



# Bridging the Energy-Water Gap in Qatar

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Gas Processing Centre

GPC Consortium members:



- **The Gas Processing Centre (GPC)**
- **Energy Challenge**
- **Energy - Water Connection**
- **Water in the Gas Industry**
- **The Qatar Case**
- **The Way Forward**
- **Conclusions**



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# GPC Grand Vision



- **To be the global leader in gas-processing, research, learning, application, and knowledge management.**
- **Play a key role in realising the 2030 vision of moving Qatar from a hydrocarbon economy to a knowledge based economy**



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# OBJECTIVES

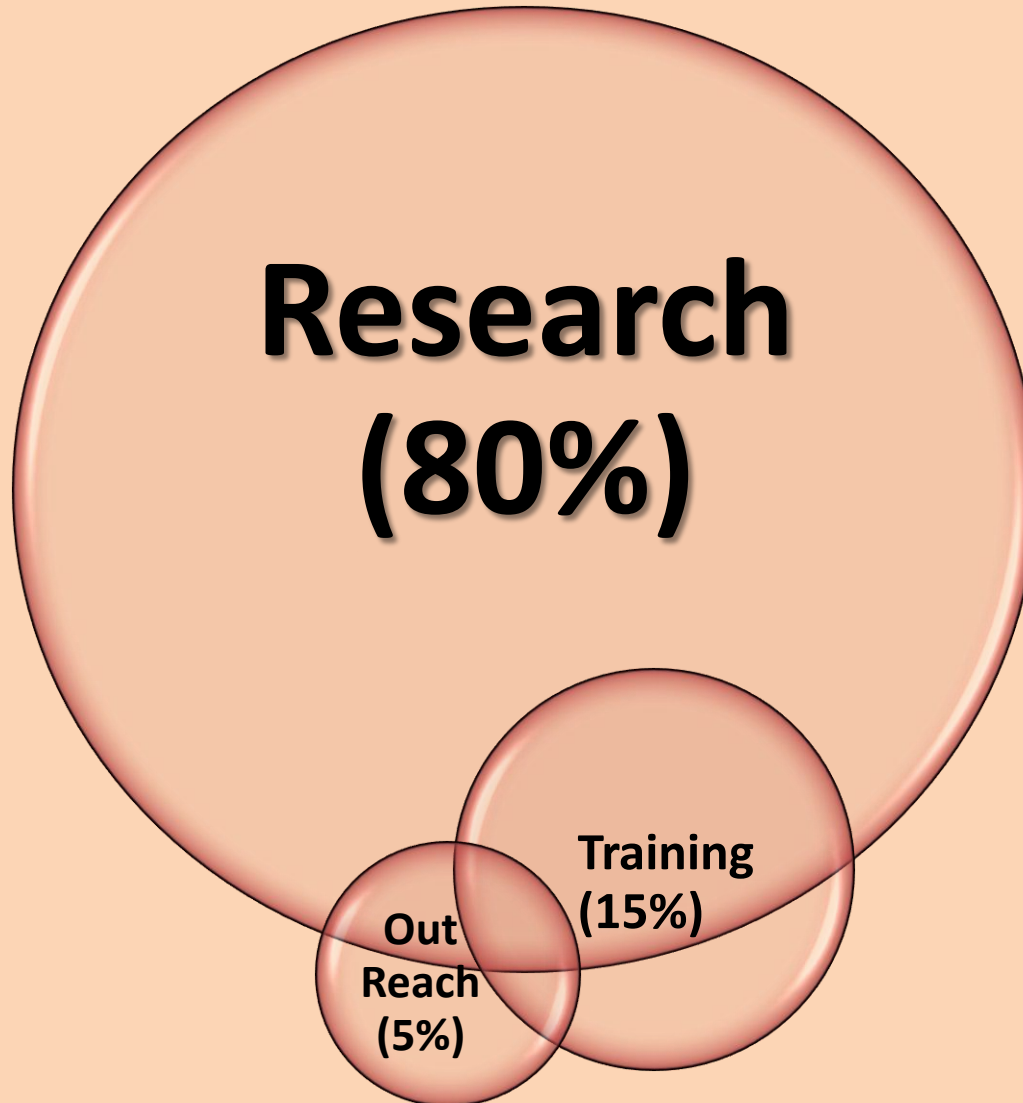
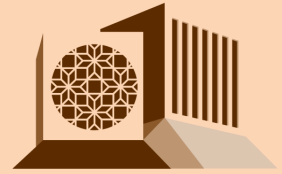


**Conduct research and development in areas pertinent to the consortium members.**

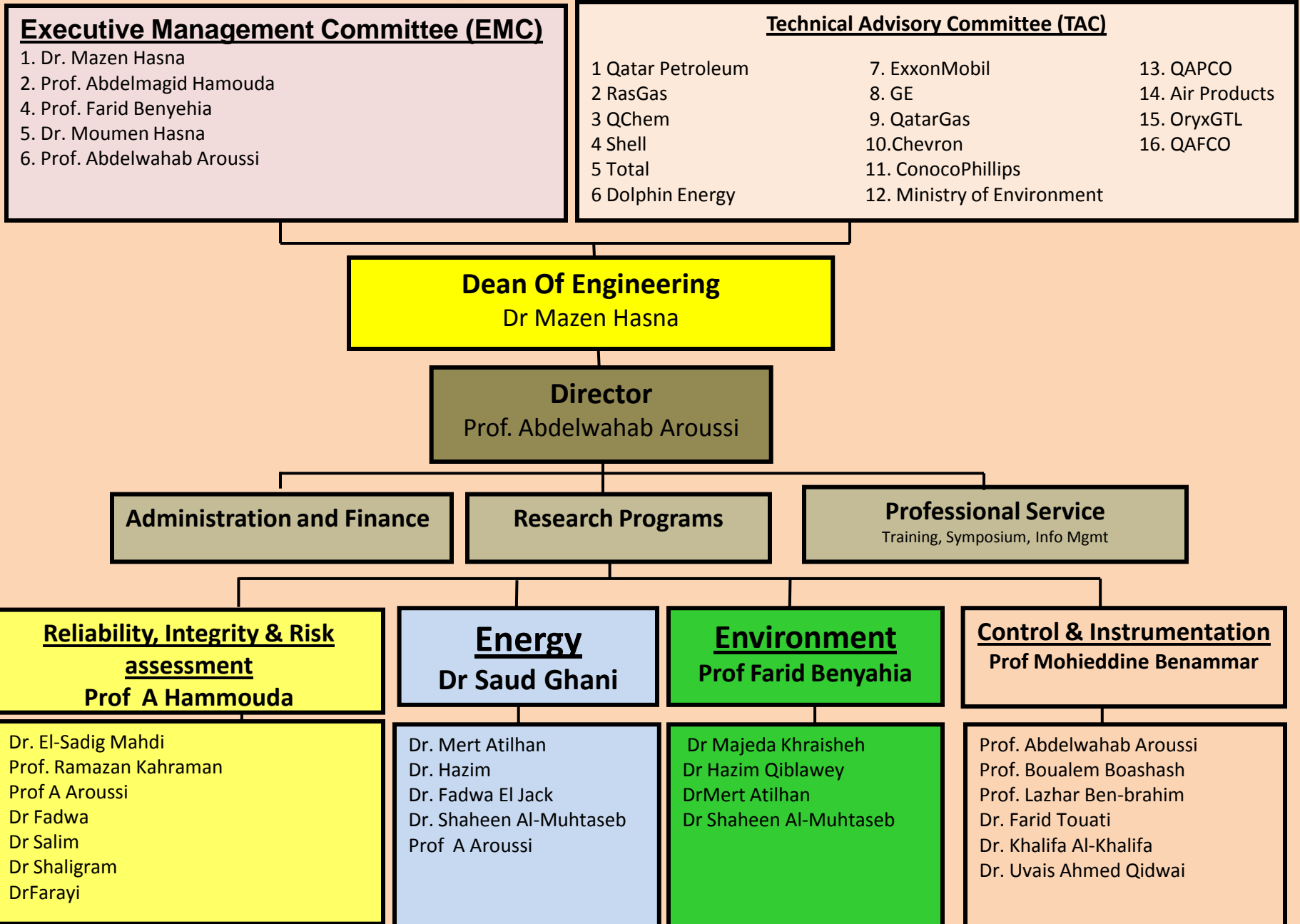
**Stimulate collaborative networks between researchers in QU and beyond, businesses and related public organisations**



# Gas Processing Center Activities



# Organizational Chart



**Carbon Abatement Technologies**

**Industrial wastewater Treatment**

**Gas Hydrates Mitigation**

**Sour Gas Treatment**

- 
- **Industrial Waste Water Treatment**
  - **Produced Water Treatment**
  - **Grey Water Treatment**
  - **Waste Water management**
    - **Reduce Production**
    - **Water Re-use within and externally**



# 3<sup>rd</sup> International Gas Processing Symposium

## 2<sup>nd</sup> Call for Abstracts

March 5 - 7, 2012

Ritz Carlton

Qatar University

Doha, Qatar



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### Overview:



Under the Patronage of His Highness the Heir Apparent of the State of Qatar Sheikh Tamim Bin Hamad Al-Thani, Qatar University's Gas Processing Center is organizing its 3<sup>rd</sup> International Gas Processing Symposium. This symposium is intended to be a primary event in the area of gas processing in the world by attracting international scholars and key industry leaders. The first 2 symposia were held in Doha, QATAR in 2009 and 2010. Feedback from the participants including, industry's managements, engineers, and academics, show satisfaction and enthusiasm for participation in the upcoming meeting. All who attended received the symposia very well and all concurred "that they provided just the right mix of input from industry and academia".

This 3rd International Gas Processing Symposium will include plenary sessions presented by key industrial senior management, keynote speakers, technical sessions, and paper presentations. In addition, there will be pre-symposium workshops and post symposium trips to Qatari Industrial Cities known to host the biggest production trains in the world. For more information about the Gas Processing Center please visit:

<https://www.gasprocessingcenter.com>

or

## 2<sup>nd</sup> International Conference on

### Desalination and Environment:

### A Water Summit

### Doha, Qatar, 2013





# World energy demand is expected to double by 2050

## Competing factors:

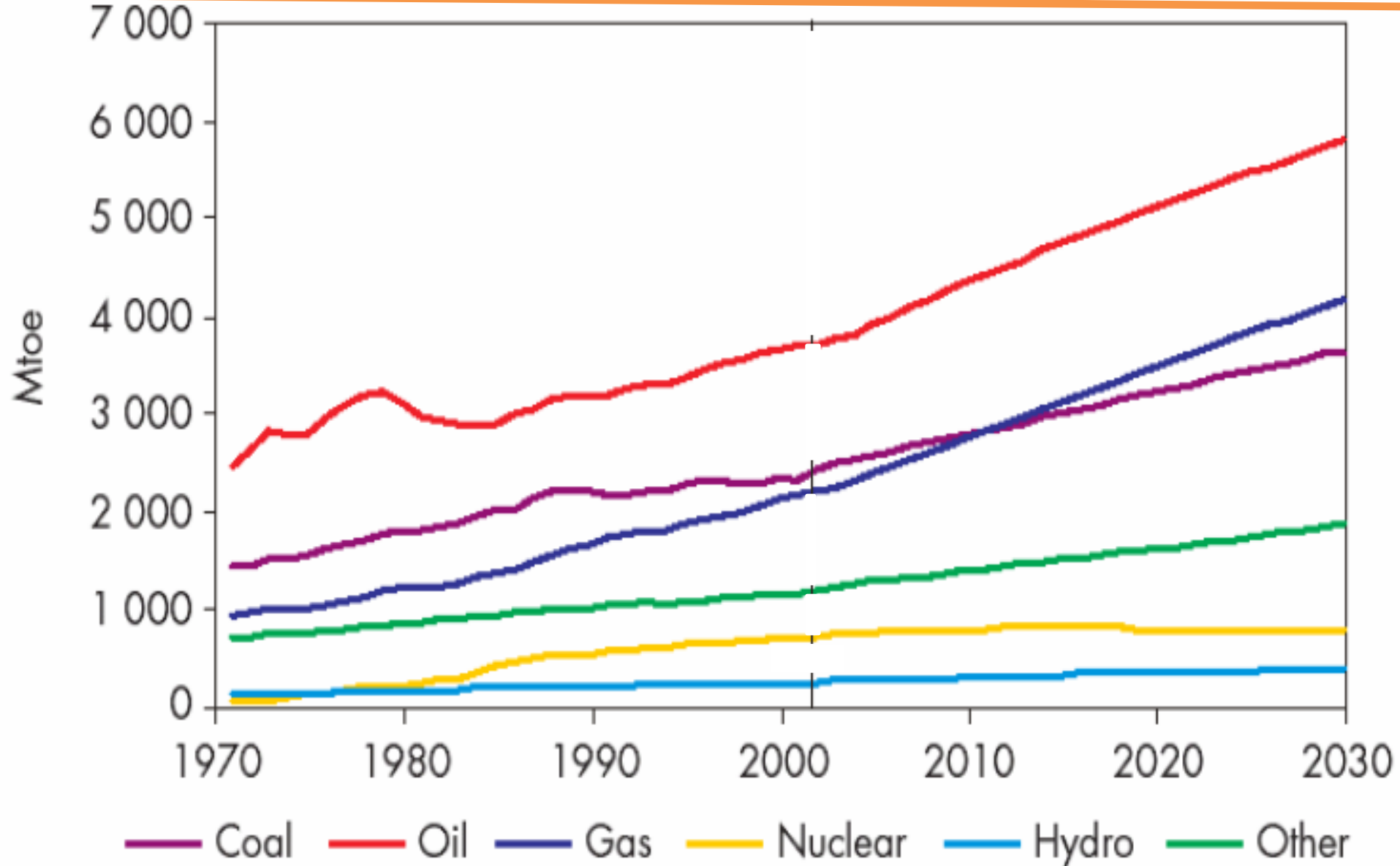
- Rising demand
- Depletion of conventional supply stocks
- Environmental and social effects



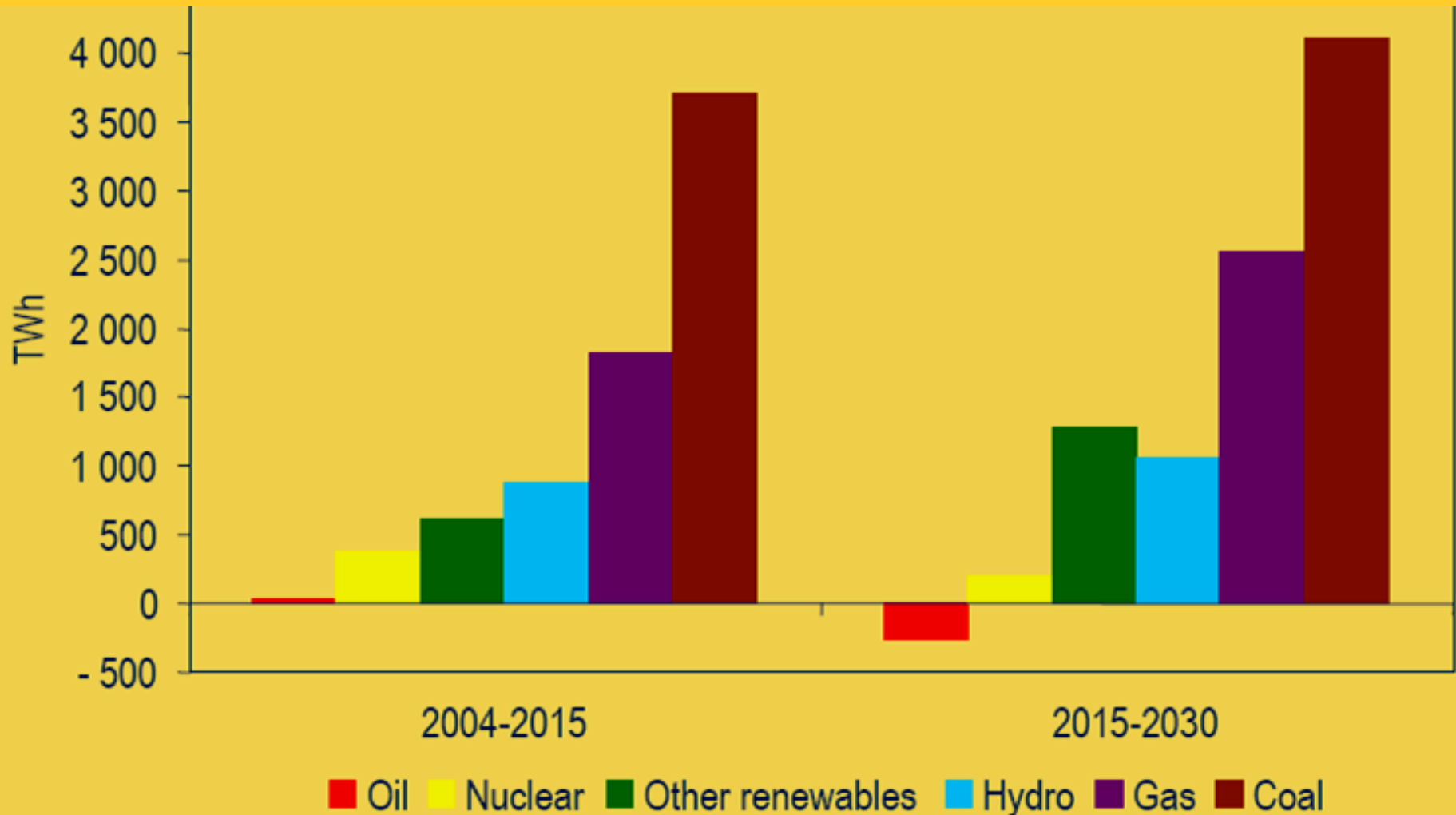
# WORLD ENERGY CONSUMPTION



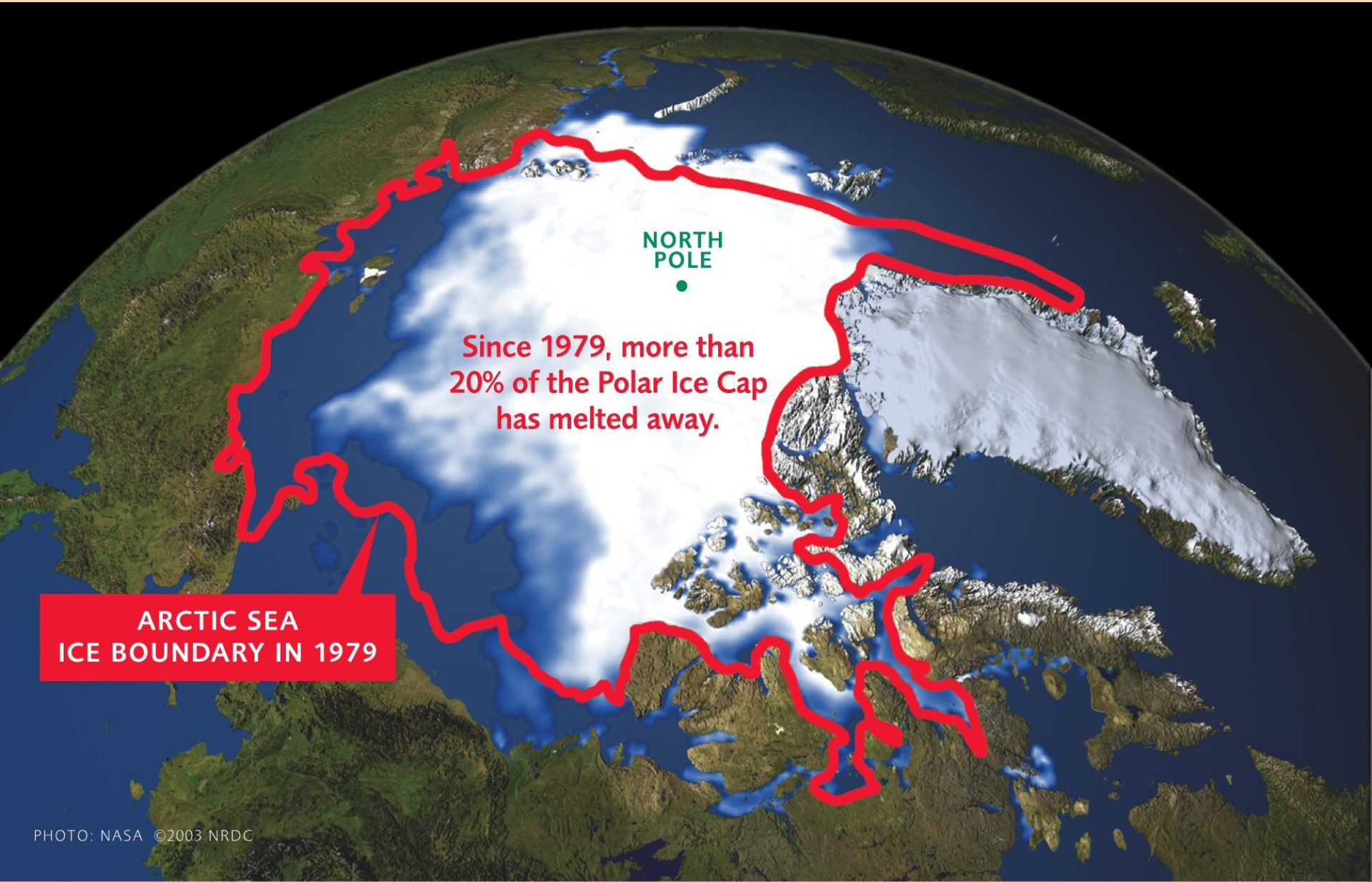
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Most of the additional demand for electricity is expected to be met by coal which remains the largest source of electricity



# Global Warming is a Reality



NORTH  
POLE

Since 1979, more than  
20% of the Polar Ice Cap  
has melted away.

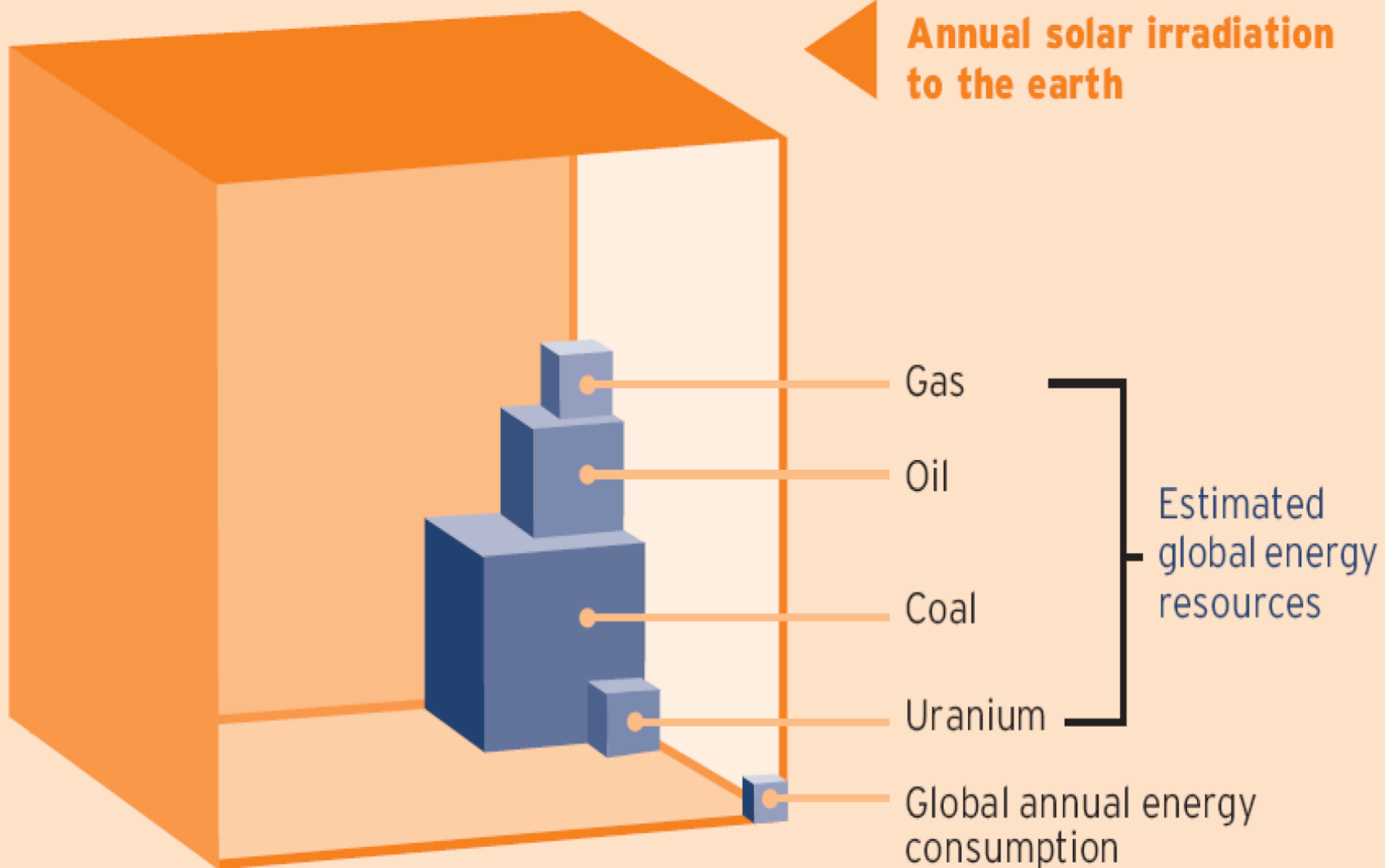
ARCTIC SEA  
ICE BOUNDARY IN 1979



# ENERGY RESOURCES AVAILABLE



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## Known reserves\* :

- Oil : 40 years
- Coal : 230 years
- Natural gas : 70 years
- Uranium : 80 years
- Sun and Wind: 5 Billion years

Our generation should NOW deal with the consequences arising from these figures.



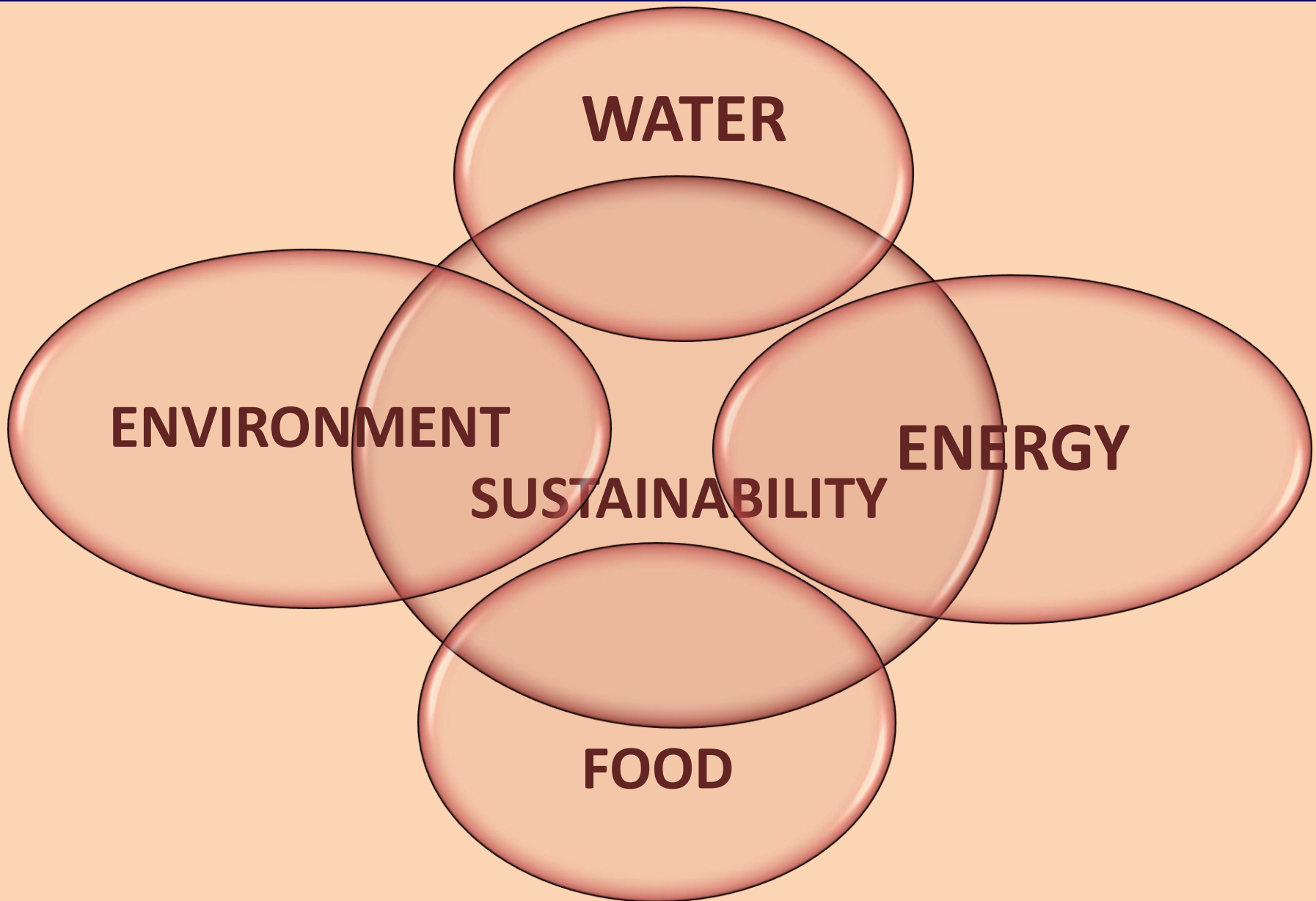
# Humanity's Top Ten Problems Next 50 Years

Richard Smalley, 2003 (1996 Noble Laureate in Chemistry)

- 1. ENERGY**
- 2. WATER**
- 3. FOOD**
- 4. ENVIRONMENT**
- 5. POVERTY**
- 6. TERRORISM & WAR**
- 7. DISEASE**
- 8. EDUCATION**
- 9. DEMOCRACY**
- 10. POPULATION**



**2003 6.3 Billion People**  
**2050 8-10 Billion People**





**In December 2007, energy experts with the International Energy Agency described what it would take to reduce emissions 50 percent by 2050.**

**This is their presentation.**



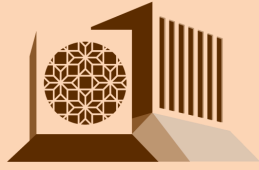
**1. 30 new  
nuclear power  
plants around  
the world.**



1. 30 new nuclear power plants around the world.
2. **17,000 wind turbines**



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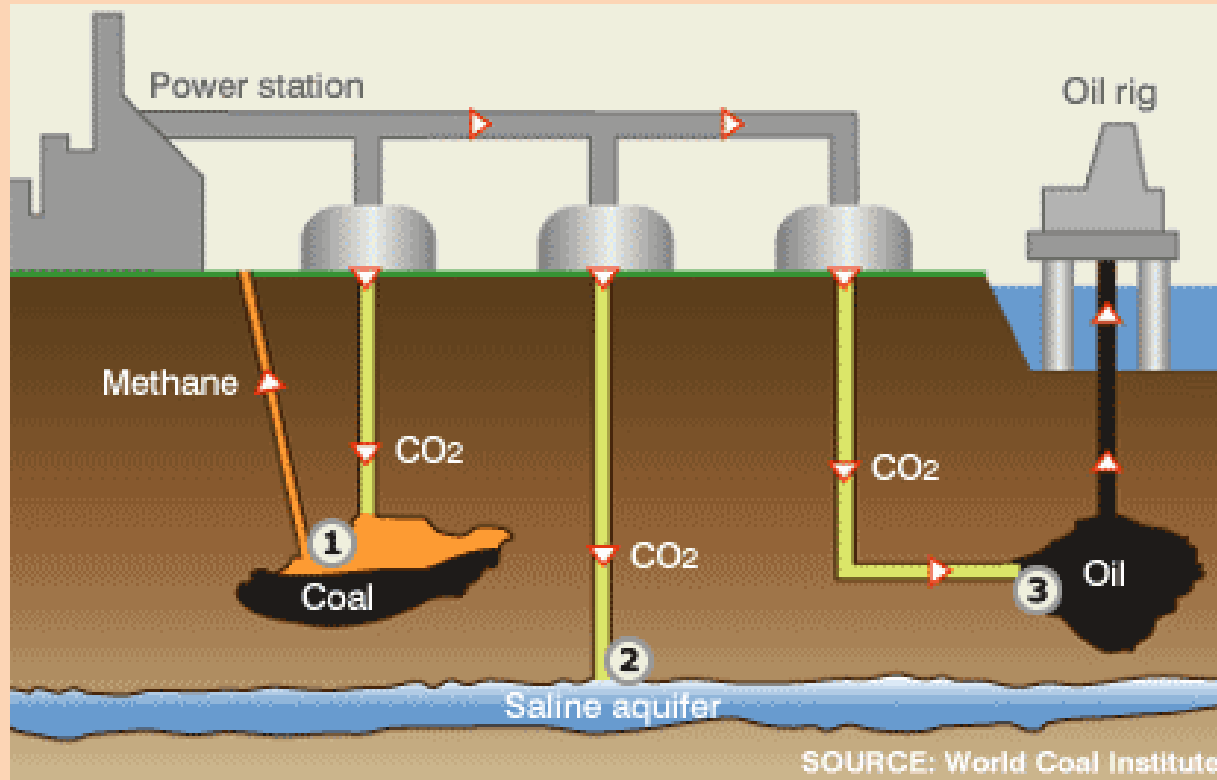


1. 30 new nuclear power plants around the world.
2. 17,000 wind turbines
3. **400 biomass power plants**



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4. **Two dams the size of China's Three Gorges Dam**





1. 30 new nuclear power plants around the world.
2. 17,000 wind turbines
3. 400 biomass power plants
4. Two hydroelectric dams the size of China's Three Gorges Dam
5. **42 coal or natural gas power plants with carbon capture and storage.**



1. 30 new nuclear power plants around the world.
2. 17,000 wind turbines
3. 400 biomass power plants
4. Two hydroelectric dams the size of China's Three Gorges Dam
5. 42 coal or natural gas power plants with carbon capture and storage.

***6. Repeat all of the above every year from 2013 - 2030.***

# Water & Energy

**Water and Energy are interconnected:**

**Energy is needed to make use of Water**

**Water is needed to make use of Energy**

## The QATAR CASE

**Natural Gas Plentiful but Natural Water Scarce**

**99.99% of the freshwater supply comes from  
desalination**

**However, the oil/gas industry generates huge  
amounts of wastewater**

# Produced Water

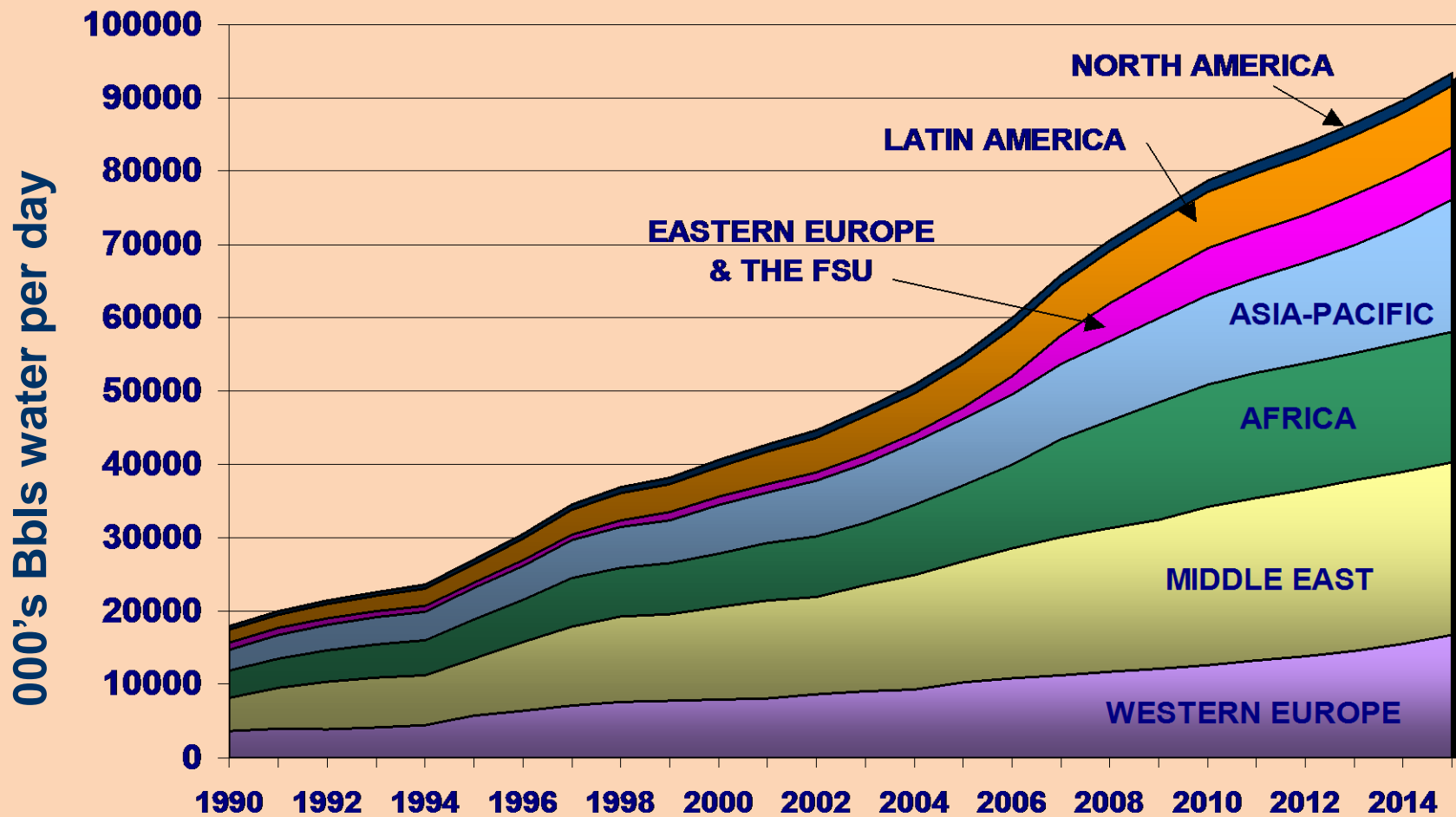
**Produced Water (PW) is water found in the same formations as oil and gas. It increases with the age of the well.**

**It is extracted at the same time and contains chemical characteristics of the reservoir.**

**Wells are shut when the cost of PW is higher than the profit from the fuel produced.**

# PRODUCED WATER

## Offshore produced water indicates significant growth



Large quantities of produced water are generated from oil and gas fields. There is a pressing need to deal with the issue:

- **Reduced oil and gas production**
  - Existing process systems unable to handle increasing water yield
  - Produced water displaces potential oil and gas processing capacity
  - High water outputs are a key driver of wells being shut.
- **Environmental**
  - Increasingly stringent environmental regulations

**PW constitutes the industry's most important waste stream. Its management include:**

- Reduce PW production through use of blockers or downhole water separators.**
- Treat and re-inject for enhanced recovery**
- Treat and discharge**
- Treat and re-use in operations such as drilling**
- Treat and use in irrigation, animal consumption or even drinking water**



## PW treatment include:

- De-Oiling
- Soluble organics removal
- Disinfection (remove bacteria, algae etc)
- Suspended Solids removal (sand, particles ..)
- Dissolved gas removal such CO<sub>2</sub> and H<sub>2</sub>S
- Desalination and demineralisation
- Softening
- Sodium Adsorption Ratio (SAR) adjustment by addition of Calcium or Magnesium ions.

**There is a natural alliance between these two sectors based on mutually beneficial water management issues.**

- **One Produces Huge quantities of unwanted water**
- **The other needs large quantities of low grade water to function**

**Table ( 2 ) Chemical Limitations for Mixing Water**

Qatar Construction Specifications QCS 2007 Section 5(4) and Preliminary Approved Modifications.

Parameter	QCS 2007 Test Method	New PRELIMINARY Approved QCS Test Method	QCS Maximum Limit, mg/	New PRELIMINARY Approved QCS Maximum Limit, mg/l
(a) Chloride (as Cl) (a-1) for Pre-stressed concrete. (a-2) for reinforced concrete. (a-3) for concrete without reinforcement.	BS 1377 : Part 3	EN 196-2	500	500 1000 4500
(b) Sulfates (as $SO_4^{2-}$ )	BS 1377 : Part 3	EN 196-2	1000	2000
(c) Alkali (c-1) Alkali carbonates and bicarbonates (c-2) Alkali equivalent sodium oxides	BS 2690 : Part 109	BS 6068-2.51 BS EN ISO 9963-1 BS EN ISO 9963-2	500	500 1500
(d) Total dissolved ions, including a, b and c above (d-1) for pre-stressed concrete (d-2) reinforced concrete. (d-3) for concrete without reinforcement.	BS 1377 : Part 3	EN 196-2 BS 1377 : Part 3	2000	1000 2000 5000
(e) pH	BS 2690 : Part 5	BS 6068-2.50	7 - 9	6.5 - 9.0
COD		SM 5220 B		100
Phosphate; expressed as $PO_4 - P$		SM 4500 P B, C, SM 4500 PD by subtraction		30
Nitrate; expressed as $NO_3^- -N$		ISO 7890-1		100
Lead; expressed as $Pb^{2+}$		SM 3125B (ICP/MS)		100
Zinc; expressed as $Zn^{2+}$		SM 3125B (ICP/MS)		100

**There are other natural alliances on water issues including**

- **Transport**
- **Landscaping**
- **De-dusting**
- **Irrigation**
- **Cooling (Heat exchangers)**



# Conclusions

- **Produced water challenge to the oil and gas industries worldwide is real**
- **Develop strategic alliances between different sectors with complimentary needs, services and products.**
- **Creative and integral PW management system that is cost effective, environmentally sound, responsible and sustainable becomes a necessity**
- **The right mix of policies to address both energy and water security as well as climate concern depends on the balance of costs and benefits, which vary among countries**
- **Promote energy efficiency should be priority – not only will contribute to reduce GHG emissions but it will also reduce the investment needs to meet rising demand for energy services.**



# Conclusions

- Many of the policies to alleviate energy insecurity could also help to mitigate climate change.
- The right mix of policies to address both energy and water security as well as climate concern depends on the balance of costs and benefits, which vary among countries
- Promote energy efficiency should be priority – not only will contribute to reduce GHG emissions but it will also reduce the investment needs to meet rising demand for energy services.
- Integrated oil and gas: oil companies could be part of the solution to climate change, through the development of clean hydrocarbons, and possible participation in development of CO<sub>2</sub> sequestration technology

**“The world has enough  
resources for everyone's  
need - but not enough  
for everyone's greed”**

**Mahatma Gandhi**



Ted Trainer

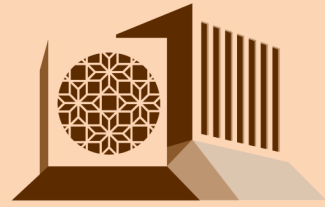
# Renewable Energy Cannot Sustain a Consumer Society



Springer

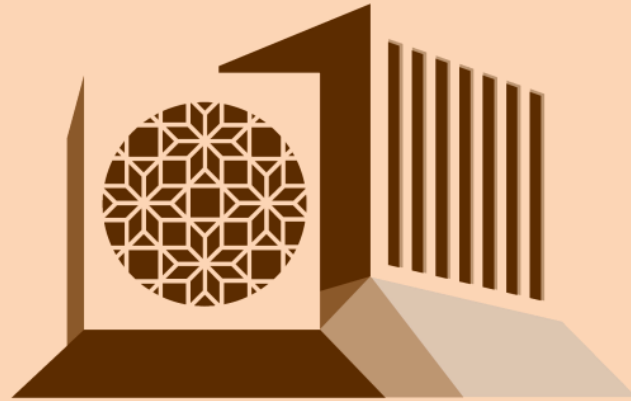


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# Thank You



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## US Environmental Protection Agency (USEPA) Produced Water Effluent Limitations

- Produced water discharge must meet both a daily maximum of 42 mg/L and a monthly average of 29 mg/L of oil and grease
- Sample type shall be either grab or a 24-hr composite which consistent of the arithmetic average of the result of 4 grab samples taken over a 24-hr period
- Samples shall be collected prior to the addition of any seawater to the produced water stream.



## European Legislation

**Produced water for offshore is based on the Paris Commission (PARCOM) standard target**

**Average Oil Contents of discharged PW to within the range of 30-50 ppm (using oil separation system)**

**PARCOM Recommendation**

**“Each national authority should set limit on the total amount of waste water permitted to be discharged from each platform. This limit should be fixed for each platform individually, taking into account its own treatment capacity”**