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TOWARDS A ZERO WASTE URBANISM: A MANIFESTO FOR SUSTAINABLE FUTURES

The ecological catastrophe and the role of cities. – The recent IPCC (2021) report warns it is "unequivocal": climate change is manmade, and the scale of change is "unprecedented" and "irreversible." Though this picture seems grim, researchers have long warned that we are reaching inevitable tipping points, beyond which are long-term, irreversible changes (Lenton *et al.*, 2019). The most pressing ecological issue is global warming due to CO2 emission, and the clock is ticking[1]. There are multiple ecological challenges, however, and so it is crucial that we do not cross the planetary boundaries (Steffen *et al.*, 2015) to rethink practices of production, consumption, and disposal as well as their environmental impacts (Van Ewijk, Stegemann, 2016; Velenturf, Purnell, 2017). Moreover, climate change will disproportionately affect the most vulnerable and low-income populations (Levy, Patz, 2015; Islam, Winkel, 2017).

Cities are at the forefront of this crisis, and rethinking how cities are planned, built, and managed has renovated an interest in urbanism. For example, the growing literature around eco- (Caprotti, 2014) or green-cities (Lehmann, 2010) highlights the renewed interest in – as well as the importance of – nature and human/nature relations. There are numerous calls for companies, universities, cities, states, and regions, to reach a "net zero target", with the direct reduction of emissions, or neutralisation of emissions through offsetting, or CO2 removal (NewClimate Institute & Data – Driven EnviroLab, 2020). Among them spreads a relatively new concept: zero waste. Accordingly, this approach has also been applied to the urban environment, coining the term *zero waste city* (Lehmann, 2010)[2].

[1] See: https://climateclock.world, a project that indicates the time left CO2 emissions so as not to exceed 1.5 C°.

[2] More recently, Zero Waste Europe developed a program called Zero Waste Cities to help cities and communities transition towards zero waste, focussing on reducing municipal solid waste (Zero Waste Europe, 2020).

This article seeks to highlight the strengths and limitations of zero waste cities in order to discuss and develop a zero waste urbanism. The proposal of zero waste urbanism is intended not as a mere analytical tool, but as a unifying framework to analyse the current crisis and to generate answers. This work is both a contribution to the discussion of our current socio-ecological crisis and a call for meaningful action in response to it.

The centrality of cities. – Within the picture of an ecological catastrophe, the recent report *Empowering Cities for a Net Zero Future: Unlocking resilient, smart, sustainable urban energy systems* (International Energy Agency, 2021) summarises the role of cities:

> Cities account for more than 50% of the global population, 80% of global GDP, two-thirds of global energy consumption and more than 70% of annual global carbon emissions. These factors are expected to grow significantly in the coming decades: it is anticipated that by 2050 more than 70% of the world's population will live in cities, resulting in massive growth in demand for urban energy infrastructure (p. 3).

Cities are where the majority of the world's population lives, where the majority of energy is consumed, and where the majority of pollution is produced. This trend will continue in years to come. This alone makes cities central in any discussion of our current socio-ecological crises.

The urban environment represents, simultaneously, problems and their possible solutions. Cities are the locus where energy and material consumption as well as waste and by-product production are incredible high, and cities are best positioned to make finding solutions possible (Fertner, Große, 2016). Indeed, the only way our densely populated world can dramatically reduce waste and consumption, share resources, stop sprawl and save energy is to rely on city living, because cities – reimagined – can greatly reduce our ecological footprint. To stay within the planetary boundary in a world of finite resources is a quest, however, that requires efficiency as well as a sharp decline of total resource and energy consumption (*ibidem*).

The challenge ahead is not only that we avoid ecological catastrophe; we must also fight for a more just and inclusive world. What we are

witnessing is widespread social crisis built upon economic inequality, as the reports from Oxfam periodically reminds us, and based on unequal access to resources, on gender/racial/class discriminations, on widespread conflicts, on the Global North-South divide, and on and on. Under this lens, it becomes clear that cities are not only an arena for intense social and ecological conflicts, they are also the frontier of capital reproduction, where inequalities continue to grow (Harvey, 1985, 2012).

International bodies know the importance of cities. It was within the United Nations Conference that a *Manifesto for Cities: The Urban Future We Want* was developed in 2012. It clearly states that, «Cities are the world's greatest assets for pursuing sustainable development. How we plan, build and manage our cities today will determine our future» (World Urban Campaign, 2012, p. 3).

Since then, a lot has been said and written about cities. The recent *World Cities Report 2020 The Value of Sustainable Urbanization* (UN-Habitat, 2020) stresses that one-third of all urban residents are poor and poverty increases with the increasing pace of urbanization, resulting in a greater concentration of poverty in urban areas, and it concludes (again) that: «The particular ways cities are planned, designed and built says much about what is valued there, and planning processes can either help or hinder development of opportunities for all» (*ibidem*, p. 106). Unfortunately, despite this growing interest, cities and the crises they can address are not getting any better.

International bodies know the importance of cities, and they also seem to agree on the importance of fighting inequalities. Positions like the following are getting more common:

> Harnessing the social value of urbanization entails promoting gender equality and ensuring that the right to the city is secured for all, particularly vulnerable and marginalized groups. It also requires guaranteeing equal opportunities and access to urban resources, services and goods while fostering effective citizen participation in local policies with responsibility, enabling governments to ensure just distribution of resources and acknowledging cultural diversity as a source of social enrichment. (*ibidem*, p. 177)

Unfortunately, again, despite this shared acknowledgment, there is not much action.

Waste and Zero Waste. – The literature on waste is growing (Moore, 2012). In nature, interactions happen in closed loops. There is no burning or dumping of waste. For human societies, waste is mainly an urban problem, and, historically, solid waste management started with cities (Buck 2020). While waste is a major contribution to pollution and CO2 increment (Steffen *et al*., 2015; IPCC, 2021), the worldwide trend of increasing waste production does not seem to stop, and we continue assisting it (Kaza *et al*. 2018).

Whereas Moore (2012) contends that multiple views of waste exist depending on methodological, epistemological, and ontological different positions, Reno (2018) convincingly argues that waste matters from three different (and potentially complementary) perspectives: ecological, utilitarian, and moral-political.

To tackle the production of waste, Paul Palmer introduced the term *zero waste* in the early 1970s. Looking back, it can be considered problematic «because it implies a condition applied to waste» (Palmer, 2009). Regardless, Zero Waste is often framed from an engineering perspective (Khan, Islam, 2012), and over the years – particularly since the early 1990s – the term has evolved to encompass more, and zero waste experiences are growing in all the continents (Zaman, 2015). Liss, a leading advocate of zero waste, rightly points out that «Zero Waste is a Policy, a Path, a Direction, a Target; it's a Process, a way of thinking, a Vision» (1997). Working towards a circular system, zero waste aims to build a society that minimises waste production in all stages of a product's life or a service (Venturini, 2021). Moreover, it proposes a different waste hierarchy (Simon, 2019), one in which burning waste is unacceptable, one that favours refuse/rethink/redesign, reduce and reuse. Preventing and recovering waste avoids emissions in all other sectors of production and thus the zero waste approach benefits go well beyond the management of product in the last part of their life.

Although zero waste is mainly applied in waste management (Zaman, 2015), it can be an approach to, it can be applied to, multiple fields, such as construction and demolition (Elgizawy, El-Haggar, Nassar, 2016), industrial manufacturing (Curran, Williams, 2012; Singh, Ramakrishna, Gupta, 2017), fashion design (Rissanen, McQuillan, 2016) and events (Hottle *et al*., 2015). Recent attempts have even centred on applying zero waste to educational processes (Venturini, 2021).

Pietzsch *et al.* (2017) highlight that while the success of zero waste implementation depends on political, cultural/behavioral, economic, technological variables (applied at different levels), it proposes benefits for the community, for the environment and for industry.

To collectively find and implement shared solutions, a participatory governance with all stakeholder engagement is fundamental (Velenturf, Purnell, 2017). There are growing examples of community-based waste management systems (Petts, 1995; Mongkolnchaiarunya, 2005). Different stakeholders are to be involved (Velenturf, Purnell, 2017; Zaman, 2017): all the different actors along the waste chain (from designers, manufacturers, consumers, and waste processers), the universities, politicians and third sector associations.

Zaman (2017) proposes a three-stage planning approach for achievement of Zero Waste:

1. preliminary assessments, to identify key issues, indexes, strong aspects;
2. implementation of strategic elements, based on localities;
3. and post-evaluation, monitoring and assessment;

with three strategic axes to be addressed concurrently: «(i) sustainable production through a cradle-to-cradle design and product stewardship; (ii) collaborative and responsible consumption of natural resources; and (iii) zero waste management through conservation of resources» (*ibidem*, p. 1).

Zero waste is growing despite a number of cultural, market, regulatory and technological barriers (Bartl, 2011; Kirchherr *et al.*, 2017). Bartl (2014) argues that any attempt to prevent waste generation is at odds with the current economic system, where economic growth is often coupled with waste production. Indeed, for the final goal of a "zero waste humanity" we should go beyond technological or economical perspectives and open ethical and political questions. Zwier *et al.* (2015) pose a challenge that so far has been neglected: proposing to work towards a zero waste humanity, for a future with «a humanity fully captivated by the logic of scarcity and utility» (p. 49).

The zero waste city and urban metabolism. – Ideas for a zero waste city were first introduced in Lehman's *The Principles of Green Urbanism*[3]. There,

[3] Despite different research referring to the term zero waste city, few researchers have paid attention from a comprehensive point of view as Lehmann and Zaman.

Lehman (2010) proposes a framework for sustainable urban development based on a triple-zero: «zero fossil-fuel energy use, zero waste, and zero emissions» (230), and he outlines fifteen principles for a green urbanism[4]. The term is first introduced as principle 3, where a zero waste city is characterised «as a circular, closed-loop eco-system» (p. 232).

The concept of zero waste cities is spreading. The six key drivers of a zero waste city (Zaman, Lehmann, 2013) are awareness, education & research, new infrastructure & system thinking, 100% recycling & recovery, sustainable consumption & behaviour, transformed industrial design, zero depletion legislation & policies.

Lehmann (2012) clarifies the relations between urbanism, green urbanism, and zero waste city:

> *Urbanism* is the academic discipline concerned with understanding the spatial organization and dynamics of urban areas [...]. *Green urbanism* is the holistic concept of urban systems that exist and change (grow or shrink) without negatively impacting the ecosystem. [...] The *zero waste city* model takes the concept further, and optimizes all urban material flows in a way that leads to 100% resource recovery, and does away with landfill. (p. 109)

If urbanism is the discipline of reference, consider zero waste city as a development of green urbanism.

Re-using building components and integrating existing buildings (instead of demolition) is a basic principle of any eco-city and eco-building project. Lehmann (2012) stresses how the construction sector produces much waste while recycling little, and that building differently would have huge effects on an urban scale. However, it is acknowledged that achieving zero waste would require rethinking physical processes of

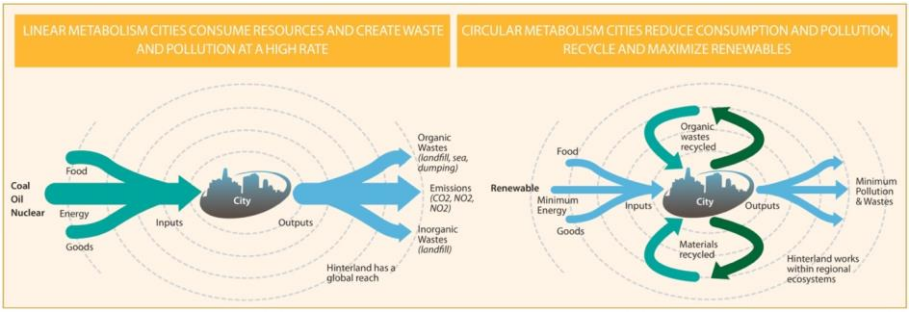
[4] The principles are introduced in great length in chapter 2, *The principles Of Green Urbanism - Putting It All Together* and they are: 1. Climate and Context; 2. Renewable Energy for Zero CO2 Emissions; 3. Zero Waste City; 4. Water; 5. Landscape, Gardens and Biodiversity; 6. Sustainable transport and good public space; 7. Local and sustainable materials with less embodied energy; 8. Density and retrofitting of existing district; 9. Green buildings and districts, using passive design principles; 10. Liveability, Healthy Communities and Mixed-Use Programmes; 11. Local food and short supply chains; 12. Cultural heritage, identity and sense of place; 13. Urban governance, leadership and best practice; 14. Education, research and knowledge; 15. Strategies for cities in developing countries.

construction as well as the guiding principles behind them. Within this framework, the zero waste city is deeply concerned with metabolic flows in the city.

Modern cities are based on a linear mode of production, where high flows of resources (food, energy, goods) are consumed by cities that generate, as outputs, high quantities of waste and pollution (fig. 1). In contrast to this linear system, zero waste cities should have a circular metabolism (fig. 1):

> The city of tomorrow must be transformed from an unsustainable linear throughput of materials to a closed-loop circular metabolism, in which materials, energy, water, food, and other resources are fully recovered and continuously circulated for material gains and greenhouse gas reduction. (Lehman, 2012, p. 115).

Fig. 1 – *Linear and circular metabolism*



Source: Girardet (2010, p. 11)

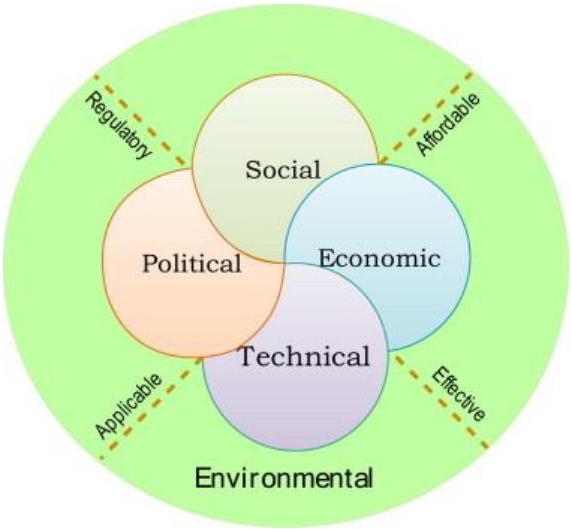
The systemic change hopes to minimise all the outputs from the cities while at the same time switching to renewable energies. It seeks to reduce the request of food, energy, goods (thanks to efficiency, to decreased consumption, and to new lifestyles). It seeks, also, to maintain energy and raw materials in closed loops as much as possible. Closed-loop systems would necessitate that a high proportion of the energy and materials consumed are those which come from re-used waste, that fresh water is made from wastewater.

Lackner and Jospe (2017) assert that climate change is a waste management problem: «Carbon dioxide is a waste product; dumping it into the open air is a form of littering» (p. 83). The rise of temperature is

caused by the accumulation in the air of carbon dioxide, it follows that key is to drastically cut the emissions. However, Buck (2020) problematises this approach, showing how a technocratic approach to sequester the carbon dioxide produced is limited and the need of coupling scientific approach with renovated social values. Nevertheless, what is important is that we can apply this change of perspective to zero waste, suggesting that zero waste matched with new critical values and can be a new framework. We must focus our efforts on waste avoidance, waste reduction, and behavioural change.

As stressed by Lehman (2012, p. 110), achieving a circular metabolism should be coupled with an effort towards resilience, towards interconnectivity of all systems and networks, and towards finding local solutions that are influenced by climate, context, or site.

Fig. 2 – *Spheres in a sustainable zero waste city*



Source: Zaman and Lehmann (2011, p. 82)

A zero waste city approach is divided in five interrelated spheres that all must be addressed together and at once. The spheres represent the social, the political, the technical, the economic, and the environmental. The environmental sphere houses all others (fig. 2). The best solutions should be consistent with the concept of applicability, effectiveness,

affordability, and consistency with regulations, and they must always exist within the framework of environmental sustainability.

Problematising zero waste and zero waste city. – The fifteen principles of green urbanism are constructive and grounded ideas, both necessary and effective to reach a sustainable city. However, they are not enough. The zero waste cities approach shows some limitations. Krausz *et al.* (2013) and Premalatha *et al.* (2013) show that cities that adopted a zero waste to landfill goal have failed, and that such policies have not been achieved anywhere. The key problem is that Zero Waste is applied to waste management, and only to the final life of products (similar to issues regarding recycling). Strategies for addressing waste upstream are critically absent, with insufficient downstream measures such as recycling the prevailing norm – reinforced by a consistent preference for technical solutions over fundamental behaviour change (Krausz *et al.*, 2013, p. 10). Moreover, despite waste hierarchies having some merit for their ability to reduce landfill waste, they show limits in overall waste reduction due to the lack of power of waste managers and to the shortcomings and difficulties in implementing the priority order (Van Ewijk, Stegemann, 2016).

The references to "zero terms" can be misleading, creating

> an impression that a shift from fossil fuels to renewables would foster environment-friendly growth if the present *rate* of increase in energy and material consumption is maintained. A shift to renewables can be helpful only and only if it is accompanied by a drastic cut in energy and material consumption across the world. (Premalatha *et al.*, 2013, p. 667)

Only a dire downscaling of production and consumption would allow us to switch to a circular metabolism.

Multiple cases of zero wastes cities exist (Zaman, Lehmann, 2011, 2013) but many have already abandoned their zero waste target (Krausz *et al.*, 2013). The case of Masdar City is emblematic. Located near Abu Dhabi in the United Arab Emirates, its construction started in 2006. Masdar City was designed to be the world's first carbon-neutral, zero waste city (Nader, 2009). Unfortunately, it soon moved away from a zero-carbon strategy to a low-carbon one (Griffiths, Sovacool, 2020). When the environmental goals were dropped and the human rights

violations during the constructions came to light, it then became clear that the main aim of Masdar was economic expansion. Thus, Masdar become another instance of a recent green city failing to address urban inequalities and social injustices (Cugurullo, 2013; Kaika, 2017).

The zero-city tradition has a narrow use of urban metabolism, focussing mainly on flows of materials and energy. Indeed, as Swyngedouw and Heynen (2003) remind us, metabolism has already been used by Marx highlighting:

> that labour constitutes the universal premise for human metabolic interaction with nature, the particular social relations through which this metabolism of nature is enacted shape the form this metabolic relation takes. [...] Social relations operate in and through metabolising the "natural" environment and transform both society and nature (p. 905).

From this perspective, cities should be conceived as the interlink of nature, the built environment, and the socio-political relations where we assist to continuous «material flows of commodified nature, labor power, technology, capital investment, and social relations» (Kaika, 2004, p. 10).

While Lehmann (2010) mentions political difficulties as one of the major barriers for a sustainable future, even he fails to develop either a clear critique or a possible way forward. His principles for a green urbanism seem as though they were developed more through the calculations of an architect or the measurements of an urban planner. They are principles that fail to address systemic key issues, such as power dynamics, political organisation, and urban inequalities. It seems that so far, the discourse of zero waste cities has focused on the economic and technical spheres (fig. 2), neglecting the social and political.

The result of these repeated oversights seems to have poisoned the idea of zero waste cities, plaguing it with a common issue:

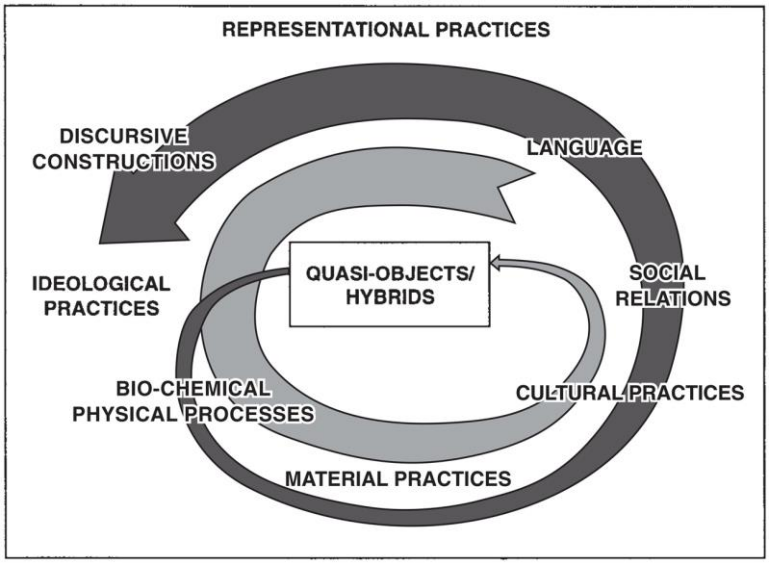
> The emerging emphasis on eco-cities, resilient cities, smart cities, zero carbon cities and other ecologically inflected types of urban form has emerged out of attempts to rework both the environmental and socio-technical characteristics of capitalist urbanisation. (Gandy, 2015, p. 152)

To paraphrase a famous quote from Albert Einstein, it would be quite bizarre to solve our socio-ecological problems within the same framework that created them.

What is crucial is that we rethink and remember cities as something more than geographical expressions or societal containers (contra Khan, Zaman, 2018). Indeed, cities are built by a complex relation of cultural/social the political/economic (Bridge, Watson, 2011). Indeed, urbanisation is a distinctive trait of human society (Soja, 200) where cities have become privileged sites of capital accumulation (Harvey, 1985, 2012). In this process of world urbanisation (Merrifield, 2013), waste is a distinctive aspect of capitalist urbanisation (Kaika, 2004). Social and ecological issues are strictly interconnected, as well as the solutions of the current crisis (Swyngedouw, Heynen, 2003; Bookchin, 1995, 2005). There is a direct link between social inequality and municipal waste production: with the increase of inequalities, waste production per capita soars (Islam, Winkel, 2017).

To put the development of zero waste cities on our agenda means to discuss our current political and social system: capitalism. Looking at the current social-ecological crisis means to forge a new relation between nature and the urban (that should be read, with humans) that should be a political quest (Swyngedouw, Kaika, 2000; Kaika, Swyngedouw, 2011). Kaika (2017) effectively argues that solutions should not be searched for with «old methodological tools (e.g., indicators), techno-managerial solutions (e.g., smart cities), and institutional frameworks of an ecological modernization paradigm that did not work» (89). Instead, we should look to the roles of dissent practices and grassroots initiatives. Unfortunately, the situation is complicated given that «the polis as a 'political' space is retreating while social space is increasingly colonised or sutured by consensual techno-managerial policies» (Swyngedouw, 2011, p. 11). It follows, necessarily, that reopening spaces for political and social interventions is crucial.

Fig. 3 – *The production of socio-nature*



Source: Swyngedouw (2004, p. 22)

Towards a zero waste urbanism. – The Zero Waste city project, while excellently focussing on the new design of the city and partially proposing new ways of life, seems to neglect the socio-political dimension of the urban question. In order to succeed, it cannot. For zero waste urbanism to solve anything, the zero waste city must fully address the political questions behind waste production and management in tandem with the realities of urban inequalities. Only then can a zero waste urbanism solve the challenges of waste and beyond. Only then can a zero waste urbanism bring forth a sustainable and just city.

An original sin lays at the prevailing definition of zero waste. Even The Zero Waste International Alliance, one of the worldwide leading bodies on zero waste, characterises zero waste as «[t]he conservation of all resources by means of responsible production, consumption, reuse, and recovery of products, packaging, and materials without burning and with no discharges to land, water, or air that threaten the environment or human health» (2018).

This definition focuses on the different life phases of a product and all the diverse ways of discharge, highlighting the importance of the environment and human life. Unfortunately, it says nothing about key

questions linked to production such as who produces and who consumes and why. It fails to interrogate the socio-political questions behind production, or the socio-political effects of production. Furthermore, it does not propose any ancillary concepts related to social and political dimensions.

Zero Waste Europe, more recently, defines zero waste as «a holistic, community-led approach that focuses on the creation of systems which do not generate waste in the first place and largely contribute to job creation and increased social integration» (2020, p. 6). While this is less precise regarding the production of waste, it does focus on social aspects, as the centrality of the community and the positive aspects towards society. The concepts of equity and justice are also, albeit briefly, mentioned. This change is mirrored in Hannon *et al.* (2018). It is a move in the right direction but given the interdependence of the current socio-ecological crisis, it is hardly enough.

Conclusion. – Building from the valuable experiences of zero waste cities, zero waste urbanism is an attempt to politicise the zero waste approach to cities by making its key questions those that interrogate power. Questions like, *Who produces waste and why? Whose values inform current modes of production? Who do the current modes of production benefit? Who do they harm?*

Answering these questions is crucial for contributing to developing sustainable and socially just solutions to the challenges ahead of us.

Our aim is to deal with problems in the urban environment by addressing the deep roots of them. Zero waste urbanism seeks to position the city as a process of collective co-design and co-production, where discourses of autonomy and self-determination, mutualism, feminism, decolonization, and community empowerment transform into practices.

While being a fresh and much needed approach, zero waste has much to learn from critical theory of many kinds (among them green materialism, postcolonial theory, political ecology, feminism, social ecology, and degrowth). To do so, zero waste urbanism must learn from the rich histories of critical traditions.

As we learn, we seek to find points of contact and strength so that we may develop better understandings, better practices as we tackle our current socio-ecological crisis.

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Verso un urbanismo a rifiuti zero: un manifesto per un futuro sostenibile. – Le città sono il principale luogo di produzione e consumo di rifiuti, nonché di rapida urbanizzazione. Questo articolo prende in considerazione la tradizione rifiuti zero, guardando in particolare alle città rifiuti zero, e mettendola in dialogo con le tradizioni critiche, in particolare con l'ecologia politica urbana. L'urbanismo rifiuti zero viene presentato come una nuova prospettiva e un invito all'azione, non solo per progettare città migliori, ma anche per cambiare la società e rielaborare i sistemi politici. Ponendo le sue domande chiave quelle che interrogano il potere, l'urbanismo rifiuti zero radicalizza l'approccio rifiuti zero, sviluppando nuovi modi di esplorare la realtà proponendo una visione ricostruttiva per creare futuri urbani sostenibili. In tal modo, questo lavoro mira a raggiungere sia i professionisti di rifiuti zero, sia i ricercatori interdisciplinari che gli attivisti-ricercatori.

Keywords. – Rifiuti zero, Ecologia politica urbana, Metabolismo urbano, Urbanismo, Sostenibilità

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