

Why does the world need societal metabolic analyses?

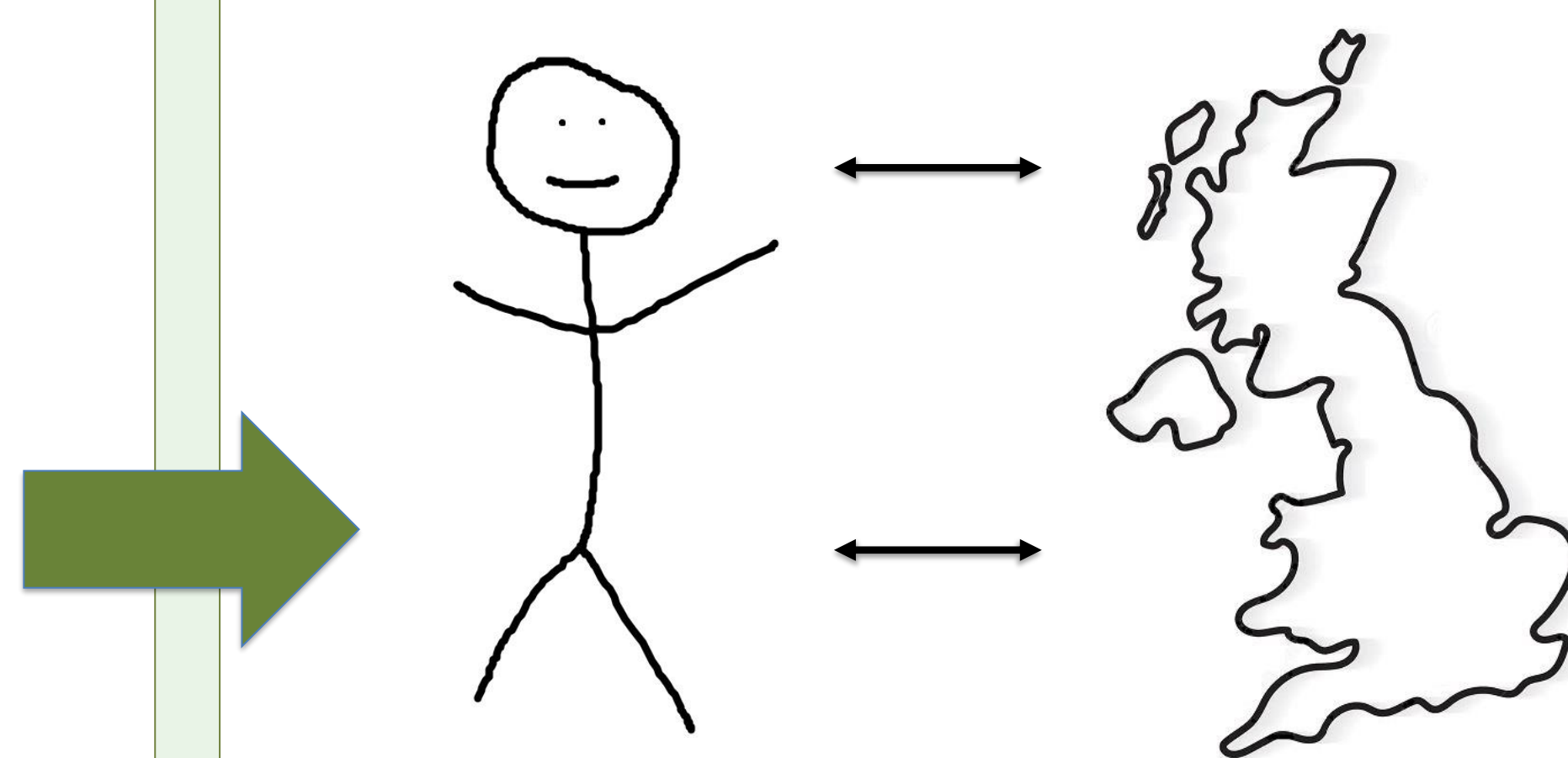
Introducing MuSIASEM: Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism



Feel free to contact me regarding this poster. I'm happy to hear comments and critique.

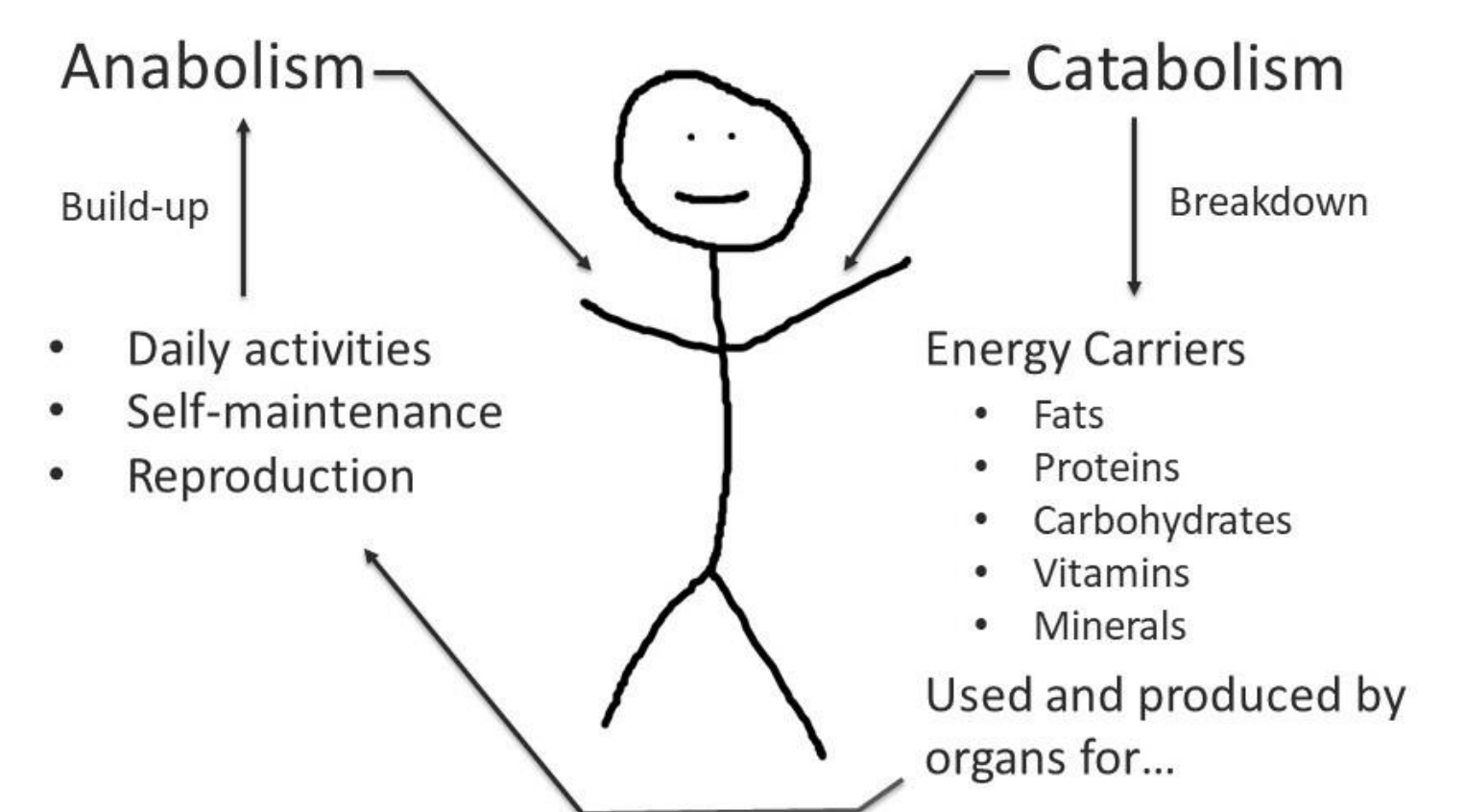
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SOCIETAL METABOLISM EXAMINES A SOCIETY LIKE AN ORGANISM, AN ORGANISM WITH A METABOLISM... LIKE A HUMAN METABOLISM...

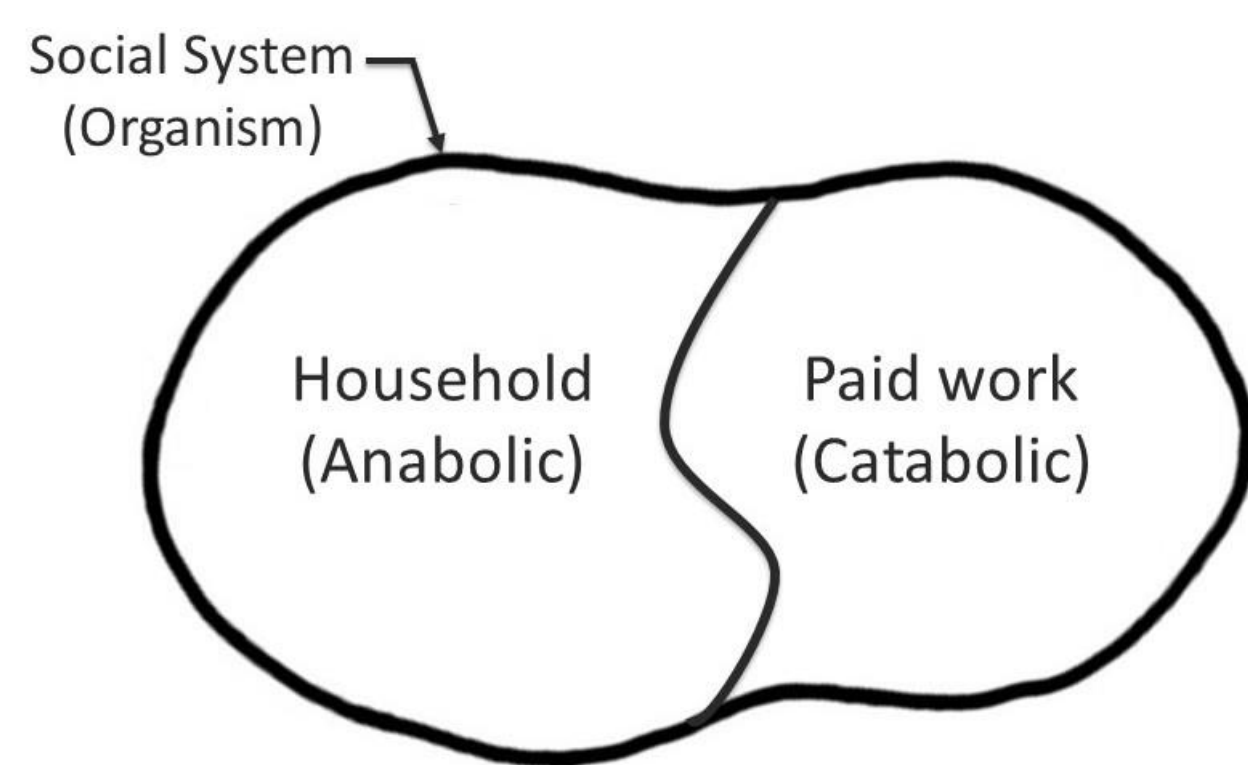


SO, WHAT IS METABOLISM?

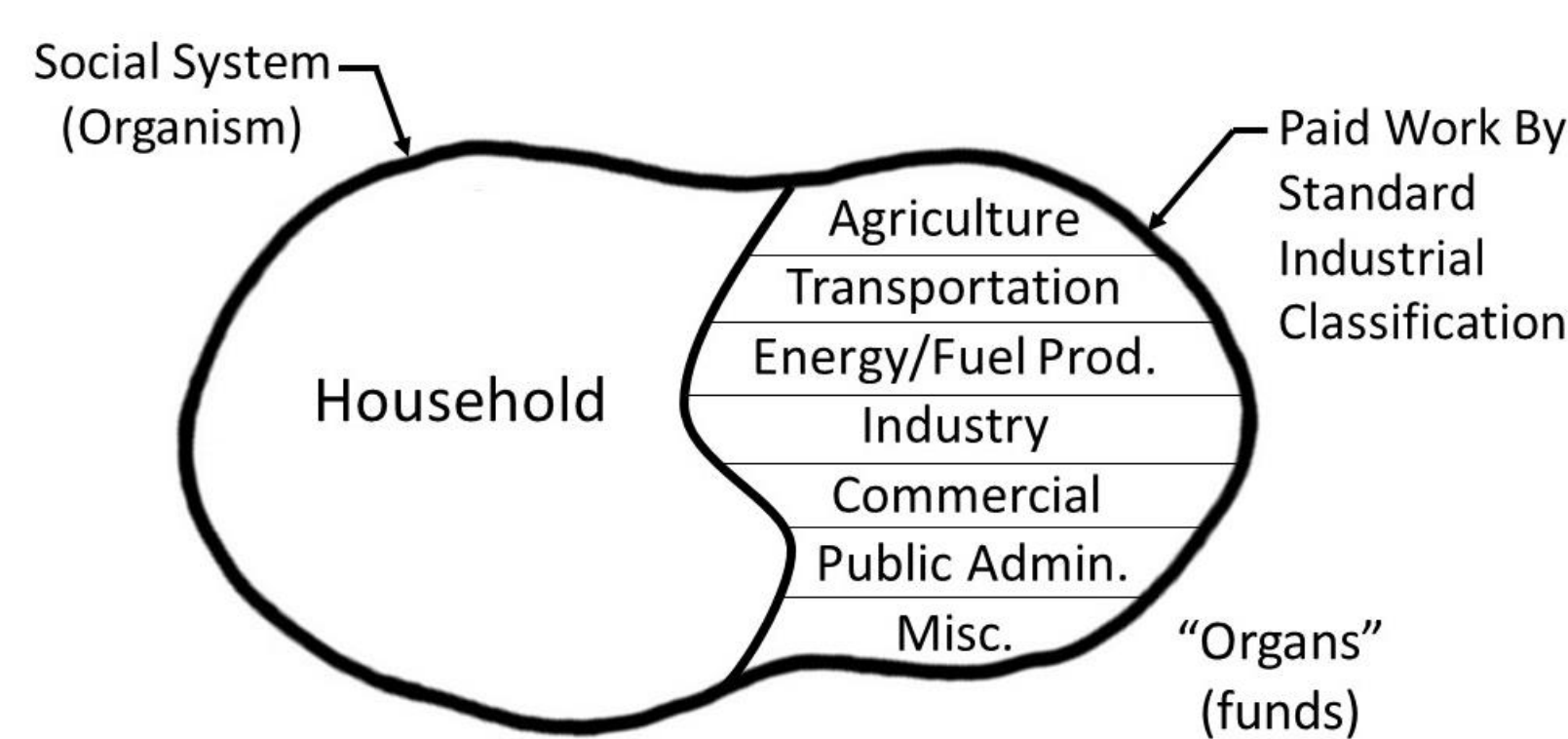
METABOLISM IS HOW ENERGY IS DISTRIBUTED IN AN ORGANISM; IT HAS BOTH ANABOLIC AND CATABOLIC PROCESSES. Anabolism builds up the body and catabolism transforms inputs like food into useable energy forms.



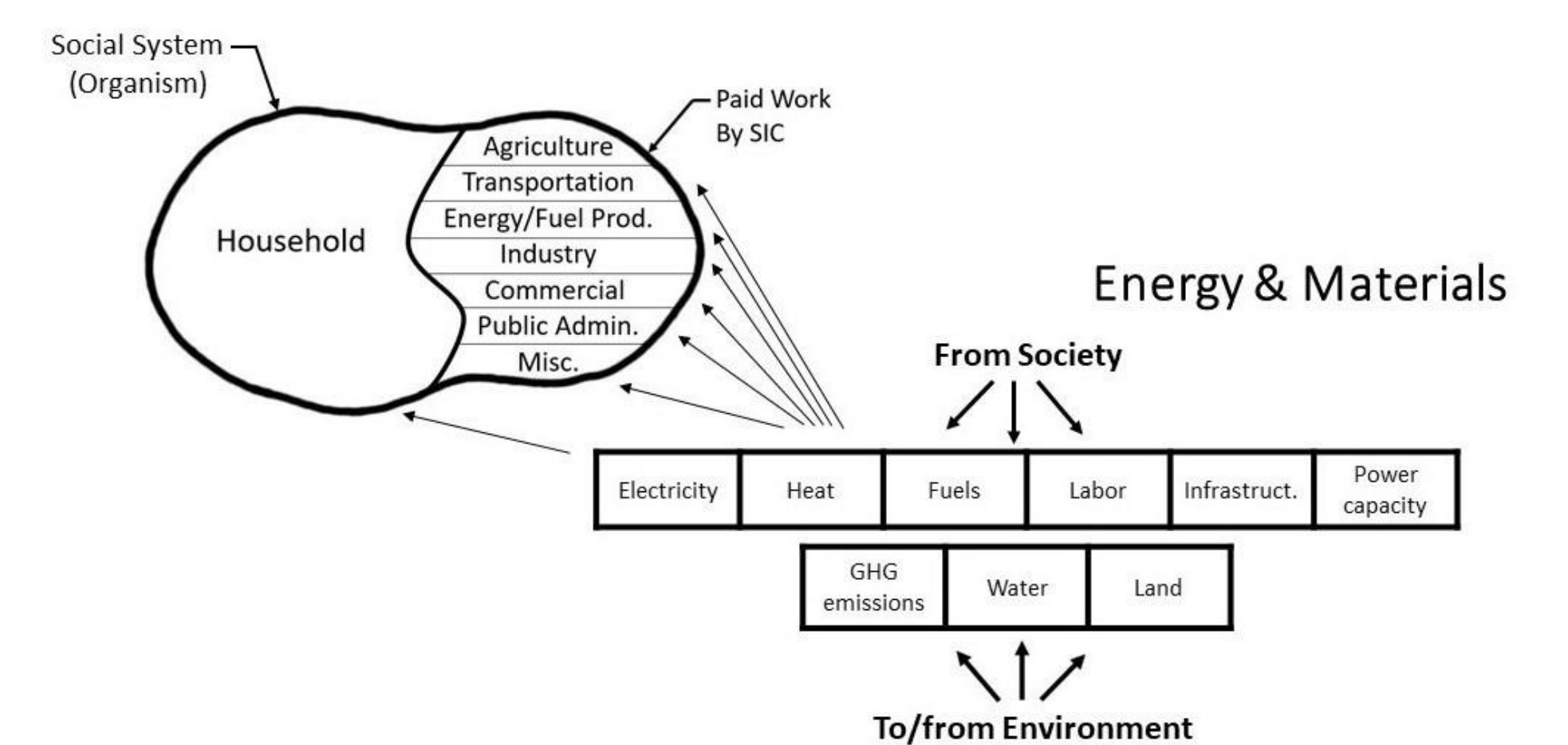
WE CAN APPLY THE SAME METABOLIC CONCEPTS TO A SOCIETY. Anabolism, reproducing society, occurs in households and catabolism, the breaking-down-of-resources-into-usable-energy, occurs in the paid work sector.



PAID WORK IS THEN DIVIDED INTO ECONOMIC SECTORS: THE CATABOLIC ORGANS OF SOCIETY...



... THAT BREAK-DOWN RESOURCES INTO ENERGY AND MATERIALS—LIKE ELECTRICITY, HEAT, FUELS, WATER, LAND, GHGs, ETC.—AND THESE ARE USED BY ALL SECTORS AND HOUSEHOLDS TOO!



SINCE THESE ENERGY CARRIERS CROSSCUT THE DIFFERENT ECONOMIC SECTORS, THEY LEND THEMSELVES TO TABULATION AND WE CAN ASK... WHAT CAN MuSIASEM TELL US ABOUT THE METABOLISM OF THE UK IN 2019? (PreBrexit and PreCOVID)

2019 UK - Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM)

LEGEND

- RED TEXT EXPLAINS HOW THE TABLE IS STRUCTURED
- BLACK TEXT DETAILS HIGHLIGHTS & INSIGHTS
- GREEN TEXT REFERS TO PRESENT & FUTURE CHALLENGES

HIGHLIGHTS & INSIGHTS

- Item A: note how the paid work sector is more fuel-intensive than the household sector
- Item B: note the high-intensity fuel use of the transportation sector
- Item C: the transportation and energy/fuel production sectors have the highest energy metabolic rates but for different reasons: fuel use for transportation versus heat in energy/fuel production
- Item D: energy/fuel production has the highest metabolic intensity for heat of any sector
- Item E: energy/fuel production has the highest economic job productivity rate; with low hours of paid work, this sector is very capital-intensive
- Item F: note the high values for all coupled GHG rates in agriculture
- Item G: note the high rate of GHG to paid work hours in energy/fuel production
- Item H: note the lower GHG intensities in the commercial and public administration sectors

A	B	C	Energy Metabolic Rate				Economic Job Productivity (GVA/Hr)	Energy Flow				Gross Value Added (ME)	Energy intensity of £ (GJ/£)	PW total Income (est) (ME)	PW intensity of GVA (E/£)	GHG	Coupling		
			Total (MJ/h)	Elec (MJ/h)	Heat (MJ/h)	Fuels (MJ/h)		Total (PJ/yr)	Elec (PJ/yr)	Heat (PJ/yr)	Fuels (PJ/yr)						GHG Intensity of Hour (ktCO2e/Mh)	GHG Intensity of Energy (ktCO2e/TJ)	GHG Intensity of £ (ktCO2e/ME)
Level 1	All Society	585,140	11.1	2.1	4.1	4.8	3.4	6,469	1,238	2,415	2,816	2,017,344	3.2	688,517	0.34	447,877	0.8	69.2	0.22
Level 2 (HH & PW)	Household Sector	539,179	3.0	0.7	2.1	0.2	-	1,605	373	1,128	104	-	-	-	-	132,948	0.25	82.8	-
	Paid Work Sector	45,961	105.8	18.8	28.0	59.0	43.9	4,864	865	1,287	2,712	2,017,344	2.4	688,415	0.34	310,909	7	63.9	0.15
Level 3 Paid work breakdown	Ratio PW to HH	0.09	35.6	27.2	13.4	306.8	-	3.0	2.3	1.1	26.2	-	-	-	-	2.3	27.4	0.8	-
	Agriculture	271	225.1	56.1	33.6	135.4	50.9	61	15.2	9.1	36.7	13,802	4.4	2,598	0.19	47,352	175	776.3	3.43
	Transportation	1,185	1998.3	16.9	63.2	1918.3	36.8	2,368	20.0	74.9	2272.9	43,618	54.3	16,223	0.37	24,960	21	10.5	0.57
	Energy/Fuel Prod	436	1435.8	397.9	642.1	395.8	119.3	626	173.4	279.8	172.5	51,984	12.0	9,405	0.18	85,639	196	136.8	1.65
	Industry	7,359	132.1	45.1	71.8	15.2	48.0	972	331.9	528.6	111.7	353,544	2.7	114,182	0.32	109,826	15	113.0	0.31
	Commercial	20,449	27.1	12.7	11.0	3.4	54.4	554	260.0	224.8	69.0	1,113,378	0.5	313,739	0.28	28,940	1.4	52.3	0.03
Public Admin	14,635	15.7	4.4	9.2	2.1	25.3	230	64.3	134.9	30.8	369,748	0.6	211,596	0.57	12,260	0.8	53.3	0.03	
Misc	1,613	33.2	0.0	21.5	11.7	44.2	54	0.0	34.7	18.8	71,270	0.8	20,672	0.29	1,954	1.2	36.5	0.03	

BY 2050, THESE GHG VALUES MUST DROP TO NET ZERO: HOW WILL THIS HAPPEN AND HOW WILL THIS AFFECT PAID WORK, HOUSEHOLDS, AND RELATED TYPES OF ENERGY CARRIERS AND GROSS VALUE ADDED?

WE ARE TRYING TO ADD WATER AND LAND DATA HERE

SOURCE: This is real data for 2019 UK and from different sources like the Department for Energy Security and Net Zero for energy and greenhouse gas statistics and the Office for National Statistics for population estimates, paid work hours, and gross value added.

CONCLUSION:

THE WORLD NEEDS MuSIASEM BECAUSE, AT A GLANCE, IT ILLUSTRATES RELATIONS AND TRADE-OFFS AT MULTIPLE SCALES AND INTEGRATES SECTORS, ENERGY AND MATERIALS, PAID WORK, ECONOMIC VALUE, AND ENVIRONMENTAL PRESSURES. IT THEREFORE PROVIDES A SUPERIOR FRAMING OF ISSUES ON WHICH TO BASE COMPLEX POLICY DECISIONS.

ACKNOWLEDGMENTS:

MuSIASEM WAS DEVELOPED BY MARIO GIAMPIETRO & KOZO MAYUMI. FOR MORE DETAIL, SEE THEIR 2011 BOOK, "THE METABOLIC PATTERN OF SOCIETIES: WHERE ECONOMISTS FALL SHORT."

ALSO, A BIG THANK YOU TO KEITH MATTHEWS AND THE MACAULAY DEVELOPMENT TRUST FOR THEIR GUIDANCE AND SUPPORT.

Collaborator: Keith Matthews

SEE QR CODE FOR A VIDEO OF THIS PRESENTATION

