# Co-Benefits of Efficient Use of Water, Energy and Food to Address Climate Change Impact, Biodiversity Loss and Pollution: Q-Nexus Model a Tool for Decision-Making

# المنافع المشتركة للاستخدام الفعال للمياه، الطاقة والغذاء في معالجة تأثير تغير المناخ وفقدان التنوع البيولوجي والتلوث: نموذج Q-Nexus أداة لصانعي القرار

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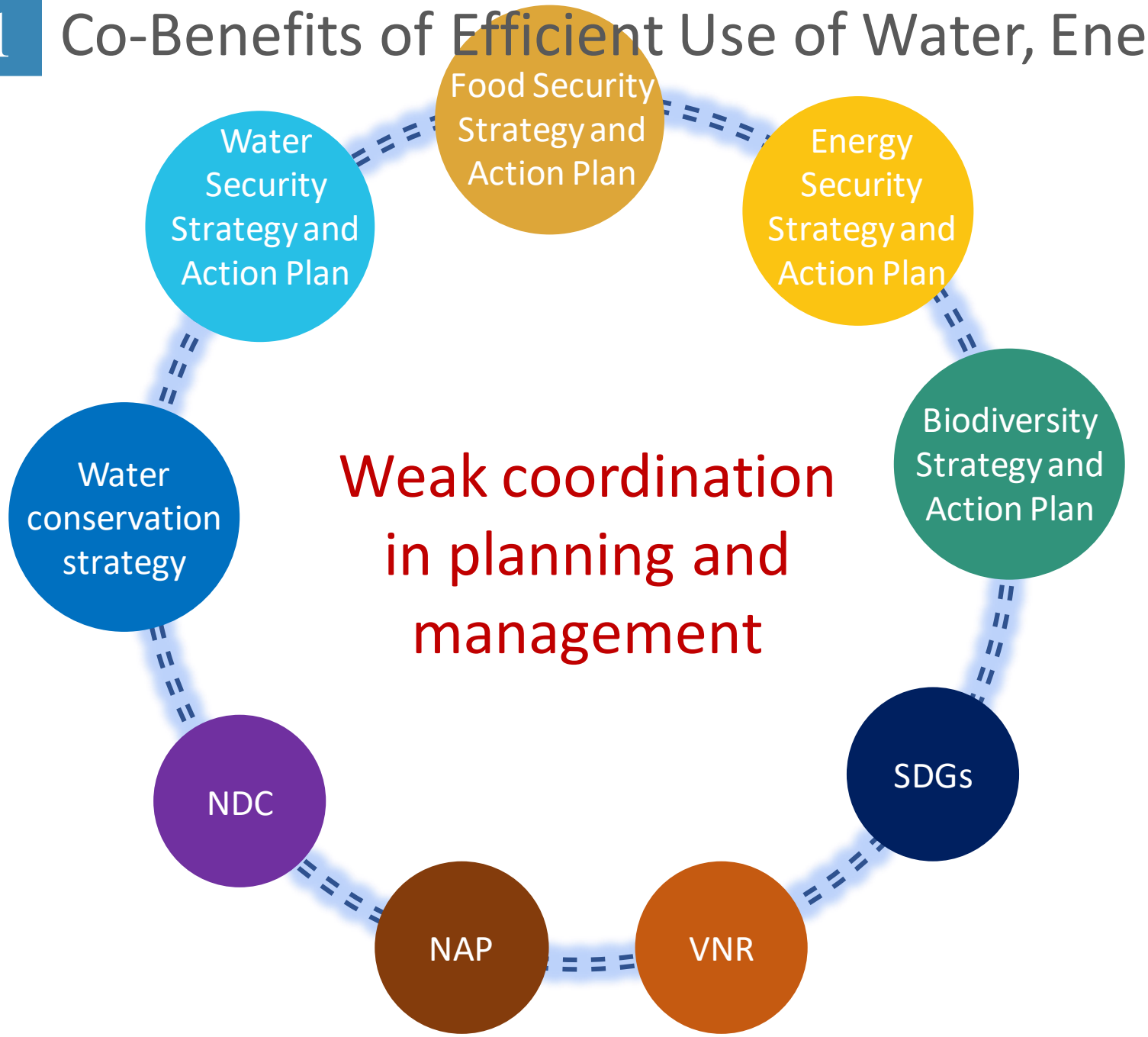
# Outline

1. Co-Benefits of Efficient Use of Water, Energy and Food
2. What is the Q-Nexus tool?
3. Case Study - Assessing the Water-Energy-Food- Nexus in Kuwait

# 1 Co-Benefits of Efficient Use of Water, Energy and Food

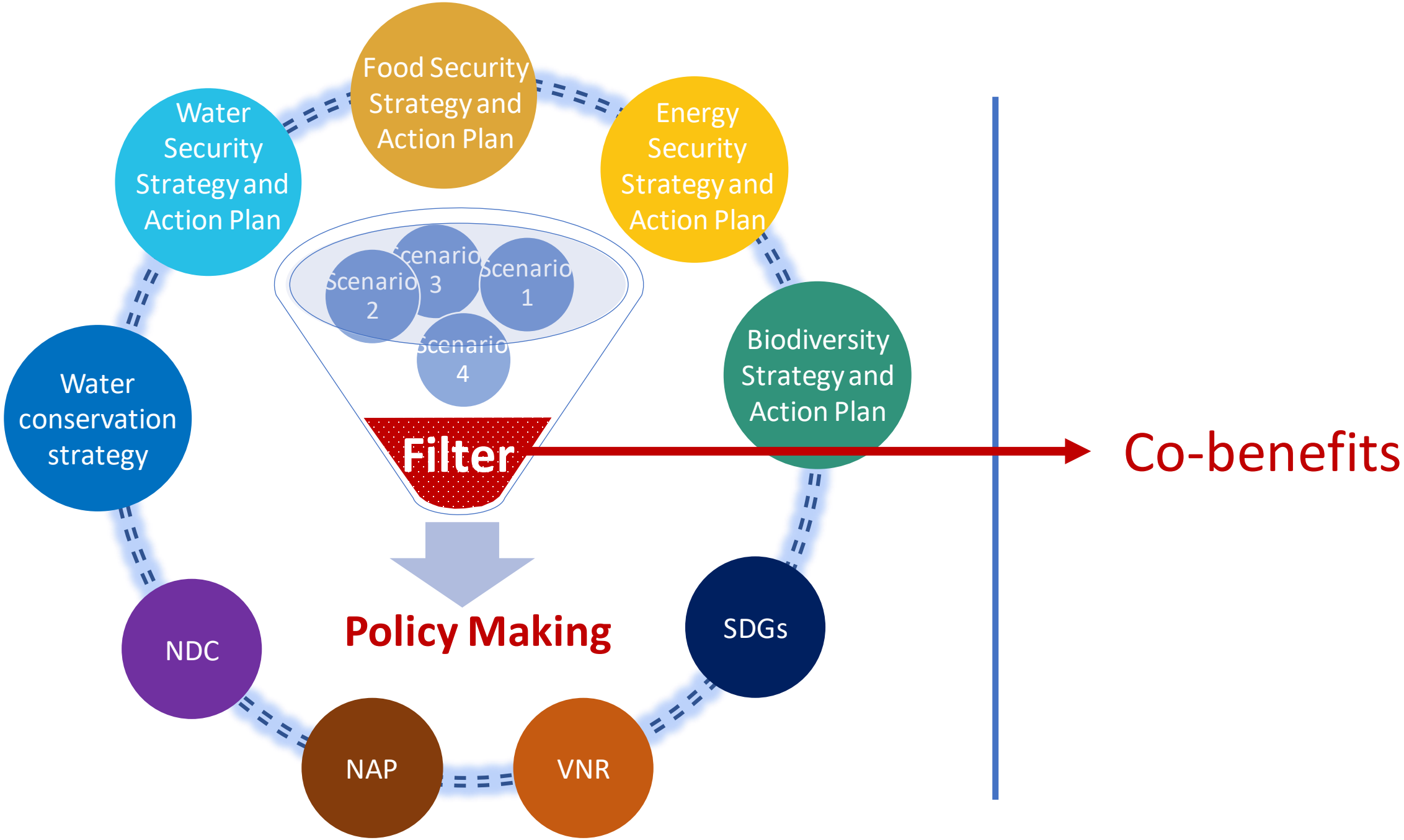



Weak coordination in planning and management

**Best Coordinated Actions?**

**Today?**

**Future?**


Food Security Strategy and Action Plan
Water Security Strategy and Action Plan
Energy Security Strategy and Action Plan
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Water conservation strategy
Biodiversity Strategy and Action Plan
Filter
Co-benefits
Policy Making
NDC
SDGs
NAP
VNR

# 1 Co-Benefits of Efficient Use of Water, Energy and Food

**Examples of co-benefits of efficient use of water:**

- Reducing energy consumption, which in turn reduces greenhouse gas emissions.
- Irrigation systems that use less water and more efficient water pumps can result in energy savings.
- Enhance biodiversity by reducing the depletion of water resources and reducing the risk of habitat loss.
- ……

# 1 Co-Benefits of Efficient Use of Water, Energy and Food

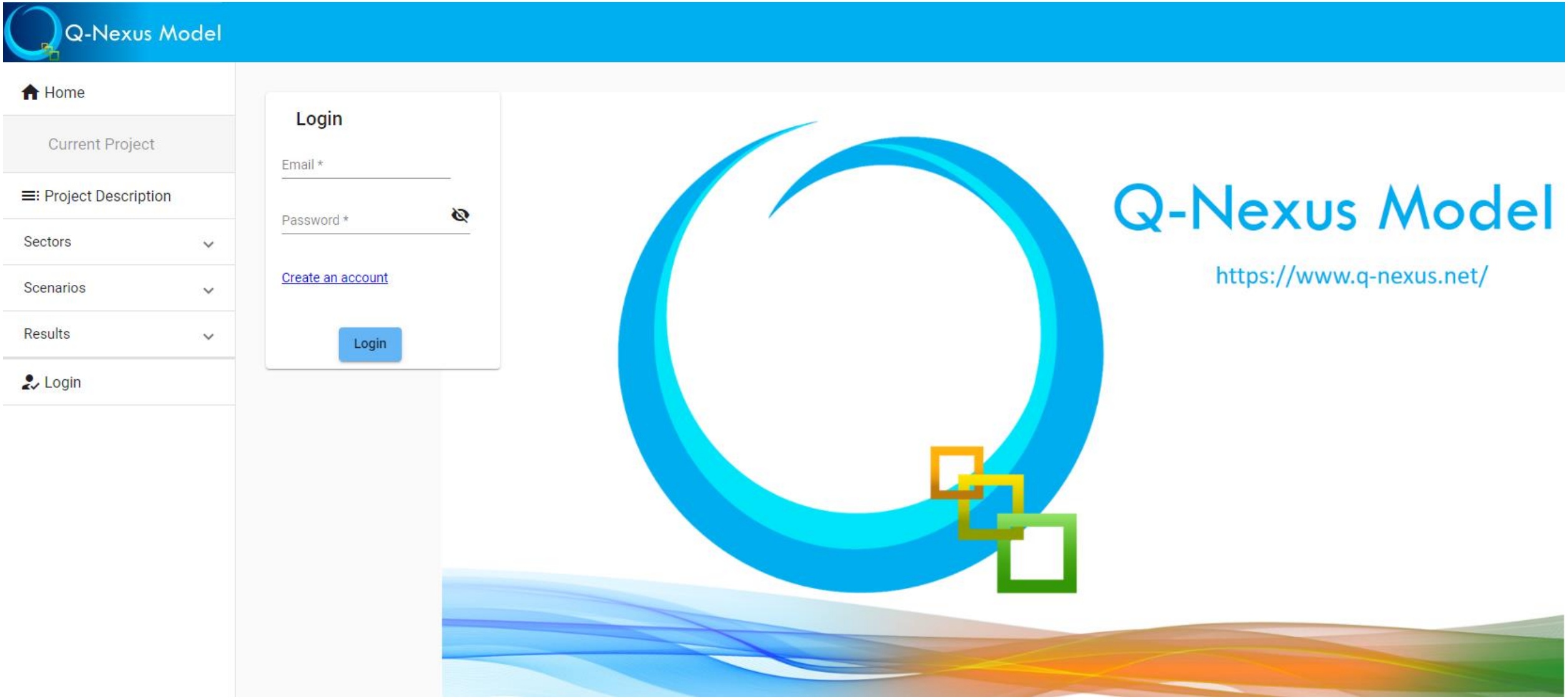
**Examples of co-benefits of efficient use of energy:**

- Using renewable energy sources such as solar and wind can reduce greenhouse gas emissions and air pollution, leading to improved air quality.
- Energy efficiency measures such as insulation, efficient lighting, and energy-efficient appliances can result in energy savings, leading to reduced greenhouse gas emissions.

**Examples of co-benefits of efficient use of food:**

- Reducing food waste can result in reduced greenhouse gas emissions from the decomposition of organic waste in landfills.
- Sustainable agriculture practices can enhance biodiversity by reducing the depletion of soil resources, reducing the risk of soil erosion, and reducing the use of pesticides and fertilizers.

# 2 What is the Q-Nexus tool?



# 2 What is the Q-Nexus tool?

**End Use change:**

- Future projection of WEF demand
- Reduce per capita water consumption
- Reduce WEF losses at the demand side
- Increasing water recycling and reuse
- WEF trade (imports/exports)
- Impact of Climate Change of WEF Demands

**Technology Options change:**

- Renewable energy
- Increase irrigation efficiency
- Increase water production efficiency
- Increase energy production efficiency

**Resource Allocation change:**

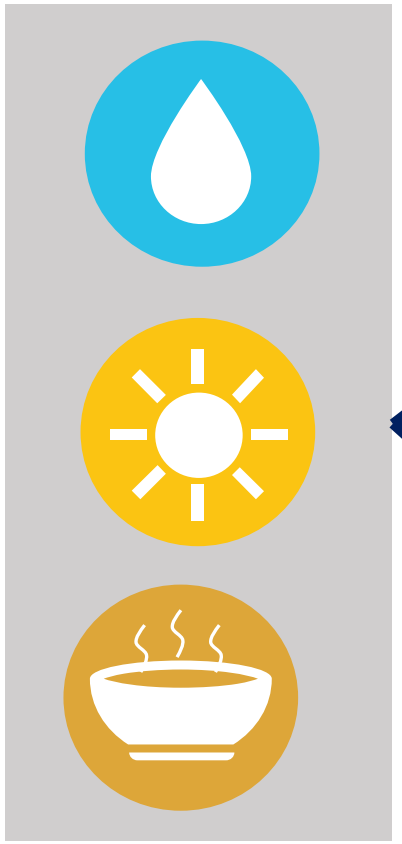
- Switching to more efficient resource production
- Change intersectoral use allocation policies

Supply Side & Demand Side Policies

\+ Combined scenario

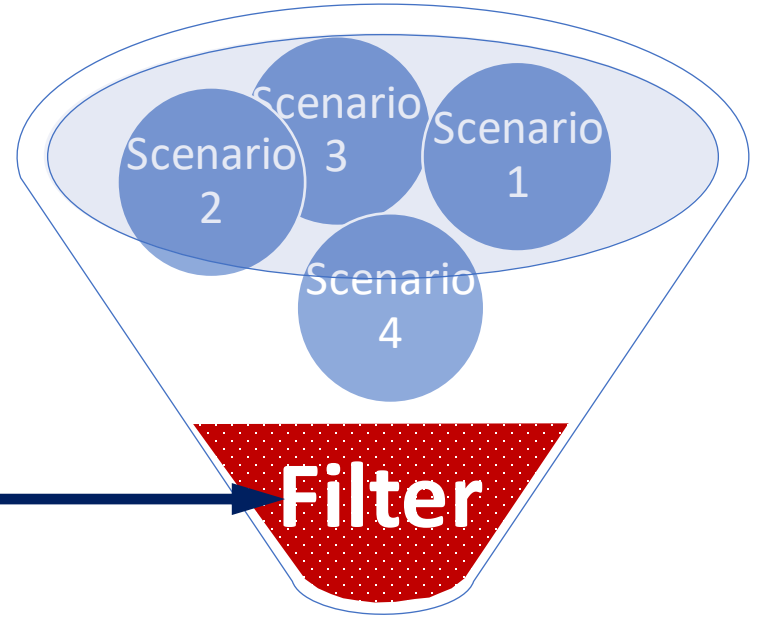
# 2 What is the Q-Nexus tool?

**q-nexus quantitative results**



- Cost Estimation
- GHG emissions
- Brine discharge from desalination
- Other……

**Pool of Scenarios Across Sectors**




**Policy Making**

# 3 Case Study - Assessing the Water-Energy-Food- Nexus in Kuwait

**Water scenarios:**

- Reduction of Per capita water consumption
- Switching to more energy efficient desalination technologies

**Food scenario:**

- Increase of irrigation efficiency

**Energy scenario:**

- Switching from oil to natural gas for power generation

\+ Combined scenario

Source: Al Edwani, Zubari, Karnib, Sadek (2022), AGU

# 3 Case Study - Assessing the Water-Energy-Food- Nexus in Kuwait

## Assessing the Water-Energy-Food- Nexus in Kuwait

**Results for all scenarios by 2035**

| Indicators | Reduction of Per capita water consumption scenario | Switching to more efficient technology scenario | Irrigation efficiency scenario | Switching to more efficient fuel scenario |
|---|---|---|---|---|
| Total water demand ($m^3$) | (-40%) | (~0%) | (-18%) | (~0%) |
| Total energy demand (KWh) | (-40%) | (-7%) | (-18%) | (~0%) |
| Desalinated water ($m^3$) | (-45%) | (~0%) | (~0%) | (~0%) |
| Financial costs (production, transmission and distribution) (USD) | (-40%) | (-7%) | (-18%) | (0 %) |
| Cost of fuel (USD) | (-40%) | (0%) | (-18%) | (6%) |
| Desalination (GHG) emissions (kg $CO_2/m^3$) | (-45%) | (-6%) | (~0%) | (-1%) |
| Ratio of brine discharge (produced/ $m^3$ fresh water) | (-45%) | (~0%) | (-4%) | (~0%) |

Please note that the numbers are preliminary results

Source: Al Edwani, Zubari, Karnib, Sadek (2023), AGU

# Thank you