

Urban Metabolism

An Introduction

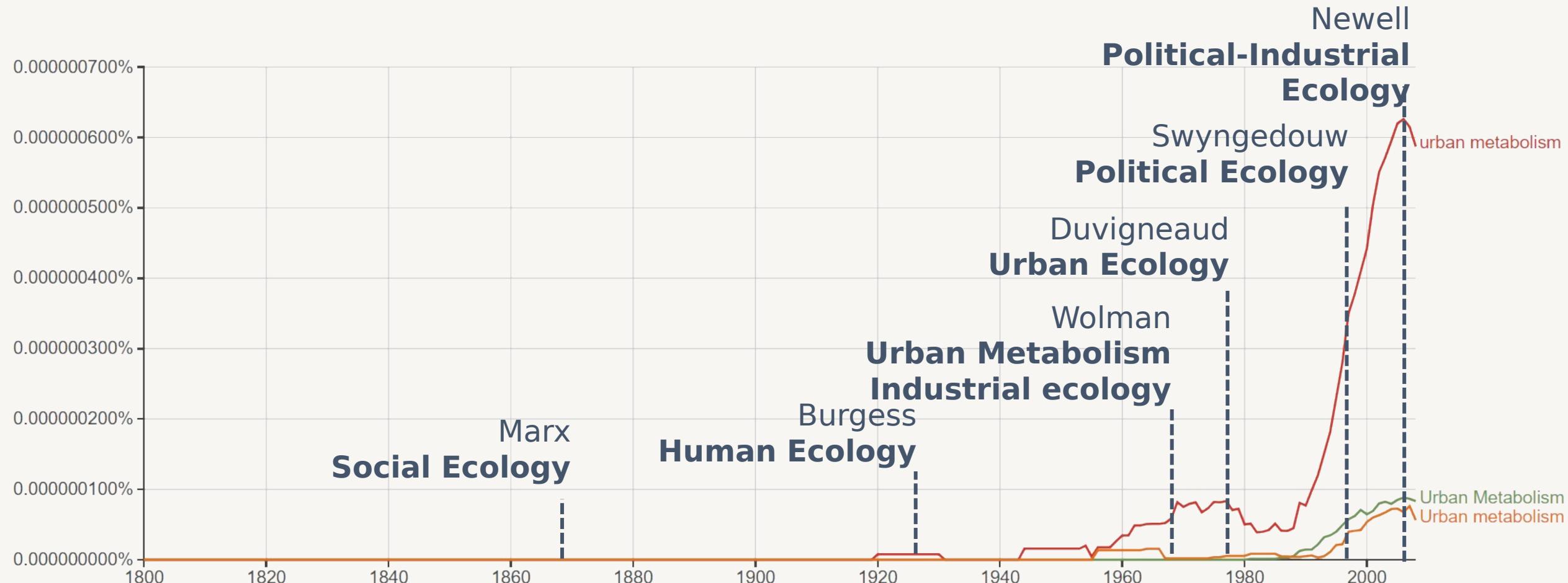
Paul Hoekman
Metabolism of Cities



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An analogy used to better understand cities



Use of « urban metabolism » over time

Core principles

Research field studying **flows**
and **actors** from a **systemic** perspective

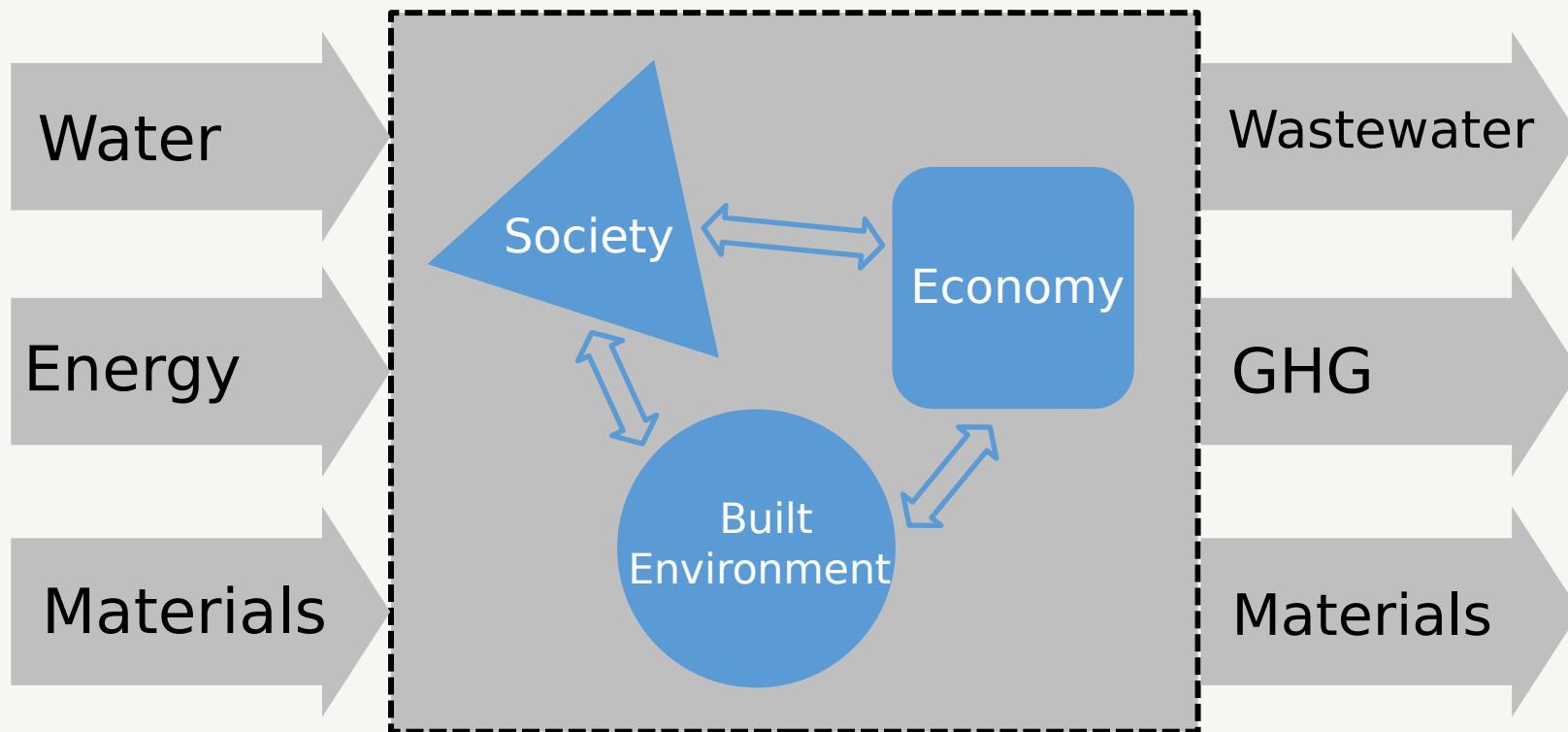
Urban metabolism approach



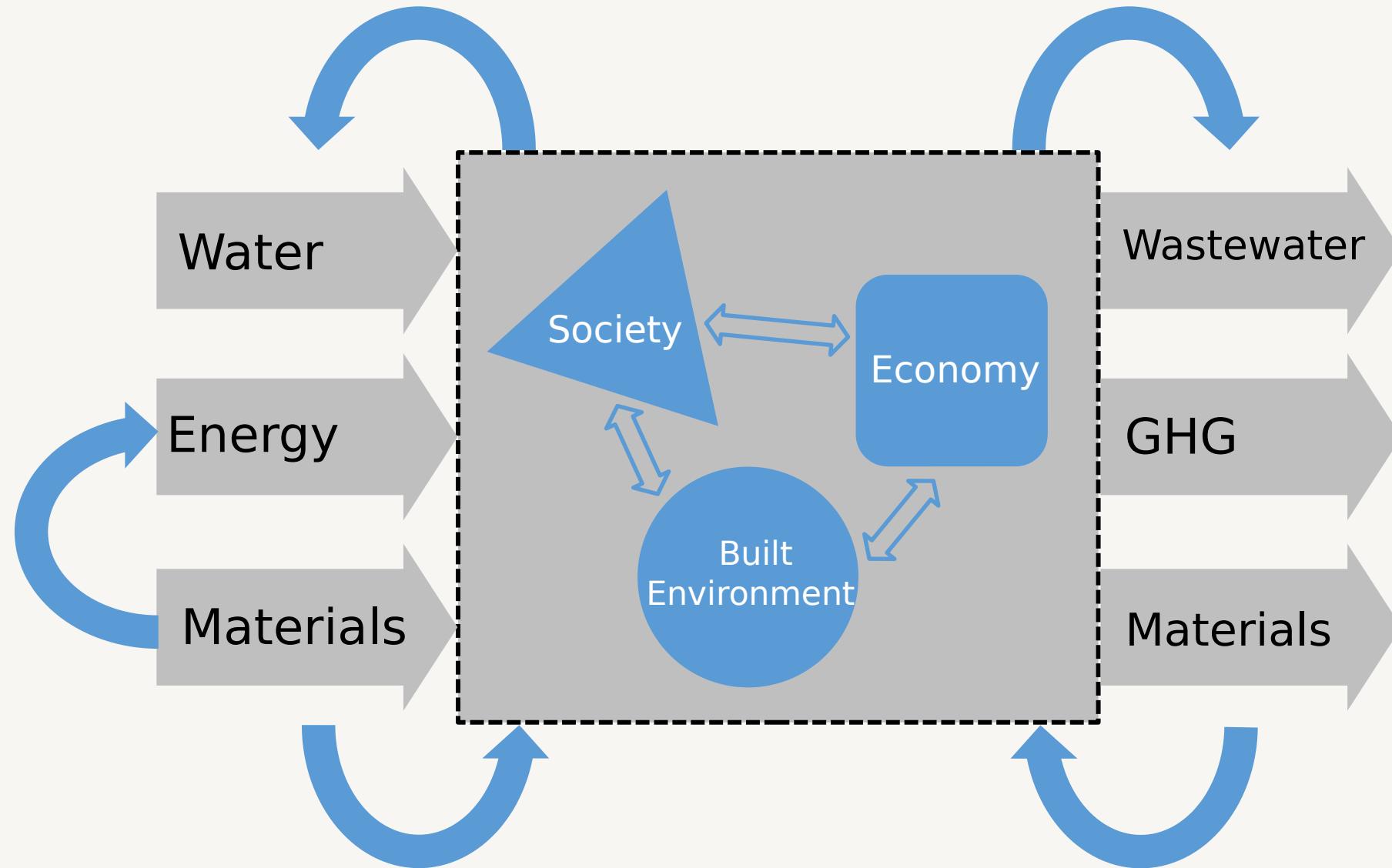
Urban metabolism approach



Urban metabolism approach



Urban metabolism approach



An ever-expanding field

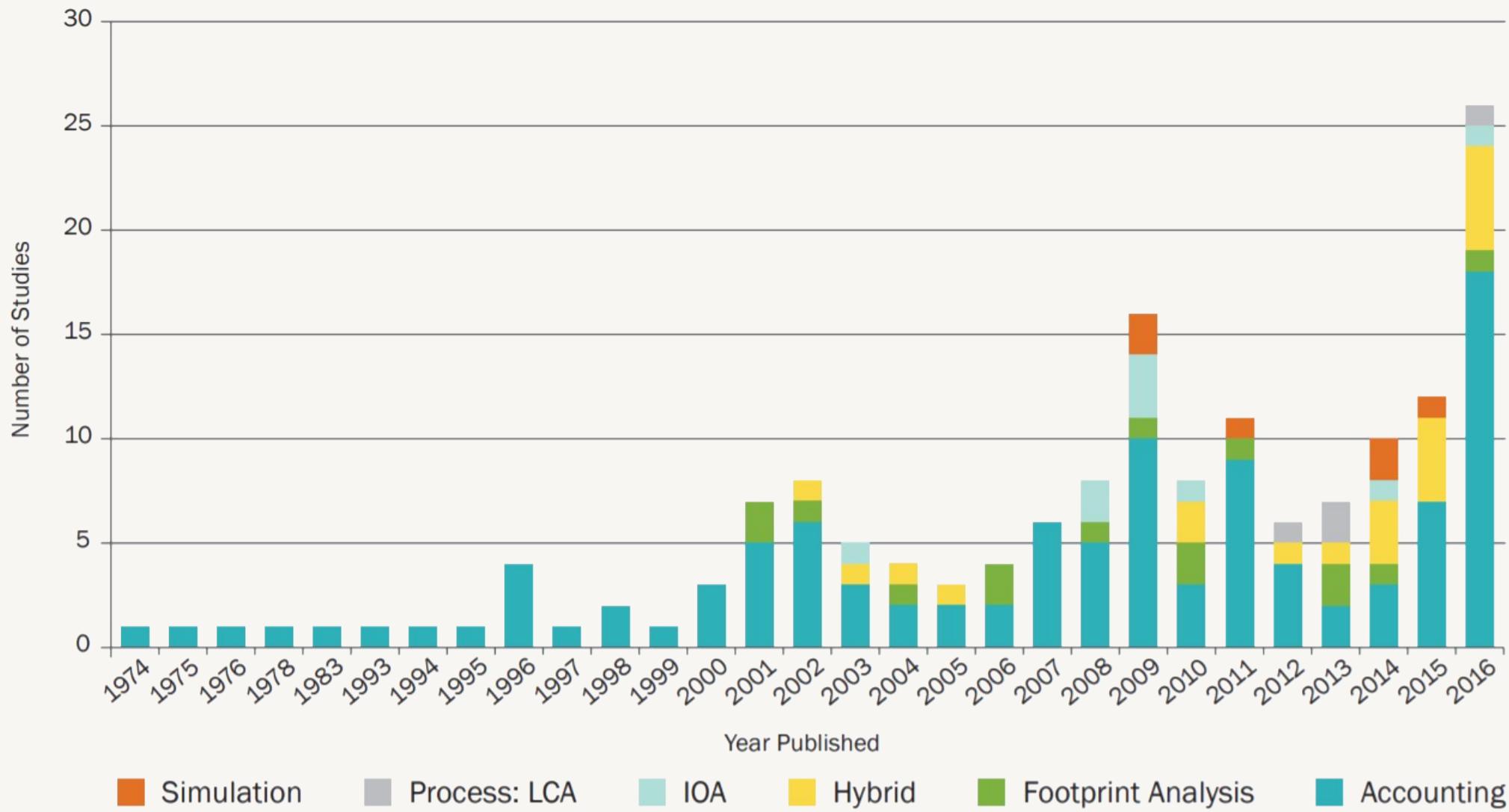


Figure 5: Number of urban metabolism assessment studies over time, showing the increasing diversity of approaches utilised.

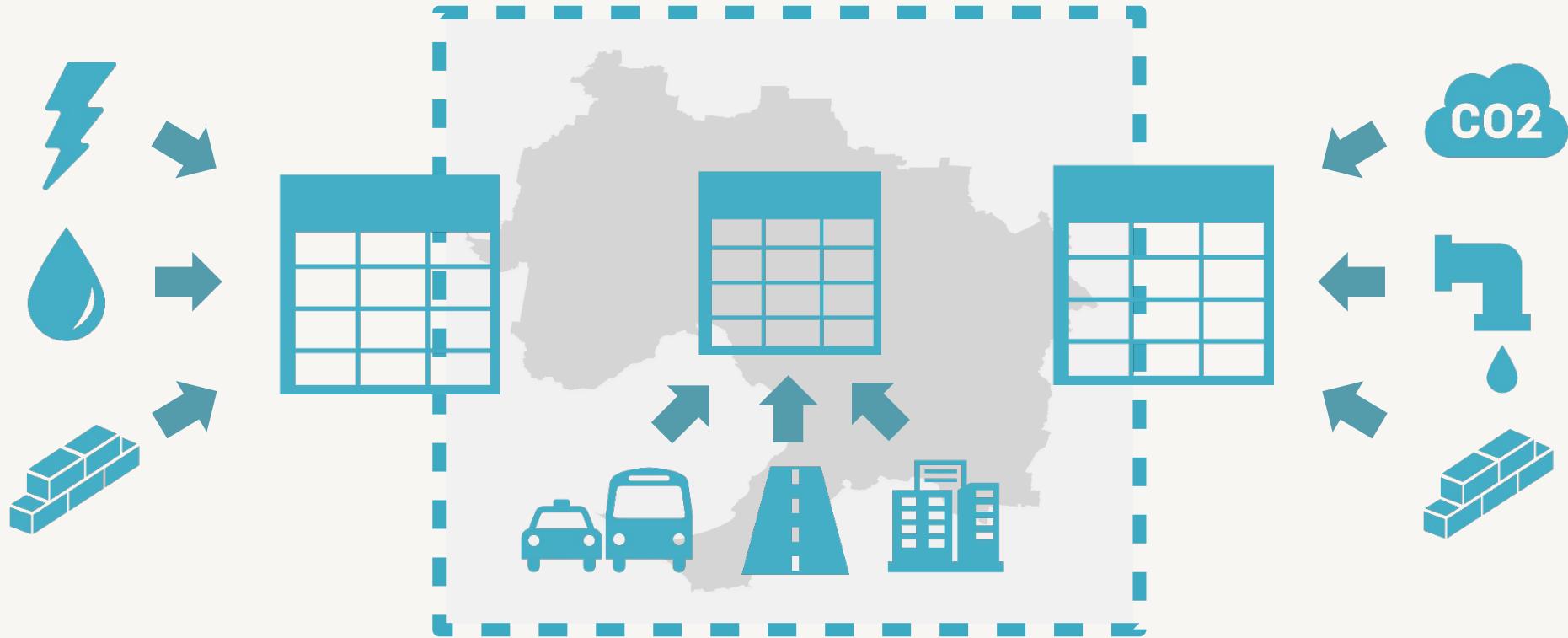


Map with Urban Metabolism publications

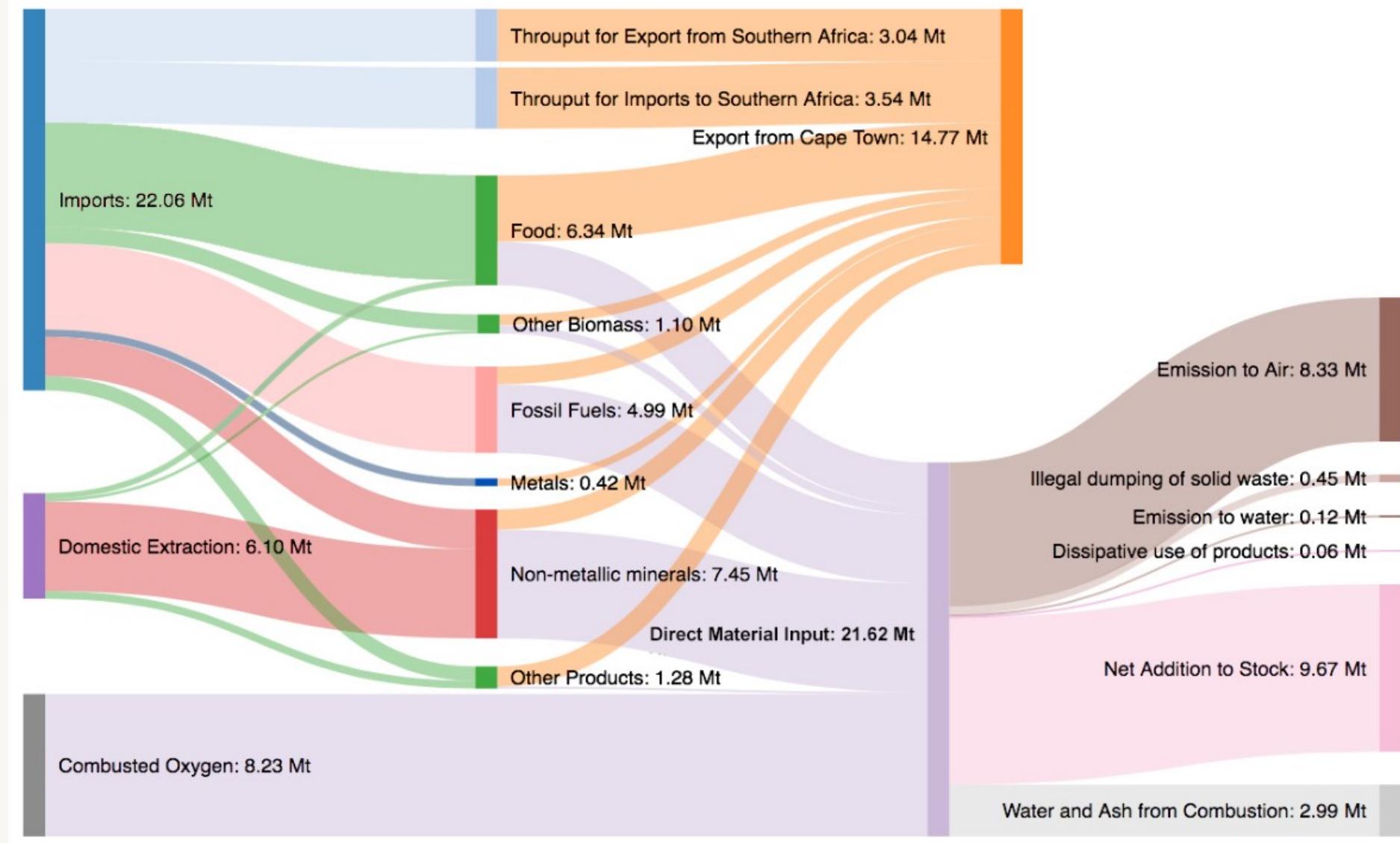


<https://metabolismofcities.org/page/map>

**What
can urban metabolism
do?
(from an industrial ecology
point of view)**

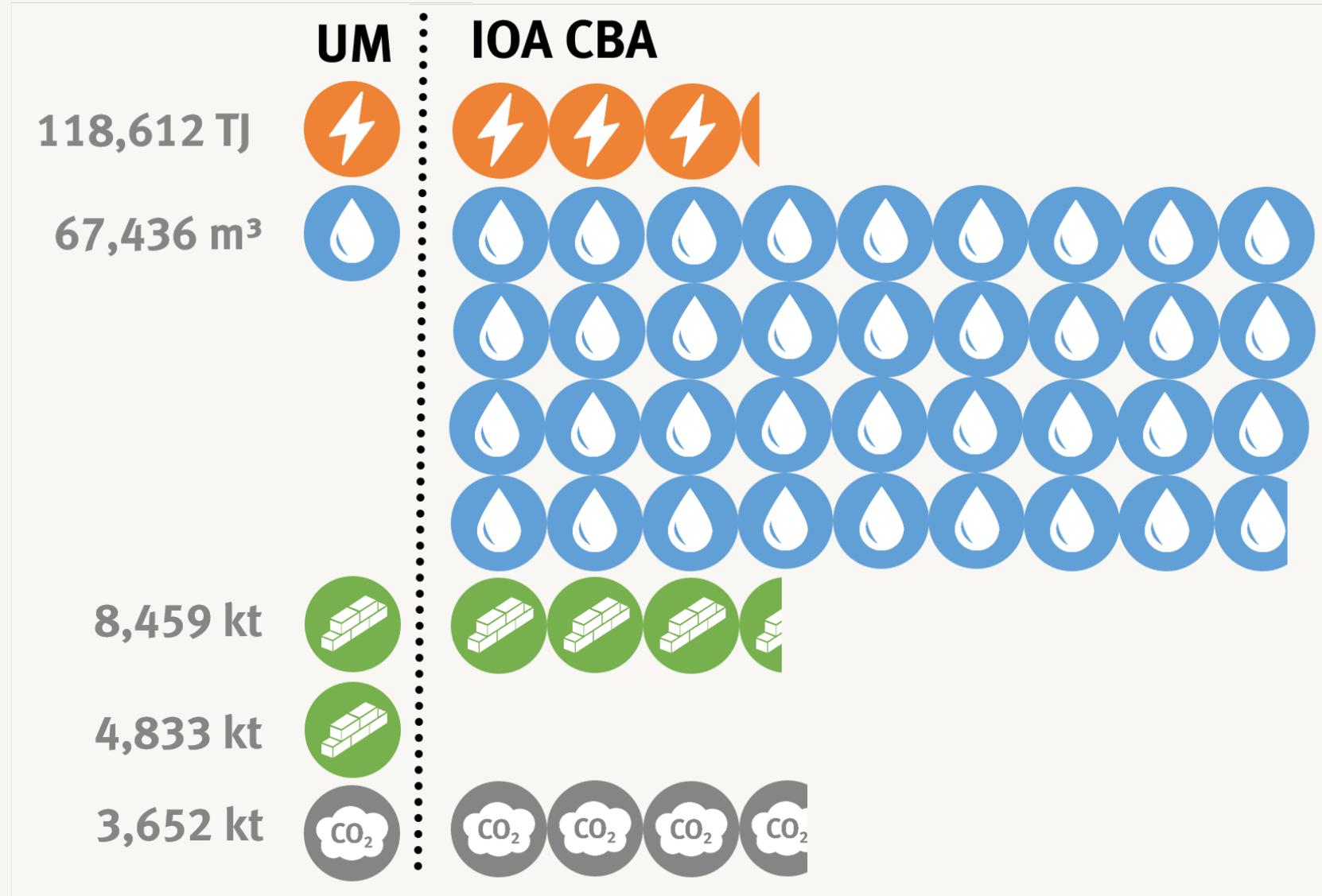


Monitoring urban resource use and pollution emissions



Cape Town's material balance (2013)

Data: Hoekman, P & Von Blottnitz, H. 2017. Cape Town's Metabolism: Insights from a Material Flow analysis. *Journal of Industrial Ecology*. 21(5): 1237-1249
 Visualisation: Currie, P.K., Musango, J.K. and May, N.D. 2017. Urban metabolism: A review with reference to Cape Town. *Cities*. 70:91-110



Indirect effects/impacts of cities

Athanasiadis, A., M. Christis, P. Bouillard, A. Vercalsteren, R. H. Crawford, and A. Z. Khan. 2018. Comparing a territorial-based and a consumption-based approach to assess the local and global environmental performance of cities. *Journal of Cleaner Production* 173: 112-123.

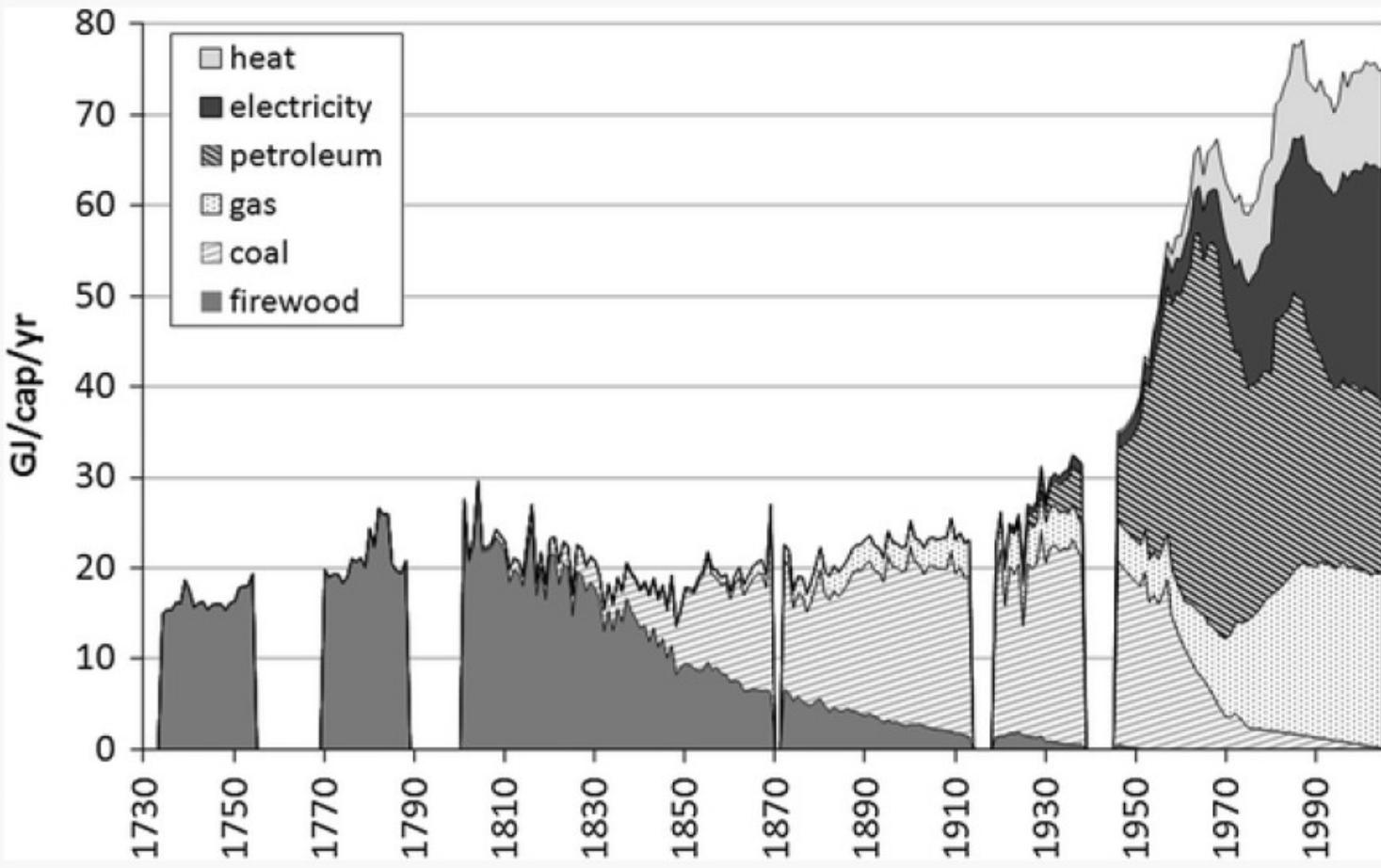
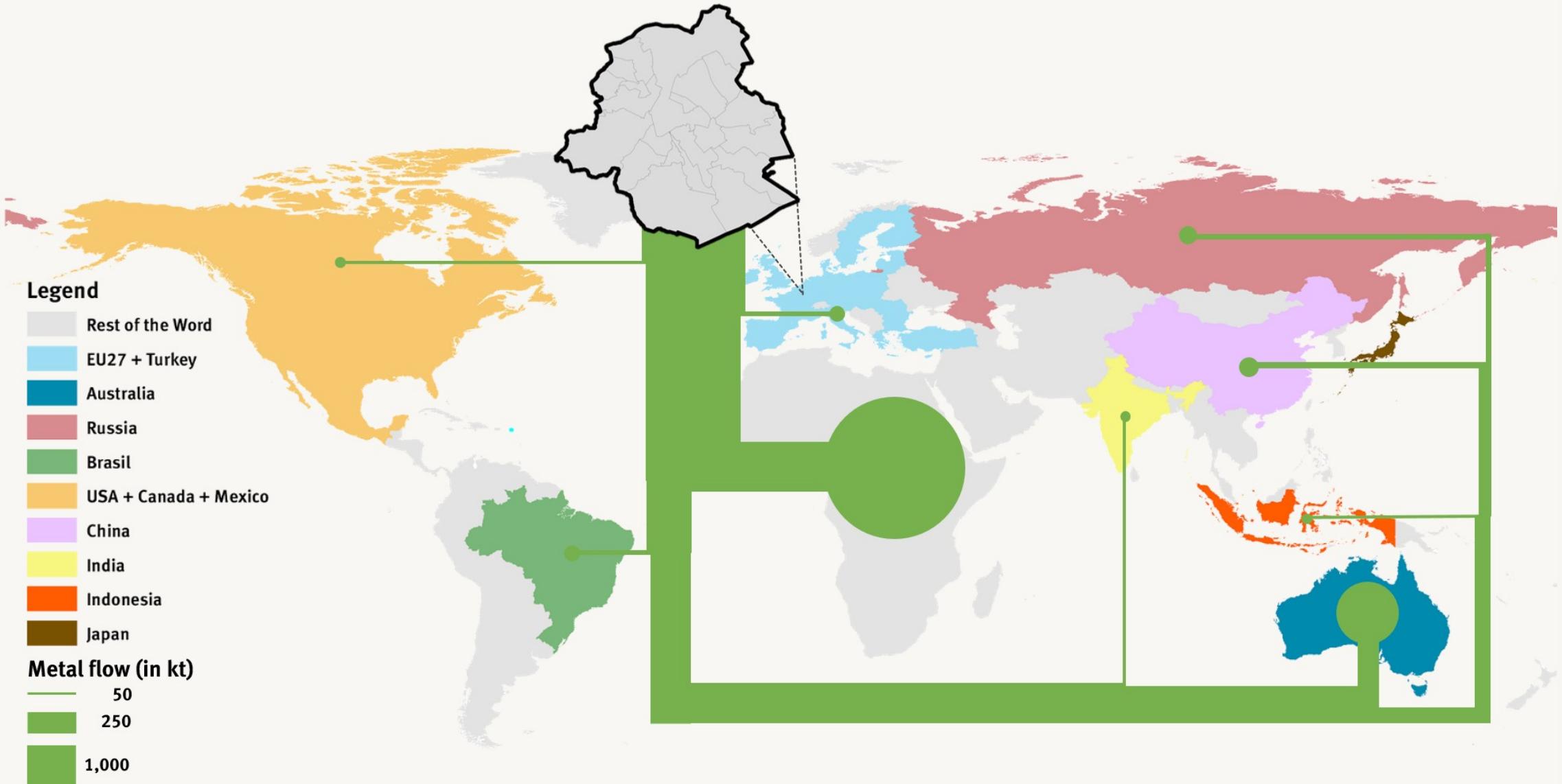


Fig. 4

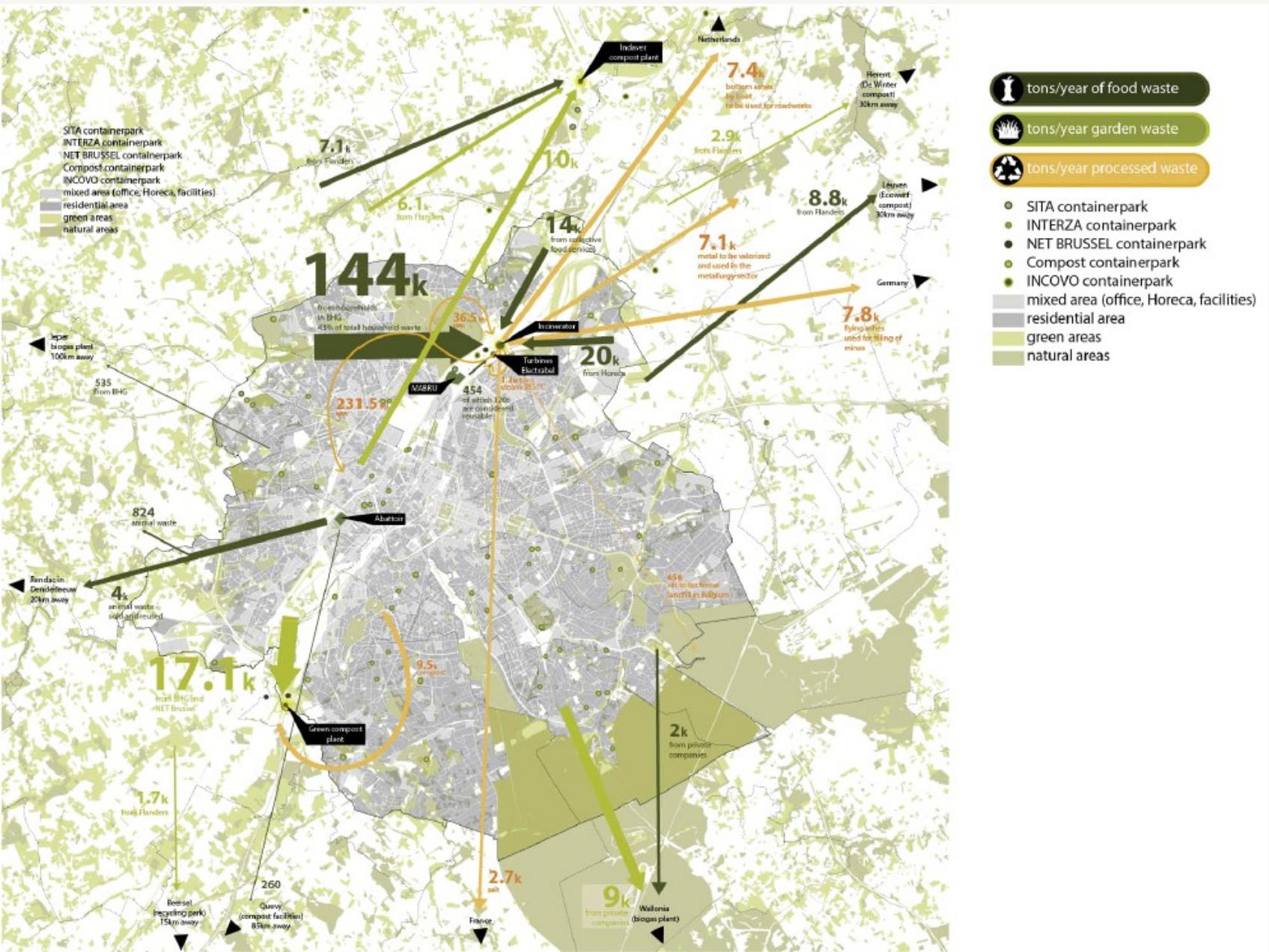
Total final energy consumption (TFEC), Paris, 1730–2000 GJ/cap/year. Firewood includes firewood and charcoal in final terms. Gas includes manufactured and natural gas in final terms

Socio-ecological regimes

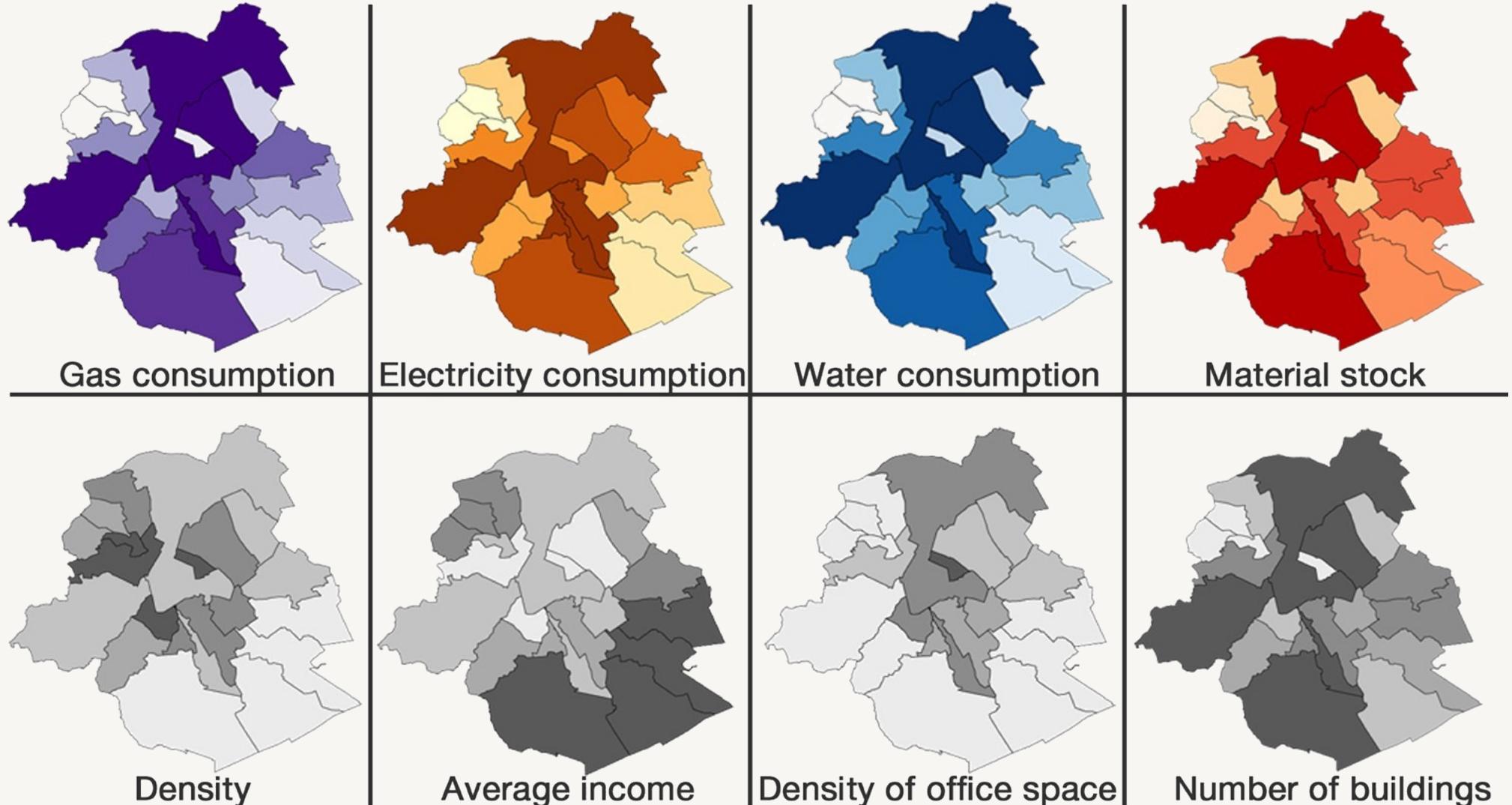
Athanassiadis, A., M. Christis, P. Bouillard, A. Vercalsteren, R. H. Crawford, and A. Z. Khan. 2018. Comparing a territorial-based and a consumption-based approach to assess the local and global environmental performance of cities. *Journal of Cleaner Production* 173: 112-123.



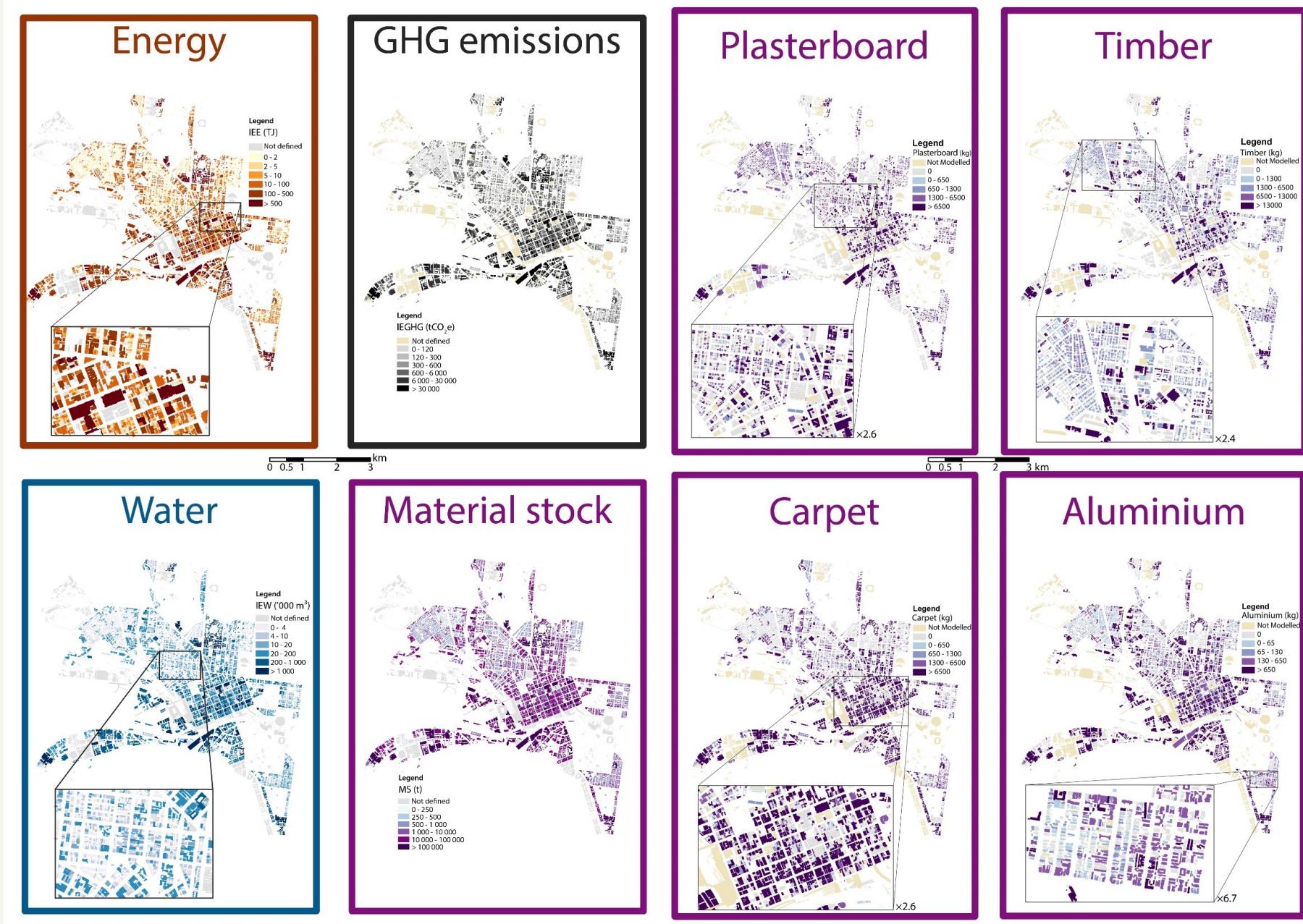
Impossible to be circular?



Mapping flows & manifesting actors/infrastructure



Identifying drivers



Mapping the urban mine

Stephan, A. and A. Athanassiadis. 2017. Quantifying and mapping embodied environmental requirements of urban building stocks. *Building and Environment* 114: 187-202.

Stephan, A. and A. Athanassiadis. 2018. Towards a more circular construction sector: Estimating and spatialising current and future non-structural material replacement flows to maintain urban building stocks. *Resources, Conservation and Recycling* 129: 248-262.



Undercover use of urban metabolism principles

Table C1.1a: Quantity of water services provided / water balance (m³ per annum) as at June 2017

WSDP Ref. #	Regulations Ref. #	Description	m ³ per annum			Ml/d		
			Year 2017	Year 2016	Year - 2015	Year 2017	Year 2016	Year - 2015
			FY2016/17	FY2015/16	FY2014/15	FY2016/17	FY2015/16	FY2014/15
RAW WATER								
7.2.1		Surface water purchased	208 481 967	228 472 634	250,273,421	571	626	686
7.1 / 7.2.2		Surface water abstracted	79 386 420	93 518 803	93,198,389	217	256	255
7.1 / 7.2.3		Ground water abstracted	2 144 854	1 606 064	1,006,715	6	4	3
7.2.14		Effluent recycled	0		0	0	52	0
7.2.4		less Raw water supplied to others	0	0	0	0	0	0
7.2.5		Sub-Total: Raw Water supplied	290 013 242	342 716 999	344,478,525	795	939	944
	10.2 (g) (i)	BULK WATER SUPPLY						
7.2.6		Volume of water treated	287 030 829	329 003 715	342,696,439	786	901	939
7.2.7	10.2 (a) (ii)	Purchased treated water	0	0	-	0	-	0
7.2.7A		Ground water not treated	0	0	-	0	-	0
7.2.6A		of which Treated water supplied to others	26 478 719	33 556 585	37,764,262	73	92	103
		Sub-Total: System Input Volume	313 509 548	362 560 300	380 460 701	859	993	1042
WATER CONSUMPTION								
7.2.8.1		Billed Metered:	216 358 789	255 971 841	266,229,322	593	701	729
	10.2 (a) (i)	External Customers	26 478 719	33 556 585	37,764,262	73	92	103
	10.2 (a) (i)	Internal customers	189 880 070	222 415 256	228,465,060	520	609	626
7.2.8.2		Billed Unmetered	0	0	0	0	0	0
7.2.8.3		Unbilled Metered	9 447 791	13 396 500	13,345,632	26	37	37
		Informal Settlement	7 100 951	11 049 660	10,998,792	19	30	30
		Formal metered unbilled	2 346 840	2 346 840	2,346,840	6	6	6
7.2.8.4		Unbilled Unmetered					0	0
		Formal unmetered	8 820 000	8,820,000	8,820,000	24	24	24
	10.2 (g) (i)	Sub-Total: Authorized consumption	234 626 580	278 188 341	288,394,954	643	762	790

Thank you

Questions