NEXUS Gains:
Realizing Multiple Benefits
Across Water, Energy, Food
and Ecosystems

Impacts of the implementation of SDG 6.4 on global food security

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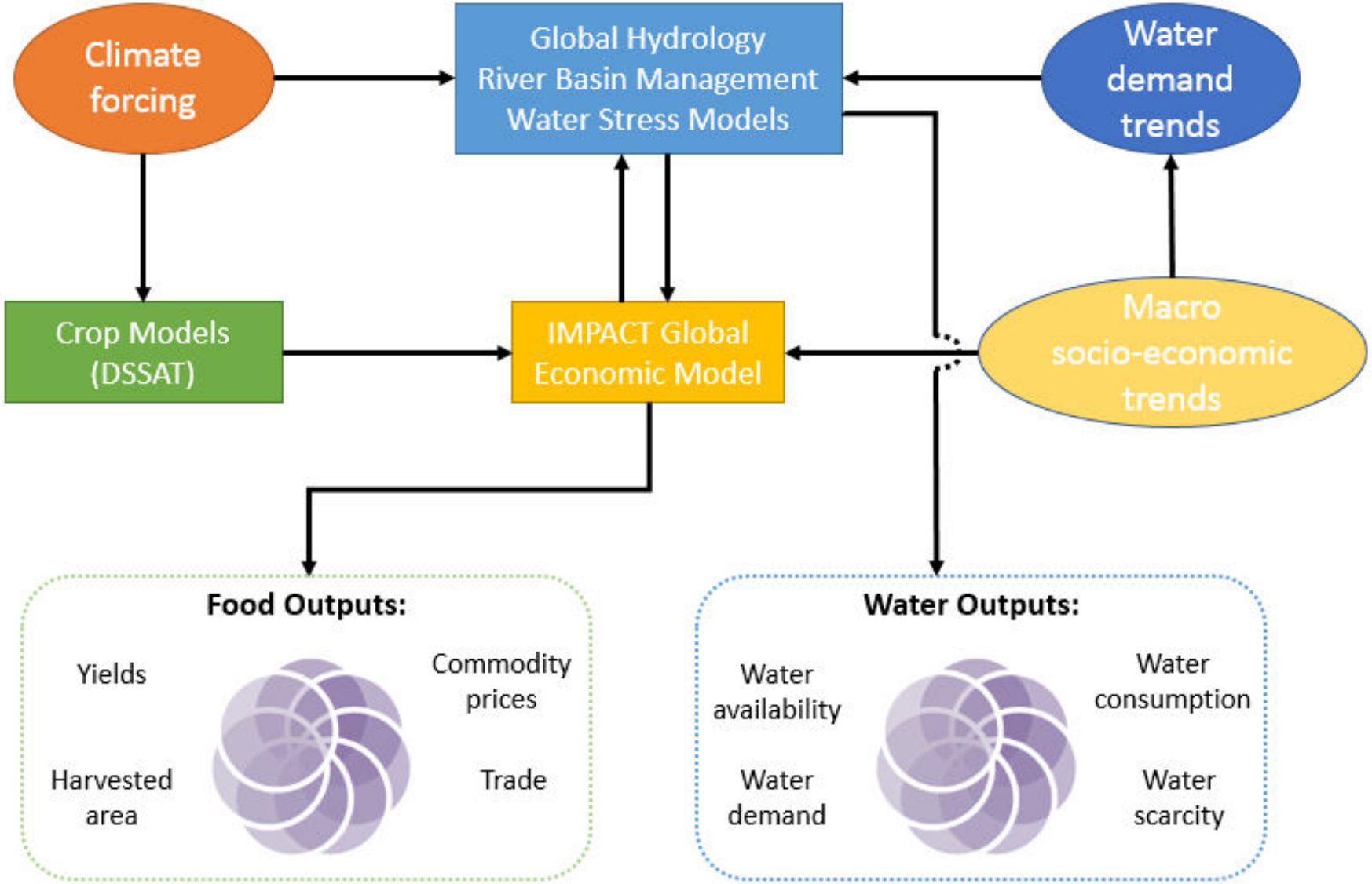
Introduction

- Irrigation has helped reduce prices of key staple crops, in particular rice and wheat, and has thus been an important contributor to reducing the number of people at risk of hunger or undernourished population
- Irrigation has also helped save large forest areas from deforestation as crop yields are substantially larger on irrigated plots and plots are often double- or even triple-cropped
- But irrigation has critically increased water depletion and degradation (pollution)
- To address this, SDG6.4 aims to, "By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity"
- How do alternative irrigation management investments and options affect food security, including improvements in water use efficiency?

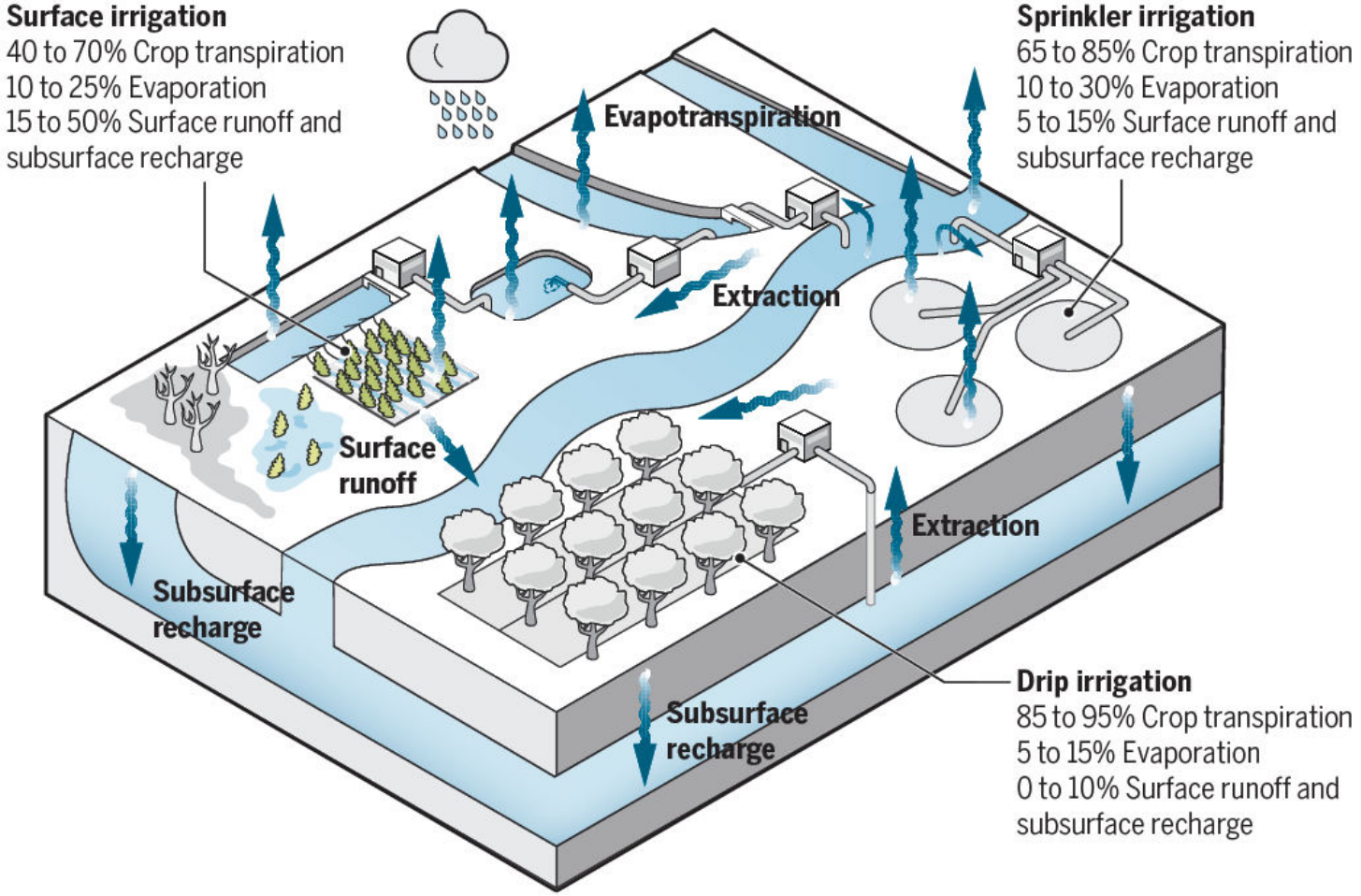
International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT)



Challenges in modeling Irrigation Efficiency (IE)

Accounting for water

The paradox of irrigation efficiency (surface, sprinkler, and drip) and the water inflows and outflows can be seen in a watershed example. Ranges of crop transpiration, evaporation, runoff, and recharge are authors' judgment of possible values. These values depend on crop and soil types, weather, and other factors.



Grafton et al. (2018)

Irrigation Efficiency (IE)

$$\text{Classical Irrig Efficiency [IE]} = \frac{\text{beneficial crop ET}}{\text{water delivered to the field}}$$

$$\text{Effective IE} = \frac{\text{beneficial crop ET}}{\text{water delivered to the field} - \text{return flows}}$$

$$\text{Economic Effective IE} = \frac{\text{net profits}}{\text{water delivered to the field} - \text{return flows}}$$

Keller and Keller (1995)

IFPRI IMPACT Model: Effective Efficiency at Basin Scale (Basin Efficiency)

Scenarios

Scenario name	Implementation
Baseline CC	Business-as-usual with climate change [RCP 8.5 and average of 3 climate scenarios]
Basin **E**fficiency Im**pro**vement (BEPRO)	Gradual improvements in effective basin efficiency in LMICs by 0.15 by 2030 compared with a cap of 0.85 by 2050
Enhancing **R**ain **W**ater **H**arvesting (RWH)	For areas with aridity index < 0.65, gradual increase in effective use of rainfall by 15% during 2015-2030, and continuation at the 15% level thereafter; for the rest, gradual increase of 10% during 2015-2030, continuation at the 10% level thereafter
BEPRO & RWH	Aggregates BEPRO & RWH

Changes in projected cereal yields, by region, including in low, moderately and highly water stressed regions

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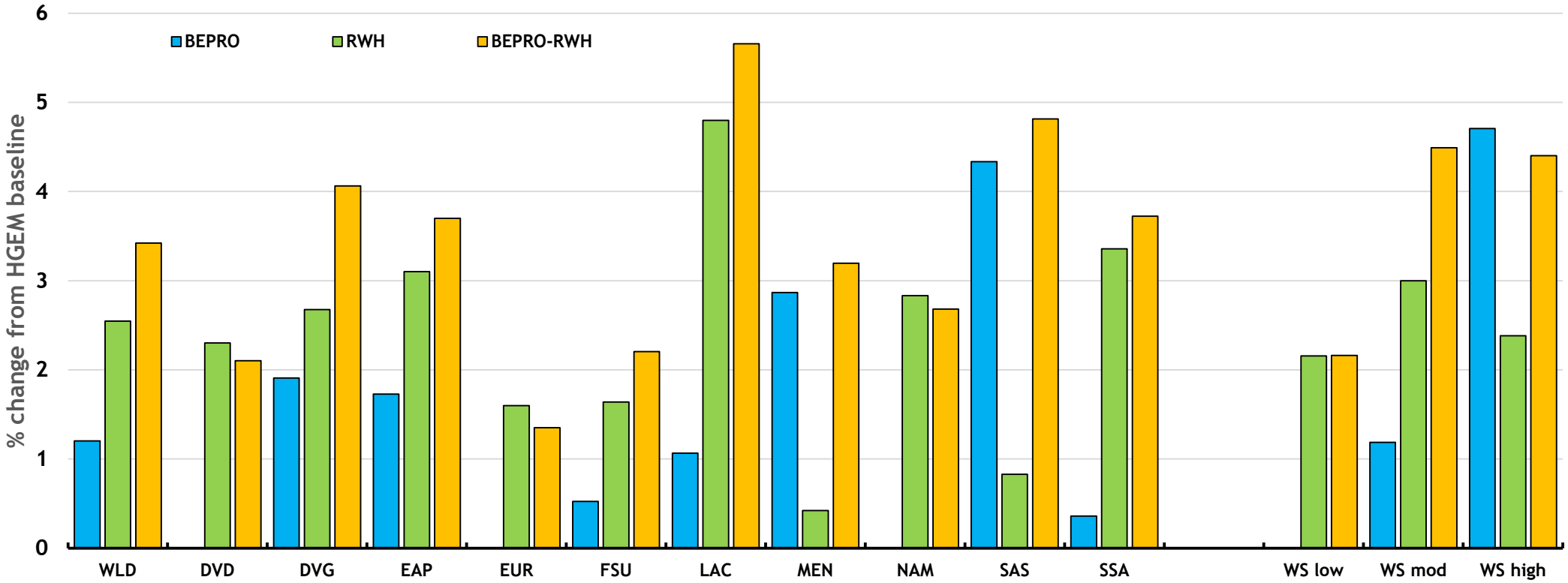
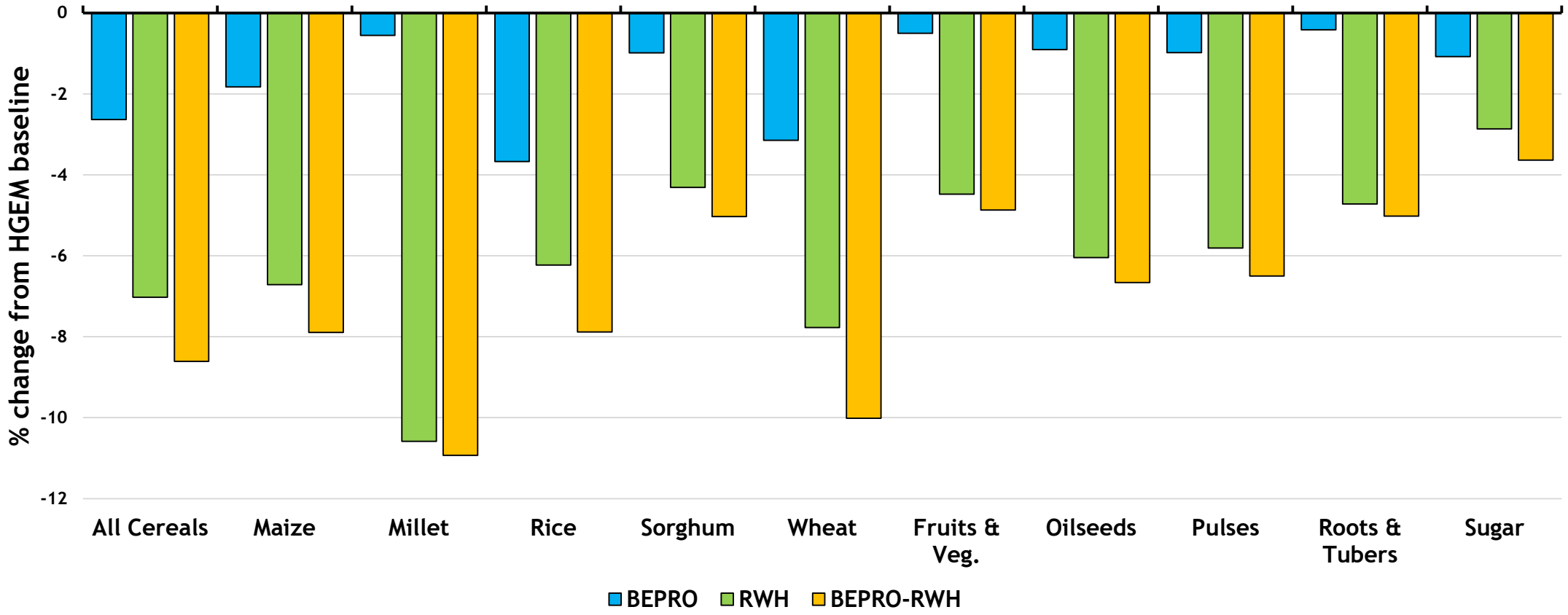


WLD-World
DVD-Developed countries
DVG-Developing countries
EAP- East Asia and Pacific
EUR-Europe
FSU- Former Soviet Union
LAC- Latin America and Caribbean
MEN-Middle East and North Africa
NAM-North America
SAS-South Asia
SSA-Africa south of the Sahara
WS-water stress

Source: IFPRI

Changes in projected world prices from alternative WUE scenarios



Source: IFPRI

Summary

- WUE improvements boost agricultural production
- The increased food production due to WUE improvements brings down global food price by up to 10% and enhances food affordability
- The implementation of SDG6.4 can support global food security

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