Food Security in the Desert
What does it take?

Bassel T. Daher

11-13 June 2014
Qatar

- Ranks 3rd in NG reserves; Ranks 12th in Oil reserves
- Arid Climate
- **Water**: 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)
Conceptual Framework

Water
- Water Balance
- Gap Identification
  - Agriculture
  - Municipal
  - Industrial

Food
- Consumption %DPC %DPE %IMP
- DPC: Domestically Produced and Consumed
- DPE: Domestically Produced and Exported
- IMP: Imported

Energy
- kl/m³ of water produced for food production → kl/ton
- Surface water pumping
- Ground water pumping
- Water Treatment
- Wastewater Treatment
- Desalination
- Other

Reallocation
- Scenario 1: Importing Products
- Scenario 2: Domestic Production
  - Intensify Agriculture
  - Arable Land Availability
  - Open Vs. Protected Ag.
  - Technologies

Climate
- Amounts of water for irrigation under different climates
- Climate specific crops
- Outdoor vs. Indoor Agriculture

Environmental Cost
- Degradation of soil and water quality
- Ppm of NOx, SOx...
- Ton CO2/ton food

Conventional & Non-Conventional Water Resources
- Rainfall
- Surface Water
- Treated Water
- Treated Waste Water
- Desalinated Water

Technologies and Efficiencies
- Tillage
- Fertilizer production
- Harvest
- Local Transport

Global Costs
- Environmental Costs
  - Energy Costs
- Local Costs
  - Financial Costs
  - Dependency Risks (uncertainty)
  - Product + Transport Cost
    - CO₂/ton food
    - Kj/ton food
    - Virtual water import
  - Land saving
Qatar Case Study

Combined self-sufficiency = 15% (2010)

Tomato and Cucumber are partially done in protected agriculture

Groundwater is main source for agriculture

Natural Gas is main source of energy

Imports secured from 15 different countries

<table>
<thead>
<tr>
<th>WATER (m3)</th>
<th>5,783,797</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND (ha)</td>
<td>792</td>
</tr>
<tr>
<td>E1 (kJ)</td>
<td>24,699,706,932</td>
</tr>
<tr>
<td>E2 (kJ)</td>
<td>15,000,733,177</td>
</tr>
<tr>
<td>C1 (ton CO2)</td>
<td>3,039,436</td>
</tr>
<tr>
<td>C2 (ton CO2)</td>
<td>1,089</td>
</tr>
<tr>
<td>F Local (QAR)</td>
<td>48,940,200</td>
</tr>
<tr>
<td>F Import (QAR)</td>
<td>3.68E+08</td>
</tr>
<tr>
<td>E IMP (kJ)</td>
<td>1.2117E+12</td>
</tr>
<tr>
<td>C IMP (kJ)</td>
<td>92,987</td>
</tr>
</tbody>
</table>
Increase food production by 100% for coming year

Hypothetical Scenario

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

<table>
<thead>
<tr>
<th>Resource</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER</td>
<td>+411%</td>
</tr>
<tr>
<td>LAND</td>
<td>+764%</td>
</tr>
<tr>
<td>E1</td>
<td>+411%</td>
</tr>
<tr>
<td>E2</td>
<td>+486%</td>
</tr>
<tr>
<td>C1</td>
<td>+411%</td>
</tr>
<tr>
<td>C2</td>
<td>+461%</td>
</tr>
<tr>
<td>F Local</td>
<td>+390%</td>
</tr>
<tr>
<td>F Import</td>
<td>-60%</td>
</tr>
<tr>
<td>E-IMP</td>
<td>-55%</td>
</tr>
<tr>
<td>C-IMP</td>
<td>-55%</td>
</tr>
</tbody>
</table>

Discussions
• Most **sensitive** does not mean most **critical**!
Integrative Planning

Two necessary spaces for collaborative and integrative planning

- Among decision making entities
- Among decision making entities & science

Science
- Environment
- Economy
- Energy
- Water
- Agriculture
- Other
Thank you