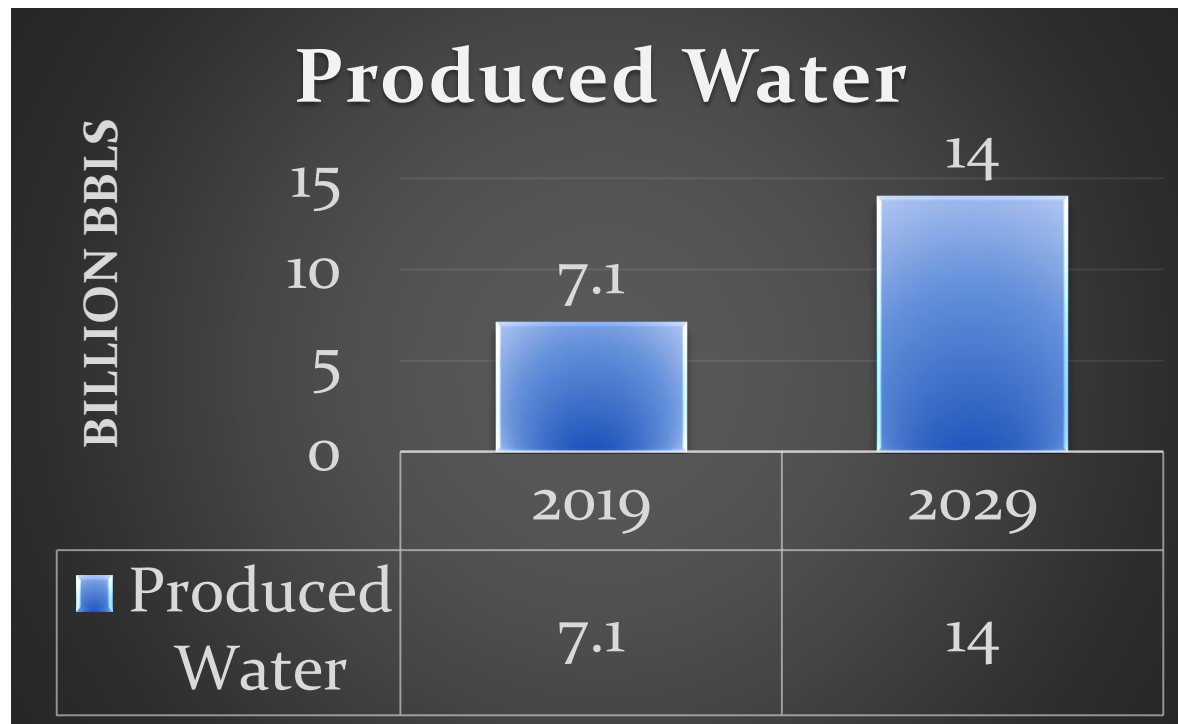
7,000,000,000 BBLs

Produced Water Forecast (MM BBL/D)



EXPLORATION & PRODUCTION - OIL & GAS REVIEW 2007 - OTCED
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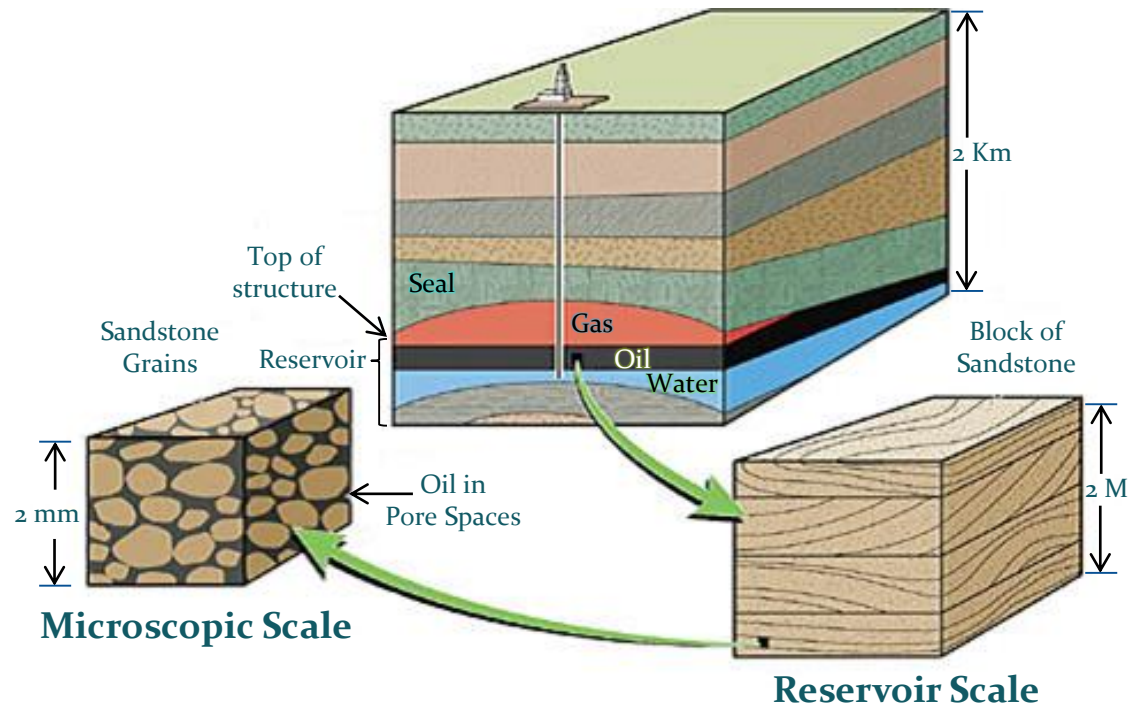
Produced Water In GCC



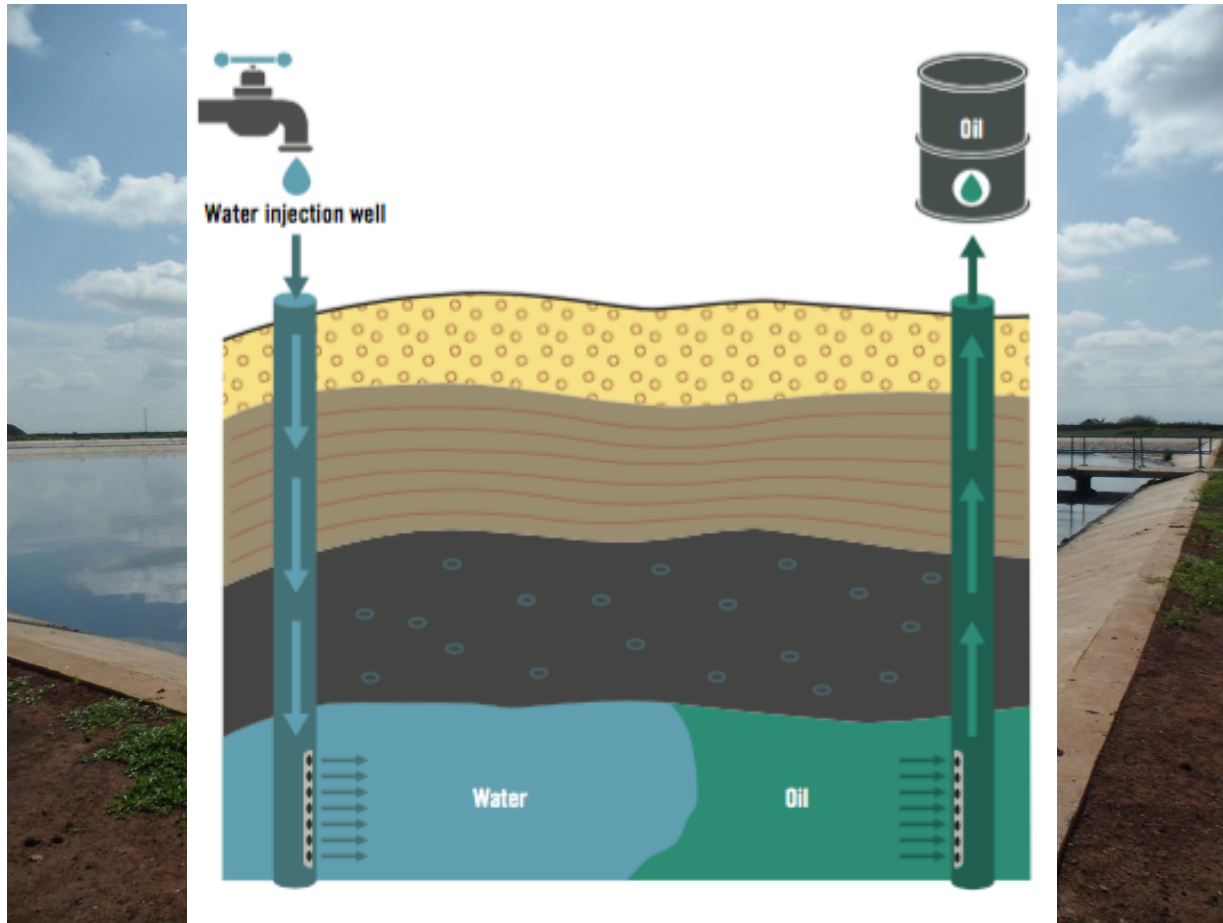
15-25 GWH

Subsurface Water

- Water naturally underlies oil in the reservoir, lifting oil and gas from oil-bearing formations
- Gas rises above oil layer
- Natural reservoir pressure will initially drive oil production
- Later, water is injected to maintain reservoir pressure and move oil toward production wells

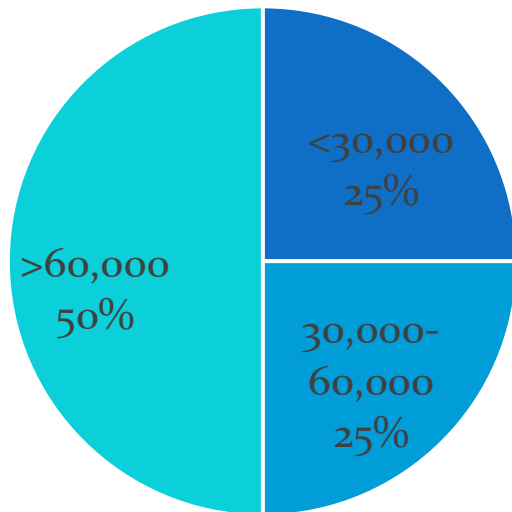


What Do We Do With It?



Produced Water Characteristics

Produced Water Salinity



Oil Greases

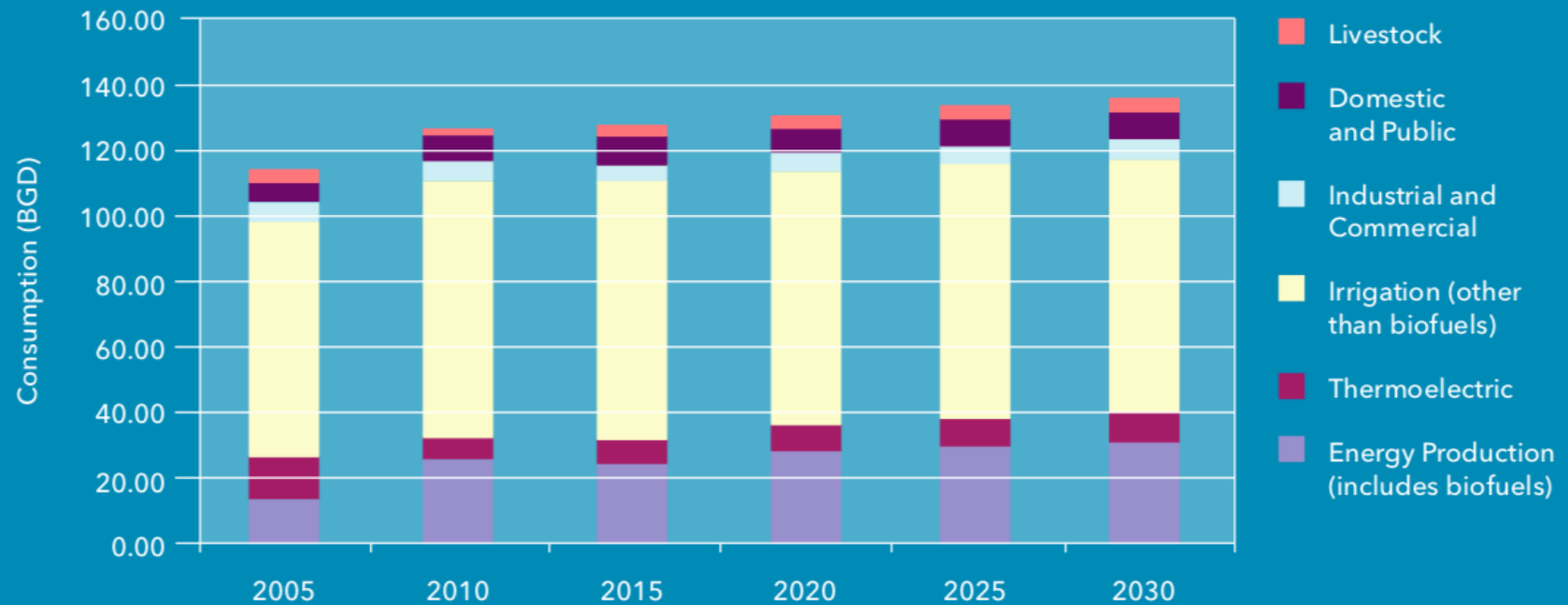
- Free Oil
- Dissolved Hydrocarbon

Dissolved Solids

- Calcium Carbonate
- Calcium Sulfate
- Iron Sulfide
- Barium
- Strontium

Fresh Water Consumption in Oil and Gas Operations

Figure 1: Project Trends in Water Consumption



Fresh Water Uses in Oil and Gas



Primary Recovery



Secondary EOR

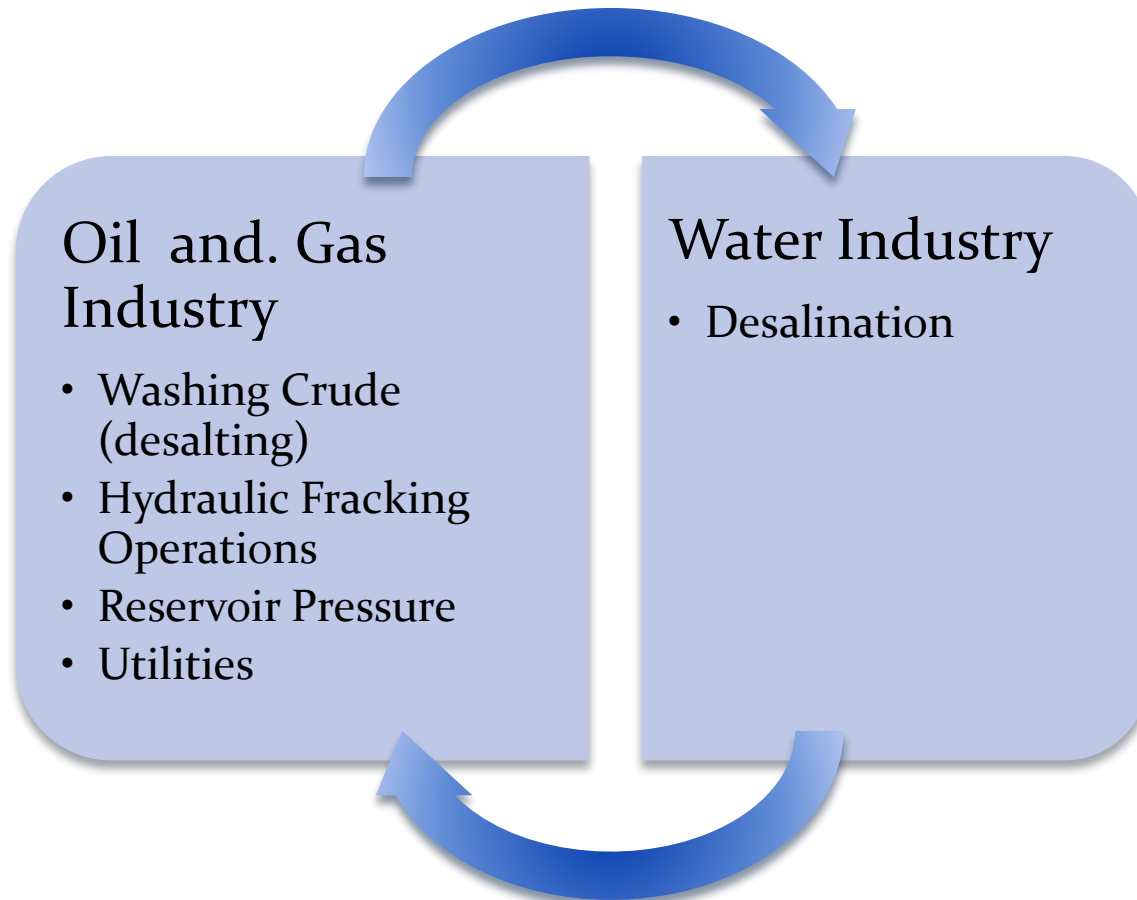


Crude Washing



Fracking Operations

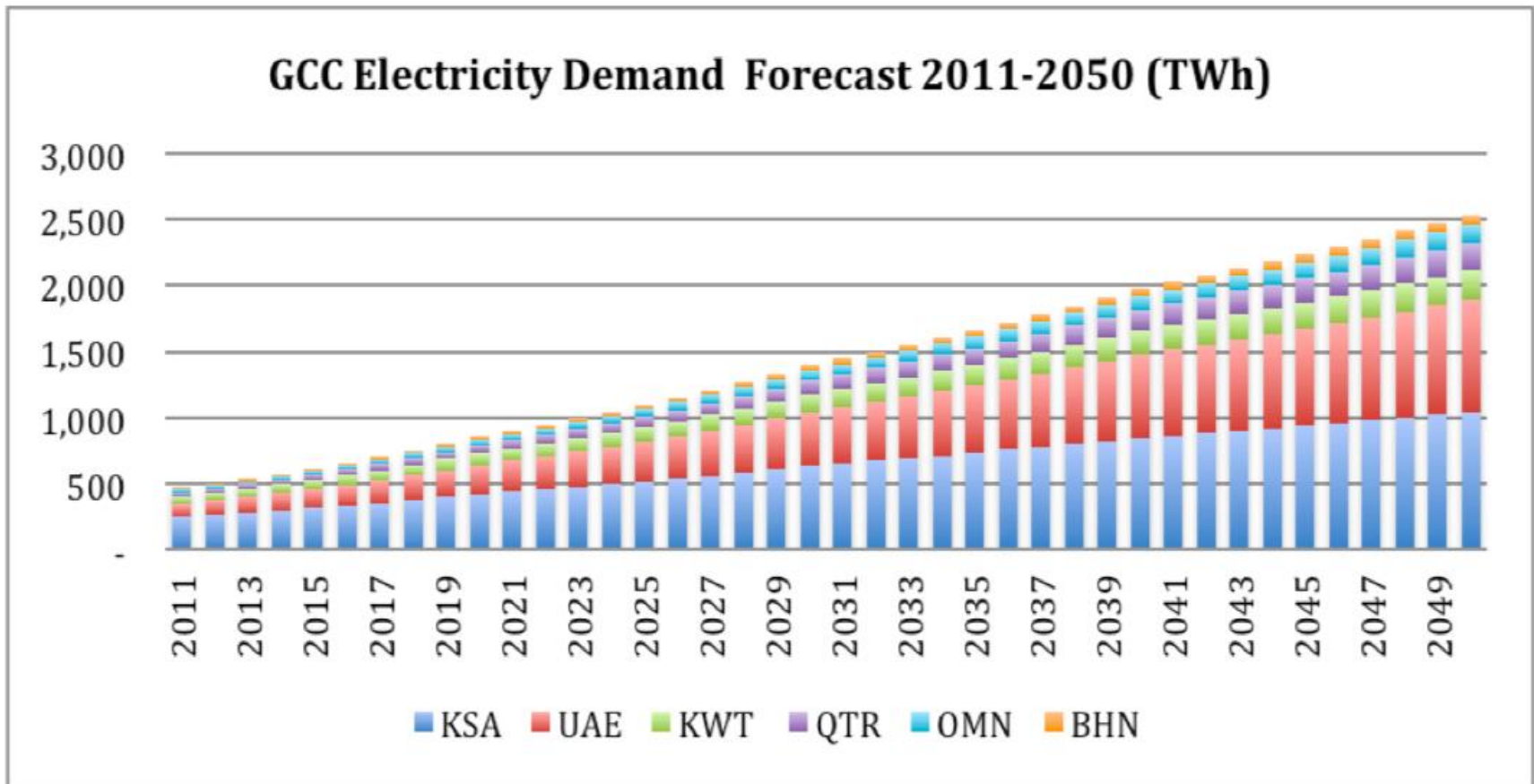
Oil and Gas and Water Industries



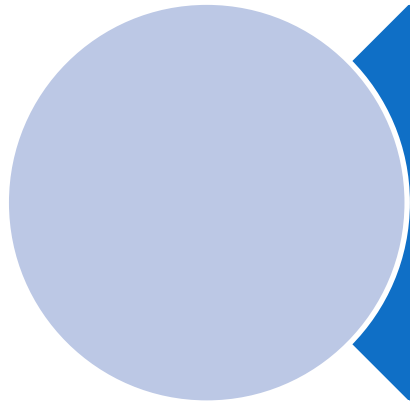
Water Desalination in GCC

| | Number of Desalination Plants | Capacity (GI per day) | % Share of the world capacity |
|------------|--|----------------------------------|--|
| KSA | 128 | 12.5 | 17% |
| UAE | 98 | 9.5 | 12% |
| KWT | 24 | 1.7 | 4% |
| QTR | 13 | 1.9 | 2% |
| OMN | 19 | 1.6 | 2% |
| BHN | 12 | 1.4 | 2% |

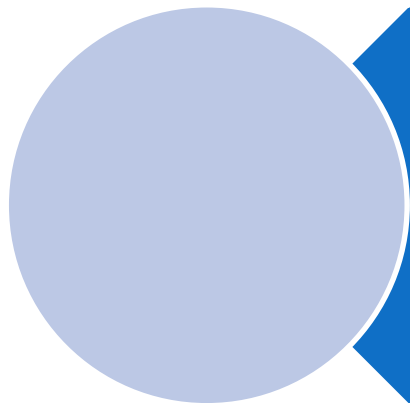
GCC Electricity Demand



Oil and Gas Industry Role

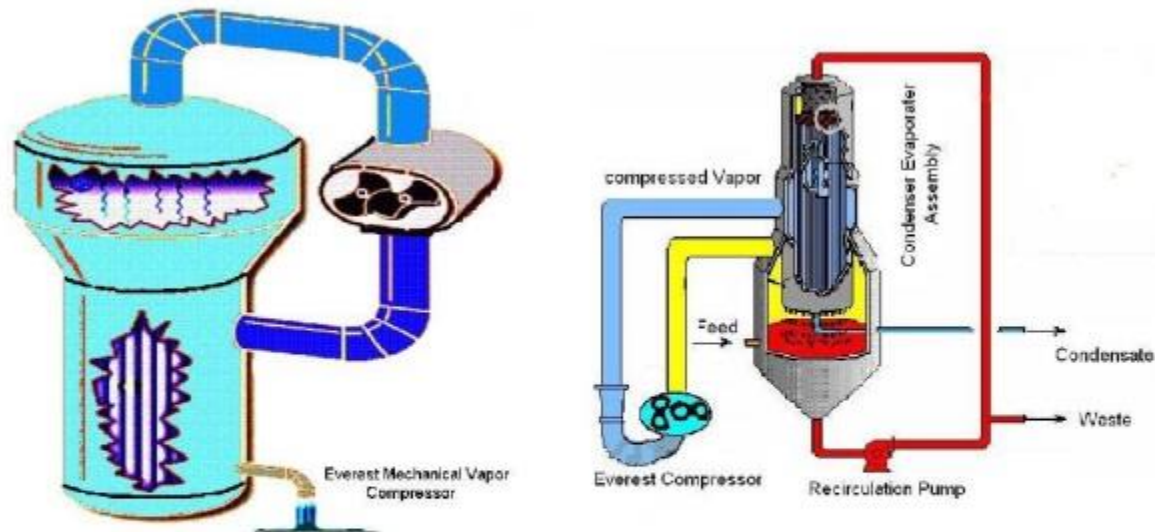


Reduce Fresh Water
Consumption



Treat Produced
Water for Alternative
Uses

Produced Water Desalination



**Fig. 4: TYPICAL MECHANICAL VAPOR
RECOMPRESSION CYCLE**

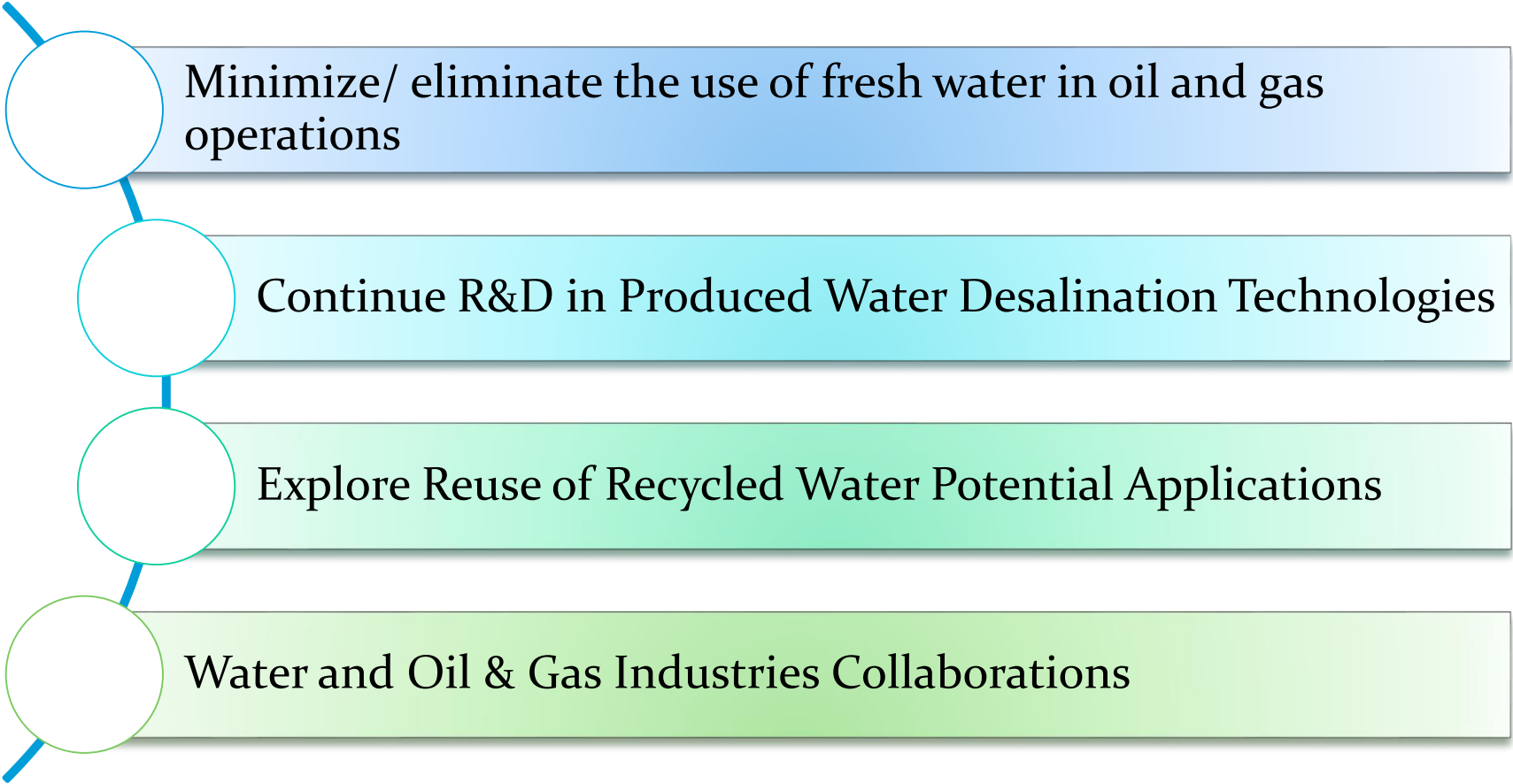
Nimir Project



Potential Uses of Produced Water

- Irrigation
- Desalination
- Cooling Water
- Fresh Water

Path Forward



Minimize/ eliminate the use of fresh water in oil and gas operations

Continue R&D in Produced Water Desalination Technologies

Explore Reuse of Recycled Water Potential Applications

Water and Oil & Gas Industries Collaborations



Thank You