biomonitor

Monitoring the Bioeconomy

Some practical insights into simulation modelling in BioMonitor - The MAGNET Model

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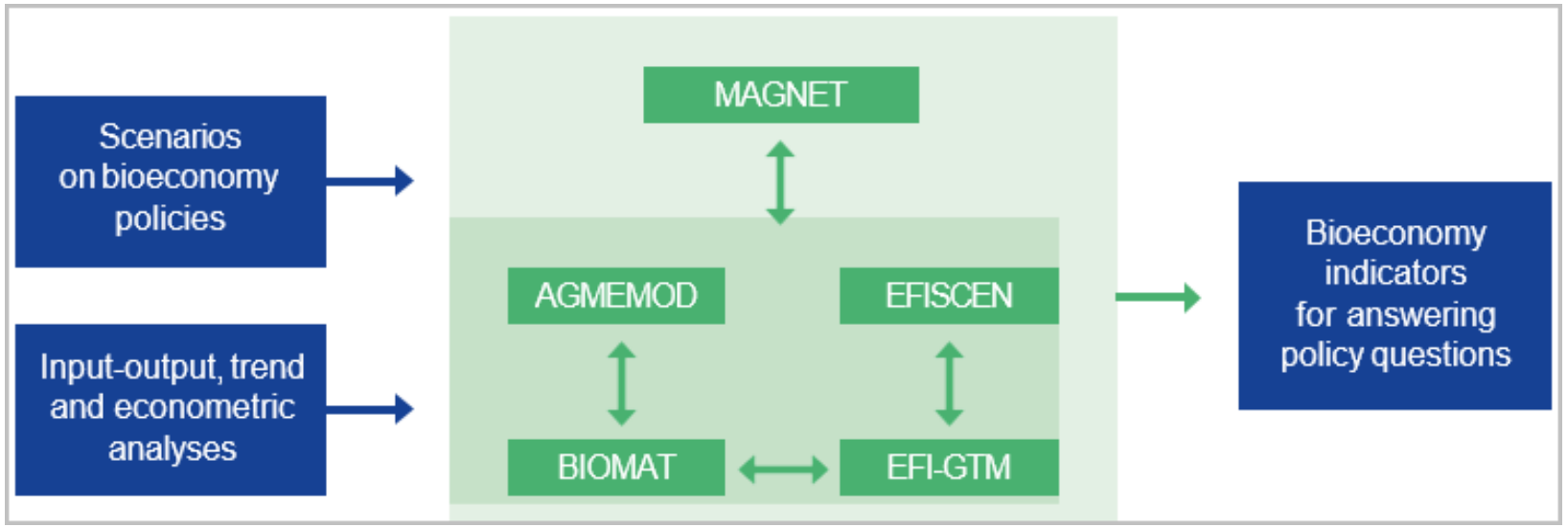
The BioMonitor Model Toolbox

Table No. 2 - Indicators in the BioMonitor Project Covered by the BioMonitor Model Toolbox

Driving forces of the bioeconomy for which assumed future trends constitute prior information for the models

Indicators calculated by the model

	AGMEMOD	BIOMAT	EFI-GTM	EFISCEN	MAGNET
1. Food and Nutrition Security					
Availability of food	■				■
Access to food	■				■
Utilisation	■				■
Stability					■
2. Sustainable Natural Resource Management					
Sustainable threshold levels for bioec. technology					■
Biodiversity				■	
Land cover	■	■		■	■
Primary biomass production	■	■	■	■	■
Sustainable resource use		■		■	
3. Dependence on Non-Renewable Resources					
Bioenergy replacing non-renewable energy					■
Biomaterial replacing non-renewable sources	■	■			■
Biomass self-sufficiency rate	■	■	■	■	■
Material use efficiency		■	■		
Certified bio-based products					
4. Mitigating and Adapting to Climate Change					
Greenhouse gas emission			■	■	■
Climate footprint					■
Climate change adaption				■	■
5. Employment and Economic Competitiveness					
Innovation	■	■	■	■	■
Investments	■	■	■	■	■
Value added					■
Production/consumption of non-food/feed bio-based products	■	■	■		■
Import/export of bioeconomy rawmaterials	■	■	■		■
Employment					■
Policies	■	■	■	■	■



	Value chains	Indicators	Geographical location	Timeframe
Input-Output, econometric, trend analysis	Bioeconomy sectors, biobased products	Socio-economic, environmental	Case based; country based data	Case based
AGMEMOD	Agro-food products markets; biofuels	Environmental, economic	EU member states, Balkan coutries, East-African countries, Ukraine, Russia	2030, 2050
BIOMAT	Bio-based product markets	Techno-economic	EU member states	2030, 2050
EFISCEN	Forest resources	Environmental	EU member states, other European countries	2030, 2050
EFI-GTM	Forest and wood-based products and markets	Economic	EU member states, world regions	2030, 2050
MAGNET	Bioeconomy sectors; overall economy	Socio-economic, environmental	EU member states; 141 world regions	2030, 2050

MAGNET: What kind of questions do we use it for?

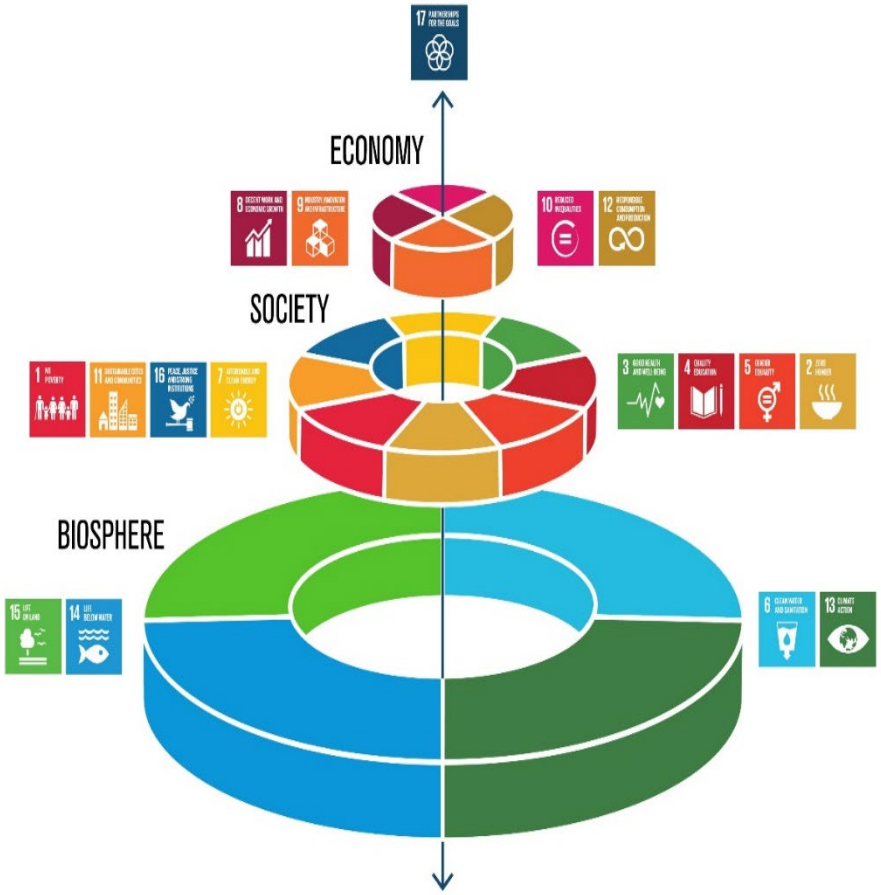
Planetary boundaries are finite. Choices must be made – implies trade-offs.

Stockholm Resilience Centre – EAT Foundation
"Food System-sustainability-healthy diets-healthy planet"

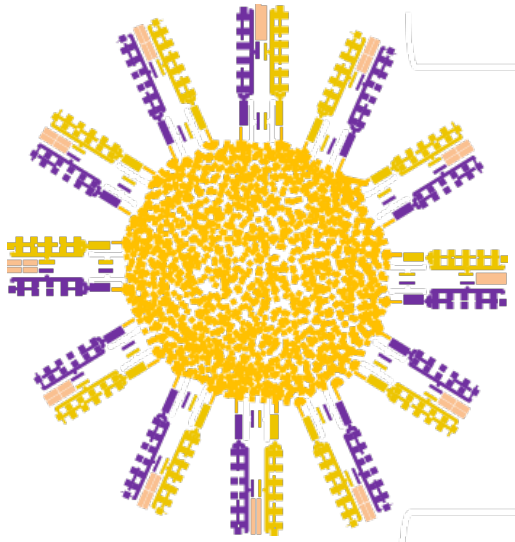
Keynote speech 2016 EAT Forum: Wedding Cake. Three ‘layers’ are matched with SDGs

Postulates a strong role for the food system and broader bioeconomy in positively influencing the SDGs.

Closed systems wide theoretical paradigm requires a closed systems wide empirical model complete with total resource restrictions, total activities, feedback effects and trade-offs all internalised.



A systems wide issue requires a systems wide model framework



imports

PRODUCTION of commodities

agriculture | manufacturing | services

commodity supply

≡

commodity demand

Prices

factor demand

≡

factor supply = income

land | labour | capital | natural resources

exports

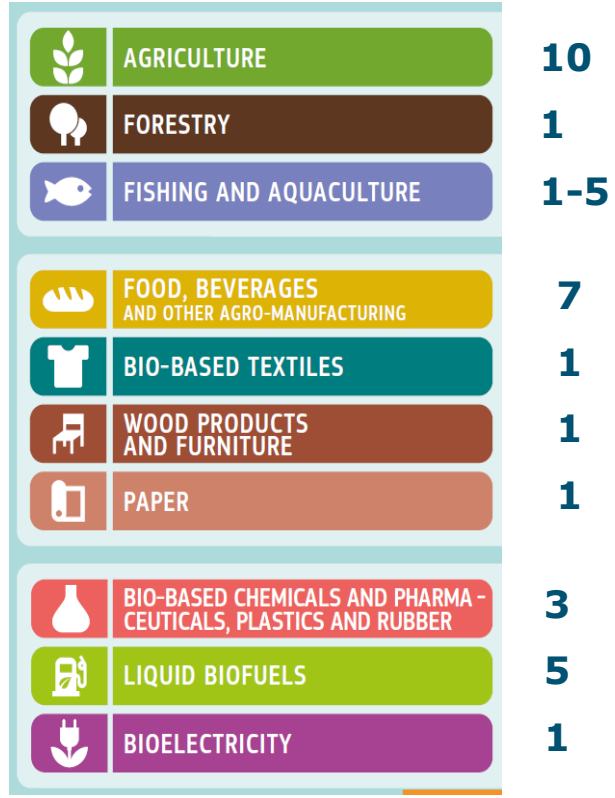
CONSUMPTION of commodities

government | households

A model of global bioeconomy through the lens of the SDG indicators

- The 'core' is an economic model
- Ex-ante medium to long-run market model, understanding trade-offs between multiple market drivers, isolation and quantification of said drivers
- Based on Global Trade Analysis Project (GTAP) consortium model & database
- Global coverage (140 countries, 57 sectors)
- MAGNET database includes numerous additional non-standard bio-based activities and sources of biomass.
    - Biomass sources: crop and forestry residues, solid biomass for electricity, lignocellulosic biomass
    - Biomass using activities: aquaculture, liquid biofuels, bioelectricity, advanced generation biochemicals, municipal waste management….work in progress!

'Bio' sectors in MAGNET



Bioeconomy related SDG metrics along alternate transition pathways to 2050.

Global Energy and Climate Outlook : European Commission : Consistent set of GDP, population change, GHG drivers and energy markets based on energy balance sheets

Reference pathway (REF): energy and emissions projections are driven by market forces and technological advancement. Does not even match the ambition of Paris agreement.

Inspired by the 2°C (SUS) and 1.5°C (SUS+) pathways: restrict global warming to 2°C and 1.5°C above pre-industrial levels by the end of the century.

Transition is based on three main levers:

- Energy efficiency ('decoupling' economic growth from energy consumption)
- Energy carriers shifted toward electricity (away from liquid fossil fuels)
- Decarbonisation of energy system (reliance of (bio-)renewables)

Report bioeconomy related SDG outcomes: 12 /17 indicators, 60+ indicators. Synergies and trade-offs presented reflect the wedding cake pillars of ***economy***, ***society*** and ***biosphere***. **Isolate the relative strengths of the drivers and apparent conflicts between objectives**.

Biosphere

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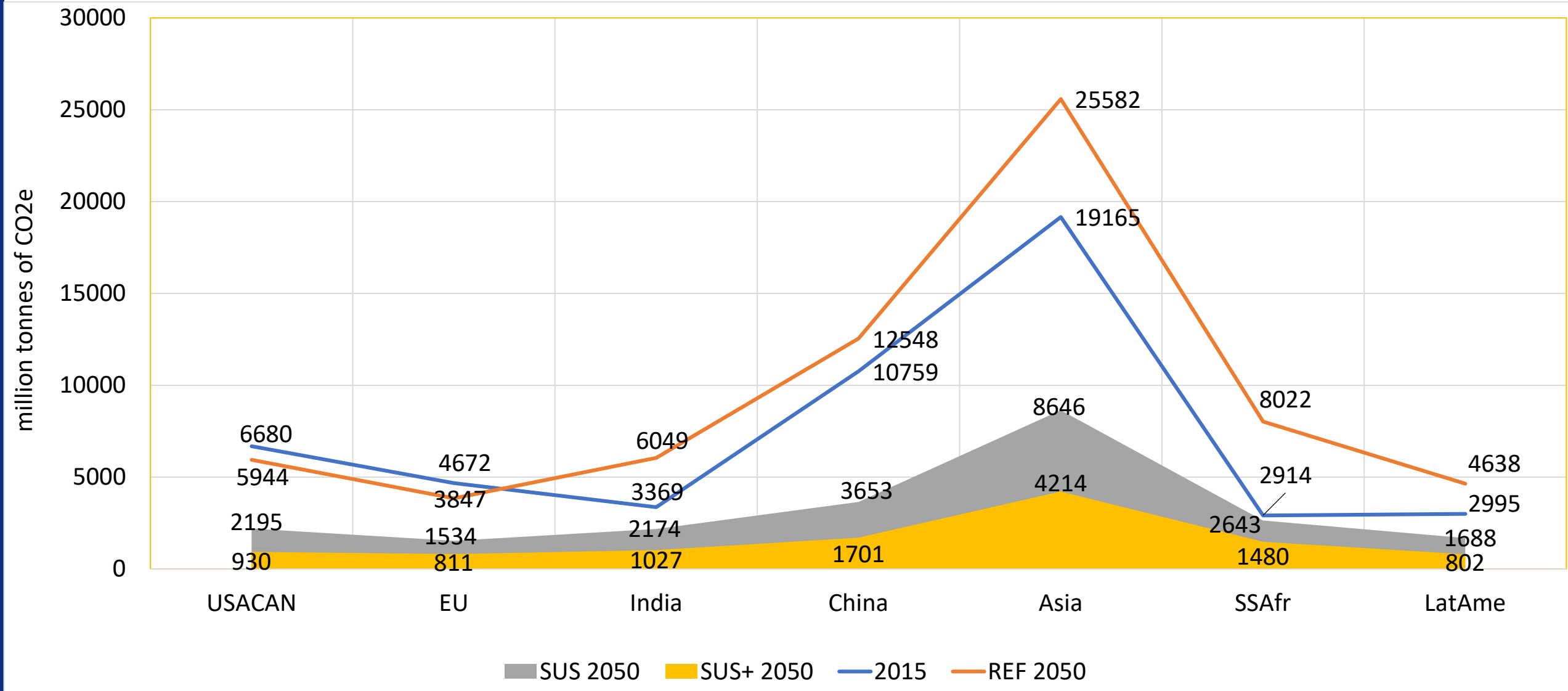
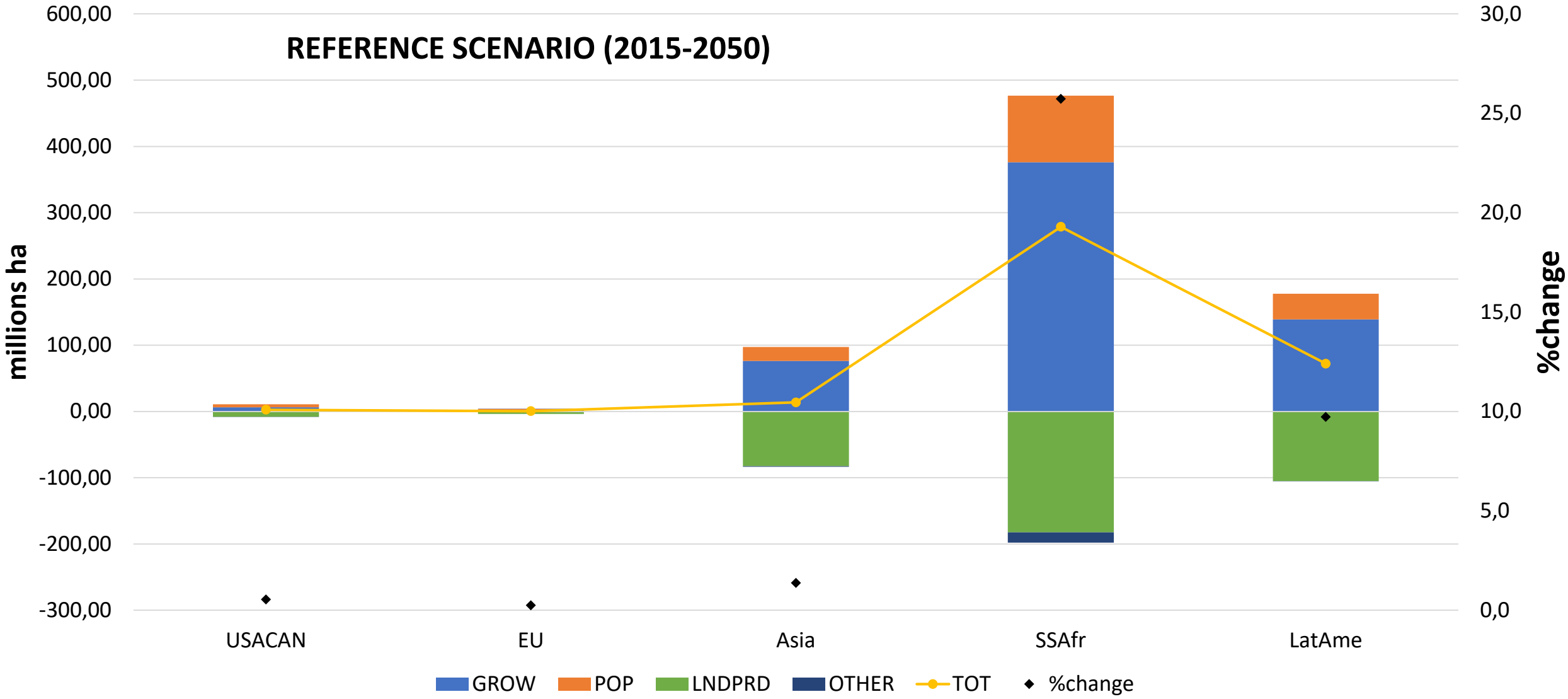
SDG 13 – Climate Action (GHGs)



Example: SDG 15 – Life on Land (agricultural land req.)



Society

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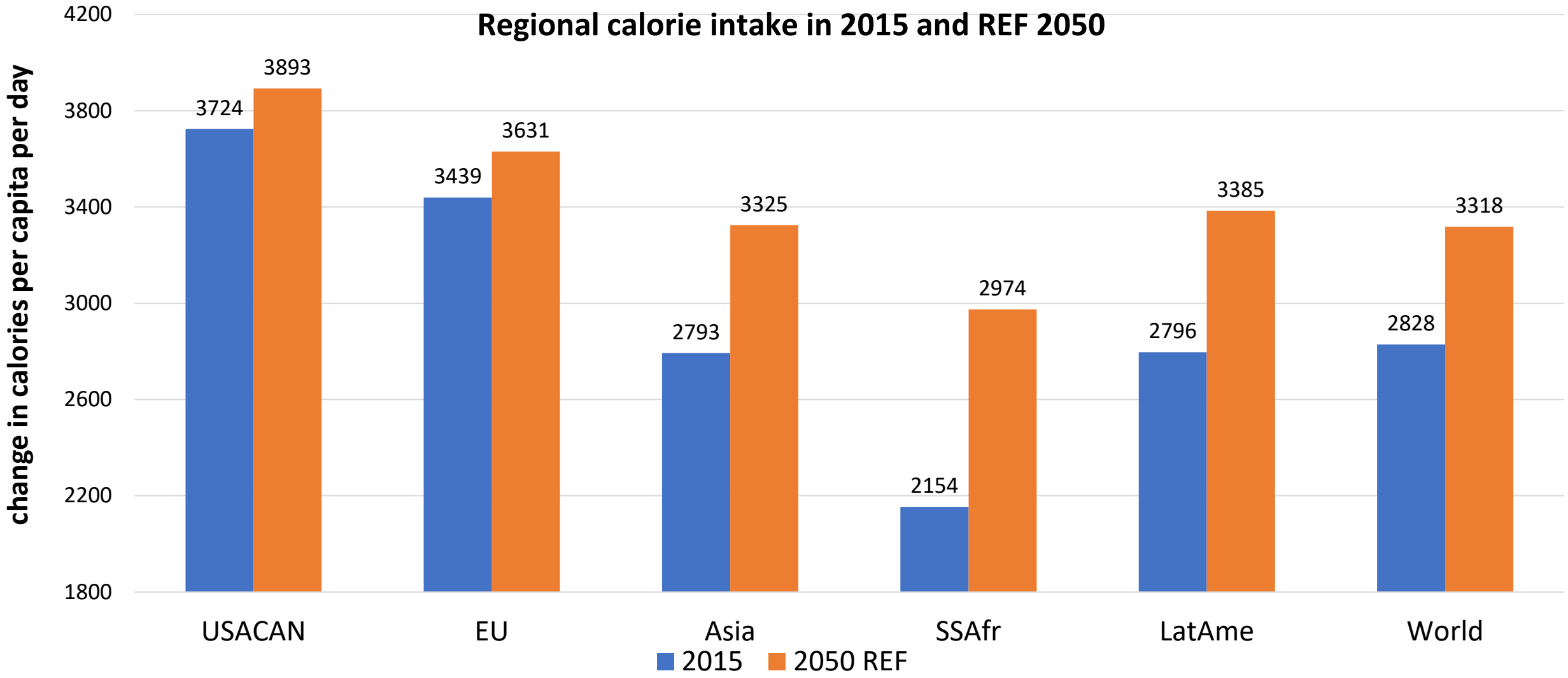
SDG2: End Hunger (average calorie consumption)



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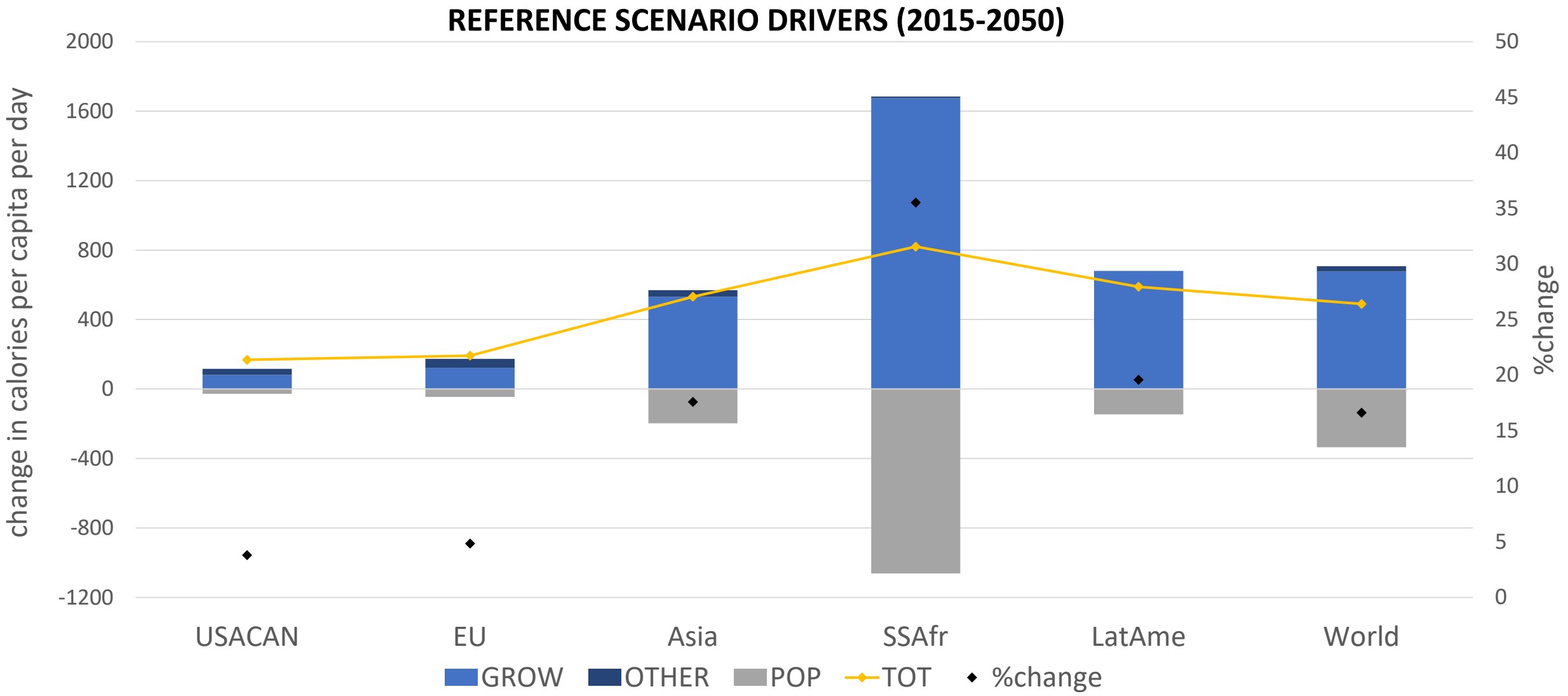

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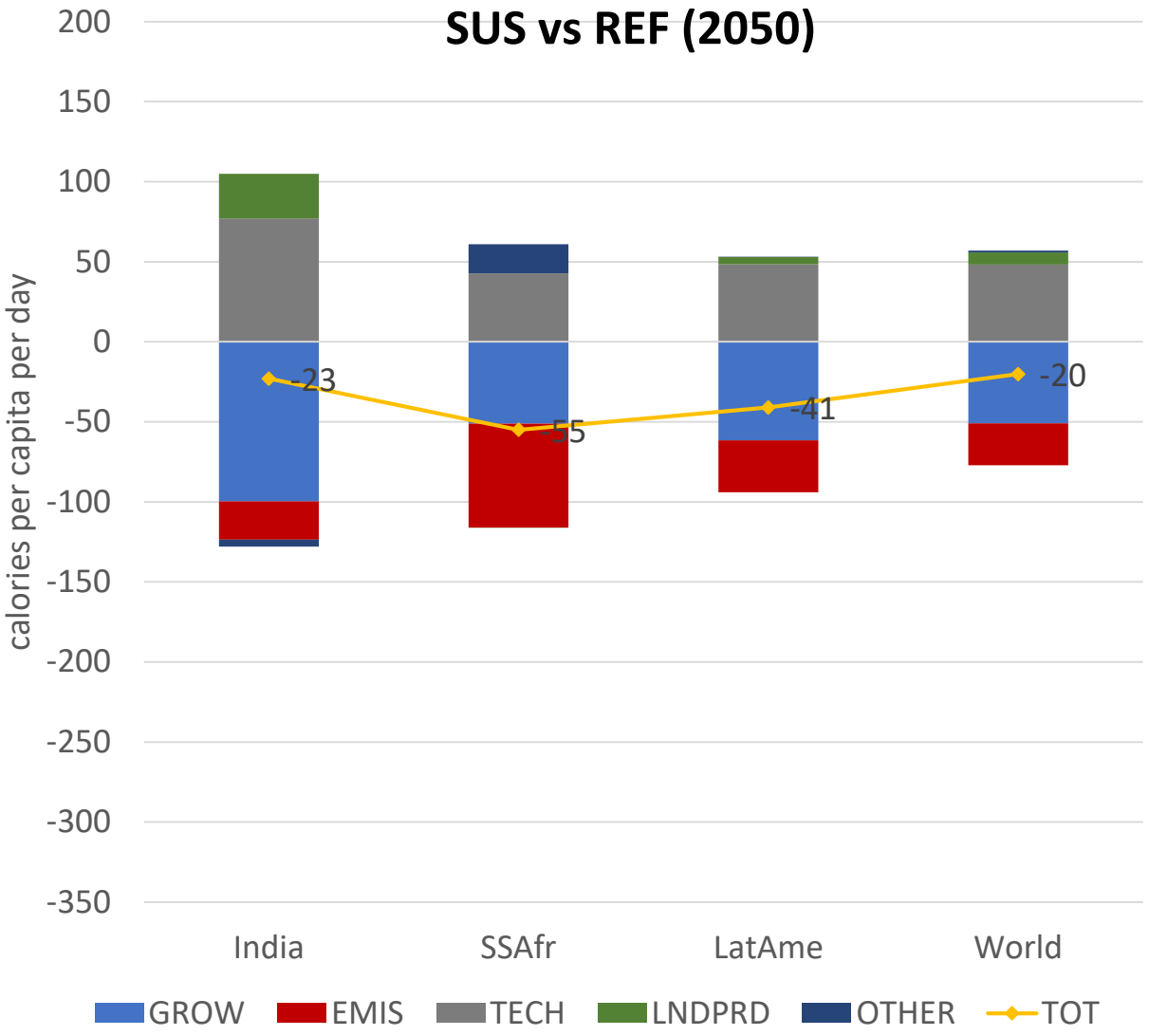

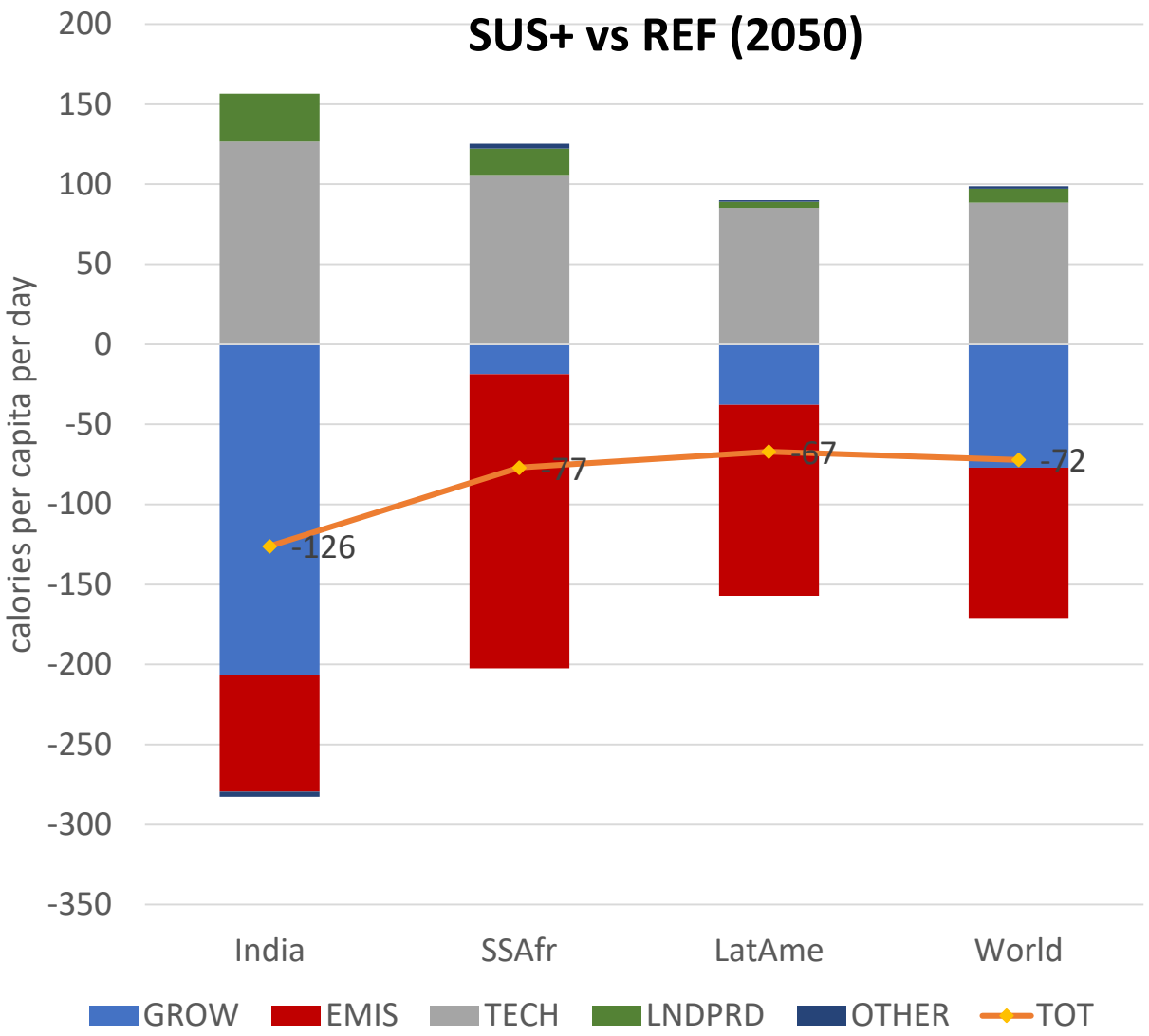

Economy

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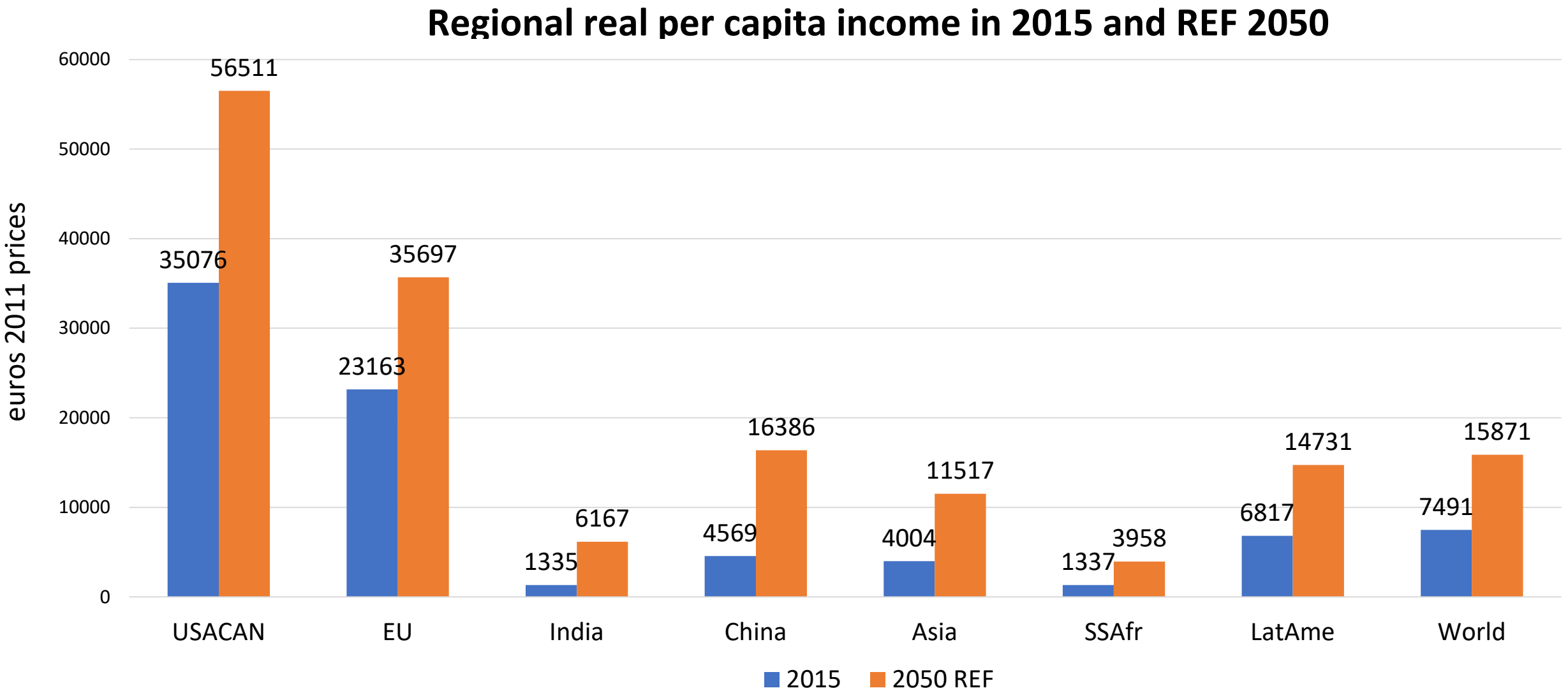
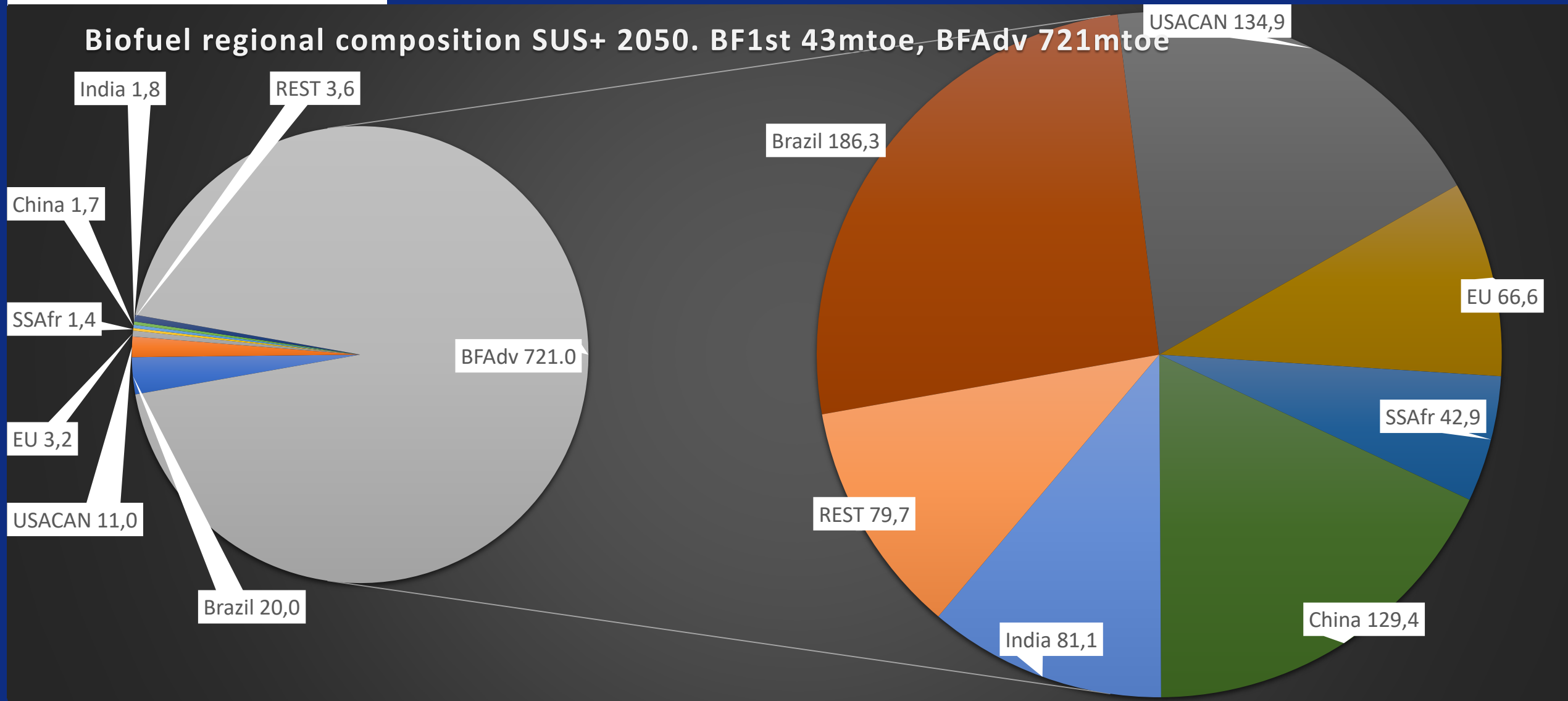
SDG10: Reduce Inequality (per capita real income)



SDG 12 – Sustainable Consumption and production & SDG 7 Sustainable Energy (biomass for renewable energy mtoe)



Some take home messages

- Evidence of 'population' weight on planetary boundaries (SDG15 land use results)
  - Malthusian pressure reaffirms need for family planning programs in world poorer regions
- Land use results show high reliance on biotechnological land productivity improvements.
- Climate control (SDG13) evidence of synergies and trade-offs
  - Synergy effect of lower temperatures (SDG13) on reduced land pressures (SDG15) up to 30 million ha worldwide -> approx 1/6th of EU agricultural land area
  - Food affordability (not shown here) and food calorie/security (SDG2) is compromised – especially in poorer regions (SSAfrica)
  - Reinforces message of burden sharing or emissions credits systems essential
- SDG10: Income convergence, but VERY slow. Other pathways make little difference
- Sustainable pathways promote switches to advanced generation biofuels (SDG7 & SDG12) with relatively moderate effects on food affordability (SDG2) or land use (SDG15)
  - <u>But</u> is the technology there to support this switch?

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Monitoring the Bioeconomy

Thank you.

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