

Improved food intake in OECD countries as a key global climate mitigation driver

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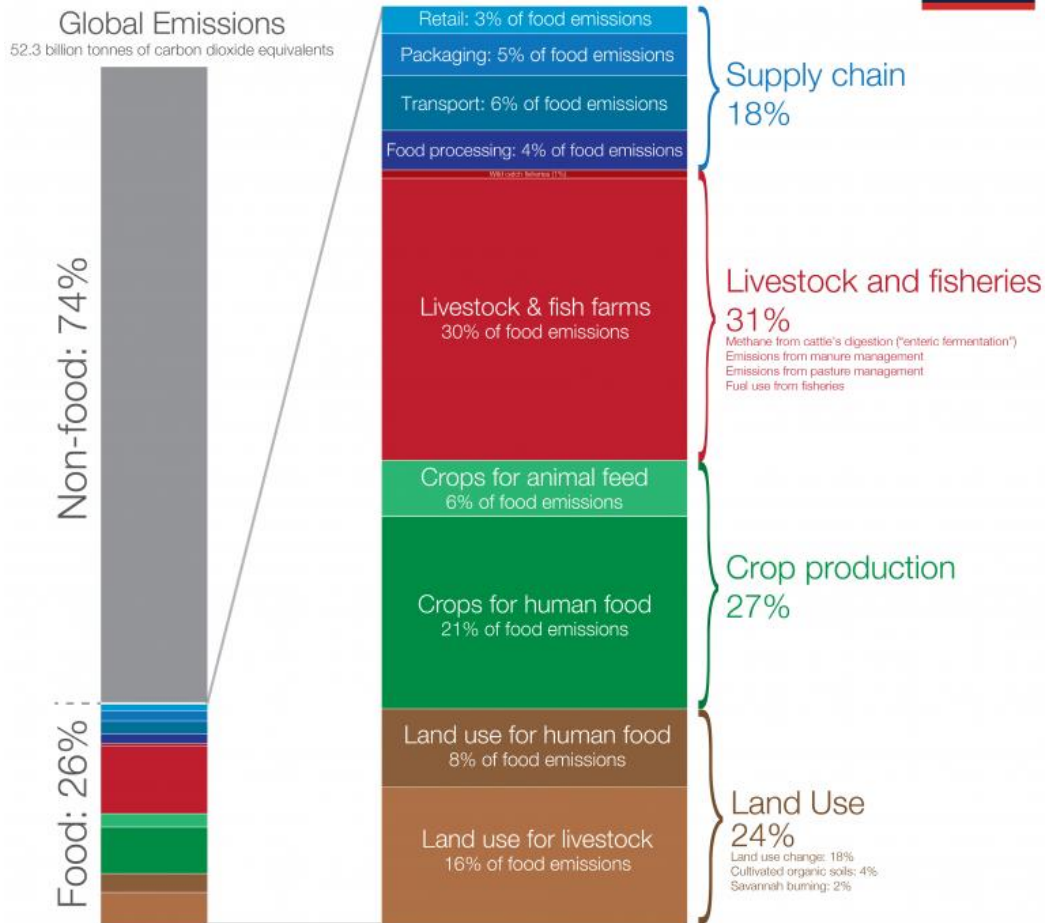
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1 Climate Change, Health and the Need of Improving Food Intake

- Food in the Anthropocene represents one of the greatest health and environmental challenges of the 21st century, due to the adverse effects related to food systems transitions and changes in dietary patterns.

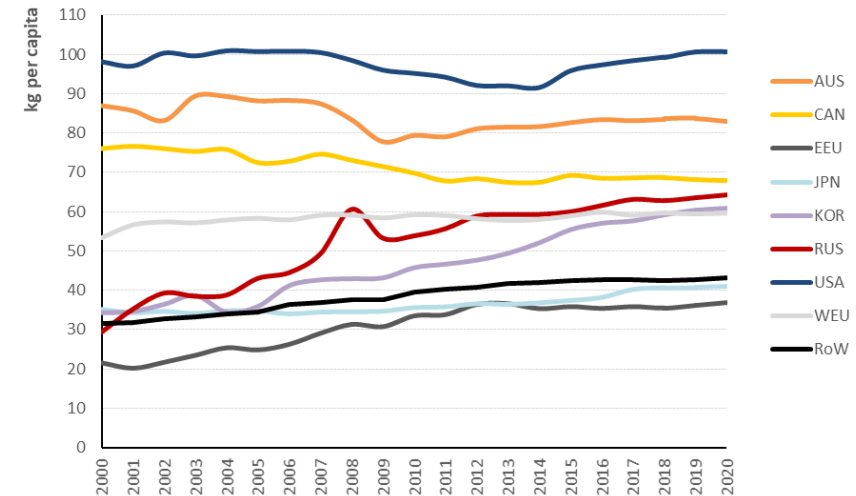
1 Climate Change, Health and the Need of Improving Food Intake

Global greenhouse gas emissions from food production Our World in Data

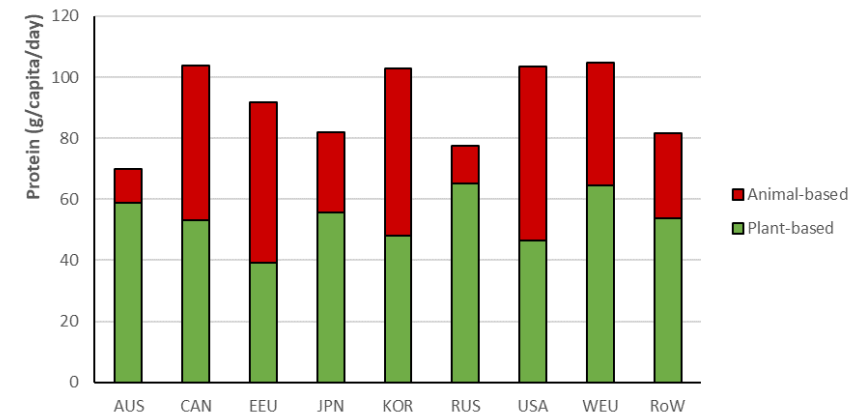


Data source: Joseph Poore & Thomas Nemecek (2018). Reducing food's environmental impacts through producers and consumers. Published in Science.
OurWorldinData.org - Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Hannah Ritchie.

Meat consumption in OECD regions (OECD, 2021)



Plant- and animal-based food consumption in OECD regions (FAOSTAT, 2021)



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- Transforming food systems to operate within planetary boundaries towards healthy, culturally appropriate and available diets for all require an urgent shift in mindset to recognize the importance of consumers' choices.
- The concept of healthy diets gained importance in the debate, especially in relation to the trade-offs between plant- and animal-based foods.

1 Climate Change, Health and the Need of Improving Food Intake



Food in the Anthropocene: the EAT–*Lancet* Commission on healthy diets from sustainable food systems

Prof Walter Willett, MD • Prof Johan Rockström, PhD • Brent Loken, PhD • Marco Springmann, PhD •

Prof Tim Lang, PhD • Sonja Vermeulen, PhD • et al. [Show all authors](#)

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Food systems have the potential to nurture human health and support environmental sustainability; however, they are currently threatening both. Providing a growing global population with healthy diets from sustainable food systems is an immediate challenge. Although global food production of calories has kept pace with population growth, more than 820 million people have insufficient food and many more consume low-quality diets that cause micronutrient deficiencies and contribute to a substantial rise in the incidence of diet-related obesity and diet-related non-communicable diseases, including coronary heart disease, stroke, and diabetes. Unhealthy diets pose a greater risk to morbidity and mortality than does unsafe sex, and alcohol, drug, and tobacco use combined. Because much of the world's population is inadequately nourished and many environmental systems and processes are pushed beyond safe boundaries by food production, a global transformation of the food system is urgently needed.



1 Climate Change, Health and the Need of Improving Food Intake

- Food in the Anthropocene represents one of the greatest health and environmental challenges of the 21st century, due to the adverse effects related to food systems transitions and changes in dietary patterns.
- Transforming food systems to operate within planetary boundaries towards healthy, culturally appropriate and available diets for all require an urgent shift in mindset to recognize the importance of consumers' choices.
- The concept of healthy diets gained importance in the debate, especially in relation to the trade-offs between plant- and animal-based foods.
- How a voluntary improved food intake in OECD countries contributes to global GHG emissions reduction?

2 Methodology and Data

- Total Economy-Assessment (TEA) is a recursive dynamic, multi-regional and multi-sectorial computable general equilibrium (CGE) model that tracks the production and distribution of goods, energy and food in the global economy (Cunha, Garaffa and Gurgel, 2020).

- 18 regions:

- 
- OECD Countries: Australia & New Zealand, Canada, European Union, Japan, Rest of Europe, Russia, South Korea and the USA.
 - Rest of the World: Africa (excluding South Africa), Brazil, Caspian Region, Central America, China, India, Middle East, Rest of Asia and Oceania, South Africa and South America (excluding Brazil).

- 20 sectors:

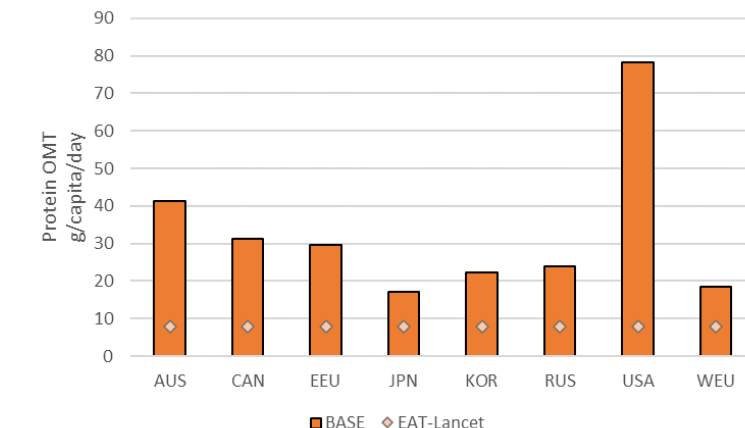
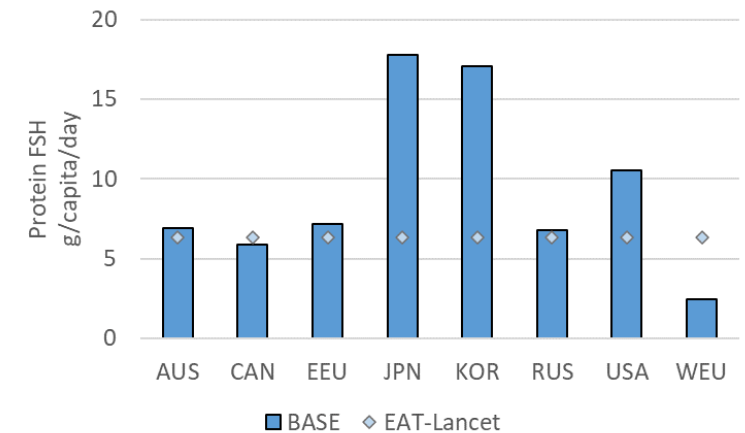
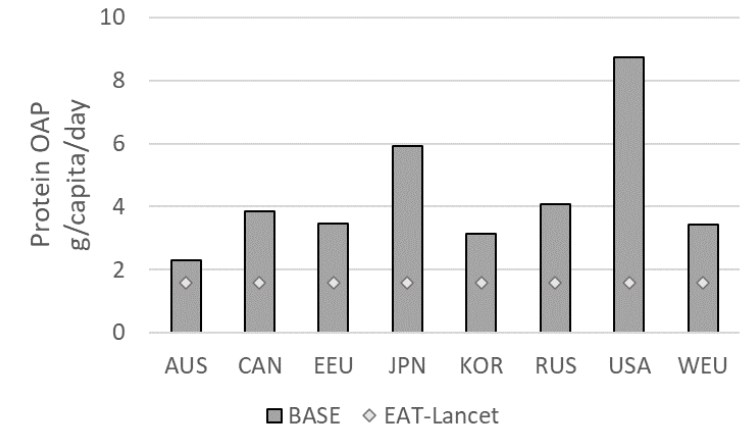
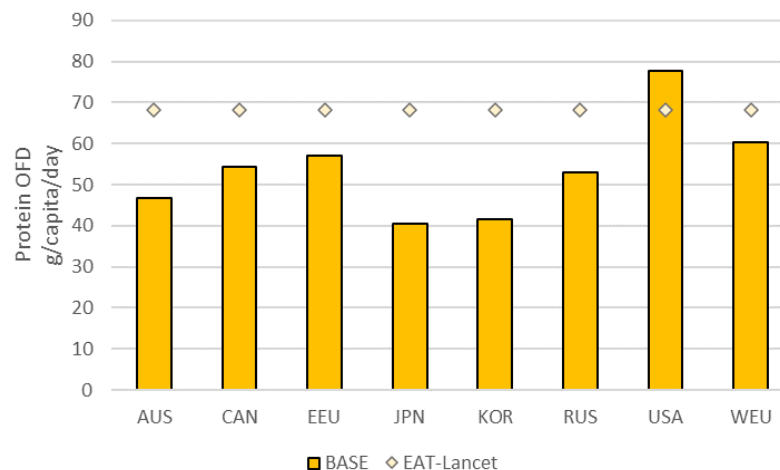
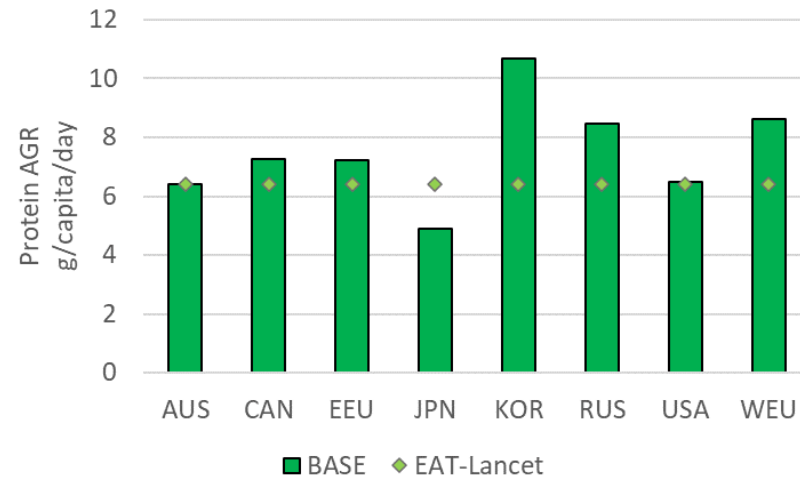
- Detailed representation of energy supply and demand, as well as flexibility in the possibilities of substitution between energy sources, mainly in the power sector.
- Food system: agricultural and livestock sectors, as well as plant- and animal-based food industries.

2 Methodology and Data

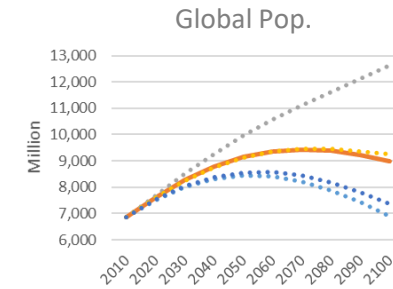
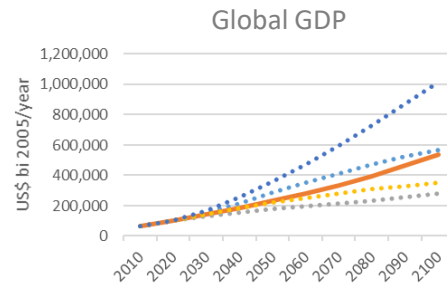
EAT-Lancet reference diet vs. OECD current diet

			Macronutrient intake grams per day (possible range)	Caloric intake kcal per day
	Whole grains Rice, wheat, corn and other	OFD	232	811
	Tubers or starchy vegetables Potatoes and cassava	AGR	50 (0–100)	39
	Vegetables All vegetables	AGR	300 (200–600)	78
	Fruits All fruits	AGR	200 (100–300)	126
	Dairy foods Whole milk or equivalents	OFD	250 (0–500)	153
	Protein sources	OMT		
	Beef, lamb and pork		14 (0–28)	30
	Chicken and other poultry	OAP	29 (0–58)	62
	Eggs		13 (0–25)	19
	Fish	FSH	28 (0–100)	40
	Legumes		75 (0–100)	284
	Nuts	OFD	50 (0–75)	291
	Added fats			
	Unsaturated oils	OFD	40 (20–80)	354
	Saturated oils		11.8 (0–11.8)	96
	Added sugars			
	All sugars	OFD	31 (0–31)	120

Willett et al. (2019)

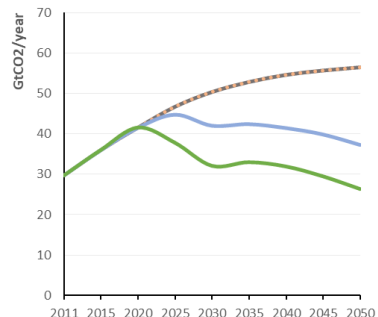


3 Scenarios



Scenario description

BASE	Socio-economic drivers from SSP2 storyline. Without carbon budget restriction.
OECD_Diet	Socio-economic drivers from SSP2 storyline. Without carbon budget restriction. More healthy and sustainable food consumption patterns in OECD countries according to the reference diet targeted in 2050 by the EAT-Lancet Commission.
WB2C_1000	Stabilization of global average temperature in well-below 2°C by 2100. 1000 GtCO ₂ of global carbon budget restriction. Market-related climate policy: global cap-and-trade for energy-related CO ₂ emissions; agricultural non-CO ₂ emissions pricing mechanism.
WB2C_600	Stabilization of global average temperature in well-below 2°C by 2100. 600 GtCO ₂ of global carbon budget restriction. Market-related climate policy: global cap-and-trade for energy-related CO ₂ emissions; agricultural non-CO ₂ emissions pricing mechanism.

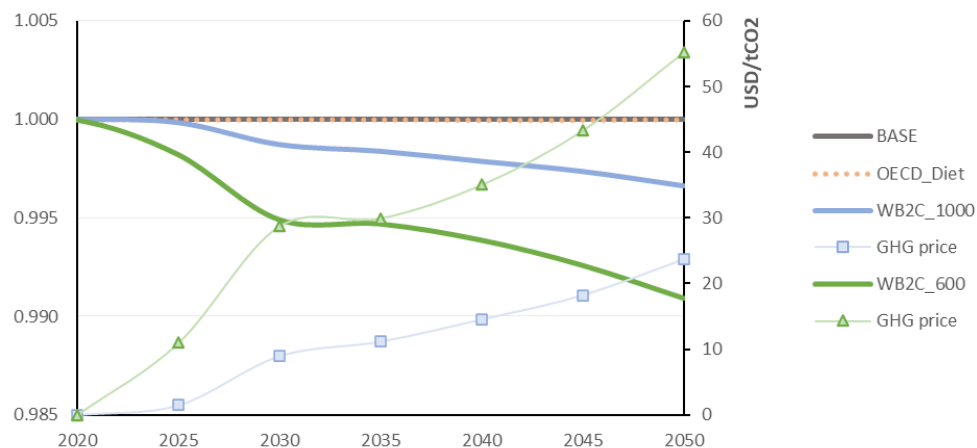


$$p_K^i = p^{CO_2} \cdot GWP_{100}^i$$

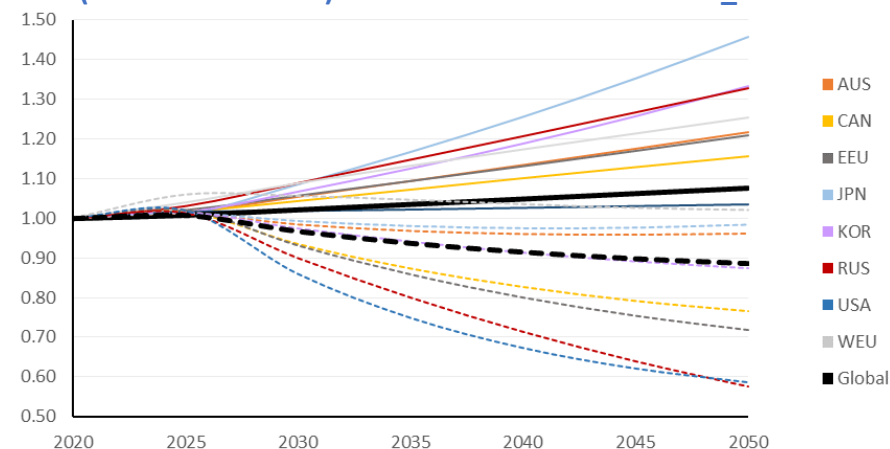
$$i = CH_4; N_2O$$

4 Results

Impacts on global GDP (index GDP BASE = 1.000) and GHG prices trajectories by scenario



Plant- (solid line) and animal-based (dashed line) food production trajectories (index BASE = 1.00) between 2020-2050 in OECD_Diet scenario

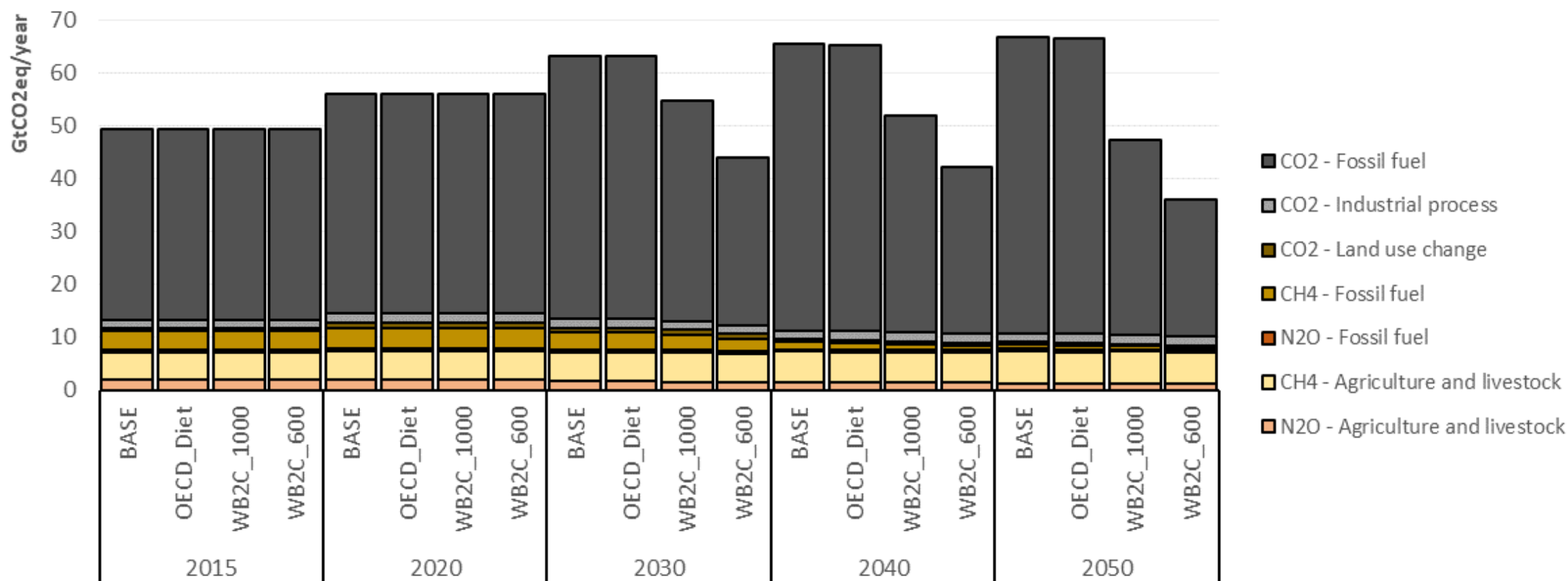


Annual growth (%) of food demand by households between 2011-2050 for each scenario

		AUS	CAN	EEU	JPN	KOR	RUS	USA	WEU	Global
BASE	AGR	1.05	1.07	1.11	0.13	0.65	0.51	0.71	-0.01	1.75
	OAP	1.04	0.63	0.54	-0.19	-0.24	1.32	0.49	0.29	1.64
	FSH	1.08	0.96	1.19	0.26	0.88	0.15	0.61	-0.38	1.94
	OFD	1.70	1.43	1.64	0.48	0.77	1.16	1.23	0.87	1.83
	OMT	1.62	1.44	1.66	0.38	0.72	1.57	1.19	0.75	1.74
OECD_Diet	AGR	1.95	1.44	1.71	1.01	0.25	1.14	1.40	0.98	1.88
	OAP	1.37	0.14	0.57	-1.65	-0.03	0.08	-1.43	0.20	1.56
	FSH	1.60	1.63	1.51	-1.26	-0.58	1.38	0.45	2.94	1.97
	OFD	2.73	2.12	2.30	1.49	2.04	2.20	1.33	1.85	2.13
	OMT	-0.74	-0.58	-0.27	-0.68	-0.54	-0.11	-2.31	0.18	0.88
WB2C_1000	AGR	0.99	1.06	1.11	0.12	0.65	0.47	0.70	-0.02	1.74
	OAP	0.99	0.61	0.52	-0.19	-0.25	1.26	0.46	0.26	1.63
	FSH	1.05	0.96	1.19	0.26	0.88	0.11	0.61	-0.39	1.94
	OFD	1.67	1.42	1.64	0.48	0.78	1.13	1.22	0.86	1.83
	OMT	1.56	1.42	1.66	0.37	0.72	1.53	1.17	0.73	1.72
WB2C_600	AGR	0.94	1.05	1.10	0.12	0.64	0.41	0.68	-0.06	1.72
	OAP	0.95	0.59	0.50	-0.20	-0.27	1.18	0.42	0.20	1.61
	FSH	1.02	0.96	1.18	0.26	0.88	0.06	0.60	-0.41	1.94
	OFD	1.65	1.42	1.63	0.47	0.77	1.09	1.21	0.83	1.82
	OMT	1.51	1.41	1.64	0.36	0.70	1.47	1.14	0.69	1.69

4 Results

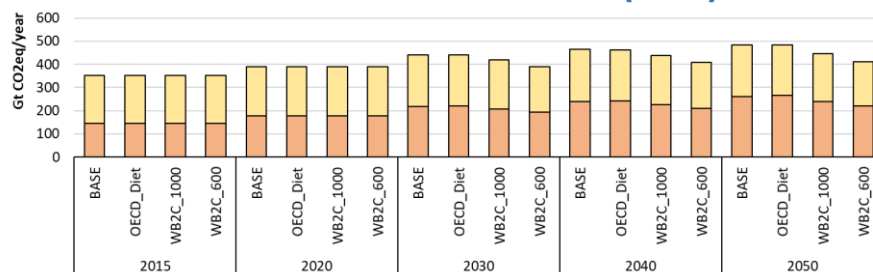
Global GHG emissions (GtCO₂eq/year) by scenario



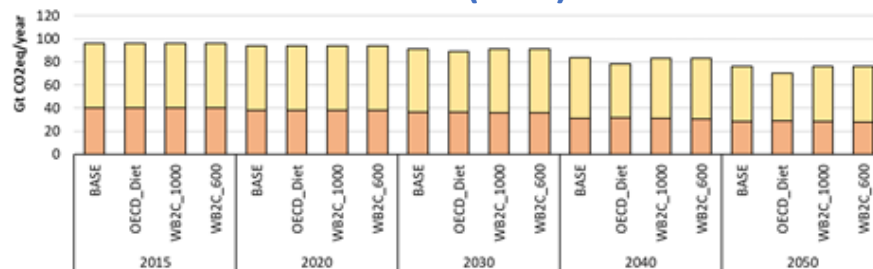
4 Results

■ CH₄ - Agriculture and livestock
■ N₂O - Agriculture and livestock

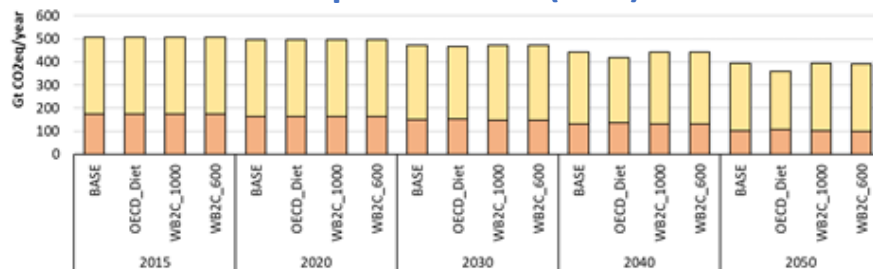
Australia & New Zealand (AUS)



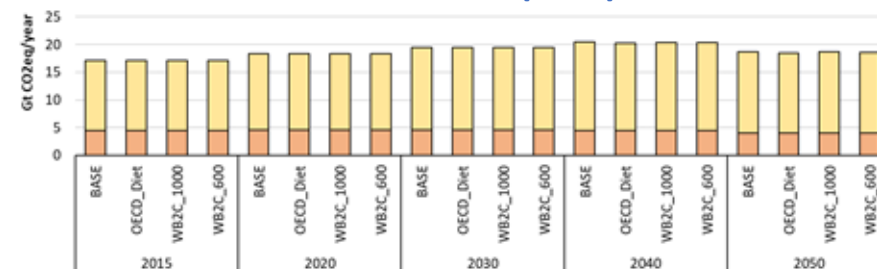
Canada (CAN)



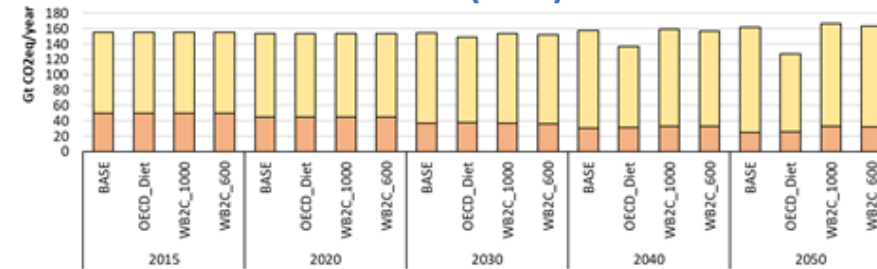
European Union (EEU)



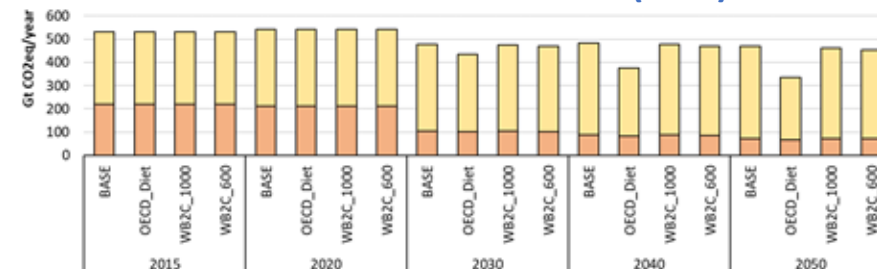
South Korea (KOR)



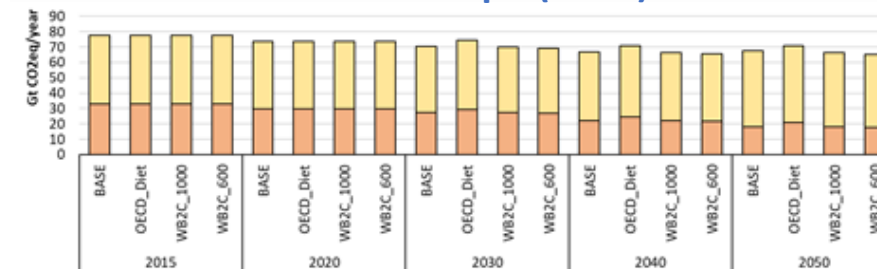
Russia (RUS)



United States of America (USA)

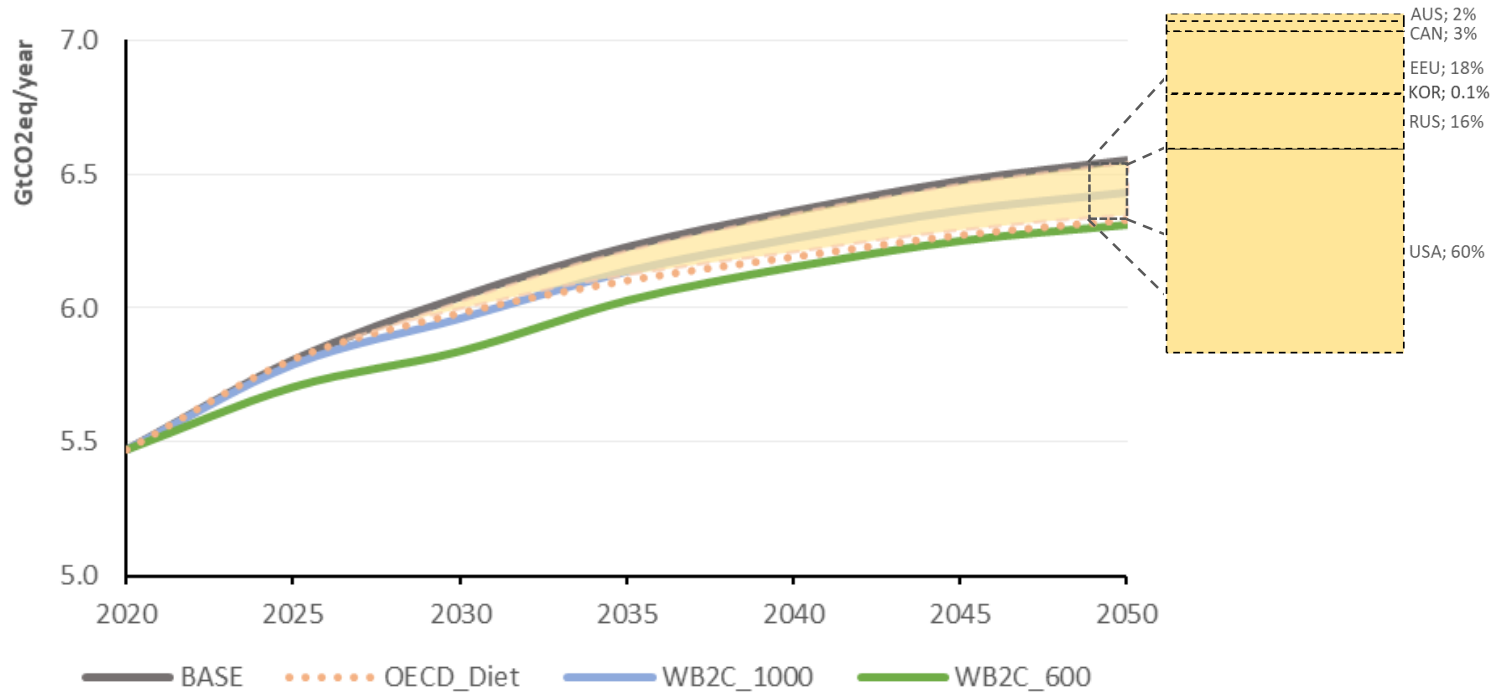


Rest of Europe (WEU)

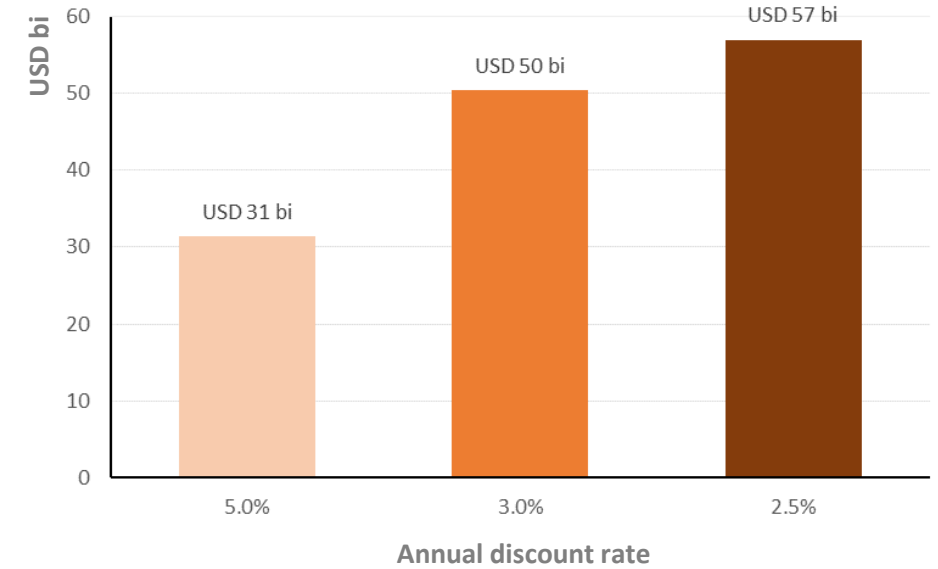


4 Results

Agricultural CH₄ emissions trajectories by scenario and the participation of regions in cut emissions of the OECD_Diet scenario compared to the BASE scenario



Global climate-related cost



$$SCC^i = \sum_{t=2020}^{2050} \frac{p^i \cdot E^i}{(1+r)^t}$$

$i = CH_4; N_2O$

$r = \text{discount rate}$

5 Final Remarks

- Climate policies may have greater impacts on the global food system.
 - Lower pressures on food demand are found in voluntary improved food intake scenario than in induced GHG pricing scenarios.
 - GHG pricing leads to a greater pressure on animal-based food prices and penalizes the livestock sectors.
- Global CH₄ emissions projections from livestock sectors in the OECD_Diet scenario are quite similar to those in WB2C_600 scenario.
- There is an opportunity cost in maintaining the current diet pattern in OECD countries.
 - Avoided social costs of carbon could amount to USD 31 billion to USD 57 billion over 2020-2050 in the OECD_Diet scenario.

Thank you!