



UNIVERSITY OF
HOHENHEIM

Bioenergies: challenges linked to the development of medium-power local energy solutions

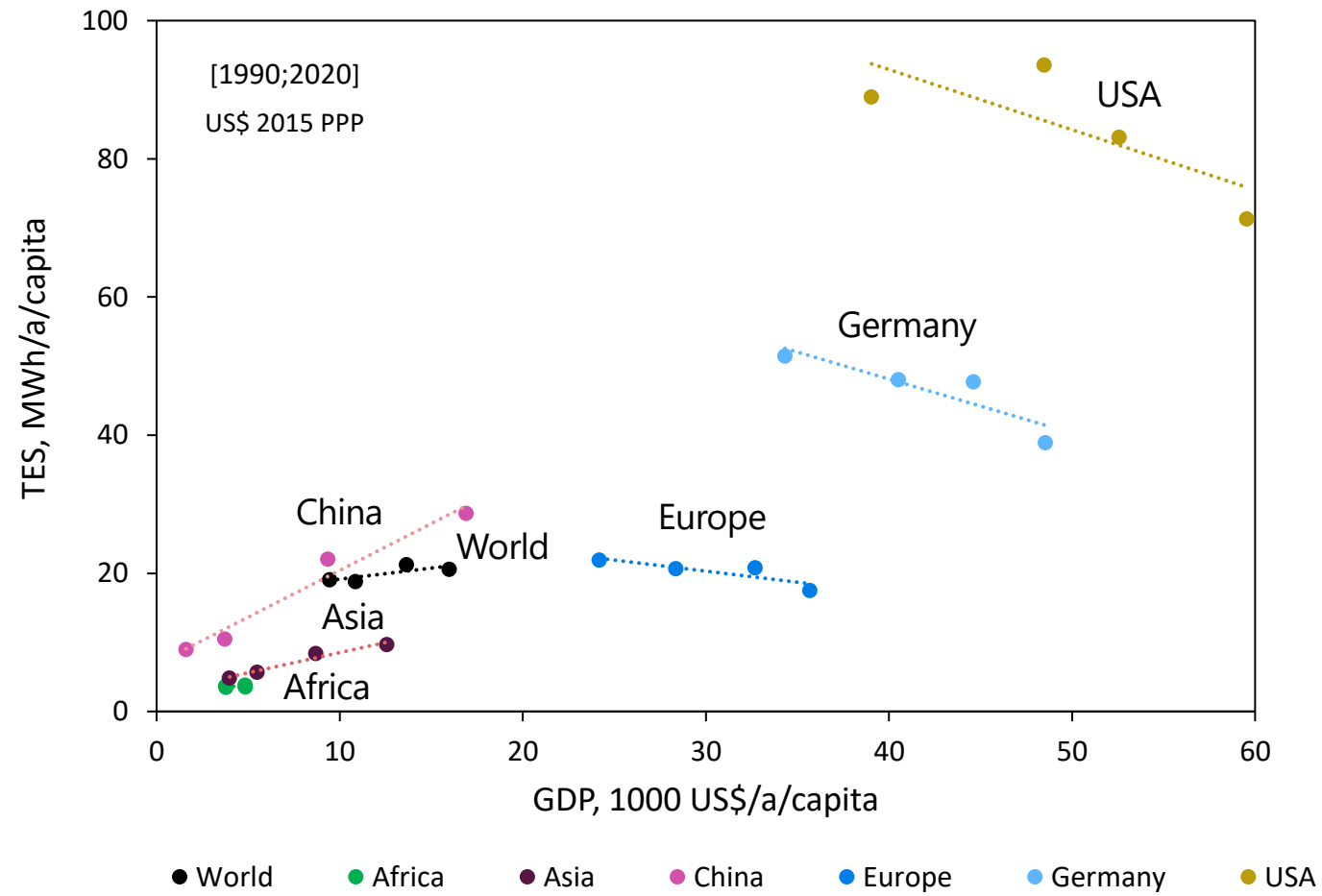
Bioénergies : enjeux liés au développement de solutions énergie de moyenne puissance à l'échelle locale

Energy Statistics

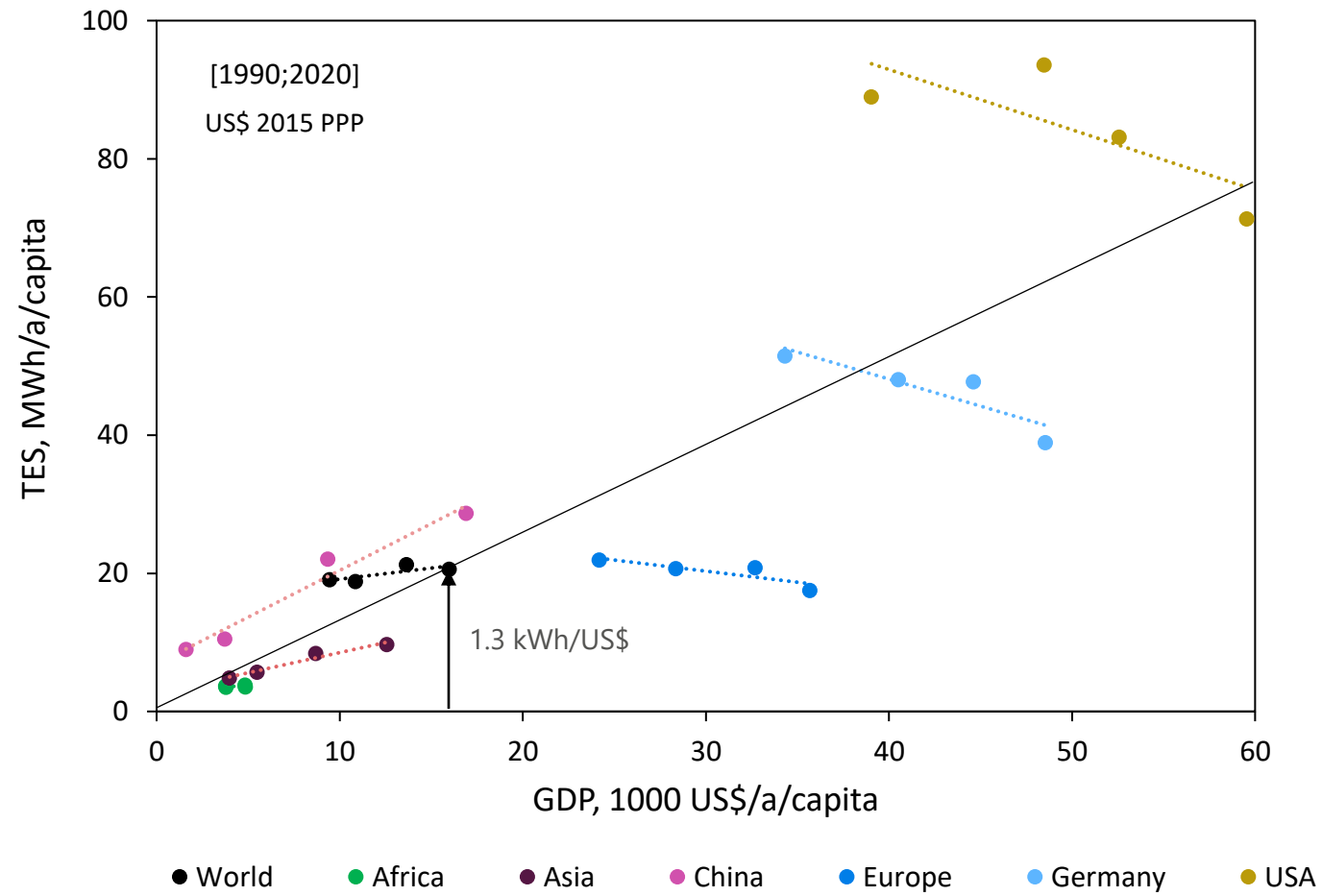
Year

2022

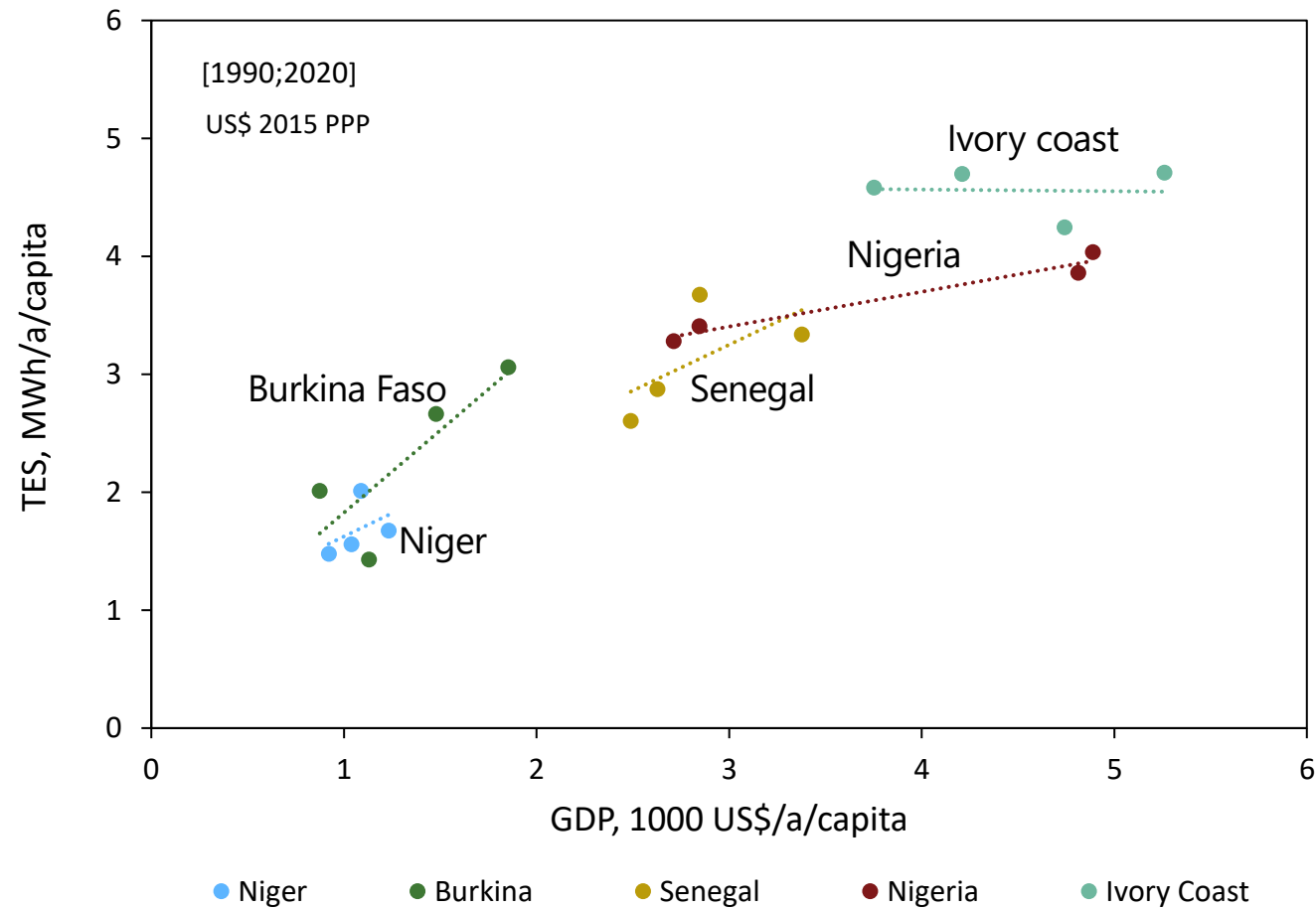
Gross Domestic Product (GDP) & Total Energy Supply (TES)



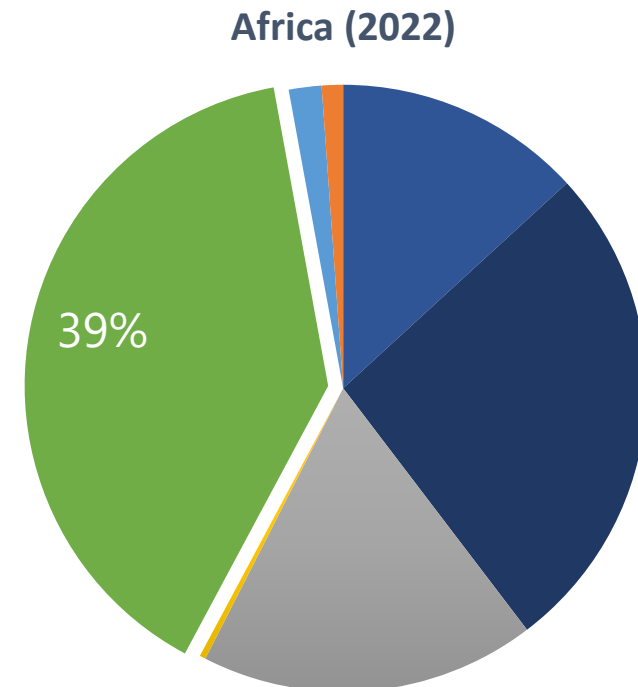
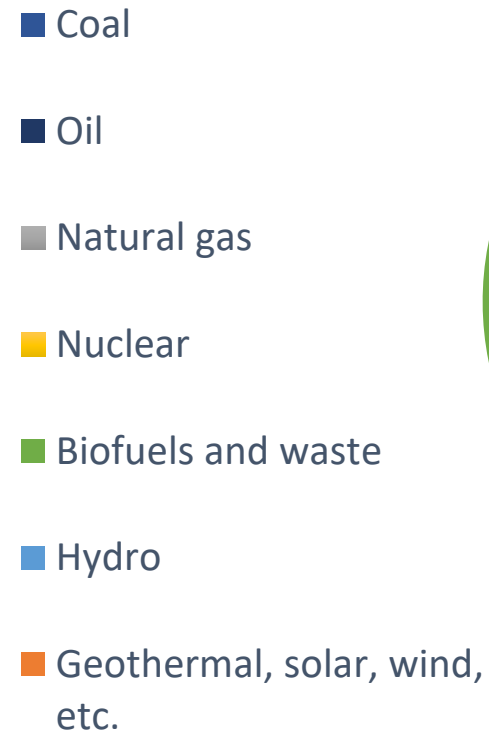
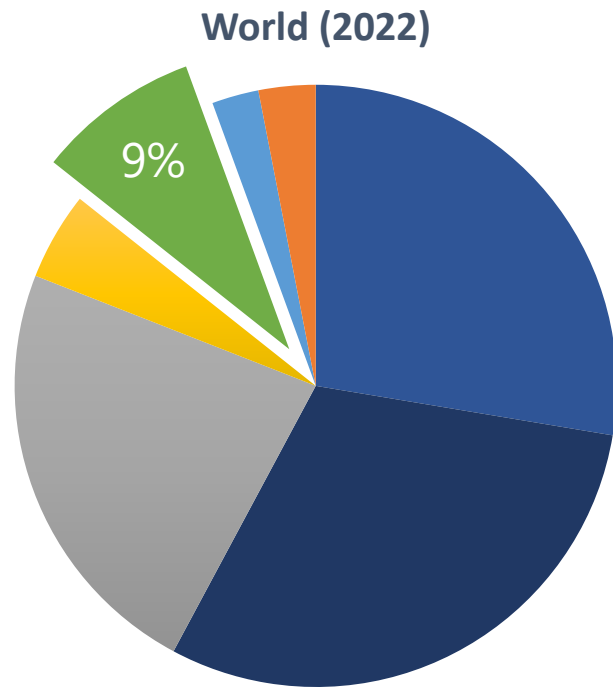
Gross Domestic Product (GDP) & Total Energy Supply (TES)



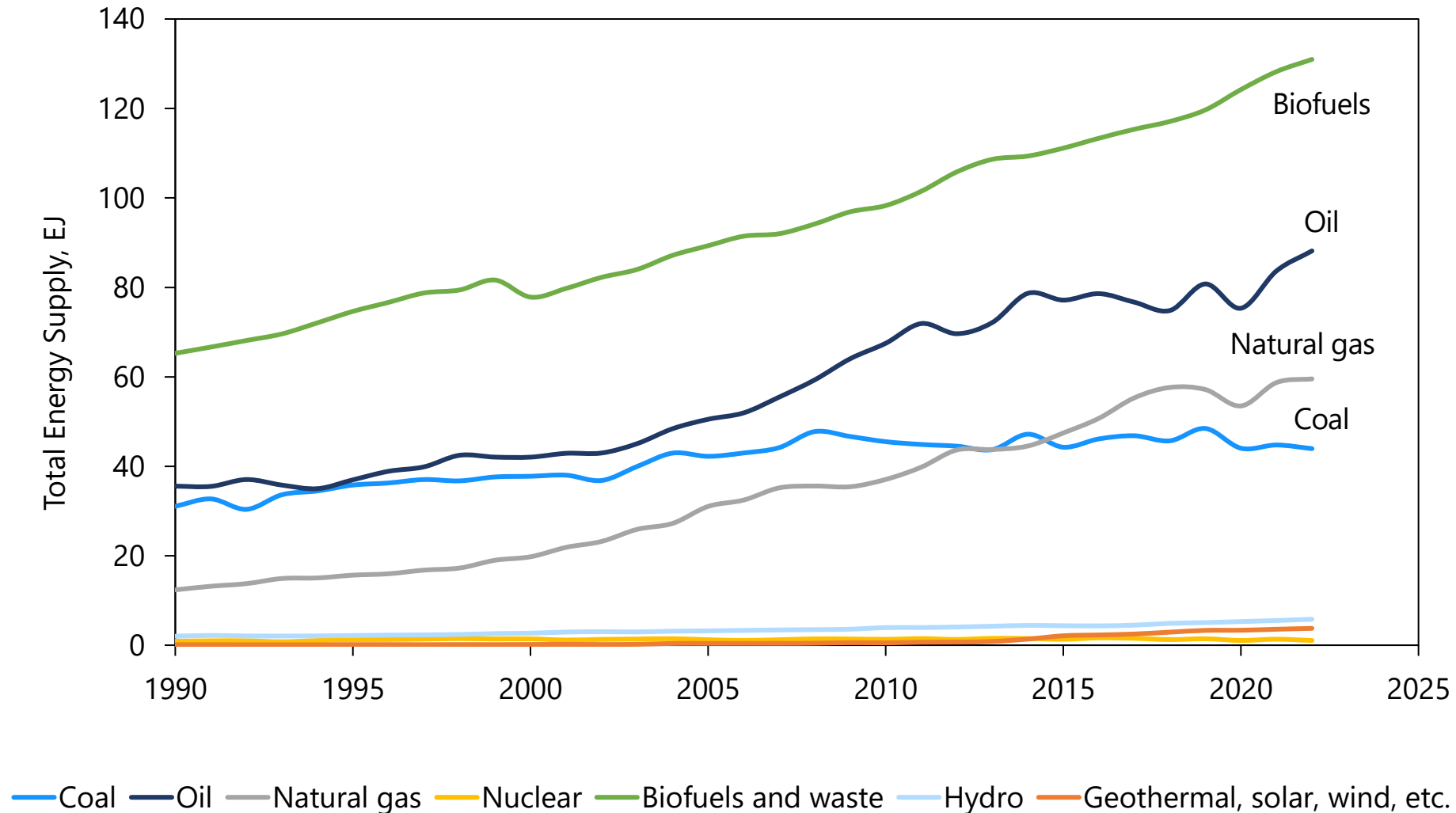
Gross Domestic Product (GDP) & Total Energy Supply (TES)



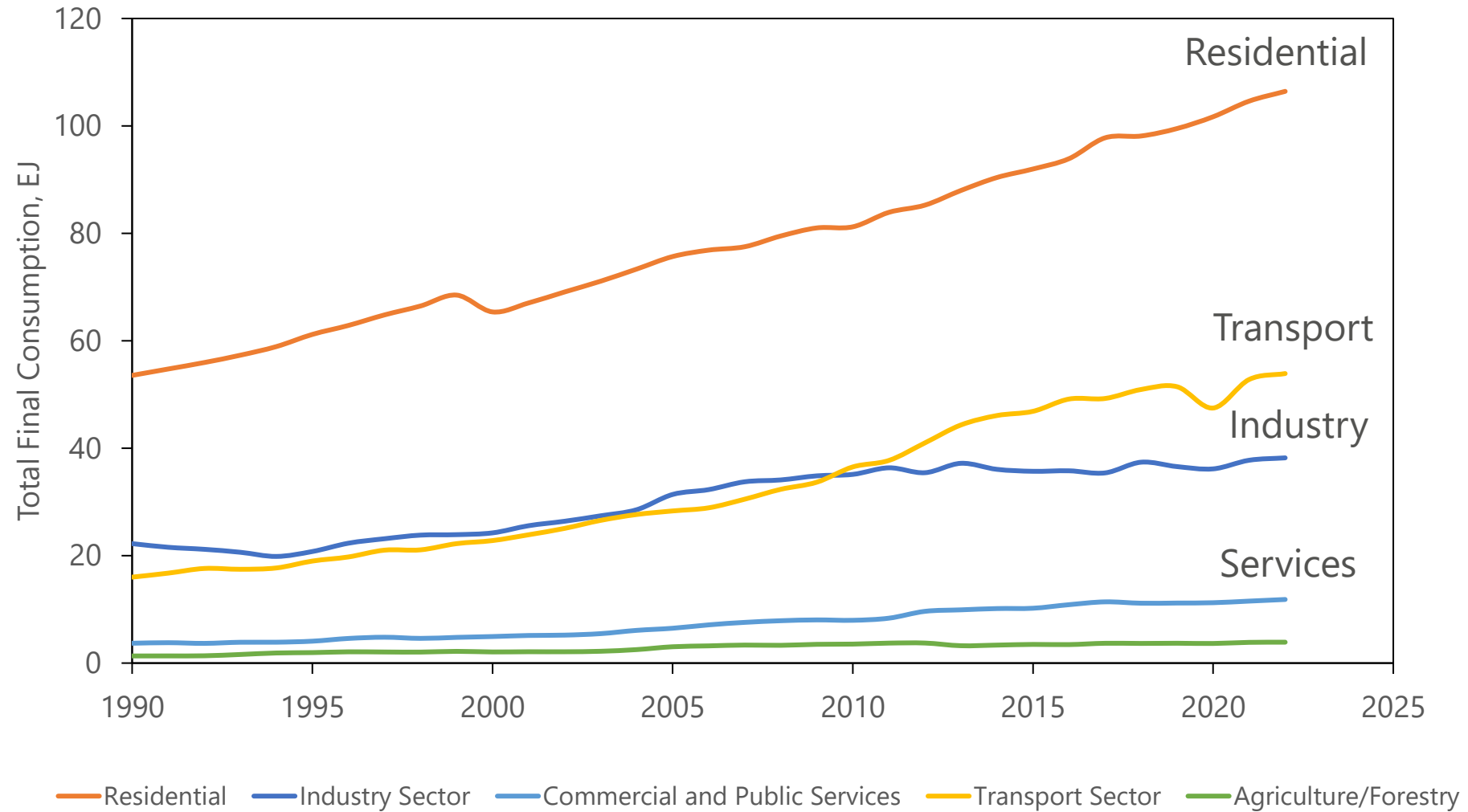
Total Energy Supply (TES) by source



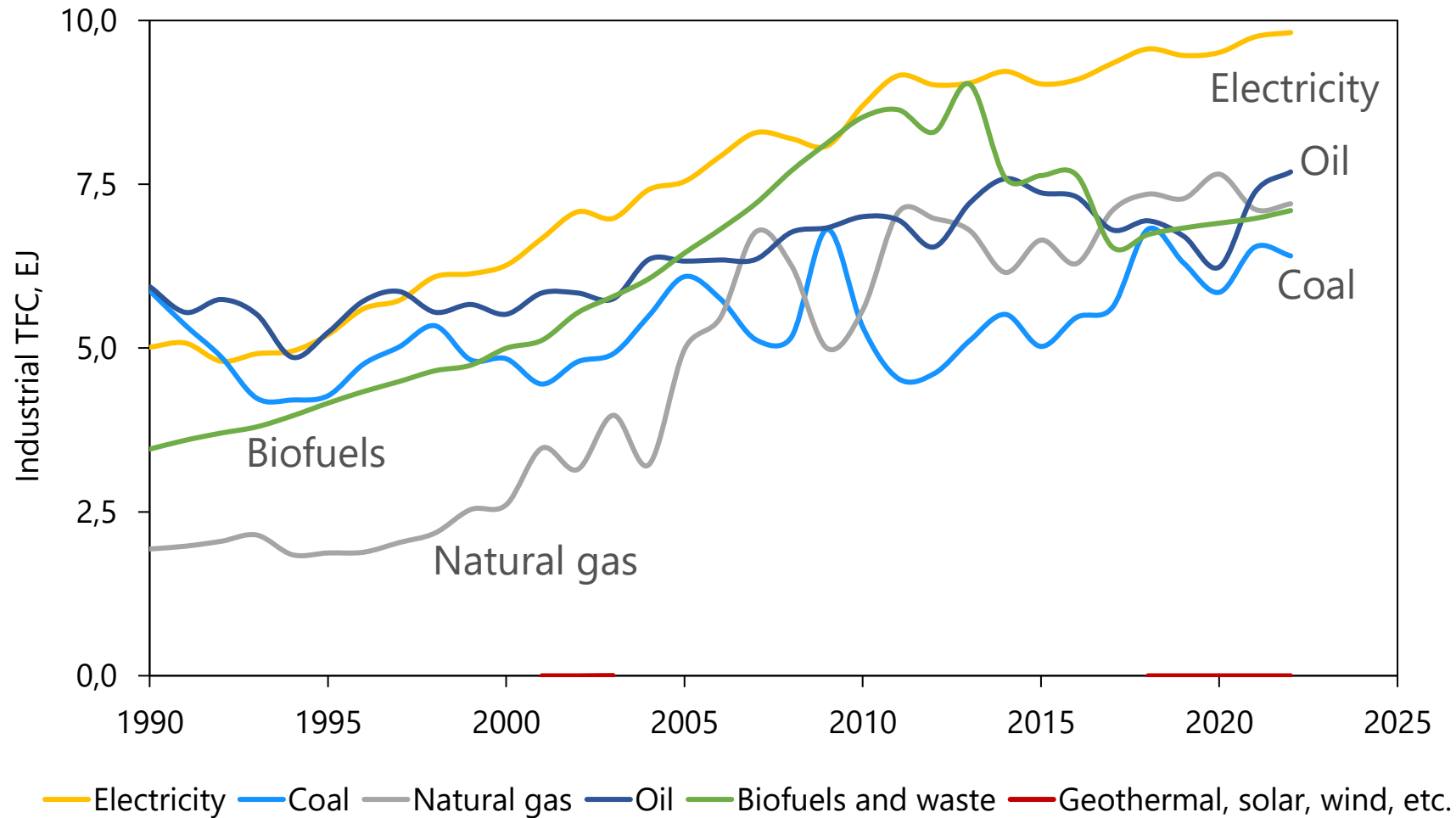
Total energy supply (TES) by source, Africa



Total final consumption (TFC) by sector, Africa



Industry Total Final Consumption (TFC) by source, Africa



Energy for Small and Medium Enterprises

SME













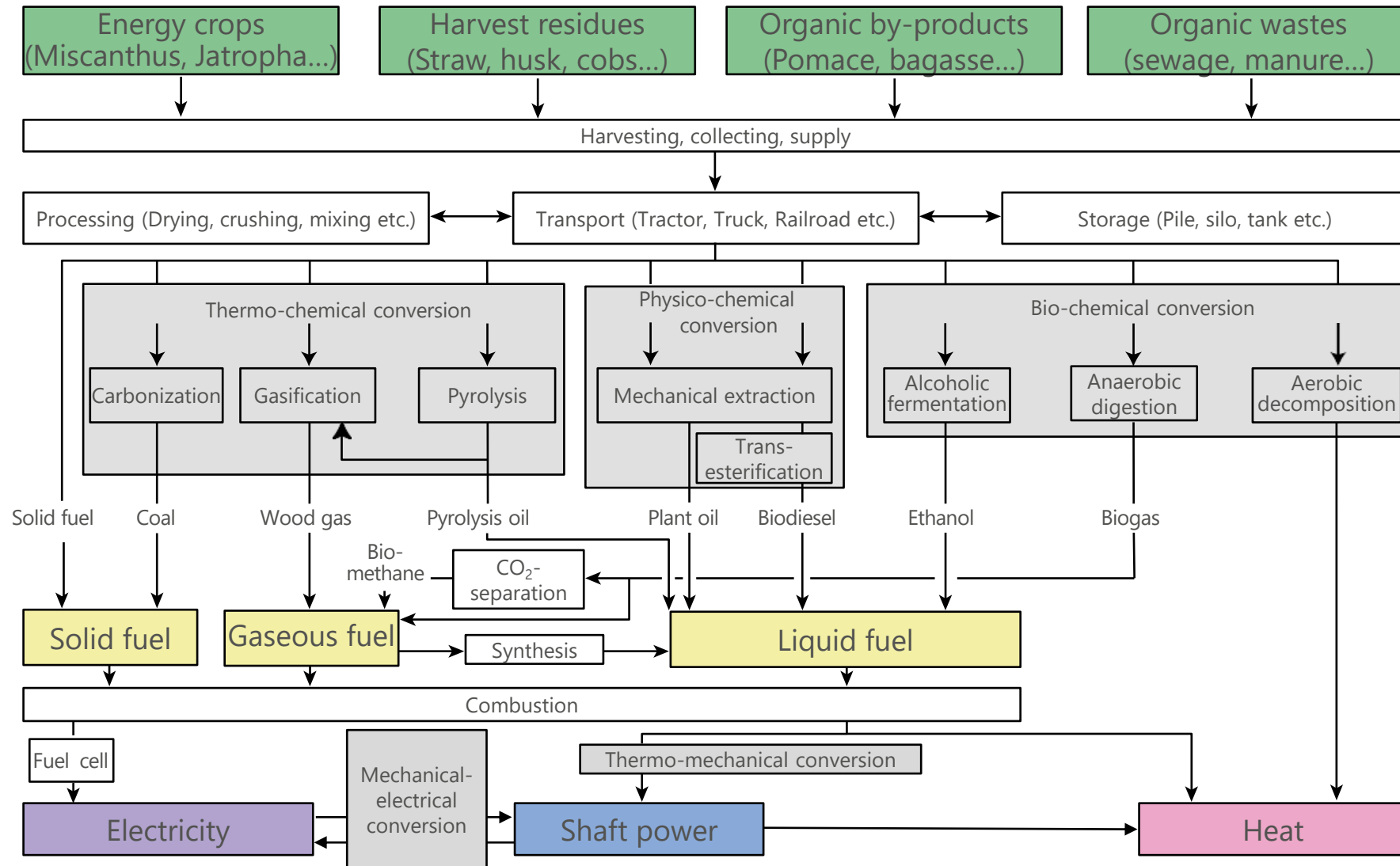


Bioenergy to Shaft Power





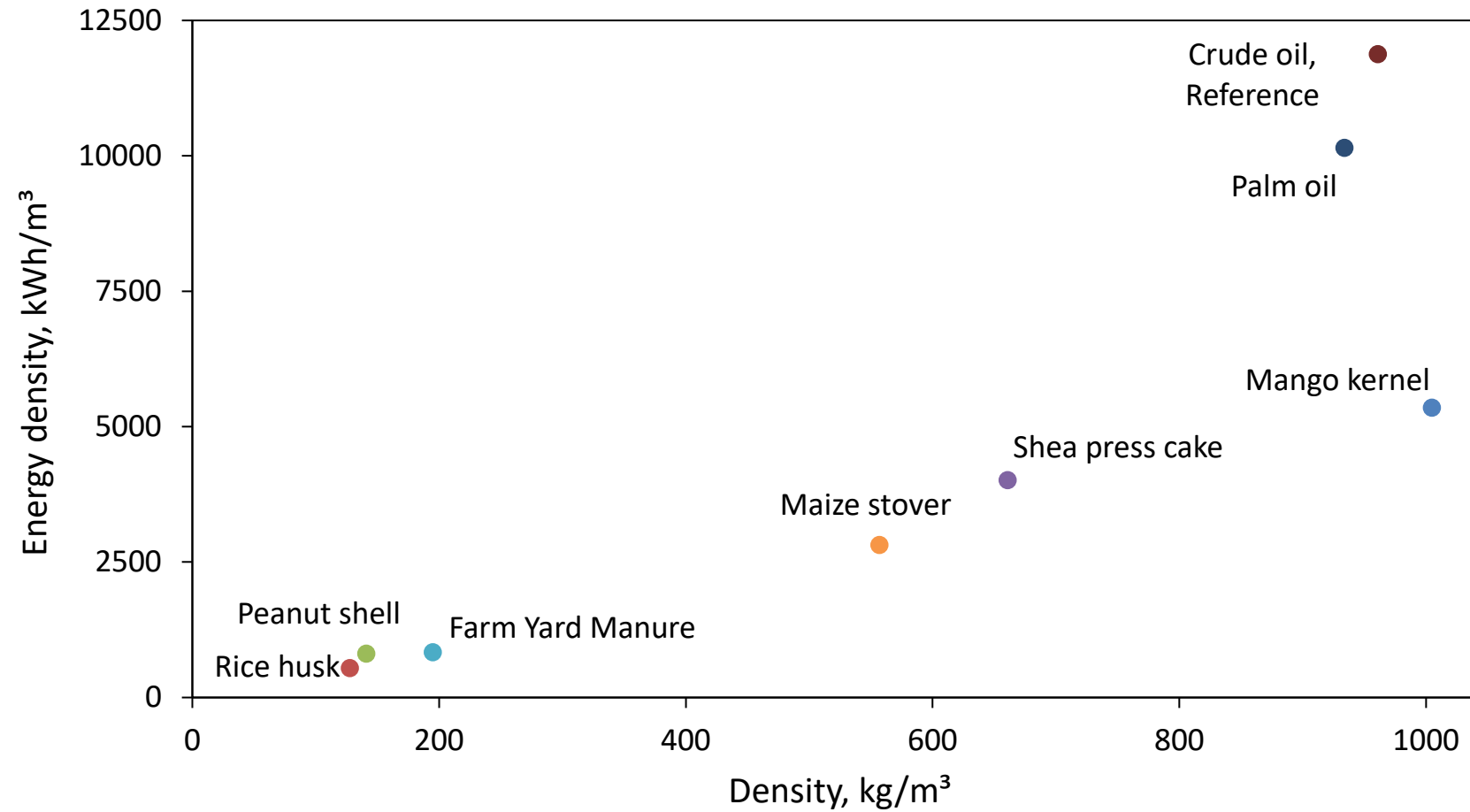
Biomass conversion pathways



Physico-chemical properties of biomass

	MC	Ash content	LHV	HHV
	%	d.b %	MJ/kg wb	MJ/kg db
Mango kernel	86	2.5	0.41	19.17
Farm Yard Manure	76	10.6	3.49	15.43
Maize stover	5.4	5.8	15.84	18.18
Shea press cake	4.1	5.6	19.95	21.86
Rice husk	3.7	23.2	13.47	15.21
Peanut shell	2.8	3.6	17.84	20.68
Palm oil	.	.		39.11
Crude oil, Reference	.	.		44.50

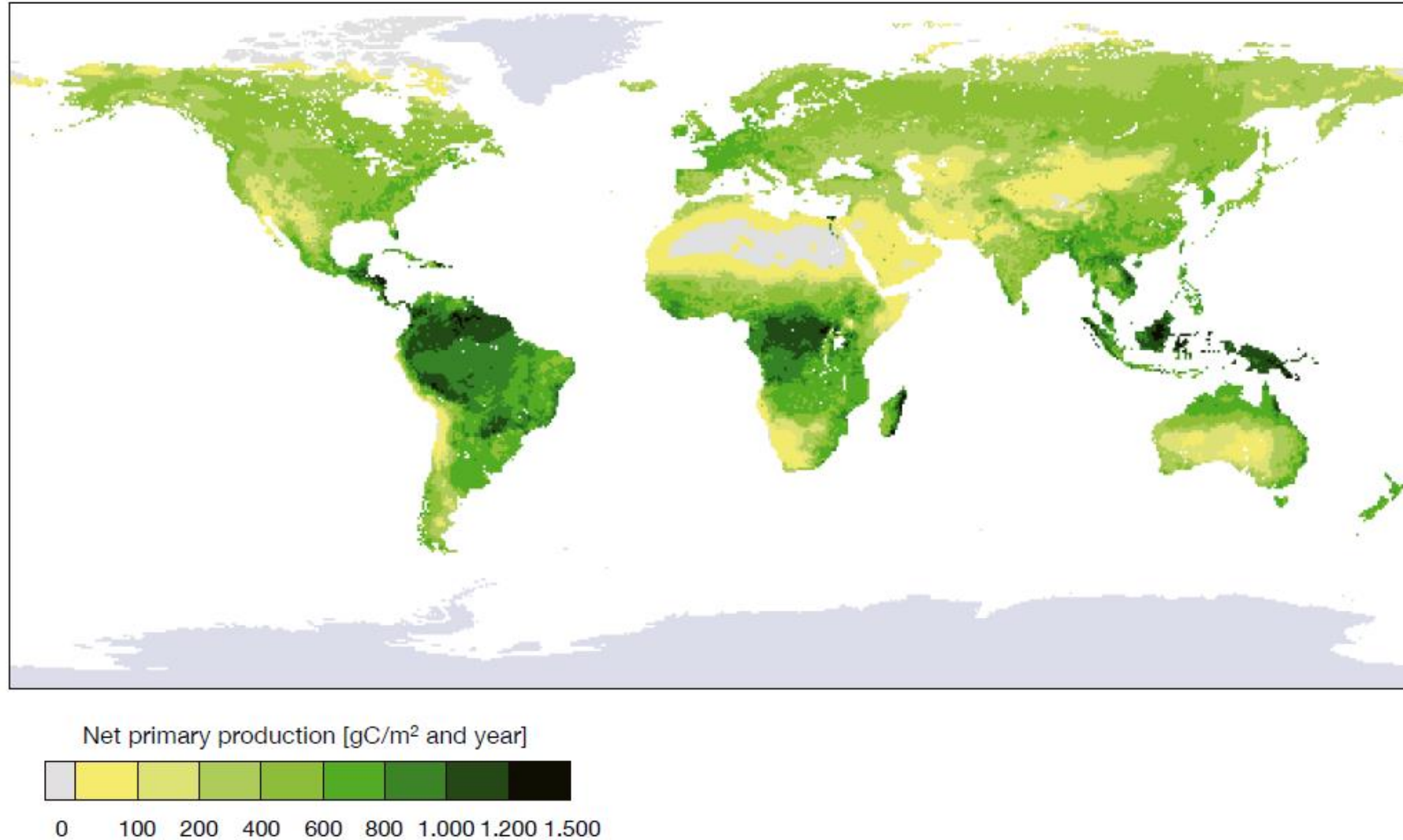
Energy density of biomass



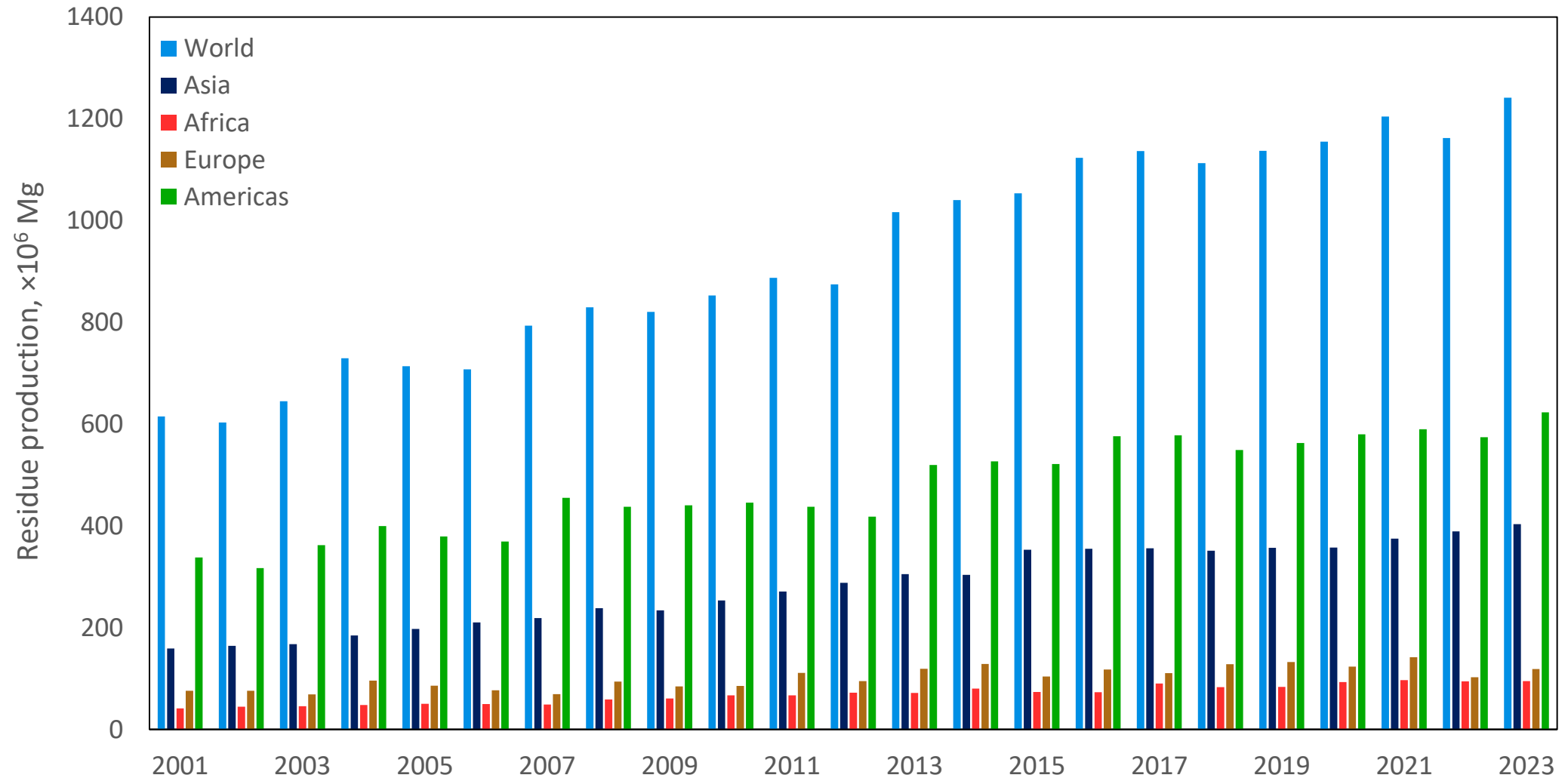
Opportunities and Threats



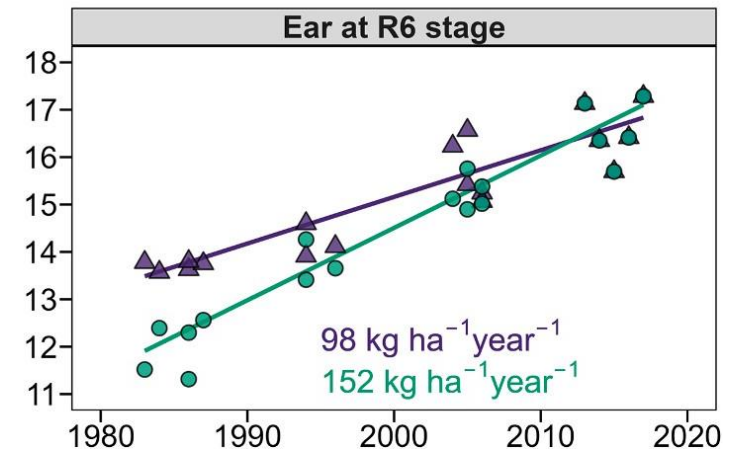
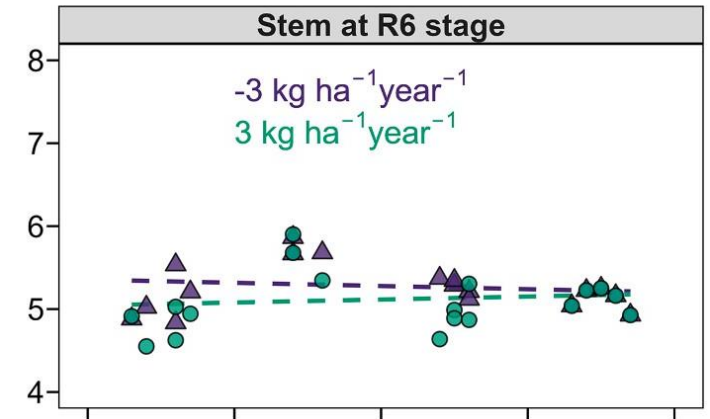
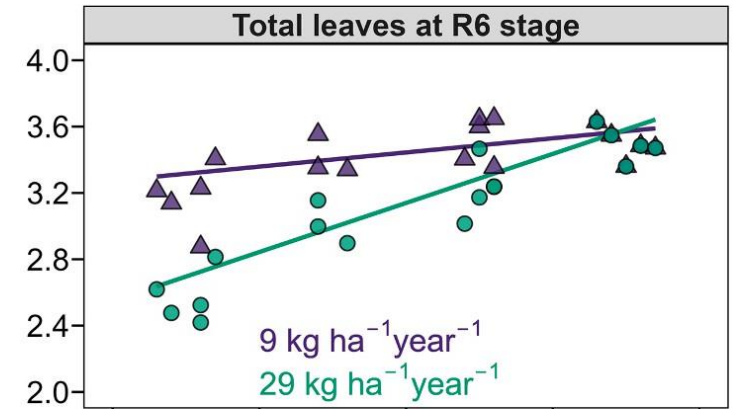
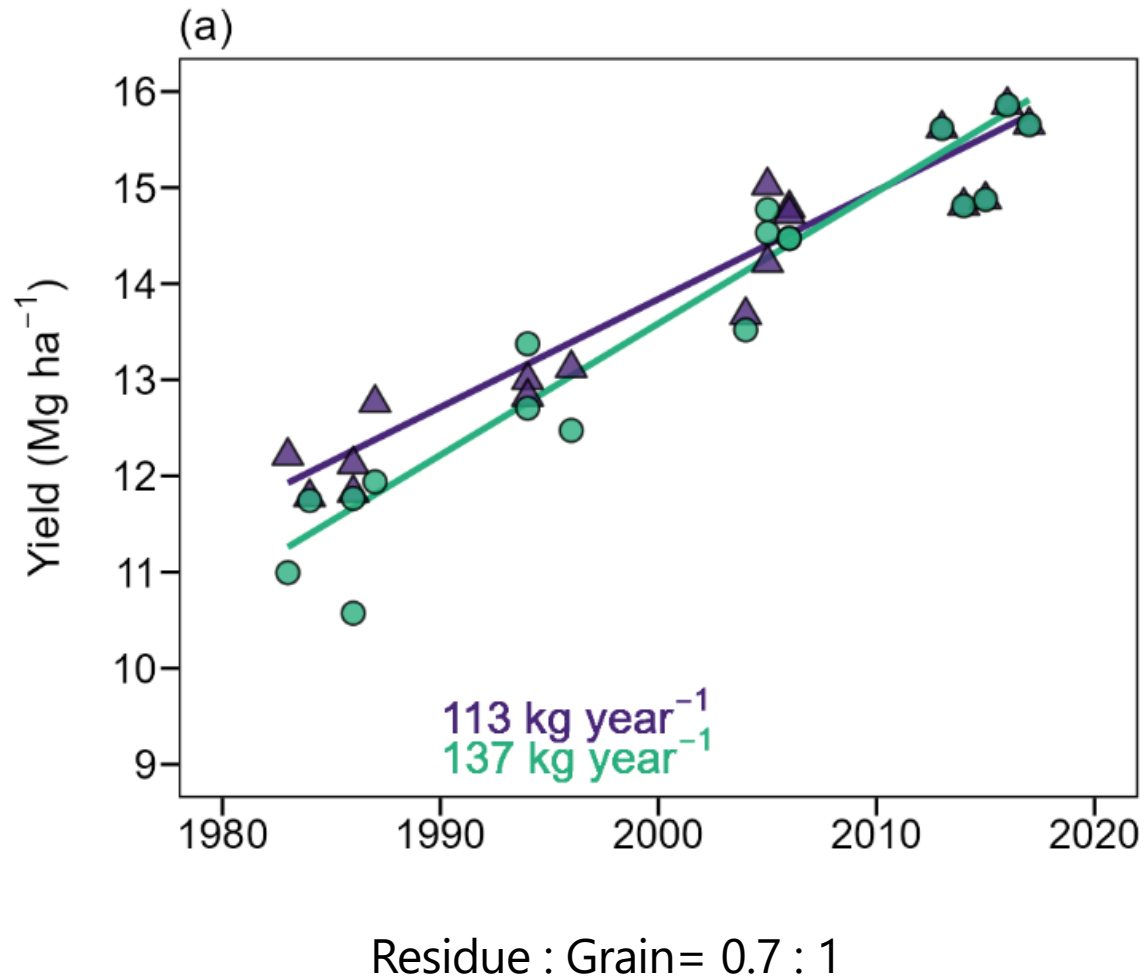
Net primary biomass production, $\text{g}_\text{C}/\text{m}^2/\text{a}$



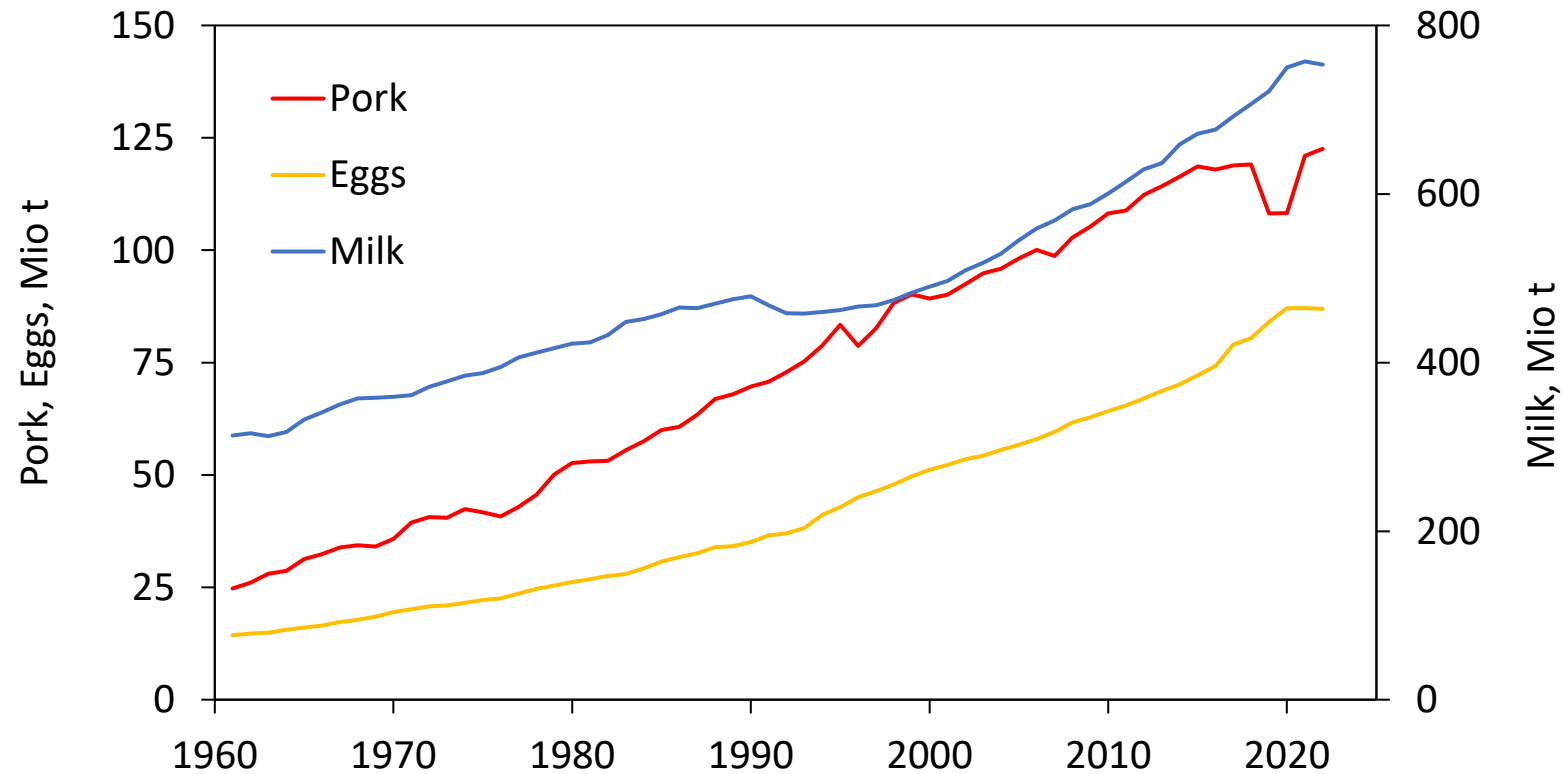
Harvest residues, maize



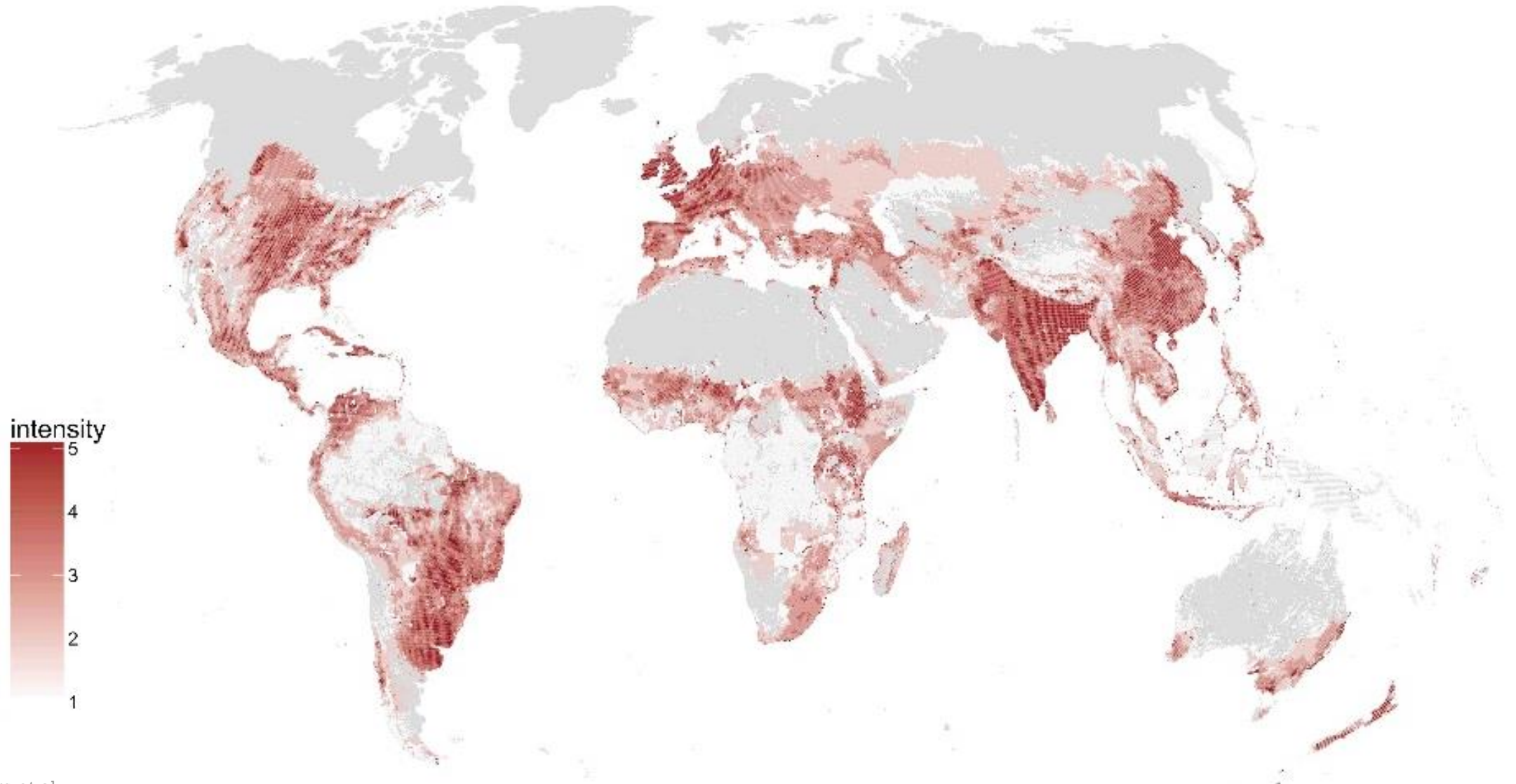
Biomass partitioning, maize



Global production of eggs, milk and pork



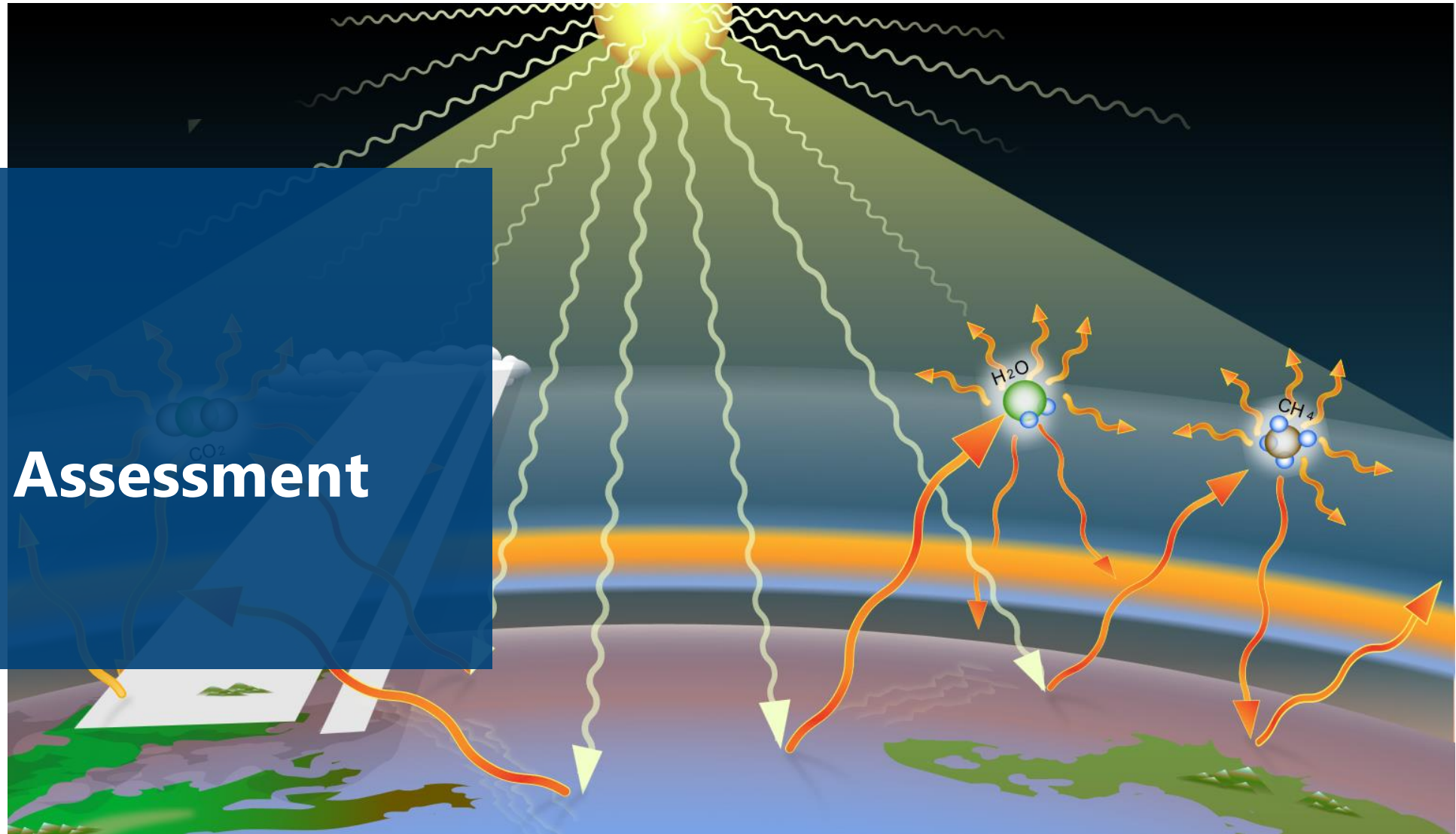
Intensity of manure production



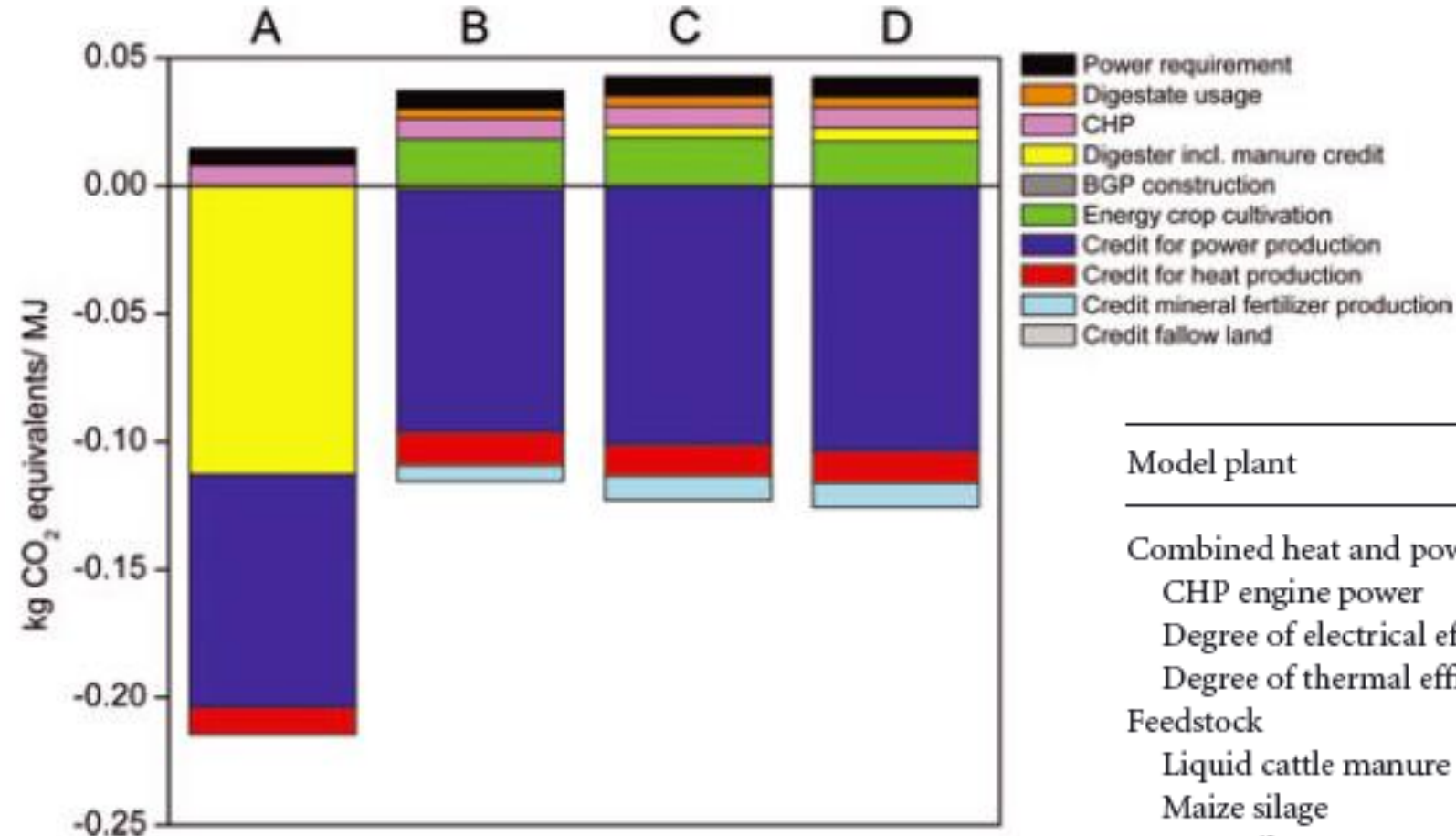


LCA

Life Cycle Assessment

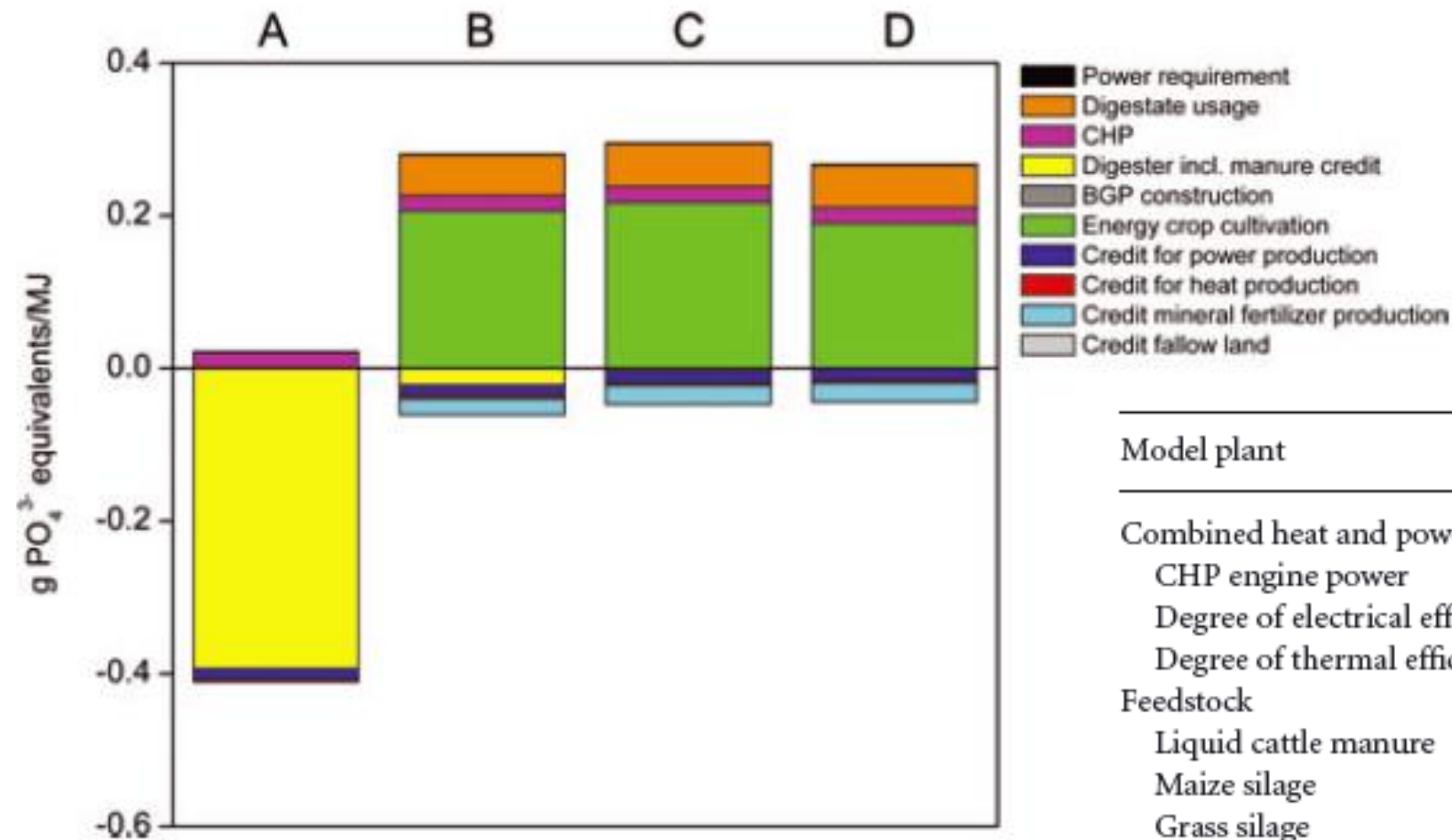


LCA – Global warming potential



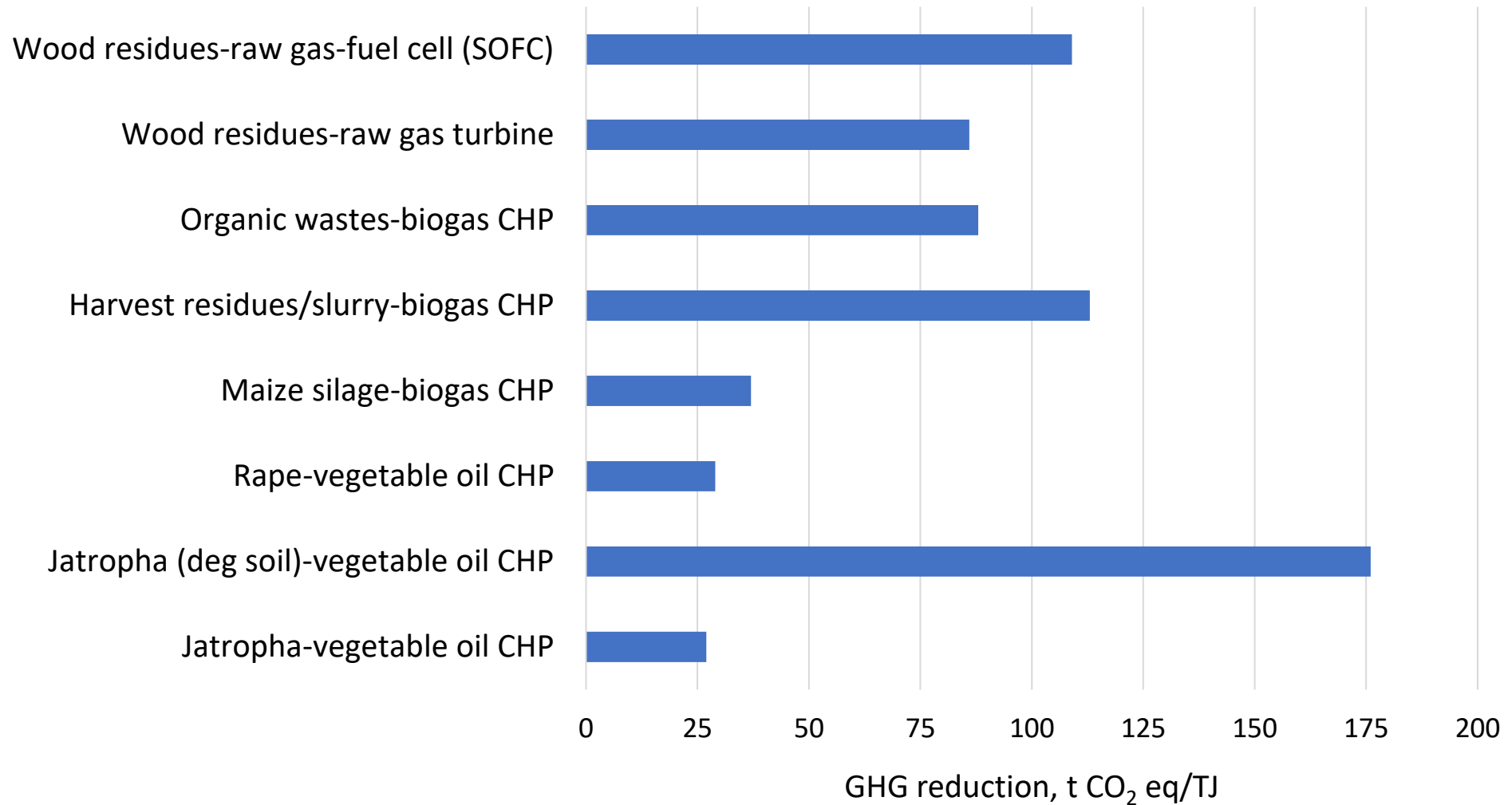
Model plant		A	B	C	D
Combined heat and power plant (CHP)					
CHP engine power	kW _{el}	50	150	500	2000
Degree of electrical efficiency	%	36	38	40	41
Degree of thermal efficiency	%	46	46	43	44
Feedstock					
Liquid cattle manure	%	100	35	10	0
Maize silage	%	0	50	75	100
Grass silage	%	0	15	15	0

LCA - Eutrophication potential



Model plant		A	B	C	D
Combined heat and power plant (CHP)					
CHP engine power	kW _{el}	50	150	500	2000
Degree of electrical efficiency	%	36	38	40	41
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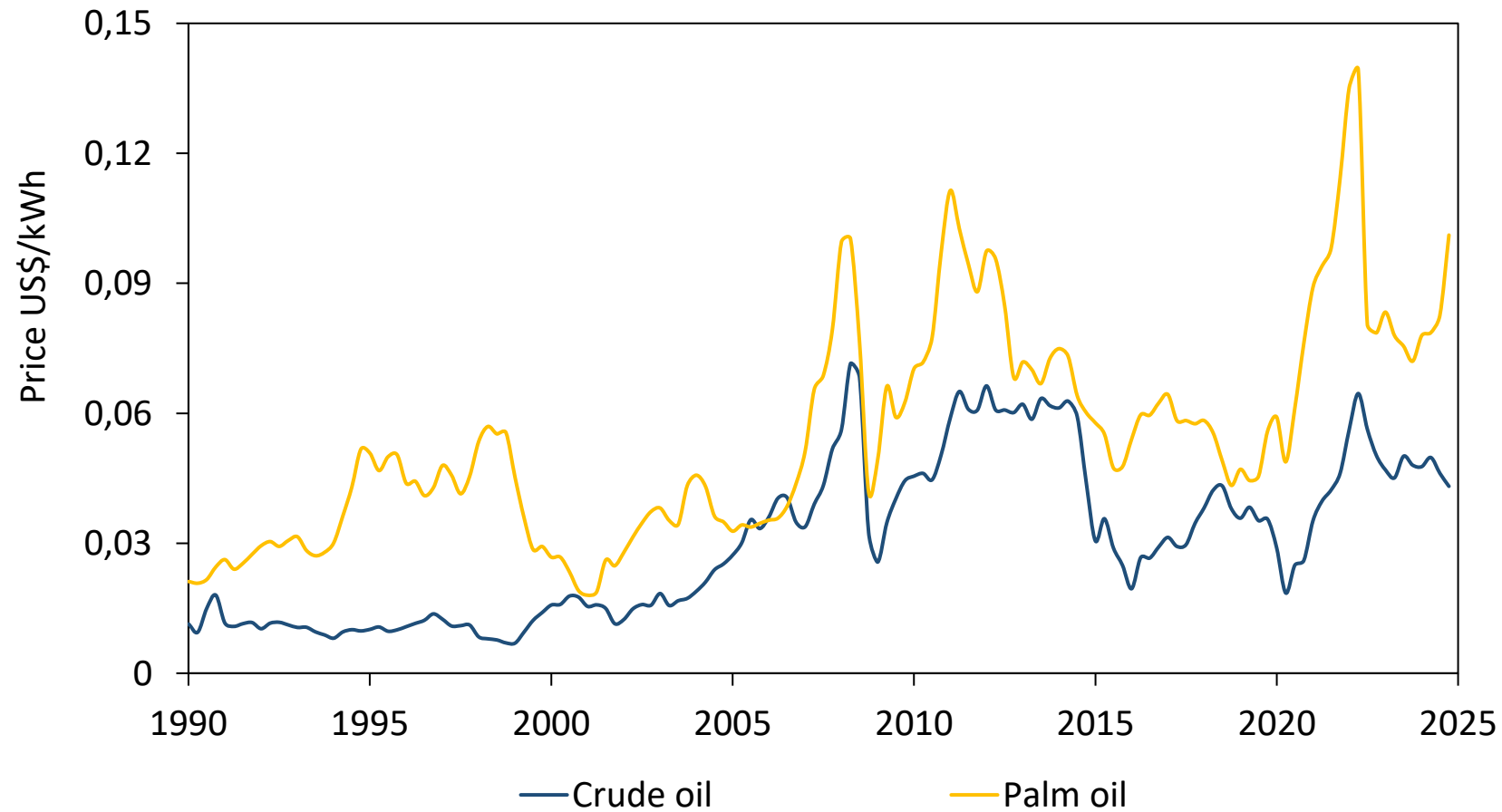
GHG reductions per unit of raw biomass, t CO₂-eq/TJ



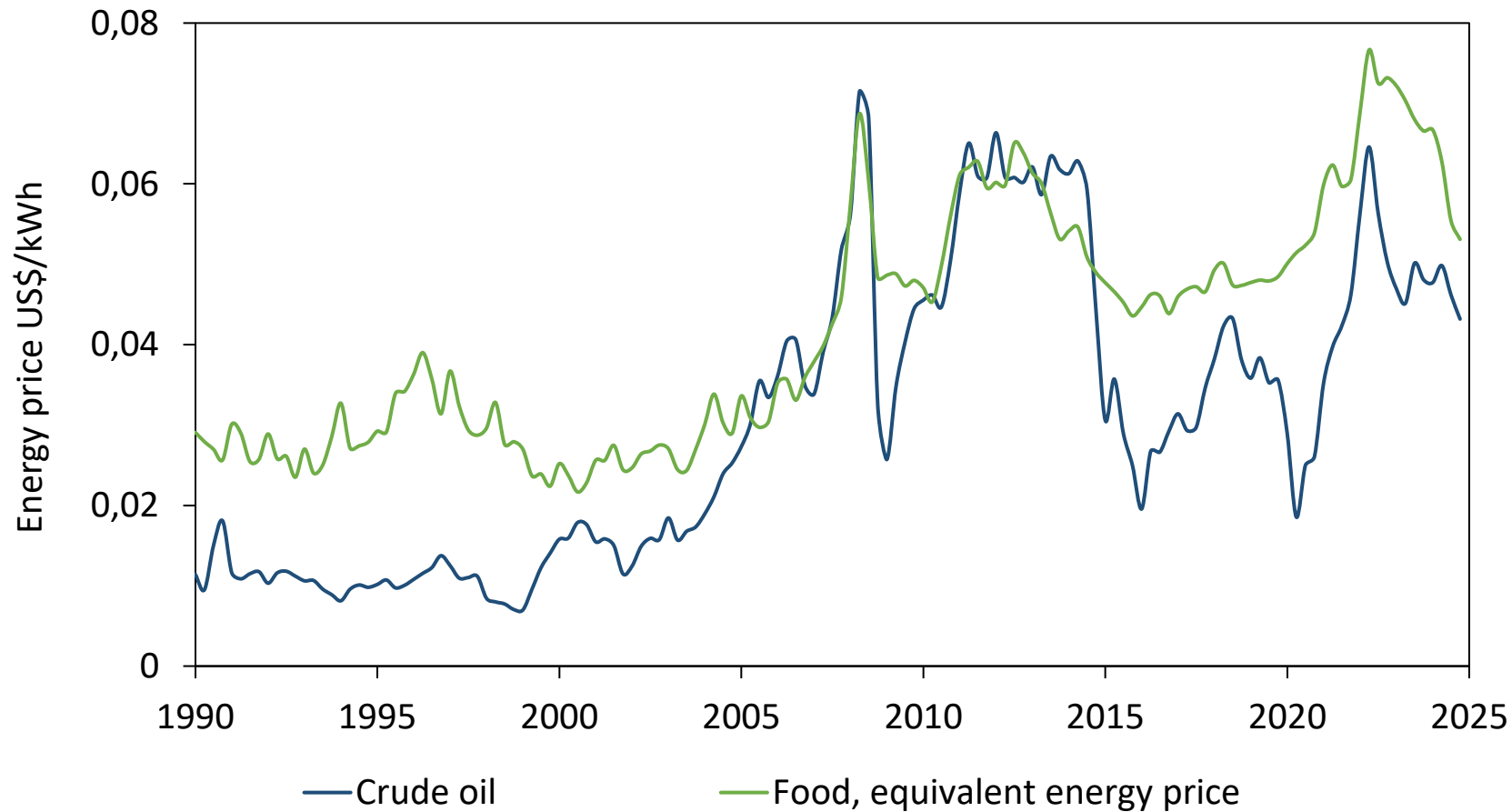
Food-Fuel competition



Price per kWh for crude oil and palm oil



Food vs. fuel



$$EEP_{Food} = \frac{P_{Food}}{HHV_{Food}} \left[\frac{US\$ \cdot kg}{kg \cdot kWh} \right]$$

EEP Equivalent energy price, US\$/kWh
P Price, US\$/kg
HHV Lower Heating Value, kWh/kg

Food includes Cereal, Vegetable Oils, Meat, Fishmeal, Seafood, Sugar, Apple, Orange, Bananas, Groundnuts, Milk, Tomato



Karte Satellit Gelände

Fundong

Nd

N11

Bamenda

Sali

N6

Batibo

N6

Mamfe

N6

N6

Bakebe

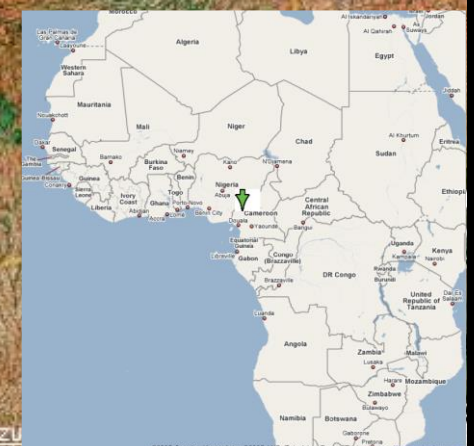
N8

Fontem

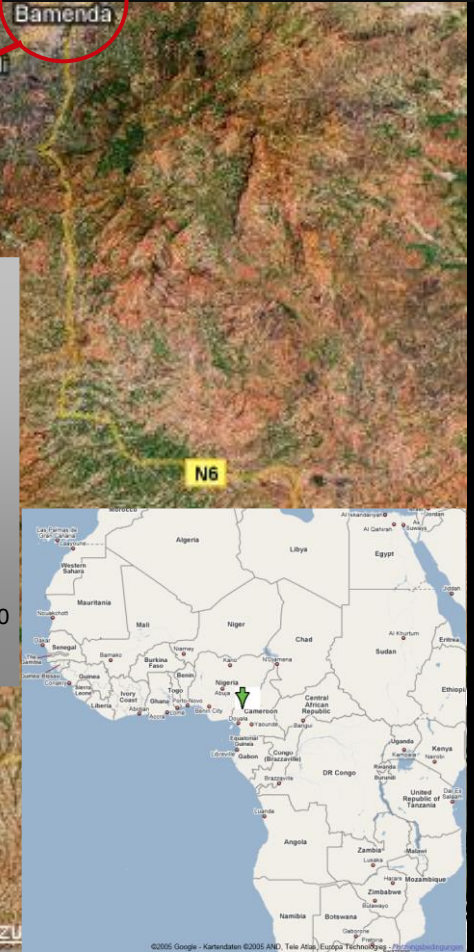
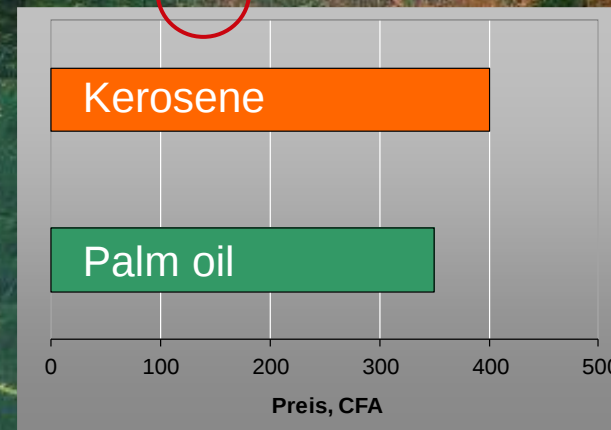
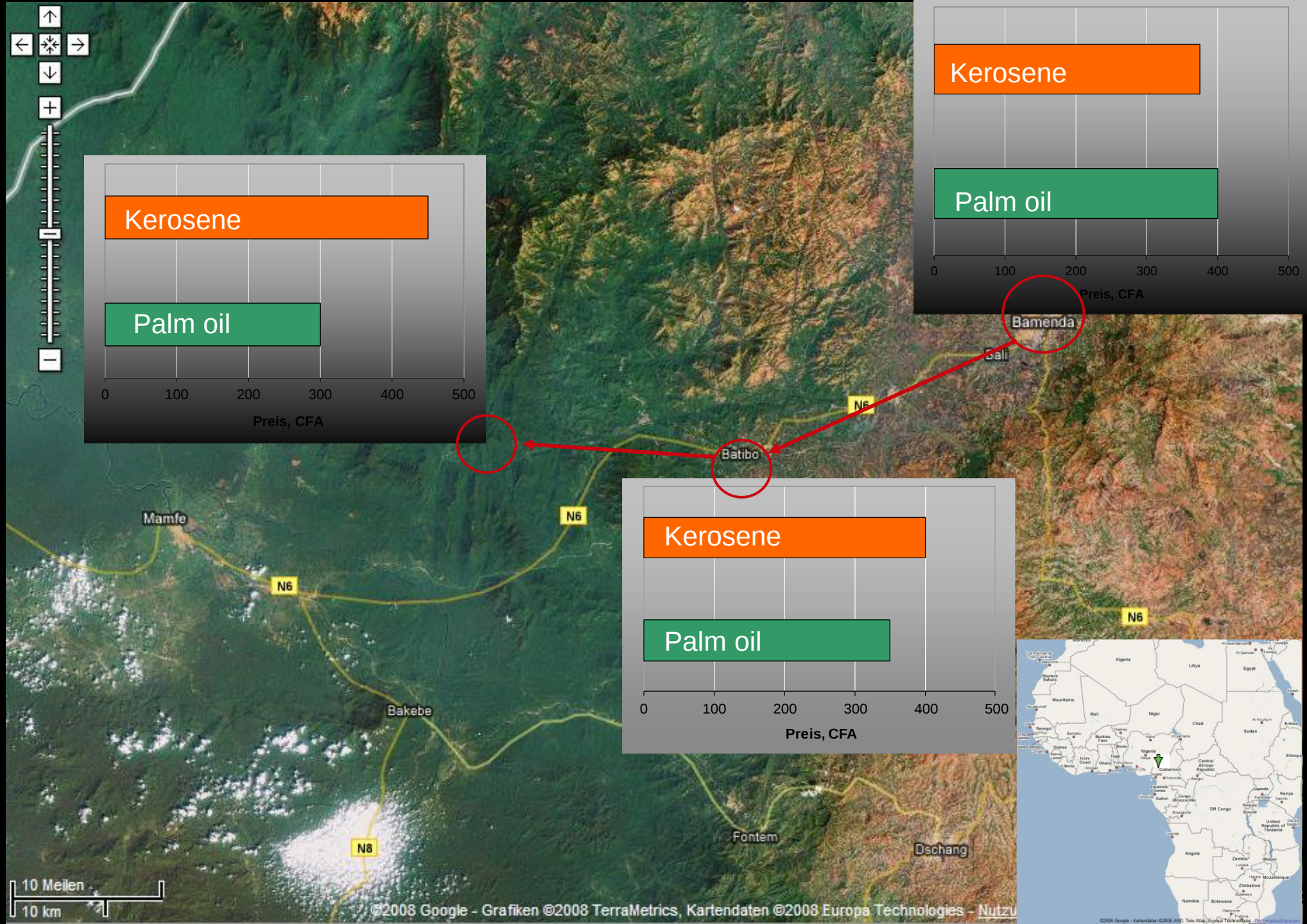
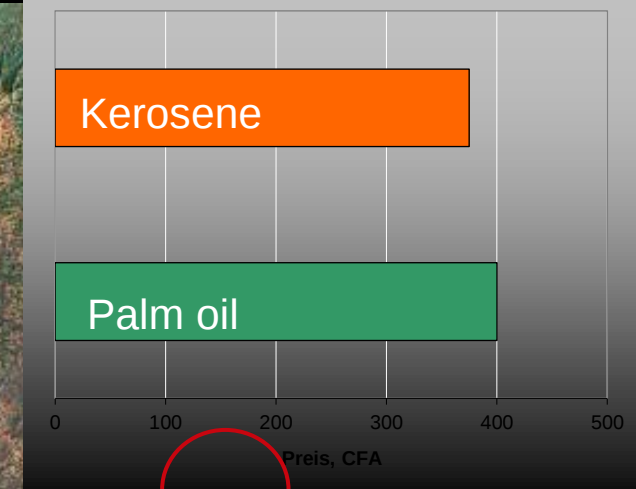
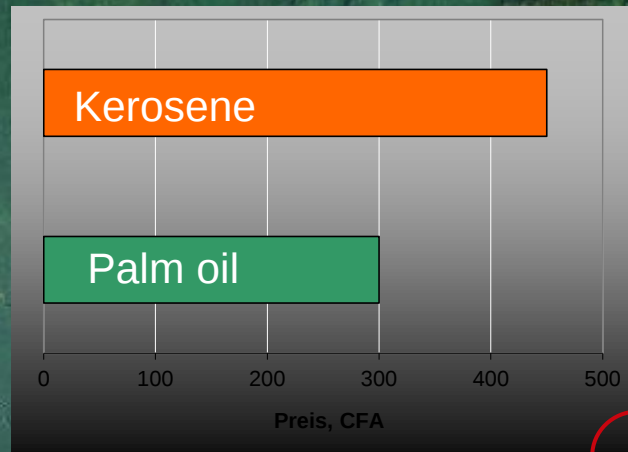
Dschang

10 Meilen
10 km

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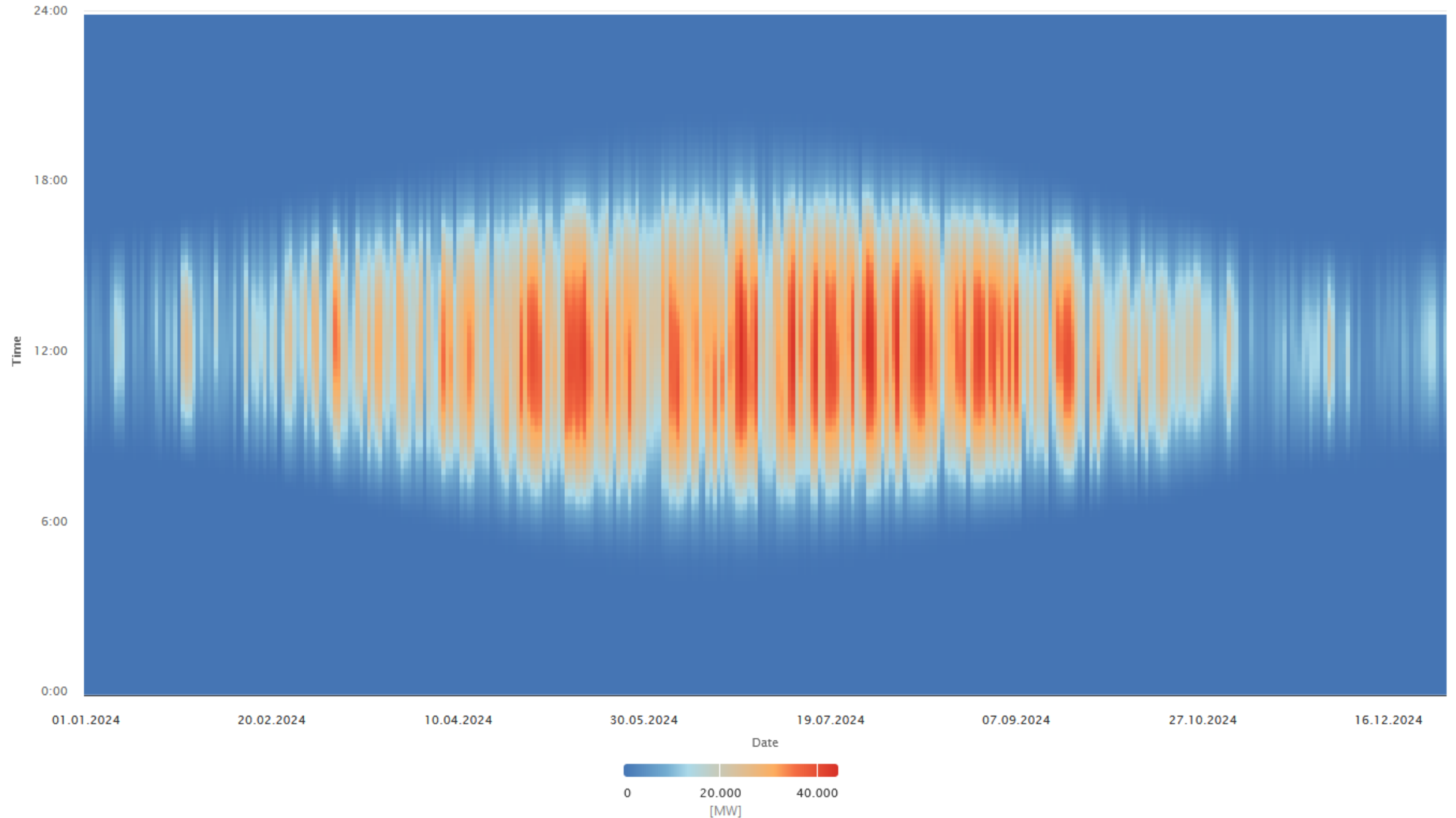




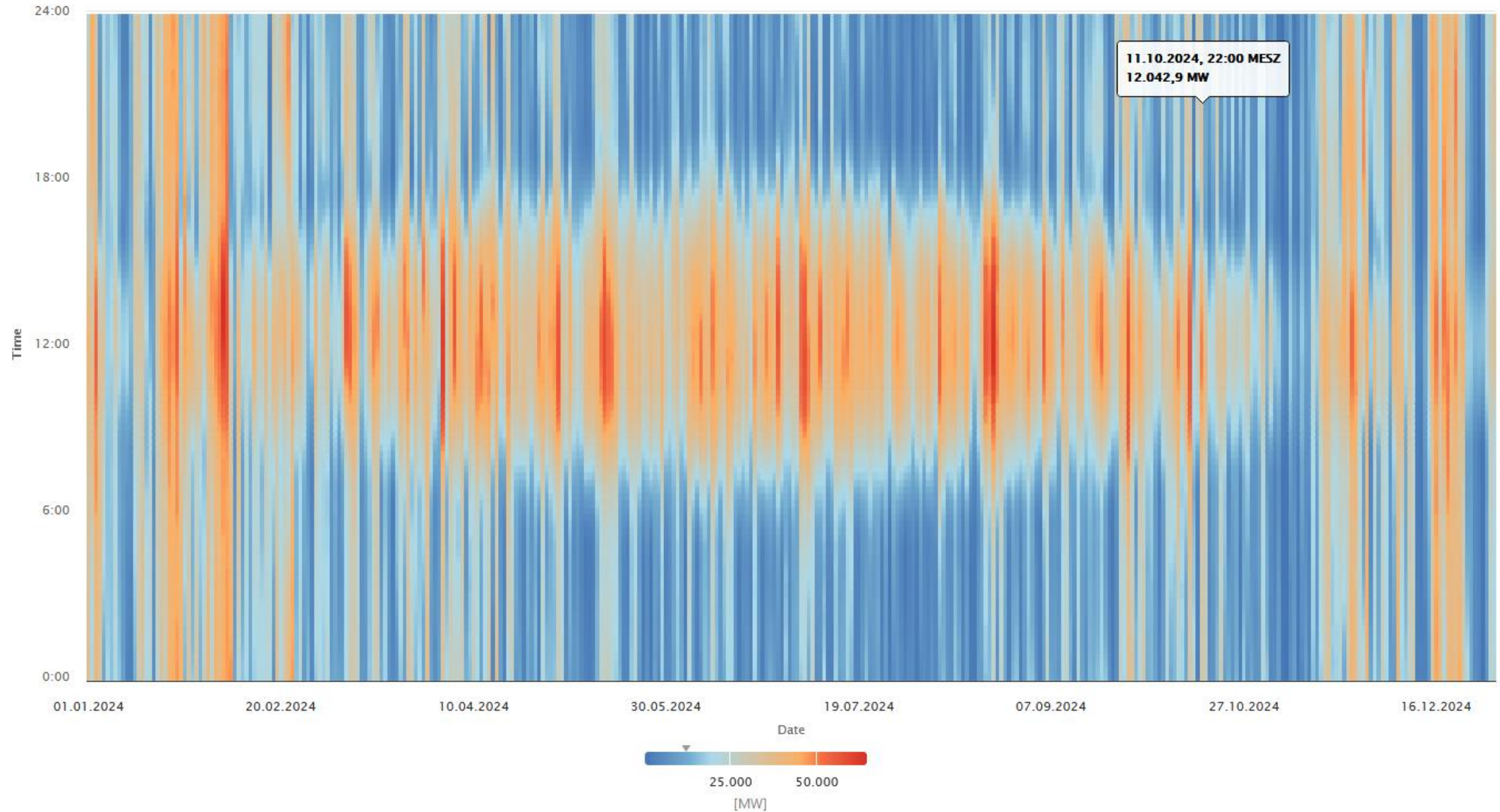
The background of the slide is a photograph of a wind farm. Several wind turbines are visible, their white towers and three-bladed nacelles standing against a hazy, overcast sky. The turbines are situated in a body of water, likely a coastal or offshore area. A semi-transparent blue rectangular box is overlaid on the left side of the image, containing the title text.

Biomass: The rescue in the Dunkelflaute?

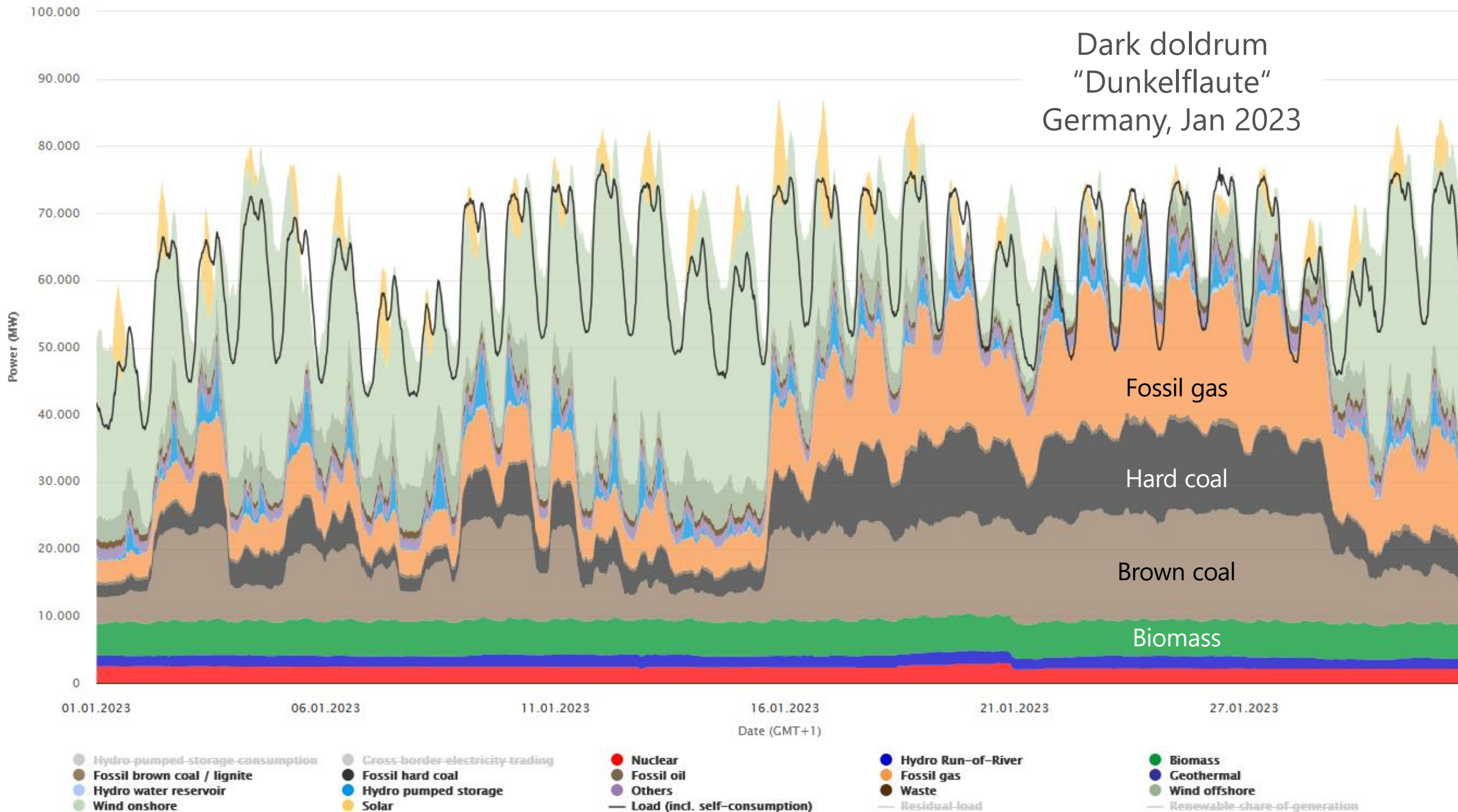
Electricity from PV in Germany 2024



Electricity from PV and wind in Germany 2024



Dark doldrum
"Dunkelflaute"
Germany, Jan 2023



Making biomass a business

















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Thank you for your attention

Special thanks to Wiomou Bonzi and Janvier Ntwali

