

CLEAN ENERGY, NEW WASTE: EXPLORING A JUST AND CIRCULAR TRANSITION

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LOW-CARBON TRANSITIONS STILL DEPEND ON EXTRACTION

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Decarbonization, population disruption and resource inventories in the global energy transition

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Check for updates

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We develop a novel approach to analysing decarbonisation strategies by linking global resource inventories with demographic systems. Our ‘mine-town systems’ approach establishes an empirical basis for examining the spatial extent of the transition and demographic effects of changing energy systems. The research highlights an urgent need for targeted macro-level planning as global markets see a decline in thermal coal and a ramp up of other mining commodities. Our findings suggest that ramping up energy transition metals (ETM) could be more disruptive to demographic systems than ramping down coal. The data shows asymmetry in the distribution of risks: mine-town systems within the United States are most sensitive to coal phase-out, while systems in Australia and Canada are most sensitive to ETM phase-in. A complete phase-out of coal could disrupt demographic systems with a minimum of 33.5 million people, and another 115.7 million people if all available ETM projects enter production.

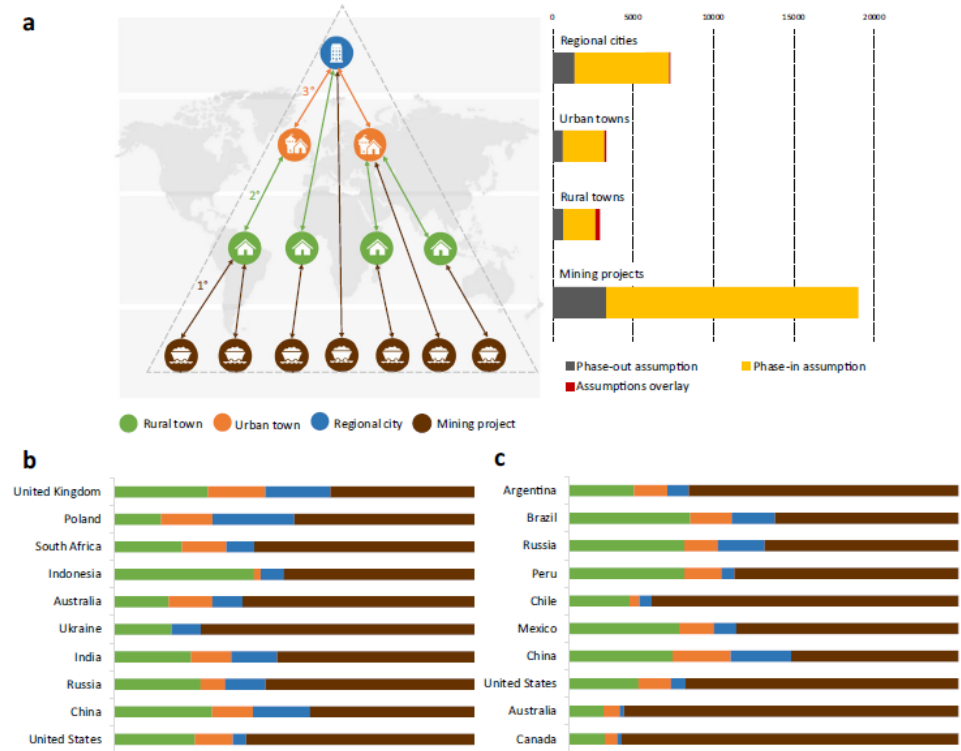
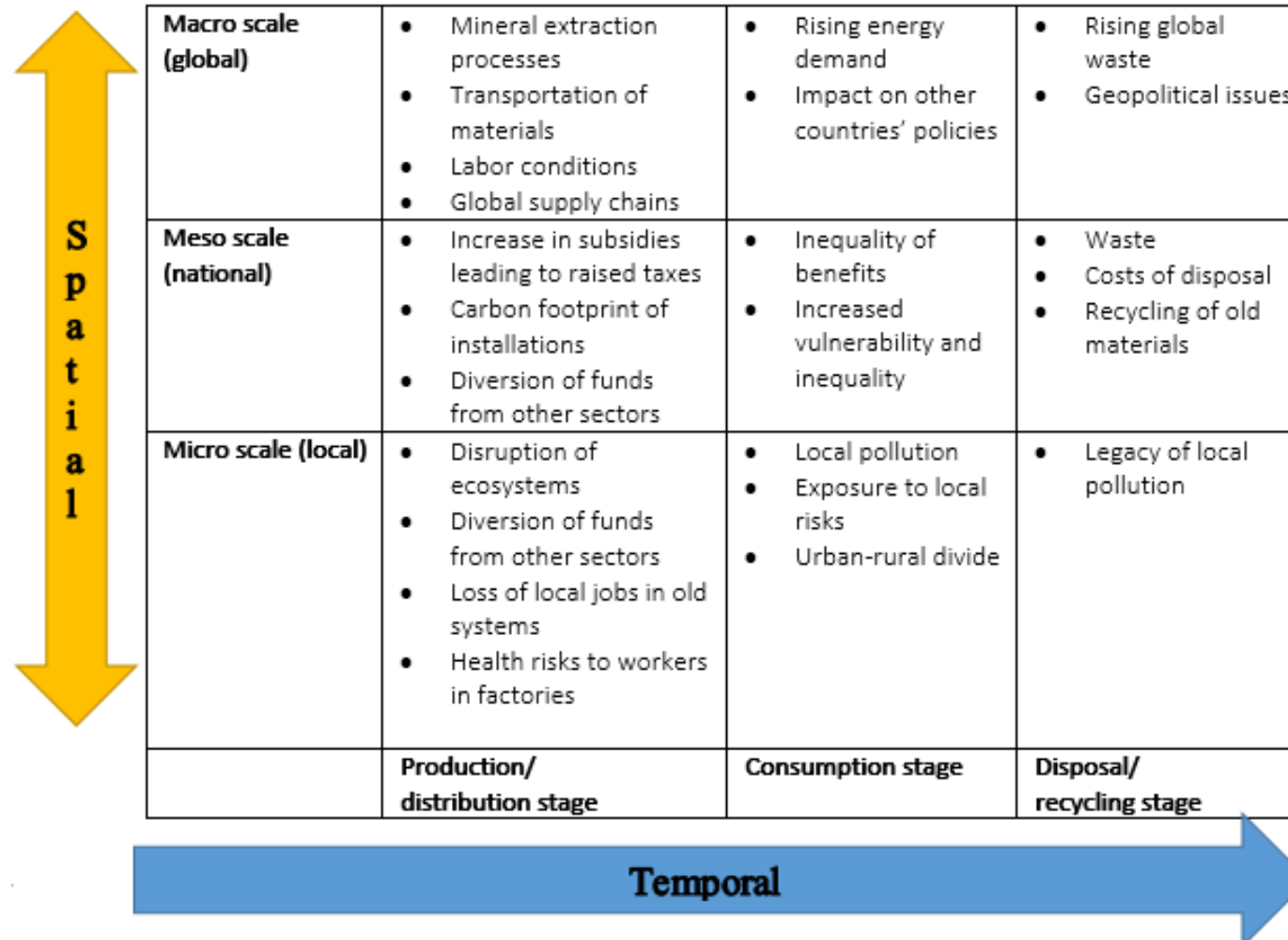


Fig. 5 | Global exposure to the coal phase-out and ETM phase-in assumptions carried in the three resource inventories. a Number of regional cities, urban and rural towns and mining projects in global mine-town systems. **b** Top 10 countries with the highest exposure to the coal phase-out assumption, i.e. countries with the

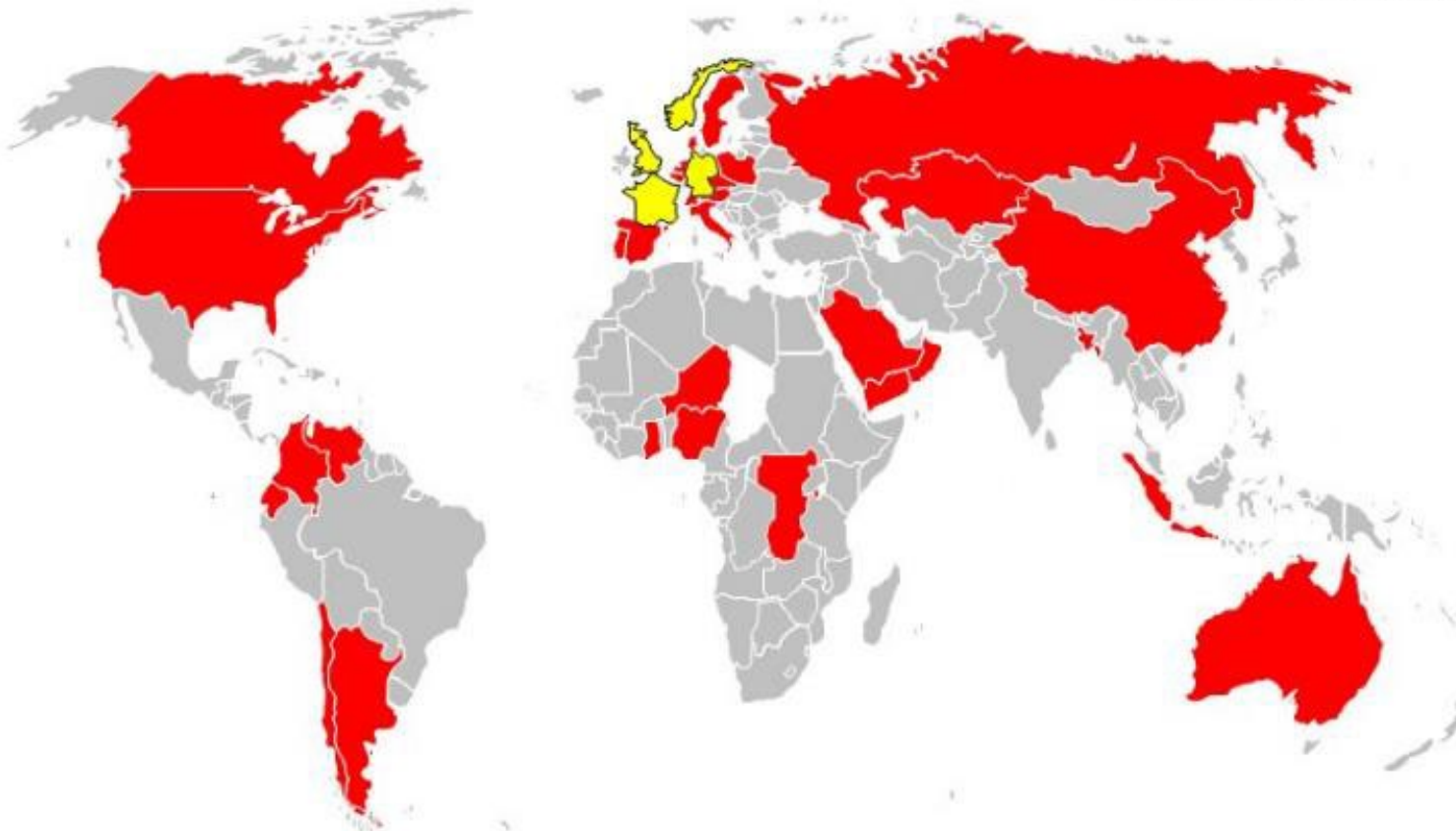
largest number of settlements and operational and closed coal mines that are linked inside mine-town systems. **c** Top 10 countries with the highest exposure to the ETM phase-in assumption, i.e. countries with the largest number of settlements and pre-operational ETM projects that are part of the mine-town systems.

MANY IMPACTS ARE AT THE MACRO OR GLOBAL SCALE



Source: Sovacool, BK, A Hook, M Martiskainen, and LH Baker. "The whole systems energy injustice of four European low-carbon transitions," *Global Environmental Change* 58 (September, 2019), 101958, pp. 1-15.

		
Micro injustices	Meso injustices	Macro injustices
Local pollution and waste	Nuclear accidents	Uranium mining and waste
Community health	Disruption of other national transitions	Unsafe nuclear exports
Property prices	Higher national energy prices	Metal and mineral inputs
Unequal household benefits	Loss of national employment	Flows of electronic waste
Traffic congestion	Expansion of roads	Exporting of dirty cars
Parking	Undermining utility business models	Poor overseas labour conditions
Closure of local coal mines	Bankruptcy of national firms	Disruption of fossil fuel industry
		Disruption of other transitions



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Phase 2 for the “lived experiences” of injustice

Method	Community	Respondents	Illustrative Institutions or Locations
Expert research interviews	French wine	FER1-7 (mix of wine representatives, wine trade experts, wine-specialized journalists, anti-nuclear associations)	Commercial representatives of wineries, Syndicat général des Côtes du Rhône, Université du Vin, Wine trade experts, Wine journalists, Sortir du Nucléaire, CRIIRAD
	German solar	GERE1-7 (mix of research institutes, private solar firms, mayoral offices, unions)	Fraunhofer ISF, municipalities, mayoral offices, private solar firms
	Ghanaian e-waste	GER1-11 (mix of government, civil society, private sector, and academic respondents)	Environment Protection Agency (EPA), Ministry of Environment, Science, Technology and Innovation (MESTI), World Resources Forum, Greater Accra Scrap Dealers Association (GASDA), Scrap Dealers Association at Agbogbloshie, University of Ghana
	Congolese cobalt mining	CER1-23 (mix of government, civil society, private sector, and academic respondents)	Service d'Assistance et d'Encadrement du Small Scale Mining (SAESSCAM, recently renamed SAEMAPE, the Ministry of Mines, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Gécamines (state-owned mining company), 'entreprise minière Congo Dongfang Mining (CDM mining), Tenke Fungurume Mining (TFM), Glencore, and Ruashi Mining, Université de Kinshasa, Université de Lubumbashi
Community research interviews	French wine	FCR1-6 (winegrowers and residents)	Various local winegrowers, wineries, and bottlers in the Rhone and Grignan-les Adhémar regions
	German solar	GERC1-7 (local community members, ex-solar workers, local journalists)	Ex-solar workers in the Bitterfeld region, other local affected community members
	Ghanaian e-waste	GCR1-21 (e-waste scrapyards workers, their families, labor leaders, politicians, and those supporting e-waste via marketing and vending)	E-waste workers and communities throughout Agbogbloshie and the greater Accra area
	Congolese cobalt mining	CCR1-48 (mix of artisanal cobalt miners as well as artisanal bosses or chiefs, crushers, carriers, drivers, refiners, safety inspectors, sorters, labor unions and members of the mining police)	Various artisanal mining teams, artisanal mining communities and households across Kolwezi, Likasi, Fungurume, and Lubumbashi

[Sovacool, BK, B Turnheim, A Hook, A Brock, and M Martiskainen. “Dispossessed by decarbonisation: Reducing vulnerability, injustice, and inequality in the lived experience of low-carbon pathways,” *World Development* 131 \(January, 2021\), 105116, pp. 1-14.](#)

Phase 2: Site visits

Site visits and naturalistic observation	French wine	7 vineyards (within and beyond AOC), wine cellars, winemaking training centers and archives, 3 nuclear sites, and 1 Wine Trade fair in Paris	Within AOCs Grignan-les Adhémar, Côtes du Rhône, Marcoule, Tricastin, Cruas-Meyssse
	German solar	8 solar manufacturing sites, affected communities, administrative decision-making centers	Solar Valley, Bitterfeld-Wolfen, Halle, Magdeburg
	Ghanaian e-waste	20 formal and informal scrapyards, affiliated industries	Agbogbloshie scrapyard, Old Fadama Market, Agbogbloshie Health Clinic, Accra Compost & Recycling Plant, Akooshi Recycling Centre, Dawa Steel Mill and Export Zone, various electrical shops
	Congolese cobalt mining	30 artisanal and industrial mines, legal and illegal mines, mines as well as trading depots and processing centers	Ruashi artisanal cobalt mine, Kasulu artisanal mine, Depot 169, Depot 2, Depot 18, Depot 1000, Depot Thomas Boss Billy, Solola and Kabica artisanal mines, Katanga and Fungerume artisanal mines, Kawama artisanal mine

Child labor: Exploitation and violence in Congolese cobalt mining for electric vehicles

- **Cobalt mining**, like any form of mining, is a **serious threat** to the environment. With mines and disposal sites comes **deforestation**, **biodiversity loss**, **air pollution** and **soil erosion**.
- Communities suffer from **polluted land** and **water** but believe mining will lift them **out of poverty**. While it allows them to survive in the short-term, this obsession with mining prevents them from **diversifying** their economy.
- Women are effectively **banned** from mining on the 'front-line', and find themselves working **tougher, less visible** jobs for **less pay**.
- Surveys found that **23%** of the region's **children** work in cobalt mining, yet the UN classifies it as one of the **worst forms of child labour**.
- Children are exposed to **beatings**, whippings, **sexual abuse**, carrying heavy loads, **exposure** to toxic agents. They work underwater, underground, at dangerous heights and for long hours.

Child labor: Exploitation and violence in Congolese cobalt mining for electric vehicles

“ASM cobalt mining is not living, it’s dying. The moment you step inside the mine, the clock starts ticking. You are exposed to dust which can lead to silicosis, or be poisoned by mercury. You can drown, or become trapped in a mine collapse. You can get crushed by rocks, or even contract diseases by people shitting or urinating into the mine. You can suffer diseases from sitting in water all day, such as cholera or malaria, or get bitten by animals, as many miners will bring them into the mine. This is especially the case when they remain underground in deep shafts for 5 or even 7 days at a time—it’s an underground circus at that point, full of animal and human excrement, I’ve even heard of people contracting the plague in such conditions ... Even if such things cannot kill you, they can still dismember or injure or disable you. I know of people who lose arms or legs in a collapse, they have to painfully break their bones to pull free. Many then bleed to death in the jungle.











Embodied externalities: The toxic effects of smart meters, batteries, and e-waste in Ghana

- **Agbogbloshie**, a neighborhood in the capital of Accra, is known as Ghana's electronic waste (**e-waste**) hub.
- **Solar panels** represent about **80kg of waste** per installation, and European **wind** turbines will result in around 730,000 tons of e-waste by 2050.
- For the world to **complete** and **maintain** its renewable energy transition, it needs a "**mineral foundation**" that will include heavy/toxic waste increases.
- Less than **1 square mile** in size, Agbogbloshie is home to 40,000 people, and a scrapyard that contains **90% of Ghana's e-waste**.

Embodied externalities: The toxic effects of smart meters, batteries, and e-waste in Ghana

- Ghana's own Environmental Protection Agency warns of **innumerable toxic** elements in Agbogbloshie's air, water and soil.
- The electronic scrap yard is situated next to **food markets, schools** and **homes**. Some of the **toxic scrap metal** is even used by the community.
- Children aged **12-15** living there have been found to have **kidney failure, heavy metals** in their urine and body systems resembling **90 year old** adults.
- Mothers are victim to **spontaneous abortions**, premature births and birth defects while inhabitants show high levels of **endocrine disruption** and **neurotoxicity**.
- **Children** and **minorities** find themselves working or living in the scrapyard to survive, subject to the **nefarious effects of our waste**.

Embodied externalities: The toxic effects of smart meters, batteries, and e-waste in Ghana

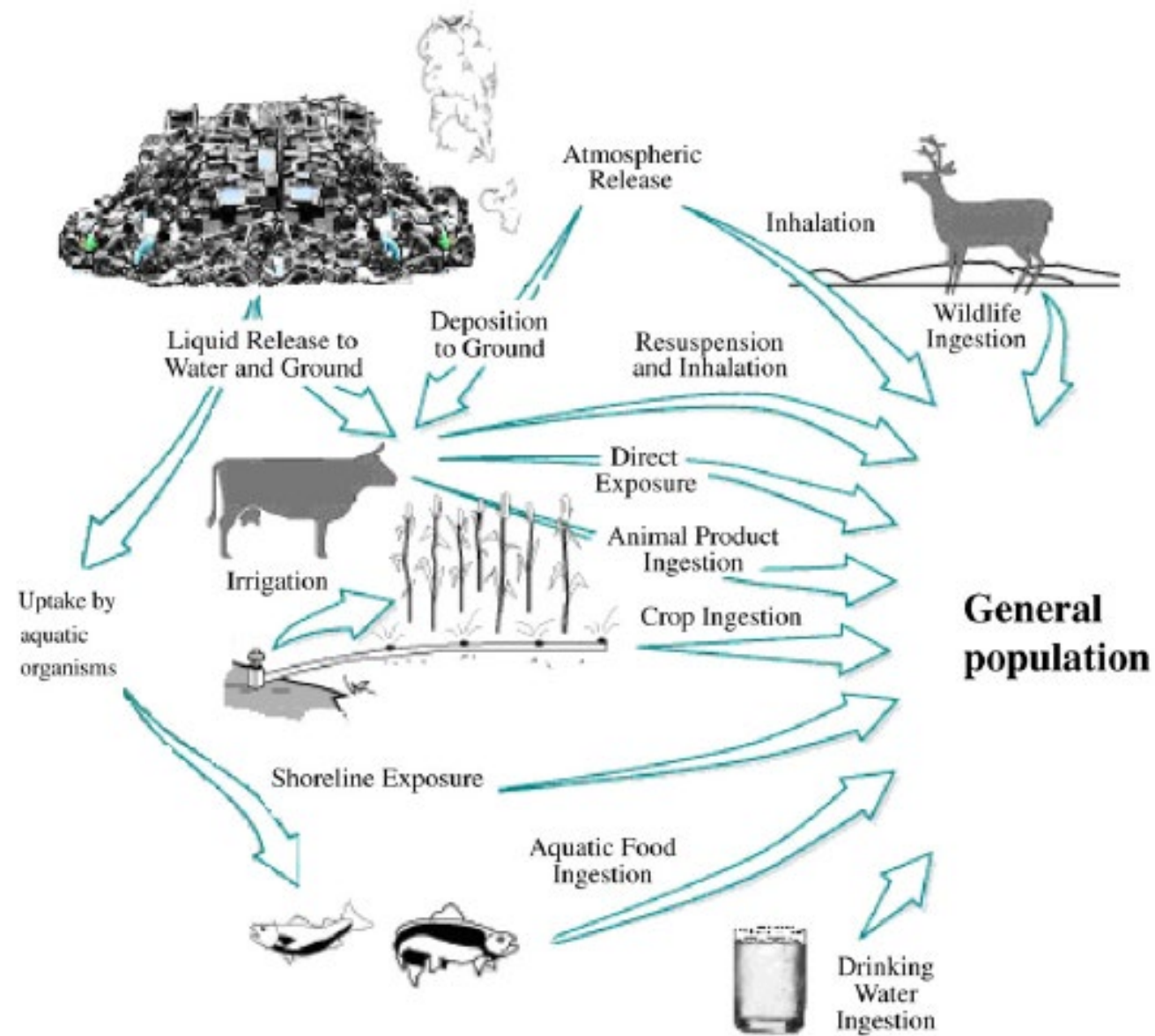
“More than 100,000 people live here in abject poverty, home to the biggest dump for scrap metal and e-waste in the world. Young boys and girls, children as young as six, seven, and eight years old are engaged in this business. They miss school or end up dropping out of school, they go to the slum for a career, or they look for scrap to finance their own education. Even though they go to look for scrap metal, they end up doing it for the rest of their life. I know a story of a young boy, who was not wearing any protective clothing, who got so damaged by the hazardous material he died at the age of 12. Others see their life shortened by decades. They cough, get infected, and fall sick. They dedicate their youth to renting a wooden structure to sleep at night, 5-6 children in a shack, close to the metal business so they can work longer hours”



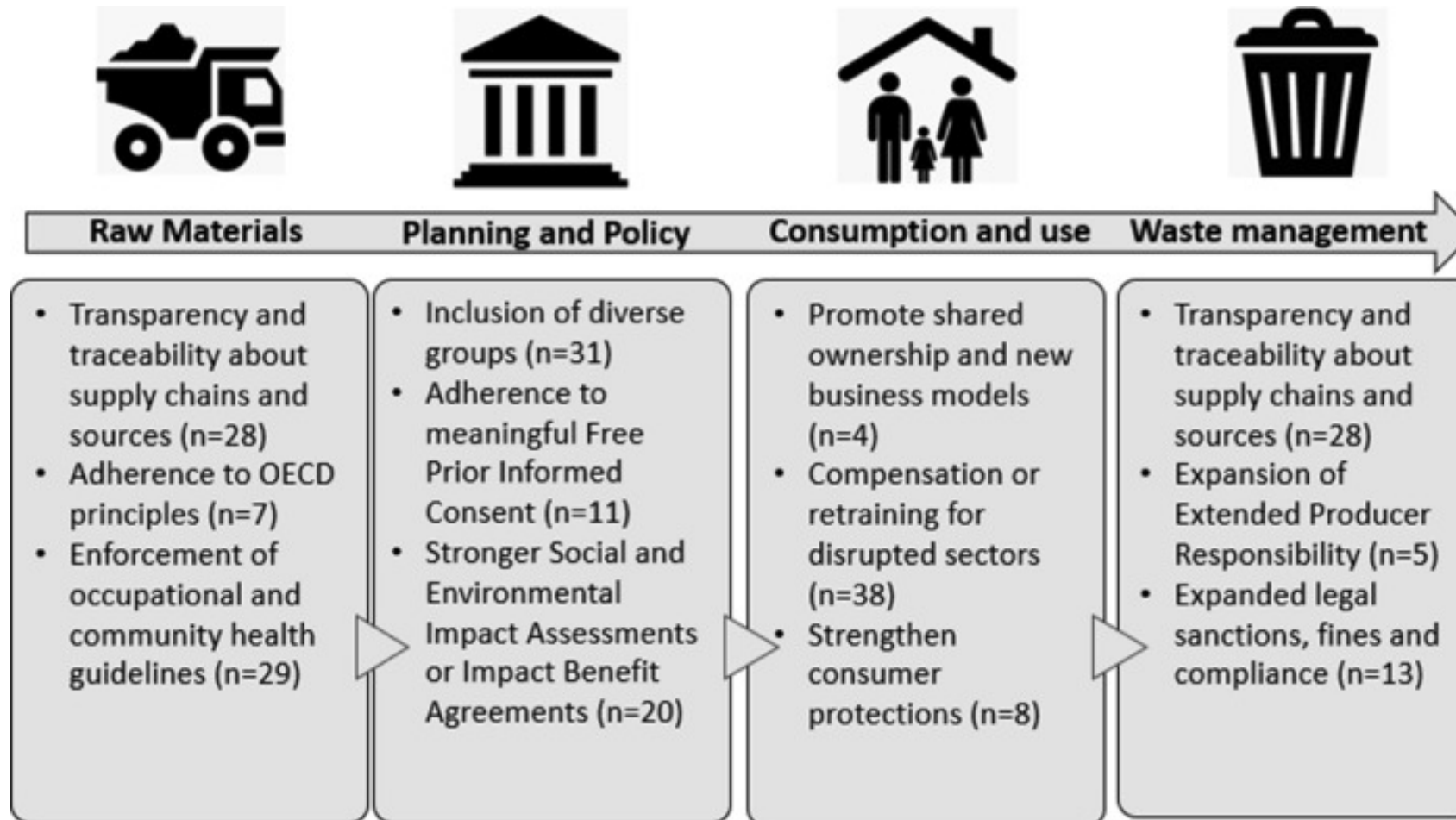








TOWARDS MULTI-SCALAR POLICY MIXES



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