The Water-Energy-Food Nexus in Bioenergy Landscapes

Why it Matters , Where we Stand and What is FAO Doing about it

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Outline

1. Why it Matters
2. Where we Stand
3. FAO’s work

1. Why it Matters

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**

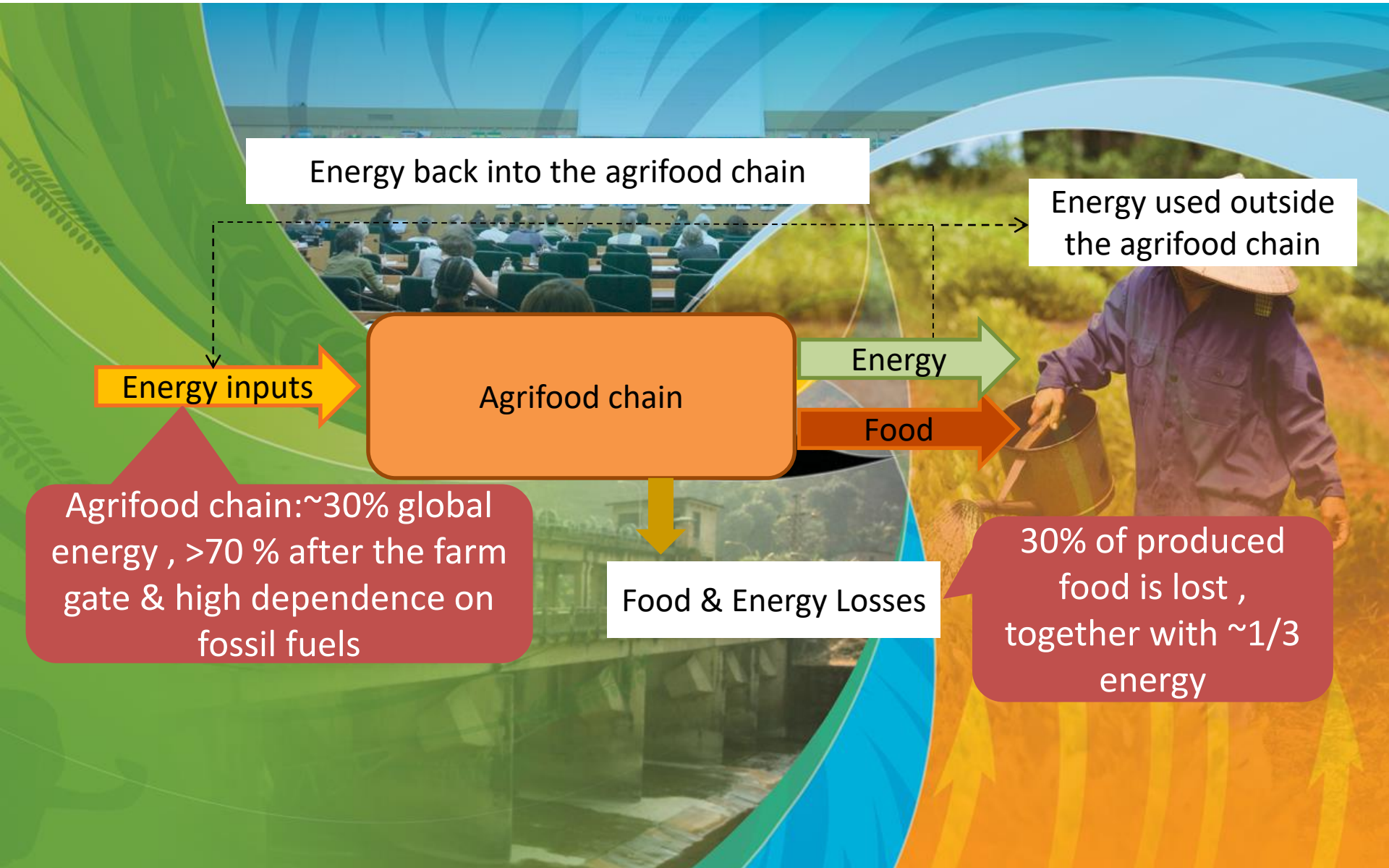
Need to "Do More with less" / "Save and Grow"

Be Innovative

and

Collaborate

Energy in Agrifood Systems is Needed for Food Security but is currently Unsustainable



WEF Nexus – Climate Change Links

- **Climate change can affect the availability of water** and **renewable energy** and the **production of food**

- **Energy/food/water provision can affect climate change** via
  - Changes in **natural cycles** (water, nitrogen, carbon)
  - Mitigation: Changes in **GHG emissions** (e.g. renewable versus fossil energy, decomposition of food losses) and **carbon sequestration**
  - Adaptation: **More resilience through more self sufficiency** in and **more efficient use of WEF** and possible **income diversification** (e.g. sale of energy)

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 ?**

Example of Added value of WEF Nexus Approach: 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 **faces problems:**

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

Nexus-type solutions work better

- **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

2. Where we Stand

2.1. Technologies

2.2. Tools & Approaches

2.3. Projects

2.2. Enabling Environment

2.1. WEF Nexus Technologies

- **Precision agriculture t**o improve input efficiency, and **ICT** to make it user-friendly and affordable

- **Using every drop of water**
  - Making **desalination** energy clean, efficient, and affordable - in particular in the MENA Region
  - **Reusing/recycling water** with reduced energy bill as co-benefit, in particular in the beverage industry, and for bioenergy purposes

- **Renewable energy** in agrifood chains, including regained worldwide interest in **solar irrigation**

2.2. WEF Nexus Tools and Approaches

- **A lot of tools** on **scenarios**; **fewer** tools on **existing situations and interventions** (FAO has some)

- **Interesting developments on M&E**
  - **Screening tools** (e.g. PAEGC and REEEP)
  - **Increasing number of trade off/synergy indicators** (e.g. FAO)
  - Measuring **impacts** versus **indications on progress** with proxies (default, good practices, 'ask people')

- **Significant need for capacity building** on new tools and approaches

2.3. WEF Nexus Projects

- **Growing uptake by large agrifood corporations** to use reduce risks in resource availability by using them more efficiently, with lower costs as co-benefits

- **Support to SMEs fostered** through **call for proposals** (e.g. PAEGC and REEEP)

- **Bioenergy projects** are **a minority**

2.4. Enabling Environment - Major Challenge : WEF Nexus for real requires Multi-level and Multi-stakeholder Collaboration

Level	What is needed
Global	Recognize global linkages and interests
Regional	Transboundary cooperation
National	Cross-sectoral and coherent policy making and planning
Local	Involvement of all relevant local stakeholders in decisions related to planning and implementation

2.4. Enabling environment at International Level: WEF Nexus and the SDGs

- **Direct links to three SDGs** (Food, Energy, Water)
- Progress toward **12 SDGs** directly related to the sustainable use of resources, including **land, food, water,** and **energy**
- WEF Nexus approach **not sufficiently used in defining SDG targets and indicators,** and in **SDG implementation**

2.4. Enabling Environment at International Level - Climate Change Agenda

- **WEF –climate change links** relevant to several commitments made in the **Paris Agreement** - Hence discussed at **COPs**

- However WEF-related aspects not sufficiently taken into consideration in **INDCs/NDCs implementation**

2.4. Enabling Environment at Regional Level – BMZ/EC supported Regional Policy Dialogues 2014-2018

- **Five Regions** (West & Southern Africa, Latin America, Central Asia and MENA)
- Should lead to **policy recommendations** and **action plans**
- Outputs should be **endorsed** both at **regional** and **national levels**
- **WEF entry points vary** according to regional priorities and conditions

2.4. Some Generic Considerations on the WEF Nexus Enabling Environment

- **Similar challenges as its sectors but amplified** by need for multi-stakeholder and multi-level cooperation
  - What added value for sectors?
  - Differences in power between stakeholder groups and levels?
  - How to develop cross-sectoral policies and programmes?
  - What cross sectoral institutional set up?
- As a result, **solutions** are often **context-specific** and require proper **stakeholder engagement**
- **Added challenge for some developing countries** which already struggle with sectoral governance
- **Opportunities** through **Nexus links to SDGs** and **Climate Change**, provided these links are given proper consideration

Examples of Nexus applications

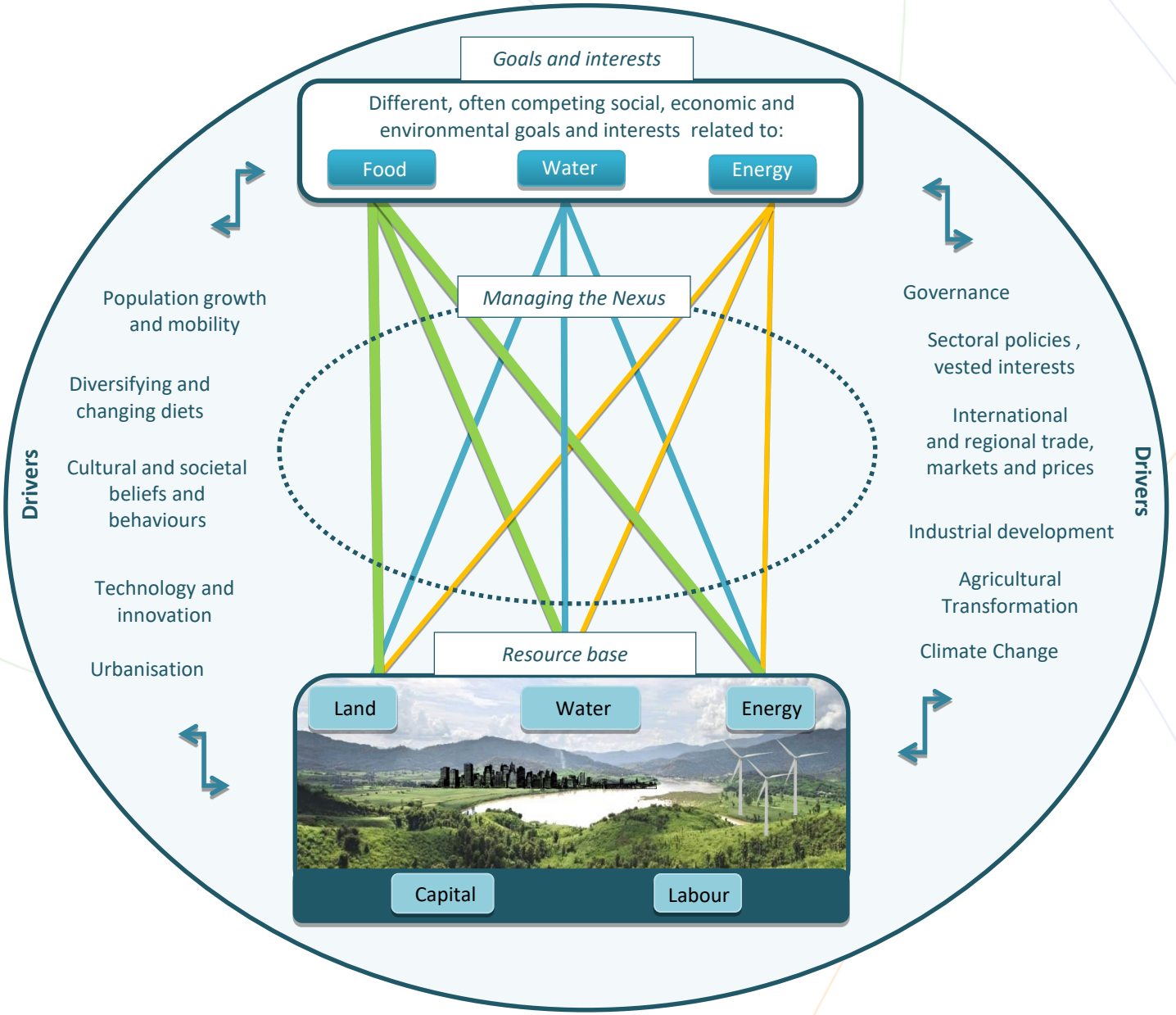
Solar pumps – many places

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

Wind energy for water desalination for agriculture Spain

3. Examples on What FAO is Doing About it

The FAO approach to the Water-Energy-Food Nexus



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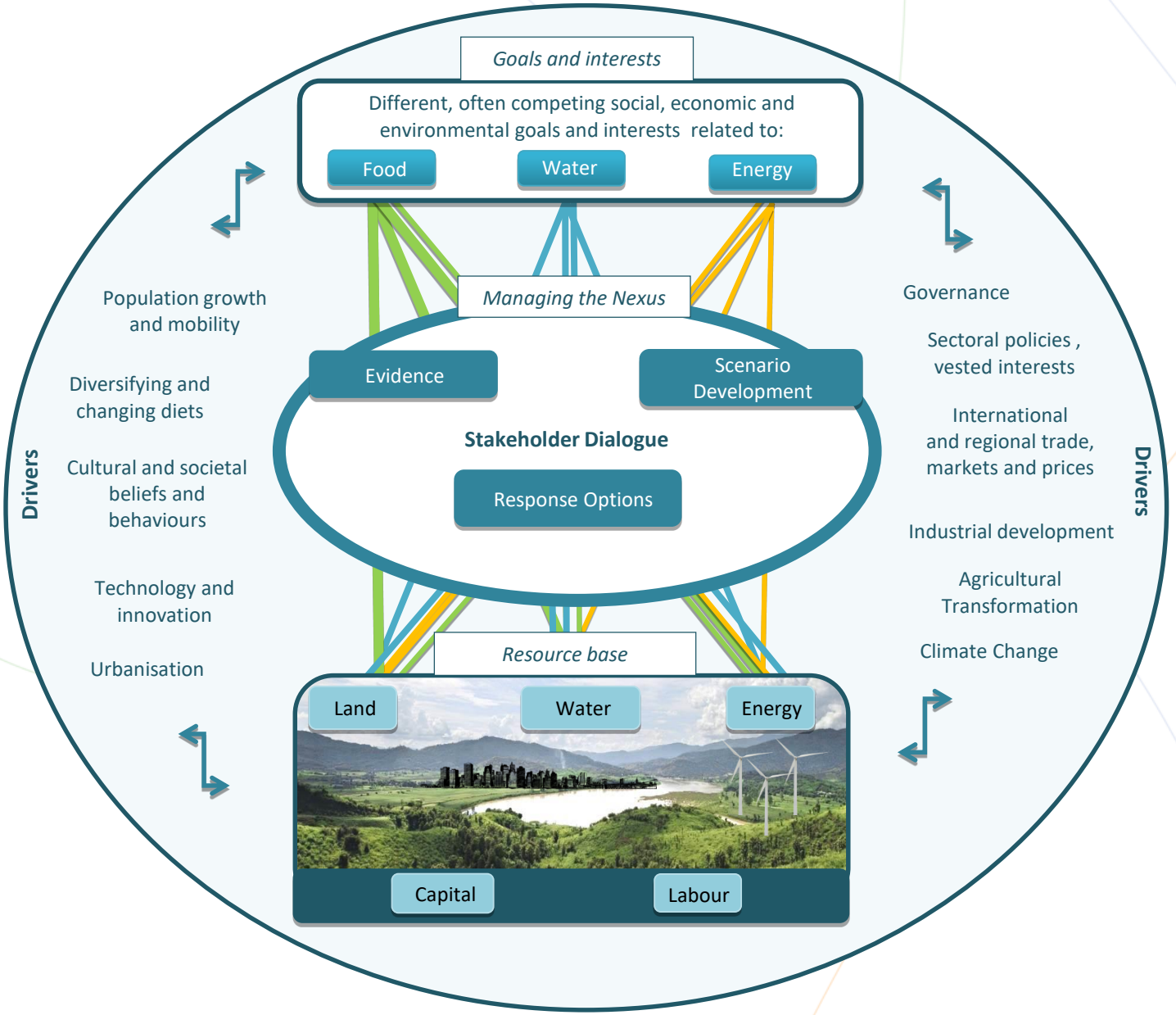


The Nexus Assessment is

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

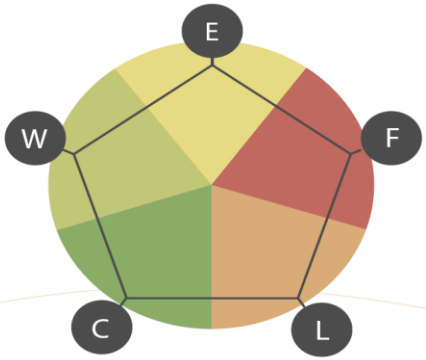
1. **Raise awareness** on nexus **tradeoffs** and **synergies** understanding the key interactions between WEF systems in a specific context
2. Evaluate nexus **sustainability** (bio-economic pressure) of a context
3. Evaluate the **performance** of a (technical or policy) intervention
4. **Compare interventions**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

Raising awareness on nexus tradeoffs and synergies

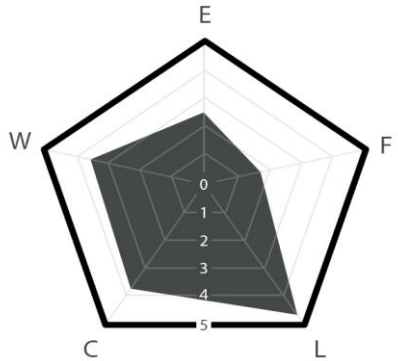
Synergies Tradeoffs	Access to modern energy services	Efficient use of energy	The energy produced and consumed is clean/renewable
Food availability	**Yield increase and income** Access to modern energy leads to higher yields, therefore an increased food availability **Energy for irrigation and improved 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)

Nexus Assessment Methodology

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

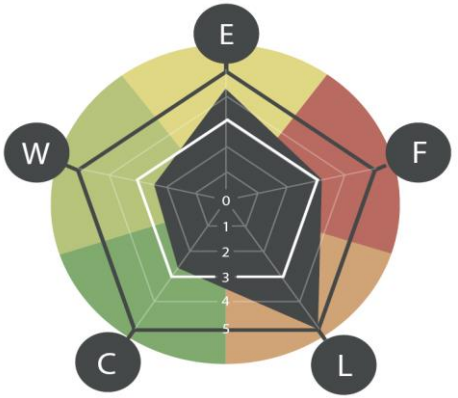


Context status



Performance per se

Not enough !!



Performance vs. context status

- To **compare interventions regarding nexus performance**

A. SOLAR IRRIGATION IN REGION a

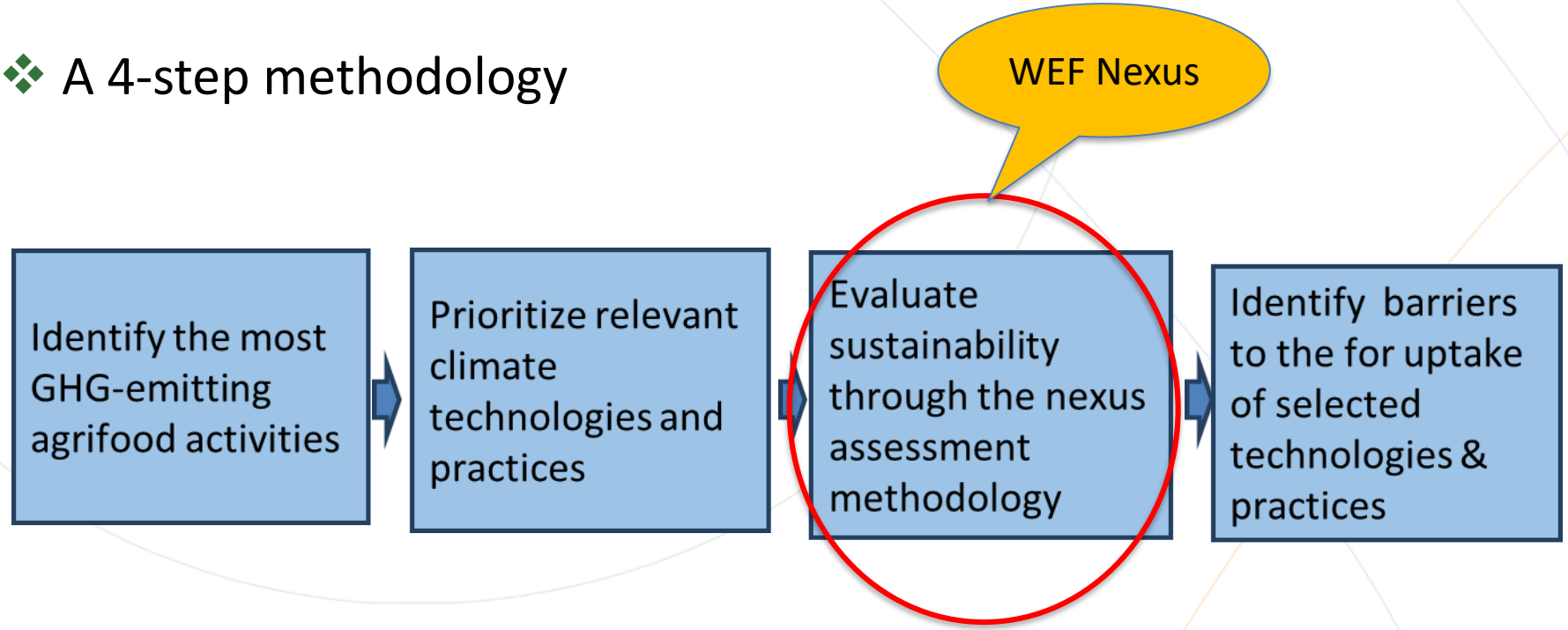
B. HYBRID DIESEL-SOLAR IRRIGATION IN REGION a

C. MINI-HYDRO IN REGION a

Adoption of Sustainable Climate Technologies for the Agrifood Sector (FINTECC / EBRD)

- FAO's work to support the EBRD-EU-GEF initiative to **support the introduction of sustainable climate technologies**

- A 4-step methodology



- Used in **Morocco** in 2016, and in **Kazakhstan** and **Kyrgyzstan** in 2017-18

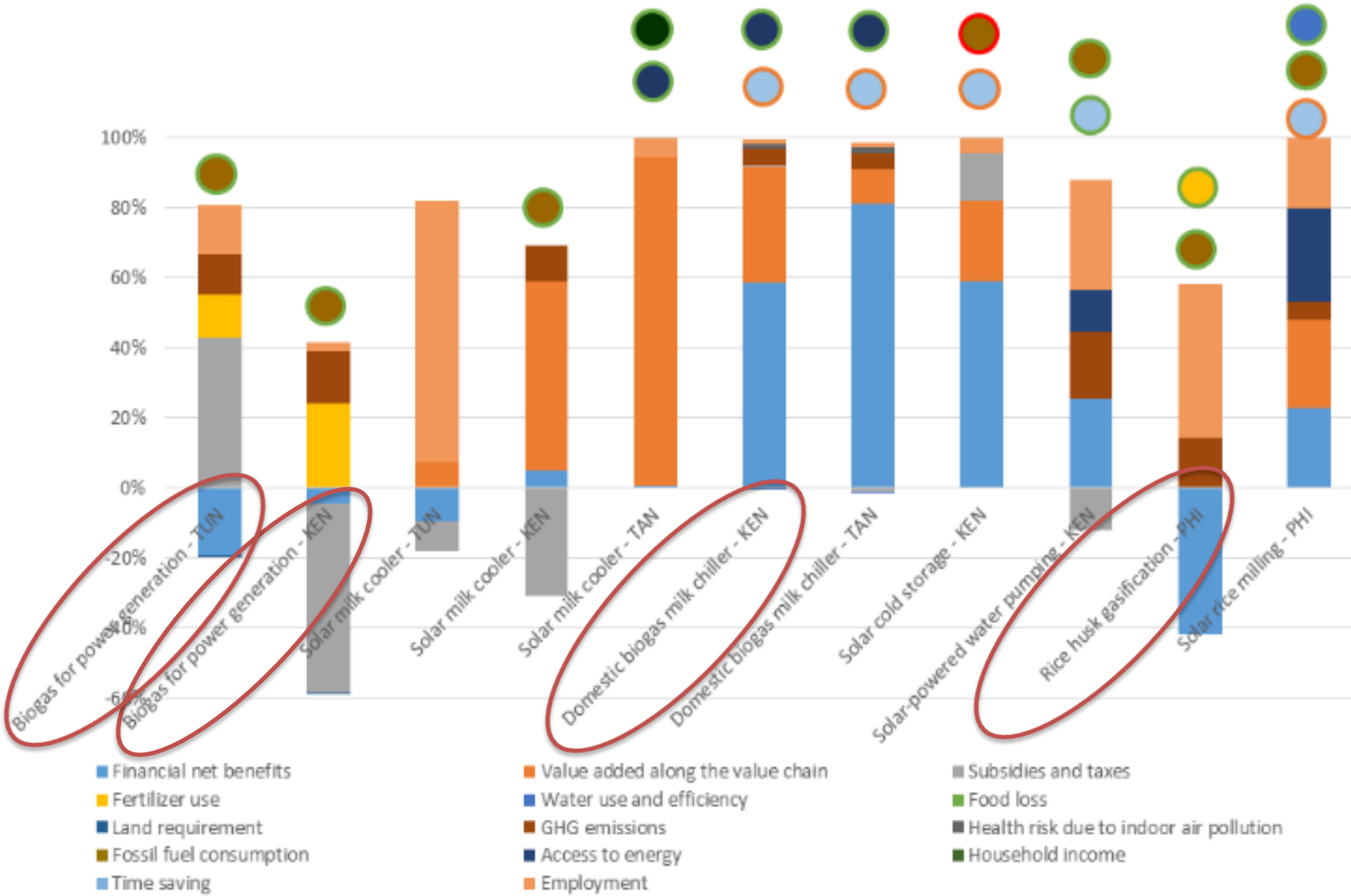
Fostering investments in sustainable renewable energy in the agrifood sector (INVESTA/GIZ)

- **Cost-benefit analysis (monetized and non monetized) of selected renewable energy technologies** in the **milk**, **vegetable** and **rice value chains** at operation and country levels

- **Tunisia, Kenya, Tanzania** and **Philippines** as country case studies

- The work resulted in recommendations on **how policy-makers and investors can foster investments in clean energy technologies**

INVESTA project – summary of case studies



FAO's Sustainable Bioenergy Support Package

- **An in-depth understanding** of the situation and related opportunities and risks as well as synergies and trade-offs;
- **Implementation of good practices** by investors/producers in order to reduce risks and increase opportunities;
- **An enabling policy and institutional environment** to promote the implementation of good practices;
- **Appropriate monitoring and evaluation** of impacts and performance of good practices and policy responses

Typology of FAO Tools for Sustainable Bioenergy –used in more than 25 countries

	Before project implementation: Screening and risk prevention	**After project implementation: Assessment and monitoring**
Local Impact	BEFS Operator Level Tool	IFES analytical framework
Regional/ National impact	BEFS Rapid Appraisal	GBEP indicators

Solar Irrigation

2016 : International Workshop on the Potential of Solar Powered Irrigation Systems in Developing Countries

2017 – 2018 – Solar Irrigation Project

- **Main Objective:** To improve knowledge, develop capacities and empower relevant stakeholders to make informed decisions about how to promote, manage and regulate the use of solar irrigation
- **GLOBAL level/ NENA and West Africa** : global/regional status reports, study tour'; policy briefs, training international workshop → learning from experience & establishing a position on solar irrigation
- One important product: The **FAO-GIZ toolbox on solar irrigation**

Thank you for your attention

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