The Water-Energy-Food Nexus @ FAO

A new approach in support to food security and sustainable agriculture

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Policies and Methodologies for Fostering and Assessing the Deployment of Low-Carbon Technologies in the ETC and SEMED regions

15-16 June, Istanbul.

Current Nexus Challenges – Already Huge

- 0.87 billion people are undernourished
- 1.3 billion people lack access to electricity
- 0.9 billion people lack access to safe drinking water and 2.6 billion to adequate sanitation

Exacerbating factors:

Climate Change

Population growth

Consumption patterns

Huge Nexus Challenge in the future

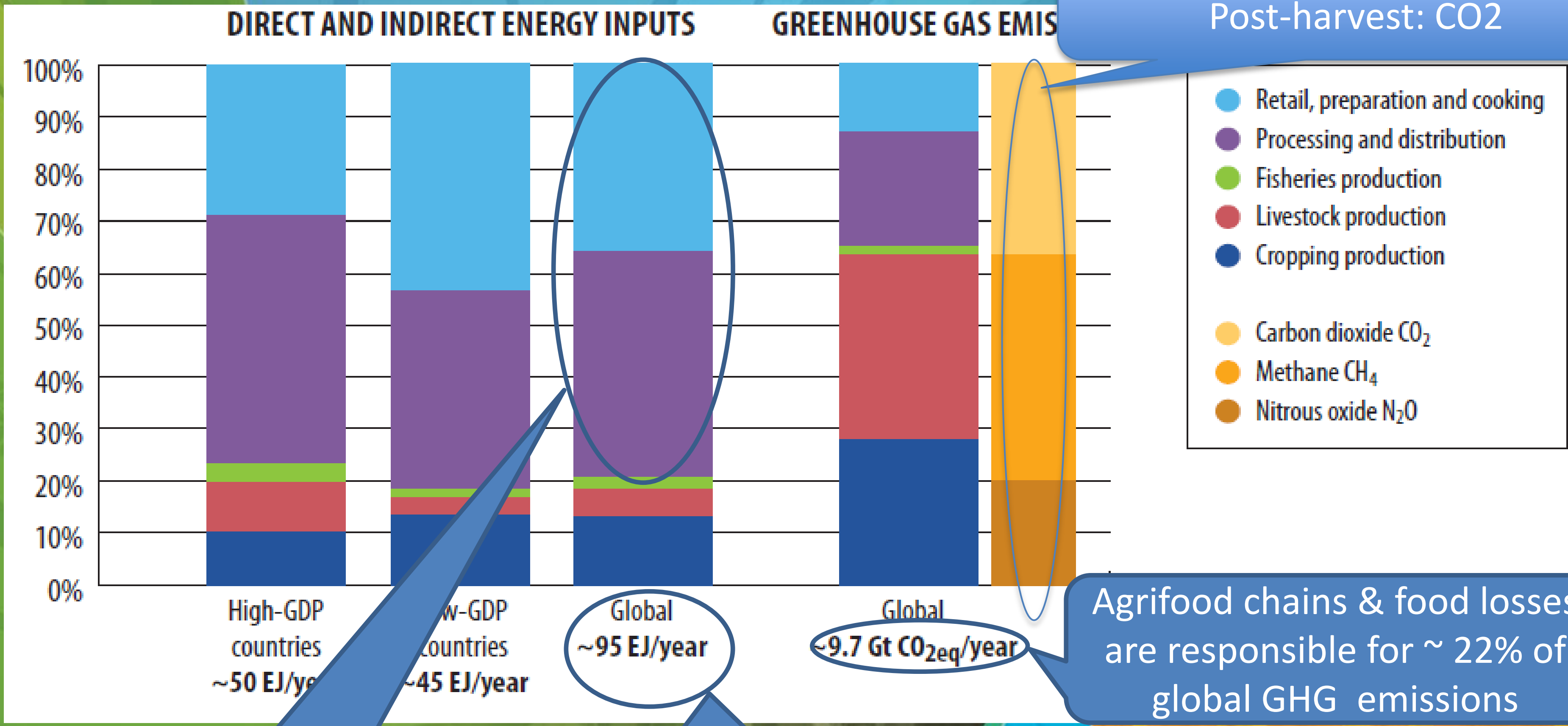
- Water-Energy-Food Nexus: 60% more food by 2050 – **mostly from yield increase – hence a lot more energy**, 40% more water and 40% more energy in 2030
- **Stressed Natural Resources**
- **Climate Change**

Need to "Do More with less" / "Save and Grow"

and

Be Innovative

Energy used in agrifood systems in the context of climate change is unsustainable



Before harvest (60%): CH4 & N2O
Post-harvest: CO2

Agrifood chains & food losses are responsible for ~ 22% of global GHG emissions

>70% energy is used after the farm gate

Agrifood chains use ~30 % of global available energy - and most of it as fossil fuels

Source: FAO, 2011

FAO's response: The "Energy-Smart Food for People and Climate" Programme

Need to become **"Energy-Smart"** in agrifood chains:

1. Improve **access** to modern **energy** services.

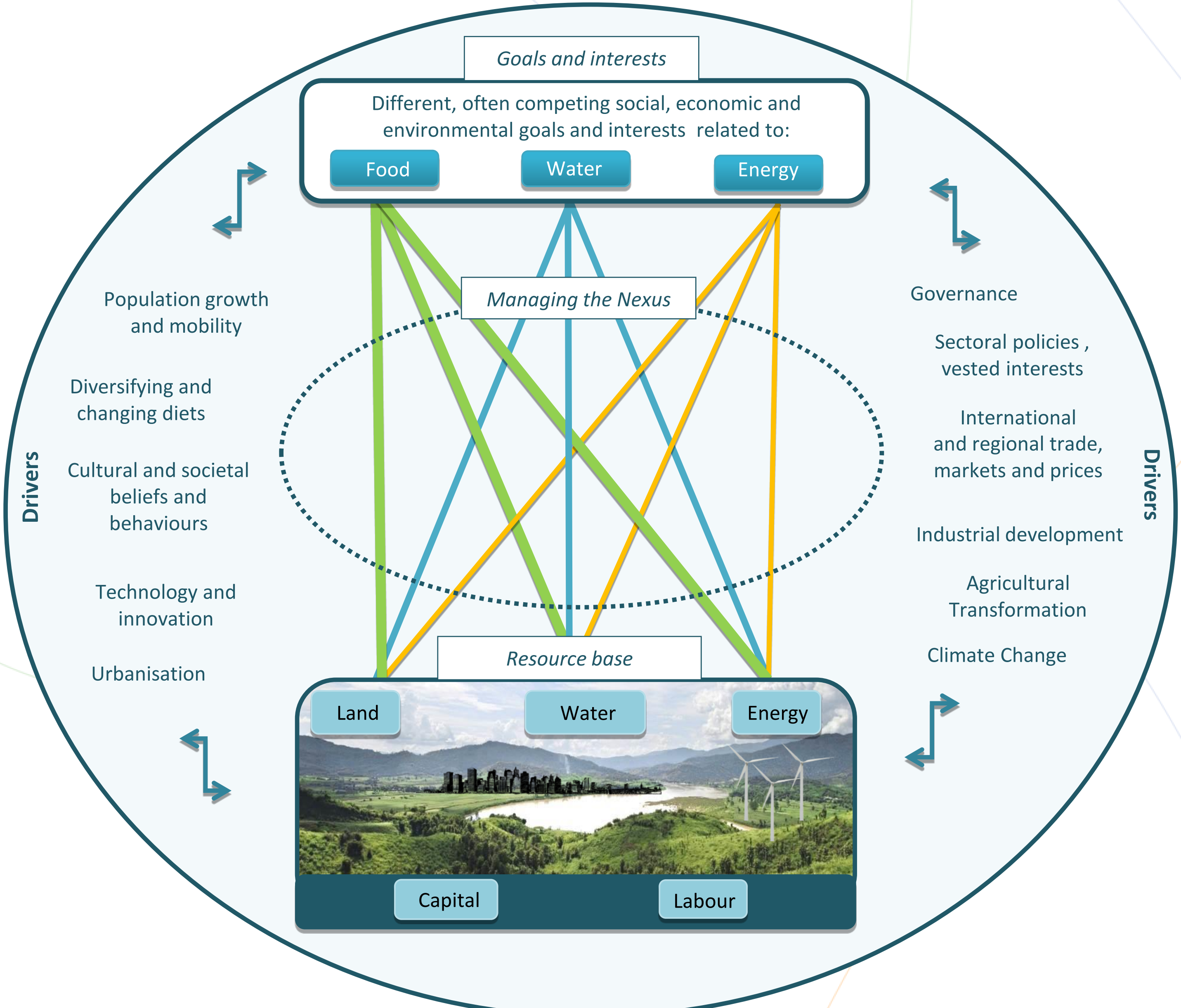
Do it in a way that

2. Improves energy **efficiency**

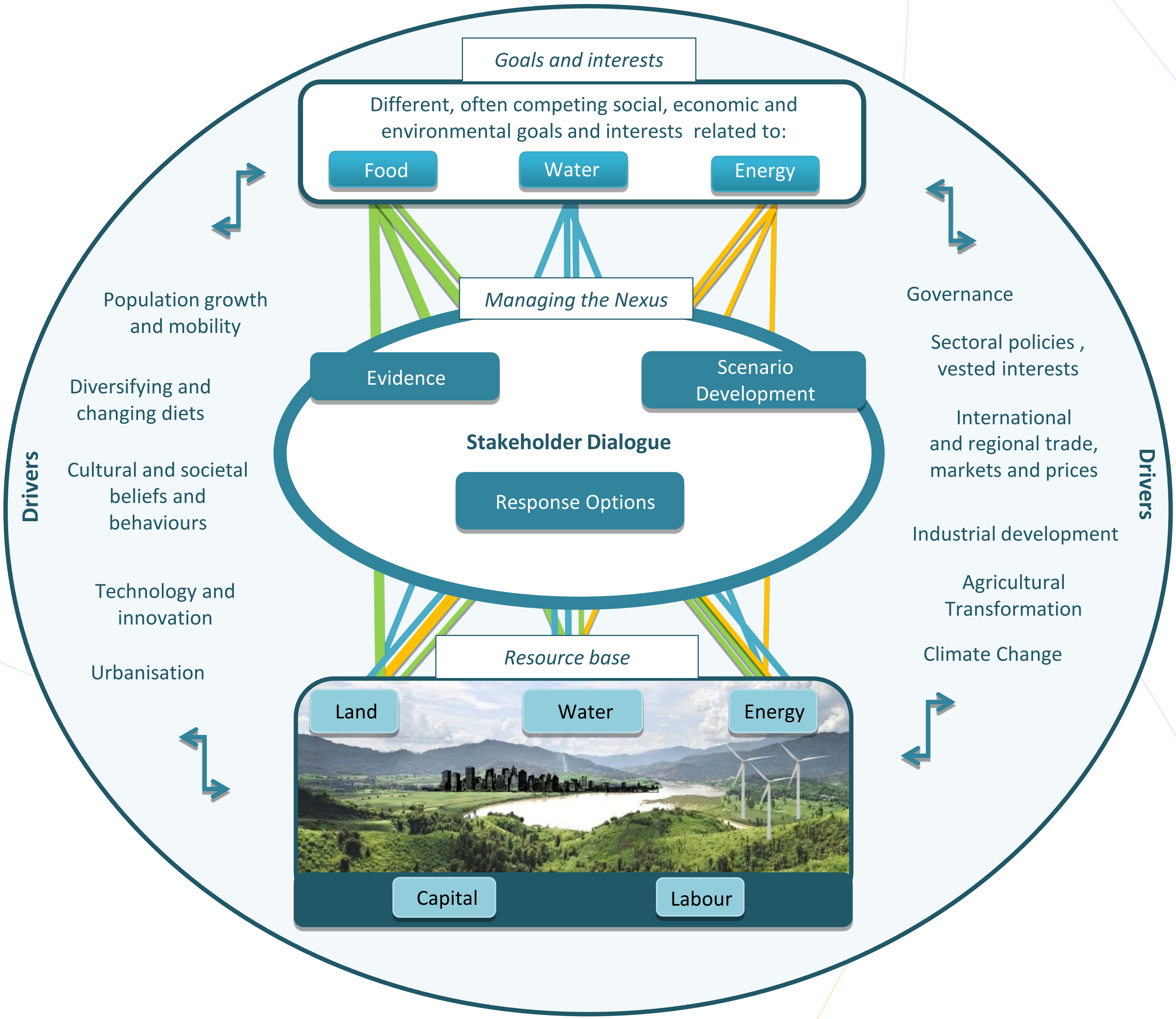
3. **Gradually** uses more **renewable energy**

4. Promotes a **water-energy-food nexus approach**

The FAO approach to the Water-Energy-Food Nexus



The FAO approach to the Water-Energy-Food Nexus



Some Issues on the Water-Energy-Food Nexus

- **Trade offs between water use efficiency and energy use efficiency** (e.g. gravity versus drip irrigation)?

- **Trade offs between water for agriculture and water for energy**

- How can **"free energy" influence the use of water and land in agriculture ?**

The Nexus Assessment is

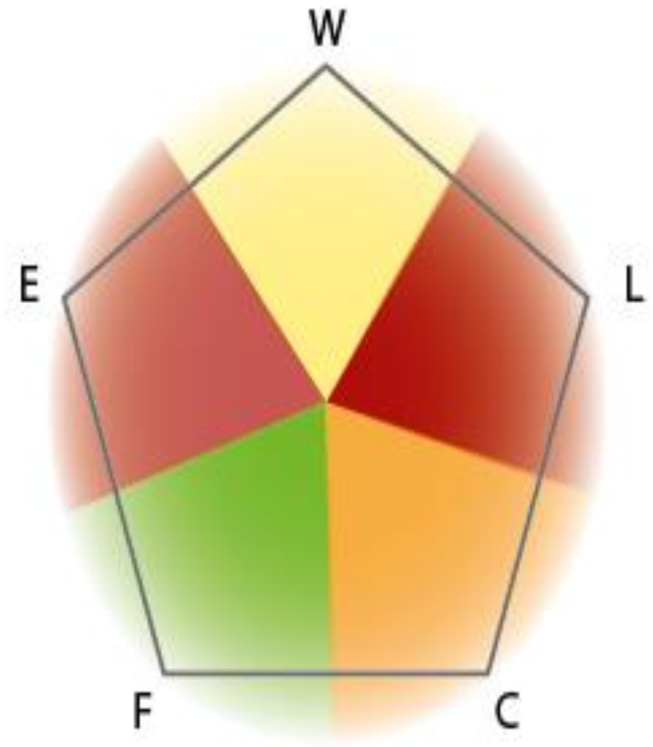
A structured way to carry out a WEF nexus assessment in order to:

1. **Raise awareness** on nexus **tradeoffs** and **synergies** understanding the key interactions between WEF systems in a specific context
2. Evaluate nexus **sustainability** (bio-economic pressure) of a context
3. Evaluate the **performance** of a (technical or policy) intervention
4. **Compare interventions** and derive informed **response options**

Raising awareness on nexus tradeoffs and synergies

Synergies Tradeoffs	Access to modern energy services	Efficient use of energy	The energy produced and consumed is clean/renewable
Food availability	**Yield increase and income** Access to modern energy leads to higher yields, therefore an increased food availability **Energy for irrigation and improved yields** Irrigation usually increases yields but over use of water due to better access to cheap energy can lead to water stress, runoff, salinisation and erosion, hence risk of reduced yields in the long run.	**Agricultural productivity** There is the risk that energy efficiency is achieved at the expense of agricultural productivity (e.g. reduced use of fertiliser) **Energy efficiency and economic return** Reduced use of fossil fuel in agri-food systems has usually a positive effect on economic returns of food production in the long run **Livestock production** The use of animal waste and manure for biogas production increases the overall energy	**Energy bill** Increase of renewables usually translates in a saving on the energy bill – so more money to invest in food production – But some RE require high initial investments **Bioenergy** Food crops used for bioenergy can compete for food availability (although they can increase food availability through yield increase that leads to both food and bioenergy production)

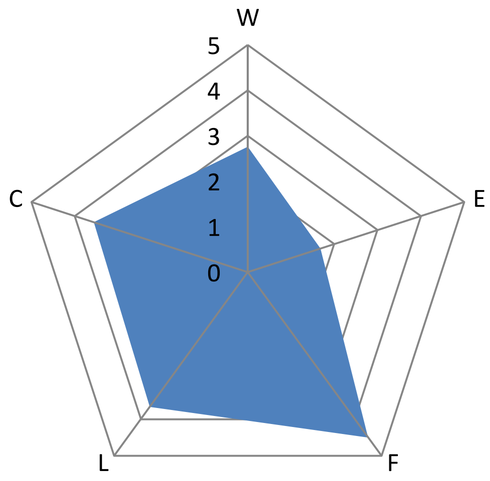
Context Nexus Status

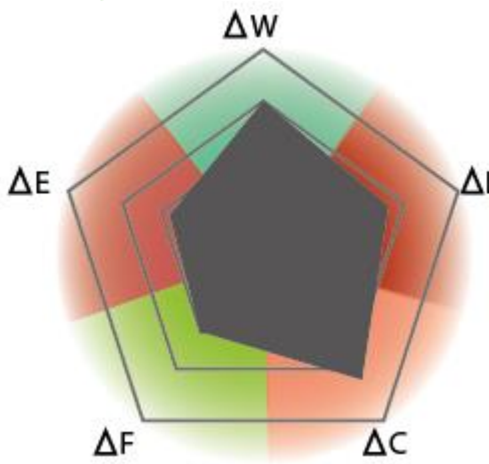


- Green: Positive/abundance
- Orange: Neutral /no scarcity, no abundance
- Red: Negative/Scarcity

W: Water; E: Energy; F: Food; C: Capital; L: Labour

Nexus Performance of Intervention per se and compared to Nexus Context Status



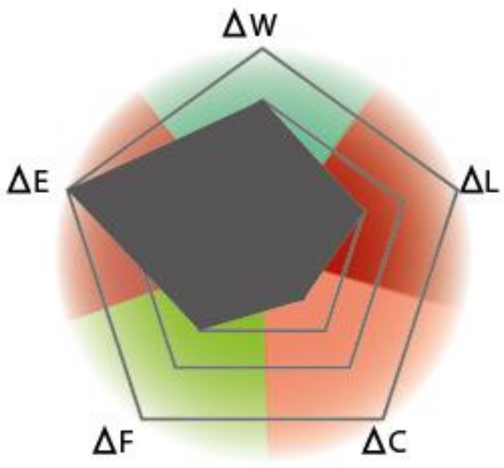


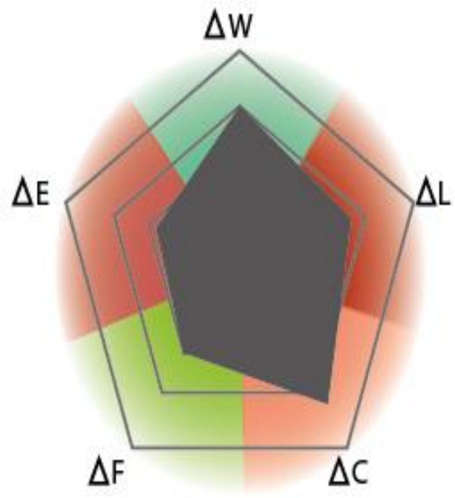
Performance per se

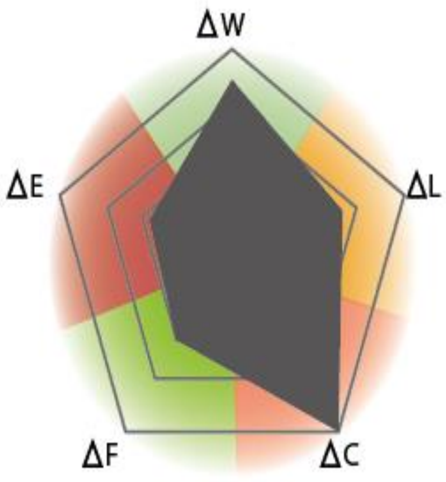
Not enough !!

Performance versus context status

Comparing different interventions in the same context







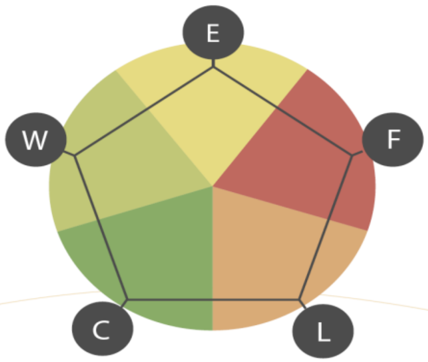
Solar irrigation in region A

Hybrid diesel solar irrigation in region A

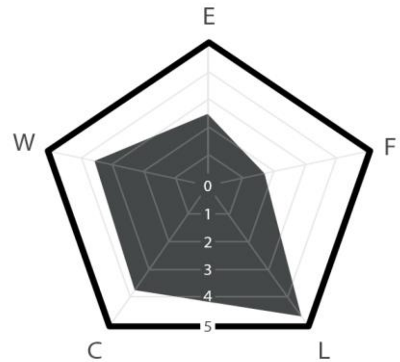
Mini hydro in region A

Nexus Assessment Methodology (work-in-progress)

- To assess the **nexus status of a given reference context**
- To assess the **nexus performance of interventions** (e.g. irrigation)

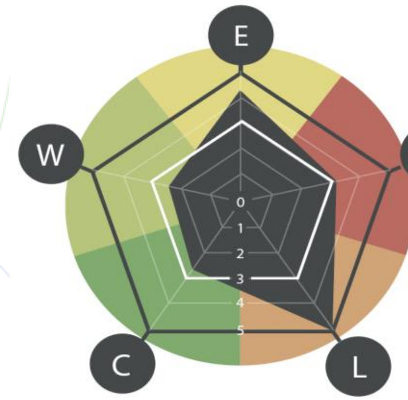


Context status



Performance per se

Not enough !!



Performance vs. context status

- To **compare interventions regarding nexus performance**

A. SOLAR IRRIGATION IN REGION a

B. HYBRID DIESEL-SOLAR IRRIGATION IN REGION a

C. MINI-HYDRO IN REGION a

Responses: Examples of Nexus applications

Solar pumps – many places

Bioenergy from degraded soils + treated discard water for irrigation – South Africa

Wind energy for water desalination for agriculture Spain

Nexus Example : Electricity for irrigation, India

- Often **"free" power to irrigation**
- This policy is **not sustainable** due to:
  - over-exploitation of groundwater
  - inefficient use of electricity
  - financial problems for energy utilities

Energy sector only solution - one-size -fits all metering also **has problems**:

- improves energy efficiency but
- reduces access to energy for poorer farmers

Nexus-type solutions work better

Energy – water – agriculture

- **Smart subsidies**: Minimum to each farmer – subsidy in KWh not $ and amount based on land size
- **Reduce leakages** in irrigation systems: reduced energy costs
- **Guaranteed energy when needed**: Synchronization of energy supply with irrigation needs
- **Adapt**: use less water intensive varieties
- **Diversify**: use crops that provide higher return per m^3

Next Steps

- Need to test the nexus assessment methodology
- Draw lessons from testing to improve the tool
- Engage in partnerships and dialogue to support governments, international organisations and the private sector to “walk the water-energy-food nexus talk”

Thank you for your attention

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