

UNITED NATIONS

Economic and Social Commission for Western Asia



Prospects and challenges of promoting links between water and energy in the region

Carol Chouchani Cherfane
Chief, Water Resources Section
Sustainable Development and Productivity Division
ESCWA



24 April 2012



Outline

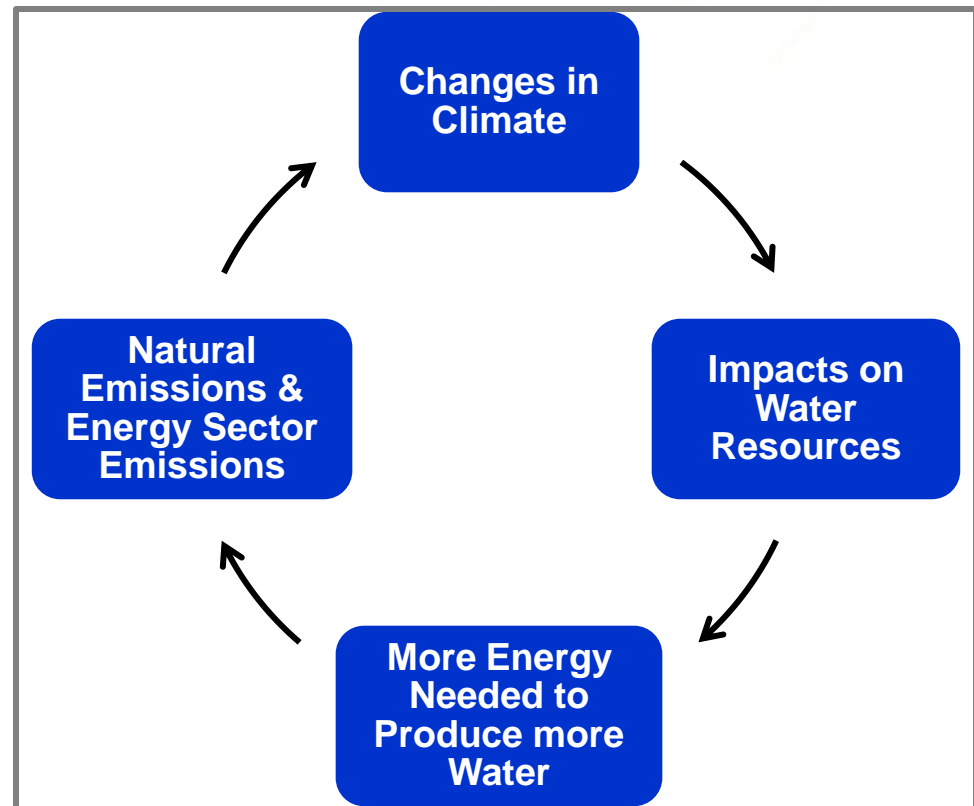
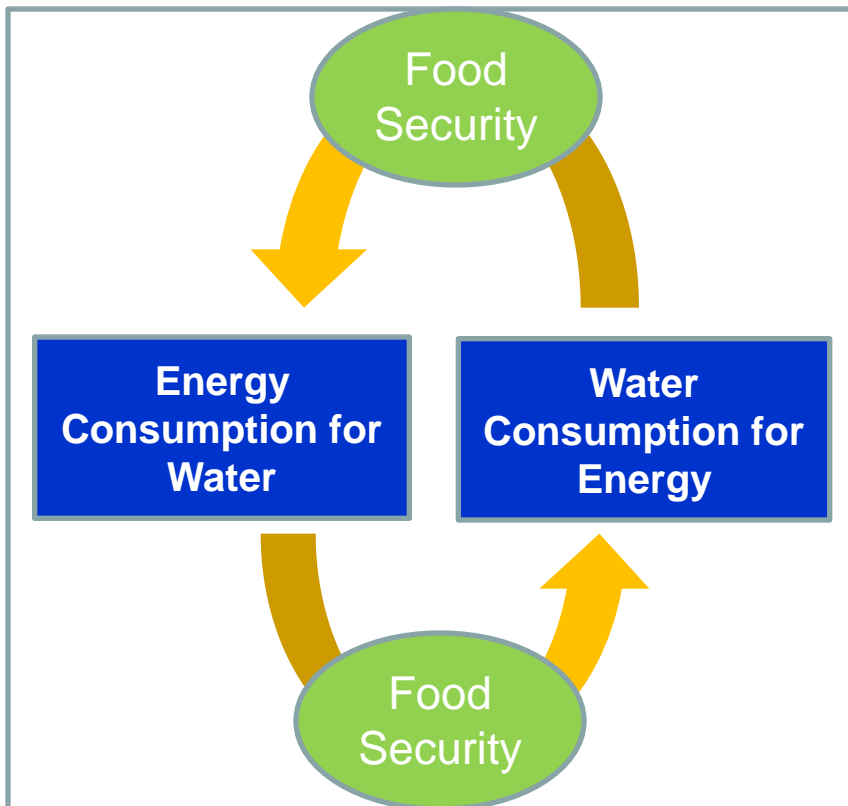
I WATER AND ENERGY LINKAGES

II CHALLENGE: WATER SUPPLY & SANITATION

III CHALLENGE: SHARED WATER RESOURCES

IV CHALLENGE: CLIMATE CHANGE IMPACTS ON WATER RESOURCES

V PROSPECTS FOR REGIONAL COOPERATION



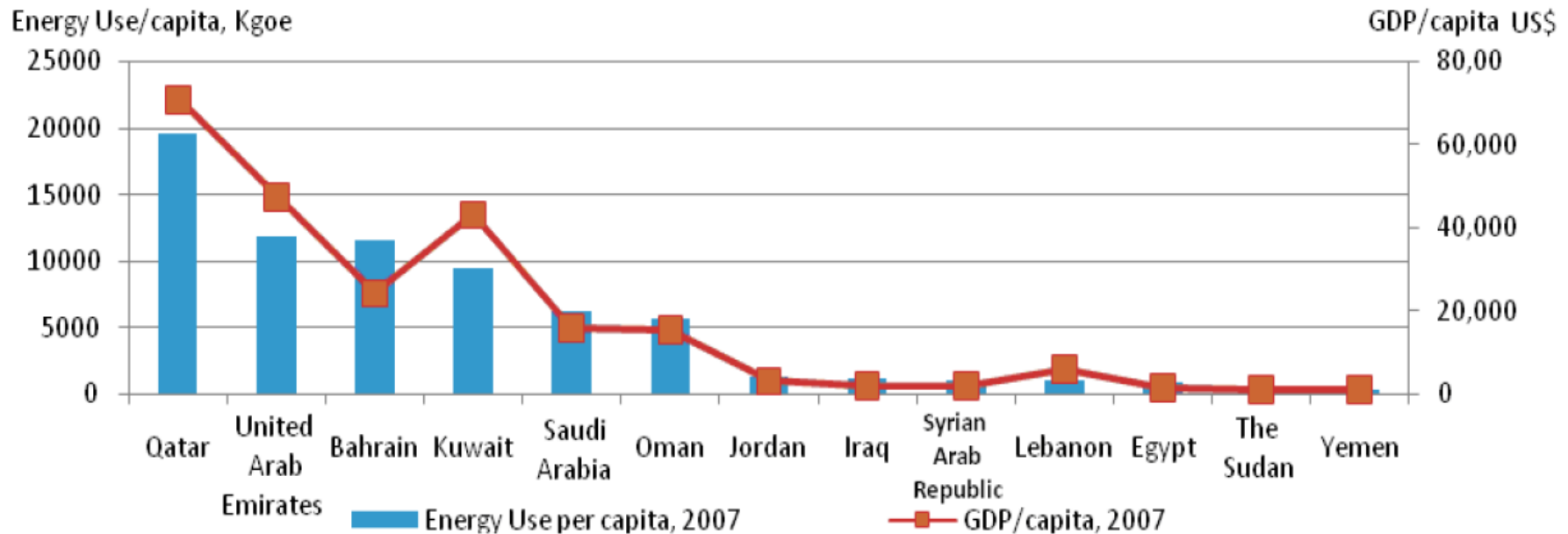
Linkages:

- ✓ Production & Consumption Interdependency
- ✓ Transmission/Distribution Losses
- ✓ Environmental Externalities

Linkages:

- ✓ Climate Change Adaptation and Mitigation
- ✓ Potential increase in frequency of extreme weather events

GDP & ANNUAL ENERGY CONSUMPTION PER CAPITA OF ESCWA COUNTRIES



Source: World Bank, World Development Indicators. Available at: <http://data.worldbank.org/indicator>.

Linkages:

- Need to decouple water and energy consumption and production trends from GDP growth.
- Requires integrated thinking about water & energy resource management & investment in efficiency improvements.

Arab Ministerial Water Council



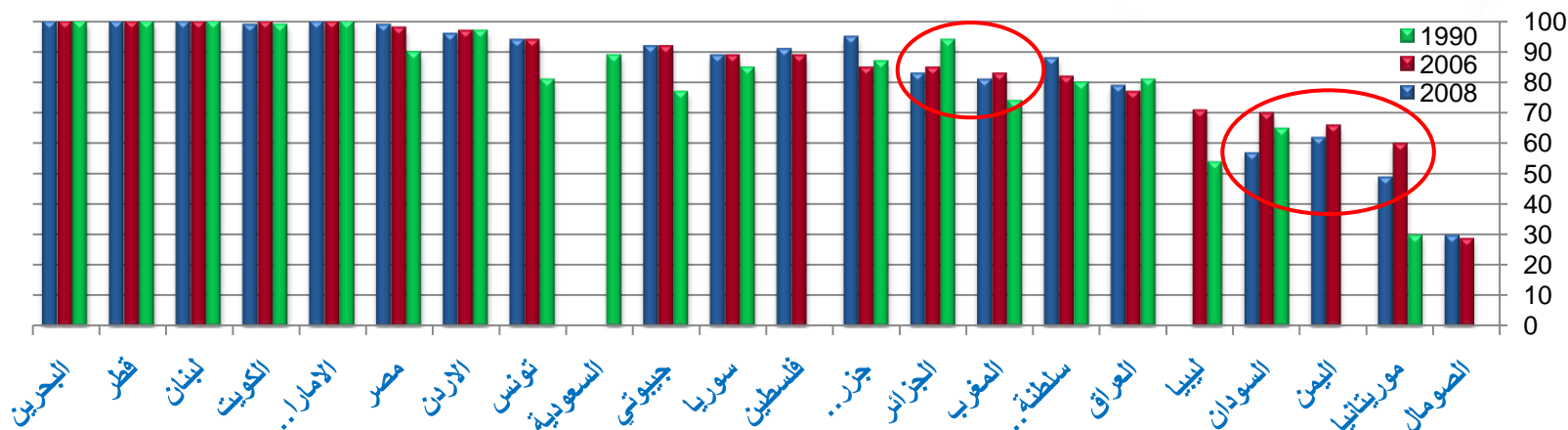
- ❖ Arab Economic and Social Summit (2008)
- ❖ Arab Ministerial Water Council (First Session in Algiers, 2009)
- ❖ Arab Water Security Strategy (Adopted 2011)
- ❖ Arab Water Security Strategy Action Plan (preparation initiated 2012)

The Arab Water Security Strategy:

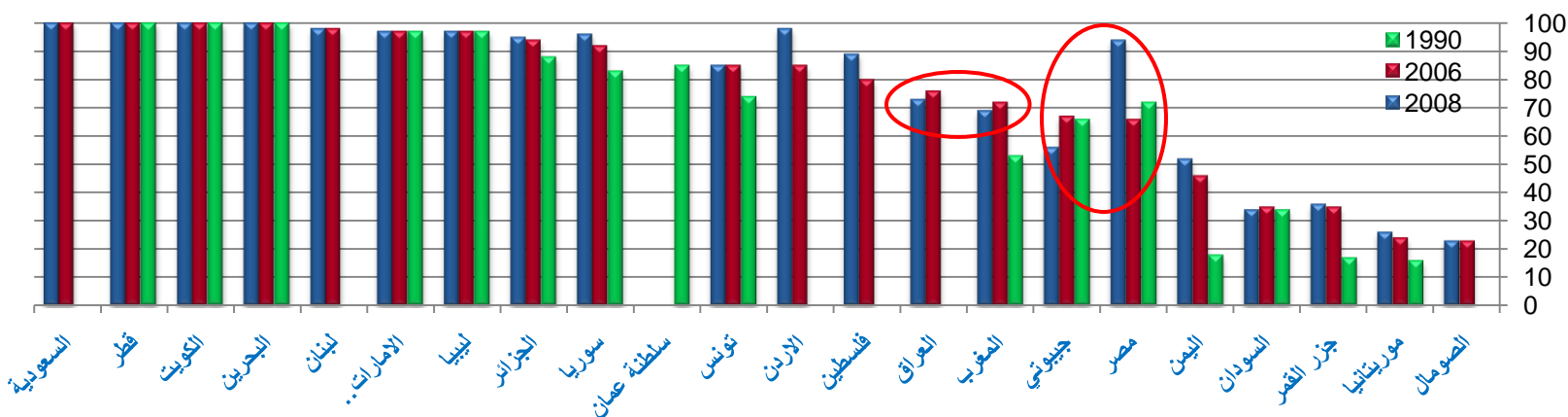
- **Encourages** greater research on desalination and the use of renewable energy for desalination
- **Calls for** increased scientific research in the Arab region on the linkages between sanitation and energy, with a view towards locally appropriate technologies
- **Identifies** food security, shared water resources management and climate change impact assessment & adaptation as key priorities.

MDG: ACCESS TO IMPROVED WATER & SANITATION IN THE ARAB REGION

Population with access to improved water supply source (%)



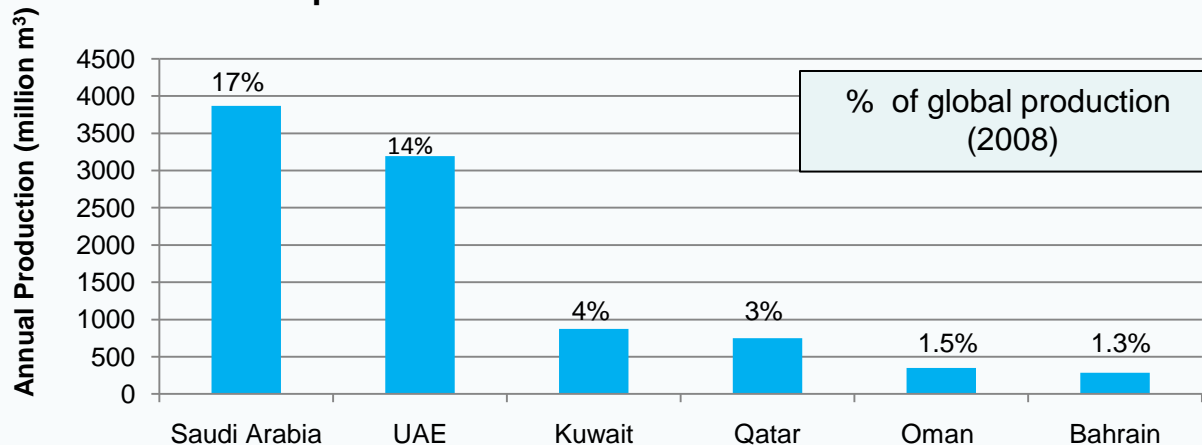
Population with access to improved sanitation facilities (%)



Figures to not reflect quality, continuity and vulnerability of service provision

DESALINATION: Energy Dependent

Annual production of desalinated water in GCC countries



ESTIMATED ENERGY CONSUMPTION OF MAJOR DESALINATION PROCESSES

Process	Heat (Megajoule per cubic metre)	Electrical (kWh/m³)	Total electric equivalent (kWh/m³)
Multi-stage flash	250-300	3.5-5	15-20
Multi-effect distillation	150-220	1.5-2.5	8-20
Vapour compression			
Thermal vapour compression	220-240	1.5-2	
Mechanical vapour compression	None	11-12	11-12
Reverse osmosis			
Seawater	None	5-9	5-9
Brackish water		0.5-2.5	0.5-2.5
Electrodialysis	None	2.6-5.5	2.6-5.5

Source: Banat and Qiblawey (2007)

BIOFUELS: CHALLENGE OR OPPORTUNITY?

Primary Biofuels produce energy at expense of:

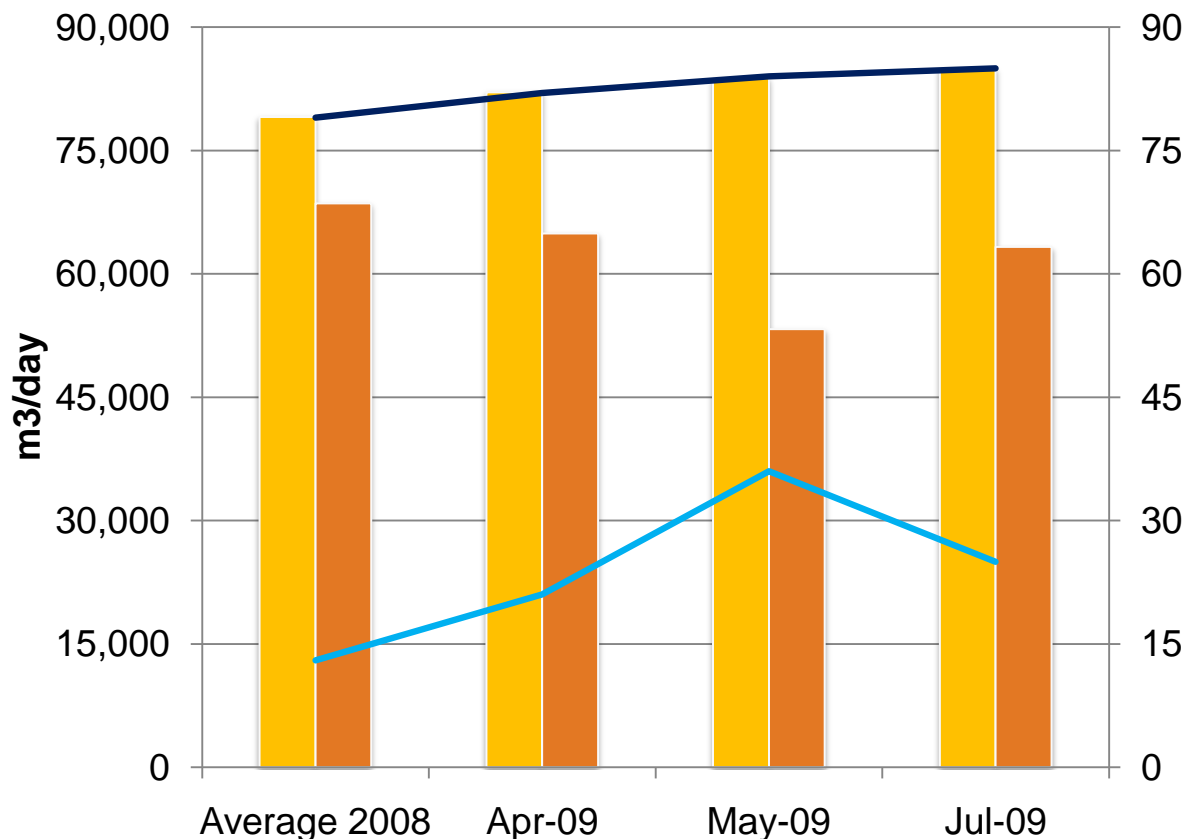
- **Water Security** – Arab region already water scarce environment
- **Land Resources** – land degradation; large landowners v/s farmers for income
- **Food Security** - takes land away from cultivating consumables
- **Marine Resources** – oceans already under threat; alga productivity in face of desalination needs and brine releases to consider

Second Generation Biofuels offer potential for:

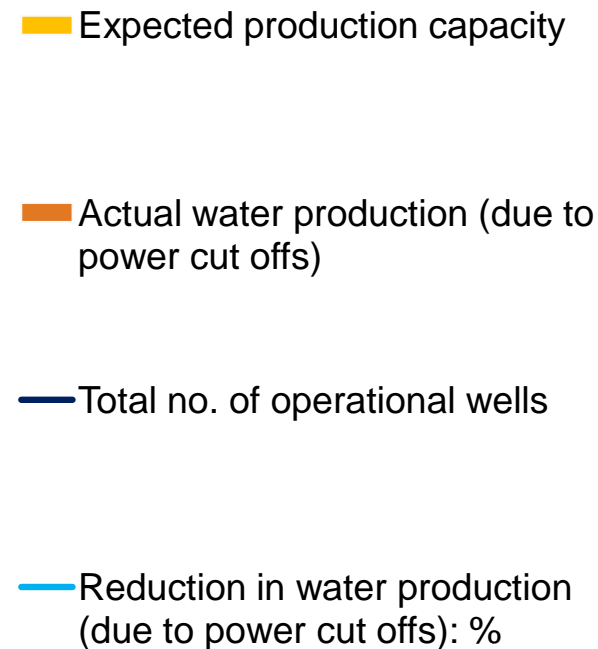
- **Reducing solid waste** - agriculture solid waste can be reused/recycled (e.g., sugarcane stalks, data pits)
- **Reusing of wastewater sludge** – contributes to sustainable management of wastewater
- **Protecting groundwater** – less sludge and waste left in landfills reduces infiltration into aquifers



Water production (bar graph)



number of wells (line graph)



Source: SWSSLC & ESCWA

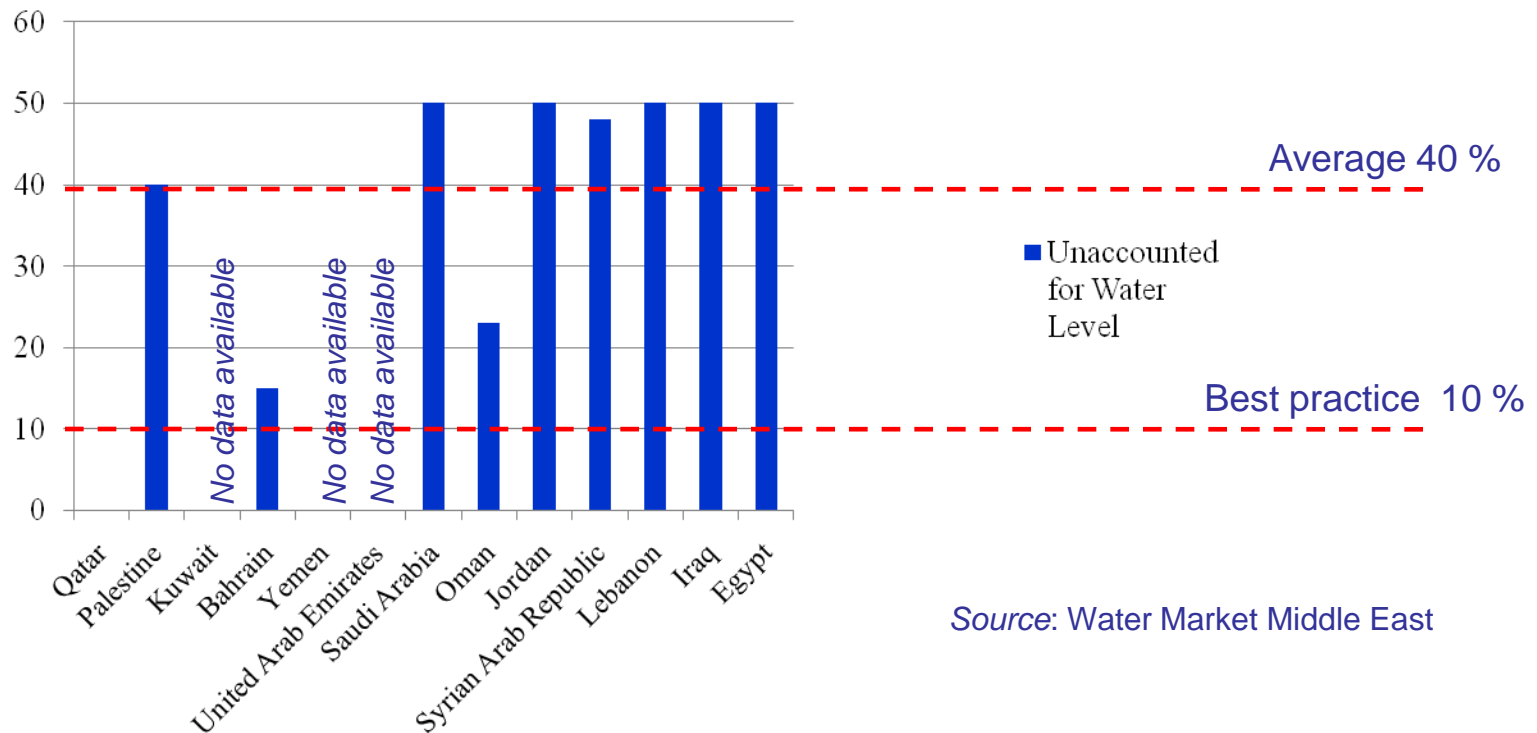
**Intermittency
Challenge**

**30% reduction in service delivery due to power cuts
deprives 250,000 people of water in Sana'a**

UNACCOUNTED FOR WATER

- The average of Unaccounted for Water Levels (UWL) in ESCWA Region is 40 %. The best practice for UWL is 10 %.
- The Result is a loss of Water and Energy Resources & Increased Costs

Unaccounted for Water Level



Source: Water Market Middle East

MDG+ Indicators

Water Supply

- Water consumption
- Continuity of supply
- Water quality
- Distance to source
- Tariff structure
- Affordability

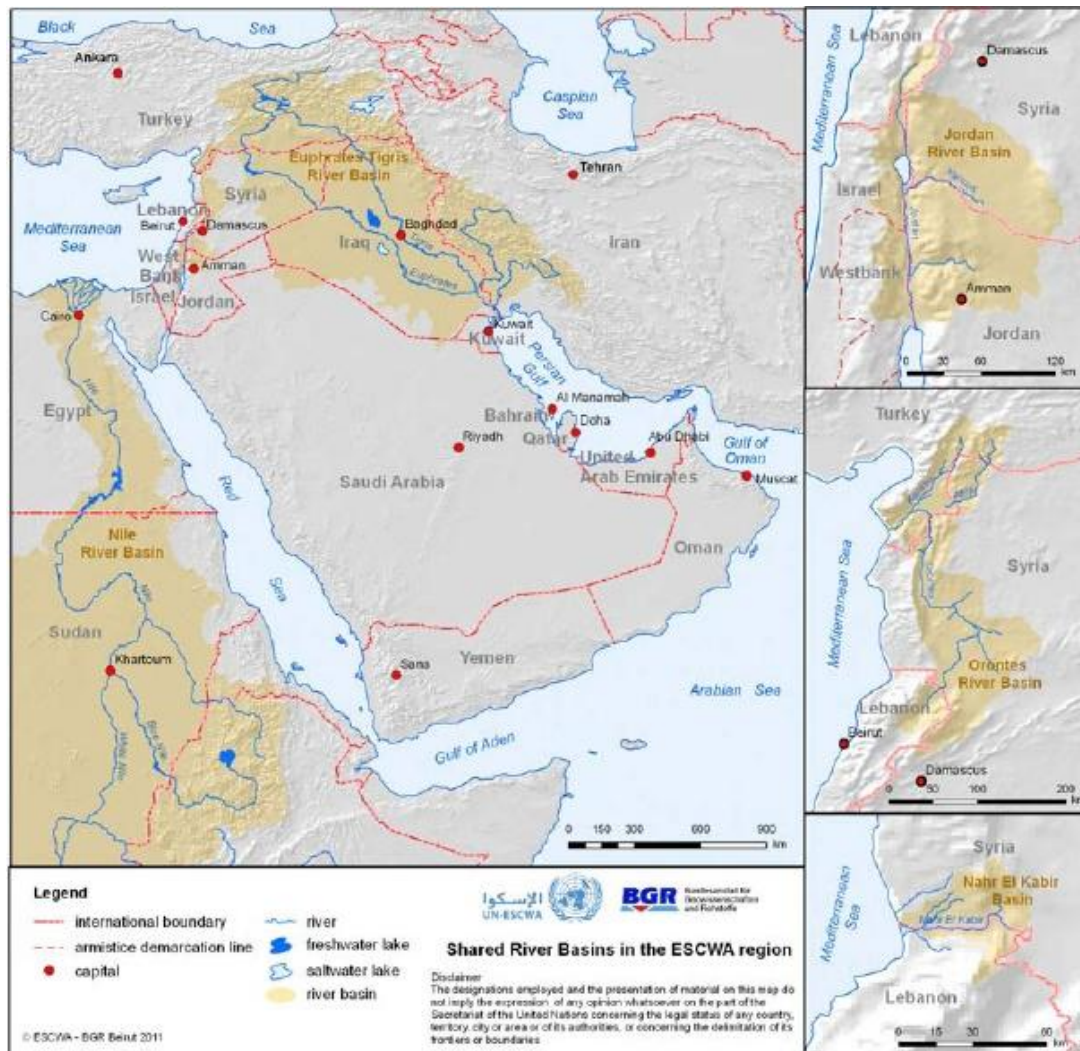
Sanitation

- Treated quantity
- Treatment type
- Reuse utilization
- Reuse type
- Tariff structure
- Affordability

- Purpose is to consider not only accessibility to improved infrastructure, but also reliability, regularity, affordability, sustainability and quality of service provided.
- These are particularly important issues to consider in water scarce environments and developing countries.

ESCWA-BGR INVENTORY OF SHARED WATER RESOURCES IN WESTERN ASIA

Overview map of shared rivers in the ESCWA region

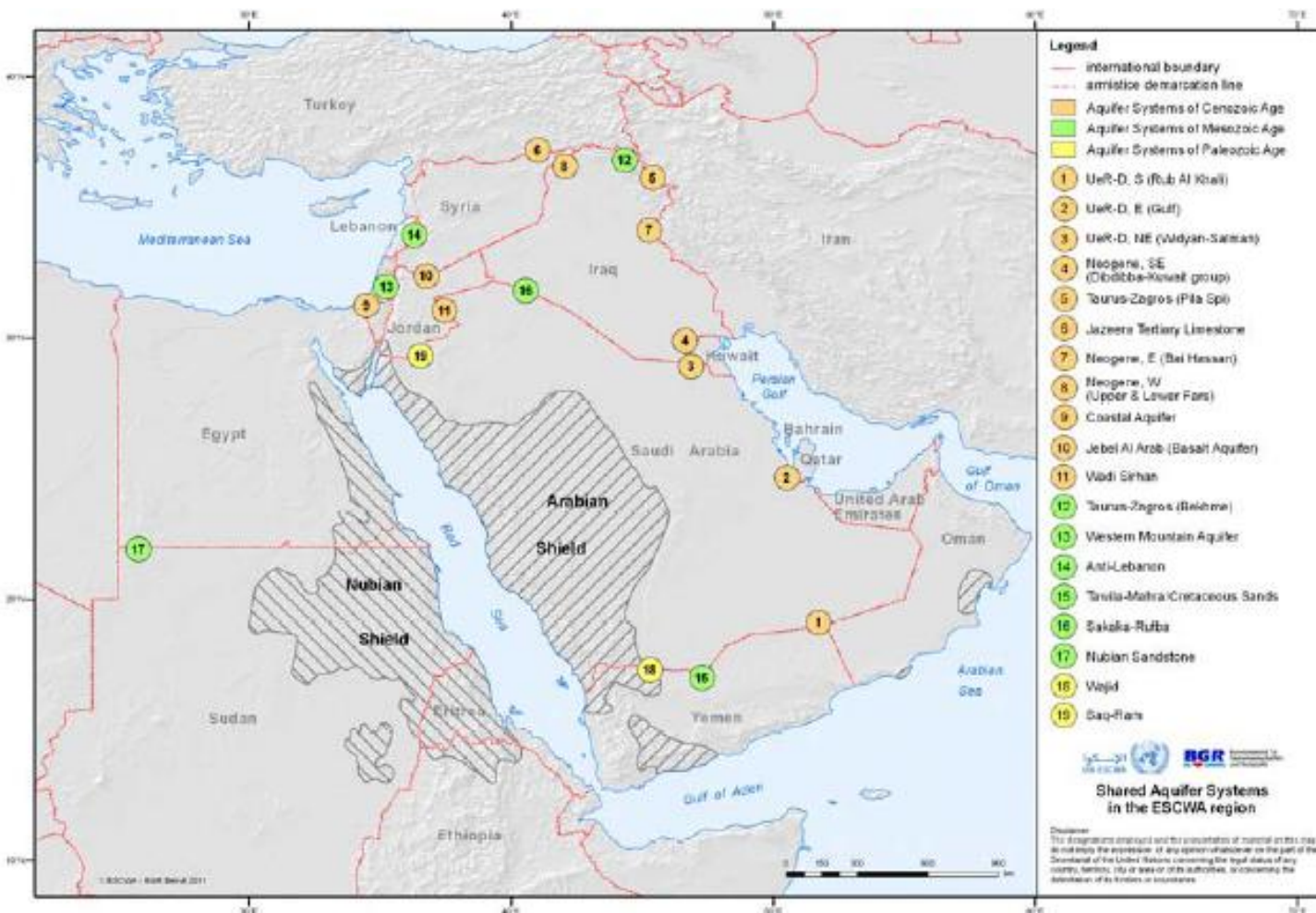


Water-Energy Trade-Offs to consider within a water & energy security framework:

- **Hydropower production**
- **Irrigation – water pumping from surface waters**
- **Linkage to Food Security**
- All linked to national development plans balancing urban and rural development needs.
- Countries need to prioritize between shared water resource management for drinking, agriculture or energy production.

ESCWA-BGR INVENTORY OF SHARED WATER RESOURCES IN WESTERN ASIA

Overview map of groundwater resources in the ESCWA region



Gulf Region shares a significant amount of renewable & non-renewable groundwater resources.

Introduces potential trade-offs between development goals in different countries

**Geological Maps produced for the Petroleum Sector supported review of aquifer systems*

LEGAL FRAMEWORK FOR SHARED GROUNDWATER RESOURCES IN THE ARAB REGION - under preparation

- International agreements on shared water resources have been prepared at the global, regional, basin and bilateral levels.
 - International Watercourse Convention
 - General Assembly Resolution on Transboundary Aquifers
 - UNECE Water Convention; SADC Convention & Protocol
- Arab Ministerial Water Council is preparing a legal framework that would establish guiding principles for the management of water resources shared between Arab Countries.
 - LAS Center for Water Studies and Arab Water Security & ESCWA technically supporting AMWC on this activity.
 - Draft legal framework prepared, revised and is under comment by Member States

For more info, see:

ESCWA Water Development Report #4: National Capacities for the Management of Shared Water Resources in the ESCWA Region

www.escwa.un.org/information/pubaction.asp?PUBID=1120

CLIMATE CHANGE: MULTIPLE WATER-ENERGY LINKAGES & DIMENSIONS

➤ Assessment & Information

- Climate change impact assessments that have been conducted to date and reported upon by the Intergovernmental Panel on Climate Change (IPCC) have been ineffective in assessing climate change impacts in the Arab region
- IPCC based on WMO geographic regions based on continents
- IPCC assessment sourced from journal articles
- Arab and Gulf region lagging in analysis that is specific to their circumstances.

➤ Adaptation

- Requires understanding of socio-economic vulnerabilities (present and projected)
- Access to information, technology and investment
- Regional cooperation

➤ Mitigation

- Requires clarity regarding rights to development, responsibilities for past pollution, and global commitment to future generations.

REGIONAL INITIATIVE FOR THE ASSESSMENT OF THE IMPACT OF CLIMATE CHANGE ON WATER RESOURCES AND SOCIO-ECONOMIC VULNERABILITY IN THE ARAB REGION

Objective

- To assess the impact of climate change on freshwater resources in the Arab Region through a consultative and integrated regional initiative that seeks to identify the socio-economic and environmental vulnerability caused by climate change impacts on water resources based on regional specificities.
- *The Regional Initiative aims to provide a **common platform** for addressing and responding to climate change impacts on freshwater resources in the Arab region by serving as the basis for **dialogue, priority setting and policy formulation on climate change adaptation at the regional level.***

See: www.escwa.un.org/RICCAR

الهيكل التنفيذي للمشروع – Implementation Framework



حصر المعلومات الأساسية المتاحة وإدارتها
Baseline Review & Knowledge Management



Integrated Assessment (تقييم متكامل)

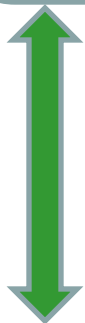
تقييم تأثير التغير المناخي
Climate Change
Impact Assessment



تقييم قابلية التأثر من التغير المناخي
Climate Change
Vulnerability Assessment



بناء القدرات
Capacity Building & Institutional Strengthening
for Water Ministries, Meteorological Offices, Arab Research Centers



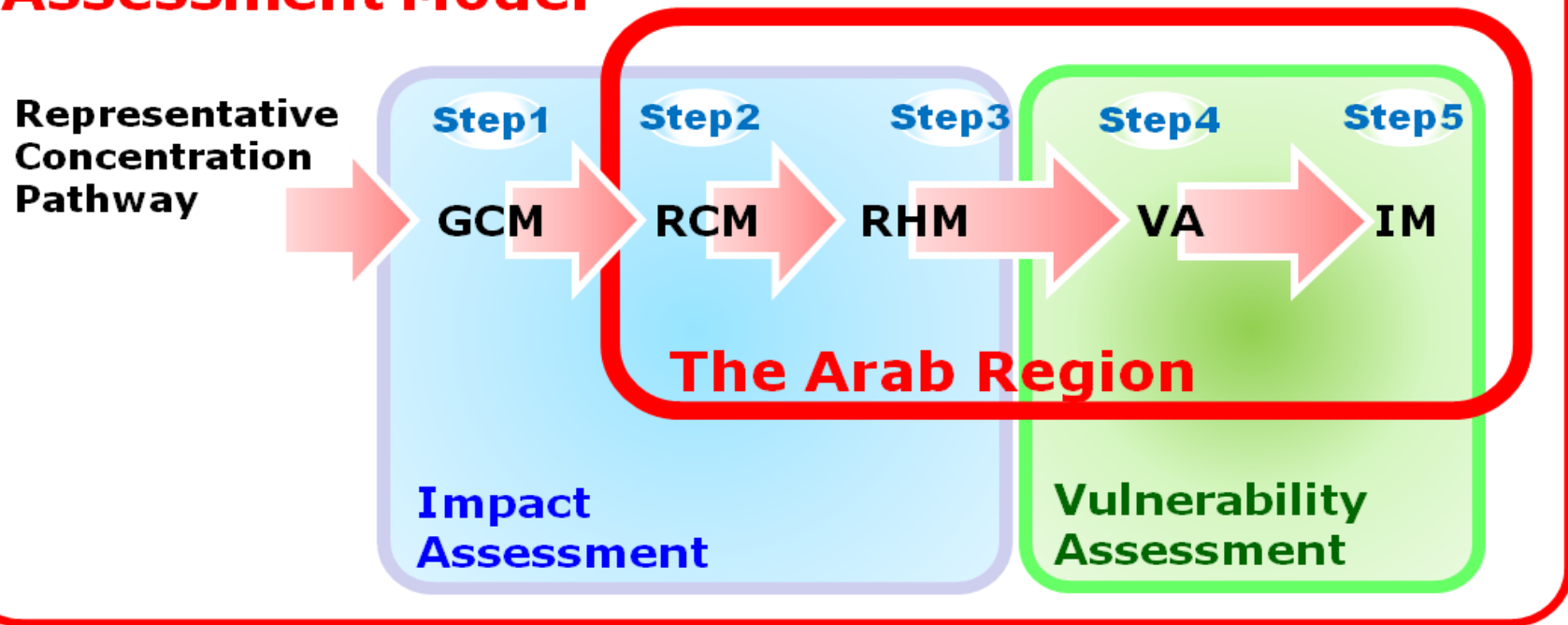
رفع الوعي
Awareness Raising & Information Dissemination

Regional Initiative Integrated Assessment

Methodological Framework



The Integrated Assessment Model



Step 1: Global Climate Modeling using General Circulation Model

Step 2: Regional Climate Modeling

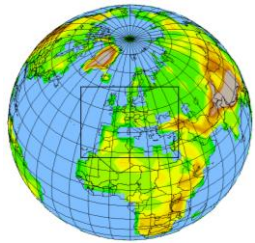
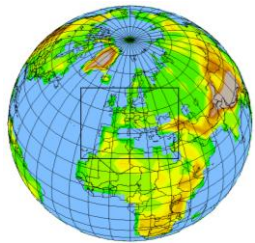
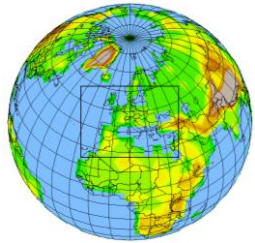
Step 3: Regional Hydrological Modeling

Step 4: Vulnerability Assessment

Step 5: Integrated Mapping

Impact Assessment Component

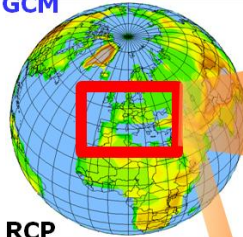
Different GCMs



for the
Same RCP

General Circulation Model (GCM)

GCM



RCP

GCM at
300 km x 300 km

Ensembles
used to
reduce
uncertainty
at level of
RCMs &
RHM

Ensembles
aggregate
findings of
different
RCMs &
RHMs
applied for
same RCP
& Domain

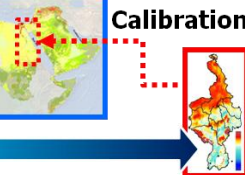
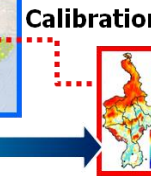
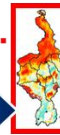
Regional Climate Model (RCM)

50km x 50km

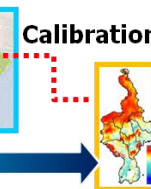
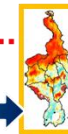
25km x 25km

Regional Hydrological Model (RHM)

Calibration

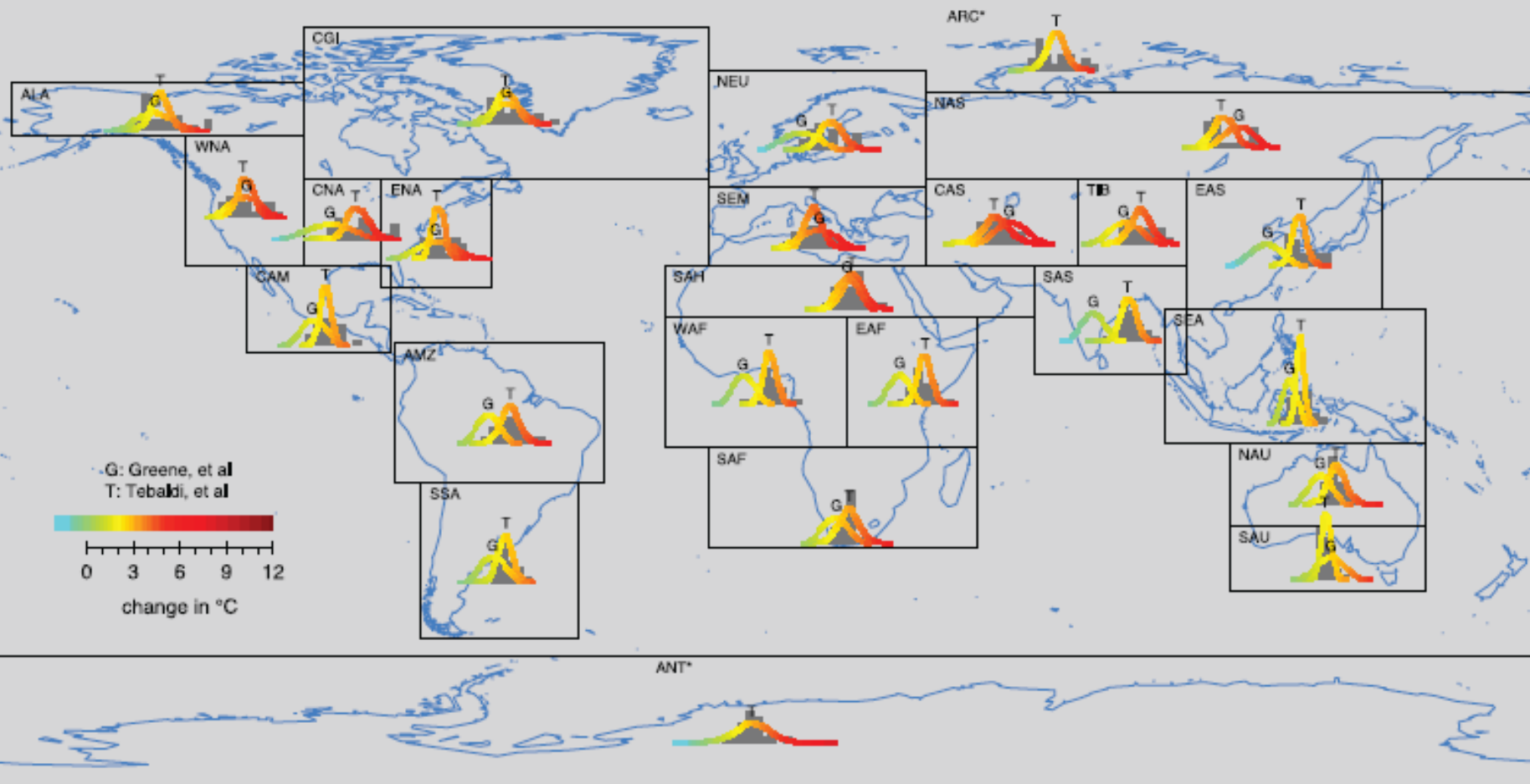


Calibration



Inter-Governmental Panel on Climate Change

Areas considered for regional averages in IPCC AR4



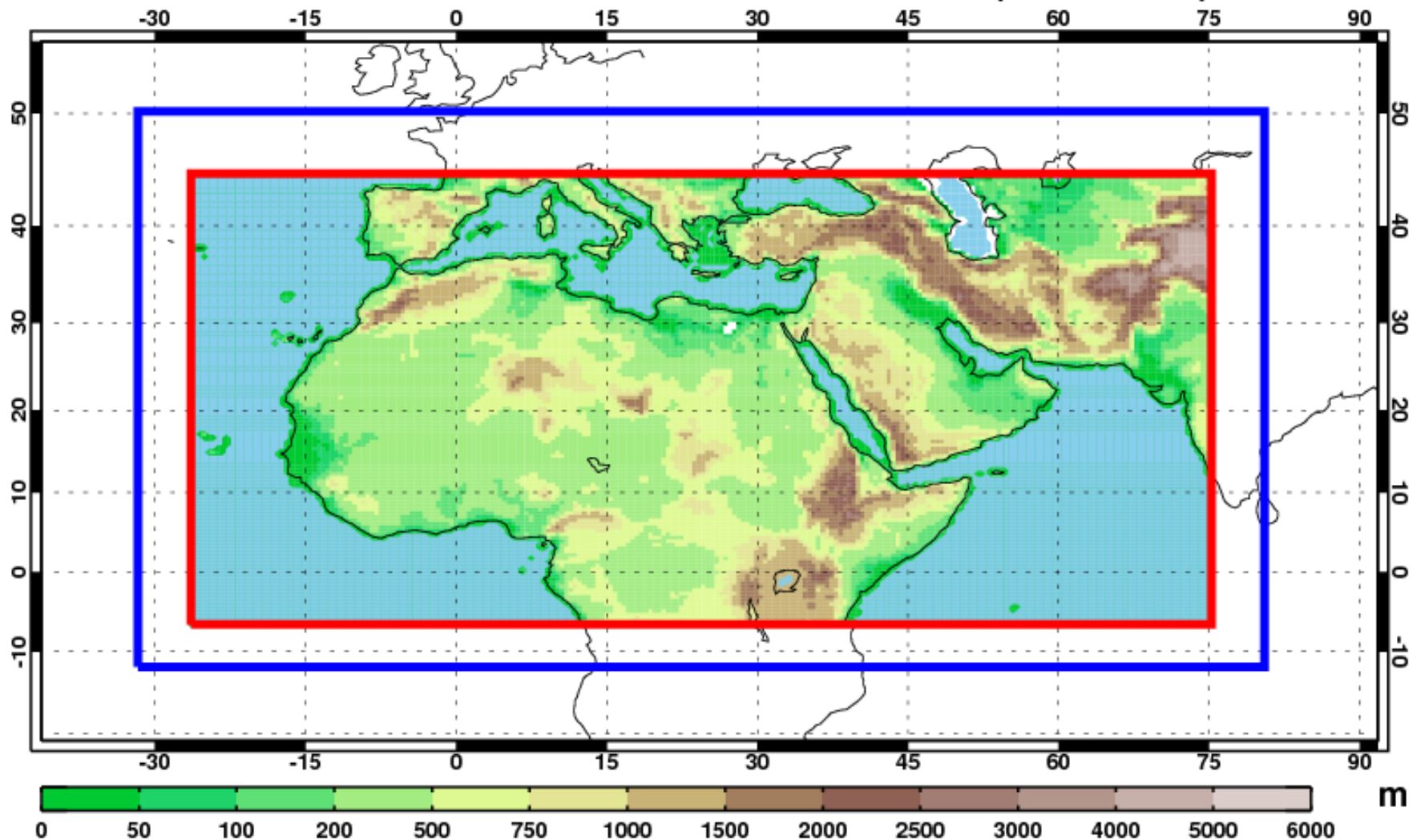
From R.K Kolli, WMO
ESCWA EGM #2 on Regional Initiative (Beirut, 2010)

ESTABLISHING AN ARAB DOMAIN

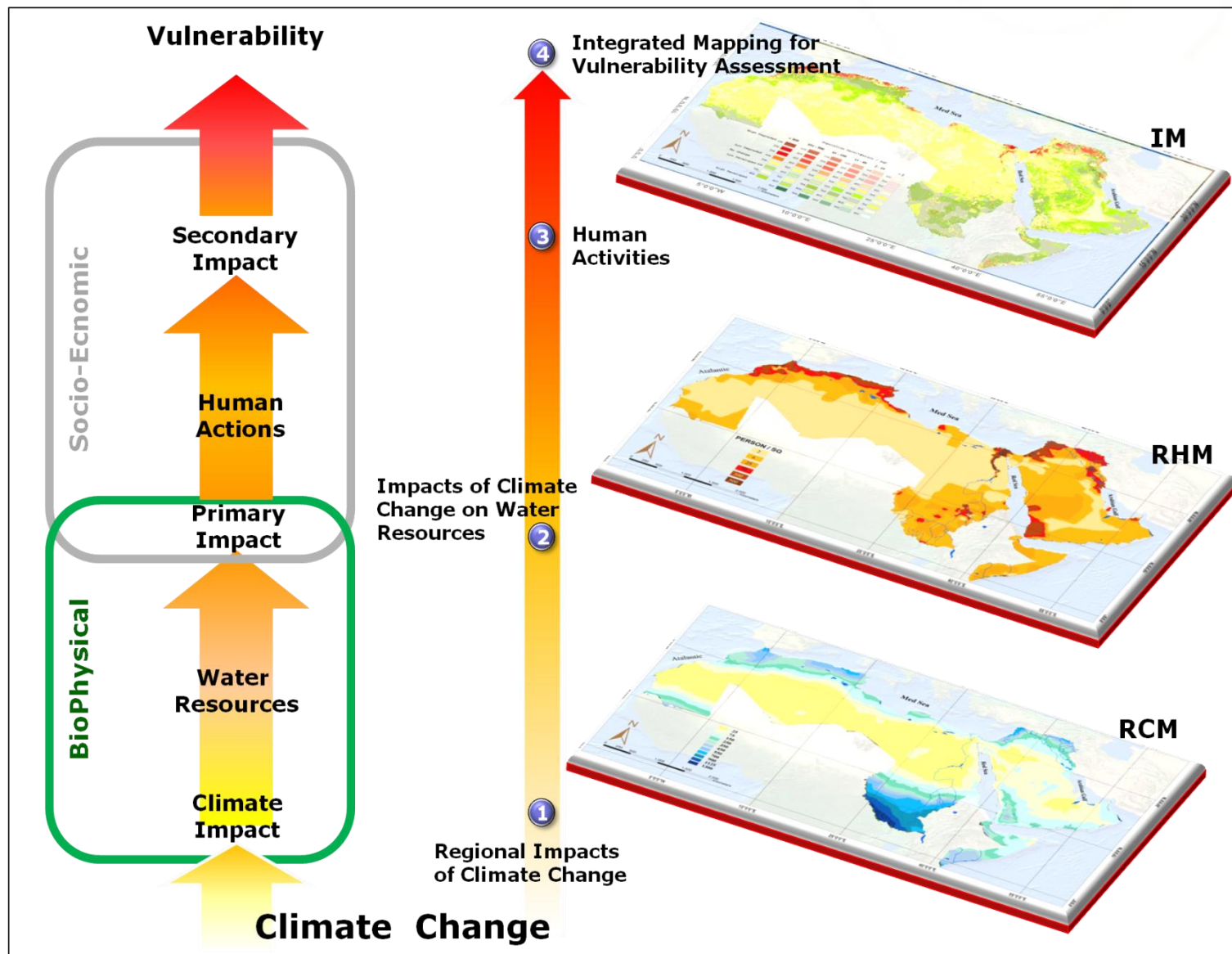
CORDEX ARAB DOMAIN | 0.44° (50 km)

— ACTIVE DOMAIN

— FULL DOMAIN (SMHI-RCA4)



Vulnerability Assessment Component



Regional Initiative Implementation Partners



Partners



UNITED NATIONS
UNIVERSITY

UNU-INWEH



United Nations
International Strategy for Disaster Reduction



Donors



National Research Institutes *(under formalization)*

Environmental and Climate Research Institute (ECRI)
Ministry of Water Resources and Irrigation (Egypt)

Center of Excellence for Climate Change Research
King Abdulaziz University
Presidency of Meteorology & Environment (KSA)

Arab Water Security Strategy (2010-2030)

- ❖ Strategy adopted in June 2011
- ❖ Arab Water Security Strategy Action Plan – under preparation
 - ACSAD leading preparatory process with support of ESCWA, UNEP, CEDARE, AWC, GIZ, Centre for Water Studies & Arab Water Security
 - First Preparatory Meeting (Beirut, March 2012) under chairmanship of Government of Iraq (current chair of Arab Ministerial Water Council).

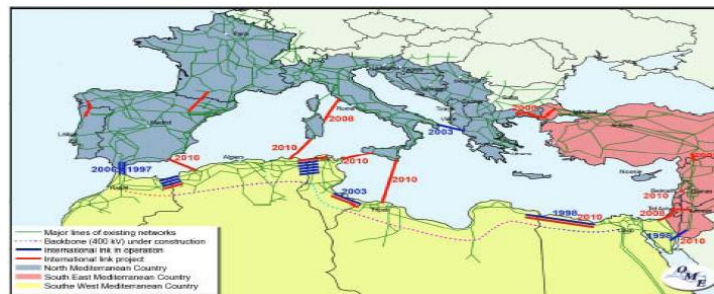
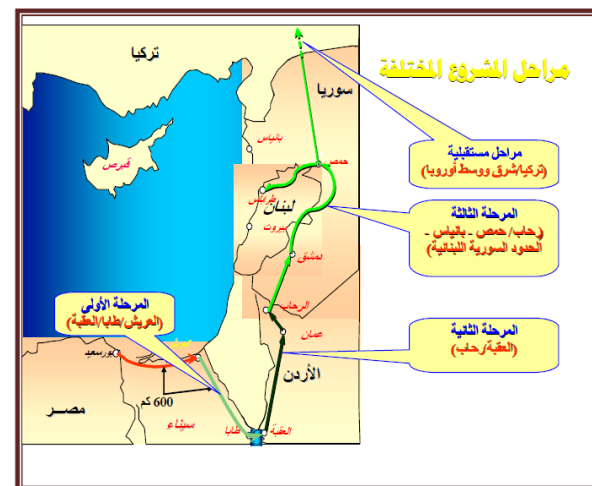
Arab Water Security Strategy Action Plan – 5 preliminary cluster areas:

- Enhanced provision of updated information on the status of water
- Improved implementation of IWRM
- Strengthening the scientific, technological and industrial base in the water sector
- Increased funding for water projects
- Enhanced capacity for climate change assessment and adaptation

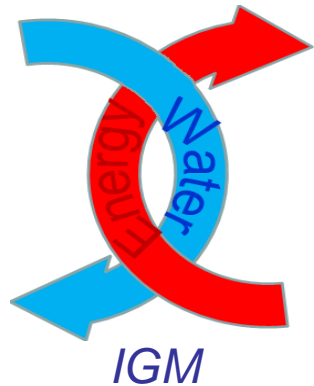
REGIONAL COOPERATION IN ONE SECTOR BENEFITS THE OTHER SECTOR

Enhancing energy networks between the ESCWA countries can generate economic, technical and environmental benefits and increase access and reliability of power grids to supply water/sanitation services.

- **Arab Gas Pipeline** project, the total length of which will be 1,200 km once completed, at a cost of US\$1.2 billion;
- **Dolphin Energy Limited** of Abu Dhabi, which connects Qatar, Oman and the UAE.
- **Electrical Grid Interconnections** projects, all of which encourage the exchange of energy between ESCWA member countries.



ESCWA: Inter-governmental Consultation



ESCWA Inter-Governmental Processes:

- ❖ **ESCWA Committee on Water Resources**
- ❖ **ESCWA Committee on Energy**
- Intergovernmental Consultation on the Water-Energy Nexus (Beirut, 27-28 June 2012)
- Will provide inter-governmental forum for identifying and prioritizing future work on the water-energy nexus

Mandate:

- **ESCWA Water Resources Committee** recommendation (March 2011) asks ESCWA to “Consider the **relationship between shared water resources, food security, energy and green economy within the context of integrated water resource management**, and particularly with respect to the integrated management of shared waters in view of its relevance to Arab water security.”
- **ESCWA Strategic Framework (2012-2013)** aims to: “enhance technical, human and institutional capacities of member countries to **develop and implement policies, strategies and action plans for the sustainable management of energy and water resources** in line with Johannesburg Plan of Implementation”.

Proposed priority areas for a strategic framework for fostering a policy nexus for addressing water and energy linkages

A

Improved monitoring and assessment tools

B

Increased R&D and Investment for Improved Efficiency

C

Integrated Management of Renewable & Non-Renewable Water & Energy Resource Management

➤ With linkage to land & marine resources

D

Regional Cooperation

Thank you!

Additional Information available at:

www.escwa.un.org