Examining the water-energy security nexus

Developing the Capacity of ESCWA Member Countries to Address the Water and Energy Nexus for Achieving the SDGs: Regional Policy Tool Kit

October 2016

Economic and Social Commission for Western Asia

UNITED NATIONS

الاسكوا

ESCWA

Table of Contents

Introducing the Water-Energy security Nexus

UNITED NATIONS

الاسكوا

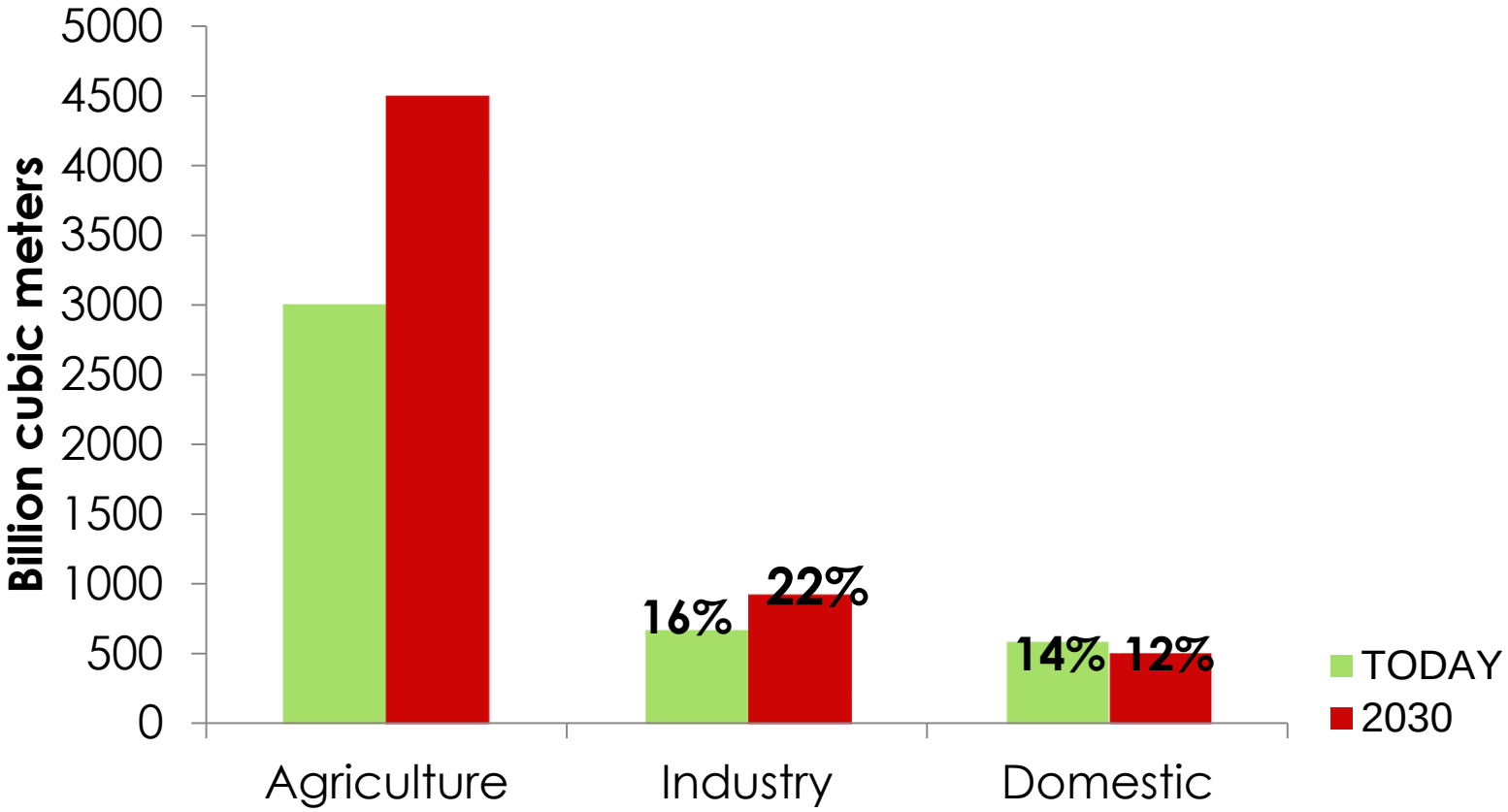
ESCWA

Introducing the Water-Energy Security Nexus

World Economic Forum Global Risk 2015 Report

The Big Risks: Economic, environmental and societal risks dominate. Although they were noted as major causes for concern, geopolitical and technological risks didn't come high on the radar.

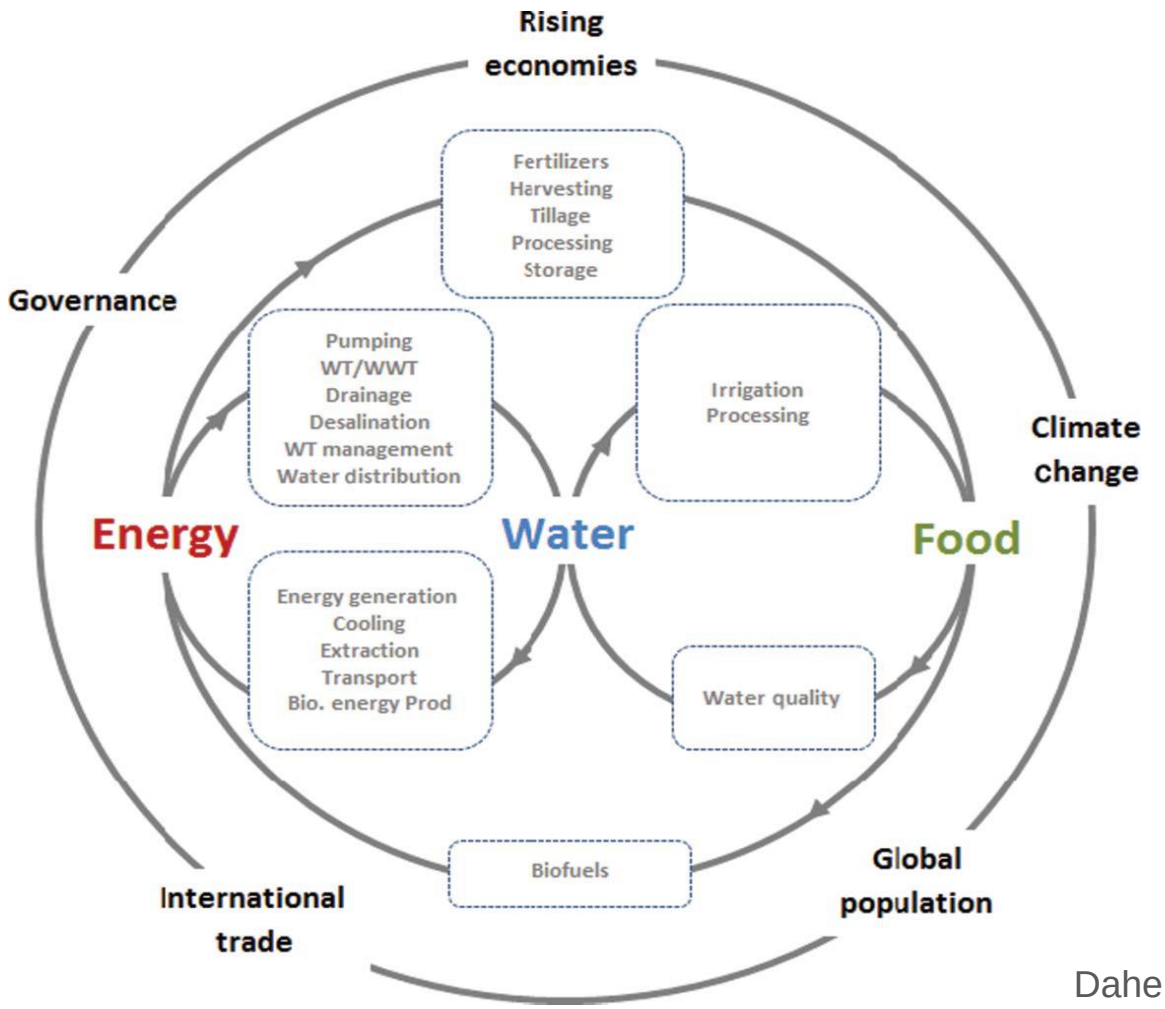
Grand Challenges



Projected Water Deficit in Texas Mirrors the Global Trends Excluding Energy Boom

Source: Water Security: The Water-Energy-Food-Climate Nexus. WEF, 2010

The water–energy–food nexus with effecting parameters



Daher and Mohtar, 2015

Water-energy food nexus approach requirements

1. Be inclusive of all stakeholders and create dialogue
2. Be quantitative and provide clear indicators for decision makers in the policy making process
3. Be evidence based and create synergies for data generation and sharing
4. Build on current structures and scenarios rather than have a substitution approach

Why do you need the nexus?

Public Sector:

Future planning for water, food and energy security (resources portfolio; sustainable use of resources)

Nexus governance, financing and incentive framework

Private Sector:

Long term assessment of investment (Bond etc.)

Optimal resources management and operations

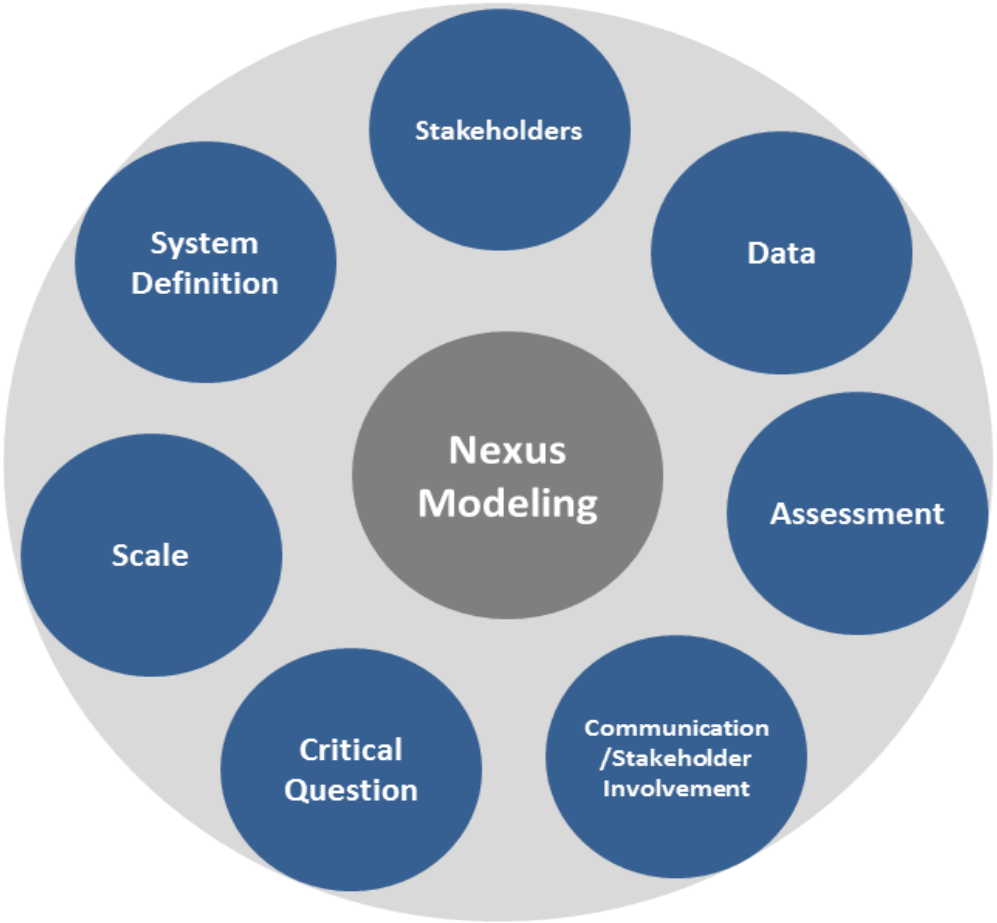
Nexus - friendly technology trends

Civil Society:

Informed citizenship about tradeoffs and choices

Quality of life (health and risk)

7-Question Guideline for modeling nexus issues



Daher et al, 2016

Obstacles and Solutions to Nexus Integration

UNITED NATIONS

الاسكوا

ESCWA

Lack of coherence: 'Silo' thinking

'Silo' or fragmented approaches arise from competition between urban and rural local governments and inadequate management coordination.

How to best allocate water to meet the needs calls for finding synergies and trade-offs across all sectors.

Data Gaps

Lack of coordination is due to poor or non-existing data regarding the availability, demand and regulations of primary resources.
The absence of this information can make the nexus implementation very inefficient.

These inefficiencies can carry across sectors and make it hard for governments to respond adequately to demands and stresses.

Technological Barriers

Technologies and existing infrastructure in most of the developing countries are fairly inefficient.

Promoting innovations in technology and governance systems will help countries move forward towards sustainable development goals and sustainable growth.

Example: production of solar energy in the desert areas of many of the MENA region and the affect of dust storms.

Lack of Communication and Negotiation tools and skills

Reaching water and energy security requires that all sectors find a common platform to agree on what their national security goals are.

Lack of communication tools and skills:

- Different institutions governing resources do not communicate with each other
- Unclear interface between science and policy making
- Decision makers to do not have appropriate tools to analyze trade-offs

A W-E nexus approach is an important tool to create platforms for dialogues and facilitate a better integration of scientific data and policy considerations

Production and Consumption Behaviors

Per capita consumption of domestic water in the Arab world ranks among the highest in the world. The Gulf region is one of the major energy demand regions in the world.

Energy consumption is growing at an annual rate of 3-4%, twice the world average.

Electricity generation is growing at an annual rate of 6-8%, three times the world average.

In Syria, up to 9% of annual electrical energy consumption is attributable to groundwater pumping and desalination (data prior to recent conflict) .

Governance, Implementation and Financing of the Nexus

Governance solutions must be country-specific and only be identified through collaborative partnerships

Models for regulating nexus:

1. Distributed (decentralized) model
2. Centralized model

Operationalizing these models in the Arab Region

1. Private Public Partnerships (PPP):

Private enterprise provides a public service and assumes financial, technical and operational risks
Need for seed funding
Great importance in states where resources have been privatized
Community partnership (PPCP) and social partnership (PPSP)

Governments, private enterprises, and social organizations for social welfare work together in a private model

Operationalizing these models in the Arab Region (continued)

2. Cooperative (community) model

Useful in remote or rural communities in West Asia and North Africa
These communities associations or coops own small scale projects for off-grid production of renewable energy and/or water distribution
For example: Tunisia

Water users associations developed pricing system of their own that encouraged more efficient use of water

Regional Perspective of the Water-Energy Security Nexus

UNITED NATIONS

الاسكوا

ESCWA

The Nexus Stakeholders: Ownership of the Nexus

The Nexus dialogue relies upon an approach that is vertical in scale and horizontal in audience.

The public sector should address ownership and governance.

The private sector should seek to optimize operations and minimize costs.

Civil society should seek to improve quality of life by safeguarding health and reducing risk.

Energy Governance Models

1. In the ESCWA region: regional cooperation and grid integration can help stabilize and secure electricity

Example: DESERTEC

2. In rural areas: decentralizing energy sources due to off the grid technologies being more economically feasible

Capacity Building and Knowledge and Institutional Gaps

1. Assemble multi-stake holder working group from the WEF sectors to help guide management.
2. Develop specific institutional and individual capacity building programs across sectors.
3. Determine right tools and data sets for scale specific conditions and goals.

Capacity Building and Knowledge and Institutional Gaps (continued)

4. Apply outcomes from holistic nexus tools and comprehensive data sets to guide the management of WEF resources
5. Create training programs across sectors to build capacity on the analytics and the negotiation aspects of the implementation of nexus solutions

Decision Support systems: Nexus Analytical tools

UNITED NATIONS

الاسكوا

ESCWA

Requirements of existing tools: uses and data requirements

Adopting a nexus approach to sector management encompasses the use of different quantitative and qualitative decision support tools.

Tools that meet three important criteria:

1. Address at least 2 of the 3 elements of the nexus
2. Allow policy analysis at national and local levels
3. Have an open access for end-users

Data and modelling challenge

A. Stakeholders:

Define your stakeholders!

Private, public, or science sector

At local, regional or national

B. Modeling:

Scale & Scope of modeling consistent with needs

Process modeling or tradeoffs analysis

C. Data:

Interlinkages data

Data resolution: Aggregation ad Disaggregation

Data quality and access

Data Gaps and Capacity Building

Extensive data inputs are needed for most of the tools, and in many cases, the data is not available.

Energy production, consumption and transformation data is available
Data availability for water is limited and gaps remain due to its physical characteristics
Even more complex to obtain data of water consumption in electricity generation.

“Water for Energy Framework” initiative
Creating a common database platform among sectors is another tool in creating synergy and productive negotiations

Water for Energy Production as a Policy Guide

UNITED NATIONS

الاسكوا

ESCWA

Grouping of Arab countries depending on how energy intensive water extraction and delivery is

1. High-energy demand: countries that depend on groundwater and desalination

GCC countries

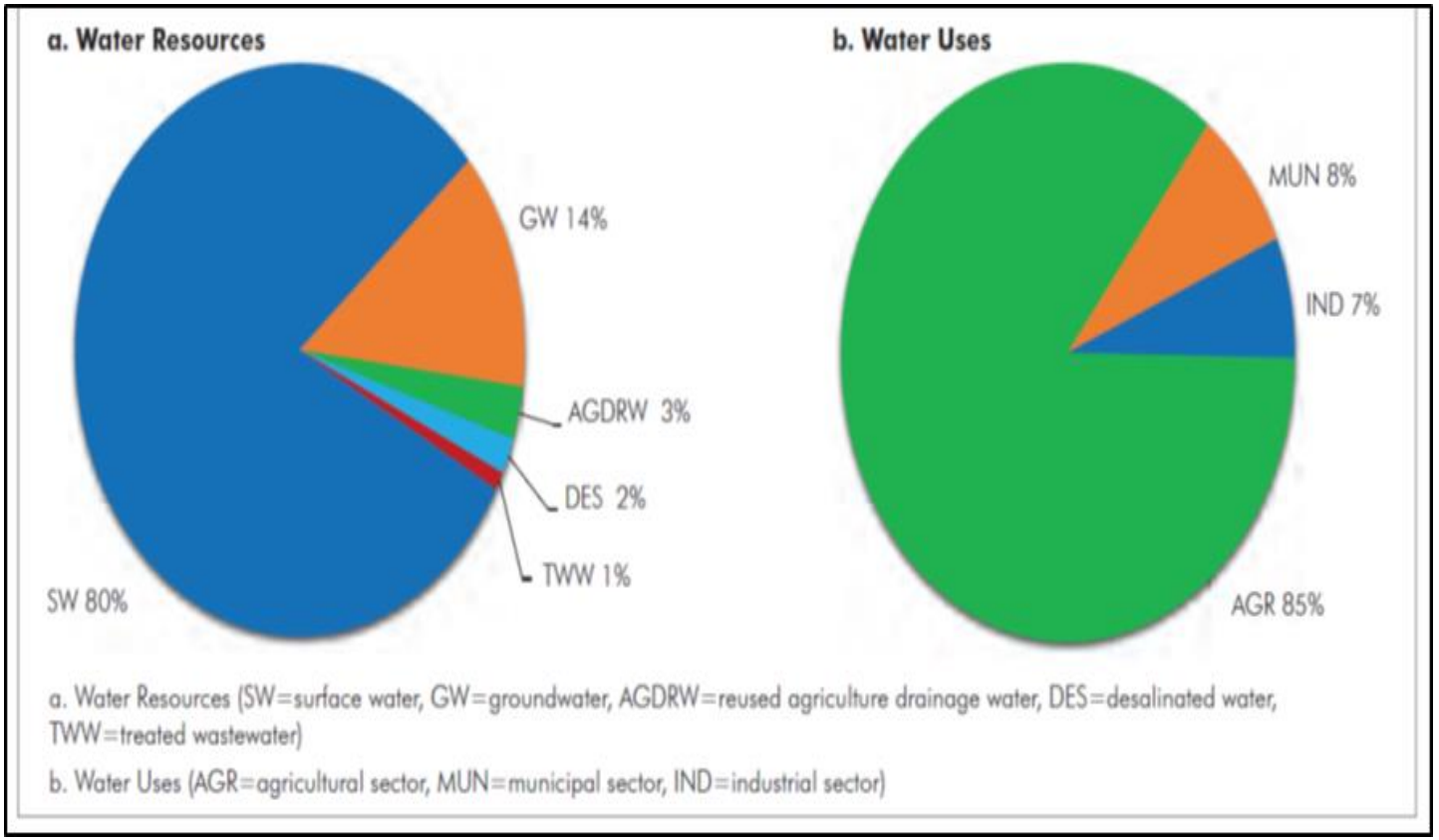
2. Medium-energy demand: countries that depend on a mix of sources

Jordan, Lebanon, Tunisia, and Yemen

3. Low-energy demand: countries that largely depend on surface water

Egypt and Syrian Arab Republic

Water resources by source and Uses in the Arab Region



Source: AFED, 2015

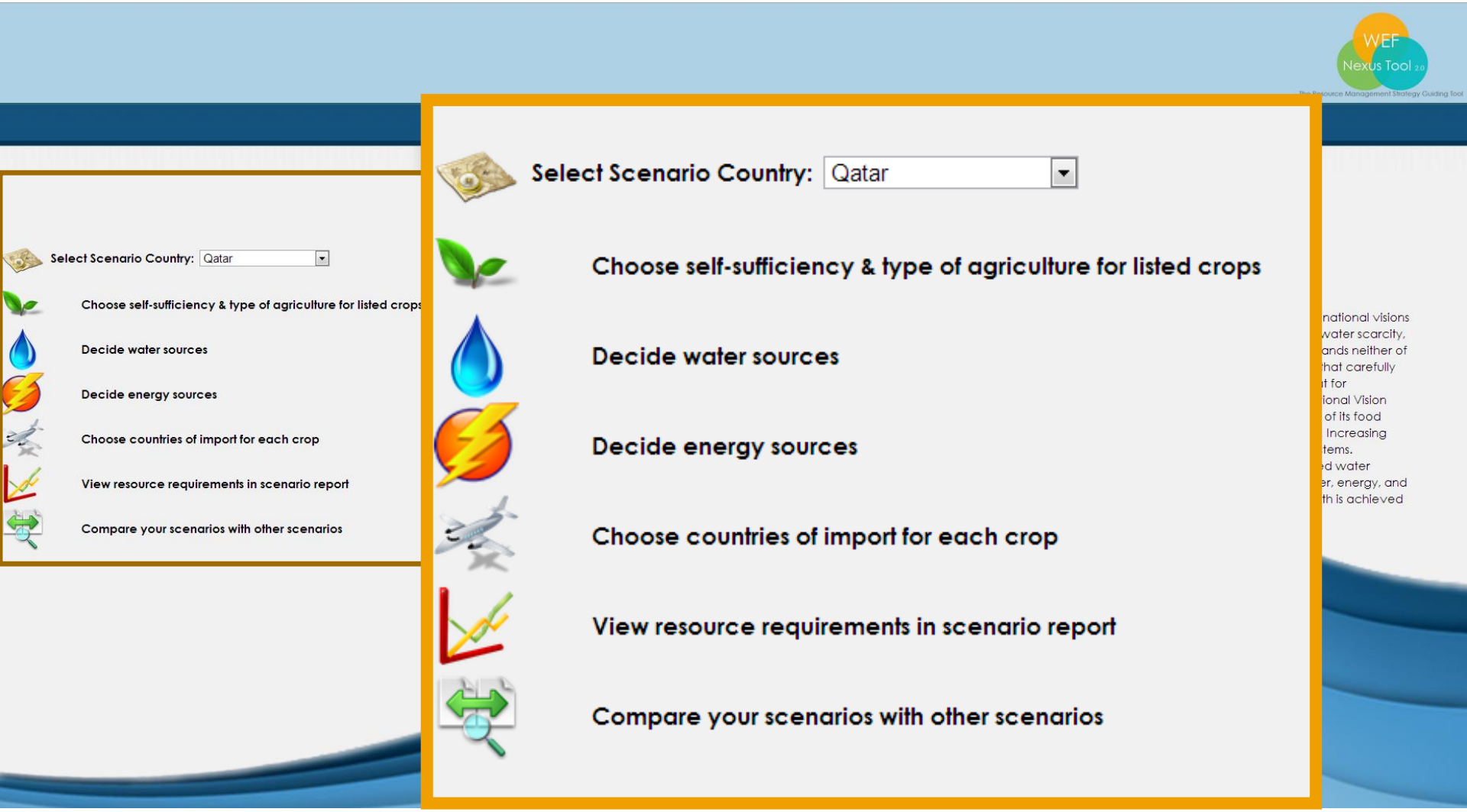
Case Study: The Qatar Food Security Program

UNITED NATIONS

الاسكوا

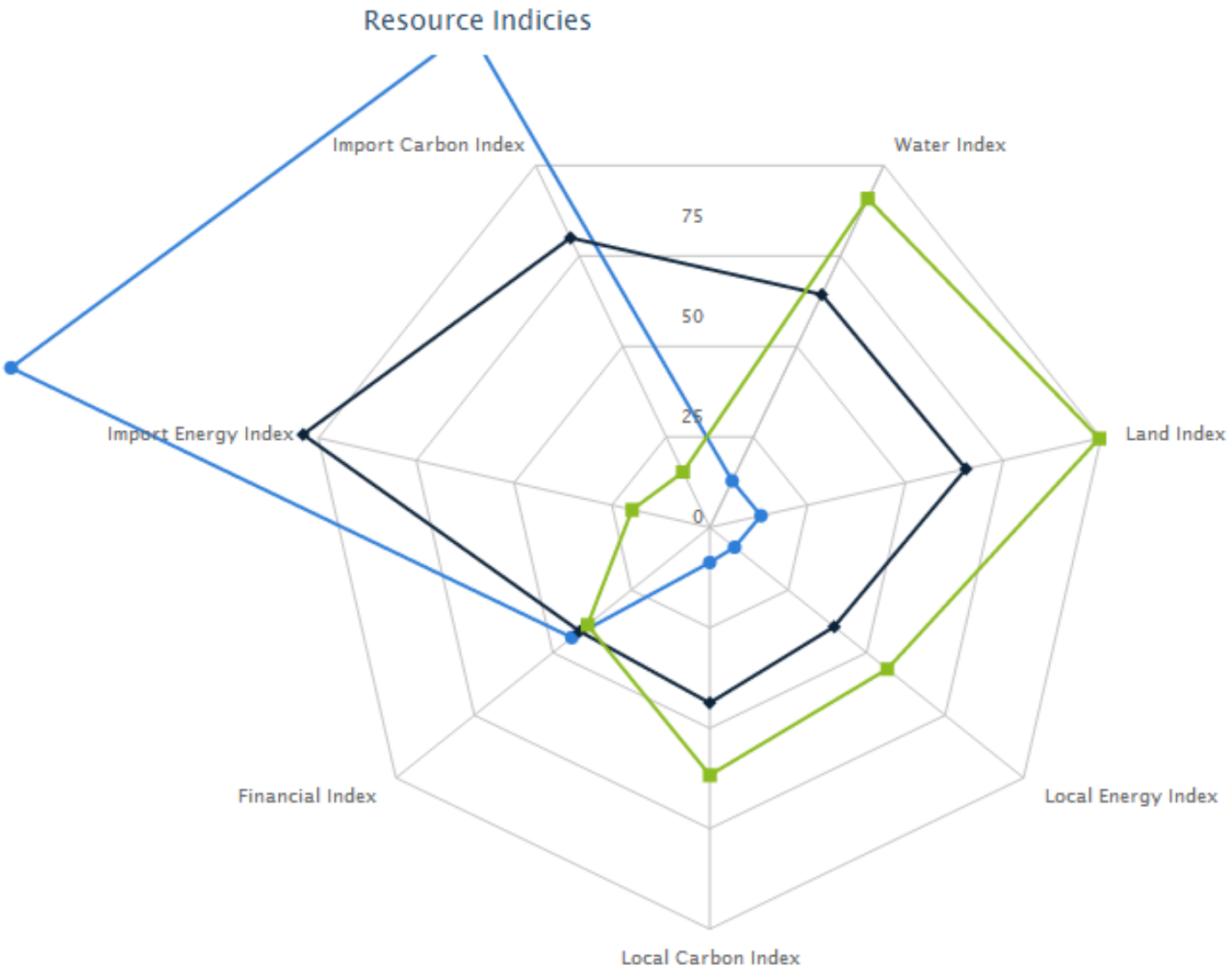
ESCWA

The WEF Nexus Tool 2.0 User Interface



View resource requirements in scenario report

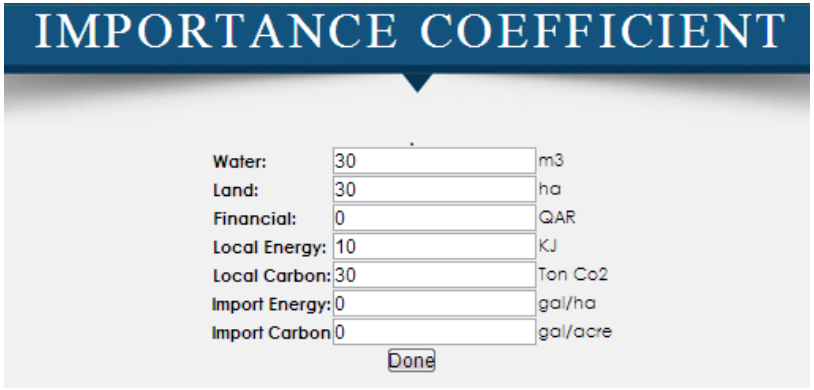
View resource requirements in scenario report



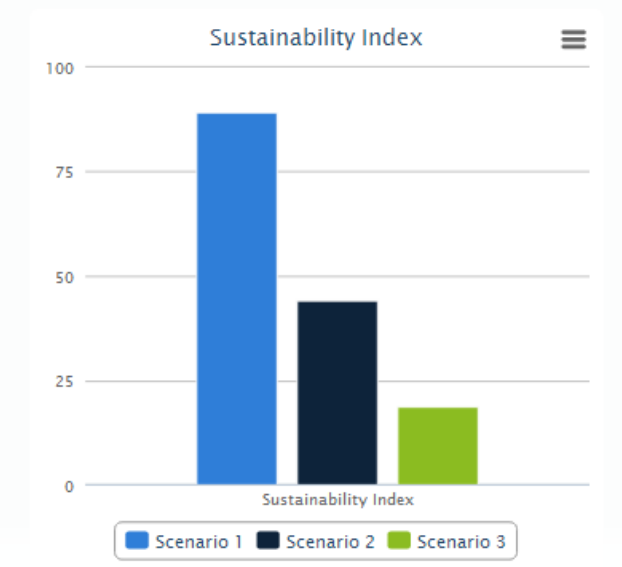
View resource requirements in scenario report

Resource Requirement Graphs

Edit Importance Coefficients



Sustainability Index



Case Study: Qatar

- Ranks 3rd in NG reserves; Ranks 12th in Oil reserves
- Arid Climate
- **Water**: 99% Desalination
- **Agriculture**: limited by low water quantity and quality, unsuitable soil, climatic conditions→ low crop yields
- Food imports exceed **90%**
- Qatar National Vision 2030
- Qatar National Food Security Program (QNFSP)

(Source: Athaia, 2011)

Scenario Assessment

Combined self-sufficiency = 15% (2010)

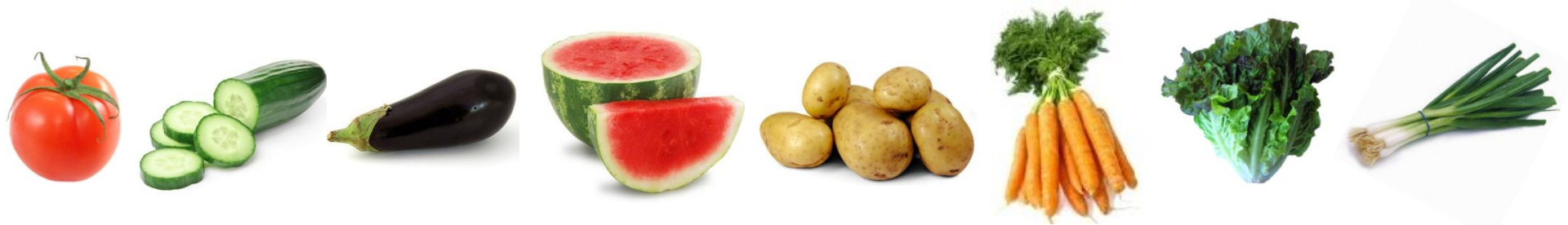
Tomato and **Cucumber** are partially done in protected

Groundwater is main source for agriculture

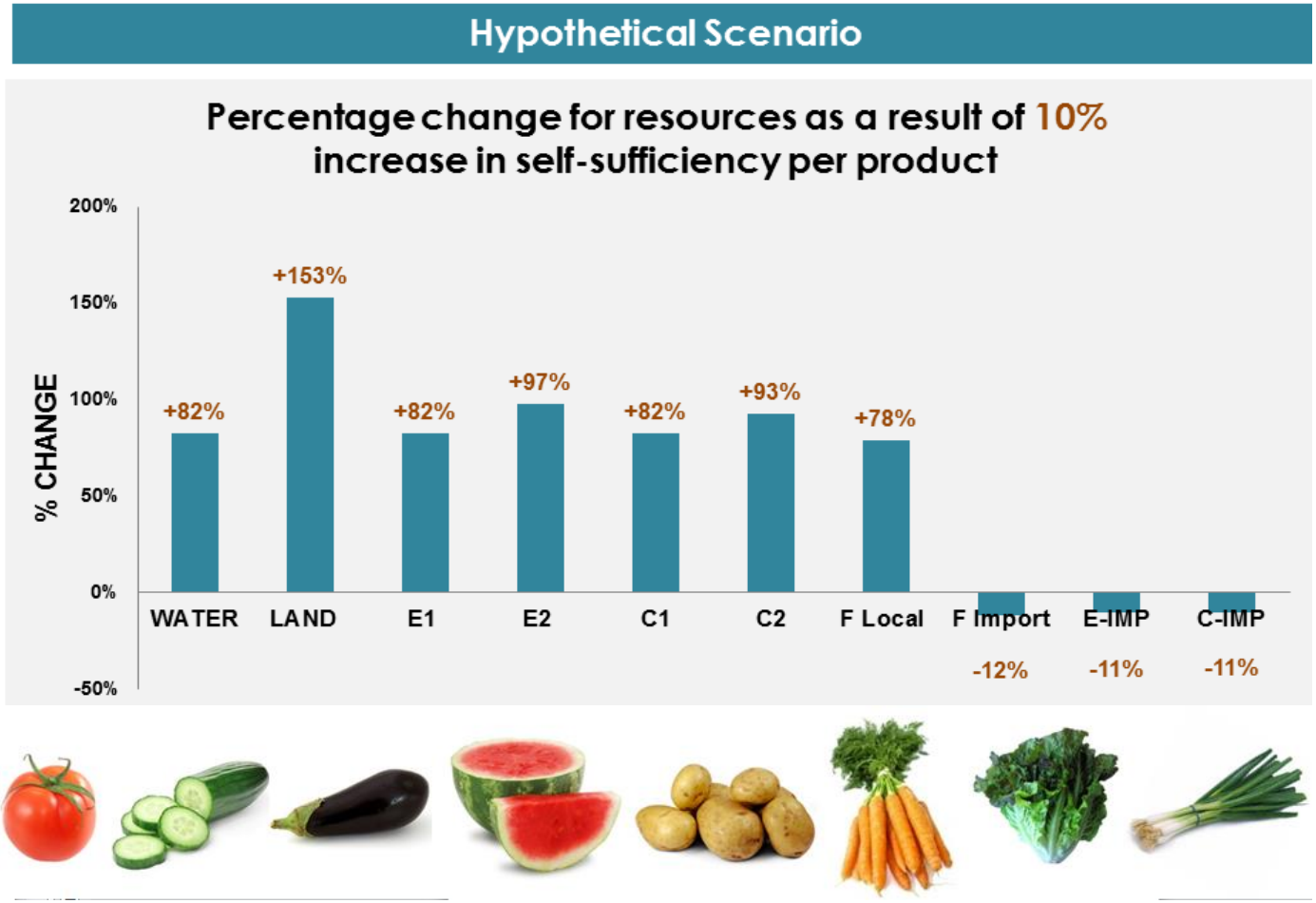
Natural Gas is main source of energy

Imports secured from **15 different countries**

WATER (m3)	5,783,797
LAND (ha)	792
E1 (kJ)	24,699,706,932
E2 (kJ)	15,000,733,177
C1 (ton CO2)	3,039,436
C2 (ton CO2)	1,089
F Local (QAR)	48,940,200
F Import (QAR)	3.68E+08
E IMP (kJ)	1.2117E+12
C IMP (kJ)	92,987



WEF Nexus 2.0 tool: Qatar Case Study



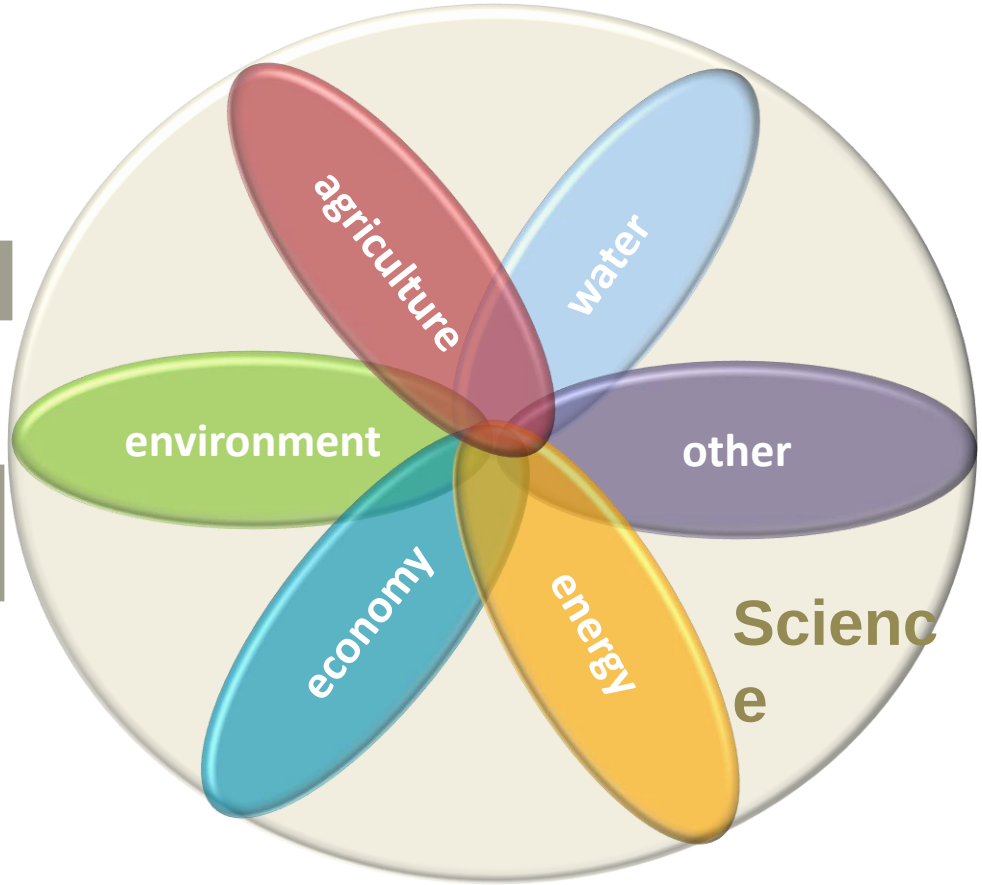
Source: Daher and Mohtar (2015)

Integrative Planning

Two necessary spaces for collaborative and integrative planning

among decision making entities

among decision making entities & science



Key Messages

UNITED NATIONS

الاسكوا

ESCWA

Key Messages

1. There is no one-size-fits-all approach to an integrate and sustainable management of resources.
2. Human rights and access to water, energy and food resources should be the foundation of these primary resources production and management
3. People centered approach grounded in the SDGs will allow to map the needs and create cooperation
4. Build capacity of local structures and institutions

Key Messages (continued)

5. The WEF nexus governance can be implement in the existing institutional programs that are country and region specific
6. Public sector should be looked at as a major stakeholder.
7. Develop strategies that allow Arab countries to implement the national and international commitments already signed for economic and sustainable development
8. Important to look at different type of governance of the primary resources management such as decentralization of governance

Key Messages (continued)

9. DSS for nexus management and interlinkages allow decision makers to look at various scenarios
10. Decisions affecting the energy sector need to include water resources consideration to avoid strains in the water sector
11. The energy requirement and carbon footprint for water technologies such as desalination and water treatment should be considered as a policy guide in the water sector

Thank you

UNITED NATIONS

الاسكوا

ESCWA