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## KEY PILLARS OF THE URBAN TRANSITION: ENERGY AND MOBILITY

- BEYOND GREEN, BEYOND THE DEAL: TOWARDS THE RENEWABLE CITY

*Peter Droege*

- PATHWAYS FOR ACCELERATING TRANSITIONS TOWARDS SUSTAINABLE MOBILITY IN EUROPEAN CITIES

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## BEYOND GREEN, BEYOND THE DEAL: TOWARDS THE RENEWABLE CITY

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The European Green Deal (EGD) offers a glimpse into a greener future for our cities, and a role for them to contribute to a greener future for Europe and the world. But it is no longer enough to be green. It is no longer enough to aim at deals. A fundamental rewiring of the European city and the wider economy is needed. In order to attempt to counteract the climate tailspin the world is in, Europe has to move more boldly and quickly to a distributed and fully renewable energy system and restructure its agricultural and forestry practices, and its food, building, automotive and other manufacturing industries. The EGD falls short of this need.

The critical aim for the 2020s is to go far beyond the soft carbon neutrality aims of the 1990s and pursue a climate-positive regeneration of the European biospheric systems of which our cities are very much part. When tallying emissions balances in 2050 substantially more carbon should be found to be drawn from the atmosphere than injected into it. Fundamental drivers are, for example, the cessation of fossil fuel and cement emissions and the widespread ramping up of industry, agriculture, forestry and wetland capacities to absorb and retain atmospheric carbon.

The very notion of a “deal” is to be challenged. The EGD moniker is a term twice removed from its original – the New Deal of Franklin D. Roosevelt’s 1930s economic and social reforms in the United States, associatively transformed into the US Green New Deal (Friedmann, 2019), and now used by the European Commission without the “new” and hence strongly implying the old, reinforcing its Trumpian connotations (Schwartz & Trump, 1987).

The very idea of a “deal” is misleading. Survival is not a game of cards, or a process of negotiation with win-win outcomes but a question of ecological fit. Nature does not bargain, and punishes those bent on disrupting it. Global atmospheric CO<sub>2</sub> concentrations in the year 2020 are at 415 ppm and those of CH<sub>4</sub> – methane – approach 1,900 ppb. At selected Arctic hotspots they are almost twice as high, as the remobilisation of potentially massive amounts of greenhouse gas (GHG) hitherto

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locked up in methane hydrate ice concentrations begins. These largely fossil fuel-driven gas levels are now 150% and 300% above the long-term planetary stable peaks of 280 ppm and 600 ppb, respectively, and are rising exponentially (NOAA, 2020). Earth’s atmosphere was at these high levels during the Pliocene 3.3 million years ago, prior to the extraordinary climate stabilisation period of the Holocene. But due to the delay between GHG rise and thermal energy forcing we are now racing back into Earth’s distant past to the mid-Miocene 15 million years ago (de la Vega et al., 2020). Mean average temperatures (MATs) then were 3°C–4°C higher across the globe including the seas. Because oceans absorb the majority of excess heat and have lower levels of surface temperature increase than land, this translated into land temperatures that were between 7.5°C and 10°C higher than today (Xu et al., 2019).

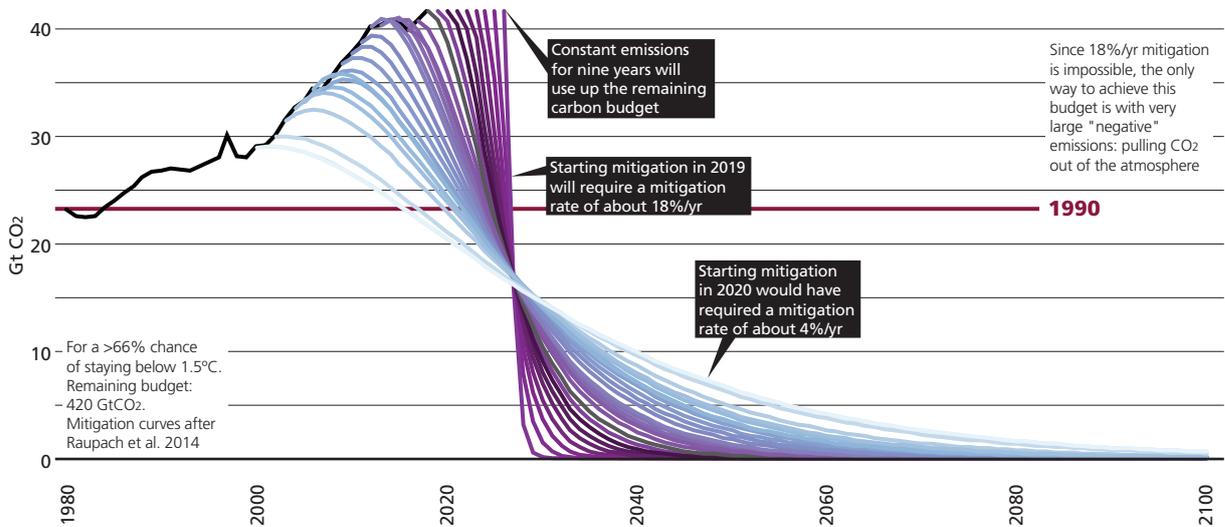
Even when using the unrealistically low near-linear projections along the “Business as Usual (BAU)” RCP8.5 path, or a three-degree MAT rise, one-third of the world’s population is likely to be exposed to mid-Saharan temperatures by 2070 (Xu et al., 2019): 7.5°C higher than in the 1880s, or MATs of over 29°C. This is far beyond any reasonable expectation for the survival of anything resembling today’s society, and even most species alive today, including *Homo sapiens*. The evidence is stark. Current global average temperature levels – nominally 1.2°C above industrial levels of the late 19<sup>th</sup> century – are already over 2°C above mid-18<sup>th</sup> century true pre-industrial levels. We watch helplessly as Arctic sea ice, the Greenland ice pack and global glaciers melt away like ice cubes on hot asphalt, while many of our forests, peatlands and wetlands now combust easily and frequently in Australia, South America, North America, Europe and across Siberia and the Arctic circle. Farmers and miners lend these fires a most unhelpful hand with their slash-and-burn accommodation of the voracious global hunger for soy beans, palm oil, beef and gold. Temperature increases and changing weather patterns due to increasingly erratic jet stream patterns triggered by Arctic heating makes this even worse. And yet, very little – if anything – is being done to try and halt it, let alone reverse its course. The EGD only vaguely and weakly points in a general direction and at too distant a target date. It could be seen as a step in the right direction, but without admitting its inadequacy it carries the risk of cementing complacency.

### The role of cities

Commercial energy is largely used in the building and transport sectors, making urban areas crucial to transforming the energy paradigm. Energy renewability, embodiment, efficiency and sufficiency continue to form a magic quadrangle that can guide immediate action. The great potential contribution to be made to transforming our immediate living environments and general place in the world is being missed in the EU’s so-called Green Deal, and by a wide margin. For example, by aiming at reductions relative to 1990 levels, it actually perpetuates a very high annual emissions level (Figure 1). It does not sufficiently seize the opportunities to lower carbon<sup>1</sup> emissions embodied in the production, maintenance, powering, heating and cooling of our residential environments, work spaces and the built environment in general.

1. “Carbon” here stands for *carbon dioxide equivalent greenhouse gas (GHG-e) emissions*: not all GHGs actually contain carbon.

**Figure 1: The minimum annual emissions reduction path required to adhere to the Paris Climate Agreement's 1.5°C aspirational ceiling with a 66% success perspective – compared to the 1990 baseline against which the EU's 90% reduction target by 2050 is set – is far too little and too late.**



Source: (Global Carbon Project, 2020; 1990 baseline superimposed by author).

Material carbon embodiment and biosequestration in particular offer potentially important growth: the future lies in nurturing a *negative-carbon* society (NCS). This strategy is essential to lowering the quantities of GHGs in the atmosphere, to keep our well-tempered greenhouse Earth from rapidly sliding into a hothouse state. However, the shift towards an NCS is not on the EGD's agenda. It should be amended to embrace the rapid proliferation of NCS principles and projects and their mobilisation across the EU's built environment production system. It is a call to reform and sustainably open the energy markets and structure them for sustainable, renewable resources by exposing costly fossil and nuclear power to their real costs, creating the required regulatory and policy frameworks and removing all the overt and hidden ways fossil fuels are subsidised with several trillion USD annually: the IMF reported 5.2 trillion USD global in such post-tax subsidies in 2017 (Coady et al., 2019). This is no longer just urgent, it has become manifestly and long overdue as a result of political delays and incumbent industry inertia. And, given the primacy of cities and urban areas in global human settlements, the Renewable City – urban environments, economies, movements and systems entirely reliant on renewable energy resources – is now an essential, even basic, precondition to any hope of stabilising the global climate (Droege, 2006). The future lies in a negative carbon cycle and, consequently, in highly carbon-retentive cities and regions.

A truly carbon-negative built and cultural environment removes, sequesters, stores and binds anthropogenic surplus greenhouse gases that are already in the atmosphere. Even this nominal balance will not be enough: a massive regenerative action agenda needs to enact "global gardening", the un-development and re-nurturing of Earth's biosphere. To turn this exceptional emergency into a survivable future will require virtually all the COVID-19 recovery funds (Whitlock, 2020) or other economic stimulus funding, and a repurposing of military expenditure and assignment of national and EU-wide climate defence budgets, many times the size of current defence budgets,

while engaging in intensive climate diplomacy. In these fraught, fragile and fractured times, if the EU does not lead, who will?

## I. Green Deal predicaments

The future lies in a negative carbon cycle and, consequently, in highly carbon-retentive cities and regions.

The delay tactics of incumbent interests and resistance to critical action over the past generation mean that today 100% renewable is no longer enough and the zero emissions target is set too high to meet climate stabilisation aims. We now know what some of us have long suspected: the United Nations Framework Convention on Climate Change (UNFCCC) targets and frameworks were not only far too loose and narrow but also aimed in the wrong direction: up, rather than down. Similarly, the projections of the Intergovernmental Panel on Climate Change (IPCC) have been notoriously scientifically slow and conservative – and in their summaries for policymakers influenced by both political pressure and wishful thinking. We can now plainly see that throughout the past decades of “climate negotiations” there was never a “carbon budget” to work with. It had already been depleted by the time the very image of a “carbon budget” was implanted in the dominant policymaking consciousness. Another long-held myth concerned the mechanical systems thinking that led to linear projections and simple-minded graphs showing how lowered emissions would directly correspond to lowered temperatures via the global climate and carbon systems. The fact is that by the late 1980s, when climate change began to be popularised in earnest, atmospheric CO<sub>2</sub> concentrations were already substantially above the long-term stable level of 280 ppm, namely at 350 ppm (NOAA, 2020). No evidence then – let alone now – suggests that such elevated levels would allow climate stability to be retained.

The most promoted and accepted of these comforting illusions, and already baked into the fallacious Kyoto Protocol, was the notion of emissions trading. Many popular “inconvenient truth” presentations and reports by climate protagonists from Al Gore to Prince Charles and Sir Nicholas Stern relied on this. A coterie of carbon compensation and offset scheme operators quickly began peddling their services in the 1990s to ride the offset guilt wave, for example in the putative greening of airline passenger miles. The unnerving notion of living inside a great and expanding excess carbon bubble was made to feel safe by the reassuring construct of the carbon “budget”. It is currently presented as being just above 400 Gt and will be “exhausted” at current emission rates in less than ten years. In truth it was exceeded back on June 10<sup>th</sup> 1986 when (then) NASA’s James E. Hansen, an early purveyor of the carbon budget myth itself, correctly predicted the very hot water humanity finds itself in now before a US Senate committee (US Congress, 2014; Mooney, 2016). Only two years later Hansen returned to Congress to assert that he was 99% certain that climate change had started (Shabecoff, 1988).

## II. Stuck in neutral: 100% is not enough – and 0 is too high

The EGD has been developed as *“a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth*

*is decoupled from resource use*" (EC, 2019: 2). This valiant summary statement is flawed: "no net emissions" is an inadequate aim, since CO<sub>2</sub> concentrations in the atmosphere today exceed levels from stable civilization-supporting times by 150% (and 300% in the case of CH<sub>4</sub> methane). To continue to aim at emissions neutrality is like trying to stop a car racing at high speed towards a brick wall by putting it into neutral. Unfortunately, "climate neutral by 2050" has also become an uncritically promoted and adopted target for many European cities (Salvia et al., 2021). To aim at a false, weak and distant target may be a far worse strategy than simply working to replace urban energy systems with renewables-based ones as quickly and practically as possible, and by whatever means.

The best future a revised EGD can aspire to is massive propagation of current knowledge in regenerative developments such as practical innovations in buildings, neighbourhoods and communities; here most importantly – and challengingly – it must tackle the existing building stock. Elevating the retrofitting and refurbishment of the energy-wasting building and plant stock to a European priority and making it the very foundation of construction and planning regulations is fundamental (here, the Renovation Wave for Europe that was launched as part of the EGD in October 2020 is a step in the right direction (EC, 2020a). It pales only in comparison to decarbonising and denuclearising the EU's energy sources and the dramatic shift away from coal, oil and gas, while finally retiring the all-too-slowly waning, costly and, in times of rising heat waves and drying rivers, increasingly dangerous nuclear reactor fleet.

The carbon budget myth has helped foster a widespread and tragic complacency. The EGD also fails to face up to the urgent challenge of endowing the building, transport, industrial and agricultural sectors with the ability to withdraw copious amounts of excess GHGs from the atmosphere and bind them in soils and materials, supporting biodiversity and sustainably managing increasingly scarce water resources. These simple means have existed as the basis of good land management for millennia. Largely lost today, they would help regenerate the natural photosynthetic systems on which we depend for life support. When urban agendas lead to major afforestation and carbon sequestration not only in products such as wood or carbon products for buildings but in agricultural soils, regenerated wetlands, mangroves and coastal areas, then cities can begin to help stabilise the climate.

Sustainability principles have emerged as urgent survivability measures, it's just that not everyone has noticed it yet. Relying on renewable energy, ending the combustion of fossil resources, ending carnivorous food culture and industrial agriculture, lowering atmospheric GHGs and binding them in soils and materials, shrinking lifestyle footprints, revolutionising water management and shoring up biodiversity supports are essential elements in NCS actions and demands for the built environment.

### III. Cities and regions embracing renewable energy

Imagine a world with abundant and ubiquitous energy for all, based only on sunshine, wind and water, powering and empowering our cities and communities from within at little or no resource cost, building local prosperity and strengthening security and social cohesion. Energy

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and energy technology represent an embedded dimension in this new world rather than an external source or supply system – an essential characteristic of cities rather than an imported commodity. This world is within reach not only because it is so easily imaginable and compelling, but because it is already developing across many cities, towns, businesses and communities today.

No more oil wells and pipelines, coal mines, radiation alarms or power decisions made behind closed doors. Instead, a diverse yet connected multitude of renewable transport, building and industry-integrated generation and transmission systems will supplant the centralised power behemoths of the 19th and 20th centuries. This new energy world is renewable and sustainable, local and global, continental and regional. It emerges as a loose and redundant – and hence more resilient – tangle of systems, kept energised by a myriad of consumers and providers, often and frequently switching roles. It links power, heating and cooling, storage and networks, stationary and mobile systems and agents. Applied in islands and across grids alike, it embraces utilities and networks as enablers and communities as accountable partners.

This new world liberates and empowers, resists control by monopolies and sidesteps attacks by terrorists alike. “Smart” network technologies and protocols support the smooth functioning and transactional accuracy of the system. Here, cities power themselves and their regions, providing their own industrial, transport, agricultural and residential energy. Indistinguishable from cities and their economies, the energy infrastructure will be financed and owned by communities, investors, users and producers. This is an equitable and exciting world of intelligent prosumers (or *conducers*, or, more accurately, *prod-users*), engaged city leaders, advanced self-sufficient industries and communal cooperatives made elegant, proficient and efficient by smart web architectures and information technology-based trading platforms.

And now imagine how to get there from here. The remainder of this chapter seeks to plot the plethora of possible pathways between the already achieved and the still needed in policy, practical, conceptual and visionary ways. The energy supply in the early 21st century is still overwhelmingly fossil fuel-based and kept centralised by the doggedly defended inertia of incumbent interests – but the great and dynamic transformation is already underway and tangibly active, from individual initiatives to industrial investments. What may seem utopian to some has already become a reality for others.

Cities are formed of and around energy infrastructure: they are increasingly interconnected and sophisticated bundles of generation, distribution, networking and storage systems bridging power, thermal energy and mobility, storage and networks. Urban centres and their neighbourhoods and districts, but also their wider regions, become particularly critical, if not essential, in the great energy transformation defining the 21st century – more tangibly so than in each of the sectoral domains of agriculture, industry or transport. This transformation follows a wider emerging trend: the rise of renewable electricity as paramount societal infrastructure around which thermal,

mobile, storage, network and, above all, power carrier and conversion strategies are woven, enabling ubiquitous energy harvesting, storage, dispatch and arbitraging – but also local trading and financial empowerment for individuals, neighbourhoods, districts and regions.

A haunting past is still with us: a vast GHG stream is constantly being pumped into an atmosphere that has long been oversaturated with fossil fuel exhausts, if we take the planet's ability to maintain a habitable temperature and biological equilibrium as the "saturation" gauge. This system has been in overshoot for at least a generation now, since we have long passed a 1°C and now perhaps even 2°C mean annual temperature rise above real pre-industrial levels. To bring it to a sustainably steady state, nothing short of an immediate and all-consuming massive emergency agenda akin to wartime mobilisation is required – a world at peaceful but constructive conflict with its own incumbent energy habits. When it comes to the organisation of societal action, cities could have an advantage over national governments: local communities can measure time and change in immediate and concrete outcomes. City and also state or provincial leaders are held accountable in more direct ways than national politicians can be. Many cities and urban alliances have emerged that are taking on the role of energy policymakers, innovators, contractors, producers, consumers and implementors in this transformation towards a renewable world.

Nowhere is this change felt more strongly than in shifts from old-style centralised power supply contracts to a ubiquitous world of energy markets, increasingly interconnected with if not defined by global, regional and local information systems. The actual shift to renewable energy may not yet have become quite mainstream, even in Germany where half of electricity is already provided by renewable sources. But the very idea has long galvanised an entire technology-savvy generation – not least because it fits the new decentralised paradigm of a networked society. The popular imagination of technology aficionados increasingly connects the idealised civic benefits of ubiquitous computing and telecommunications of the 1980s with those of an energy singularity, embracing encrypted electronic accounting systems providing access to every energy user on the grid, however small or large. The energy web (Droege, 2006) is here to stay and grow.

Cities and regions still rank among the most tangible and dynamic change agents in transformative energy policy and societal action worldwide. The steady rise of renewable energy policy adoptions and target setting measures among European urban centres and agglomerations is expressed not only in the numbers of active urban energy programmes but also in the rising popularity of renewable energy among voters and corporate constituents. A significant change since the late 2000s has been the sharp decline in the cost of renewable energy systems, their storage and production. This explains in part why strong progress and very substantial renewable energy transformations are being achieved by companies, countries, states and local communities against a background of persistent, even growing, policy resistance at some national but also EU levels, inspired by incumbent industries and dressed up as progressive-sounding "climate-neutral" policies (Droege, 2018).

The EGD would do well to adapt what I call a “regenerative European policy protocol”, which shifts towards a paradigm of renewable energy by focusing on individual and collective innovation across cities and regions.

#### IV. Regenerative European policy: the new energy market framework

Local, national and global proliferation of the principles underlying these initiatives has long been critical, even without policy, regulatory and market frameworks being fully adjusted. Unfortunately, in some jurisdictions, like Germany, they have become ever more onerous and complex. Simplification and bold adjustment to match the new technological – and climate – reality is urgently needed. The EGD would do well to adapt what I call a “regenerative European policy protocol”, which shifts towards a paradigm of renewable energy by focusing on individual and collective innovation across cities and regions. The EU needs to support its member states, regions and cities in the fundamental transformation of their economies, institutions and governance to enable the systematic replacement of inherited energy systems with distributed renewable energy infrastructures that are fully founded on new technologies and community benefits. This includes finding ways of regenerating and retrofitting existing neighbourhoods and their building stock.

Halting the current, accelerating slide into a climate abyss is the true meaning of “sustainability”: it has always been about “survivability”. The rising number of innovations provide the methods and projects for a sustainable development trajectory that is fast becoming a global paradigm. It is the very core, the seed, of overdue emergency action agendas. The initiatives that form Europe’s “seeds of the future” include the many extraordinary successes and advances in the proliferation of renewable energy already made: the powerful feed-in tariffs; the rise of 100% renewable buildings, communities and regions; the broad march of solar and wind into many countries’ power mixes; the revolution of national policies to embrace energy transitions; and the rise of renewable energy investment – which has long become the dominant mode in annual capital expenditures in new power generation capacity worldwide.

A renewable city supports and thrives on closer cooperation with its hinterland, region, nation-state and beyond. It relies on intelligent renewable energy networks that monitor a constellation of decentralised renewable energy plants and generators at varying scales. It will need improvements and extensions to existing energy supply infrastructures to improve integration, connection and, most importantly, increase accessibility to different types of renewable energy. Favourable and compatible spatial planning policies and guidelines at the urban, regional, federal and even EU levels will be sought to achieve equitable, safe and reliable flows and access to such energy sources.

Six market shifts are essential to construct a new, entirely emission-free urban energy agenda as the basis of a new market framework for Europe’s countries and community. These focus on a) *Proliferation of European and worldwide policies*; b) *Regulations*; c) *Technical support*; d) *Finance*; e) *Barrier removal*; and f) *Infrastructure and regeneration*. The European Association for Renewable Energy, EUROSOLAR, has developed, elaborated and promoted this New Energy Market Order (NEMO) over a number of years (see Eurosolar, 2013–2021).

## V. Negative carbon balance: Climate positive frameworks for the European city

The great carbon bubble our civilisation, its economy and our cities float on represents one of the greatest, most radical and rapid disruptors in the known history of this planet – even surpassing those that caused previous extinctions. The EGD seems unaware that without massive concerted action this has an existential inexorability. Its proposed actions require sharpening, emboldening and transforming in order to go “beyond the deal” –realising that this is not about creating yet another feeble “win-win” but to avoid the big lose-lose. Especially in cities this “beyond the deal” agenda of NCS – the negative carbon society – can and must become concrete, specific and tangible.

No city is an island. Only a renewable energy-based, net carbon concentration-lowering European economy can offer the foundation for the urban-focused negative carbon society that needs to be established urgently. Arithmetical neutralisation is not enough. Only by a) eliminating and b) reversing the flow of GHG emissions from construction, building (cement and other materials) and food (agriculture) production and consumption can we begin to rectify the direction of the emission vector – in other words, reverse it.

Because cities and their policy apparatuses have a powerful role to play in that transformation, they must receive more knowledge, technical and financial support in their efforts to face this great calamity. Local, national and global proliferation of the principles underlying the documented initiatives has long become critical – without current policy, regulatory and market frameworks having been sufficiently adjusted. To articulate the call for action, we propose what we call a “Regenerative City Protocol”, a set of paradigms and principles that support the regeneration of cities and regions and the complete shift towards renewable energy. It also supports government guidance for individual, community, industry and research innovation in adopting carbon sequestering construction and manufacturing processes. The fostering of biodiversity is fundamentally a core urban and regional planning task. European cities and urban communities are challenged to promote ecologically much more accountable and aware lifestyle choices and consumption patterns, including urban integrated and peri-urban organic and carbon-negative agricultural supply systems.

It is a call to Europe, its member states and cities – as well as regions, nations and cities elsewhere – to stand up and support fundamental transformations in the economy, institutions and governance. This is the only way to systematically replace inherited energy systems with distributed renewable energy infrastructures founded on new technologies and community benefits – a fundamental requirement for a broad draw-down agenda for destabilising atmospheric carbon. Crucially, it also involves finding ways of regenerating and retrofitting existing neighbourhoods and their building stock – moving to renewable energy surplus production and simultaneous negative carbon flows. Other paramount policy targets include investments in regenerative agricultural and forestry transformations, building and industrial carbon entombment practices, and rapid coal, natural gas and petroleum phase-out paths.

The Circular Economy (EC, 2020b; EP, 2020) is well-placed to become the basis and driver of a negative carbon economy. For the moment, it remains a weak and weakly applied guidance instrument: only a small fraction of the EU's resource stream is reused or recycled. But circular economy processes must be strengthened in a way that ensures that agricultural, building and construction, road infrastructure, energy and industrial processes become carbon sequestering, in wood or other atmospherically extracted carbon rich materials such as algae-derived carbon fibre. At the same time, fundamentally flawed technologies such as nuclear power, natural gas as "transition energy", "clean coal" and carbon capture and storage (CCS) – a not only costly but also technically disconcerting and impractical technology – must be strenuously avoided.

At the time of writing, the COVID-19 pandemic stalks Europe and the world. Many trillions of dollars and euros are being created by central banks to shore up faltering economies. Far too much of this is being applied to subsidise toxic, old and fossil-fuelled industries. The existential opportunity for the European Central Bank is to designate all of these funds to a broad restructuring and regeneration of the European economy (Eurosolar, 2020). In this way cities and distributed urban infrastructures become empowered as both engines and focusses of a green economic renaissance and meaningful urban metabolism of truly planetary significance.

## References

Coady, D., Parry, I., Le, N.-P., Shang, B. Global Fossil-Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates. 2019. [Accessed on 23.12.2020]: <https://www.imf.org/en/Publications/WP/Issues/2019/05/02/Global-Fossil-Fuel-Subsidies-Remain-Large-An-Update-Based-on-Country-Level-Estimates-46509>

Droege, P. "The Great Transformation: Cities and Regions Embracing Renewable Energy". In: Droege, P. (ed.) *Urban Energy Transition – Renewable Strategies for Cities and Regions*. Elsevier, 2018.

Droege, P., Genske, D. D., Ruff, A. and Schwarze, M. "Building Regenerative Regions Rapidly: The STAR Energy Model as Regional Planning Tool" in: Droege, P. (ed.). *Urban Energy Transition – Renewable Strategies for Cities and Regions*. Elsevier, 2018.

Droege, P. *Renewable City – a comprehensive guide to an urban revolution*. Wiley, 2006.

Eurosolar. New Energy Market Order NEMO, 2013–2020 (online). [Accessed on 18.12.2020]: <https://www.eurosolar.de/en/index.php/text-and-media/memoranda-papers-eurosolar/755-new-energy-market-order-nemo>

Eurosolar. Regenerative Earth Decade: 100% are only the beginning, 2020 (online). [Accessed on 18.12.2020]: <https://www.eurosolar.de/en/index.php/text-and-media/press-releases-eurosolar/938>

EC - European Commission. *The European Green Deal*, 2019 (online). [Accessed on 18.12.2020]: [https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN&https://ec.europa.eu/info/sites/info/files/european-green-deal-communication\\_en.pdf](https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN&https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf)

EC – European Commission. *A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives*. Brussels, COM(2020) 662 final, 2020a (online). [Accessed on 18.12.2020]: [https://eur-lex.europa.eu/resource.html?uri=cellar:0638aa1d-0f02-11eb-bc07-01aa75ed71a1.0003.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:0638aa1d-0f02-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF)

EC - European Commission. *The Circular Economy Action Plan*. Brussels, COM(2020) 98 final, 2020b (online). [Accessed on 18.12.2020]: [https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC\\_1&format=PDF](https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF)

EP - European Parliament. *The Circular Economy, 2020* (online). [Accessed on 18.12.2020]: <https://www.europarl.europa.eu/thinktank/infographics/circulareconomy/public/index.html>

Friedmann, L. "What is the Green New Deal? A Climate Proposal, Explained". *New York Times*, 21 February 2019 (online). [Accessed on 18.12.2020]: <https://www.nytimes.com/2019/02/21/climate/green-new-deal-questions-answers.html>

Global Carbon Project, 2020 (online) [Accessed on: 18.20.2020]. [https://www.globalcarbonproject.org/global/images/carbonbudget/Infographic\\_CarbonAtlas2015.jpg](https://www.globalcarbonproject.org/global/images/carbonbudget/Infographic_CarbonAtlas2015.jpg); [https://folk.universitetetioslo.no/roberan/img/GCB2019/PNG/s00\\_2019\\_Mitigation\\_Curves\\_1.5C.png](https://folk.universitetetioslo.no/roberan/img/GCB2019/PNG/s00_2019_Mitigation_Curves_1.5C.png)

Kılıç, Ş. "Benchmarking the sustainability of urban energy, water and environment systems and envisioning a cross-sectoral scenario for the future". Elsevier ScienceDirect. *Renewable and Sustainable Energy Reviews*. Vol. 103, April 2019, pp. 529–545.

Mooney, C. "30 years ago scientists warned Congress on global warming. What they said sounds eerily familiar", *The Washington Post*, 2016 (online). [Accessed on 18.12.2020]: <https://www.washingtonpost.com/news/energy-environment/wp/2016/06/11/30-years-ago-scientists-warned-congress-on-global-warming-what-they-said-sounds-eerily-familiar/>  
NOAA - National Oceanic and Atmospheric Administration, Earth Systems Research Laboratory, 2020: <https://www.esrl.noaa.gov/gmd/ccgg/trends/monthly.html>

REN21. *Global Renewable Energy Status Report 2017*, (online). [Accessed on 22.01.2018]: [http://www.ren21.net/wp-content/uploads/2017/06/17-8399\\_GSR\\_2017\\_Full\\_Report\\_0621\\_Opt.pdf](http://www.ren21.net/wp-content/uploads/2017/06/17-8399_GSR_2017_Full_Report_0621_Opt.pdf)

Salvia, M. , Reckien, D., Pietrapertosaa, F., Eckersley, P., Spyridakie, N.-A., Krook-Riekkola, A., Olazabal, M., De Gregorio Hurtadoh, S., Simoes,S.G., Geneletti, D., Vigiú, V., Fokaides, P.A., Ioannou, B.I., Flamos, A., Szalmane Csete, M., Buzasi, A., Orrun, H., de Boer, C., Foley,

A., Rižnar, K., Matosovi, M., Balzan, M.V., Smigaj, M., Baštáková, V., Streberova, E., Belšak Šel, N., Coste, L., Tardieu, L., Altenburg, C., Krkoška Lorencová, E., Orru, K., Wejs, A., Feliu, E., Church, J.M., Grafakos, S., Vasilie, S., Paspaldzhiev, I., Heidrich, O. "Will climate mitigation ambitions lead to climate neutrality? An analysis of the local-level plans of 327 cities in the EU". Elsevier ScienceDirect. *Renewable and Sustainable Energy Reviews*. 135 (2021) 110253, 2021.

Schwartz, T. and Trump, D. *The Art of the Deal*. Random House, 1987.

Shabecoff, P. "Climate Change Has Begun, Expert Tells US Senate", *The New York Times*, 1988 (online). [Accessed on 18.12.2020]: <https://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>.

US Congress. CLIMATE CHANGE; Congressional Record Vol. 162, No. 94. June 14, 2016 - Issue: Vol. 162, No. 94 — Daily Edition, 2014 (online). [Accessed on 22.01.2020]: <https://www.congress.gov/congressional-record/2016/6/14/senate-section/article/S3871-3>

de la Vega, E., Chalk, T. B., Wilson, P.A., Bysani, R. P. and Foster, G. L. "Atmospheric CO<sub>2</sub> during the Mid-Piacenzian Warm Period and the M2 glaciation", *Nature. Sci Rep* 10, 11002, 2020 (online). [Accessed on 22.01.2020]: <https://doi.org/10.1038/s41598-020-67154-8>

Ward, B. *Spaceship Earth*. Columbia University Press, 1966.

Whitlock, R. "Eurosolar appeals to European policymakers to use the opportunity presented by COVID-19 to fight climate change". *Renewable Energy Magazine*, 2020 (online). [Accessed on 18.12.2020]: <https://www.renewableenergymagazine.com/panorama/eurosolar-appeals-to-european-policymakers-to-use-20200506>

Xu, C. (徐驰), Kohler, T.A., Lenton, T.M., Svenning, J.-C., Scheffer, M. "Future of the human climate niche", *PNAS* 117 (21) 11350-11355, 2020 (online). [Accessed on 18.12.2020]: [www.pnas.org/cgi/doi/10.1073/pnas.1910114117](http://www.pnas.org/cgi/doi/10.1073/pnas.1910114117)