



Keynote Water-Energy-Food Nexus

Hani Sewilam

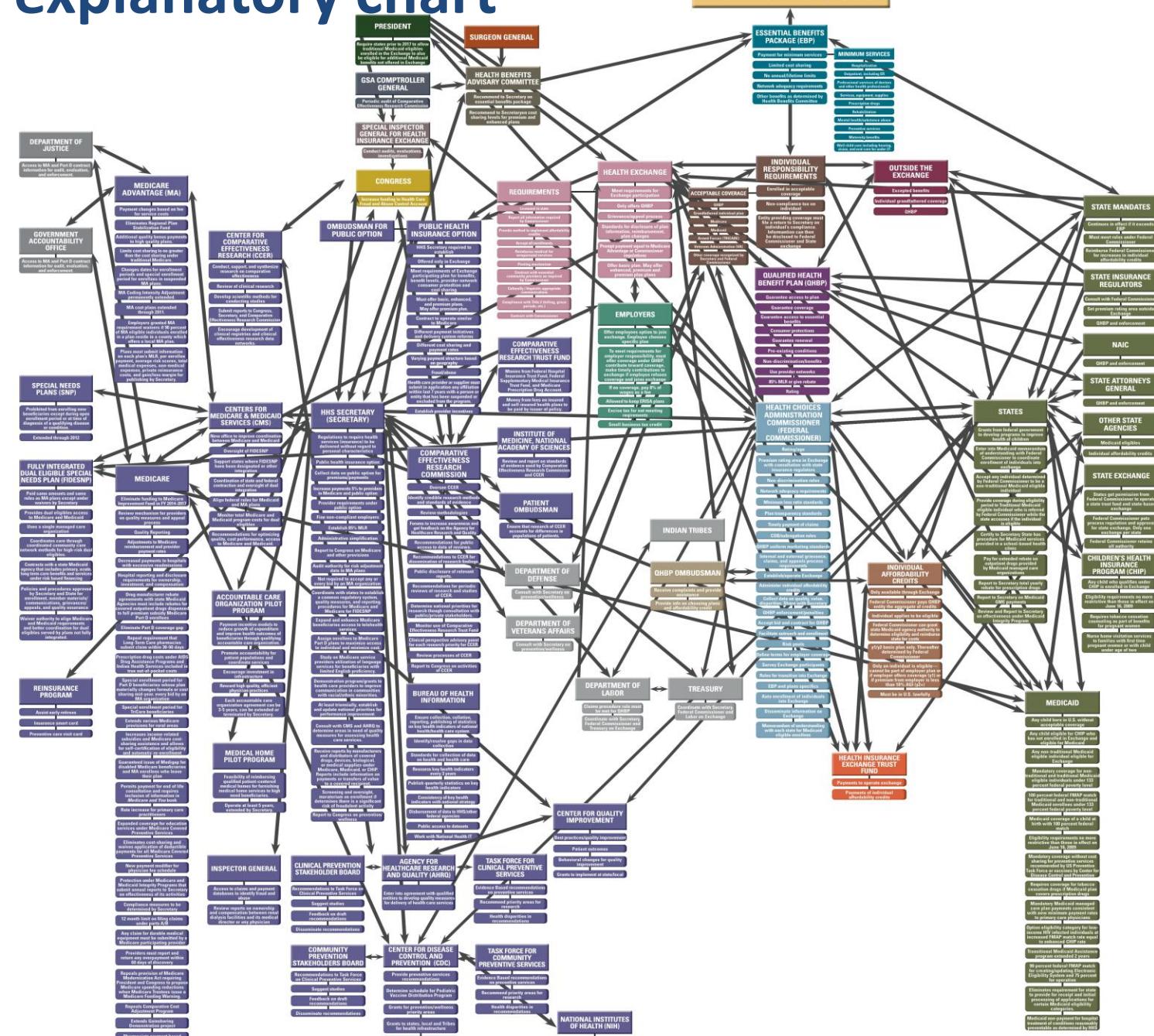
Professor & Director,
The Center for Sustainable Development
The American University in Cairo
Egypt

Self-explanatory chart

Water
Energy
Food
Nexus



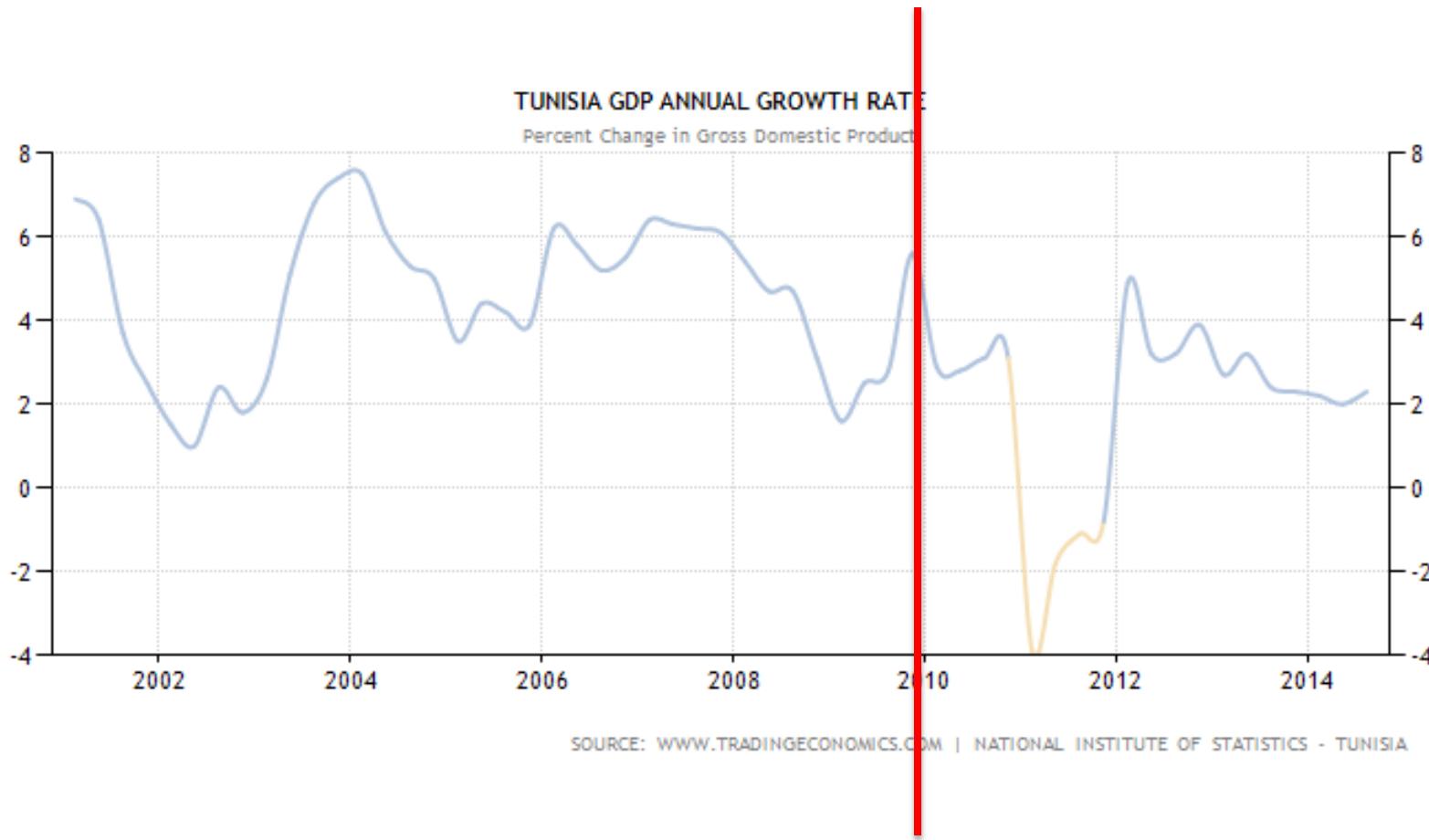
HEALTH INSURANCE PLANS





What is Development?

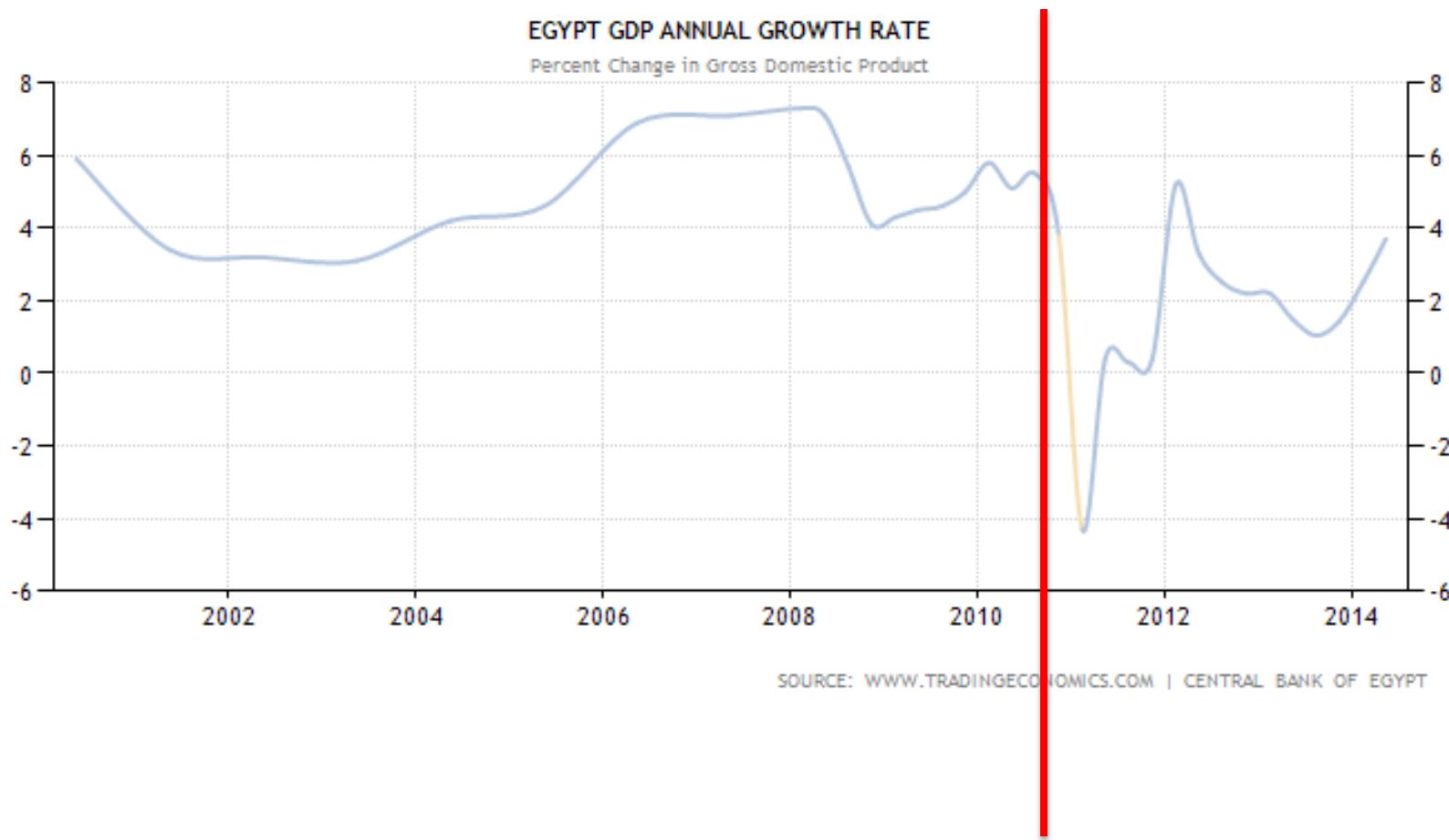
GDP – Growth Rate in Tunisia





What is Development?

GDP – Growth Rate in Egypt





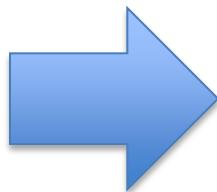
GDP in Egypt

2001	2002	2003	2004	2005	2006	2007	2008
3.5%	3.2%	3.2%	4.1%	4.5%	6.8%	7.1%	7.2%
2009	2010	2011	2012				
4.7%	5.1%	1.8%	1.5%				

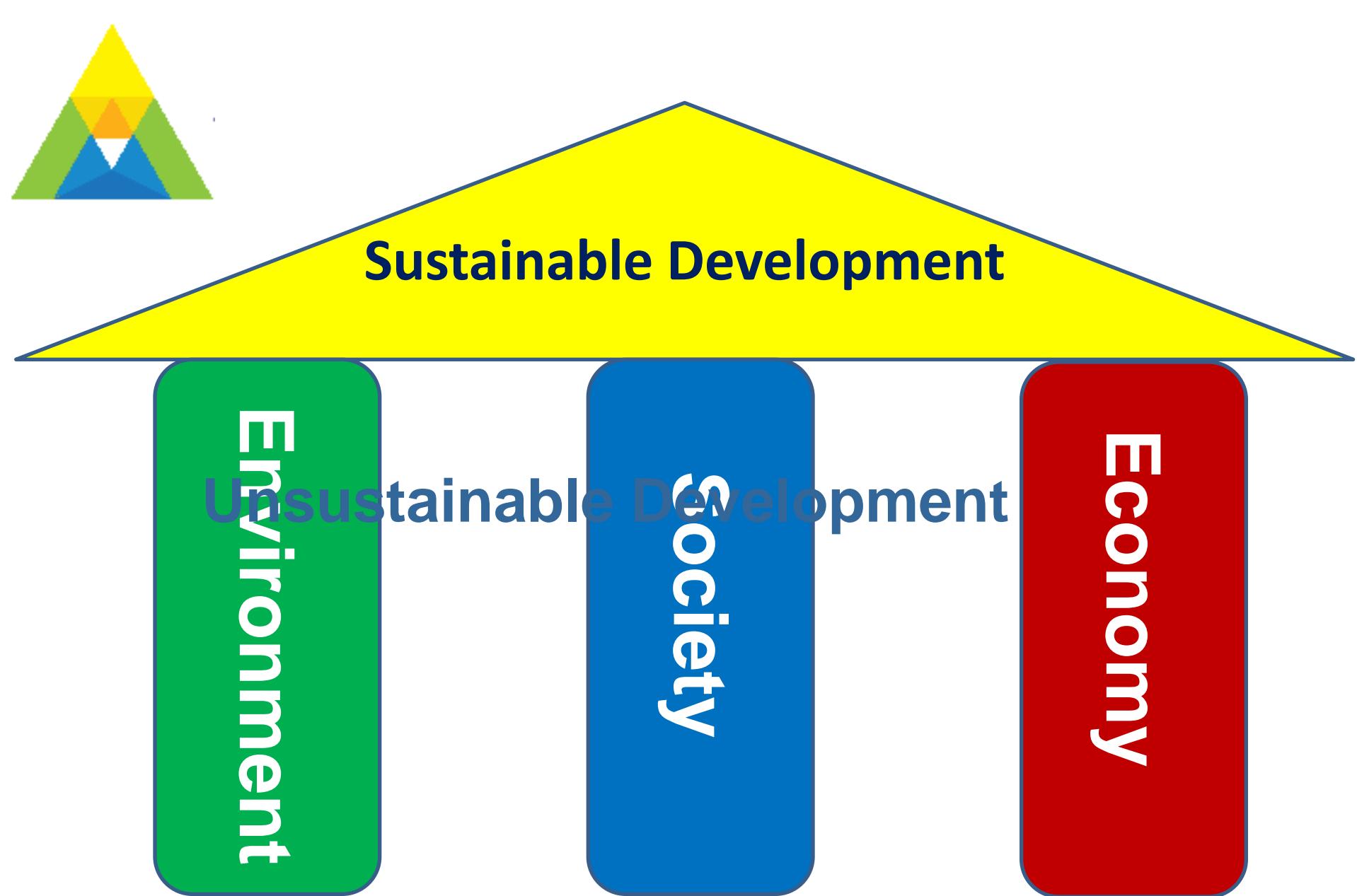
GDP is calculated as the value of the total final output of all goods and services produced in a single year within a country's boundaries.



Economic Growth



- Food Security
- Health Services
- Education Services
- Employment Opportunities
- Environmental Protection







Food



Food security

“Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe, and nutritious food which meets their dietary needs and food preferences for an active and healthy life”

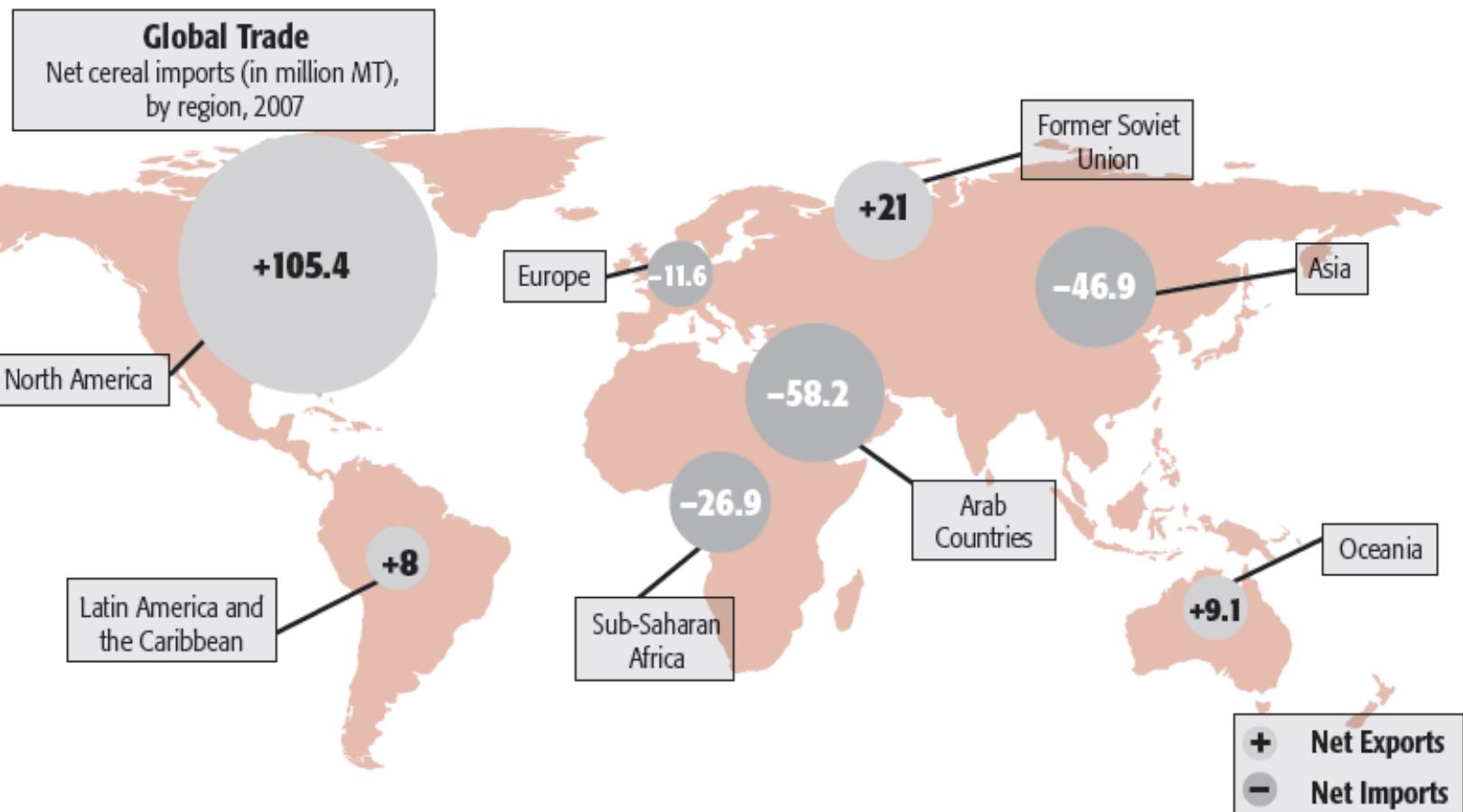
(World Food Summit, Rome, 1996).



- ***Food availability:*** sufficient quantities
- ***Food access:*** accessible by individuals
- ***Utilization:*** adequate diet, clean water, sanitation and health services
- ***Stability:*** accessibility over time

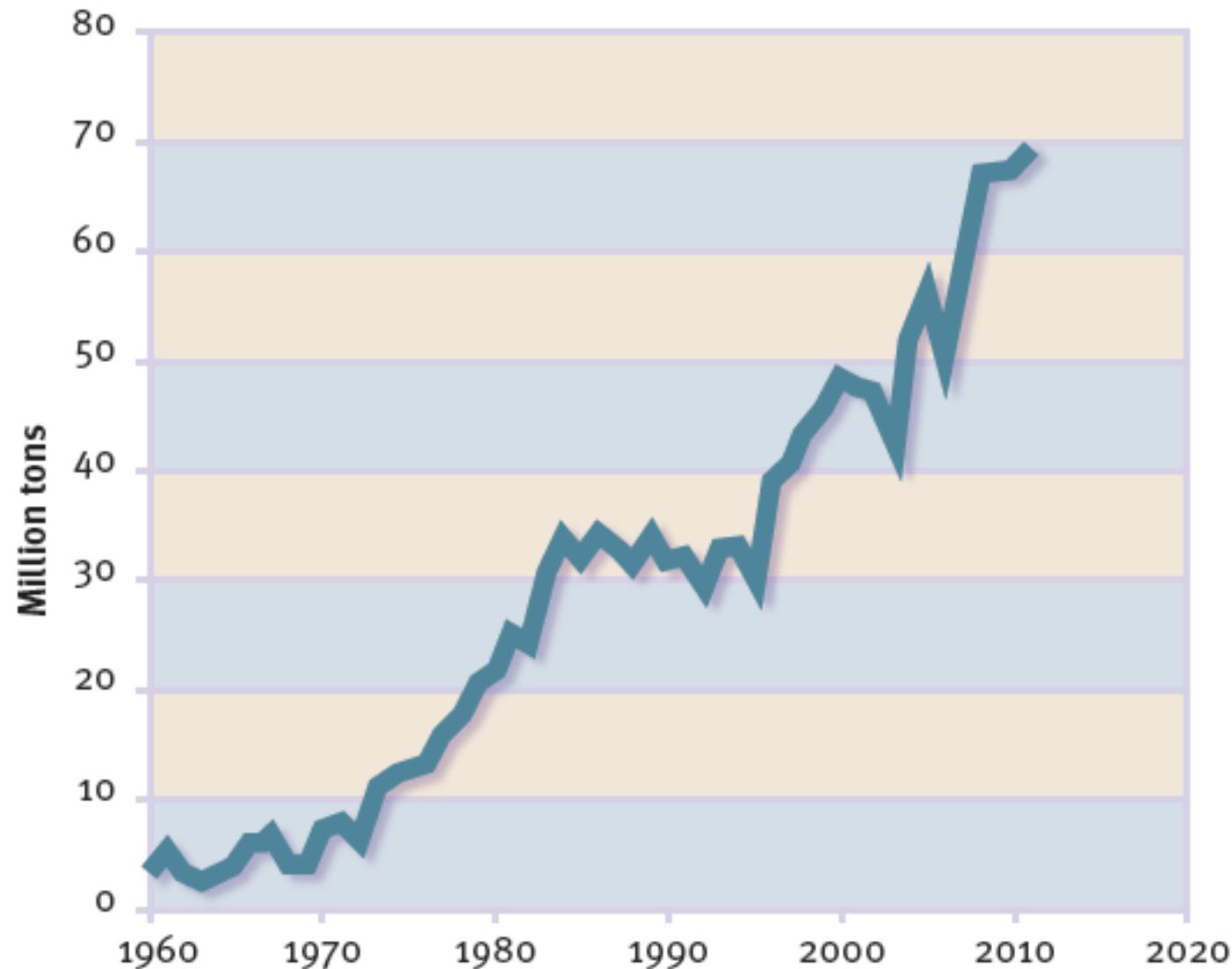


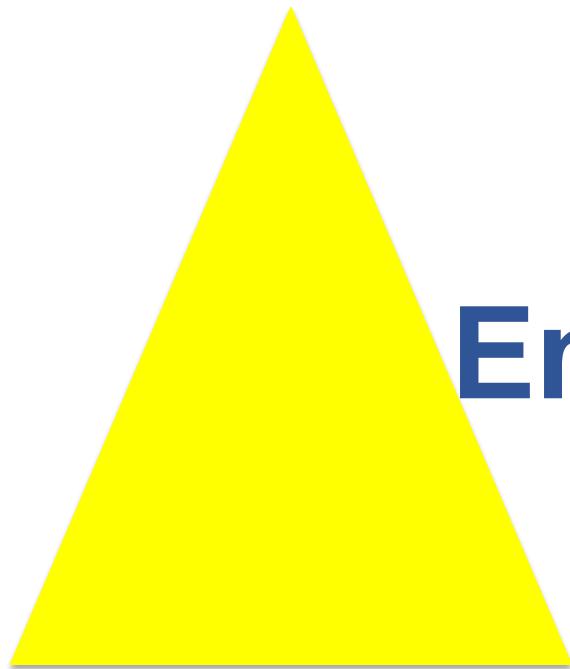
Arab Countries Are the Largest Net Importers of Cereal in the World





Net grain imports to the Arab Middle East and North Africa, 1960–2011



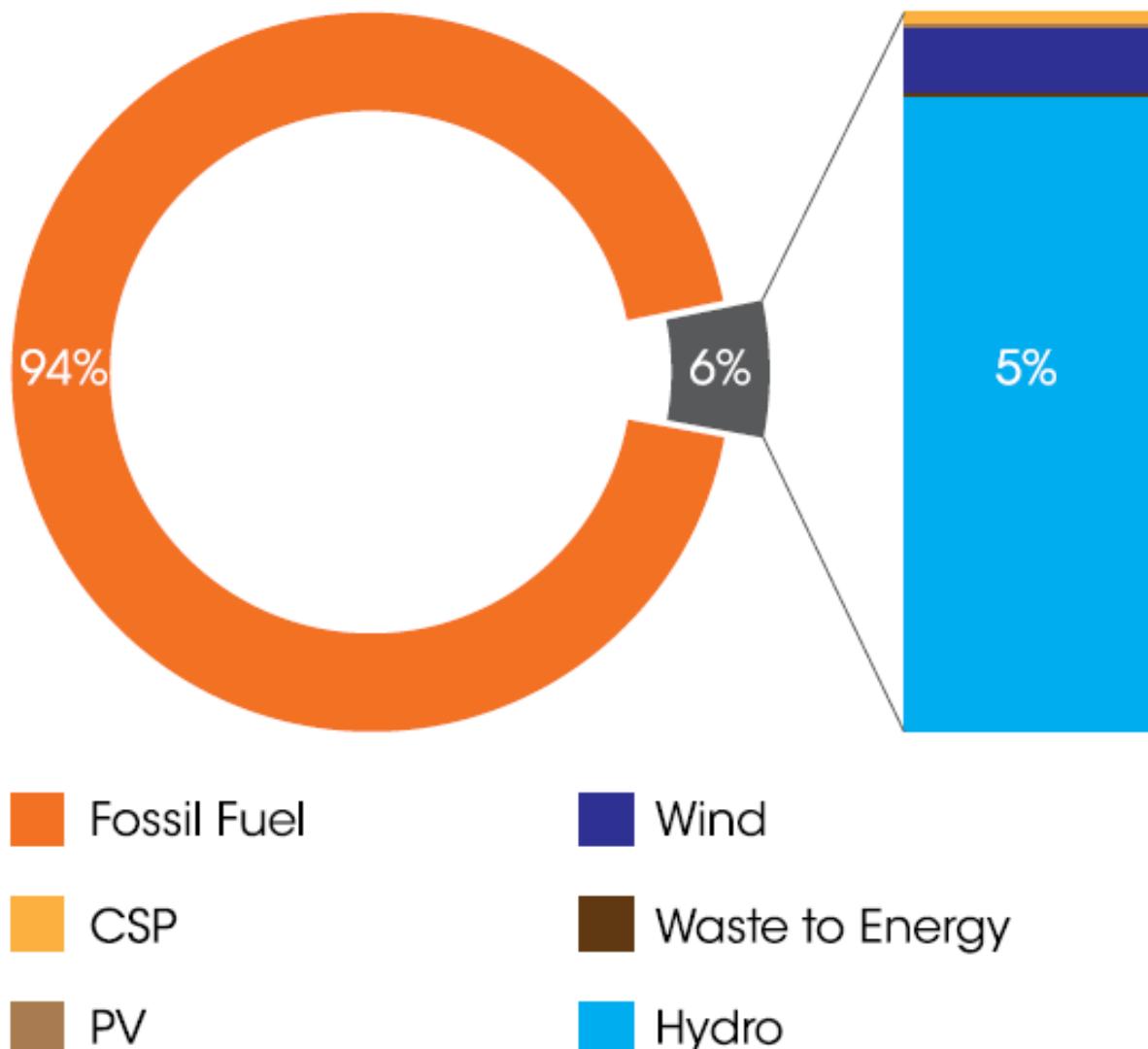


Energy



Energy in the Arab Region

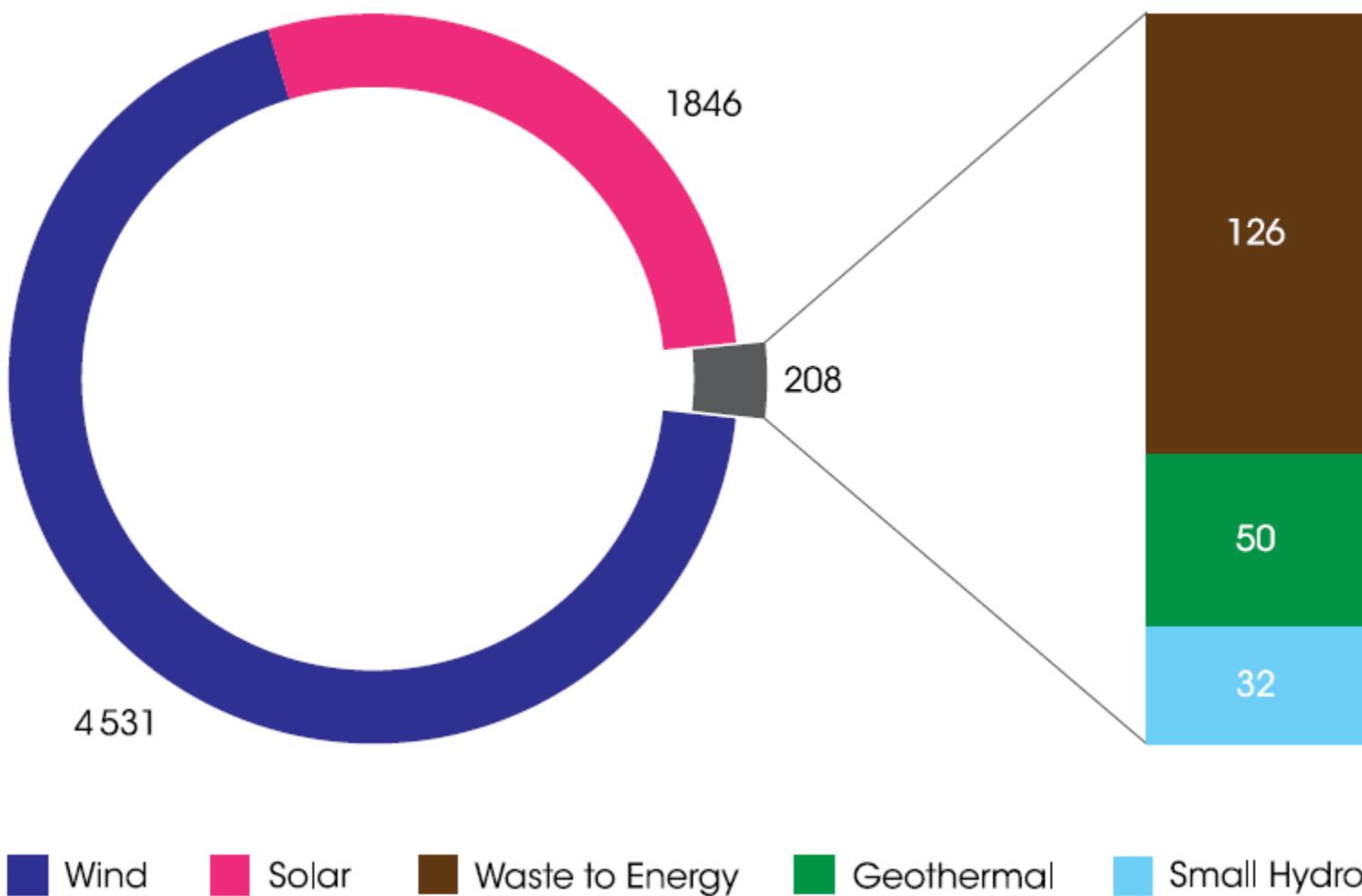
Share of installed power generation capacity by technology in 2012

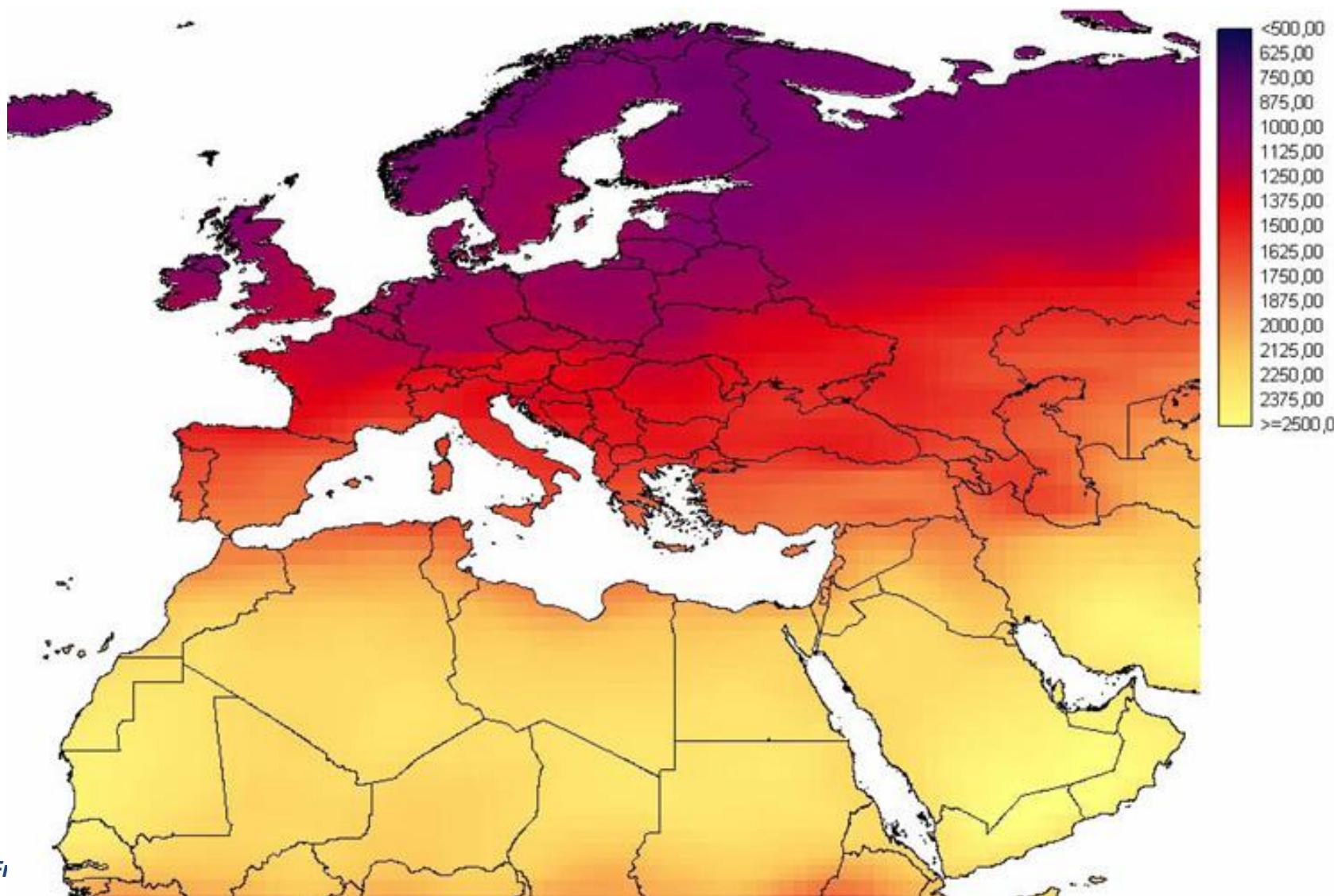


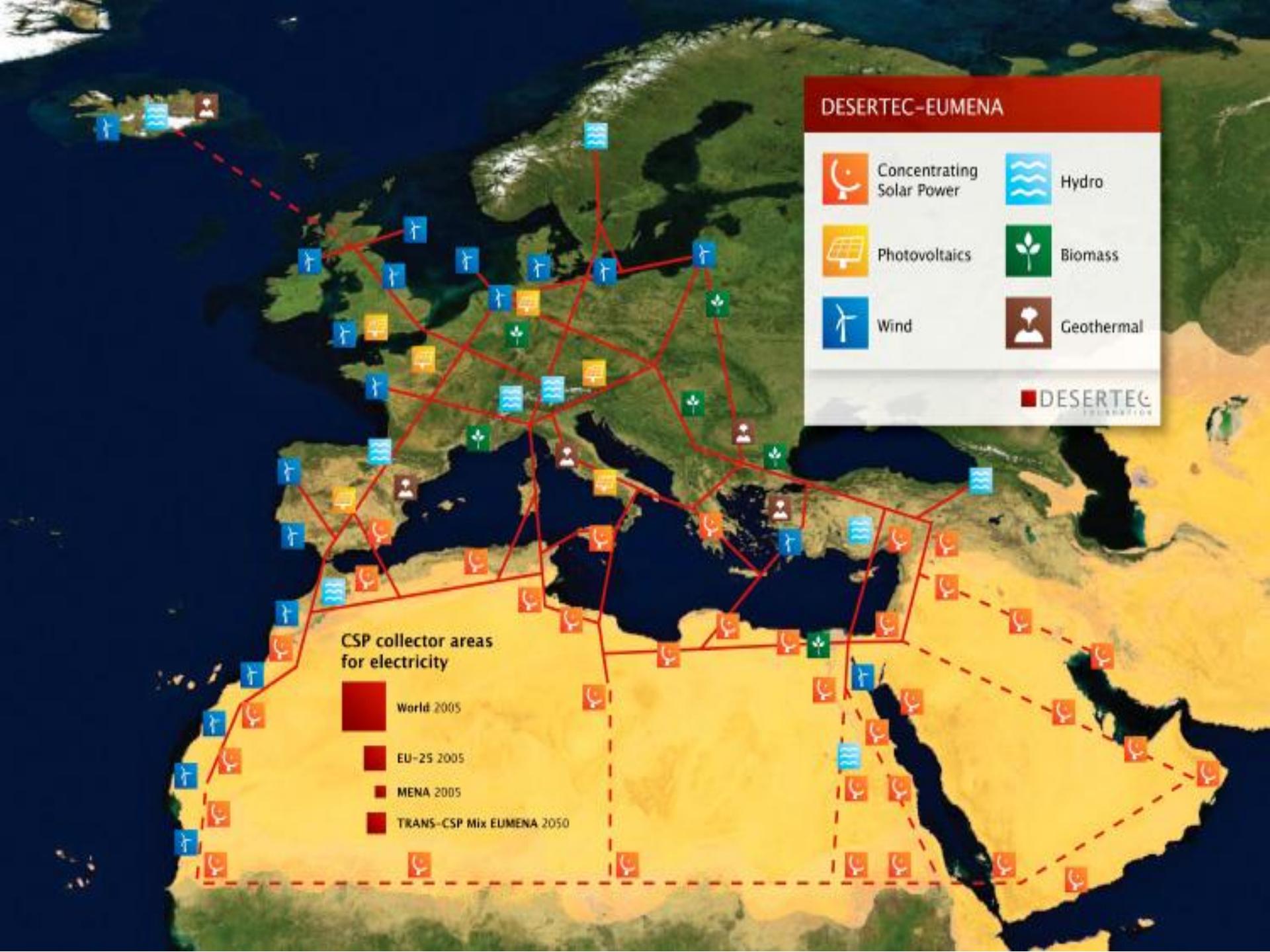
Source: AUE 2013, REN21 2013, RCREEE, 2013



Renewable Energy Project Pipeline (MW) Announced in 2013







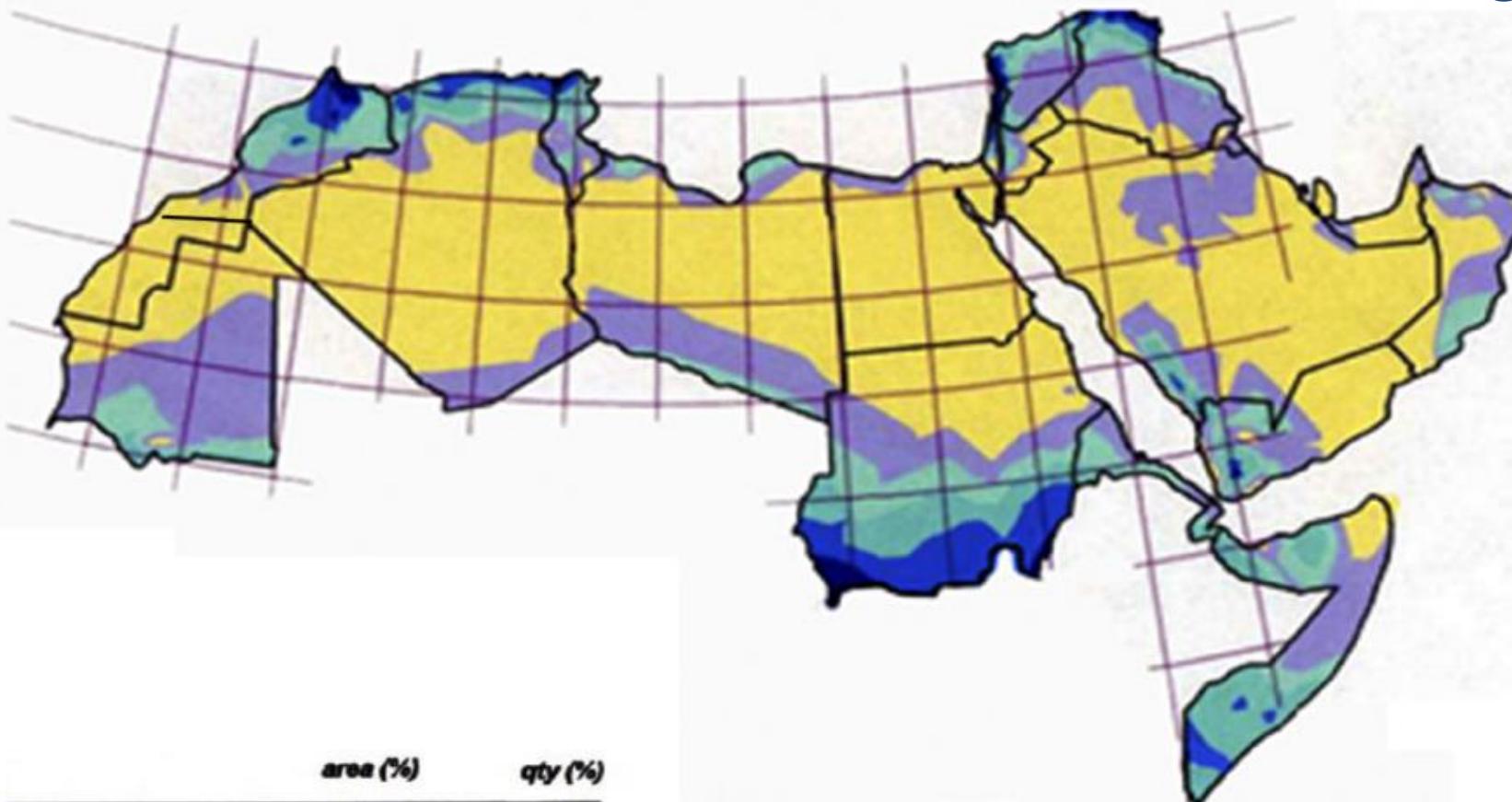


Water



Water in the Arab Region

Rainfall in the Arab Region

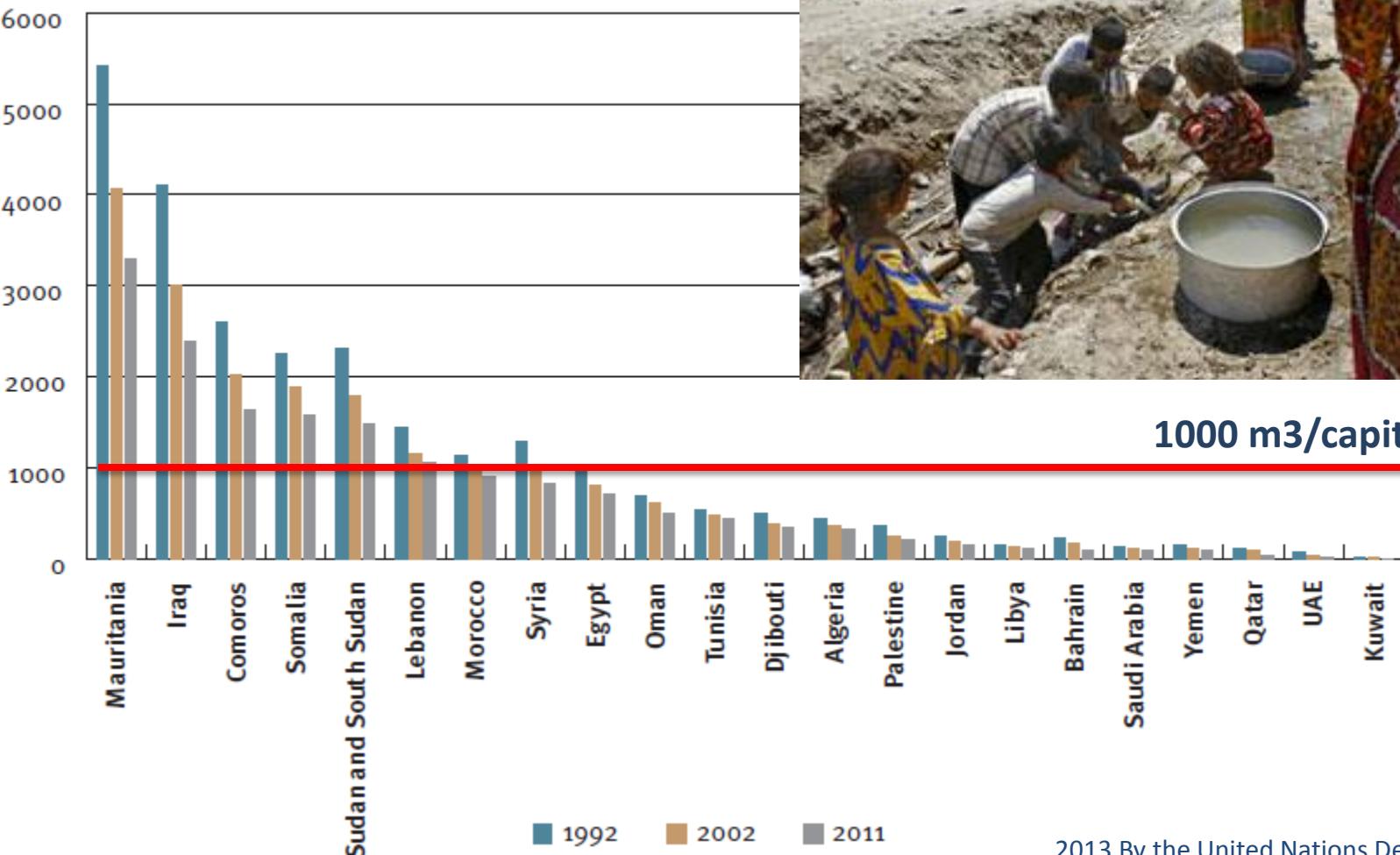


For areas and quintiles calculation , Albers equal area Projection was used
Standard Parallels 7° 40' N and 38° 20' N



Total renewable water resources per capita, 1992, 2002 and 2011

Cubic metres per inhabitant per year

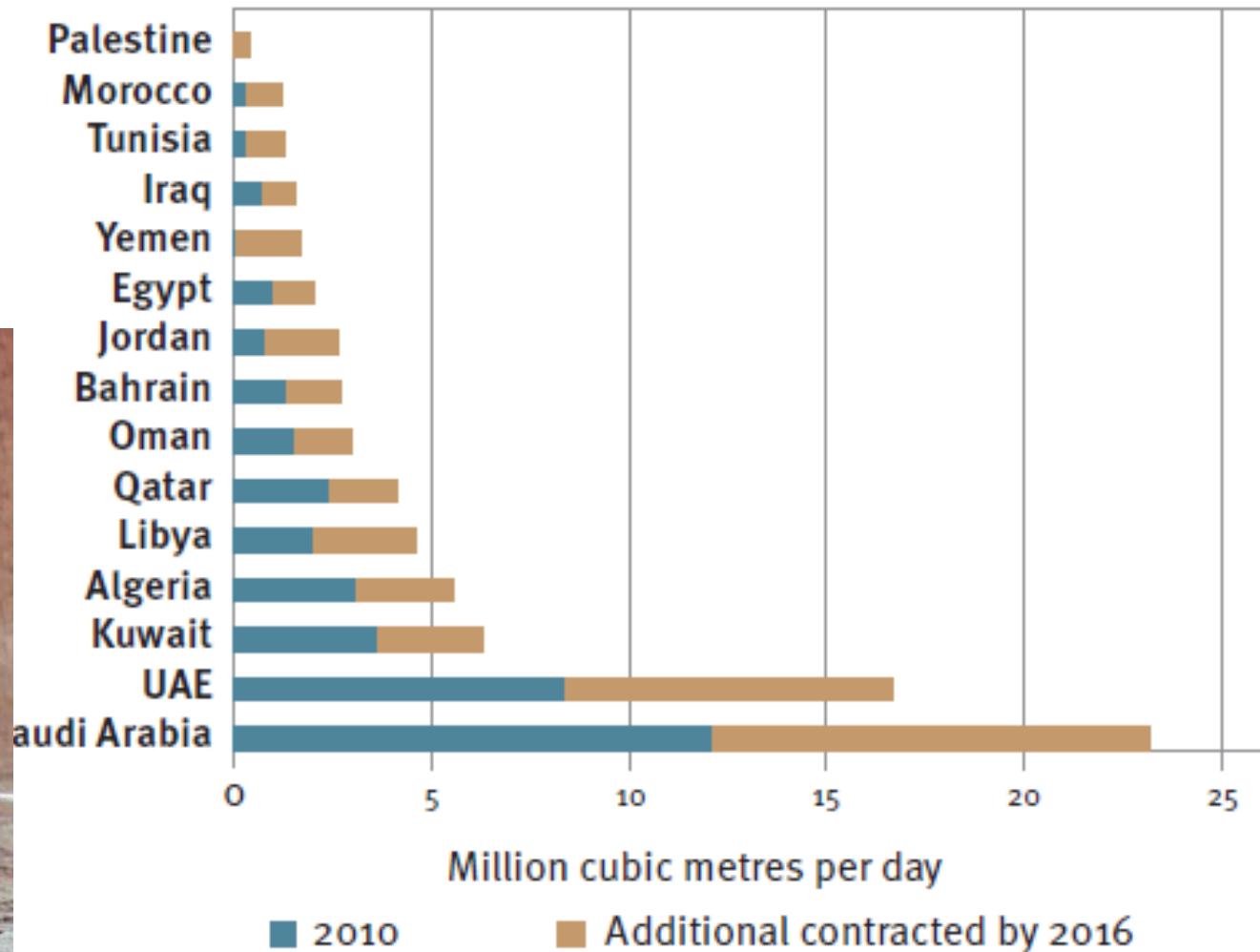




Accumulated desalinated water in selected Arab countries,

2010 and 2016.

Total contracted capacity of all desalination plants in Arab countries

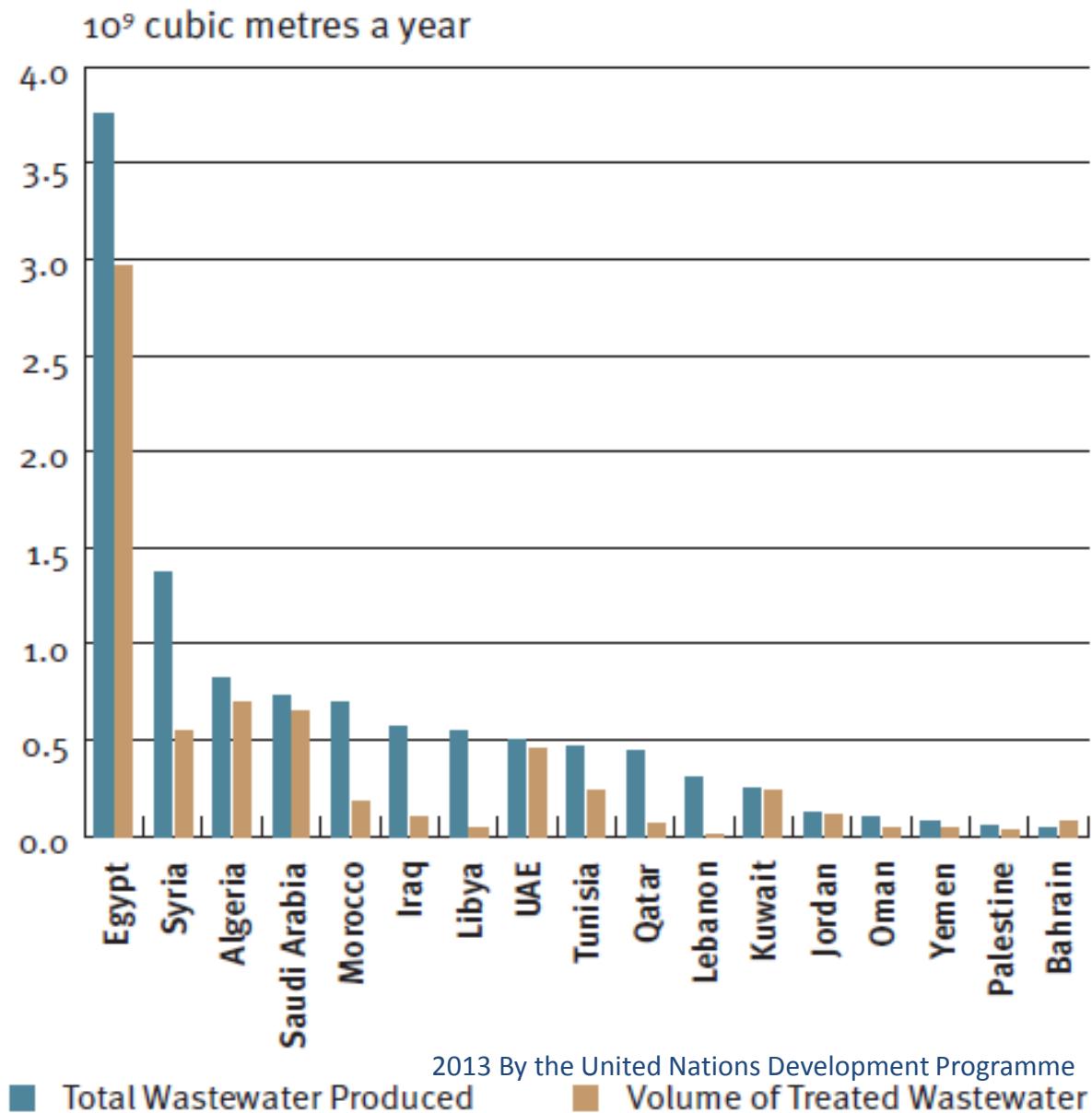


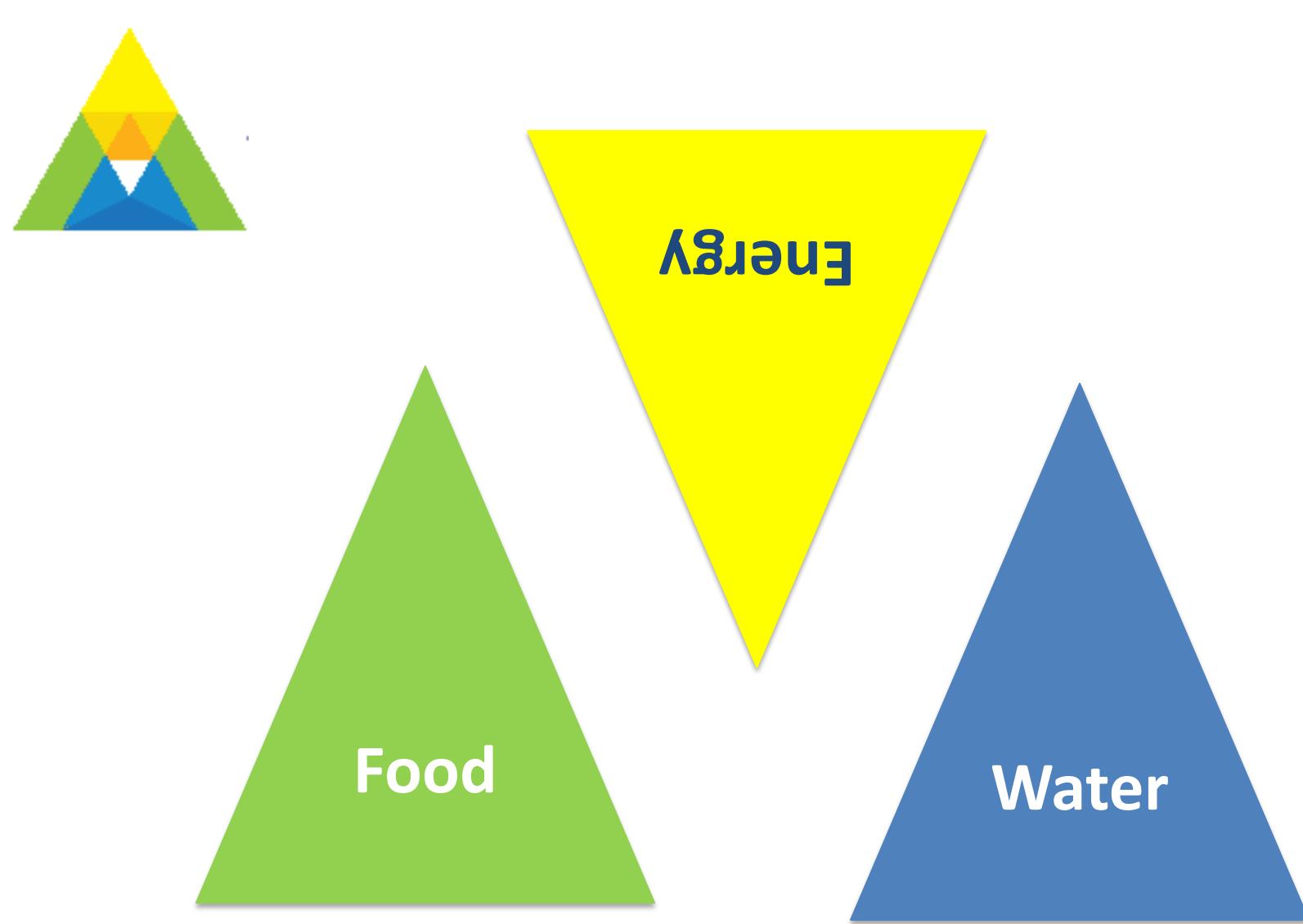


Wastewater produced and treated in some Arab countries,

2009–2010

- Treated wastewater is 4.7 billion m³/year
- few countries have institutional guidelines for regulating treated wastewater
- about 40 per cent of wastewater is untreated.







Slice of Pizza

333 gallons (1,260 liters) of water



dough, tomato sauce and cheese

1 glass of milk



200
litres

1 cup of tea



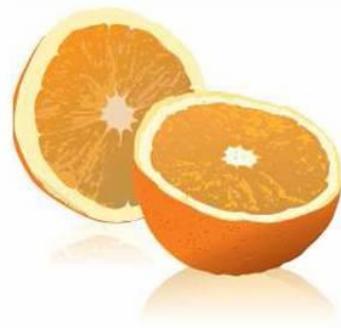
35
litres

1 cup of coffee



140
litres

1 orange



50
litres

1 apple



70
litres

1 glass of wine



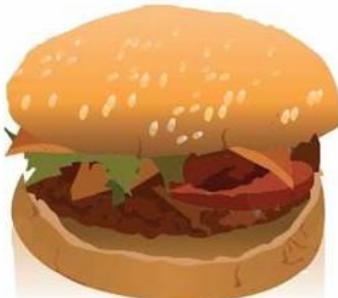
120
litres

1 potato



25
litres

1 hamburger

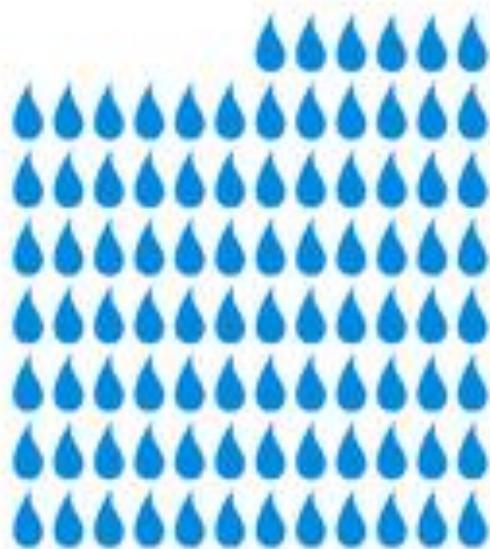


2400
litres



Virtual Water

VIRTUAL **WATER**



4500



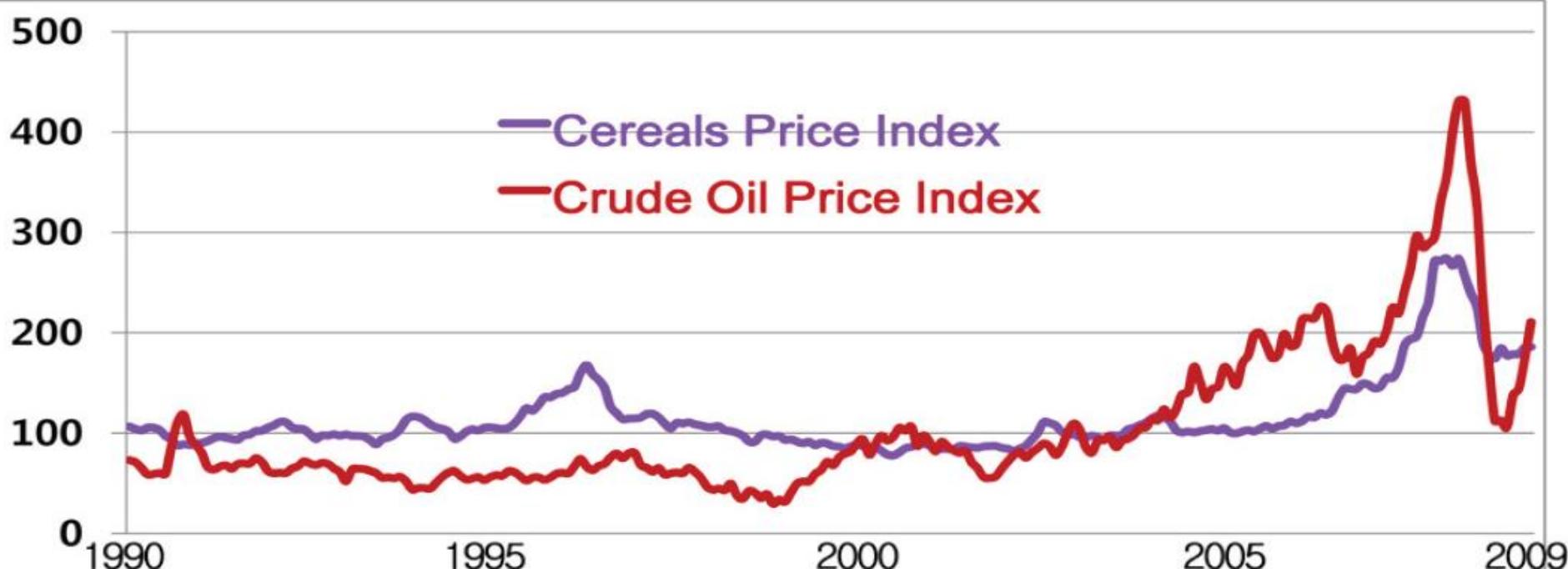
*litres of water for
one steak (300g) of
Beef*





Energy & Food

The food sector currently accounts for around 30 percent of the world's total energy consumption.





Energy & Food



Energy for Food	Food for Energy
Producing fertilizers	Biofuels
Agriculture processes	
Food Processing	



Energy & Water



Energy for Water	Water for Energy
Pumping	Cooling
Sewage treatment	Hydropower
Transport	Biofuel
Desalination	Heating

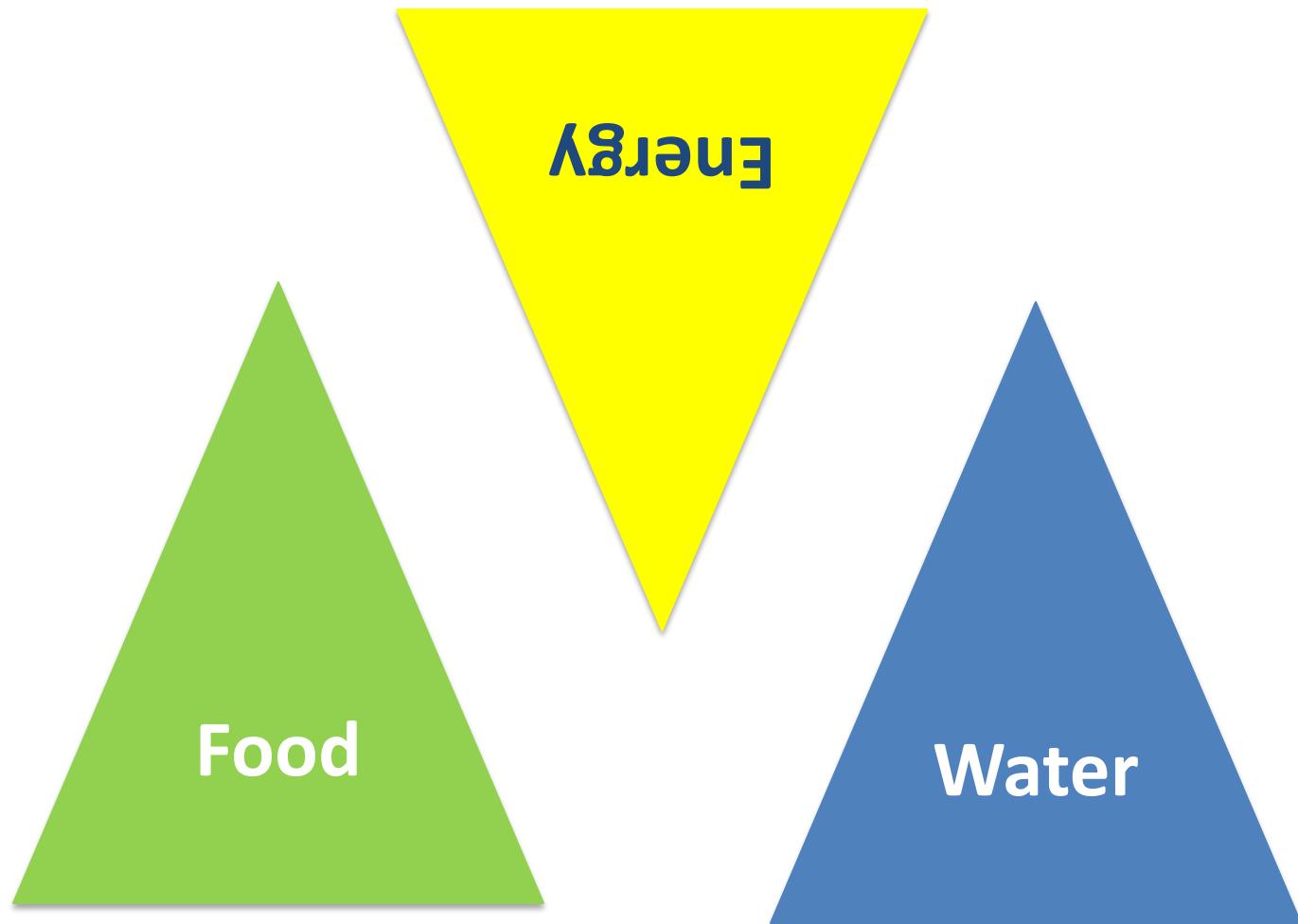


Food & Water





Water-Energy-Food Nexus





Water-Energy-Food Nexus





The Case of Egypt



WEF Policy Framework

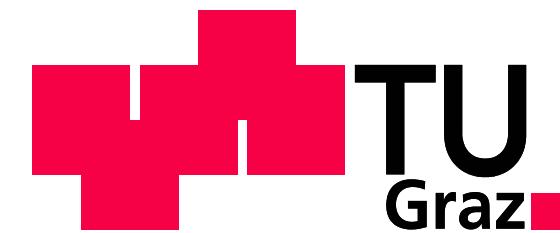


Knowledge Triangle Platform for Water-Energy-Food Nexus

- Develop a national Water-Energy-Food strategy and collaboration platform
- Training junior researchers on interdisciplinary water-energy-food research and offering PhD Summer Schools
- Developing a web-based knowledge-sharing system



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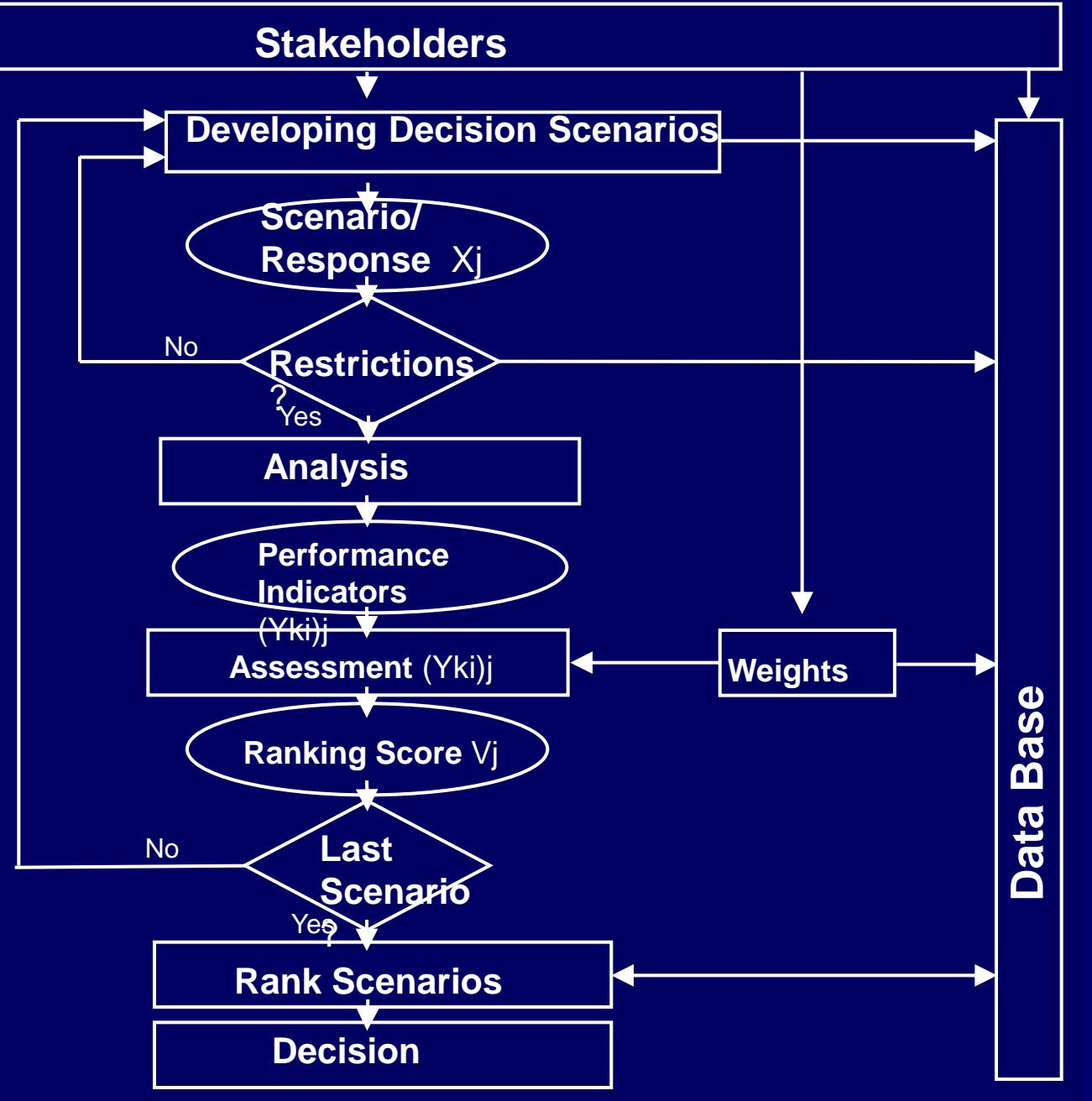
National WEF Council (Stakeholders)



National WEF Council



WEF Nexus Decision Making Process



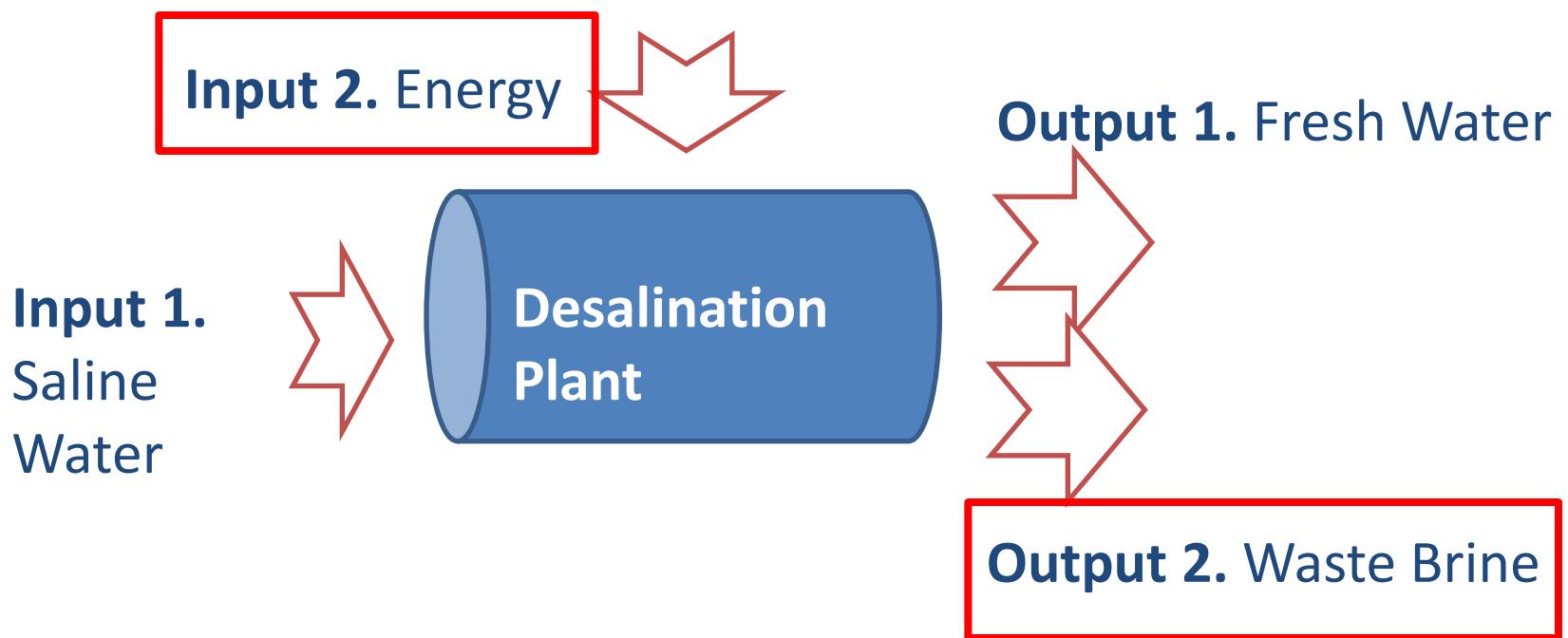


WEF Research



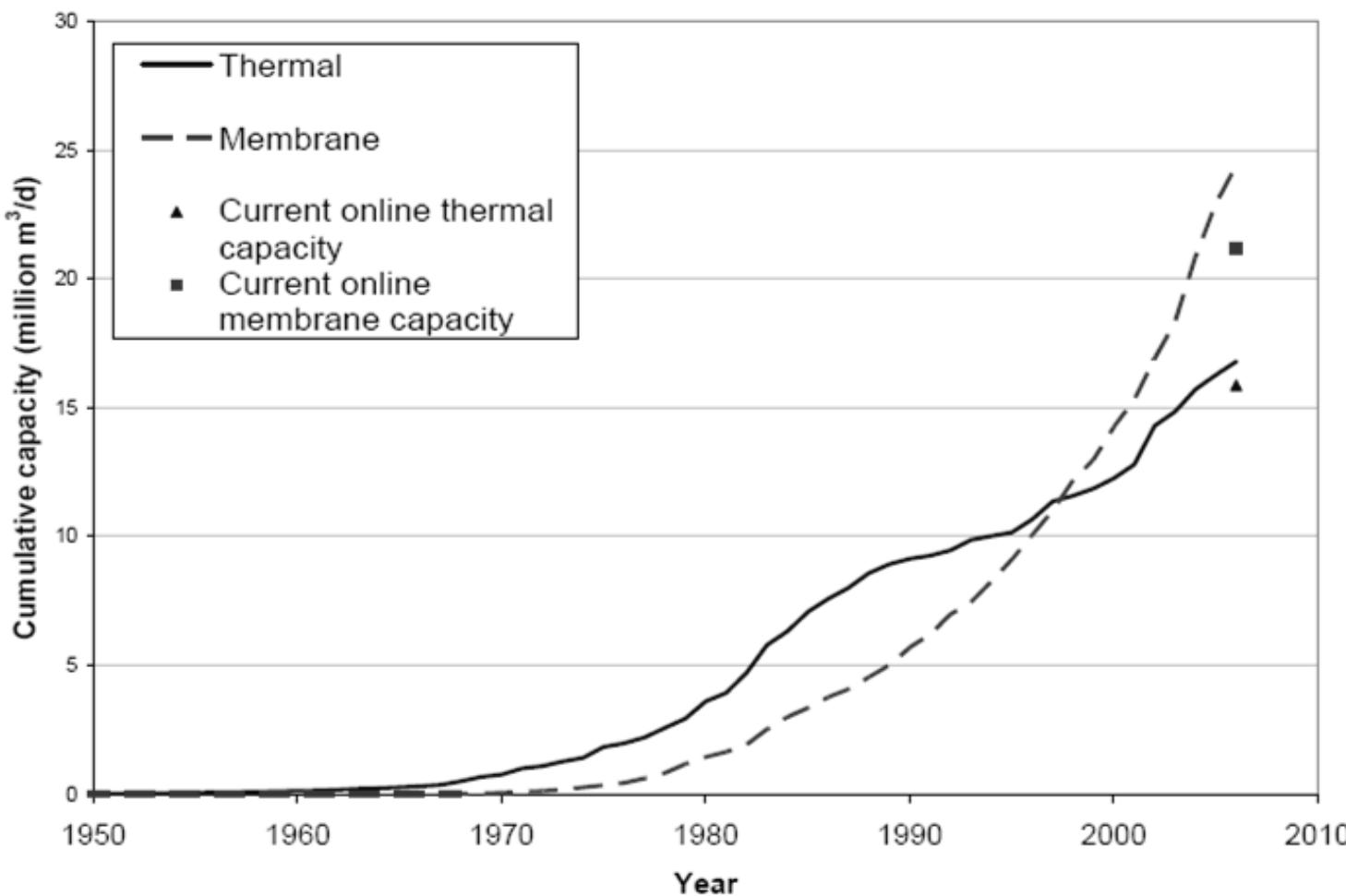


Greening the Desalination



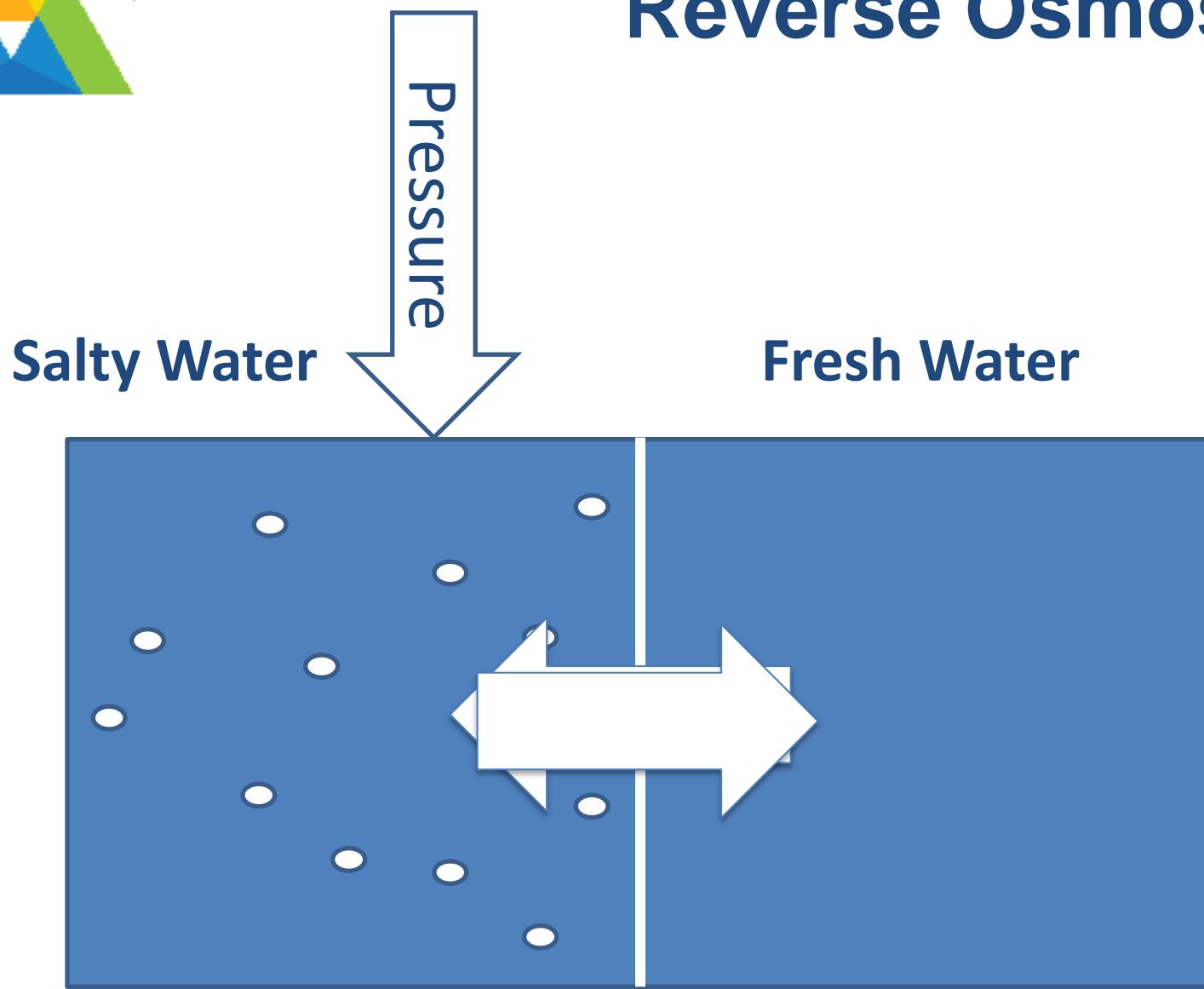


Thermal vs. Membrane





Reverse Osmosis

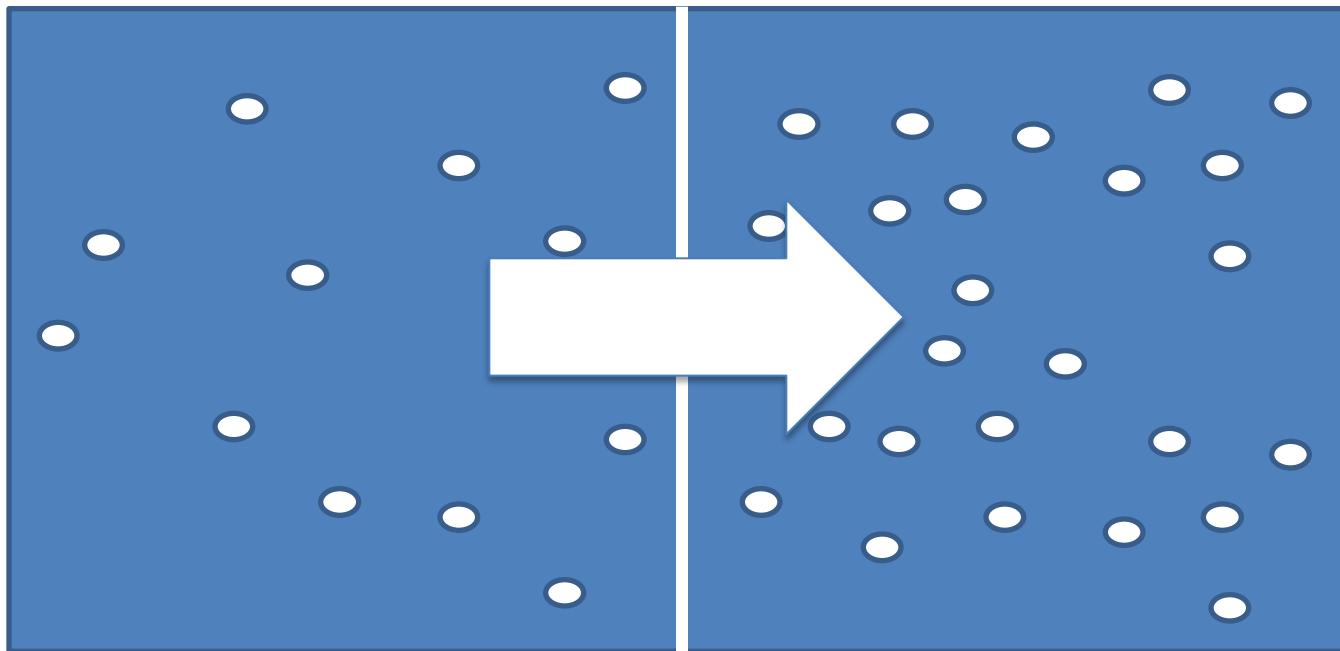




Forward Osmosis

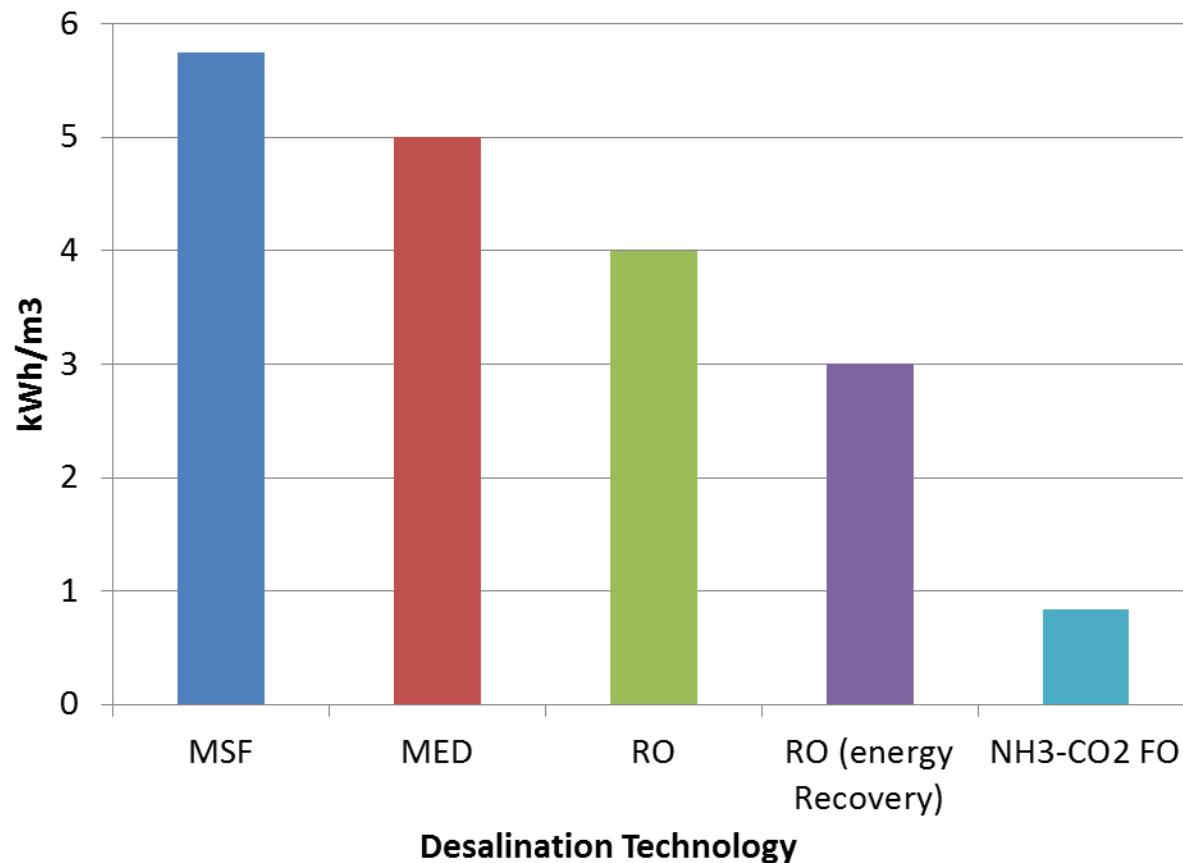
Salty Water

Draw Solution (e.g. Mg Sulphate)



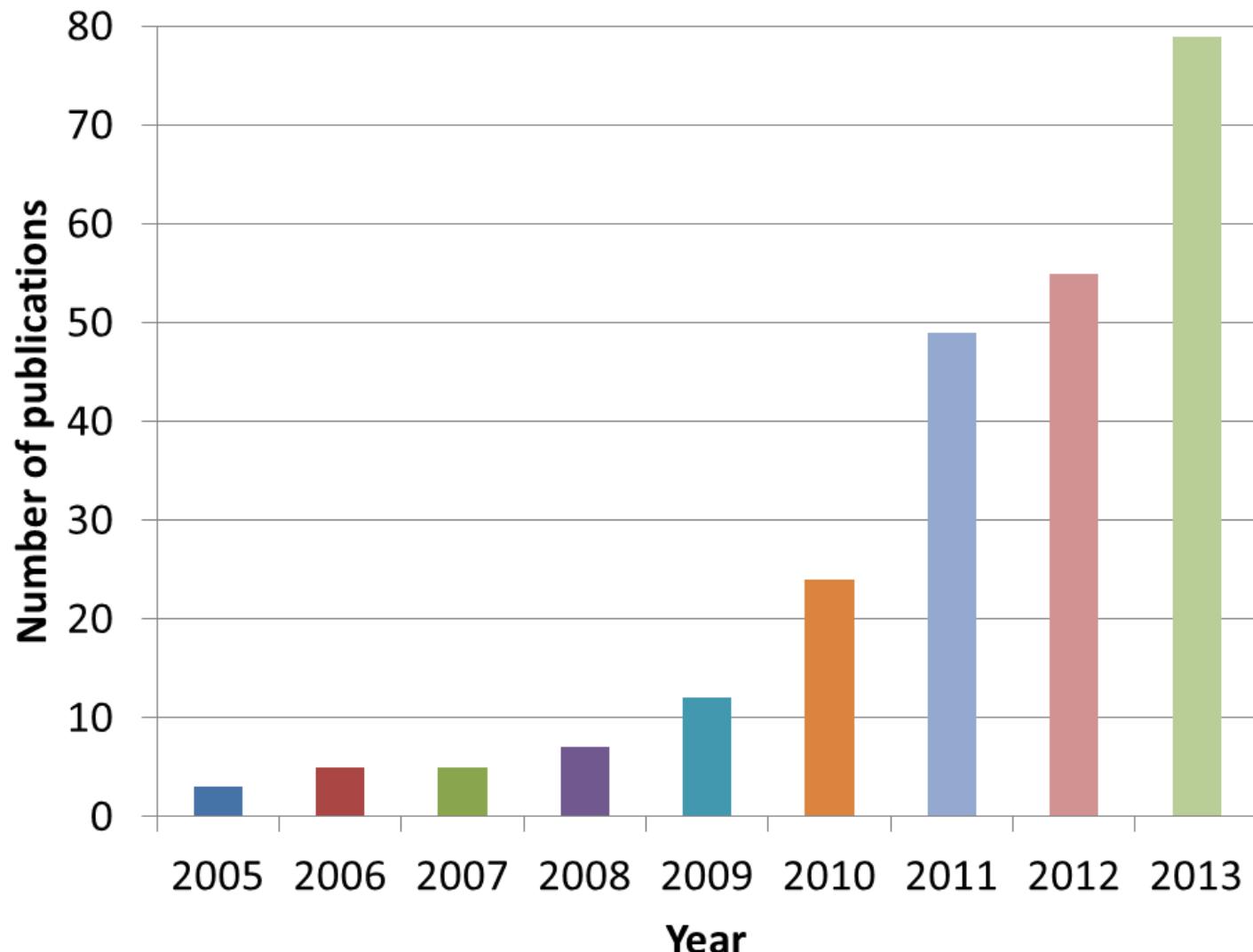


Energy for Desalination



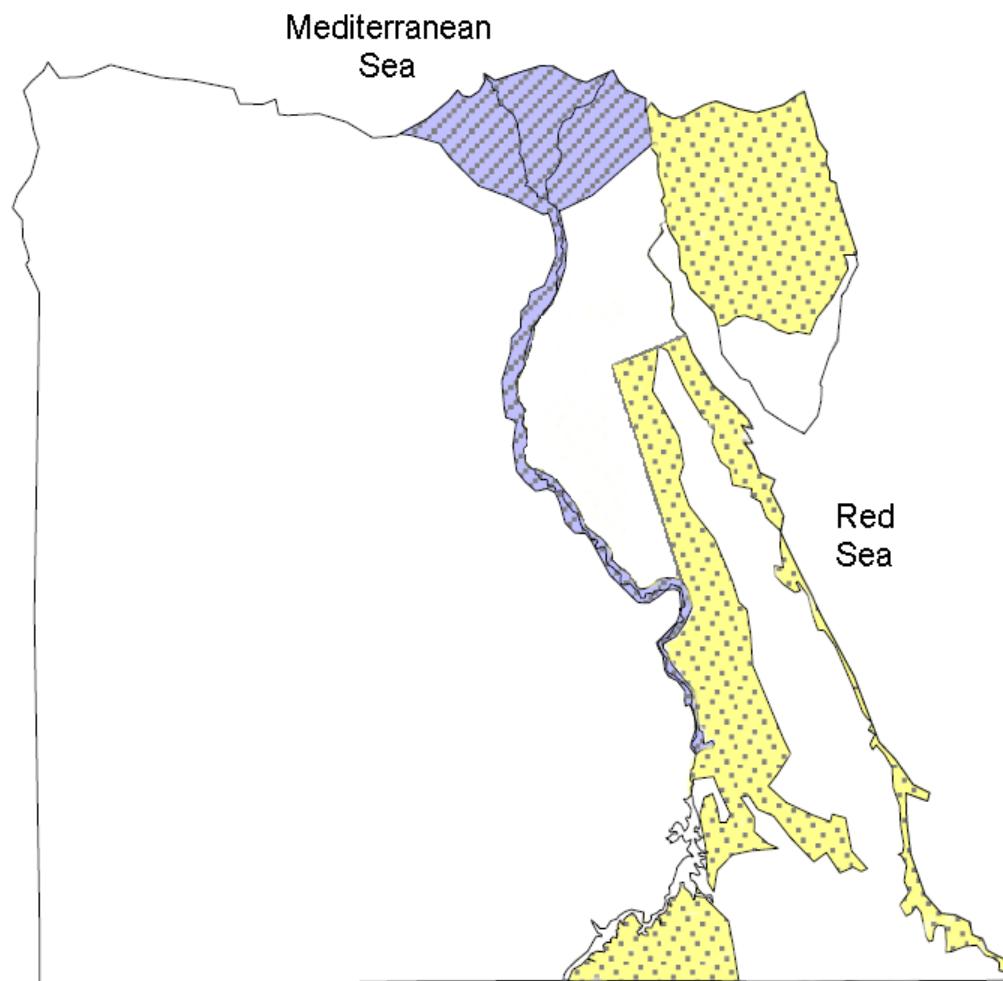


Growing Nr of Publications





Selected Areas for potential FDFO application in Egypt



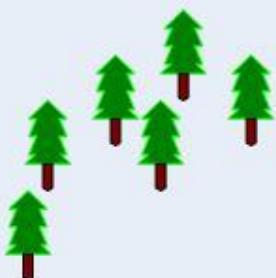
ZLD

Photovoltaic



Solar Energy

Subsurface
Irrigation



Desalination Unit



Fish Farming

Byproduct

Irrigation with
salty water





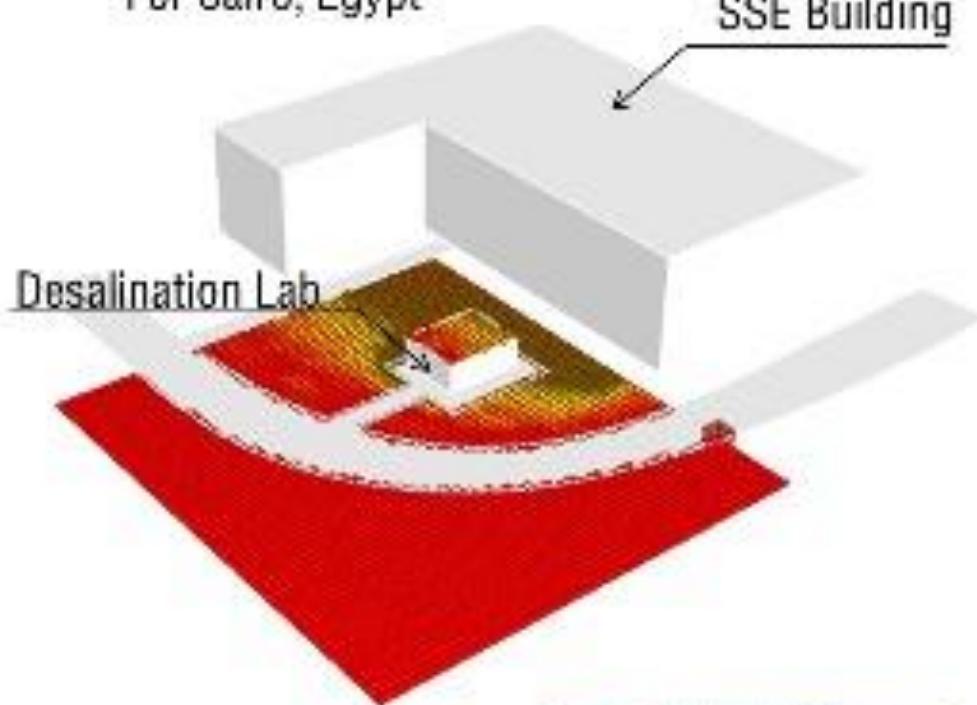
The Nexus Model





Annual Solar Radiation

For Cairo, Egypt

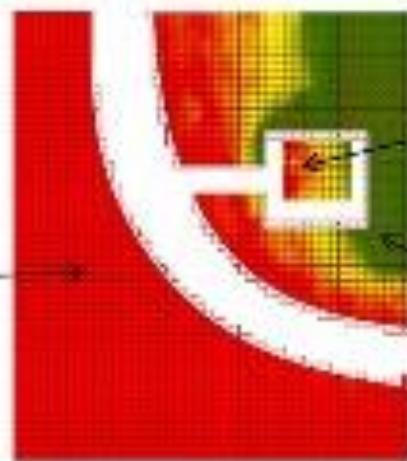


Possible PV area*
Total 1,946 m²

1,111 m²

58 m²

777 m²



*Roughly Estimated



The Nexus Model



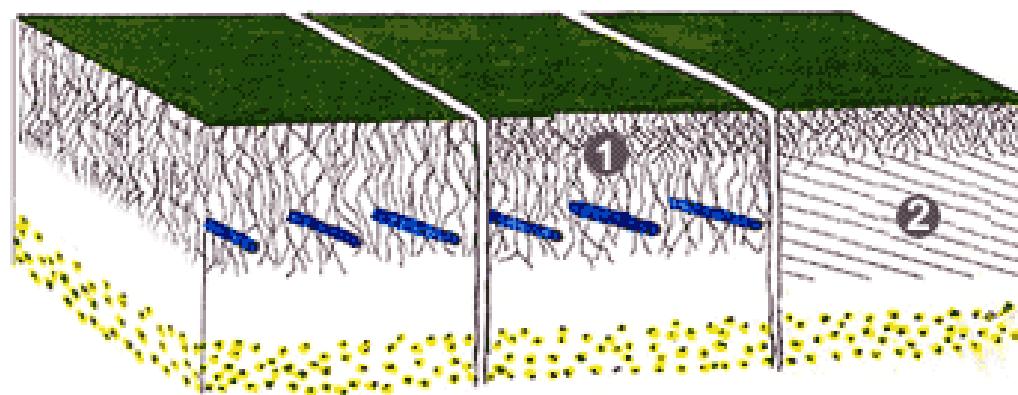
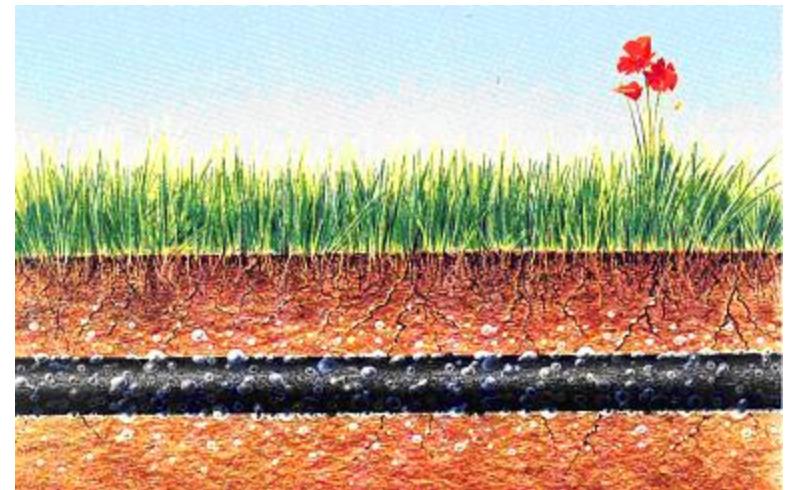


The Nexus Model





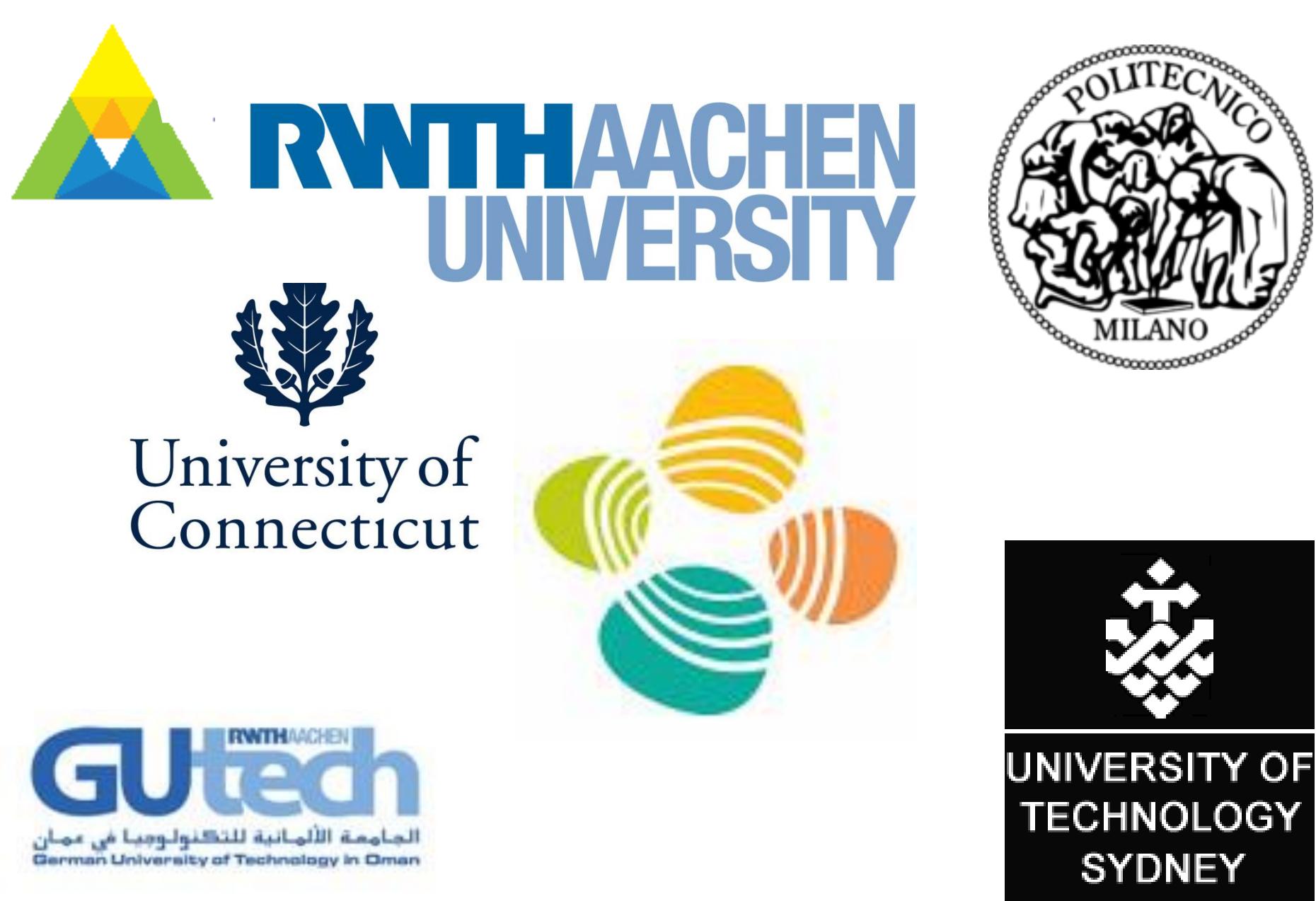
Sub-surface Irrigation

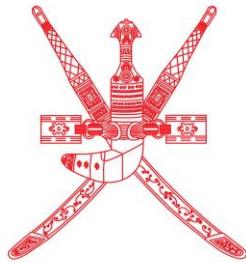




End Products

- Zero CO2 Energy
- Low cost desalinated water
- Energy-smart food





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