Water–Energy–Food (WEF) Nexus Tool 2.0
Guiding Integrative Resource Planning and Decision Making


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IWRA | Sustainability in the Water–Energy–Food Nexus Webinar | February 24, 2016
Decision makers do not have access to comprehensive tools that:

1. Are inclusive and multi-scale
2. Define and quantify interconnectivity between water, energy, and food
3. Support development of an integrative strategy for holistic management and planning for the future of these resources
Objectives

- **Present a scenario-based framework** that offers an explicit quantification of the existent interlinkages between water, energy, and food systems.

- **Present and evaluate** assessment tool corresponding to developed framework.

- **Demonstrate the tool’s utility** in supporting decision making in food security case study in Qatar.
Case Study: Qatar Food Security

- 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)
Increase food production by 10% for coming year

Hypothetical Scenario

<table>
<thead>
<tr>
<th>Resource</th>
<th>2003</th>
<th>2010</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER</td>
<td>5,783,797</td>
<td>10,551,955</td>
<td>+82%</td>
</tr>
<tr>
<td>LAND</td>
<td>792</td>
<td>2003</td>
<td>+153%</td>
</tr>
<tr>
<td>E1</td>
<td>2.47E+10</td>
<td>4.51E+10</td>
<td>+82%</td>
</tr>
<tr>
<td>E2</td>
<td>1.5E+10</td>
<td>2.96E+10</td>
<td>+97%</td>
</tr>
<tr>
<td>C1</td>
<td>3,039,436</td>
<td>5,545,145</td>
<td>+82%</td>
</tr>
<tr>
<td>C2</td>
<td>1,090</td>
<td>2,099</td>
<td>+93%</td>
</tr>
<tr>
<td>F Local</td>
<td>48,940,200</td>
<td>87,282,896</td>
<td>+78%</td>
</tr>
<tr>
<td>F Import</td>
<td>3.68E+08</td>
<td>3.24E+08</td>
<td>-12%</td>
</tr>
<tr>
<td>E-IMP</td>
<td>1.21E+12</td>
<td>1.08E+12</td>
<td>-11%</td>
</tr>
<tr>
<td>C-IMP</td>
<td>92,988</td>
<td>82723</td>
<td>-11%</td>
</tr>
</tbody>
</table>

Percentage change for resources as a result of 50% increase in self-sufficiency per product

Discussions
Based on preliminary projections of the study sample in Qatar:

• **Land** is the most sensitive resource requirement
  - invest in research and consolidate efforts towards improving local yields
  - detailed soil suitability mapping for potential food products
  - investigate different food growing technologies

• **Food production energy and carbon footprint (E₂, C₂)**
  - invest in less carbon emitting machinery
  - control over energy consumption during the food growing phases

• **Water, Energy for water, and respective carbon footprint (W, E₁, C₁)**
  - Relying on groundwater for irrigation is catastrophic/use other sources
  - less water demanding technologies/ new irrigation techniques
  - invest in less energy demanding technologies
  - explore potential of renewables to fuel these water sufficing technologies
• Most sensitive does not mean most critical!

Percentage change for resources as a result of 10% increase in self-sufficiency per product
• **Research Limitations:**
  - data unavailability
  - absence of locally measured data
  - confidentiality of present data

• **Potential improvements to tool:**
  - water quality & water degradation
  - soil quality & soil degradation
  - improve financial assessment
  - quantify risk for scenarios
  - projection models
Conclusions

- **NO** one-size-fits-all tool
- **Need to identify the critical question** and prescribe proper tool
- Different tools answer **different questions at different scales**, requiring **different data resolution**, involving **different stakeholders**
- Choice of tool will depends on the **output** needed and **resources** and **time** available
Thank You