Towards a First Philosophy of the Bio-Based Economy

Roel Veraart

Propositions

1. The Bio-Based Economy (BBE) is not yet an economy that is literally based on the limits of the biosphere such as the Earth's carrying capacity.
   (this thesis)

2. Current biorefining practices still operate within the traditional, productivist paradigm of energy as fuel.
   (this thesis)

3. A radical economic paradigm shift beyond neoclassical liberalism is necessary to address the climate crisis, promoting sustainability, social justice, and ecological integrity.

4. The Digital Revolution automates cognitive labour.

5. The ubiquitous spread of smartphones indicates a moral failure in contemporary society that demands a rethinking of our values and priorities.

6. Nicholas Georgescu-Roegen was correct when predicting that: "Perhaps, the destiny of humankind is to have short, but fiery, exciting and extravagant life rather than a long, uneventful and vegetative existence." (1976, 35) Georgescu-Roegen, N. (1976). *Energy and Economic Myths.* New York: Pergamon Press.

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Colophon

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Towards a First Philosophy of the Bio-Based Economy

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Chapter 1 – Introduction

Introduction

The need for a New Economic Paradigm

Today, society faces serious environmental challenges. In order to mitigate climate change, the European Union invests into projects such as the Bio Based Economy (BBE). The main ambition of the BBE is to design an economic system that operates within the biophysical limits of planet Earth. It seeks to do so by building on the idea of: "an economy that relies on renewable natural resources to produce food, energy, products and services. The BBE will reduce our dependence on fossil natural resources, prevent biodiversity loss and create new economic growth and jobs in line with the principles of sustainable development" (Bosman & Rotmans, 2016). This is to be achieved by basing our economic system on the biosphere, which means imitating natural metabolisms and cycles that emit zero waste and are renewable in the long term. Current BBE-strategies to realise this comprehensive economic transition for example consist in establishing renewable production processes, optimizing energy usage efficiency, innovating for technological solutions and replacing fossil fuels with natural inputs.

There is a lot at stake in the project of the BBE. It has become evident that current linear economic systems are depleting the planet's resources and hitting ecological tipping points, beyond which future socioecological catastrophes will be inevitable. Human-induced climate change is the core problem to which the BBE should provide a response. As such, the very survival of humankind is a central concern behind this project of transforming economic behaviour into a sustainable paradigm. Furthermore, accomplishing that feat is a major challenge which concerns producers, governments, businesses, consumers and scientists. Changing the economic landscape and its infrastructures at large is a societal challenge of which the difficulty can hardly be overestimated.

The urgency, scale and complexity of the project of the BBE make it so that an unprecedented, interdisciplinary effort is required in the sciences. Empirically, every major discipline must be involved. Biologists are figuring out how to mutate algae for waste processing, physicists and chemists are looking for new energy solutions, engineers are innovating more than ever, and so on. The BBE includes solar and wind fields, biorefineries, forestry, agriculture, fishing, water management, and much more. Establishing fluent cooperation between all these parties around the objective of future sustainability requires a common understanding, a shared vocabulary, broad consensus and a unified, feasible strategy – none of which have been successfully realised as of yet. In fact, the theoretical development of the BBE is still in its infancy. There are many concepts and definitions of importance surrounding the term 'bioeconomy', such as Circular Economy (CE), biomimicry (Benyus, 1997) and cradle-to-cradle (Bosman and Rotmans, 2017). The exact definitions of and relations between these concepts, as well as the specific policies and practices attached to them, remain unclear. For example, the concept of a bioeconomy has itself been understood in many different ways from many different scientific and economic perspectives, such as biomass-based, degrowth, science and innovation based, and more.

Already more than a decade ago, the European Commission itself has called for "clear and unambiguous" standards, including a "common context" for discussing how economic sectors and companies can be engaged in the BBE (EC, 2012). These standards have hitherto failed to become a reality (Vivien et al., 2019; Stagner, 2022; Rafiaani et al., 2018). One of the explanations for this failure consists in a fundamental conceptual ambiguity in the ideal of the BBE; it has been unclear whether the BBE is primarily a metaphor (i.e. a rhetorical concept merely inspiring minor recycling practices) or a necessary, *normative* goal of transforming the economic system towards one that operates within the carrying capacity of planet Earth (Pfau et al. 2014; Asveld et al. 2019; Blok, 2022). For example, Jonker et al suggest that if companies adopt BBE in their business practices, it is often still a side event and not part of their core-business (2017). This ambiguity is persistently present in dominant conceptualisations of bioeconomies and calls – especially in the context of the interdisciplinary scientific endeavour – for philosophical reflection on the basic concepts and values involved in the BBE.

The current issues in the model of a BBE are not just a technological, scientific or a policy problem but indicate a fundamental conceptual lack of clarity. In response, this research aims to investigate the conceptual structures at stake in the contemporary discussion on the relation between the biosphere and the economic system, to gauge which consequences a normative understanding of sustainability has for businesses operating in the BBE. A dedicated philosophy of the BBE does not yet exist, but could be exactly what is required in this context. By involving alternative perspectives, looking at the bigger picture from multiple angles, critically engaging with the (discrepant) semantics involved in the core concepts and offering constructive insights from its rich tradition of thought, philosophy can provide an indispensable addition to the project of the BBE at large. A philosophical analysis of the BBE could gauge, for instance, how realistic a closed cycle of full renewability (Circular Economy within a BBE) actually is: how similar are the cycles of *oikos*-nomos and *oikos*-logos, and what differences remain truly insurmountable? An answer to such questions could prove ethically helpful as the principles that can be called bio-based inasmuch as they derive from nature are not self-evidently ethical: in natural cycles, entire species go extinct, which would be unacceptable in human ones (cf. Blok and Gremmen, 2016).

As the novel notion of 'bioeconomics' correlates two opposite spheres, in this research project we will, firstly, explore the precise nature of the relation between the biosphere and the economic sphere that is presupposed in the BBE discourse. The encompassing aim of clarifying this relation in this research project is to formulate a consistent concept of a bioeconomy. Providing a first philosophy of the BBE, the project contributes to our understanding of the challenges and the developmental potentials of the BBE in the natural and material sciences. Furthermore, developing a clear, fundamental conceptual framework is necessary to understand the normative character of the BBE and its practical efficiency in terms of genuine sustainability, i.e. in a literal sense of basing the economy upon the biosphere.

Questions that need to be asked in this context include: if BBE and CE are to function as normative design-principles, must not the consistent entanglement of economic benefits and ecological constraints be carefully weighted by more than the current boundaries of the market-economy? Related to this is the problem of Jevons's Paradox: if sustainable production becomes more efficient, production only tends to intensify, resulting in the same ecological harm as before, instead of saving energy and resources by producing the same amount but more efficiently. This paradox of

optimalisation leading to more production and more consumption does not correspond to the ideal of the BBE to establish a different, new economy altogether, one that goes beyond the current paradigm of control, management, efficiency, growth and exploitation, and actually operates within the carrying capacity of the biophysical system of planet Earth. If the normative aspect of the notion of a BBE is not adequately worked out, the BBE might be misapprehended by individual actors as a new way of doing business-as-usual, in which biomass is primarily conceived of as a source of added value for economic returns (e.g. minor recycling efforts). These tensions comprise the context of our research problem.

How to Base an Economy upon Natural Cycles?

The primary aim of this dissertation is to employ philosophy to make an empirically informed contribution to the concrete yet also all-encompassing problem of the climate crisis. Philosophical concepts will be used to improve upon the conceptuality of the BBE, working towards the establishment of a common vocabulary for it. Critically engaging with both the official policies of the BBE-strategy and the scientific literature surrounding the ideas and practices of bioeconomies, the major concepts at play will be questioned, scrutinised and rearranged by involving alternative perspectives. By thus critically dissecting the general project of the BBE, this dissertation aims to provide a *conceptual contribution* to this project. We will show what assumptions remain implicit, which elements are disregarded, which notions are contradictory and why, and investigate the manner in which problems and solutions are articulated and framed. As such we aim to contribute to the foundation of an unambiguous standard, a common context and a shared conceptuality in the case of the BBE, as is called for by the EC (2012; 2014). The general research question of the dissertation as a whole is:

> *How can the idea of a bioeconomy be conceptualized to inspire economic practice that operates within the carrying capacity of the biosphere?*

The second major question, which should be understood as a sub-question to the general research question, is:

> *What explains the dominance of ecomodernism in current BBE-strategies and what critique of it would be required for a transition into a sustainable system?*

Accordingly, we derive three general research objectives; 1. Clarify the basic relation between the biosphere and the economic sphere in the BBE; 2. Investigate the consequences of this basic relation for the human condition, asking how the normativity of the notion of a BBE can be understood as an environmental perspective, inspiring sustainable production *and* consumption; 3. Investigate the consequences of these basic relations for our understanding of biobased technology, which enables the execution of the BBE-project but is also itself the subject of fundamental critique, as many BBE-related activities remain fossil-based today.

A Critical Analysis of the BBE's Fundamental Concepts

The research as a whole is a critical philosophical response to the major policies, concepts and practices at stake in the design of a BBE. Each chapter focuses on a specific element of this encompassing strategy, asking what 'biobased' means, what it could mean otherwise, and hypothesising what it maybe should mean. It asks what a 'transition' into a sustainable system would look like, and why the required, radical transformation has not taken place yet. We demonstrate that the BBE has not yet materialized as an 'actual' *biobased* economy. More pointedly, Chapter 2 argues that the current conceptualization of the BBE is closer to an *economy-based* economy (EBE); Chapter 3 argues how the current conceptualization of the BBE is more of a *human-based* economy (HBE) than a biobased one; and Chapters 4 and 5 argue that the current conceptualization BBE is primarily a *technology-based* economy (TBE).

Beyond the critical analysis of core concepts in the BBE, we also offer constructive ideas from the philosophical tradition to show alternative possibilities and pathways for the future development of a real bio-based economy that contributes to sustainable development. As both ecology and economy investigate the reciprocity between organisms and environment, these relations require a fundamental reflection on what it means, ontologically, to act within the carrying capacity of our home, our Earth. Elaborate theories on these relations already exist in the philosophical tradition. Therefore, instead of reinventing the wheel ourselves, we closely analyse the conception of economy in relation to ecology in the works of Emmanuel Levinas. Accordingly, for the relation between economy and technology, we turn to the philosophy of Bernard Stiegler.

We will start our research in chapter 2 by discussing the concept of Bio-Based Economy (BBE) from a philosophical perspective, aiming to clarify the semantic discrepancies of the BBE and to offer alternative perspectives. The main ideal of the BBE is identified as making the economy similar to biological processes, such as the circularity of natural ecosystems, energy cycles and the Earth's carrying capacity. However, the BBE has not yet set out a clearly delineated route into sustainability. We discuss the work of Emmanuel Levinas, who thinks about economy in relation to ecology as the metabolic manner in which humans always already exist. Two major concepts from Levinas are discussed: the concept of uncontrollable, elementary nature and the purpose or function of the BBE in the form of the human condition. Without a solid concept of elementary nature, it is impossible to indicate clearly the boundaries of the biosphere in which a bioeconomy should operate. Without an explicit place for the human condition in BBE-policy, the system is at risk of reducing the human condition into purely economic functioning. Accordingly, to compare and complement Levinas's insights, the chapter discusses the work of Nicholas Georgescu-Roegen, who debunks multiple 'energy myths' that still guide our concepts regarding biobased practice today. The alternative conceptualisations of ecological economy in Levinas and Georgescu-Roegen open novel ways of thinking about the grand themes at stake in a project that at its core is supposed to respond to today's environmental challenges.

In chapter 3 we will continue to analyse the Bio-Based Economy with specific regards to its relation to the human condition, further exploring the Levinassian concepts of elementary nature and enjoyment beyond economy as the human condition. We will argue that at the core of the BBE project is a tenacious ambivalence, as humans are inherently destructive towards the biosphere and yet, on the other hand, have no choice but to control and dominate the natural world in order to fulfil their economic desires – even without any maleficent intent. This ambivalence is reflected in BBE policies,

which attempt to sustain life while still exploiting natural resources. We therefore further analyse the human tendency to prioritize enjoyment over sustainability, which is leading to a detachment from ecological concerns. We will find that enjoyment is located on the verge of the contradictory structures at stake, including the paradox between growth and sustainability, control and uncontrollability, and the discrepancy between the direct sensibility and the harmful consequences of consumption.

Subsequently, a thematic shift is made in chapters 4 and 5. From analysing the role of individual human beings in both ecological and economic systems, the focus now moves to understanding why humanity collectively fails to become genuinely sustainable by actually basing economics on ecological principles. In chapter 4, we still ask here how to conceptualize the idea of a bioeconomy in such a way that it can inspire economic practice that operates within the carrying capacity of the biosphere. However, the focus is now on explaining humanity's collective failure to become sustainable and literally base economics on ecological principles. We analyse the two major paradigms of current literature on biobased practice: the techno-optimist approach of ecomodernism and the romantic ideal of degrowth theory. The dominance of ecomodernism in BBE strategies is explained, and it is shown how a critique of it is required for a transition into a sustainable system.

Finally, in chapter 5, we continue the discussion of ecomodernism and the libidinal economy in the context of the Bio-Based Economy. We argue that the dominance of ecomodernism in BBE-strategies needs to be critically evaluated in order to transition into a sustainable system. Bernard Stiegler's theory of the libidinal economy is explained. This theory holds that human, unconscious desires have been shaped over time by technological structures. We suggest that the mode of human existence needs to be adapted and modified in order to achieve long-term sustainability, and that this involves overcoming a degraded mode of desire which is focused on short-term, finite, instant gratification rather than long-term, structural investments into an infinite future. We critically state that current bioeconomic practice is caught up in traditional economic structures, which are driven by the need for constant innovation, meeting targets of energy production and competing with other energy producers. We suggest that the economy is not yet based on the biosphere in the current version of a bioeconomy. Rather, the biosphere continues to be exploited in the service of economy. We discuss Schumpeter’s creative destruction and Jevons’s paradox to clarify the techno-economic situation of chronic innovation, which leads to an increase of both production and consumption. We defend the hypothesis that the addition of the existential dimension in the conceptualization of a successful bioeconomy offers a third option in the classification of types of bioeconomy, which must be explored if a true solution to the problem of energy in the BBE is ever to be conceived of.

Chapter 2 – Towards a Philosophy of a Bio-Based Economy: A Levinassian Perspective on the Relations between Economic and Ecology Systems

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Towards a Philosophy of a Bio-Based Economy: A Levinassian Perspective on the Relations between Economic and Ecology Systems

This chapter investigates the fundamental idea at stake in current bioeconomies such as Europe's Bio-Based Economy (BBE). We argue that basing an economy upon ecology is an ambivalent effort, causing confusion and inconsistencies, and that the dominant framing of the damaged biosphere as a market-failure in bioeconomies such as the BBE is problematic. To counter this dominant narrative, we present alternative conceptualisations of bioeconomies and indicate which concepts are overlooked. We highlight the specific contradictions and discrepancies in the relation between economy and ecology, and then work towards outlining a genuine and consistent conceptualisation of the BBE. The philosophical perspective of Emmanuel Levinas is employed to develop a more profound understanding of the tensions at stake; Levinas' work is compared with that of Nicholas Georgescu-Roegen's work on bioeconomics, and found to be of complementary value. Our hypothesis is that, rather than the impossible, absolute amalgamation of economy and ecology striven for today, a principal heterogeneity between humankind and nature must be acknowledged if a bioeconomy that truly operates within the carrying capacity of planet Earth is to be achieved.

1. INTRODUCTION

One of the most important concepts for addressing environmental challenges is the 'Bio-Based Economy' (BBE) – a new economic system, into which the European Commission (EC) has already intensively invested (see McCormick and Kautto 2013, 2589–2593). This transitional concept faces many difficulties, however, as it currently remains ambiguous whether the BBE is primarily a metaphor (i.e. a rhetorical move inspiring merely minor recycling practices) or a necessary, *normative* goal of transforming the economic system towards one that operates within the carrying capacity of planet Earth (Pfau et al. 2014, 1232f; Asveld, Osseweijer and Posada Duque 2019a).1 As this ambiguity is persistently present in the current, dominant understanding of bioeconomies, we seek to explore the precise nature of the relation between the biosphere and the economic sphere.

The EC itself repeatedly emphasises the current need for a 'clear and unambiguous standard', including a 'common context' for discussing how economic sectors and companies can be engaged in the BBE and an operationalisation of 'all pillars of sustainability – environmental, social and economic' (European Commission 2012, 13f). This call stresses, for example, that guiding concepts such as sustainability, Life Cycle Thinking and Circular Economy (CE) are still in need of thorough clarification. In consequence, it can be seen how the general project of establishing a bioeconomy might benefit significantly from the establishment of a common language, including a consensual vocabulary, more transparent conceptualisation and generally accepted semantics (Parada et al. 2018, 32–42). Therefore, providing a philosophy of the BBE will also contribute to understanding the challenges and developmental potential of the BBE within the natural and social sciences.

In this chapter, we aim to contribute to a consistent and common understanding of the main idea of a bioeconomy: to base economy upon *bios*. We show how the BBE does not, currently, fulfil its supposed normative role. Recent studies indicate that although the idea of the BBE is promising, actual practices remain marginal. If companies adopt the BBE in their business practices, it is often still as a side event and not part of their core-business plan (Jonker and Faber 2017, 21). For most contemporary economic actors, the BBE is understood as a new way of doing business-as-usual, in

which biomass is primarily understood as a source of added value for economic returns, e.g. ancillary recycling projects. Consequently, the concept of a BBE is still fundamentally determined by economic principles that hinder the transition into a system that is inherently sustainable, i.e. based on the intrinsic limits and possibilities of the biosphere (Richardson 2012, 284f).

In what follows, we outline alternative conceptualisations of the notion of a bioeconomy, such as Nicholas Georgescu-Roegen's (1971; 1975a) vegetative version. We contrast these with contemporary bioeconomic models and provide an elaborate analysis of Emmanuel Levinas' (1963; 1969; 1998) phenomenological perspective on economy to clarify these discrepancies. Our hypothesis is that primary human tendencies directed towards 'enjoying life' conflict with tendencies to embed our living patterns sustainably into the carrying capacity of planet Earth. While these tendencies might explain the BBE's overly narrow focus on economic linearity in terms of growth, competition, production and consumption, they also provide insight into the ambiguity of contemporary policies and the principal impediments to mitigating climate change they cause.

Our argument starts by displaying – and disambiguating – the current conceptualisation of the BBE. We position ourselves within current debates and carry out an initial, descriptive investigation of the semantics currently at stake regarding the idea of a bioeconomy. Next, we explain our methodology, analyse Levinas' understanding of economy and pursue a comparative discussion of his conceptual contribution. The main analysis focuses on the relation between economy and ecology and uncovers a realm of qualitative concepts that are notably absent from current policy. In the final section, we summarise the outcomes of the research and display the main differences between models like the BBE and the concept of a genuinely bio-based economy.

2. THE BIO-BASED ECONOMY – CURRENT SITUATION

It is evident nowadays that linear economic systems based on fossil fuels and other non-renewable resources are rapidly depleting the Earth's ecological capacities and hitting insurmountable bioecological limits, resulting in the socioecological catastrophe that is human-induced climate change. In Europe, one of the major response strategies has been the transition towards a BBE. The European Commission has defined the BBE as a system comprised of:

> 'Production paradigms that rely on biological processes and, as with natural ecosystems, use natural inputs, expend minimum amounts of energy and do not produce waste as all materials discarded by one process are inputs for another process and are reused in the ecosystem' (EC, 2012a: 22).

However, there are many concepts and definitions of importance surrounding the term 'bioeconomy', such as Circular Economy (CE), biomimicry and cradle-to-cradle (Bosman and Rotmans 2017). Furthermore, the concept of bioeconomy has itself been understood in many different ways.

In order to frame the scope of our inquiry, and to make general sense of the main conceptualisation at stake, we must first attempt to dismantle some ambiguities. The concept of bioeconomy has been recently classified into three types (Vivien et al. 2019, 189–190). Type I, coined by Georgescu-Roegen (1971), concerns a degrowth conceptualisation. This type of bioeconomy recognises the explosive nature of our exponentially growing economy and argues we should make fundamental, qualitative changes in our economic system and respect the ecological limits this system is founded upon to survive as a species. Type II is the 'science-based bioeconomy', in which technological innovation is seen as the key factor for solving ecological problems. This perspective is paradigmatic of

contemporary tendencies but can also be seen to offer an 'economy of promises' (Jasanoff and Kim 2015; Vivien et al. 2019, 194). Finally, Type III is the 'biomass-based economy', which is closest to the strategy put forward by the EC. This type is not as technology driven as Type II, but focuses on forestry, agriculture, fishing, chemistry and the use of biorefineries, aiming to transform biomass from a diversity of resources. Type III is not yet fully fossil-fuel free but might become sustainable in the future (Asveld 2019b, 6f).

Types II and III currently dominate both the vision and practice of Type I – a situation that Franck-Dominique Vivien and colleagues (2019) define as the 'hijacking of the bioeconomy' (195). These types fit together closely (both to each other and to contemporary economic tendencies) and oftentimes intertwine or overlap. Though opting for relatively 'weak' sustainability, they receive by far the most attention, support, resources, energy and investments. Both seek to maintain traditional economic growth as well as general comfort and consumption, and put their hopes in potential future projects (see Birch, Levidow and Papaioannou 2010, 2903f). Although this might already give a clear indication as to why people might intuitively prefer II and III over I, we seek to deepen this understanding and connect it to principal tendencies within the human condition.

In recent years, the policy concept promoted most actively by the EU is the Circular Economy (CE) (EC 2014). This shift is justified and relevant, as both BBE and CE are design-principles with the shared goal of effectively closing material cycles, just as nature does with biomass. Furthermore, CE in general poses a stronger form of sustainability than bioeconomies of Type II and III (Ellen MacArthur Foundation 2015; Raworth 2017; Murray, Skene and Haynes 2017, 373f).2 Yet, the addition of CE into the general conceptualisation of a bioeconomy only complicates the task of providing an encompassing definition further because CE is itself already being approached from a variety of perspectives.

Julian Kirchherr and colleagues (2017) have gathered and analysed 114 existing definitions of CE in 17 dimensions and formulated the following definition:

> 'A circular economy describes an economic system that is based on business models which replace the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations' (Kirchherr et al, 2017: 224).

There are two more concepts of importance here. First, the concept of 'biomimicry' has become a common denominator for the imitation of nature's models in technological designs (see Benyus 2002; Blok and Gremmen 2016; Dicks 2017). Indeed, taking inspiration from nature has become a prevalent strategy in current technological innovation (e.g. surgical instruments based on octopus arms). The design of a 'bioeconomy' is nature-inspired as well, but on the macro-level of global systems and cycles, rather than specialised devices and mechanisms. Second, the 'cradle-to-cradle' concept forms an essential aspect within this analogy; it views ecological cycles, in which all resources are cyclically regenerated, as a primary inspiration for economic systems (McDonough and Braungart 2002, 13f). These systems should imitate natural patterns wherein no energy is lost in the transition from usage to depletion.

This multitude of fundamental concepts creates confusion and inconsistencies, as the EC admits (2012, 11). There is not yet a single, clearly framed 'bioeconomy' to focus joint efforts upon as, whether

semantic, conceptual or in practice, each definition has its own shortcomings. In an attempt at conceptual unification, we present Figure 1. This, admittedly imperfect, yet both pragmatic and paradigmatic visual representation of the CE provides a first step towards comprehending the general, underlying idea of the concepts of BBE, CE, biomimicry and cradle-to-cradle. The depiction can be seen as a biomimetic effort to base human designs upon processes in the biosphere; systems of biological and technical nutrients (top) are aimed to function analogously, namely as ecological circularity. The biological ingredients – biomass – (left) can, after consumption (centre), be safely re-introduced into the biosphere, instead of resulting in redundant waste, similar to the energy reuptake from compost by vegetal species (cradle-to-cradle). Technical, non-consumed materials (right) cannot be recovered in the same way, yet the aim is to establish an analogous metabolism in which all used materials provide renewed inlet (far right) for the next production cycle. Such an objective is typical of Type II and III bioeconomies, which – rather than adapting the internal economic system to fit ecological boundaries – pose a promise of sustainability through technological innovation and biomass-usage.

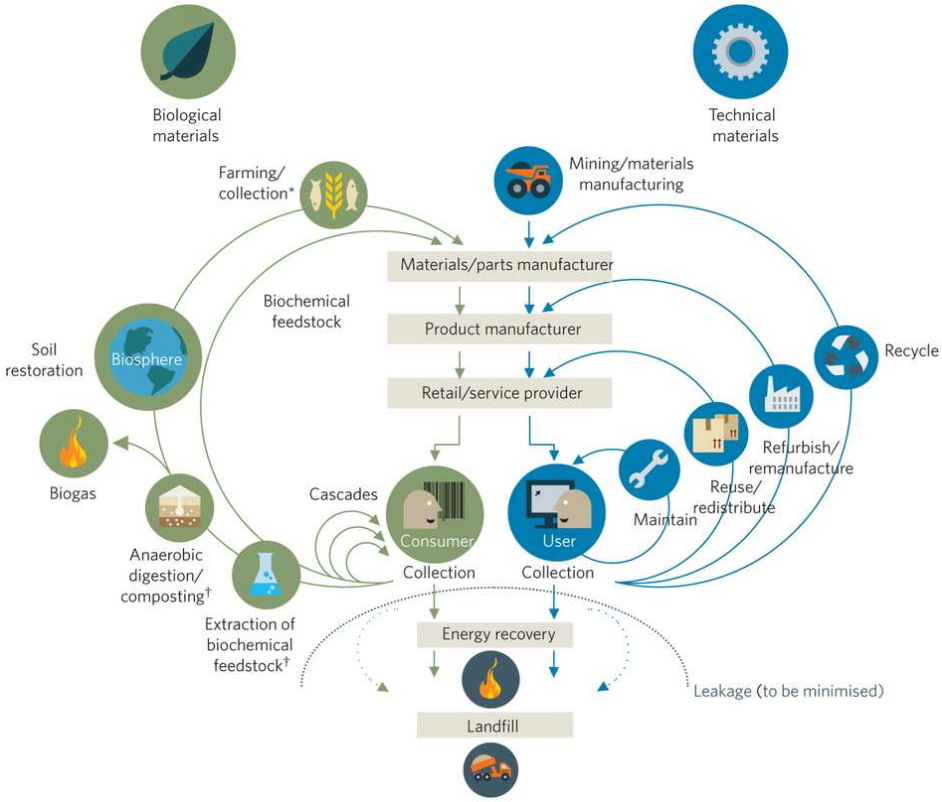

Figure 1: *schematic overview of the CE. Image source: Ellen MacArthur Foundation – adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough (2014).*

If we take this idea of reshaping current systems into cyclical and regenerative ones, based on and inspired by ecological processes, we can identify the central, underlying aim of both BBE and CE as connecting economy to ecology: that is, basing an economy on the biosphere. The main idea is to make (human) economy similar to biological processes, such as the circularity of natural ecosystems, energy cycles and the Earth's carrying capacity, as these ecological lapses appear to be structurally renewable and in accordance with balanced ecosystems. This idea can be recognised in all projects and goals of describing economic and ecological cycles – whether producing and implementing biomass on as many levels as possible (e.g. agriculture, plastics, marine environment); replacing non-renewable resources; improving waste processing; transforming manufacturing; converting waste into value-added products; maintaining energy levels; or, innovating for technological solutions. All

types of bioeconomy (including CE, cradle-to-cradle and biomimicry thus involve design principles with the common goal of closing material cycles, just as nature achieves with regards to biomass. Currently, however, these principles mainly provide guidelines for future objectives, i.e. they are not yet optimally realised. The non-circular arrows that end in 'landfill', for example, show how the biosphere is only partially or metaphorically instructive for the technological cycle (see Figure 1). This difference between ideas and actual practice demonstrates how the aim of basing the *economic sphere* on the *biosphere* is essential in the transition towards an accomplished bioeconomy.

However, in order to adequately and consistently base an economy upon the biosphere, it should be transparent what this 'basing on' entails. Ecology and economy are certainly related, but the borderlines are blurred and their exact relation remains unclear. This is because the two spheres at stake in the BBE have both clear and fundamental differences (ecology refers to systems in nature, which humans affect by economic practices) *and* intriguing similarities – crucially, both concern the *oikos*: the house or environment in which a certain reciprocity between human and extra-human nature exists. This ambivalence has already resulted in a field of ambiguities and questions, such as what exactly it means to operate within the carrying capacity of our *oikos*, planet Earth (Jonker 2014; Wahl 2006; Muijsenberg et al. 2017). This leads us to ask three questions: how is the environment understood in the BBE? How are economic systems and processes understood in the BBE? And what can be said about the central idea of combining ecology with economy into create sustainable bioeconomies?

As the BBE is a vast, encompassing project, spread over a multiplicity of sectors and fields and comprising a total worth of about two trillion euros per year (EC 2012, 11), a significant amount of discussion already exists. The majority consists in analyses of specific parts of the BBE (biomass production, technologies, the food-fuel debate, use of genomics, etc.) with regard to the possibility and details of their practical execution (e.g., Asveld, van Est and Stemerding 2011, 109). Problems arise here regarding internal consistency, general clarity and agreement on key terms within the BBE as a comprehensive undertaking (e.g. Osseweijer, Landeweerd and Pierce 2010, 27f). Extensive analyses of the varying understandings of the BBE, e.g. biotechnology, bio-resource and bio-ecology have been made in an attempt to reach consensus (e.g. Bugge, Hansen and Klitkou 2016). Normative research has taken up this general confusion to argue that the BBE's consideration of sustainability should be addressed in a more interdisciplinary and therefore more effective manner (e.g. Pfau et al. 2014, 1222). This kind of normative conceptualisation is shared by more fundamental critiques of discontinuity within the BBE paradigm, which insist on the vital importance of clarifying the basic relations between natural and economic systems (e.g. Benyus 2002; Dicks 2017).

The hiatus between economic and ecological systems is a common topic in literature on the BBE in relation to business ethics (Frazzetto 2003; Finegold et al. 2005). This literature is mostly focused on the social and political aspects of the BBE, such as governance, responsible innovation and differences between national economies (Benner and Löfgren 2007; Kitchen and Marsden 2011). Finally, literature that both investigates the BBE in an ad hoc fashion and considers the ethical aspects and fundamental relations at stake therein – for example, the relation between economy and energy (Zwier and Blok 2015), or between nature and technology (Blok and Gremmen 2016) – is upcoming, but still scarce. Especially relevant in this latter category is the work of Mario Giampietro (2019), who argues that the panacea being sought in bioeconomies – to simultaneously avert the ecological crisis and enable uninhibited economic growth – is unrealistic. Instead, he proposes the entropic perspective of Georgescu-Roegen to develop the necessary theoretical foundation for a true bioeconomy that understands the difference between economic narratives (business models) and thermodynamic narratives (biophysical constraints).

The relation between the biosphere and the economic sphere is highly complex, which partially explains the confusion and inconsistency in bioeconomy debates. Already, in the three different types of bioeconomy, we see three different conceptualisations of this relation: Type I is eco- or bio-centric, understanding ecology as a realm that encompasses and conditions all economic activity; Type II is techno-centric, considering technological (i.e. economic) innovation the best candidate to solve ecological problems; and Type III is biomass-centric, which means it deems biomass (as an ecological resource) to be of fundamental importance in practicing sustainable economics (Vivien et al. 2019, 191–193). As Type II and III are currently dominant, one might enquire whether they express the relation correctly.

The biosphere and the economic sphere are thus neither clearly distinct nor clearly similar. Firstly, an economy is, too, subjugated to natural boundaries: financial actors, like all organisms, have biophysical foundations and require oxygen, sleep and nourishment to function. This reality is nevertheless reversed in our everyday conceptualisation, which understands the biosphere as mere provider of resources for economic processes. Secondly, what we deem to be 'economic processes' – such as networks of trade, communication, house-holding and even management structures – can also be encountered in natural systems. For example, competition for light amongst trees (resource distribution), elaborate reciprocal reticulations between fungi and vegetation (forms of trade) and cooperation for survival in the animal kingdom (by exchanging services and/or manipulation) can all be recognised as economic realities (Oudemans and Peeters 2014). Thirdly, even if the two spheres were clearly distinct, economies cannot just blindly mirror ecological principles as entire species often become extinct in evolutionary cycles, which is unacceptable from an ethical perspective in human society (Blok and Gremmen 2016, 207f).

In light of the effect of human economic systems on natural systems through processes of pollution, temperature change, biodiversity decrease, energy depletion, etc., the ecological and economic spheres might seem fundamentally *opposed* (see Hamilton 2017). However, even this distinction is ambiguous, for it overlooks a fundamental similarity between the spheres: the prefix 'eco-', meaning *oikos* or home. Both economy (nomos-of-the-*oikos*) and ecology (logos-of-the-*oikos*) investigate the reciprocity between actors and their home-environment (*oikos*), ranging from living within a household to living within the eco-systems of planet Earth.

One cannot demonstrate the failure of an idea in itself; nevertheless, specific instances of the realisation of an idea *can* be investigated. These specific instances can, accordingly, show which underlying idea is at stake, both semantically and normatively. We choose as an example a quote from the EC's policy on the bioeconomy:

> 'To conquer this new frontier [seas and oceans], advanced knowledge on marine living resources is necessary to maximise its exploitable value in a sustainable way, optimise the response to climate change and mitigate human impacts on the marine environment (…)' (EC, 2012a: 33).

From this, it can immediately be seen how BBE policies presuppose a very specific understanding of the relation between economics and nature, through which a language of technological control, efficiency, management and dominance is employed. However, it is clear how those semantics contradict the idea of 'mitigating human impacts on the marine environment', put forward in the same sentence that states we must 'conquer' the ocean and 'maximize its exploitable value' (ibid.). The relation between the biosphere and the economic realm is here notably and overtly *asymmetric*, as economic demands determine the manner in which the biosphere should receive assistance – assistance, *from humans* to help the ecosphere *cope with* humanity.

The section on sustainable fisheries in this document continues to take this asymmetric approach. For example, consider the following quote:

> 'It can be expected that applications from blue biotechnology will contribute to the production of sustainable and healthy aquaculture products by ensuring better control of reproduction processes, developing innovative methods for selective breeding, feed ingredient optimisation (…) [and] energy production' (EC, 2012a: 34).

To sustain ocean-life (i.e. to not consume all fish at once, leading species and populations to decrease drastically or even go extinct), the policy suggests 'ensuring better control' over these populations (ibid.). Technology is put forward to establish controlled reproduction processes: managing, overseeing and manipulating the ecosystem will *help* these systems to be exploited in a repeatable manner. Ecology appears here as a dimension in need of assistance, control, regulation and exploitation, and never as a sphere with any intrinsic value.[1] For example, the vassalage of the fish's reproduction cycles is overlooked and implicitly deemed unproblematic.

The perceived need for *help* in and by ecological systems is consistently addressed through a strategy of manipulation, management and, ultimately, control. This can be shown by discussing another exemplary case of EU policy, this time in the context of agriculture:

> 'Research and innovation will aim at increasing the adaptive capacity of plants, animals and production systems to cope with rapidly changing climate conditions and environments, as well as increasingly scarce resources' (EC, 2012a: 30).

The human reaction of *helping ecosystems* – in this case, to subsist within a changing climate – is developed and justified in the context of the increasing scarcity of resources. Trees are not discussed as vital components for Earth's life-supporting ecosystem but, rather, deemed scant assets in a market. These semantics of scarcity are evident everywhere in the EU's policies, which state, for example, that.: 'An important goal is to mobilise more wood in appropriate areas while safeguarding biodiversity and other public goods delivered by forests' (EC 2012, 31). The biosphere is once again conceptualised as source of resources or 'goods' for human use, and the necessity of sustaining it is motivated predominantly by the perspective of economic return. Unhealthy eco-systems are, first and foremost, at risk of market failure (Blok 2018, 205). Our preliminary analysis of the relation between the economic sphere and the ecological sphere in the BBE encounters a presupposed, univocal dominance of economic processes over ecological boundaries. The biosphere is consistently and solely discussed in the context of market competitiveness, economic growth, industrial purposes, stakeholder interest and technological innovation (symptomatic of Type II and III bioeconomies). These predominantly economic semantics are, in their context, understandable and sensible. Yet contemporary strategies harbour a paradox because, on the one hand, the idea of becoming 'bio-based' seems to imply a solid or even inherent connection between economics and the biosphere, while, on the other, the biosphere is understood as an extension of the economic sphere in which market failures are addressed. This onerous ambiguity must be clarified.

[1] The eco-centric concept of intrinsic value holds that nature has value in itself, independent of any anthropocentric or economic functionality (Hill 2006; Preston 2001).

3. LEVINAS ON ECONOMY AND ECOLOGY

Levinas' philosophical concepts have been influential in many different disciplines. His ideas reverberate through fields as diverse as medicine (Clifton-Soderstrom 2010), pedagogy (Zembylas and Vrasidas 2005), business ethics (Tajalli and Segal 2019), business administration (Blok 2018) and psychoanalysis (Todd 2003). Although his ethical work has been recognised globally (see, for example, Druker 2006), Levinas' ontological writings on economy and elementary nature have barely been employed in environmental philosophy. Importantly, Levinas provides an original account of what 'economy' means that is directly connected to its biological limits, whilst simultaneously explaining the human tendency to seek control over nature. However, whereas for example Martin Heidegger's (1954) ontological-phenomenological analyses have already been broadly used to consider notions such as degrowth and releasement with regards to threatening technology (see Heikkurinen 2018; Kerschner et al. 2018; Schomberg and Blok 2018; Blok 2020), Levinas' most crucial additions to this discourse remain largely untouched.

Edward Casey uses Levinas' (1963) notion of 'the Other' to discuss the human attitude towards nature. He writes:

> 'Whatever the profitability of the situation may be in the eye of a logging company executive, there was undeniable disfigurement in the land: the aesthetic join forces with the ethical in this scene of destruction. My glance was drawn into the heart of its darkness. This is the moment of pain that calls for alleviation by the appropriate action.' (Casey, 2003: 200).

Casey's straightforward approach to making ethical claims for the *sur-face* of the Earth via Levinas' concept of the face of the Other is, however, a much debated position in contemporary literature on the topic. Indeed, even in highly similar and related perspectives, it remains consistently problematic whether Levinas' ethics can be applied to the environment in this manner (Joldersma 2013; Nelson 2012; Diehm 2000; Welsh 1998). Yet, contrary to Casey, the ethical rupture between two human individuals is not the only original structure in Levinas' work; indeed, a similar separation occurs between his conceptualisation of the Self and nature. The ambivalent structure of said gap fundamentally underlies Levinas' ontological work (Derrida 1978; Cools 2015), and is therefore more adequate for discussing questions pertaining to sustainability and economics.

Ted Toadvine (2003; 2012) argues that it is possible to distil from Levinas' thought a heterogeneous conceptualisation of the relationship between man and nature that remains relevant today. More such advanced connections between (Levinassian) philosophy and environmental issues can also be found in books such as: *Eco-Phenomenology: Back to the Earth Itself* (Brown and Toadvine 2003) and *Facing Nature: Levinas and Environmental Thought* (Edelglass, Hatley and Diehm 2012). The former project provides the basis for the approach taken here. Our aim is to demonstrate the relevance of Levinas' philosophy in the concrete context of conceptualising a bioeconomy.

First of all, it should be noted that Levinas did not discuss ecological sustainability directly. In fact, one of the only authors to explicitly discuss something like a (Type 1) bioeconomy in his time was Georgescu-Roegen. Nevertheless, Levinas provides us with an elaborate *phenomenological* perspective to strengthen and deepen our conception of these bio-based economic processes. For example, a Levinassian perspective raises the question of 'enjoyment' – the qualitative aspect of the human condition – as directly pertaining to the relation between the economic sphere and the biosphere.

The second part of Levinas' (1969) *Totality and Infinity* is titled: 'Interiority and Economy' (109 –183). Here, his phenomenological discussion of economy is in the context of the (ontological) Self, or

'interiority', as opposed to the vast majority of his writings which aim to address the (ethical) Other, or 'exteriority'. Consequently, the 'economy' appears as a matter that must be discussed in the realm of egoic survival, quantitative existence and necessity. Moreover, Levinas' understanding of economy cannot be complete without considering his reference to the ecological conditions of economic realities.

Between the Self and nature there is, in Levinas' thought, a distinct ontological separation. Nature *in itself* constitutes a dimension from which humans are principally separated because Levinas deems an absolutely eco-centric perspective impossible for us as anthropocentric beings. Beyond our view is an unpredictable, unfathomable, interminable (bio-)sphere – nature itself – which Levinas calls the '*il y a*' (there is). Of course, we are dependent upon the biosphere to the extent that we require continual supplies of oxygen and food. However, as humans, we also fundamentally tend to overcome and transcend this dependence by establishing protective habitation and safeguarding resources through labour and other economic activity. For Levinas, economy is about the establishment of personal identity (the Self) within the vast biosphere, which entails securing the presence of nourishment via labour and living in a house to protect oneself from the elements of nature. The Self is thus constituted through both a natural metabolism of an economic character and human commerce with an inscrutable biosphere. This dual intercourse between economy (here, a category of the human condition) and ecology allows for an analysis of the '*il y a*' as the biosphere itself. Hostile, unknown, elementary nature is not an (infinitely) different person to be faced, but an ominous ecological enigma.

Economy, then, is the process by which the Self conserves its egoic existence, interacting with the world in order to stay alive. Principal interactions consist of acquiring nourishment and safeguarding shelter, both of which can be achieved through the effort of labour. Levinas (1969; 110) describes this economic process as one of *living-from*, arguing that the Self lives *from* the external world, deriving sustenance from nutrients, oxygen, housing, etc. *Living-from* indicates a certain kind of 'metabolism': economy for Levinas means living *via* the environment by consuming other organisms, seeking shelter and obtaining and trading resources (ibid.). These economic concerns about self-preservation originate from the uncertainties inherent to the vast, all-encompassing biosphere upon which the survival of the Self is dependent: will there be enough to eat tomorrow? Will I have a place to live? Will we be able to breathe tomorrow?

Levinas' discussion of economy thus displays an intrinsic connection between economy and ecology. Overcoming fear of shortage through labour, for example, is directly linked to the uncertainties springing from an unpredictable, hostile environment in which only the fittest survive. From this perspective, the relationship between the two eco-spheres can be more specifically thematised as a form of reciprocity between 'The I and the not-I' (Levinas 1969, 87; 143f). Eating, for example, is the transferral of something from the external biosphere into the sphere of the Self: through the process of metabolism, parts of the surrounding world become part of and help sustain the Self. This back-and-forth between the Self and all things outside of it is a distinctive characteristic of economy for Levinas, because it is through *labour* that externalities are modified into individual preservation. By catching fish, to stick with a familiar theme, one takes from the external biosphere; labour is the economic means of translating or shuttling between the raw element ('pure nature', in this case the ocean) and the ultimate consumption of a specific sardine by a specific person. In the same way that the body processes the fish (or, the non-I) into energy for the Self, labour translates concerns for the future into controllable systematics. The economic structure of labour exists as a mediation of the biosphere into modes of self-preservation. Nature in this sense can, indeed, be controlled and translated into resources that support individual and societal continuity.

Yet this back-and-forth between the I and the not-I has clear limits for Levinas. Although seizure is a primordial structure of the Self, not everything can be grasped and usurped within a closed metabolism. For example: systematic fishing establishes a certain dominance over the ocean by helping to overcome fear of shortage; however, the ocean as such cannot be controlled in its entirety. As a primary element of the biosphere, the ocean has its own elemental shape and remains exterior, self-regulating and unfit for total human stewardship (NOAA 2019). For Levinas (1969, 169), this pure nature is never directly, 'eco-centrically' visible but, rather, is principally *beyond* human, anthropocentric knowledge. Economy is, certainly, in a strict relation with ecology, but they do not fully coincide: the biosphere (from which we originate and upon which we depend for our survival) is only conquered by economic practices to a certain degree. The impossibility of full dominance over the biosphere indicates an essential heterogeneity between economically controllable nature and uncontrollable nature itself, making the relation between economy and ecology twofold.[2]

The connection between economy and ecology, and the limits therein, can be sharpened from Levinas' understanding of 'the house', *oikos*, or the place 'from-which' we live (ibid.). Living in the *oikos* or ecosphere means being dependent upon oxygen, food, water, etc. *Living-from* the economic house, on the other hand, means protecting oneself from the elements, modifying our place within the ecosystem, and constituting a fundamental domain of accommodation from which we depart and to which we return in daily, self-evident familiarity. In the same way that labour creates the bridge between raw nature and human consumption, the house translates the interminable, infinitely differentiated outside world into structures of exploitation, complacency, possession and seizure. Living in a house is not the objective of labour, but its condition: as the locus from-which one lives and works, and even through which one sees and understands the encountered world, the house is a prerequisite for typically human affairs such as hospitality, welcoming, visiting and withdrawing to privacy.

The house thus embodies the necessity of overcoming the anonymous, hostile ecosphere in which we live – altering and controlling it through specific economic structures. Ecology and economy share the aspect of *oikos* (eco-), as both terms indicate a locus of habitation, but Levinas' understanding of this 'living-from' demonstrates, once again, a strict difference between raw, unforgiving nature (*il y a*) and economically established comfort (*oikos*). Living-in a biosphere means being dependent upon an unfathomable outside world; living-from a house means having controlled certain aspects of nature, enabling a more worry-free existence.

In Levinas' conceptualisation, humans tend to overcome their natural habitat, and this reciprocity can be seen as a (morally neutral) metabolic process, concerned with the survival of the Self. This means that it is implied in our very ecological conditions that we seek to overcome those conditions (hostile, elementary nature) through economic practices. Economy for Levinas, then, is *sine qua non* of human life – of the constitution of the human Self – in that economic processes are necessary to overcome the anonymous, elemental biosphere that constitutes our origin. Nevertheless, being involved in an economic system does not necessarily coalesce with being-human; indeed, human life itself is always also something more than use, function, sense or objective. Beyond merely staying alive, finding nourishment and engaging in trade, Levinas indicates an independent dimension within which pleasantries can be enjoyed, but also where pain can be felt: the dimension of enjoyment (*jouissance*), or fulfilling the egoistic Self with life's content or meaning. Enjoyment is the completion of the constitution of the Self, located before any ethics. To be a human individual means to originate from

[2] The contradictory semantics encountered in literature such as the European Commission's (2012) 'Sustainable Growth' report are symptomatic of this original juxtaposition.

a constitutive biosphere, to overcome it through economic practice and, ultimately, to enjoy being human.

Levinas therefore marks a difference between the practice of *obtaining* food and nourishment as a mere means to survive or satisfy hunger, and the *enjoyment* of the food which cannot be reduced to such economic rationality since it does not have any metabolic functionality. Enjoyment emerges *from* economic commerce, but cannot be reduced to economic labour or the struggle for survival, as it consists in the very act of the corporeal 'me biting into the bread' itself (Levinas 1969, 111). The concept of eating as sensual experience transcends both the elementary biosphere *and* the labour aimed at obtaining resources for Levinas, because the act of sinking one's teeth into food and enjoying it constitutes an absolute *independency* from any ecological necessity or financial concern. Enjoyment does not have a function, but it is valuable because it establishes the very independence that makes us human.

4. COMPARING LEVINAS AND GEORGESCU-ROEGEN ON THE BIOECONOMY

The value of Levinas' analysis can be further understood through a comparison with Georgescu-Roegen's ideas on bioeconomy. According to Levinas, we *live-from* the world in the sense of originating from a conditional biosphere upon which we, as an organic species, are dependent; in this sense, our economic practices are always already 'bio-based' in the literal sense of the word. Simultaneously, however, *living-from* means living *away from* in the sense of overcoming the elemental, hostile biosphere by transfiguring our natural being through economic structures such as labour and housing. Thus, from Levinas' perspective, we must say that, on the one hand, *all* economy is bio-based – and not just in the specific sense of basing processes upon renewable resources – and, on the other, that a system of economy can never be *totally* bio-based because something like a BBE is conditioned by a *bios* that cannot be absorbed in the economy itself and must be lived away-from: the elementary nature, *il y a*.

Georgescu-Roegen (1975a) raises the issue of a bioeconomy when he points out how the ecological (that is, thermodynamic) law of entropy should be taken seriously in economics. Here, he points out a crucial distinction between the standard, mechanistic (neoclassical) model of production and consumption and actual biological energy-cycles, ranging from geological shifts to human metabolisms (see Giampietro 2019). In the process, he shows the faults of traditional linear thinking by demonstrating how this relies on a multitude of flawed notions, including eternal growth, immortality, stationary states and other such 'Myths' (Georgescu-Roegen 1975b, 347). He then explains how our economy actually exists within an ecological realm of entropic energy that governs everything with incomprehensible magnitude. For example, he writes that 'there is an astronomical difference between the amount of the flow of solar energy and the size of the stock of terrestrial free energy', to the extent that all the solar power harnessed in fossil reserves 'could produce only two weeks of sunlight on the globe' (ibid., 370).

While biological life certainly evades the entropic degeneration of economic resources, it *never* controls it in full – in fact, it is not even close. Rather, it is increasingly clear that our economic behaviour has particular consequences for the future availability of energy, resources and humanly inhabitable conditions. As we become increasingly dependent upon external processes of self-regeneration and lifestyle enhancement, and continue to use all the available (and not just accessible) resources of the biosphere, we should expect a systemic failure of current economic models, which will never be epistemologically able to answer to the unpredictable, qualitative novelty bound to arise

from the disrupted evolution-process (Georgescu-Roegen 1975b). In particular, Georgescu-Roegen focuses on the disturbed balance between the *natural* process of human evolution and the *exosomatic* technological objects that disrupt, accelerate and fundamentally alter this natural proceeding (Mayumi 2001). He indicates irreducible social conflict and inequality amongst exosomatic species as two of the major predicaments of current, traditional economic course (that is, exosomatic evolution), writing that:

> 'The second change is man's addiction to exosomatic instruments (…). It is because of this addiction that mankind's survival presents a problem entirely different from that of all other species. It is neither only biological nor only economic. It is bioeconomic.' (Georgescu-Roegen, 1975b: 369).

To avoid these predicaments, and depending on a multitude of economic asymmetries, would imply altering the course of increasing both production and consumption and producing new economic *processes* rather than mere commodities. For example, constituting a genuine bioeconomy would entail taking measures such as reducing surplus consumption, eliminating waste and luxury, aiding underdeveloped countries and other such drastic reversals of economic patterns (Mayumi 2009).

As shown in Table 1, there are numerous similarities between Georgescu-Roegen and Levinas' viewpoints. First, Levinas takes biological metabolisms of energy-exchange (living-from) as a methodological start to conceive of economic behaviour and, like Georgescu-Roegen, draws analogies with their functionality. Second, Levinas understands this economy-ecology relation from a fundamental notion of the separation of mankind from the natural proceeding of time. Third, he indicates an epistemological ceiling when discussing the ecological counterpart of economic systems. Fourth, he understands the human tendency to control and comfort, expressed in economic behaviour and, fifth, he recognises a great danger in the unpredictable, unknown natural world that lies behind our scientific knowledge. Finally, he thoroughly understands the limits to human control when weighing rapid consumption against a more balanced, sustainable variant, based on the cycles of the Self.

Conceptual Connection	**Levinas**	**Georgescu-Roegen**
Analogy metabolism to understand economy	Living-from	Evading entropic degeneration
Fundamental notion of separation	Il y a	Exosomatic evolution
Epistemological ceiling to our knowledge of nature/the biosphere	Anthropocentric Perspective	Principal novelty of technological advancement
Tendency to control and comfort understandable from humankind	Overcoming nature & establishing house	Addiction to gadgets and exosomatic tools
Unknown nature poses danger	Elementary Nature	Systemic failure
Limits to human control over ecology	Egoic realm	Gaia is infinitely bigger
Focus on qualitative life in bioeconomy	Enjoyment	Anti-extravaganza

Table 1: *Conceptual Comparison of Levinas and Georgescu-Roegen*

Nevertheless, a significant difference also exists between these two conceptualisations of bio-based economy. By proposing a dialectical approach beyond the traditional, arithmetic economic model, Georgescu-Roegen explicitly conceives of concrete economic strategies to counter emerging obstacles in the transition to a bioeconomy. Levinas, operating at the level of fundamental ontology, did not

propose such concrete ideas of economic transformation; rather, the value of his conceptualisation lies in its phenomenological perspective. Complementary to Georgescu-Roegen, Levinas is able to explain how it is both necessary for humans to overcome the hostile, natural world by establishing trade, labour and housing (*oikos*) and, simultaneously, impossible to gain complete control over the biosphere. This juxtaposition can be experienced on a daily basis, for example, by driving a polluting car to work without intending to do ecological harm. Georgescu-Roegen provides such concrete, everyday examples explicitly, but the Levinas' phenomenological analysis is more thorough, substantial, elaborate and incorporates the unique dimension of experienced life.

This is the true value of Levinas' philosophical view: the manner in which he makes these topical themes comprehensible from an everyday, lifelike consumer perspective. This qualitative addition to the bioeconomy debate can be seen most sharply in Levinas' notion of enjoyment – the appreciative dimension of human existence that can only exist on the basis of an ambivalent reciprocity between the biosphere and economic practice. Although Georgescu-Roegen (1975b, 353) also mentions enjoyment, writing that: 'the real output of the economic process (or of any life process, for that matter) is not the material flow of waste, but the still mysterious immaterial flux of the enjoyment of life', he does not elaborate on the precise meaning of this phrase any further. Levinas, on the other hand, explicitly connects the *qualitative* dimension of enjoyment (*jouissance*) to the economic process of self-preservation, and unpacks how both the structural, functional economic elements (*techno-oikos*) and the biological conditions for life are requisite constituents of the very human condition. From such a conceptualisation, it can be understood how humans are always already 'bio-based' and what that means today.

Levinas' analysis of economy fits among several critical, heterodox accounts of biobased economy, such as Georgescu-Roegen's. Those promoting Type I bioeconomies fundamentally argue for the need to shift our conceptualisation, to account for the fact that the biosphere is not a subsystem of our economic systems, but an all-encompassing, unfathomable realm that conditions us always. From this logic reversal, it immediately follows that future economies should focus much more on the qualitative elements of this biospheric ecosystem. Born from ecological conditions, man overcomes nature by practising economy in order, ultimately, to *enjoy life*.

In Figure 2, we display a representation of relevant and related concepts in Levinas' analysis of economy. We see how, in its economic processes, mankind (left) is intrinsically conditioned by the principles of enjoyment and ethics, which are not directly relevant to the economy-ecology relation itself. Nature (right), on the other hand, is displayed as twofold: both partially controllable and ultimately uncontrollable. As we have already demonstrated, current bioeconomies such as Europe's BBE are still located within the boundaries of a seemingly controllable *oikos* and are fully conceived of in terms of control, growth and production.

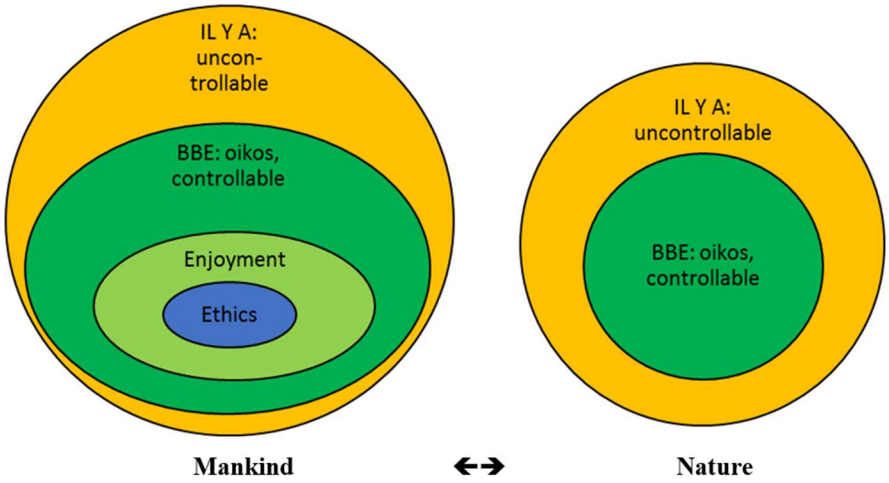

Figure 2: *Levinas's concepts displayed relatively and compared with the status of the relevant BBE-concepts.*

Comparing our model in Figure 2 with the Butterfly-diagram in Figure 1, it becomes clear that the two representations belong to two non-equivalent descriptive domains. Figure 1 attempts to depict the relation between flows of technological and biological nutrients in a controlled, economic metabolism, which includes the biosphere itself. The assumption is that there exists a common system of control based on the shared identity of the two metabolic systems: the biological nutrients on the left are assumed to be controlled by an anthropocentric metabolic cycle, while the flow of technological products on the right is presupposed to be controlled by human society. Europe's BBE, for example, fully ignores the heterogeneity of and discrepancies between humanity and nature. Indeed, it is framed entirely in economic – i.e. human/social – terms, posing merely a human-based economy without conceptualising any facet of this humanity beside its functionality. In light of the inextricability of human economy and bio-ecology, this homogeneous, pristine amalgam is labouring under a critical misapprehension.

From heterodox accounts of bioeconomy, such as Levinas' (1969) and Georgescu-Roegen's (1971), we see that the two spheres are intricately connected, yet vastly distinct. From Levinas' analysis, it became clear that the two sets of metabolised flows in Figure 1 refer to radically distinct processes of self-preservation; indeed, Levinas draws an analogy between economic processes and ecological cycles, such as our own biological metabolism, making visible our primary tendency to overcome the natural world. That said, he also indicates very clear limits to human control. Levinas thus insists on the existence of a strict (ontological) heterogeneity of and/or separation between man and nature. Both the structural, functional, economic elements (techno-*oikos*) and the biological conditions for life (*oikos*) are required to constitute the human condition of enjoyment, without which any bioeconomy would be pointless.

Figure 2, on the other hand, is an attempt to depict the system of self-preservation in all the categories that are relevant for its success as indicated by Levinas and the thinking behind Type I bioeconomies. We need a consistent view of what identities are at stake in the transition toward an economic system that is truly based on the biosphere, aiming to take in all relevant facets, not just that which is humanly controlled. From our analysis, one can see how sensibility, consciousness, appreciation and the experienced quality of life (or, enjoyment) constrain the possibilities of the human *oikos* being practised economically. We can never fully control elementary nature, and neither should we focus our aim on that sole purpose. The very tendency to overcome natural obstacles is founded in the

constitutive aspect of ecology, as Levinas showed, yet it is now time to re-embed human behaviour within the limits of the planet, precisely in order to keep living here.

5. CONCLUSIONS

The argument in this chapter has consisted of five steps. First, we demonstrated that the idea of the BBE – basing economic systems upon ecological processes – is highly susceptible to confusion, as both fundamental similarities *and* differences exist between economy and ecology. Second, the problematic consequences of such confusion were shown by pointing out how the economic sphere dictates ecology in current 'bio-based' economies: rather than a logical and direct consequence of economic growth, the broken biosphere is treated as a market-failure that is perpetually in need of help and further control. This attempted domination of the biosphere overlooks any intrinsic value of nature and is ultimately counterproductive in altering contemporary, problematic economic structures. Third, we brought Levinas' conceptualisation into the equation; through an analysis of his non-ethical conceptualisation of economy, we gained a more profound understanding of the tensions between economy and ecology. As humans, we surmised, it is both necessary to overcome the hostile, natural world by establishing trade, labour and housing (*oikos*), and simultaneously impossible to gain complete control over the biosphere (*il y a*). Fourth, we extended Levinas' conceptualisation into the discussion on bioeconomies, comparing it to Georgescu-Roegen's notions while highlighting complementarities. And, lastly, we demonstrated how Type II and III notions of bioeconomy such as the BBE are exceeded on both sides: before any human activity lies the (pre-)conditional, unfathomable biosphere, and beyond all economic value and functionality lies the human condition (enjoyment).

The relation between economy and ecology is heterogenous, ambiguous and contradictory. Aggregating the two – that is, basing an economy upon the biosphere – will pose a major challenge, and not only on the conceptual level. Current bioeconomic strategies and actions should consider fundamental dimensions of nature and mankind as an urgent priority, rather than the prevailing traditional economic models of growth and exploitation. Yet, the dominant thought on bioeconomy still seems to presuppose that all of the biosphere is an exploitable, controllable resource. Levinas insisted on an account of nature that is principally enclosed, untameable and beyond any societal domestication, and promoted an account of humanity as fundamentally qualitative, experiencing and enjoying life in every moment, and being more than just actors in a marketplace, trying to survive.

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Chapter 3 - Efficiency Versus Enjoyment: Looking After the Human Condition in the Transition to the Bio-Based Economy

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Efficiency Versus Enjoyment: Looking After the Human Condition in the Transition to the Bio-Based Economy

In In this chapter, we criticize the current focus of the bio-based economy (BBE) on efficiency and control and demonstrate the contradictions that this causes. We elucidate these tensions by comparing the BBE to alternative conceptions of economy that emphasise the relevance of both the human condition and unfathomable nature in the macro ecological transition project. From Emmanuel Levinas's philosophy, we take and extrapolate two major concepts—*il y a* and enjoyment—that help to re-evaluate the status of both nature and the human subject involved in environmental instability. From this analysis, we evaluate current economic practice in close relation to the deteriorating environment to contribute to a conception of an economy that is truly based on principles of the biosphere. We conclude that humankind and nature are notions that must be always considered in this encompassing and topical effort and explain how they have been fundamentally overlooked in current thought on the bio-based and circular economy.

INTRODUCTION

One of today's biggest projects to deal with the environmental crisis is the 'Bio-Based Economy' (BBE), a new economic system, intensively invested into by the European Commission. The BBE can be defined as an innovative economic system that "relies on renewable natural resources to produce food, energy, products and services [and] will reduce our dependence on fossil natural resources, prevent biodiversity loss and create new economic growth and jobs in line with the principles of sustainable development" (Bosman & Rotmans, 2016). The ideal of the BBE is to bring (human) economy more in line with biological and ecological processes, such as the circularity of natural ecosystems and energy cycles, as these ecological lapses appear to be renewable in the long term and in accordance with balanced ecosystems. Definitions of the BBE vary, but there is a consistent focus on sustainable economic cycles, biomass produce and implementation, improved waste-processing, replacing non-renewable resources and creating technological solutions. In short, the main ideal is to reshape economic systems into cyclical, regenerative ones, inspired by ecological lapses. It is in this sense the BBE aims to *base human economy upon biological processes* as is indicated in Figure 1:

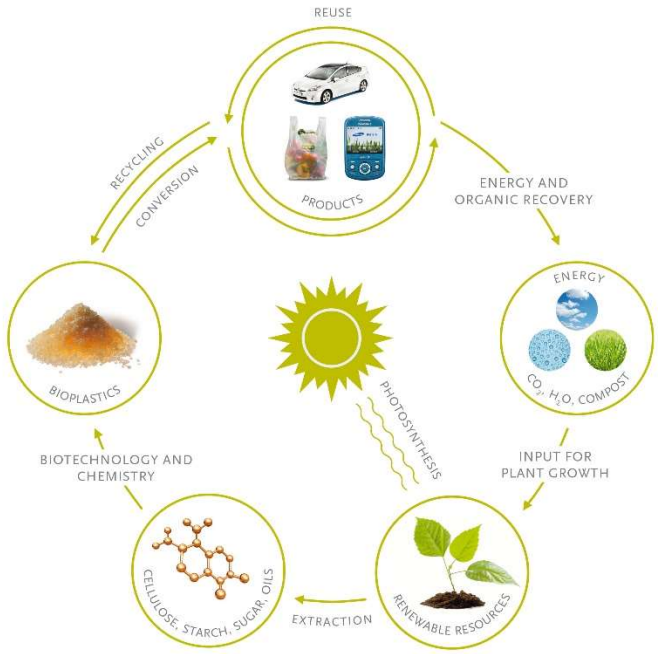

Figure 1: *Normative model of European Bio-Based plastic cycle: example of an economic structure based on ecological lapses* (European Bioplastics, 2016).

In the previous chapter, (Veraart & Blok, 2020) we have already discussed the multiplicity of definitions surrounding the concept of the BBE in detail. In this analysis of the BBE's core-concepts, such as ecology and economy, it became clear that the BBE suffers from structural conceptual problems; it stands for green solutions but is narrowly framed as a business case in which a market logic guides decisions regarding recycling and alternative energy sources (Benner& Löfgren, 2007; Blok, 2016). Theoretically, almost everything can be reused and recycled, yet, from a market perspective, non-profitable recycling options are directly excluded. Consequently, the BBE's current framing threatens to adhere to a market logic that hinders the emergence of a truly sustainable system of economics *based* on the biosphere's carrying capacity. The same holds for the role of humans in the BBE. The market logic of current BBE practices reduces humans to eco-efficient consumers. But is this reduction adequate and consistent with the ideals of transitioning to a renewable biobased economic system, or does it perpetuate specific, environmentally unfriendly tendencies of traditional economics, i.e. consumerism?

Our method will consist in juxtaposing a phenomenological perspective with the scientific view. This means that we recognise empirical truths in current policy discourse but, complementarily, aim to expose problematic presuppositions that, when explicated, can yield qualitatively different insights (Lemmens et al., 2017; Zwart, 2017). Our method can be summarised as an extrapolation of philosophical indications overlooked in regular discourse. In particular, Levinas's phenomenology offers two major concepts (*il y a* and *enjoyment*) that facilitate a fundamental reflection on the conditions for a successful BBE. We try to develop these Levinassian concepts in such a way that they recognise the carrying capacity of the planet and the limits of human life, i.e., not controlling and draining the planet in anticipation of growth, but acknowledging the limits of the natural Earth and valuing our time spent on it non-destructively.

Our research comprises two main parts. Firstly, we investigate the fundamental problems at play in the current concepts of the BBE. We then compare these problems with Levinas's notion of elementary nature [*il y a*] to see why they are perfectly understandable, yet harmful at the same time. Accordingly, we analyse a fundamental ambivalence inherent today in the BBE's main aim and map out the principal concepts of our investigation ("The BBE: Control and Contradictions" Section). The second part of our research begins by taking a closer look at the role of the human condition and elementary nature in Levinas's thought and BBE concepts. We address some obstacles to Levinas's concepts ("The Problem with Levinas's Account of Metabolic Economy " Section) and then aim to contribute to them by explaining in detail the importance of enjoyment ("The Concept of Enjoyment: from Economy to Independence" Section). Ultimately, we identify a fundamental interconnection between enjoyment and the *il y a* as the crux of our analysis ("The Verge of Enjoyment as an Indication of Uncontrollability for Policy" Section). Finally, we summarise and conclude our research.

1. THE BBE – CONTROL & CONTRADICTIONS

In order to locate the primary problems in current BBE concepts, it is first necessary to determine exactly what kind of notion of nature is presupposed in it. Firstly, the BBE's main ideal – *basing the future economy on biological principles* – currently offers merely a metaphorical perspective, and BBE policies show no genuine incentive to alter problematic tendencies such as a dominant focus on growth and systematic exploitation. This inconsistency between the BBE ideal and its practical discussion has been highlighted consistently in the literature (e.g. Finegold et al., 2005; Osseweijer et al., 2010: 27f; Bugge et al., 2016). As a concrete example, it is *possible* to recycle smartphones completely, but not *profitable*, causing such green options to be abandoned from the BBE model (Richardson, 2012: 284f; Jonker et al., 2017: 21; Veraart & Blok, 2020). This means that the BBE's concepts are framed entirely in terms of economic benefits (Veraart & Blok, 2020; Zwier & Blok, 2015). Consequently, any notion antithetical to this market logic (on the side of both nature itself and non-economic humanity) is excluded from the BBE's concepts, making it unlikely that the BBE will, in its current form, inspire an economic system that operates consistently and adequately *within* the carrying capacity of planet Earth.

Secondly, it can be seen how environmental problems are encountered from a market logic of efficiency and control. These semantics dominate the concepts used in BBE-policies throughout. Traditional notions such as growth and scarcity are deployed, for example, when sustainability and green resources are deemed *unique opportunities* for the ever-further expansion of humankind and its habitat. European Commission policy states: "The Europe 2020 Strategy calls for a bioeconomy as a key element for smart and green growth in Europe" (European Commission, 2012a); it is obvious that green growth does not mean growth of nature, growth of green. Rather, the term seems to adhere to the maintenance of established economic tendencies by adding the word green to long-since established economic plans and starting points (Kitchen & Marsden, 2011). Thus, everything is framed from the outset in purely economic terms; even climate disasters are implicitly understood as new market opportunities (e.g., for green fuel), or, conversely, environmental crises (e.g., oil shortages, destructive typhoons) are implicitly understood as market failures (cf. Blok, 2018; Dorfman, 1993; Jonker, 2012).

At this point, one must ask whether this thematization of nature as merely a sphere stocked with manageable resources is justified. A resource is an end-product, prepared for consumption and to be discarded after usage. In a regenerative, cyclical system, there are no such clearly delineated resources; rather, every output always serves as input for the following cycle (Doeland, 2019; Ellen MacArthur Foundation, 2014, 2015; Raworth, 2017). Furthermore, the concept of nature could also indicate an unfathomable, principally unpredictable realm that can never be dominated. To discuss such a concept of nature, a perspective is necessary that does not operate only on the level of known, material objects. Therefore, we now turn to alternative concepts capable of offering a better understanding of underlying structures of the BBE: Levinas's account of economy and *elementary nature* [*il y a*].

In his analysis of economy in *Totality and infinity* (1969: 109–180), Levinas describes how nature is always to be overcome, transformed, and shaped to enable humanity's inherently economic existence in the form of labour. This entails consuming external nutrients such as oxygen, animals, and plants; practicing labour to overcome the harsh struggle for survival in wild nature; and living-in-a-house (*oikos*) in order to ground one's existence in a place of familiarity, to which one can withdraw in safety and from which one departs into the vast world. Here, there is a reciprocal connection, a metabolism, between the self and everything that is not oneself, i.e., the encompassing biosphere: for Levinas, being-a-person (an egoic, self-centred, and fulfilled individual) implies being dependent upon the endless realm of nature and, simultaneously, trying to *overcome* this nature via economy (*oikos*). Wild nature is hostile and unfit for pleasant human life, yet a functioning biosphere is necessary to live and work (Levinas, 1969). Economy for Levinas is, thus, the other side of the ecological coin: a process in which the human condition metabolically preserves and expands egoic identity, being strictly tied to the overcoming or the transformation of elementary nature to create a world specifically furnished for humans (Joldersma, 2013; Nelson, 2011; Welsch, 1998; Diehm, 2000).[3]

Seeing how an original relationship with ecosystems conditions our economic existence (we are always already biobased in both living-from and overcoming our environment) leads us to ask how this economic being functions and why it is environmentally disruptive. Levinas's understanding of economy as a metabolism helps us to understand discrepancies – such as an overly dominant focus on efficiency – from a concretely human, everyday perspective. Take the following quotation: "Nourishment, as a means of invigoration, is the transmutation of the other into the same, which is in the essence of enjoyment: an energy that is other, recognized as other, recognized, we will see, as sustaining the very act that is directed upon it, becomes, in enjoyment, my own energy, my strength, me" (Levinas, 1969: 111). The other or non-I here can be understood as the external biosphere; the same being the egoic, economic human. Thus, in Levinas's thought, it is economic *humans* who are primarily at stake. By safeguarding resources for nourishment – fish, for example – humans overcome nature's hostile struggle for survival: we oversee the fish, control the fish, eat the fish, enjoy them, fill and fuel our lives with fish. In this process, Levinas locates a fundamental *independence*: our enjoyment of nourishment is conditioned by the fact that we do not have to worry about nutritional resources, as they are controlled. Having transcended nature as an uncontrollable and hostile environment (through labour, habitation, and so on), we need no longer worry about fish's availability

[3] Of course, not all societies or peoples had or have ways of life that are destructive to the planet and other species. Levinas's notion of 'overcoming nature' indicates, rather, a natural ecological metabolism at play in the manner in which humans, as living organisms, coexist with their environment by modifying it – to varying degrees in varying times and cultures.

tomorrow. Yet it is *exactly this alleged independence*, this comfort within *oikos*, that causes us to forget about the fish – or uncontrollable nature – *itself*: the fish-as-food are fully integrated into our economic networks of production and consumption.

This means that, for Levinas, the tension between ecology (sustainability) and economy (growth, control, efficiency) is a condition of possibility for human existence; working, living, and consuming can only be achieved in an endless commerce with environing entities, or the *non-I*. This connection, however, implies conquering and overcoming wild nature as an unknown and foreign sphere of danger in order to *control* it. That we are metabolic, economic beings (i.e., beings that transform and possess their environment), however, does *not* mean that all of nature can be seized and controlled, because, beyond the metabolic *oikos*, Levinas indicates the realm of elementary, uncontrollable nature, which should always be acknowledged as an irreducible and absolutely external sphere in which events occur that exceed any kind of anthropocentric dominance and even threaten human economic existence.

Elementary nature – *il y a* – exceeds the controllable biosphere as *oikos* and cannot be exhausted by economic humanity. We can begin to grasp the concept of *il y a*, but never see it in full, as the notion in itself designates an epistemological ceiling. For example, we are starting to discover the inter-relational complexity and the connected unpredictable outcomes of intertwined ecosystems.[4] For now, a lot of factual information remains hidden. Such secrecy hints in the direction of the enigmatic character of nature, but the *il y a* – the bare fact of natural existence – is categorically more unknowable still. The *il y a* makes it possible for any knowing to occur at all. Some dimension of the natural world will forever remain enigmatic to us and consequently uncontrollable. Yet, this happening of nature constitutes an inhabitable biosphere. Elementary nature could also destroy such a habitat. As both a constitutive and a threatening uncontrollable sphere, the *il y a* transcends the metabolism on which the scientific and policy perspectives are focused.

By comparing the scientific third-person perspective in BBE policy with the phenomenological first-person perspective, the difference between *oikos* and *il y a* can be further understood. Whereas the empirical perspective can provide correct, factual information, the phenomenological perspective aims to articulate the individually experienced unity between the perceptible world and the perceiving subject. To illustrate this difference, from the latter perspective it can make sense to describe the way in which walking along the ocean's shoreline 'clears one's head', is 'aesthetically pleasing' or can 'make the mind wander by losing itself in looking at the infinite, moving water'. From a scientific perspective it would at most make sense here to talk about serotonin as a mood stabiliser. The same information might be at stake but through articulating it qualitatively differently, is viewed from a distinctive angle.

That such a different perspective could be quite necessary can be seen when observing BBE semantics: "Seas and oceans provide a vital contribution to the Europe 2020 goal of smart sustainable and inclusive growth. But they also represent a largely unknown territory, changing rapidly through a combination of human and natural pressures (including climate change), which will have major implications for our health, our well-being, food and energy supply" (European Commission, 2012a). The elementary ocean can, as *terra incognita* – harbouring unpredictable consequences of incomprehensible magnitude – never be possessed or seized. Yet, it is here thematised unproblematically as a contribution to the economic system. Uncontrollable nature is formally

[4] Other examples could be the vastness of the entropic cosmos, future science paradigms, and contemporary enigma's in physics such as dark energy.

acknowledged but immediately reduced to the prospect of potential resources or the endangerment of said resources' availability and, thus, understood only insofar as *human* interventions in it have effects for *human* health, human supplies, and so on.

By focusing solely on the metabolic *oikos* and misunderstanding the uncontrollability of elementary nature, the semantics in current policy lead to undesirable discrepancies. The title of a major European Commission policy document is 'Sustainable Growth' (European Commission, 2012a). It has been pointed out in the literature that such a phrase is self-contradicting, a wooden iron (Brown, 2015; Daly, 2019). The amalgam *sustainable economic growth* is symptomatic of the BBE's endeavour to conflate economic logic with ecologic efficiency. The concrete case of oceans and seas reveals even further the ambivalent structure of the relation between economy and ecology in the BBE, conceived of as efficiency. Sea life belongs to planet Earth in the sense of habitable home, *oikos*. Fish can be managed and controlled ever further, but 95% of the ocean remains unexplored and thus, so far, unfit for total human stewardship (NOAA, 2017). Fish are, consequently, both *oikos* – controllable – and *il y a* – foreign, invisible creatures living their own lives in an ecosystem, epistemologically incommensurable with human experience. Overcoming and controlling wild nature enables us to live economic, comfortable lives in which we are not constantly struggling to survive but, simultaneously, disregards nature as a conditional, exhaustible realm of our biological constitution. It is *only from* this human, originally biobased, economic perspective that ambivalent strategies such as those encountered in BBE policy can be formulated: in order to sustain life in the ocean, we must ensure better control over fish populations. We, humans, must use our technology to exploit the sea in a repeatable manner, providing our dinnerplates with fish: *responsible exploitation* (Cf. Dicks, 2017; Gremmen, 2005; Muijsenberg et al, 2017).

By not taking elementary nature into account, the BBE is at risk of ultimately offering merely a *human*-based economy, an *efficiency*-based economy, or an *economy*-based economy; nature is discussed only *insofar* as it is controllable, i.e., domesticated by and for humans. For example, natural cycles contain plenty of catastrophes[5] excluded from the circles that the BBE seeks to imitate: the cycles have been a priori humanised. Framed as such, the 'based' in bio-based could, at best, be understood as creating a base for humans somewhere in the biosphere, which is nothing new nor has anything to do with biobased practice.

This juxtaposition of consumption and sustainability is not an accidental or 'mistaken' perspective, but can already be recognised in the broadest formulation of environmental thought: saving Earth, in general. Our primary concern lies not with nature as such—we do not even know what that would be. The Earth is not the same as a human Other, we cannot stand face-to-face with a slowly dying planet. Human ethics (e.g., Levinas's Other in distress) appear right before our eyes, offering a direct ethical relation (Casey, 2003). A slowly dying planet, however, does not move us to immediate action (Blok, 2015). We do not feel directly responsible for the planet like we might with other people or creatures (Toadvine, 2012). Even now that our apparent dominance over the global ecosystem has resulted in a new, unprecedented struggle for survival (or for sustaining life in general), we persist in wanting to control nature. Save the Earth means: do not let the Earth be, but influence the biosphere so that we might inhabit it still. Save the Earth means: save future generations of *humans*.

[5] Species going extinct, typhoons, toxic eruptions, murder, and so on (cf. Blok & Gremmen, 2016: 207f).

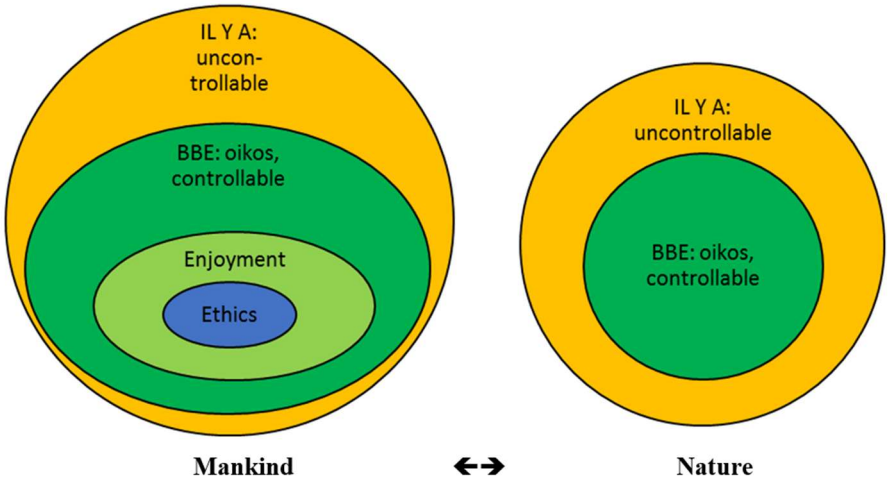

Figure 2: *Schematic overview of ontological concepts in and beyond the BBE (Veraart & Blok, 2021)*

The human way of economically inhabiting the biosphere is a necessary mode of existence, to be experienced throughout daily practices (eating meat, buying products containing plastic, driving cars, and so forth). We always already live in an economy and an ecology (*oikos*), but our economic lives seem to have taken absolute priority, turning our attention towards the biosphere as a resource for nourishment and away from elementary nature as *terra incognita*. We only ever regard the economic part of the biosphere—trees as mere producers of oxygen and wood—and either overlook or downplay the relevance of uncontrollable nature. In this discrepancy between our original, biobased condition (our dependence on the *il y a*) and our everyday, innocent or ignorant striving for growth, we encounter the same heterogeneity that is at stake in the project of establishing a bioeconomy; we emerge from nature, requiring oxygen and so on, then forget about it and disturb it—though without any explicitly harmful intent. From Levinas's concepts it seems that human existence is conditionally within the contradiction between sustainability (bio) and growth (economy). Basing economy on ecology would then be a paradoxical task in general as we destroy what we want to grasp, losing dominance as we seek to establish it, disrupting the life-world by trying to adapt it to our needs. How do we resolve this tenacious ambivalence? Before proceeding with our conceptual analysis, let us summarise the relevant concepts for our investigation in a relative comparison by means of the image in Fig. 2.

2. THE HUMAN CONDITION: CONSUMPTION VS. ENJOYMENT

Having identified in the bioeconomy project a fundamental, contradictory situation symptomatic of topical problematics, we identify a similar problematic tendency in human existence related to the environment. This requires a critical evaluation of the role of humanity and nature in Levinas's thought. ("The Problem with Levinas's Account of Metabolic Economy" Section). After this critical note, to address these problematics, we introduce the concept of enjoyment. We discuss a number of issues with this notion but aim to defend an account of the human condition as being indispensable in any bioeconomy project ("The Concept of Enjoyment: from Economy to Independence" Section). Finally, we show a fundamental interconnection between enjoyment and the *il y a* to indicate both how the problems discussed all concern the same ambivalence between ecology and economy and

how Levinas's notions could form a consistent solution to those problems ("The Verge of Enjoyment as an Indication of Uncontrollability for Policy" Section).

The Problem with Levinas's Account of Metabolic Economy

Following Levinas, a necessary condition for human life consists in overcoming hostile (wild or elementary) nature to escape the struggle for survival. According to this logic, it is necessary for human existence to be involved in economic structures and practices. The tendency to overcome untameable nature and establish an anthropocentric realm (*oikos*) is, accordingly, seen as a precondition for individuals to become and to be a Self (an egoic identity, a complete individual) and ultimately to attain the transcendence Levinas identifies with ethics. However, from Levinas's conception of the economy as a metabolic relationship with the biosphere that inherently overlooks and overcomes its own, natural counterpart, it might be seen how the environmentally harmful tendency towards economic interest (growth, production, consumption, and so on) is, actually, quite understandable from the concrete perspective of a human individual. This would mean that Levinas sympathises – unknowingly – with some of these problematic presuppositions in current BBE policy.[6] Therefore, we have to examine the specific structure of the human condition so urgently at stake; if it is a necessity for humanity to overcome and control the biosphere, i.e., if the human condition is inherently destructive, we must ask what exactly this human necessity entails and how it has come to disrupt the relation between humanity and planet Earth.

With Levinas, we can understand how it is fundamentally necessary for humans to overcome and exploit nature, i.e., to behave economically. He calls this metabolism a *living-from* the world or from the non-I: the I, or the Self, is fundamentally dependent upon ecological and economic prerequisites. Economic connections are inherent in every brick in our cities, every stitch in our clothing, every signpost in the woods. Economy, then, is not something imposed upon the world by humans; rather, just as people need oxygen, they are always already economic beings. We are both biobased and economy-based, originally and universally. In Levinas's thought, economic subsistence directly implies overcoming the biosphere (or the non-I) which, in our time, has become equivalent to ecological destruction. In enacting economy, e.g., working, one always does more than one intends, leaving certain traces and establishing connections beyond one's individual scope. As humans, we seize the day by seizing the planet, dominating and controlling our hostile environment. Thus, this analysis results in a topical ambivalence: to be human, we must overcome nature, which we can never do completely because of the *il y a*. To save nature – to save ourselves – we should act differently than we do, but this would never be entirely possible.

Levinas's account of economy as a metabolism helps to make visible an uneasy discrepancy. The contemporary separation between humankind and nature – encountered in global warming, technological development, and the systematic exploitation of the biosphere – is, in Levinas's view, not a contingent, cultural structure emerging in a specific epoch but, rather, a symptom of the human

[6] In Levinas's time, there was not yet any talk of a difference between the Holocene and the Anthropocene epoch. A primary aim of this research is to make Levinas's concepts topical again, seeking out the added value of phenomenology alongside general scientific discourse on such concepts as the Anthropocene.

condition *as such*.[7] Now, if our economic tendencies are, in fact, necessarily ecologically harmful, our systems would be doomed eventually to implode along with our *oikos* (unless sustainable behaviour magically became profitable). If we conditionally establish ourselves, humans, in the world by dominating, consuming, and using our environment, humans can and will exist only as *homines economici*, seeking efficiency beyond anything else and repeating metabolic cycles until all resources are finally depleted. It is, indeed, in this very way that the present tendency towards control, seen so clearly in the BBE project (as in many other contemporary semantics), does not recognise any environmental limitations but is merely aimed at continuous growth.

The problem confronting us at this point, however, concerns the subjective side of the *individual* existing within a degrading Earth. If economic dominance (i.e., ecological disruption) is indeed a principal, necessary aspect of human existence – and not just a contingent power structure, for example – we would never be able to alter it. And if, within this tendency to control, it is given from the outset that we cannot and will never see – let alone *control* – the ecological conditions for our survival (the *il y a*), we could never even hope for a perspective outside of our metabolic systems. Unless Levinas's philosophy offers some kind of concept that is capable of transcending our closed, egoic cycles, his thought would, in logical consequence, deem us lost without further ado – the human condition would be inherently suicidal and unsustainable, consuming its own conditions for existence.

Levinas's phenomenological notion of uncontrollable nature is, of itself, not entirely fit to provide an escape route away from our economic cycles of efficiency. This is because Levinas indicates that a principal aspect of the *il y a* consists in its *unknowability*. Indomitable nature is indomitable precisely because it is impossible to oversee, grasp, seize, or control. Phenomenologically, it is impossible to experience the ocean comprehensively in its entirety, to wrap one's mind around it; the horizon seems as an infinity, the edge of the world, even if we empirically know this to be false. No manageable strategy can be deduced from the unknowable, elementary ocean out there. It does not care for us, just exists, but it does constitute and threaten us. However, a first insight appears by via negativa, as by embedding the notion of uncontrollable nature in his explanation of economy, Levinas shows that it is *not* impossible to conceive of the biosphere in a way that acknowledges strict limits to our control.

Regarded only from the current, ambivalent situation, humans are necessarily metabolic creatures that tend to conquer their environment and reduce it to utilitarian and efficient structures such as nourishment, housing, and work. BBE policy, by nowhere referring to any possibility outside of this eco-efficiency, is already framed entirely in this human logic of market efficiency and does not seem open to altering its language, even if it results in downright contradictions such as sustainable growth. The fact that there exists an essential overlap between these reductive BBE semantics and Levinas's account of metabolic efficiency reinforces our current problematic juxtaposition of economy and ecology and leads us towards the following question: is humankind's controlling, metabolic-economic nature total, or does the possibility of fundamentally not coalescing with these disruptive tendencies also exist? As we continue to investigate this issue, we encounter another Levinassian concept (enjoyment) that helps both to deepen our current understanding of the situation and to work towards a more progressive framework of concepts in the context of sustainability.

[7] This separation would, necessarily, be a precondition for any possible economy and not just capitalism (e.g., Aristotle's Polis, in which the *vita activa* is a precondition for civilians to serve the state). This does not mean, however, that the struggle of man versus nature is a *sufficient* condition for a complete eco- nomic system (cf. Aristotle, 1905).

The Concept of Enjoyment – from Economy to Independence

Because contemporary BBE policy focuses solely on the preservation of humankind rather than on something like nature itself, we have said that it offers merely a human-based economy (HBE). Although current BBE concepts are framed entirely in economic—i.e., *human*—terms, any facet of humanity beyond its eco-efficiency is unseen, just like the principal insuperability of nature itself was disregarded. Rather, current conceptions tend to frame humanity in terms of labour and limitless efficiency, without offering alternatives or even the possibility of a human condition beyond this mere optimalisation. Levinas's alternative discourse can add to this conception a relevant notion of anthropocentrism. For him, the human tendency to control and dominate efficiently (metabolic economy) makes sense only because it is always directed at *enjoyment*. Enjoyment, or independence, is the ultimate fulfilment of economic existence: all our metabolic endeavours aiming to preserve individual, egoic identity are always rooted in, and heading towards, the outcome of the enjoyment of life (Levinas, 1969). It is only because we are able and willing to transcend into this realm of enjoyed independence that we tend to overcome – and thereby disrupt – the natural world at all.

In enjoyment, disconnected from all earthly struggle, we obviously experience the contents of our lives as such: just the very sandwich, dance, walk, conversation, affair, journey, or drink in itself, only as such, but also just the very sadness, pain, wound, confusion, or obstacle in itself, as such. Enjoyment, or independence, indicates the very *quality* of our economic affairs, the sensibility of our skin. The very act of eating is itself something qualitatively incomparable with obtaining, requiring, or safeguarding food as a resource. Enjoyment is concrete reality, experienced every day by everyone. *Before* the reality of economic practice lies our ecological origin, our being biobased in the sense of dependence upon a vast, endless ecosystem (*il y a*); *beyond* our economic affairs lies the fact that we *enjoy* their result (*jouissance*). As an example, one might think of music; competition, mass production, and new purchasable technologies constitute a vast realm of economic commerce, but the personal enjoyment of a certain song, piece, or part is – to some tiny, yet crucial, extent – incommensurable with the work put into, or price put on, it.[8]

Enjoyment conditions economic existence by offering a reason to *live-from* a world and a house, to calculate, work, optimise processes, and so on; but enjoyment also emerges from this metabolism as an ultimate result in the form of an instant in which we are completely withdrawn from calculation or functionality. In this pure sense of concretely experienced nourishment, fulfilment, and consumption, enjoyment embodies our *true independence* from the world for Levinas. Enjoyment is independence; the concept designates exactly that dimension in which we go about and live, without experiencing our concrete ties to the practical, material, economic world. Thus, enjoyment is more fundamental than emotions or even moods – it is the very precondition for such experience, the bare fact of being-a-person that is alive and able to sense and experience as such. That is what is independent in enjoyment: our experience of not-being-tied-down or, put positively, the emergence of a qualitative space in which we notice life and simply live it. Enjoyment indicates a certain distance, a departure from struggle, survival, and hardship, not at all necessarily as the limitless excess of a human-based market economy but, rather, in the form of appreciation *as such* within the human condition.

[8] For example, music can be consumed through algorithms and the volatile supply of a certain day, but an instrument can be practiced passionately for a lifetime and even expand over multiple generations. In this fashion, the signification of human life itself is something principally different from the constitution or maintenance of that life.

However, in order to do full justice to this distinction, something still remains to be said about the overlap between Levinassian enjoyment and plain consumerism. Levinas wrote this too long ago to see the ecological consequences of our behaviour himself, but in enjoying – or consuming— – very food in front of us, we are directly engaged in a concrete present and, consequently, not directly concerned about the ecological consequences that this food might have. We drive cars without purposefully wanting to pollute the planet, enjoying the ride as it is; we eat meat for the sake of enjoying an adequate meal, whilst being existentially detached from any concern for cows, water supplies, or plastic residues. Now, it was, indeed, precisely this being absorbed in everyday economic processes, this experienced (innocent or ignorant) *independence* (from ecological constitution) that we previously deemed highly problematic, as it causes us to forget about the indirect impact of our behaviour.

Levinas recognises this problem to some extent, because, even without an experience of climatic instability, he knew that there was a difference between experienced independence and plain material dependence upon the physical, ecological world. In the chapter, 'Separation as life', Levinas writes: "A being has detached itself from the world from which it still nourishes itself!" (Levinas, 1969: 116). This independence within the dependence is precisely enjoyment. Thus, enjoyment is *both* rooted within economy and separated from it: the independence experienced is not absolute but founded in an objective dependence upon oxygen, resources, and so on. Commerce, metabolism, and labour are necessary to be able to enjoy at all – enjoyment *emerges* from this (originally biobased) economy, but enjoyment, when it exists, is also something principally different from the effort to trade and survive – emerges (away) *from* economy. The emerging-from-economy of enjoyment is, thus, twofold.

Indeed, the enjoyment of one's own life is principally intertwined with the metabolism between the subject and external entities, but this does not mean that the meaningfulness of existence fully *coalesces* with the usefulness of economic affairs; enjoyment indicates the very real difference between the economic obtainment of commodities and the qualitative enjoyment of (things in) this life. Levinas here distinguishes between satisfaction as the elimination of all needs and enjoyment as the *fulfilment* of needs, constituting a realm of pure appreciation, beyond every rational structure of control. Living in the sense of enjoyment is more than being economic, something quite different from achieving objectives or managing commodities. Food, for example, is not only consumed *in order to* keep living, but also poses a goal in itself. The corporeal act of letting one's teeth sink into bread is qualitatively incomparable with the purchase, production, or preparation of the bread as a meal.

The human condition is intertwined within all functionality, objectives, dependence, systematics, exploitation, and machinery. It is a dimension that transcends all such worries, inquiries, calculations, rationality, and measurements and enters a realm of absolute independence or happiness (not to be confused with *eudaimonia* in this sense, as this happiness can also entail misery). Although Levinas's demarcation is strict, enjoyment also remains interrelated with problematic tendencies such as accumulating ever-more wealth, working to enable certain 'enjoyable' purchases, and unhealthy nourishment, because all of these economic endeavours can potentially lead to the independent state of enjoyment. Another way to observe this relation is to notice our tendency to control and optimise enjoyment, to have its inefficient instant readily available at all times, extract it out of thin air as it were (e.g., cigarettes, burning coal). Because the concept of enjoyment entails precisely something that cannot be stored or extracted, this gesture already poses a contradiction. Enjoyment cannot be

instrumentalised in itself, yet seems to fuel a very human, ambivalent addiction to entertainment and pleasure.

Enjoyment itself is, surely, utterly inefficient – yet, simultaneously, it somehow remains tied to economic discourse. It could, for example, be said that the fact that we, as humans, are able to transcend hostile nature is both a blessing – enjoyment – and a curse – climate instability. Thus, enjoyment expresses the same twofold structure that we have repeatedly seen to be at stake in the current climate crisis: the paradox between growth and sustainability, the juxtaposition of control and uncontrollability, the discrepancy between our direct, everyday sensibility and its harmful consequences—enjoyment is located *precisely on this verge,* exactly *amidst* the contradictory structures of our time.[9]

Thus, Levinas's economic thought overlaps with problematic BBE tendencies (i.e., control, efficiency, overcoming the biosphere) only to the extent that these tendencies are inseparable from a different energy or desire, more fundamental than the mere control of the biosphere – the human condition. This demarcation is so complex, because enjoyment is located precisely on the borderline between economy and ecology, on the one hand both conditioning and transcending economic practice, yet on the other hand being at risk of falling into problematic overconsumption, losing its unique properties by being systematically exploited. Being heterogeneous, enjoyment possesses exactly the ambivalent structure required to answer the topical juxtaposition of economic growth and ecological sustainability that we have consistently indicated.

The Verge of Enjoyment as an Indication of Uncontrollability for Policy

One insight that arises from our analysis of Levinas is most important: *enjoyment has everything to do with the il y a.* Levinas's notion of enjoyment indicates precisely that small element of transcendence that always emerges from economic commerce as independence. Enjoyment indicates the human condition, the very liveliness, openness, being underway, yearning, and striving of human beings, which cannot be eradicated so long as people live. Enjoyment means being disconnected from the struggle for survival and designates existing within the endless process of life itself and experiencing this participation as such. Enjoyment thus offers a genuine possibility to experience the human condition within the all-encompassing metabolism that is our current economic climate by disconnecting our attention from this machinery for a moment. Becoming aware of the quality of human life could shift our focus away from continuous economic practice and towards the endless, invisible, and uncontrollable realm of nature behind this everyday business, conditioning and enabling our very lives.

Let us one last time demonstrate the difference between the concepts used in phenomenology and policy discourse. In one of the major bioeconomy policies, "definitions, summaries and strategies" are put forward to frame the task and goals of a transition to a sustainable economic system (European

[9] Enjoyment is not yet ethical, but it is a precondition to becoming ethical. It is a departure from ontology and into ethics, not fully ontological itself, but not completely ethical either. It is the heterogeneity of this verge. A lively debate about Levinas and the environmental crisis already exists (e.g. Toadvine, 2003). In the current interpretation of Levinas, we chose to focus solely on the ontological, rather than the ethical aspects of Levinas's philosophy, and used those concepts to discuss the BBE. Further debate about this specific approach is expected but falls beyond the scope of the current analysis.

Commission, 2012a). The methodical format of this policy is phrased entirely in terms of "benefits vs. risks", "achievements vs. obstacles" and "proposed actions to support the development (…) fostering (…) and building of society involvement, the Research and Innovation base [and] Enhancing the Creation of Jobs and Ensuring Availability of Required Skills" (European Commission, 2012a). Such a cost–benefit analysis still fully coalesces with the language of familiar economics that has nothing to do with the transition towards a biobased variant. The production and enhancement of ever-new things, technological solutions, and 'helpful' commodities is precisely symptomatic of the economic metabolism aimed at efficient alignment of supply and demand—the very metabolic tendency to control that created the environmental crisis. This means that the BBE, by seeing only the metabolism, can never answer the need for individuals to transform themselves into subjects respecting the ecological boundaries (*il y a*) of our *oikos*.

Bio means *life*. We have explained why the *il y a* must be taken seriously as a *condition* for life: there is (*il y a*), rather than there is not. Enjoyment poses the possibility of *experiencing* this very life: I exist, as opposed to not existing. Moreover, if I want to keep existing, I should behave sustainably. Behaving sustainably means acknowledging nature's uncontrollable force, the invisible *il y a*. But how does one (not) control the uncontrollable? However, acknowledging that is not possible from a management policy perspective. The phenomenological experience of enjoyment, however, enables a *detour*, a route departing from the human condition as such and making visible what our lives truly mean. Enjoyment could enable a fundamental shift in attention. Once we see, feel, or live this transcendence – e.g., when suddenly touched by absolute beauty or profound injustice – we might acquire a genuine, aesthetic glimpse of the nourishing world behind our everyday activities, the ecological conditions enabling them, and the possible destruction of the biosphere. Such phenomenological awareness – located amidst the experience of the very quality of life and the elementary, infinitely distant nature enabling this life – could, ultimately, reunite our behaviour with its consequences.

The biosphere can be known, empirically, but never in full; always only bit by bit, piece by piece. Technological innovation can grow and learn, develop and bear fruit, but only as long as there is mankind, i.e., a viable ecosystem. Nature might, in this way, appear as an enemy, as being hostile towards us, as an angry God, judging us with a life-encompassing omnipotence. The notion of God is metaphysical, but the *il y a* is a very real, natural limit that must be kept in mind. Experiencing enjoyment, i.e., *life*, might be the quickest way to develop an awareness of the invisible realm of ecosystems so essential for human existence. For behind the free market dream of infinite, limitless growth with its stubborn tendency to control lies the human condition, partaking in the infinity of life. Enjoyment lies on the *verge* of the juxtaposition of a sustainable Earth and a world dominated by systematic economics and, consequently, points towards this Earth, this infinitely unpredictable ecosystem conditioning us (*il y a*) – something completely different from mere consumption.[10]

If the BBE wants to be a project for keeping the planet inhabitable, it must be turned towards this ecological background. To avoid internal contradiction, the notion of any bioeconomy should, in

[10] In an environmental context, enjoyment, before it is in a relationship with the Other, is the culmination of the human condition. This human condition is, to be more accurate, never truly completed, but always a process of (re)constitution. This means that elementary nature (*il y a*), ecology, is the very start of human existence, at least in the economic sense of metabolic self-preservation and commerce; and that enjoyment is, then, the end of this process. Thus, instead of stretching and remodelling Levinas's ethics into environmental thought, it suffices to see here how an endless, unfathomable realm principally conditions our being and how we, humans, can experience this condition in everyday practices such as eating meat and driving cars.

policy, be founded on the human condition, which already is the ultimate aim of the project. Especially as we know that the BBE is secretly an HBE and 'save the Earth' always actually means 'save the humans', this must be explicitly acknowledged by an understanding of the human condition that is broader than mere eco-efficiency; humans are the *goal* of a bioeconomy, not the *means*. Instead of a strategy of growth, i.e., gathering ever-more resources to prepare for doomsday, bioeconomies should recognise that such growth can only exist in strict relation to an ominous-yet-constitutive biosphere that cannot be controlled. Rules and guidelines should be conceived to determine when control is appropriate and when we should simply let nature be, precisely in order to sustain human life in it. This—at the very least—implies letting vast, wild areas remain, weighing the accumulation of resources against structural survival; halting management strategies until a more complete understanding is obtained, even if this requires paradigm shifts or turning to alternative concepts; recognising clear limits to controllable *oikos*; and always weighing strategies of efficiency against their end purpose of qualitative, enjoyed existence. The descriptive aim of the current research suffices to show that an experience of our own (enjoyment) indicates a nature beyond any interference. To gauge its normative consequences, future investigation is necessary.

3. CONCLUSION – THE HUMAN CONDITION WITHIN A GENUINE BBE

In this chapter we have indicated several contradictions in current BBE concepts, such as the paradoxical relation between growth and sustainability, or between saving the planet and saving ourselves. We explained how the tendency towards control and efficiency results in problematic discrepancies, now that we face environmental destruction, by demonstrating how the BBE's notion of economy is exceeded on both sides: before any human activity lies conditional, unfathomable nature (*il y a*), and beyond all economic optimisation lies the human condition (enjoyment). The role of the human condition – the status of the subject immersed in a degrading ecosystem – must be addressed adequately if a genuine and consistent bioeconomy account is ever to be formulated. This means firstly that humans are qualitatively more than labourers for eco-efficiency; secondly, that this 'more' – enjoyment – should become an explicit aim of bioeconomy policy; and, finally, that there is a difference between ignorant overconsumption and genuine enjoyment. Enjoyment is deeply intertwined with problematic tendencies of innocently or ignorantly overcoming and disrupting nature; this discrepancy cannot be resolved by making biobased processes ever-more efficient, because the *il y a* poses an absolute limit to this controllable *oikos*. In the same way as the BBE frames nature purely as controllable *oikos* and disregards *il y a*, it frames the human beings in it as eco-efficient actors and disregards their enjoyment. Future bioeconomies should reserve structural room for explicit appreciation of human beings as more than eco-efficient labourers and nature as an uncontrollable realm.

With Levinas, who explained how the human subject was torn between overcoming the biosphere and enjoying its economic metabolism, we found an original account of economics. The problem of overconsumption could, following Levinas, be identified as the human tendency to control and overcome the hostile environment by safeguarding resources, work, shelter, and so on. This tendency is, indeed, similar to the notion of enjoyment, yet also completely different. The attitude of control is highly understandable, both because Levinas could show how that it is *only* human to think, act, and live in this manner and because we can see clearly how economic systems of efficiency create resplendent lives of wealth and comfort for Earth's inhabitants. However, because current BBE policy

sees only this metabolic realm (*oikos*), it fails to look beyond it for qualitative notions of life, such as enjoyment, so indispensable for the required ecological transformation of economic life. Regarding nature, current BBE concepts are overly focused on a humanised biosphere; regarding humanity, current BBE concepts are overly focused on economic, functional aspects. The BBE is, today, an HBE, while simultaneously *neglecting* any notion of humanity beyond the semantic field of production, consumption, and growth.

For the BBE, our research means, first and foremost, that policies should take a radical turn away from economic benefit and eco-efficiency, and towards the project of *life* (bio) on which it claims to base itself. Currently, BBE policies neglect both an account of insurmountable nature and a serious notion of the human condition. On the micro-level of the individual, immersed in a deteriorating environment, what is currently needed is a fundamental awareness of the fragile value of life – enjoyment indicates precisely the realm in which such a consciousness is possible. On the macro-level of global destruction, what is currently needed is a fundamental respect for the boundaries of complex ecosystems to radically adjust our semantics of control – the *il y a* indicates precisely the realm that should be considered here. Through an experience of our own, qualitative human condition, we might be able to answer more adequately to nature's disruptive, uncontrollable, and constitutive power.

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Chapter 4 – The Limits of the Bio-Based Economy within a System of Technologically Modified Short-term Desires

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The Limits of the Bio-Based Economy within a System of Technologically Modified Short-term Desires

In this chapter we provide the basis for a critical analysis of the concept of technology in the current design of the Bio-Based Economy (BBE). Looking at the current status of the BBE, we observe a dominant focus on technological innovation as the principal solution to climatic instability. We take a critical stance towards this 'ecomodernist' worldview, addressing its fundamental assumptions, and ask why a successful transition toward a sustainable BBE – i.e. one that fully operates within the Earth's carrying capacity – has not yet been reached. The philosophical perspective of Bernard Stiegler is used to develop a more profound understanding of why ecomodernist strategies are dominant today. His notion of the libidinal economy offers an analysis of controlled and exploited human desire as the primary driver behind modern techno-economic structures. Our hypothesis is that, if the BBE is to bring about a system that can truly operate within the Earth's carrying capacity, a critique of contemporary technofixism *as* a critique of libidinal economy is necessary. Such a critique is necessary for transcending current affairs of accumulating artefacts and work towards a therapy in the sense of a fundamentally revised manner of practicing economy altogether. In order to develop this hypothesis, the current chapter introduces and explains the ecomodernism and associated technofixism that prevail in current conceptualizations of the BBE, and shows how Bernard Stiegler's work on libidinal economy sheds light on this prevalence. This provides the groundwork for the next chapter, in which the consequences for the specific situation of the BBE will be exposed.

1. INTRODUCTION

As climate change has become a global topic of concern, major strategies are being deployed worldwide to address this challenge. In the European Union context, this project is called the 'Bio-Based Economy' (BBE). The BBE is defined as "Production paradigms that rely on biological processes and, as with natural ecosystems, use natural inputs, expend minimum amounts of energy and do not produce waste as all materials discarded by one process are inputs for another process and are reused in the ecosystem" (EC, 2011a: 5). The BBE, as a concept, expresses the idea that our 'economy' would be more sustainable if we 'base' it on processes present in the 'bio'-sphere, as such natural cycles are deemed renewable and therefore sustainable in the long run.

There are several types of conceptualizations of the bioeconomy (Vivien et al, 2019: 189-190). A first type adheres to the idea of degrowth and was coined by Georgescu-Roegen (1971). This version of a bioeconomy recognises the ecological dangers of our rapidly growing economy and argues we should make fundamental changes in our economic system to recognise the ecological limits and foundations for human survival (cf. D'alisa, Demaria & Kallis, 2015; Nelson & Hickel, 2020). Such degrowth oriented bioeconomies currently exist as concepts but not yet in practice.

A second type is the 'Knowledge and Technology-based bioeconomy' in which technological innovations are seen as the essential solution to ecological instability. As this perspective adheres to an 'economy of promises', it is strongly related to the theoretical framework of ecomodernism, which essentially states that economic growth and ecological sustainability do not need to be mutually exclusive (Jasanoff and Kim, 2015; Vivien et al, 2019: 194). Another type demarcated in the literature is the 'biomass-based economy'. This type focuses on forestry, agriculture, fishing, chemistry and the

use of (technologically complex) biorefineries, aiming to transform biomass into a diversity of resources. The biomass-type bioeconomy is not yet fully fossil-fuel free but might become sustainable in the future (cf. Asveld, 2019a: 6f).

In this classification of bioeconomy-conceptualizations, two opposite paradigms can be discerned. On the one hand, in the first conceptualization, we recognise the theoretical notion of a moderate, plant-based, *degrowth*-oriented economy. This degrowth-paradigm might not seem exceptionally attractive, pleasant or even efficient because transiting into it would require a drastic revision of the contemporary economic system. On the other hand, we recognise a *growth*-oriented economy in the knowledge, technology and biomass types of the BBE. The latter paradigm explicitly seeks to maintain the contemporary neoclassical orientation on economic growth as well as growth of comfort and consumption (cf. Birch et al, 2010: 2903f). The assumption for the future here is that the BBE provides new opportunities for inventions and developments that will lead mankind into a sustainable era. It is presumed that innovative technologies, such as biorefineries, will *fix* the sustainability problems we face today as a society. We can frame this paradigm underlying knowledge and biomass-based BBE-conceptualisations in terms of an *ecomodernist* orientation of the BBE (David Keith, Erle Ellis, Peter Kareiva, Michael Shellenberger, Ted Nordhaus, 2015).

The ecomodernist orientation, which was described most explicitly in the 2015 *Ecomodernist manifesto* (ibid.), holds that the environmental crisis could best be dealt with by further modernising technological capabilities. The ecomodernist vision accepts that humanity has become and has been for a long time the primary geo-factor shaping the face of the Earth and proposes to continue this development forward in order to bring about a growing, flourishing and sustainable future for humanity. Contrary to the degrowth movement, which assumes that only the radical reduction of production and consumption can save the planet for future habituation, the ecomodernist attitude assumes that science and technology will create a sustainable future. Technological development and innovation are here understood as something that is supposed to offer – through vast amounts of institutions practicing science and R&D across the globe – eventually, some paradigm-shifting 'green technology'-panacea for the sustainability-problem. This perspective can as such also be understood as techno-optimism or the 'techno-fix' approach, as it presupposes that we can innovate our way out of the climate crisis (Howson, 2020).

In current BBE-practices, the techno-optimist orientation of ecomodernism is the dominant strategy in dealing with sustainability challenges (Veraart & Blok, 2020). BBE-policy consistently emphasizes how biorefineries offer new business opportunities for value creation to remain competitive on the global market in the future, e.g.: "By supporting new bio-based industries and the 'greening' of traditional industries, a bio-economy will change Europe from being a net oil importer to exporter of technology and bio-based products" (European Commission, 2011: 12). The reasoning is that in order to base economic processes on biological cycles, new (industrial) technologies are to be employed. The main ideal of replacing linear fossil fuel economics with more circular or sustainable processes is, in practice, realized by the technology that is the biorefinery.

These industrial plants use advanced equipment to convert biomass into energy, in which they strongly depend on traditional technologies such as heavy machinery and fossil fuels to move, adapt and process the required resources (Dragone et al, 2020). The conversion and production of biofuel is a chemically complex process that requires specific scientific knowledge for each of its fields of application, such as heat, road transport and aviation (Tsiropoulos et al, 2018). Alongside these

chemical engineering approaches, a variety of advanced technologies – such as metabolomics, genomics and proteomics – are deployed to produce biobased resources. In addition, these technologies are becoming more and more accompanied by digital tools. Machine learning and Big Data are key components in many bioeconomic practices today, such as Smart Farming Technologies (van den Burg, Bogaardt & Wolfert, 2019).

Because the current Bio-Based Economy is exclusively established through advanced, industrial, chemical and digital technologies, this raises the question of how *bio*-based, *technology*-based and biotechnology-based strategies are related in the BBE. This is important, as it is not self-evident that technology-based strategies serve the BBE as a sustainable economy. Furthermore, technology can be considered to have been the major cause behind environmental pollution since the industrial revolution, leading to the very climate crisis we face today. Despite these obvious ambiguities, the question whether a techno-optimistic ecomodernist approach is legitimate has not been explicitly raised in the context of the BBE.

Degrowth theory diametrically opposes the ecomodernist narrative and its emphasis on technological innovation by arguing that if the BBE is to realize its primary ambition of transitioning into a new, sustainable, biobased production paradigm, it should be oriented on fundamentally revised economic structures altogether, i.e. shaping a new 'world' of doing economy, instead of relying on the worldview of techno-optimism. Degrowth does not, however, actively question the economic assumptions on which techno-optimism is built, or provide any feasible programme explaining how this radical, minimal, plant-based way of doing economy should work. It can be argued that offering a hypothetical alternative is not enough, as degrowth still is a theory and not put into any substantial practice (Rocha, 2022). Furthermore, the conceptual alternative of degrowth does not offer an explanation as to why a fundamental economic transition has not occurred to date. Indeed, the very existence of this option beyond the current path of ecomodernism, articulated already in the seventies, reinforces the necessity of the question as to why a fundamental paradigm-shift has not occurred to date (Georgescu-Roegen, 1975b). To obtain conceptual consistency regarding the foundation of the BBE it is necessary, rather than asking which of these paradigms suggests the superior strategy, to critically investigate the fundamental premises of techno-optimism at play in the BBE. The main question of this chapter is therefore: *what explains the dominance of ecomodernism in BBE-strategies and what critique of it would be required for a transition into a sustainable system?*

This encompassing question is twofold and will have to be answered in two distinct parts. The current chapter focuses on answering what explains the dominance of ecomodernism in BBE-strategies. The following chapter will further explore what kind of critique would be needed for an actual paradigm-shift. The hypothesis of the current chapter is that beyond the question of whether technological development is either harmful (degrowth) or helpful (ecomodernism) in answering to the climate crisis, a more fundamental reason exists for the current lack of initiatives to build a BBE that actually operates within the carrying capacity of planet Earth. Instead of policy decisions, stakeholder engagement, governance or consumer responsibility, we will here suggest that – most fundamentally – a 'corrupted' mode of collective human *desire* is at the heart of humanity's current failing to establish a new paradigm of sustainability. In order to develop this hypothesis, the current chapter introduces and explains the ecomodernism and associated technofixism that prevail in current conceptualizations of the BBE, and shows how Bernard Stiegler's work on libidinal economy sheds light on this prevalence.

This provides the groundwork for the next chapter, in which we will translate the philosophical insights on the libidinal economy into the context of the BBE.

We begin by analysing biobased practice to understand what an ecomodernist, innovation-oriented techno-fix strategy entails concretely. We consider the biorefinery as an example of bioeconomic practice and discuss the manner in which such practices are currently criticized. This will both demonstrate the current prevalence of ecomodernist strategies in current BBE-practice and provide insight into the nature of this strategy when put into practice (Sec. 2). Accordingly, we can start asking *why* ecomodernism is so dominant, arguing that this is not a problem caused by certain technologies or policies, but of a fundamental structuring of collective human desire. We consult the philosophy of technology of Bernard Stiegler to analyse the nature of the libidinal economy of corrupted desire (Sec. 3). Finally, we conclude the current chapter by stating that it is human desire and consciousness itself that lie at the root of the current hegemony of ecomodernism – and only in second instance a matter of policies and technologies (Sec. 4). If this is true, it should be elaborated upon what this entails for the ambitions of the BBE and if, in the light of the libidinal economy, these should be revised. This critical application of the theory of the libidinal economy will be executed in the following chapter.

2. TOWARDS AN ENCOMPASSING FRAMEWORK OF BIOBASED PRACTICE

Before moving on to a philosophical perspective on the economic assumptions involved here, it is necessary to elaborate upon the precise problem at stake in current BBE-practices. By discussing the biorefinery as a leading example of the BBE's current approach, we can see what the ecomodernist approach entails as a concrete technological strategy. Biorefineries compose a major part of the economic energy-transition in the bioeconomy and as such constitute a prime example of contemporary biobased processes in practice. The International Energy Agency defines biorefining as: "the sustainable processing of biomass into a spectrum of marketable biobased products (food and feed ingredients, chemicals, materials) and bioenergy (fuels, power, heat)" and as "an innovative and efficient approach to use available biomass resources for the synergistic coproduction of power, heat and biofuels alongside food and feed ingredients, pharmaceuticals, chemicals, materials, minerals and short-cyclic CO2" (IEA, 2019). This processing of biomass is considered to be sustainable because bio-based products and energy do not require linear energy-use by fossil fuels but could be running in renewable cycles using non-polluting, reusable resources such as biomass. Biorefineries are generally viewed as a success when, e.g., new proteins can be converted or when lignin is made useable, or as a failure when, e.g., all the rare materials are delivered by diesel-powered trucks or the powering of the refinery itself is still fossil fuel-dependant. The structural ideal of the BBE-transition would be to have biorefineries replace all linear resource processing (European Commission, 2012a).

In the current development of the transition towards biomass as a primary source for energy and products, it has quickly been made evident that just accounting for the sustainable processing of biomass itself does not reflect the complexity of the field in which biorefineries operate. Biorefineries are often surrounded by non-sustainable practices, jeopardizing long-term viability (Palmeros Parada et al., 2017). For example, higher rates of deforestation and soil erosion, biodiversity loss, and increased pressure on water resources have been observed by adopting biofuels (Rafiaani et al., 2018). It is therefore often argued in the literature that biorefineries should be analysed in an encompassing perspective of environmental, economic and social integration and that a successful bioeconomy

requires *a greater framework* than just the promise of technological innovation by also incorporating the social, natural and economic domains at stake (Dragone et al., 2020). Concretely, this distinction comes down to the replacement of fuel types, substituting fossil by biofuels, versus the broader replacement of production cycles, also including aspects such as stakeholder engagement and policy revision.

The ecomodernist narrative, being predominantly focused on technological innovations, appears too limited to address this greater framework. The production of innovative artefacts is only one dimension of the transition into a bioeconomy as a whole. A significant amount of critical research regarding technological innovation has already been done, pointing out how technological innovations, as drivers for economic development, are always already involved in a network of related dimensions (cf. Bijker, 1987). Rafiaani et al specifically investigate one of these related dimensions in depth by analysing a dataset of 103 studies on the *social* dimension in bioeconomies. They explain that new kinds of investments in infrastructure are necessary in order to further change a fossil-based economy into a biobased economy in an encompassing way. They argue that if society is not convinced by the sustainability of the biobased economy, the costs involved in such a fundamental restructuring of factors like production location, storage, refining, and transportation cannot be justified. According to them, it is social institutions that should provide the right policies, values, identities and relationships in which technological innovations operate. If societal institutions fail, so will the employed technological innovations (Rafiaani et al, 2018). They demonstrate that biorefineries are in no way isolated artefacts but, rather, inherently connected to all kinds of cultural, societal, environmental, political and economic processes. The technology that is the biorefinery has already come into existence as a result from past economic, political, social and environmental developments.

In the book *Bioeconomy – Sharing the Transition to a Sustainable, Biobased Economy,* Pyka & Prettner likewise highlight a multitude of sociological, political and societal aspects that should be adopted in an encompassing perspective required for a sustainable bioeconomy. For example, they explain how innovations are only broadly adopted when they attract interest from consumers, whose purchasing power is guiding for market forces. Seen as such, institutional change must coevolve with technological developments for sustainable practice to occur. Pyka & Prettner also criticize innovation processes that are only result-oriented and argue the focus should be on social changes and changing lifestyles that are both an expression and a driver of the general transformation process. They conclude that if new sustainable technologies are to achieve the aspired transformation of the economic system, the technological potential of a bioeconomy is an insufficient condition for an encompassing transition, which also requires democratic consensus on the broad development and wide application of this technological potential (Pyka & Prettner, 2018: 340-341). Mapping out these intertwined aspects, Pyka & Pretnner provide a clear insight into the complexity and relatedness of social, natural, economic and technological elements involved in a future bioeconomy.

The analyses above demonstrate that the ideology of ecomodernism, by being overly focused on technological solutions, falls short of providing a fundamental perspective to make sense of the relations between humanity, technology and nature. The belief that technology is a deployable means able to 'fix' an all-embracing crisis such as climatic instability is disconnected from a multitude of worldly factors and seems in this sense more of an ideological conviction than an adequate answer to the global situation. Technology is not just a collection of tools available for employment by conscious human actors, but appears in the world that it co-constitutes, in which humans are always already

intentionally involved as users, innovators and operators. Whether it is a biorefinery, a nuclear plant, a field of solar panels, a vertical farm or a meadow of windmills, in each case an innovation emerged as central node for specific economic, social, political and environmental processes.

Neglecting the reality of the world in which technology is immersed leads to significant conceptual inconsistencies such as conceiving of a bioeconomy completely in terms of technology. Climatic instability is an all-encompassing dilemma which concerns technological, ecological, natural, economic, social, historical, political and cultural aspects and cannot be pinpointed as an issue repairable by a technologic solution. A habitable biosphere is composed of myriads of ecological processes we only partly understand (Langmuir & Broecker, 2012). The global infrastructure of technological equipment, furthermore, has been built over centuries in narrow reciprocity with the affordances provided by this natural environment and by generations of humans closely manipulating varying aspects of it such as heat, elemental conditions, distance, energy, etc. (Clark & Szerszynski, 2021). Overshadowing these worldly complexities by primarily focusing on isolated instances of technological solutions, as ecomodernism tends to do, is effectively designing a technology-based economy, or a biotechnology-based economy, rather than a biobased economy.

The excessive focus on technological innovation in the context of climatic instability can be largely explained from our current economic paradigm, in which technology is consistently understood as a means to realise economic growth. The biorefinery is viewed as sustainable when it reduces the use of fossil energy sources and as a failure when it is still dependent on those resources. The biosphere is, then, always considered first and foremost as a source of energy for economic activity and not as an ecosystem boundary condition that limits economic growth. The analyses above raise legitimate criticisms and are correct in stating that a social element is, among other aspects, lacking from current bioeconomy-strategies. However, although it has been scientifically clear since the eighties that our economic processes are unsustainable, the techno-fix solutionism of ecomodernism still remains the dominant paradigm today. Therefore, our question here concerns the self-evident dominance that causes these strategies to be the only ones actually put into practice today: why is the ecomodernist approach the dominant one and what kind of a critique is required to enable a transition into an economic system that actually operates within the limits of the biosphere?

Before we start asking about the encompassing foundation that has shaped the structures of the current bioeconomic situation, we now summarise the steps of our argument. By having indicated the ecomodernist worldview to be overly focused on technological innovation and having explained that such a perspective is too narrow to assess the global situation in which any bioeconomic activity is located, it has become clear that an encompassing worldview is lacking from current conceptualisations. It is necessary to ask about this greater framework and to identify the underlying structures at play preventing humanity from making a complete transition into a sustainable paradigm. Such foundational concepts must be able to account for the desire, hope or conviction to fix the world by using technology that is driving ecomodernism, for the complexity of the complete world that envelops all bioeconomic practice and for the fact that current sustainability-initiatives are only ever able to address a specific part of the whole of the problem of climatic instability.

Our hypothesis is that the encompassing perspective providing a fundamental explanation for the lack of actually sustainable initiatives – i.e. economic practices that have as a primary function to benefit Earth's carrying capacity – has everything to do with human *desire* as the very motor of all economic activity. Here we are inspired by Bernard Stiegler, who developed a theory of the libidinal economy in

his more recent writings. In the following, we will present Stiegler's theory and explain how the controlled and therefore and exhausted collective libido created and sustained by consumerism on the open market can be seen to be the fundamental reason for the current, excessive trust in technological redemption and the immoderate focus on materialistic gain and economic productivity. Accordingly, we will be able to defend the hypothesis that it is corrupted human desire that lies at the root of our failing to 'save the environment'.[11]

3. THE LIBIDINAL ECONOMY

Bernard Stiegler has written substantial works in the philosophy of technology. His major theory on how the human condition is fundamentally technologically constituted was published in the *Technics and Time* series (Stiegler, 1998; 2008; 2011). Relevant here is that Stiegler combines the notions of economy, desire and technology in an original way. Building on the psychoanalytic tradition, principally on Freud, (cf. Ross, 2020; Featherstone, 2020) Stiegler finds that beyond political systems and processes of production, consumption and distribution, it is ultimately human desire that shapes an economy. In Stiegler's theory, every economy of production and consumption as we generally understand it is always also a libidinal economy, i.e. an economy of *desire,* desire being the principal driving force of all human endeavours. He argues that economy is always also primarily a technological matter, since economy is always a question of desire and libidinal energy, which, for Stiegler, are technologically constituted from the outset. Later, and most succinctly, in *For a New Critique of Political Economy* (2010), Stiegler coalesces his fundamental philosophical theories of technology, economy and humanity into an essay that provides an analysis of what he calls the toxic, indeed, corrupted state of current capitalist techno-economic systems. The theory of what Stiegler calls the libidinal economy in this work can provide the fundamental critical perspective for explaining the failure of the truly biobased practice that we are after.

To understand the function of desire in the libidinal economy as Stiegler conceives it, it must be contrasted to urges, wants or needs which humans share with all other animals. Basic needs such as hunger, warmth, itch, lust, sleep, etc. can be satisfied. Such needs are *finite* as they can be solved with a conclusive solution, mostly in the form of a certain object like a bed to sleep or a drink to quench one's thirst. In contrast to such concerns about concrete things, desire is about our relation to ideas and ideals, such as truth, justice and beauty. Objects of desire are things that cannot simply be fulfilled or satisfied by any concrete object. As such, desire concerns those grand, human yearnings that are in a sense *in-finite* (Stiegler, 2010, 42). A search for beauty by an artist, for example, is never finished. Rather, the more beauty is discovered, the more possibilities are opened. Ultimately, Stiegler will argue that the problem of political economy today is the systematic substitution of infinite desires by finite, addictive needs and wants. Desire concerns the deep themes of human existence and fuels humans with libidinal energy, i.e. motivation, the will to excel, passion for justice, the will to truth, etc. To understand how infinite desires focused on long-term goals are systematically exploited today and replaced with finite drives aimed at – or, rather, addictively attached to – short-term satisfactions,

[11] Stiegler has, in his later work, written about the environment himself (Stiegler, 2013). Although informed by this work, it is not within the confines of the current research to elaborate on these theories as well. Rather, we focus on his theory of the libidinal economy only and apply it to the situation of the BBE, which Stiegler did not do himself.

causing libidinal toxicity or corruption, we must first explore in more detail the conceptual background on the basis of which Stiegler makes this claim.

Desire poses an endless opening in human existence, which is always underway, always becoming, developing, never finished. As such, desire always concerns a principally infinite temporal extension into the future. Desire is such an important concept in understanding Stiegler's critique of the current global economic system because he understands the concept of economy in general to always designate a system producing *protentions*, existential relations directed towards the future, indeed in the form of desire. Stiegler's understanding of the concept of desire and protention builds on the phenomenological tradition, in which Edmund Husserl introduced the central concept of intentional consciousness (Hansen, 2009; Husserl, 1977). That consciousness is intentional, means here that it is always related to something else, some object, thought, memory, perception or symbol. To these principal relations of intentional consciousness always belong the temporal dimensions of retention and protention. Retention is the relation of consciousness to the past, shaping the whole of a conscious moment by involving memories, associations and chronological continuity. Protention is the relation of consciousness to the future, involving our hopes, longings, anticipations, expectations and wishes. In capitalism, for example, the economic relation towards the future is shaped by entrepreneurs producing goods for the consumer market aiming to make a profit, and by consumers anticipating new products for purchase and investors looking for opportunities of return.

Because intentional consciousness, or attention, is always directed-at-something, the wholeness of an individual experience is always determined by the specific retentions (memories, associations, interpretations) and protentions (objectives, expectations, wants) a particular individual has accumulated in their life. Each individual has a specific set of protentions constituting the way in which they conceive of and live towards the future. For example, people will listen differently to the same song or have different thoughts when attending the same talk because from their individual backgrounds – containing different retentional funds – they perceive something different (Stiegler, 2013: 86). Since the composition of specific re- and protentions that an individual has accumulated in their lifetime differs per person, Stiegler refers to the whole of a consciousness as having been shaped by re- and protentions as a *process of individuation.* An individual is the unique combination of specific re- and protentions, gathered and combined in a unified, indivisible experience. Being an individual is a process of becoming one particular, singular identity, which is also an infinite process as the self lives in constant reciprocity with alterity (Stiegler, 2010, 93).

For Stiegler, an economy is a system that first of all produces protentions. Objects of need and desire are created on the market, determining what can be desired, anticipated upon and longed for. It is the way in which these objects are produced that is crucial here, because technological objects, in Stiegler's words, 'materialize experiences' and select and carry over specific knowledge and praxis over the course of human generations (Stiegler, 2010, 8). From the very first flint tools onwards, technological artefacts have formed an inheritance system of materially inscribed experience, conserving the information and applications discovered in each individual's lifetime as a legacy for the future. The point of this technological genealogy is that protentions, retentions and economic processes are *themselves* technologically conditioned structures of existence. Specific practices, skills, habits and behaviours are stored in external artefacts, functioning as intergenerational memory carriers. As time progresses and technological knowledges accumulates, what is remembered through the system of technology becomes more and more particular; certain innovations, once emerged,

continue to shape human potential, affordances and behaviour over centuries. These new instruments containing practical knowledge from the past (e.g. combustion engine, internet) never disappear but are updated, improved and recreated constantly. Over time, more and more technology becomes a standard for the techno-economic landscape in which a new individual is born (Lemmens, 2017).

Due to this technological genealogy, both the state of the economic system and the consequences thereof for the human psyche, i.e. individuation processes, are, for Stiegler, heavily conditioned by their technological environment. The production modes of economies have become increasingly technological, industrial and digital. As such, individuals living in the capitalist economy in the digital age today have no choice but to pass through the techno-industrial system in order to shape a (collective or psychic) identity, meaning individualisation processes are determined through industrial techno-economic means. This is why, within an economy, Stiegler speaks of individuation processes as shaping *libidinal circuits*. The libidinal circuits, encompassing human attention, protention and retention, have become completely intertwined with technological systems (audio-visual technologies, mass media, capitalism, industrial production systems, and so on) so that the formation of individual, psychic and collective identities now proceeds via elaborate information networks, imagery and many other innovations (Stiegler, 2010, 42-45). This is the *libidinal economy:* the technologically constituted system of (collective) protentions being produced.

This also means that the techno-economic system was not always as it is today. Rather, the argument is that it has become like this because of a specific genealogy. In order to fully grasp the theory of the libidinal economy, this process of becoming must be elaborated upon. Because, Stiegler acknowledges that the capitalist economic system, when it began, was indeed founded upon long libidinal circuits, aimed at infinity and associating motivational (i.e. what gives life meaning) structures of human existence. At this origin, economic growth appeared as an infinite potential and actors on the market were free to chase their desires of profit and the endless accumulation of wealth through production (Stiegler, 2010, 60). The philosophy behind this liberal system is that when individuals chase profit in this way, the entire economic apparatus grows and therefore the societal collective benefits from it (Cf. Locke, 1689; Nozick, 1974).

However, in a system where individuals and companies are free to chase their desires of profit, a ceiling is eventually reached. Stiegler sees, after Marx, a clear limit within the capitalist system in the form of the *tendential fall in the rate of profit* (TFRP). The TFRP works as follows. In the capitalist system of production, technological innovations automate manufacturing processes and therewith reduce workers' labour time required to complete a commodity. In a competitive market, when products become cheaper to create, the selling price lowers, attracting more consumers. Eventually, as competing companies adjust to the newly innovated situation and reach similar production efficiency, the lower selling price becomes the standard for the market at large. Early adopters of the novel technology make a windfall profit. In the long run, however, the amount of labour necessary for production decreases. Value is then less and less related to physical, manual labour and more and more to industrial production capital (what Marx calls 'fixed capital'). So, the value of manual labour decreases relative to the value of production capital. As production becomes more efficient while demand remains constant, eventually there are no more ways to increase the rate of profit, causing the rate of industrial profit to decline as well. The rate of profit will only go up again once the next innovation is exploited. But the tendency of the profit rate to gradually decline always persist, as this

innovation will also become a new standard for producers and consumers alike. Structurally, the disequilibrium between physical labour and automated production is enforced over time.

The TFRP poses a limit. Because of industrial technology, more products could be produced than sold. This limit of tendential decline was not accepted in capitalism and so a fundamental *countertendency* arose in the form of the *consumerist model* of 20th century economics. In this consumerist model, mass consumption is organised in an unprecedented manner. Production used to be closely related to consumption and demand, but in the new consumerist model, demands are artificially increased along with the new industrially raised production ceilings. The countertendency thus consists in producing more demand instead of producing on the basis of existing demand. Novel media technologies made it possible for marketing to become a primary function of the economic system. It was discovered that products could be linked to customer's unconscious desires such as greed, power and anxiety, so that people now bought things they desired instead of needed (Cf. Bernays, 1995). This technique of behavioural and psychological control – propaganda – proved able to increase and inflate customer demand so that everything could always be sold to somebody and consumption would never stop, as desire cannot be fulfilled. In this way, production did not have to cease growing and the limit of the TFRP is suspended.

Stiegler argues the consumerist model came into existence to 'absorb' the TFRP. The TFRP is not therewith dissolved, but the countertendency of the consumerist model makes it so that the inevitable falling of the profit margin is suspended ever further. In terms of efficiency, the consumerist model indeed answers to the TFRP. Because libidinal energy is by definition *infinite,* the transformation of consumer's desires into short-term drives and urges poses a vast – though not inexhaustible – reserve of fuel for the growth of techno-industrial economies. The systematic replacement of long, cognitive libidinal circuits by short, drive-based circuits eventually frustrates and exhausts the existentially motivational structures of the subjects. Eventually, this substitution of desire by drive leads to the second limit to capitalism Stiegler identifies, the *Tendential Fall in Libidinal Energy* (TFLE).

Ultimately, it is the *combination* of the two fundamental tendencies of the TFRP and the struggle against it in the form of the consumerist model that causes an increase in short-term strategies in both production and marketing. It is these short-term strategies that affect human psyches, consciousness, attention and desire. The more consumers' desires are bloated to meet the ongoing increase of production, in order for the limit of the TFRP to be avoided, the less our desires are directed at long circuits of structural investments in societal value. Before we have obtained some coveted product we already anticipate the following purchase. But products that are instantly consumed – because they are designed for short-term urges and not for long-term, motivational structures – do not contribute anything to the future. On the contrary, a libidinal economy that aims to extract the maximal value from consumers' (technologically modified) attention, only creates more economic, existential and libidinal debts. A large part of the market so becomes fictitious, speculative, less and less connected to practical societal matters and more and more focussed on artificially inflated phantasies and short-term objects of desire. The limit in value of the TFRP is not evaded but transferred to the subjects in the system, becoming the TFLE.

New audio-visual technologies such as mass media and marketing are used both to persuade consumers to buy more and to have them introduce these technologies in their daily lives, reinforcing the cycle of being affected by those technologies. Because, according to Stiegler, these technologies condition our re- and protentions and shape the whole of intentional consciousness, i.e. of attention.

As objects of desire are constantly mass-produced and marketed in the form of videos, movies, TV series, advertisements, games, apps, etc., but also as material 'gadgets', our psychosocial protentions are reduced to becoming functions in the endless cycle of production and consumption. Principally tasked with endlessly promoting and accelerating consumption, modern media techniques, which due to the economic interplay between the TFRP and the consumerist model become increasingly short-termist (TFLE), narrow our attention and dilute it with fabricated fantasies. Audio-visual messages and imagery appear on constantly changing media, are manipulated through marketing and are increasingly aimed at the distribution of advertisements. For Stiegler this means our very memory and the way it functions is affected by technologies such as photography, film, YouTube videos and other analogue and digital technologies, and our very anticipations, hopes, phantasies and dreams are affected by such technologies employed in advertisements and marketing. Human psychosocial systems in general constantly have to adapt to novel technical systems, the innovation speed of which constantly accelerates (Stiegler, 2008).

Over past decades, long libidinal circuits have progressively been replaced by short libidinal circuits, short-circuiting our very motivations, i.e., reasons to exist at all (Stiegler, 2010). This way, technological infrastructures conserving knowledge and praxis throughout generations disrupt psychic and social systems as these have to permanently readjust to the new technological environment. But psychic and collective processes of individuation are what create libidinal energy in the first instance, which is why the inner workings of this system are self-destructive. There is no longer a central institution, such as a government or a church, that interferes in this vicious cycle but the bare ratio of supply and demand, i.e. the market. As such, the influences of technologies on the human psyche (i.e. on intentional consciousness, attention, re- and protentions) accumulate exponentially (Stiegler, 2010; Lemmens, 2014). Technologically conditioned protentions shape libidinal circuits and individual's identities, meaning that human desires are shaped differently, depending on the techno-economic environment.

Libidinal structures are always technologically conditioned but the current mode of conditioning according to short-term structures is self-destructive one. To understand Stiegler's thesis regarding the transformation of desire through libidinal circuits in an economy, we must recall the distinction between needs as aimed at finite objects and desire as aimed at infinite 'things' such as beauty, freedom, morality and truth. Circuits of desire can either be *short* and *finite*, for example the instant gratification of drinking a soda, or they can be *long* and in principle *infinite*, for example when practicing the piano for years with the goal of becoming a professional piano player, only ever learning more, never being fully satisfied or finished. In both cases there is a relation with material objects determining the protentions of the subject's consciousness, but one is short, quick, for instance aimed at a sugar rush, quenching thirst and enjoying bright colours, whereas the latter is, for instance, a lifelong relationship with an instrument that only ever becomes deeper the more one learns, or constantly improving a scientific or philosophical theory. These latter, long circuits of desire are also at stake in matters such as freedom, truth, beauty, morality and the very 'meaning of life'.

Stiegler's point is that over time, more and more long-term, cognitive, intellectual libidinal circuits aimed at infinite 'objects', be they political, scientific, artistic, erotic or of any other sort, have been replaced more and more with short-term-circuits aimed at instant gratification, based on impulsive and finite urges. In our contemporary, Western economy, something has happened that caused desires to be (dis)organised and degraded into drives. People today buy lots of things, not because

they need them, but because they crave them, almost as an addiction. This means that libidinal structures of desire are no longer aimed at long-term, sustainable investments but more and more at instantly gratifying objects. In our (current, Western) version of a libidinal economy, libido has become corrupted, exploited and exhausted, altered by techno-economic development and constant, profit-driven innovation, and directed at short circuits provided by marketing.

We now summarise the findings of the current section to show how it has provided an answer to the first part of the twofold main question at stake. This will also enable us to, in the following chapter, answer the second half of the main question. Firstly, we contrasted drive-based needs with desires. Needs are aimed at finite objects and instant fulfilment or pleasure. Desire is chasing forever an infinite ideal such as beauty or truth. Desires are protentions, phenomenologically experienced extensions into future temporality. As protentions shape intentional consciousness, they play a significant role in the formation of individuation circuits. Another crucial factor in this constitution is the technological environment of intergenerational memory carriers. Together, these factors shape the libidinal circuits that make up the libidinal economy of short-term power circuits on a free market full of audio-visual mass marketing technologies directly influencing the human psyche and its constitution over generations. Accordingly, in order to fully explain the coming about of the contemporary situation of the Western techno-economy, we explained how capitalism, at its origin, harboured motivational structures for fulfilled human existence but, soon after, encountered the limit of the TFRP. The TFRP, in turn, caused the emergence of the consumerist model, allowing for industrial production to never face a ceiling but always be able to sell anything to anybody. This self-reinforcing structure of the combination of the TRFP and the consumerist model resulted in the TFLE, with which we arrived at the current situation.

The main question of this chapter was: *what explains the dominance of ecomodernism in BBE-strategies and what critique of it would be required for a transition into a sustainable system?* The theory of the libidinal economy is able to explain the fixation on technological innovation of technofixism. The degenerative development of the libidinal economy is reflected in the way in which current BBE strategies embrace an ecomodernist approach to the climate crisis. In essence, the strategy of looking for quick fixes springing from technological innovations is a clear symptom of a short-circuited mode of desire, itself conditioned by the very technological innovations shaping libidinal circuits. Revising our entire economic ways would, as a theoretical example, be a long-term project aimed at infinity. We have provided a theory of a process of becoming that is able to point out which economic structures and technological innovations have led to the short-term, drive-based, libidinally corrupted system that we live in today. To address the range of specific consequences that the theory of the libidinal economy has for current BBE-strategies and practices, however, the second half of the question must also be answered. Therefore, in the next chapter, we will gauge which contradictions this results in for the BBE, how these could be mitigated or, at any rate, critically addressed. There, we ask: if the situation of libidinal short-circuiting applies to our current economic situation, what does that entail for the biobased economy? Accordingly, we will take what we have learned from Stiegler and apply it to the specific situation of the modern BBE.

5. CONCLUSION

We began this chapter by discussing the different conceptualisations of the biobased economy, showing how the ecomodernist version is dominant and concretely put into practice today, and how degrowth theory still remains only a concept. We discussed the biorefinery as a prime example of contemporary biobased practice, criticising its techno-industrial – rather than *biobased* – approach to energy. This led us to ask why ecomodernism constitutes the dominant paradigm and what would be needed for a truly sustainable economic system to be created (Sec. 1). Accordingly, we turned to the critical literature from the field of STS to show how the framework of the BBE is overly narrow and insufficiently inclusive. Adding to this, we argued also that an existential dimension of desire escapes the BBE-perspective, emphasising the need for an answer to the question as to why humanity is collectively failing to transit into a sustainable economy (Sec. 2). Introducing a philosophical concept useful to analyse this question, we consulted the theory of the libidinal economy by Stiegler. This theory explains how the most fundamental reason for our collective failing is that the human mode of desire has been corrupted through multiple generations of technological structures adapting our very consciousnesses in such a way that long-term circuits, aimed at infinity, are being systematically replaced by short-term circuits, aimed at instant gratification (Sec. 3). Finally, we elaborated upon other relevant concepts needed to fully understand Stiegler's theory of human, technological and economic becoming. As such, this chapter has provided the basis for a philosophical analysis of the BBE that is able to answer the question as to why humanity is not actively transitioning into a novel, sustainable paradigm of economy.

For now, we have argued that the permanent innovation of technologies is caused by the consumerist model which bloats production to avoid the limit of the TFRP. This affects the consciousness of the people within the system, whose short-term drives are augmented ever more, reshaping the very manner in which they exist in such a way as to keep up with the permanent innovation of products. The grim conclusion is that consumers' libidinal energy is placed at the service of technical organisations, their attention harnessed and controlled, their libido systematically exploited within the ratio of the market. This organisation of protentions based in the first instance on the frustrated drives and desires of its subjects – as these frustrated drives both form the foundation of the system and are being disrupted simultaneously – is the libidinal economy that is draining itself from libidinal energy.

The economic system primarily oriented on growth once appeared as an infinite potential where actors on the market were free to chase their desires for profit and the endless accumulation of wealth through increasing production and consumption. Ideally, this system even provided wealth and well-being for society as a whole. But today, more than a century later, as our libidinal systems have taken on the short-circuit properties of this system of permanent innovation, the global situation no longer allows for this type of economics to flourish as it runs up to biophysical limits. The ever accelerating, ever updating and everchanging production of objects and profits depends upon the environment for resources and as a waste depot. In a deteriorating biosphere, the chase of short-term desires poses the exact opposite of what would be needed for sustainable human life, or even for healthy libidinal human life at all.

In the next chapter, the general description of the libidinal economy will be extrapolated onto the topics that formed the cause of doing this research in the first place, namely the binary debate

between degrowth theory and ecomodernism. The ultimate aim of our research is to provide a consistent and encompassing argument able to explain why humanity is not becoming sustainable.

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Chapter 5 - Ecomodernism and the Libidinal Economy: Towards a Critical Conception of Technology in the Bio-Based Economy

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Ecomodernism and the Libidinal Economy: Towards a Critical Conception of Technology in the Bio-Based Economy

In this chapter we develop the second part of a critical analysis of the concept of technology in the current design of the Bio-Based Economy (BBE). The basis for this analysis has been provided in the previous chapter. There, we observed a dominant focus in the BBE on technological innovation as the principal solution to climatic instability (the 'techno-fix' strategy) and took a critical stance towards this 'ecomodernist' worldview, arguing it falls short in providing an adequate, encompassing perspective on the issue of the climate crisis. In this chapter, we continue to work with Stiegler's theory of the libidinal economy, indicating the specific consequences of it in the context of the BBE. This philosophical perspective offers an analysis of controlled and exploited human desire as a primary driver behind modern techno-economic structures. We start by explicitly connecting this critical perspective to the concrete technology of the biorefinery as a prime example of the BBE in practice. Accordingly, we will compare the theory of the libidinal economy to classical critiques of techno-economics and make an argument that the failure of humanity to transit into truly sustainable paradigm has everything to do with the BBE perpetuating a past paradigm of economic growth. We show how this paradigm is characterised by a narrow focus on natural energy as fuel and resource. Finally, we add to the mainstream debate between ecomodernism and degrowth by arguing neither one escapes the paradigm of natural energy, proposing that a transition into a paradigm of existential libidinal energy is required for a genuinely sustainable bioeconomy, i.e. one that is literally based on the biosphere, to ever come into being.

1. INTRODUCTION

In the previous chapter, we have explained the dominance of ecomodernism in BBE-strategies from the perspective of the libidinal economy. The narrow focus on technological innovation in the context of climatic instability was explained with reference to the current economic paradigm, in which technology is consistently understood as a means to realise economic growth. We provided a theory of desires being modified by economic and technological structures leading to the short-term, drive-based, libidinally corrupted economic paradigm that we live in today. We now continue this analysis by translating the findings of the libidinal perspective into a critique on current biobased practice, aiming to contribute to the conceptuality required for a transition into a truly sustainable system. In this chapter, we will gauge which consequences the libidinal critique has in for the ambitions of the BBE and hypothesise how these could be mitigated, by asking: if the situation of libidinal short-circuiting applies to our current economic situation, what does that entail for the biobased economy? To do so, we will take what we have learned from Stiegler and apply it to the specific situation of the modern BBE. Addressing the range of specific consequences that the theory of the libidinal economy has for current BBE-strategies and practices, we will here answer the second half of our main question, which was: *what explains the dominance of ecomodernism in BBE-strategies and what critique of it would be required for a transition into a sustainable system?*

In the context of the BBE, the perspective of ecomodernism echoes the essence of the current economic paradigm of techno-economic growth. In fact, as demonstrated in the previous chapter,

virtually all existing biobased practice falls within the framework of ecomodernist strategies, because the only clear opposition to ecomodernism exists in the form of *degrowth* theory. Degrowth argues we should radically abandon all non-essential economic processes, focusing on long-term subsistence rather than on short-term luxury. The ecomodernist orientation, on the contrary, argues that the environmental crisis should be answered to by further upgrading technological abilities. It acknowledges humanity has become the foremost geo-factor shaping the planet and suggests we should take on this role and keep growing science, economies and technologies to create a future that is wealthy, high-tech and sustainable at the same time.

In the following, we aim to articulate a *third* position, underlying the binary, diametric opposition between degrowth and ecomodernism. The theory of the libidinal economy proved able to explain the fixation on technological innovation of technofixism. In essence, the strategy of looking for quick fixes springing from technological innovations is a clear symptom of a short-circuited mode of desire, itself conditioned by the very technological innovations shaping libidinal circuits. With this, the dominance of ecomodernism in current BBE-strategies is explained. Therefore, the question now becomes: *what critique of this dominance would be required for a transition into a truly sustainable system?* We might not immediately be able to define what such a truly sustainable system should look like, but diagnosing the exact issue preventing humanity from becoming sustainable seems a necessary first step to take here.

We will begin by summarising briefly the main notions of the previous chapter and then applying the explanation of techno-economic structures as being driven by (a currently corrupted mode of) human desire to the situation of the BBE, providing concrete examples of the theory in the practical context of the biorefinery (Sec.2). Accordingly, we will connect Stiegler's insights to the limits of technology, economy and the environment to classical critiques of technology-driven economics, arguing that the underlying problem of the BBE consists in the perpetuating of a past paradigm of economic growth as (exclusively) focused on fossil fuel as energy resource (Sec. 3). Finally, we suggest that neither ecomodernism nor degrowth escapes the paradigm of natural energy and propose that a transition into a paradigm of existential libidinal energy is required for a genuinely sustainable bioeconomy to ever come into being (Sec. 4).

2. THE LIBIDINAL ECONOMY IN THE BBE – THE BIOREFINERY

In the previous chapter, we discussed the practice of biorefining as the core technology within BBE-practice and addressed the fact that the current framing of biorefining in the BBE is overly narrow. Biorefining is understood to be successful when it reduces the use of fossil fuel resources and as a failure when it remains dependent on these resources (European Commission, 2012a). It has become clear, however, that just accounting for the sustainable production of biomass does not represent the complexity of the extensive field in which biorefineries operate. As such, it is often argued that this techno-economic scope of efficient resource management is insufficient to address the broad network of cultural, societal, environmental and political realities in which biorefineries are embedded (Palmeros Parada et al., 2017; Rafiaani et al., 2018; Pyka & Prettner, 2018 ; Clark & Szerszynski, 2021).

Now, we will explicitly show how an institution like a biorefinery can be ruled by a corrupted libidinal economy. To do so, it is first necessary to summarise here the important points from the previous chapter. There, we connected the theory of the libidinal economy to the specific coming about of the

contemporary situation of the Western techno-economy, explaining how capitalism once appeared as an economy providing bottomless wealth for everybody by activating humans' existential motivations. This changed, however, when limits were encountered, starting with the tendential fall in the rate of profit (TFRP), causing profits to decline after consumers' demands were satisfied. Trying to avoid this limit, the economic countertendency of the consumerist model emerged, making it so that people started buying not what they needed, but what they desired. This way, the ceiling for industrial production was raised indefinitely because anything could always be sold to somebody. Every economy is always also a libidinal economy but in our contemporary, Western economy, the event of the TFRP in combination with the consumerist model caused desires to be (dis)organised and degraded into drives. Over time, more and more long-term, libidinal circuits aimed at infinity (be they political, scientific, artistic, erotic or of any other sort) were replaced with short-term-circuits aimed at immediate gratification, based on impulsive and finite wants. The problem is that these disposable, excessive objects require an infrastructure of industry and commercialism to be produced. Moreover, an economic system that revolves around providing objects of short-term desires is itself ruled by such short-term urges, affecting policies, decision making and production systems alike to not be directed at long-term, sustainable investments. In our current version of a libidinal economy, libido has become corrupted, exploited and exhausted, altered by techno-economic development and constant, profit-driven innovation, and directed at short circuits provided by marketing. This self-reinforcing cycle of the combination of the TRFP and the consumerist model resulted in the Tendential Fall in Libidinal Energy (TFLE), which explains the tendency to technofixism.

Having defined the situation at large in this way, we have arrived at the point at which we can concretely demonstrate how the libidinal economy is at play in modern biorefineries. Because, as complex as Stiegler's philosophical analyses might appear, seeing how a degraded mode of desire is principally at play in current bioeconomic practice is in fact quite evident. Biorefineries compose a major part of the economic energy-transition in the bioeconomy and as such constitute a prime example of contemporary biobased processes in practice. Looking at the biorefinery, we can see that it is a regular institution of production. Certain targets must be met for the factory to prove its functionality and for more investments to be obtained to continue its existence. Energy output must hit certain levels for stakeholders to remain interested, the refinery must deliver more resources than it uses each financial quarter, employees must be paid, bio-nutrients must be obtained (while not going at the cost of food nutrients), and so on. A biorefinery that is sustainable but not economically viable goes bankrupt. Without a feasible business case, a BBE cannot come off the ground because BBE-frontrunners would have to close down before a sustainable transition can take place (Blok, 2022). Although a biorefinery could, in principle, constitute a meaningful step towards the long-term ambition of sustainable energy supply, it remains another institution of production operating on the free market, having to deliver on short-term goals, to come up with innovative developments and to guarantee financial growth in the foreseeable future in order to keep running at all (cf. Bos, Harmsen, & Annevelink, 2010; Schieb et al., 2015; Robson, Thomas & McQueen-Mason, 2020). The biorefinery is not yet a paradigm-transforming biotechnology but, rather, a regular artefact shaped by the same short-term, consumerist drives. These short-term economically pragmatic necessities suggest that the economy is not so much *based on* the biosphere but, vice versa, the biosphere continues to be exploited in the service of economy.

In the project of the BBE, the very survival of humanity is, at least implicitly or intuitively, at stake. Currently, this existential dimension of future human existence on Earth is not addressed in either

major policies or critical literature. The notion of the libidinal economy can help to clarify this conceptual discrepancy. For example, an encompassing study of biorefining lists the sustainability challenges of the undertaking and concludes: “Ultimately, sustainability can only be achieved on a global scale, across all sectors, over very long time frames. But it is important to recognize progress in the field of sustainable biorefineries towards this ultimate goal” (Holleman et al, 2014: 12). The problem is that sustainability is a normative concept here, describing the world not as it *is,* but as it *should be;* but the BBE does not take on this normative task explicitly, which would mean actually *basing economy on* the biosphere. Instead, the BBE is merely understood as a guideline for resource-optimisation and so, in practice, everyday survival on the open market takes precedence over normative sustainability (Blok, 2020; Veraart & Blok, 2021; Zwier & Blok, 2015).

Within a short-circuit libidinal economy, it is precisely these normative concepts of ‘very long time frames’ and an ‘ultimate goal’ that will not be accomplished. As long as the BBE essentially remains caught up in traditional economic practices such as constant innovation, meeting targets of energy production and competing with other energy producers, the drive to efficiency and short-term results in a fuel and growth-focussed paradigm of economics still completely determines the workings of the system. Within this configuration, because neither the BBE nor the biorefinery even discuss such long circuits of desire, it is implausible that long libidinal circuits will emerge from it. Still, the talk of ‘very long time frames’ in the context of ‘an ultimate goal’ might itself be understood as a long-term libidinal circuit. If – hypothetically – an economy could be conceived that is oriented on long circuits and ultimate goals, allowing for long-term investments, a normative version of a bioeconomy could work infinitely towards a more sustainable system. This would require a collective effort of recognising and acting according to long-term desires. Within the current libidinal economy, however, it is questionable whether long-term oriented individuals could unite this orientation into such collective effort.

As a mere example of BBE-practice, the biorefinery is of course not responsible to realise the structural ideal of establishing an actually sustainable bioeconomy. Yet, the very absence of such an ideal is symptomatic of the issues at stake in the encompassing transition of which it is an instance. This is not a problem caused by any individual working in a biorefinery, nor even one of collective decision-making around bioeconomy objectives at large. Such individual and collective identities are all part of the encompassing libidinal economic system, that conditions the very modes of desire and consciousness of the subjects partaking in the network. Each human identity working at the project of the bioeconomy is individualised through short-term desire-circuits (salary, profit, cost-effectiveness of biorefinery on the open market, etc.) obscuring any long-term perspective. Whether a biorefinery employs diesel-powered trucks to import waste materials across the continent, spends government grants on short-term finances, is managed by huge companies operating on the profit-driven industrial market, or even resorts to the burning of whole tree trunks or animal parts to reach the desired energy output, (cf. Schieb et al., 2015; Robson, Thomas & McQueen-Mason, 2020) all these unsustainable practices can essentially be explained from the notion of a corrupted libidinal economy in which short circuits take priority over possible long-term circuits in the service of the ultimate goal of sustainability.

3. THE LIMITS OF TECHNOLOGY, ECONOMY AND THE ENVIRONMENT

The fundamental connection between technological innovation and economics is, of course, not something first noticed by Stiegler, but has long since been observed by economists such as Karl Marx[12] and Joseph Schumpeter. In the industrial capitalist system, production becomes so efficient that it reaches a limit, which implies a limit to profit.[13] Businesses need to constantly adapt and innovate to be able to compete on the market. If nothing changes, economic growth stagnates. This is why, according to Schumpeter, the 'capitalist enterprise' and 'technological progress' are 'essentially one and the same thing' (Schumpeter 1943, 110). In order to realise economic growth, new limits of efficiency must be discovered to overcome the previous ceiling. This is what Schumpeter famously calls 'creative destruction'. Although without involving the libidinal perspective, Schumpeter identifies a cycle in which entrepreneurs explore and exploit innovations to achieve a temporary monopoly. These innovations are then copied by large firms, necessitating new innovations once again by entrepreneurs. This cycle of competitive technological innovation is what essentially drives the economic system: "The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates" (Schumpeter, 1943, 82).

Another classical observation about the relation between technological innovation and economics that is significant here, is the impasse known as the Jevons paradox (Alcott, 2005). Conceived of in 1905, when structural effects of the industrial revolution were becoming noticeable, Jevons noticed that when a new technology increases efficiency of production, total consumption *also* grows. This is paradoxical because usually, in economics, supply and demand are supposed to balance each other out; if something is produced more easily, production costs should go down and therewith consumption should increase up until a stable limit. However, in practice, increase in efficiency will lead to *increase of both production and consumption* instead of, for example, using the excess energy for sustainable practices. Moreover, the Jevons paradox is especially problematic in a sustainability context because here, if production processes become more efficient (e.g. biofuel is obtained more easily), demand rises along with supply and net pollution will still go up, making the system de facto less sustainable.

The notion of the libidinal economy can help to makes sense of the Jevons paradox. The continuous chase of novelty is a fundamental driver for businesses competing on the market, which undermines an equilibrium of supply and demand. In a system where people chase their short-term, ever-changing desires to consume, there will always be enough demand and so production processes can never become overly efficient and will keep supplying products aimed at short circuits of desire. As everything can always be sold to anybody in this short-term libidinal economy, the self-reinforcing cycle of economy and technology has no principal limits except for the natural environment. The

[12] The reason we focus here on Stiegler and not (only) on Marx is that Stiegler adds a perspective of original technicity in a non-instrumentalist manner, working further on the development of the philosophy of technology. Additionally, Stiegler's libidinal perspective enables a critique of political economy with an emphasis on its technological condition specifically. Stiegler does not offer a final answer, but his perspective is fruitful in this specific context.

[13] Picking up on analyses developed both by Schumpeter on the law of diminishing return and by Marx on the tendential fall in the rate of profit, Stiegler elaborates on these economic workings significantly. Explaining these in detail, however, fares beyond the scope of the current research.

reason for this is that the short-circuit, frantic production system makes use of the biophysical systems of the planet both as resource and as waste depot. As long as environmental problems are principally seen as market failures, the solution to these failures is found within the economic paradigm, where the environment is seen as a subset of human economy, i.e. as a resource for production (Blok, 2018). As long as the economy is not understood as a subset of the ecosystems of planet Earth, technological innovation in itself can never pose a sufficient answer to the climate crisis. Returning to the stakes of our analysis, it should accordingly be asked what the consequences of the libidinal economy are for the ecomodernist BBE ambitions to innovate our way out of the climate crisis.

The examples of Schumpeter's creative destruction and the Jevons' paradox show how on the one hand, the technological and environmental limits to economic possibilities have already been clearly indicated in the past. On the other hand, as it becomes more and more obvious that human efforts to counter climatic instability are having insignificant effects, it should be explained why our species is collectively failing to have any real sustainable impact. Stiegler's theory of the libidinal economy enables us to reflect on these ecological limits from an original perspective, which remains hitherto underarticulated in the context of the BBE. The idea that is new here, is that the main challenge is not that of inventing the best innovations to solve environmental problems, nor even a matter of individual or collective responsibility or action. Rather, it becomes a matter of the very mode of human existence being adapted and modified over generations due to the very systems of economy and technology surrounding and conditioning human being on an intentional and libidinal level (i.e. of consciousness, attention, desire). The perspective of the libidinal economy allows for biobased practices to be viewed from the existential standpoint of a species that is collectively conditioned to chase short-term desires, paralysing itself to make structural investments for the far future.

4. DEGROWTH, ECOMODERNISM AND THE LIBIDINAL ECONOMY

Because the theory of the libidinal economy applies to individuals as well as collective organisations, in the context of the BBE, it can help to make visible a lacuna in the two previously mentioned dominant ways of thinking about the BBE, ecomodernism and degrowth (Vivien et al., 2019). These two paradigms are generally posed as being mutually exclusive, but have more in common than appears *prima facie.* Both ecomodernism and degrowth frame the problem of and the solution to climatic instability in terms of *natural energy,* i.e. fuel, or what Stiegler refers to as the 'energy of subsistence' (Stiegler 2013: 91). Ecomodernism argues we should continue using our technologies to obtain plenty of energy so that we might innovate ourselves into a sustainable future one day. Degrowth theory argues we should abandon many energy-consuming processes and focus all resources on long-term survival, meanwhile living less energy-hungry lives. But the framing of the BBE in terms of the binary opposition between degrowth and ecomodernism excludes a third possibility.

On the basis of the theory of the libidinal economy, the true problem of energy is not so much one of replacing our fossil fuel based energy production systems by renewable energy production systems. Rather, it might be one of restoring or renewing *long circuits* of *libidinal energy*, which is being destroyed and decomposed currently into short-term oriented drives (cf. Stiegler, 2013). On the one hand, libidinal, i.e. social, passionate energy is the source of energy for the free market to thrive, motivating subjects to do business and grow wealthy. On the other hand, these processes are destroyed by the consumption model of marketing, i.e. infinite desires that constitute our relation to

long-term goals are disrupted by the short-termism that short-circuits libidinal circuits. Within such a corrupted version of the libidinal economy, replacing fossil fuels with renewables will not lead to sustainability because the economic system at large is still growth-oriented and will always continue to exhaust resources for short-term gain.

Without a critique on the libidinal economy, all conceptualisations concerning the BBE remain caught up in the paradigm of natural energy.[14] Even the fiercest opponent of this paradigm, degrowth theory, can be seen to adhere to it to some extent. By focusing mainly on consuming less, degrowth is caught up in a negative dependency regarding ecomodernism: it is mostly focused, *via negativa,* on what should *not* be done, without offering itself a constructive, alternative paradigm framed beyond natural energy. Accordingly, degrowth theory seems to tend to an 'anti-technology' stance. However, it could be the case that the fundamental issue is not a matter of either consuming 'more' (ecomodernism) or 'less' (degrowth) technologies but, rather, a matter of a shift in desire. By showing how both ideologies share the orientation on the libidinal economy and the paradigm of natural energy, another – third – position regarding technology beyond this dichotomy becomes visible: a libidinal one. The paradigm of control, growth, efficiency and fuel has been hardwired into our collective memory through the economic designs of institutions, laws, production equipment and other infrastructure. Human attention in general has co-evolved with the technologies from the dominant ecomodernist paradigm. This provides an answer as to why it is impossible to suddenly change back or forward to a mode of long-term mode of economy in which radically less technologies are consumed. What this comes down to, then, is that ecomodernism is correct in stating that we need to keep employing technology but incorrect in stating that the current techno-economic, free market orientation is the only or best way of achieving sustainable development. Similarly, degrowth theory is correct in stating that we need to drastically alter our modes of living, but requires a focus also on the libidinal dimension to conceptualise a strategy beyond 'abandoning' technologies or revert to a state of minimal, plant-based economic existence.

Currently, as a bioenergy fuel economy, the BBE completely adheres to the problematic libidinal structures at play in the ideal of the techno-fix and ecomodernism, making it unlikely that this system will one day become sustainable. Even if the BBE were to explicitly be a project of first establishing humanity's survival before working on the establishment of long-term libidinal circuits, as ecomodernists might argue here, this cannot be the logical order of transition. Sustainability should from the outset serve as a normative principle, inspiring long libidinal circuits for a future economic system. Framing today's energy-problem in terms of *fuel* is perpetuating the past paradigm of limitless growth (of fuel) in the incommensurable, current situation of the environmental crisis. Surely, natural energy production is important for humanity to subsist but, besides that fact that lots of energy is used to satisfy short-term urges, merely staying alive is not enough. Subsistence is not the only relevant solution but needs the addition of the existential dimension of the human condition. Such seems to be our ironic fate, that the most short-term oriented humans that have ever lived are tasked with the most long-term challenge humanity has ever encountered.

We cannot abandon the technical systems that have shaped us overnight, as might seem the wish of degrowth theory, but neither can we keep designing the technical systems in the way of the last century, as this ecomodernist paradigm of overproduction, overconsumption and excessive pressure

[14] Introducing this demarcation, from here on out we will be distinguishing between 'natural energy', as fossil or biobased *fuel,* and 'libidinal energy', as social, passionate energy concerning human desires.

on both the climate and our own consciousnesses has long since run its course. The short-circuits that run the BBE will, by definition, not survive the wear of time as fossil fuels will drain and chronic innovation will replace them anyways eventually. The question for the BBE is, then: what is the 'ultimate goal' of a biobased economy? What is the BBE *for,* what is at stake? Even though BBE-policies need not explain how humans have to live or why, it must have an answer here. Currently, the point of installing circular processes everywhere seems to be *for humans not to die.* This is a short-term goal. Of course, we must first eat and breathe and survive (maybe even producing some unsustainable energy in the process) before fulfilling higher life goals, but the objective of vegetative persistence or also includes the existential dimension, always being implicitly at stake: if we remain alive, what is that life worth living for? If it is to pursue short-term urges, not only will we be frustrated, addicted and unhappy, but neither will we survive as we will not have the attention to create sustainable long circuits. The macro-project of transiting into a new era of energy-use of the BBE might require, besides the replacement of linear by renewable fuels, nothing less than a revolution in libidinal energy. In the face of the finitude of our habitat, we might indeed require *limitless, infinite economic growth*, but not necessarily in first instance of fuel, but of a different kind of economic energy altogether: libidinal energy aimed at long-term goals, infinitely improving itself.

5. CONCLUSION

We began this chapter by recalling lessons learned from the previous one, discussing the notions of ecomodernism, desire and biorefining. Accordingly, we argued the framework of the BBE is overly narrow and that an existential dimension of desire escapes the BBE-perspective, emphasising the need for an answer to the question as to why humanity is collectively failing to transit into a sustainable economy. We connected Stiegler's libidinal perspective to classical criticisms on technology-driven economies to view the dominant economic paradigm from the angle of desire (Sec. 2). Next, we defended the thesis that the most fundamental reason for our collective failing is that the human mode of desire has been corrupted through multiple generations of technological structures adapting our very consciousnesses in such a way that long-term circuits, aimed at infinity, are systematically replaced by short-term circuits, aimed at instant gratification. We aimed to make this visible in a concrete way by referring to the biorefinery as an example throughout (Sec. 3). Finally, we suggested that neither ecomodernism nor degrowth escapes the paradigm of natural energy understood as fuel and proposed that a transition into a paradigm of libidinal energy needed for existence is required for a genuinely sustainable bioeconomy to ever exist (Sec. 4).

We have applied Stiegler's theory of the libidinal economy to the context of the BBE, arguing that a humanity caught up in short-term, drive-based, addiction-like impulses can never produce the long-term, sustainable structures required for the implicit existential goal of the BBE. We stated that both the degrowth and the ecomodernist conceptualisations of the BBE thematise the problem and solution of climatic instability in terms of natural energy, whereas conceiving of the stakes in terms of energy as libidinal, human energy offers a more encompassing and adequate perspective to criticize current practices. With this, we received an answer to our main research question. The theory of the libidinal economy explains the dominance of ecomodernism, because it is based on short-term, drive-based desires. The alternative of degrowth theory is in need of including the libidinal dimension if its conceptuality is to transcend the framing of the paradigm of economic growth and natural energy.

The analysis in general shows that what is needed is a departure away from short-circuit-based natural energy and towards a long-circuit economy of libidinal energy.

Industrialized humanity has, over generations, become caught up in a self-reinforcing cycle of technologies and economics, completely in the mode of the paradigm of economic growth and natural energy. The idea that a techno-fix could repair the biosphere, stemming from an outdated – yet still currently dominant – paradigm, is a harmful figment of corrupted imagination and structures of desire. Convinced as we are by individualised imagery and personalised advertisements that we are expressing our unique identities through the purchase of the latest shiny objects, the all too human illusion of autonomy and control remains intact while we consume ourselves and the planet towards the end. In fact, it is not even the case that we consume too much but, rather, we are ourselves *being consumed* by our very own subconscious drives, which have been brought to the surface of economic function under the purpose of profit. Remnants of a techno-economic model created more than a century ago are finally catching up to collect a significant debt. At the very least, the current analysis shows that the existential dimension of human consciousness and desire (conditioned by intergenerationally accumulating technological knowledge and infrastructures) is a relevant, yet heavily underarticulated dimension of a project such as the BBE. Whether acknowledged explicitly or not, the BBE is a project in which the survival of humanity is at stake. But merely surviving means, in this context, to continue toxic, short-term libidinal circuits and precisely not to work collectively towards the infinite goal of establishing a techno-economy within the limits of the biosphere.

What could a bioeconomy embedded within a long-circuit libidinal economy look like? To answer this question following from the analysis, future research is necessary. However, it seems clear that a fundamental role is played here by *technology*. On the one hand, our corrupted desire is technologically constituted and transformed. On the other hand, this does not exclude the possibility of future transformations in the human relation with technology. Technology and long-term circuits do not necessarily exclude each other, as is made clear by the example of the infinity involved in playing an instrument as an alternative to technological consumption and exploitation The question is then whether it is possible to re-condition libidinal structures via technology. Attempts should be made to conceptualise a biorefinery according to long-term desire-structures aimed at infinity. It should then be explored which long-term structures remain conceivable within our current technological constitution. Regarding Stiegler's theories, in this context his notion of 'pharmacology' should be further explored, as this notion means that technological systems, structures and circuits constitutive for identity are always both the toxin and the remedy, offering possibilities both of corruption and of salubrious therapy.

Hypothesising on other options for future research, in general, it seems a new *kind* of economy altogether should be practiced, which supports the regeneration of both natural and libidinal energy. Research that addresses the entire epistemic orientation in the context of nature and technology is scarce, but upcoming (Zwier, 2021; Blok, 2019; Zwier 2018). If the bioeconomy claims to be a project in the service of a grand, infinite ideal, such as sustainability, it might need to allow for certain processes to occur that are free to contribute and work toward this 'ultimate objective' instead of carrying out (capitalist) business as usual, operating only under the flag of environmental concern whilst merely focussed on the next quarter's profit numbers. Truly operating in service of a grand, infinite objective could thus imply reconsidering the very motives for human existence; what are we alive for on this planet? To eat, sleep, procreate and die, or for the pursuit of politics, wisdom, beauty,

morality, infinity? Concretely this might entail that we no longer expect the light to go on at any given instant, that energy, whether fossil, bio, or libidinal, is not always readily available. That we could again find meaning in the simpler, yet infinitely deeper – and rechargeable – affairs of life, such as a walk, a talk, a drink, a fire, art, music, theory, science, philosophy, (physical) interhuman relations, and so on. Finally, it could entail that time and space are required in which failures are admitted and open experimentation is not pressured to produce results that cannot reasonably be obtained – such as quick and consistent profits – if a surpassing ideal of a regenerative ecological economy is to ever be created.

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Chapter 6 – Discussion and Conclusions

6.1 Introduction

This thesis has reflected on the concept of a bio-based economy. It has systematically asked how the notion of a bioeconomy can be conceptualized to inspire sustainable economic practice. In doing so, a number of existing answers to this question were demonstrated to be inadequate, because they are primarily economy-based or technology-based and in fact not *bio*-based. The critical examination of such answers, to be found in contemporary strategies in dealing with the climate crisis, has led to a thorough interpretation of the meaning of the project of 'basing' an economy upon the biosphere. In this concluding chapter, we will go through the main findings of the thesis as a whole in order to answer its main question. Accordingly, on the basis of the knowledge this thesis has added to the debate, we make recommendations for future work and conclude the dissertation with some final remarks.

The dissertation as a whole should be understood as a response to the call for clear and unambiguous standards, a common context and vocabulary and a coherent conceptual model for the bio-based economy. We have developed a critical attitude of the current state of the bio-based economy, thereby dismantling and rearranging the big notions that are at stake in it. We have philosophically gauged how the biosphere, humanity, the economic sphere and the technosphere are related in the context of the climate crisis and the response to it. Rather than providing strong normative guidelines or new ethical principles ourselves, we have opened up multiple critical perspectives and made explicit the fundamental issues that have not been fully articulated before. Solving a problem necessarily implies that it is thoroughly understood. Our analysis of fundamental concepts has made the background of existing normative frameworks more transparent. By establishing its fundamental conceptuality, we have provided a first philosophy of the biobased economy.

The main question of this thesis was: 'How can the idea of a bioeconomy be conceptualized to inspire economic practice that operates within the carrying capacity of the biosphere?'. As a result of developing this question, we obtained a clear understanding of the concepts involved in it, especially in chapter 4, where the currently dominant logos of ecomodernism was introduced as a concept. Since we wanted to analyse in detail why ecomodernism obstructs a transition into a sustainable paradigm and what would be needed to overcome this obstruction, we specifically asked a second main question in the second half of the research: 'What explains the dominance of ecomodernism in BBE-strategies and what critique of it would be required for a transition into a sustainable system?'. The answers developed here can now be summarised as follows. In doing so, we go over the main argument of the dissertation again, considering the most important concepts in it and showing how we contributed to existing debates and polemics specifically.

6.2 How to Base an Economy upon the Biosphere?

In chapter 2 of this dissertation, we have shed light on the basic relations between the biosphere and the economic sphere in the BBE. We have investigated the different concept surrounding this connection between the natural environment and human, economic existence, such as the Circular Economy, the cradle-to-cradle principle, and biomimicry. We have argued that current policies still

contain many discrepancies and unclear, oftentimes contradictory concepts. The first thing that required clarification in this context was the BBE's main ideal; we critically asked whether the BBE is a normative, 'strong sustainability' concept, guiding for policy, legislation and practice – or, rather, a 'weak sustainability' concept, providing abstract inspiration for minor greening practices, such as ancillary recycling initiatives. When looking at the relation between economy and ecology, we found that the biosphere is generally understood as a depot of scarce resources, ready to be used for economic processes, instead of as the supportive ground for any human activity. Current conceptuality thus turns reality upside-down: the BBE does not try to mimic natural, sustainable cycles but, rather, dominates and exploits the biosphere through economic processes.

We then offered an alternative conceptualisation of the relation between the biosphere and the economic sphere. With Levinas, we introduced a concept of economy as a kind of metabolism in which humans always already exist. Long before any economics began, we already were – and still are – biological beings in need of oxygen and nourishment. But the concept of metabolism also applies to current economic cycles, in which 'the house' – *oikos* – constitutes the centre of economic activities such as labour and transforming externalities such as plants and animals into energy for human agents.

A second conceptualisation of the relation between economy and ecology that does more justice to reality than the BBE's reversal of the economic sphere and the biosphere was found in the work of Georgescu-Roegen. Roegen debunked multiple 'energy myths' that still guide our thinking about biobased practice today, such as ideas of eternal growth, immortality and stationary states. Roegen did so by referring to ecological entropy, the incomprehensibly bigger energy processes that occur in nature, the epistemological impossibility of answering unpredictable natural events, and the disturbance of a natural balance caused in large part by addictive technologies.

On the basis of these alternative conceptualisations, we argued that current BBE-notions could be made less inconsistent and more adequate by at least adding two fundamental concepts to the general debate: *elementary nature* (*'il y a'*) and *enjoyment.* Indeed, humans must necessarily consume other organisms and overcome the harsh conditions of the natural world. However, this does not mean humanity can overcome and control the complete natural world. Nature itself as an interminable, indominable biosphere both threatens life through the hardships of the elements, and constitutes life, by providing conditions such as oxygen and water. Not all of nature can be controlled, nor should it even be our aim to do so. A solid concept of elementary nature is essential for BBE-conceptuality to indicate the boundaries of the biosphere in which a bioeconomy should operate. Secondly, we said that what any bioeconomy is *for,* in the end, is human enjoyment: the sensible experience of life's content and meaning. Human life itself, sensibly and corporally involved in the world, is always also something more than mere economic function. The enjoyment of the reasons for existing cannot be reduced to economic rationality, nor to mere labour or survival. Economy is not itself the meaning of life but only a means to give rise to a sphere in which humans can enjoy life.

This first encounter with the fundamental concepts at play in the BBE demonstrated how the theoretical framework of this encompassing climate saving strategy is still naive. The framework is incomplete on both ends as it both lacks the macro-perspective of the fact that before any human activity there lies a conditional, unfathomable biosphere (*il y a*) and the micro-perspective of the fact that beyond all economic rationality lies the human condition as sensed experience (enjoyment). Furthermore, a bio-based economy that confuses 'bio' for 'economy' is not conceptually sound. We

critically stated that if the BBE genuinely stands for the ideal to transform economic processes into a variant operating within the biosphere's limits, it should change exactly this, that everything is always first and foremost about economy and never about nature itself.

6.3 The Economy is for Humans

Having shown how the relation between ecology and economy is fundamentally inversed in the BBE, we continued the identification of flawed conceptuality. Because, if it is true that the relation between nature and economy is completely reversed in BBE-conceptuality, then this must result in a range of consequences that we could not all address together. Whereas the BBE is exposed as more of an EBE – an 'Economy-Based Economy' – than a BBE at the start of our research, here we change to a critical stance from a slightly different perspective. This time, the BBE is exposed as a 'Human-Based Economy' (HBE). Here, our critique is not directed at the design of the BBE *per se* but, rather, focused on a fundamental problem within the human condition itself.

Chapter 3 carries out a confrontation with an ethical concern. Because, from the consulted philosophical concepts in chapter 2 it followed that human existence is, permanently and conditionally, within the contradiction between sustainability (bio) and growth (economy). Having seen there that humans, though emerging from the natural world, necessarily have to overcome their biological habitat through the establishment of economic principles and infrastructure, the question became: are humans inherently harmful creatures that cannot help but disturb the conditions for their very own existence? Because, in enjoying our everyday lives, by driving cars, consuming entertainment, eating meats and purchasing plastic stuff that we want but do not need, we are engaged in a concrete present and forget the ecological consequences of our consumerist behaviour. This disconnect between our primary desires and their disastrous results explains the current context of climate crisis but also burdens us with a more philosophical question about human existence; are we really, essentially, such ignorant, self-absorbed creatures without a care for our environment and future, or does another explanation exist? In other words, is the economic overcoming of ecology a *necessary* condition or is it a *contingent* mode of human existence?

Aiming to begin answering this significant question, we stated that the paradox between growth and sustainability in the BBE might have everything to do with the discrepancy between our direct, everyday enjoyment and the harmful consequences thereof for the planet. It cannot be a coincidence that the human condition is itself within the very same contradictory structures as the project of the BBE. We learned more about this relation when we discovered a fundamental connection between the two major concepts that have been consistently at stake in the first half of this dissertation, enjoyment and elementary nature (*il y a*). Understanding this connection could help us understand why our best policies for answering to the climate crisis can have self-contradictory titles such as 'sustainable growth'.

Our reasoning boils down to the following argument. There is being, rather than that there is nothing. Nature exists. In French: *il y a.* Within our quotidian lives we are often caught up in the metabolic relation of labour and consumption that is economy. Sometimes, however, we can notice how unique it is to be a functioning organism on a giant rock flying through a dark vacuum. Then, we can notice the fact that we exist: nature exists and, moreover, *I exist.* The existential mode from which this appreciation of existing is possible, is called *enjoyment.* Enjoyment is enabled by biophysical,

metabolic and economic processes, but does not coincide with them. As qualitatively sensed experience – e.g. *my* teeth sinking into the bread – enjoyment fares beyond labour or digestion and provides life with its content, indeed its very meaning. Humans are therefore not only a working species but also an enjoying species. Enjoyment lifts one above strictly economic processes of sustenance and labour and into a realm of qualitative experience. This makes it clear that economy is not the purpose of life, but a means towards that purpose, enjoyment. Just as enjoyment emerges from economy without coinciding with it, an economy both requires a biosphere and is simultaneously disconnected from this natural world, by overcoming, exploiting and polluting it.

Still asking whether the economic overcoming of ecology is a *necessary* condition or a *contingent* mode of human existence, we focus on the relation between the very existence of the natural world and the qualitative, sensed contents of our lives in it. We might no longer fully coincide with this natural realm but we still emerged from it and are still completely dependent on it. In irreducibly experiencing the very quality of life, there could be a link towards an appreciation of the natural world that provides the vital conditions of that very enjoyment: my existence is related to the existence of the planet, my consumption patterns are polluting the Earth; if I want future generations to enjoy a healthy biosphere, I should behave sustainably. Behind growth, control, management, efficiency and production still lies the human condition, partaking in the infinity of the unique phenomenon of life. In this sense, enjoyment could, indeed, still be something more than plain consumerism. If that is true, then our current, environmentally disruptive mode of economic behaviour would be a contingent condition, i.e. of a certain time, place, political or technological variant.

The second half of this dissertation investigates these questions in more depth and from a different angle. There, we try to find out what exactly caused the disconnect between human economy and natural ecology, whether humans are inherently destructive creatures or rather caught up in a specific mode of economic existence blurring their relation to the natural world, and why humankind is in general failing to become sustainable. For the end of the third chapter, this much has become clear, that enjoyment shows that the human condition is something more than mere economy, work, resource efficiency, and other such metabolisms. Human enjoyment is indeed the ultimate output of any (bio-based) economy. Concluding this chapter of the thesis, we stated that future bioeconomies should reserve structural room for explicit appreciation of nature as an uncontrollable realm and of human beings as more than eco-efficient labourers.

6.4 Enjoyment or Consumption?

In the foregoing analyses, it became clear that the economic realm dominates and dictates the ecologic realm in the BBE and forgets the existential realm of enjoyment, the human condition, which fares beyond efficient labour. The analyses of core concepts led to a confrontational ambivalence in the way in which humans currently deal with the biosphere and offered possible broader conceptualisations of this relation, including also people and planet besides just profit. However, indicating that there exist realities beyond the current economic reality, such as enjoyment and nature itself, is not enough to see *why* economic reality has come to be as it is, dominating all other aspects of life. It is clear that humanity needs to transit into a new kind of economic system. But to do so, it must be clear what exactly the problem is with the *economic* dimension of the BBE, i.e. why it is so dominant. Why do we keep failing to become a sustainable race, neatly existing within the biosphere's

limits? If a coherent strategy of transition into a sustainable era is ever to be made, these questions must be answered.

In the previous chapter (3), we came to the careful conclusion that enjoyment is something more than plain consumerism: there is a difference between economic activity and the existential enjoyment of its outcomes. We also argued that if that is true, then our current, environmentally disruptive mode of economic behaviour is a contingent condition, i.e. of a certain time, place, political or technological variant. But this might mean that our current mode of enjoyment is corrupted by economic consumerism. Therefore it is necessary to demarcate these concepts further and ask *why* humans today crave pleasure so much that they pay the price of a long-lasting future for just a mere moment of it: why are we the way that we are? How did humanity end up in this situation?

Philosophically, this shift in questioning is accompanied by moving on from the thought of Levinas to that of Bernard Stiegler. Because, whereas Georgescu-Roegen's and Levinas's analyses helped to shed light on the fact that humans are always already *originally* 'biobased' in the sense of being ecological beings themselves existing within a metabolic cycle that is at least as biological as it is economic, Stiegler offers insights into the *contingent* aspect of the human condition as we currently know it. His answer to our question of how humanity has gotten caught up in the current mode of economic existence would be that this is *not* the natural, necessary shape of human existence but, rather, a specific, temporal condition. Specifically, Stiegler argues that technology has, over generations, modified human desire. In chapter 4, we explore Stiegler's argument in detail, following the intuition that Stiegler's thematization of the manner in which technology has shaped human beings over past generations can help to clarify humanity's current inability to transit into a sustainable economic paradigm.

In Stiegler's theory of the libidinal economy, we do indeed find a new answer to the issue of our collective paralysis in the face of environmental degradation. According to this theory, human, unconscious desires (libido, mortido, anxiety, greed, aggression, obsession, etc.) have been shaped over time by technological structures that select specific knowledge, praxis and behaviour over multiple generations of human lives. Such technologies, in the time of the Industrial Revolution, used to consist in the automation of physical labour, raising the ceilings of material production to unprecedented heights. During the 20th century, however, the existence-modifying technologies at play in our economy started to automate also *cognitive* processes. Techniques of mass-media and marketing were consciously employed to raise, alongside the new production limits, the limits of *consumption.* Advertisements are used to convince the average subject more and more that more and more products are worthy of their desires, so that everything could now always be sold to anybody. Industrial production could now produce far more than just the bare necessities of society and started creating countless superfluous yet 'must-have' items, accessories and gadgets.

This is the theory of the *libidinal* economy: that the economic system is shaped in first instance by the runaway, addiction-like *desires* of consumers; that technology shapes both individual and collective processes of individuation. This is a complete reversal of the regular interpretation of this relation, in which it is assumed humans shape technologies. Stiegler explains that nowadays, i.e. in the current techno-economic infrastructures, in order to manifest an identity, a person or a group has no choice but to pass through the technological infrastructure of attention-modifying equipment. *Cognition* and *desire* are then formed into *libidinal circuits* that are no longer able to orient themselves on long-term, deep future investments because they are no longer occupied with matters of infinity such as beauty,

truth and morality but are concerned more and more with short-term desires such as commodities, entertainment and money.

Humanity's exceeding of the limits of the biosphere can be better understood if we enrich the perspective by involving Stiegler's theory of exceeding the *libidinal limit.* Stiegler's theory offers and understanding of people's attentions, desires, indeed their very consciousnesses, having been shaped into a mode of constantly consuming users caught up in short-term, drive-based desires instead of long-term, structural investments. In the following, final chapter (5) of the thesis, we explicitly made the connection between the biobased economy and Stiegler's theory of the libidinal economy. There, we employ the theory of the libidinal economy as a critical instrument to address current biobased concepts, technologies and practices, expecting that this analysis provides the BBE with a new perspective, as Stiegler did not make these connections himself.

6.5 Technologically Modified Desire

In chapter 5, the grand concepts of nature, economy, humanity and technology are brought together in a final analysis of the BBE, which is this time revealed as a Technology-based Economy (TBE). The dissertation began by asking how the notion of a bioeconomy could be conceptualized to inspire genuinely sustainable, i.e. literally bio-based, economic practice. After suggesting the addition of the concepts of enjoyment and elementary nature, and especially their relation, into the bigger picture of bioeconomy conceptuality, the question became: why is humanity failing to transit into a sustainable economic paradigm? In this final analysis, we provided an answer to this question from a generally underarticulated perspective. This perspective consists in the libidinal view of the current economic situation; the hypothesis that a corrupted mode of human desire is at the heart of our inability to take any real sustainable initiative. Having explained the concept of the libidinal economy in the previous chapter, in the current chapter we applied it to the concept of a biobased economy and its practices.

The chapter (5) begins by summarising the theory of the libidinal economy from the previous chapter (4). In order to put this theory to work in the context of the BBE, we apply it to the practice of biorefining. We show how such industrial producers of energy are completely caught up in the paradigm of production, stocking resources and controlling and exploiting the biosphere. This is not a fault or an issue of the biorefinery *per se*, but a general condition springing from a corrupted libidinal economic system. The biorefinery cannot evolve into a transformative practice of sustainable energy production, because it is governed by the same principles that are at work in all other branches of the economy; profit, growth, output, stakeholder margin, and so on. Within these confines, it is unlikely that biorefining can become 'biobased' in the literal sense of an economic process operating within the planet's carrying capacity.

As Stiegler is far from the first to realise there is a fundamental connection between economy and technology, this chapter discusses the notions of Schumpeter's creative destruction and Jevons' paradox. These two examples make clear how technological innovation is the driving force of the current (Western, capitalist) economic system and how this industrial production model leads not to an equilibrium of supply and demand on the open market, but to the paradoxical situation of an increase of both production and consumption. The biorefinery, too, is an example of technological innovation driven by a market economy and in that sense it does not differ categorically from non-biobased economic practice.

This techno-economic situation of chronic innovation can explain why our species is collectively failing to have any real sustainable impact when its relation to the libidinal economy is seen. Because, from

this perspective, the main challenge is not that of inventing the best innovations to solve environmental problems, nor a matter of policy-design, nor of doing the best science, nor even a matter of individual or collective responsibility or action. Rather, we suggest that fundamentally at stake could be very mode of human existence being adapted and modified over generations due to the very systems of economy and technology surrounding and conditioning human being on an intentional and libidinal level (i.e. of consciousness, attention, desire).

What has changed in the mode of existence of humans that is primarily relevant here, is that human attention-systems over time are becoming more and more oriented on short-term, finite, instant gratification and less and less on long-term, structural investments into an infinite future. This arrangement is diametrically opposed to the normative concept of long-term sustainability at stake in answering to the climate crisis. As long as the BBE essentially remains caught up in traditional economic practices such as constant innovation, meeting targets of energy production and competing with other energy producers, the drive to efficiency and short-term results in a fuel and growth-focussed paradigm of economics still completely determines the workings of the system. The inner structures of the economic paradigm actively prevent long libidinal circuits from coming into being.

This analysis allowed us to introduce a third option in the classification of types of bioeconomy. Currently, there are two categories that are generally posed as being mutually exclusive, *ecomodernism* and *degrowth*. But these two options have in common that they both frame the problem as well as the solution regarding climatic instability in terms of *natural energy,* i.e. fuel. Ecomodernism argues we should continue using our technologies to obtain plenty of energy so that we might innovate ourselves into a sustainable future one day. Degrowth theory argues we should abandon many energy-consuming processes and focus all resources on long-term survival, meanwhile living less energy-hungry lives. But this binary framing of the BBE excludes a third possibility. On the basis of the theory of the libidinal economy, we argued that the true problem of energy*,* today, is not so much one of replacing our fossil fuel based energy production systems by renewable energy production systems. Rather, it might be one of restoring or renewing *libidinal energy*, which is being destroyed and decomposed into drives. Because, within a corrupted libidinal economy, replacing fossil fuels with renewables will never lead to sustainability because the economic system at large is still growth-oriented and will always continue to exhaust resources for short-term gain. Our contribution consists in pointing out this third option, expanding the perspective of the general debate and offering fundamental, yet up until now unarticulated concepts involved in the bigger picture.

6.6 Conclusions

The main question of this thesis was: ‘How can the idea of a bioeconomy be conceptualized to inspire economic practice that operates within the carrying capacity of the biosphere?’. As became clear in the discussion above, this question has been answered from a number of angles. First, a bioeconomy should primarily be about the biosphere. It should take inspiration from nature, trying to conceive of more sustainable ways for humans to live. It should not be conceptualised as a standard economic institution, obeying the same economic laws that caused the emergence of mass scale industrial technologies that caused the climate crisis in the first place. Second, this inspiration from nature should still respect the indominable, uncontrollable aspects of the biosphere. Nature constitutes everything that lives and is able to end everything that lives, it is alpha and omega, creation itself and its own demise. Its blind exploitation is the core problem of the climate crisis and cannot be repeated in an economic strategy that is supposed to bring about a transformation into a sustainable paradigm.

Third, it should be remembered that any bio-based economy is and will remain a human-based economy. Human enjoyment is the alpha and omega, the beginning and the end, of any (biobased) economy. Whether this means that humans are the designated saviours of the mess they made themselves, or rather the self-obsessed culprits of inevitable catastrophe, economy is for humans. Fourth, the notion of a bioeconomy should be conceptualized around a different understanding of technology. Innovation might not be the solution to the climate crisis, and acting as if it were is an excuse to keep moving around resources and vehicles, to continue transportation, distribution, energy consumption, marketing and all other processes that make up the economic system that worsens, not heals, the condition of the climate.

From the main question of this thesis, around halfway, the following sub-question emerged: 'What explains the dominance of ecomodernism in BBE-strategies and what critique of it would be required for a transition into a sustainable system?'. The dominance of ecomodernism is explained by the relation between economy and technology. Having shown in the first half of the thesis which economic principles hinder the transition into sustainability, the second half elaborates upon the technological determinants structuring the biobased economy into an ecomodernist philosophy. Jevons and Schumpeter already noticed the connection between technological innovation and a profit-oriented economic system. Stiegler adds to this the existential dimension of the libidinal economy, explaining how technologies shape human beings on the fundamental level of consciousness, shortening their attention-spans and making them addicted to consumerist goods that are industrially produced. In this way we explained how ecomodernism is simply the explicit articulation of an underlying Zeitgeist, something like: 'keep producing, consuming, using energy, growing, earning profits, developing and innovating, and we will be able to fix the climate eventually'. This age-old philosophy has run its due course in economic conceptuality and should, in the transition to a system that actually operates within the biophysical limits of the planet, finally be abandoned. However, having explained humanity's inability to cope with the sustainability-problem from the libidinal economy, we have also provided a clear picture regarding the impossibility of getting rid of these economic tendencies; the technologies, driven by the economy, have entered our almost literally DNA over generations of techno-economic genealogy. The critique that is required to create a sustainable society, we cannot provide itself. But we did point out what kind of a critique is needed by pointing towards the existential, libidinal dimension.

Finally, a central question guiding the whole of this dissertation was whether or not it is inherent (or 'natural' or 'inborn' or 'necessary') to the human metabolic-economic system to overcome and exploit its natural surroundings in order to be able to enjoy life at all. In the beginning of the second part then, it was discovered that the adjective 'inherent (natural/inborn/necessary)' in this question requires nuance. From Levinas, we did see that indeed, humans have to *overcome* their environment and establish a crafted habitat. Only from this technological control over their surroundings can follow the economic processes of living and labour that transcend mere survival and can lead into enjoyment. But then we had to ask whether this 'enjoyment' is not simply the same as 'consuming'. Through our analysis of Stiegler, we learned that our consumerist society, impacting the climate, was shaped by the technologies from our past. We could then say that it is a *contingent* condition that is inherently disruptive of nature; that it is a specific variant of humanity that has escaped the planet's carrying capacity, modified over generations through a co-evolution with specific technologies. But if certain

technologies have adapted modern, capitalist, 'Western' humans (that live everywhere on the globe currently) in their very *being,* in their consciousnesses, their attentions, then it is a matter of existence, of necessity, inherence. There is no such thing as a universal human condition, as nature continuously changes. Yet, many humans today are conditioned in very specific ways. Can both be the case at the same time?

Rather than finding an answer to this central question that has guided the thread of this dissertation as a whole, it keeps adding in complexity and eventually strays away from our main question and into a fundamental debate in both current metaphysics and philosophy of technology. Do humans create technologies, or do technologies shape human beings? Or does being create a certain relation between humans and technologies? Although this problem has, as a riddle, guided and inspired the current research, it cannot be answered in it. One could say, like Stiegler, that technology serves as kind of epigenetic process that shapes humans in their very *existence*. Doing so, however, is making an *ontological* statement of the highest order of boldness, because it would almost 'reverse' the traditional phenomenological conception of the relation between the ontic and the ontological – were it not so that the conceptual pair of ontic and ontological is not one that can simply be turned upside down in this manner. This is because the nature of the relationship of the ontic and the ontological itself determines what 'up' and 'down' would mean. Philosophy would need an infinity still to answer these questions. In the face of the environmental crisis however, we will not have such time.

Summary

The current situation of the climate crisis necessitates the formulation of an adequate counter-strategy. The Bio-Based Economy is the main strategy in Europe. Its name suggests the BBE aims to establish an economic system that functions similarly to biological processes. In reality, however, it turns out this approach is not yet a clear route to sustainability. In this dissertation, the BBE is explored from a philosophical perspective, analysing its core concepts of ecology, economy, humanity and technology. As these concepts and their relationships are not clear in the current model of the BBE, we critically assess them and suggest alternative conceptualisations from the philosophical tradition. The dissertation argues that humanity has an ambivalent relation with the biosphere, both depending on it for survival and destroying it through consumption. This contradictory relationship is exposed in BBE policies, which still prioritize economic growth over sustainability. The system is diagnosed as being dominated by an ecomodernist discourse and the suggest that a transition to a sustainable system requires critical evaluation of this paradigm. The theory of the libidinal economy is used to suggest that the mode of human existence itself would require adaptation if long-term sustainability is to be achieved. The dissertation defends the hypothesis that adding an existential dimension to the conceptualization of a successful bioeconomy offers a third option in the classification of types of bioeconomy, which must be explored if a true solution to the problem of energy in the BBE is ever to be conceived of.

The Economy-Based Economy

Chapter 2, entitled '*Towards a Philosophy of a Bio-Based Economy: A Levinassian Perspective on the Relations Between Economic and Ecological Systems',* consists of a first conceptualization of the Bio-Based Economy in a philosophical context. It tries to make sense of the fundamental idea of 'basing an economy upon *bios*' by summarising, analysing and interpreting BBE-policies, literature on the BBE, BBE categorisations and investigating related concepts such as circular, biomimicry and cradle-to-cradle. The main ideal of the BBE is identified as making (human) economy similar to biological processes, such as the circularity of natural ecosystems, energy cycles and the Earth's carrying capacity, as these ecological lapses appear to be structurally renewable. Immediately after defining this objective, however, it becomes clear that the BBE has not yet set out a clearly delineated route into sustainability. In fact, there are many unclear and often even contradictory concepts at play in the policies. The aim of the chapter is to clarify such semantic discrepancies and to contribute philosophically to the general concepts by offering alternative perspectives.

Firstly, the chapter explains how it is not clear whether the BBE is a 'strong', normative goal actually transforming economic systems into processes that fit within the carrying capacity of planet Earth, or a 'weak', metaphorical narrative to inspire greenwashing practices such as minor recycling initiatives. Accordingly, it is shown how the roles of economy and ecology are completely reversed in the major BBE-policies. Instead of framing economy as a process within ecology, requiring oxygen, nutrition and resources to operate, the biosphere is understood as a depot of scarce resources, ready to be used for economic processes. A detailed explanation of these contradictions is provided and the discrepancies are summarized in the following insight: we think of nature as a sphere in need of *help.* The poor biosphere must be assisted in dealing with its ecological crisis. Nature needs help, by

humans, from humans. Through control, management, innovation and efficiency, damaged ecosystems (or, as we generally understand them, market failures) must be rescued.

After these critical remarks, the constructive conceptual contribution commences by offering alternative conceptualisations of economy in relation to ecology. Emmanuel Levinas is discussed and the way he thinks about economy in relation to ecology is presented. Very different from a standard definition in current times about neoliberalism, capitalism and the free market ruled by supply and demand according to processes of production and consumption, Levinas thematises economy as the metabolic manner in which humans always already exist. We are beings that require oxygen and nourishment, through labour transforming externalities such as fish into energy for our egoic selves. *Oikos* for Levinas is about the way in which humans inhabit the vast, elementary biosphere from 'the house' as a place from which to depart into the world and where to return safely, or offering hospitality to guests. Economy for Levinas is about the metabolic manner in which we live-from the environment, overcoming the harsh struggle for survival, departing into the outside world and transforming external energy into energy of our own. Understanding our economic processes in such an alternative makes visible how human, economic life was always already biobased in an original sense.

Two major concepts from Levinas are focussed on. Firstly, the concept of *il y a* to discuss how nature is indominable and endlessly bigger than our economic processes. In Levinas's analysis of economy it becomes clear that, even though human metabolisms must consume other organisms and overcome the harsh conditions of the natural world, it is completely impossible and unrealistic to suppose we can overcome all of nature, controlling it as we please. The bare fact that we exist at all, or that there is existence at all ('*il y a'*), rather than non-existence, is staggering, fragile and unique. Furthermore, elementary nature as bare existence (*il y a*) always encompasses humankind's affairs within it, being infinitely bigger. Nature itself as an interminable biosphere both constitutes life, by providing conditions such as oxygen and water, and threatens life through the hardships of the elements. It is shown how such a concept of nature is still lacking from BBE-policies. Without such a solid concept of elementary nature, it is impossible to indicate clearly the boundaries of the biosphere in which a bioeconomy should operate.

The second concept from Levinas that is focussed on and that the BBE-policies overlook, concerns the purpose or function of the BBE. Because, what a bio-based economy is really *for,* in the end, must be human *enjoyment.* Enjoyment is about the sensible experience of life's very content or meaning. Economy is but the means to achieve human enjoyment. Human life itself, sensibly and corporally involved in the world, is always also something more than economic function. For example, food is not only consumed in order to keep living, but also poses a goal in itself. The subjective, physical act of sinking one's teeth into bread is qualitatively incomparable with the purchase, production, or preparation of the bread as a commodity. The enjoyment of the reasons for existing cannot be reduced to economic rationality, nor to mere labour or survival.

Accordingly, to compare and complement Levinas's insights, we offer another alternative conceptualisation of economy by discussing the work of Nicholas Georgescu-Roegen. Roegen debunks multiple 'energy myths' that still guide our concepts regarding biobased practice today, such as ideas of eternal growth, immortality and stationary states. Roegen does so by referring to ecological entropy, the incomprehensibly bigger energy processes that occur in nature, the epistemological impossibility of answering to natural novelties and the disturbance of a natural balance by addictive

exosomatic processes. Roegen's concept of economy also thematizes human metabolic processes as occurring in a reciprocity with elemental nature, which cannot be fully controlled.

In Levinas and Roegen, accounts of economy as experienced by individuals are provided. These alternative conceptualisations help to demonstrate more clearly how and why the roles of economy and ecology have been turned upside down in BBE-policy and discourse. There, nature is always only discussed in so far as it can be efficiently managed or optimally exploited, never as the very condition for life upon which everything depends. Still, everyone understands that we first need a functioning biosphere before we can do economics and have technologies. Yet, the language of the BBE seems to deal only with the realities of the capitalist market and completely forgets the grand ecological picture which should be its carrying idea.

This first encounter with the fundamental concepts at play in the BBE shows how the theoretical framework of this encompassing climate saving strategy is still in its infancy. The framework is incomplete on both ends as it lacks both the macro-perspective on the fact that before any human activity there lies a conditional, unfathomable biosphere (*il y a*) and the micro-perspective on the fact that beyond all economic calculation and rationality there lies the human condition as sensed experience (enjoyment). Furthermore, a bio-based economy that confuses 'bio' for 'economy' is not conceptually sound. This reduction to an Economy-based Economy (EBE) can be said to be understandable in our time of neoliberalism, capitalism and a global open market. Yet, if the BBE really stands for the ideal to transform economic processes into a variant operating within the biosphere's limits, it should change exactly this, that everything is always about money first and about nature never.

The Human-Based Economy

Having introduced the empirical situation of the BBE as a general project, pointing out some shortcomings and contradictions within its relevant concepts in the previous chapter, the third chapter, entitled '*Efficiency versus enjoyment: looking after the human condition in the transition to the Bio-Based Economy*' picks up the Levinassian concepts of *il y a* and enjoyment for further exploration. Again, several paradoxical propositions are indicated in the BBE-policies, one of which is even called 'sustainable growth' (which is just as self-contradictory a phrase as 'wooden iron'). This time, however, the focus is on another discrepancy than the relation between ecology and economy. At stake in the BBE-project is, effectively, a grand strategy to '*save the Earth*'. In this chapter, it is demonstrated how this phrase actually means '*save the humans*' because it is the continuation of a human way of living that is at stake as being threatened – and not so much the biosphere that we feel responsible for. Save the Earth means: do not let the Earth be, but influence the biosphere so that we might inhabit it still. Save the Earth means: save future generations of humans. Continuing a critique on the its core concepts, in this chapter the BBE is exposed as a Human-Based Economy (HBE). Yet, this is not blamed on the design of the BBE *per se* but, rather, indicates a fundamental problem within the human condition itself.

At stake in the core of this chapter is a tenacious ambivalence. Humans emerge from nature (the elemental biosphere, what we have referred to as '*il y a'*), requiring oxygen and food and so on, then, having overcome the harsh elementary conditions, completely forget about it and disturb their environment. This seems to be just the way in which humans live. There appears to be no explicit

harmful intent involved in driving a car or eating meat or traveling by plane, those are just economic activities of enjoyment, experienced as innocent. Before the reality of economic practice lies our ecological origin, our being biobased in the sense of dependence upon a vast, endless ecosystem (*il y a*); beyond our economic affairs lies the fact that we enjoy their result (enjoyment). Yet, if it is a necessity for humanity to overcome and control the biosphere, i.e., if the human condition is inherently destructive, the question is *what exactly this human necessity entails* and how it has come to disrupt the relation between humanity and planet Earth. If economic dominance (i.e., ecological disruption) is indeed a principal, necessary aspect of human existence – and not just a contingent power structure, for example – we would never be able to alter it. Is humankind's controlling, metabolic-economic nature total, or does the possibility of fundamentally not coalescing with these disruptive tendencies also exist?

From Levinas's concepts it follows that human existence is conditionally within the contradiction between sustainability (bio) and growth (economy). Basing economy on ecology would then be a paradoxical task in general as we destroy what we want to grasp, losing dominance as we seek to establish it, disrupting the life-world by trying to adapt it to our needs. Yet this human, originally biobased, economic perspective also explains how ambivalent strategies such as those encountered in BBE policy have come to be formulated. For example, BBE-policy will say, paraphrasing: in order to sustain life in the ocean, we must ensure better control over fish populations. We, humans, must use our technology to exploit the sea in a repeatable manner, providing our dinnerplates with fish. But this kind of 'responsible exploitation' only reinforces the ambivalence at stake.

For Levinas, the human tendency to control and dominate efficiently (metabolic economy) makes sense only because it is always directed at enjoyment. Enjoyment, or *independence*, is the ultimate fulfilment of economic existence: all our metabolic endeavours aiming to preserve individual, egoic identity are always rooted in, and heading towards, the outcome of the enjoyment of life. The problem is that in enjoying – or consuming – the very food in front of us, we are directly engaged in a concrete present and, consequently, not directly concerned about the ecological consequences that this food might have. We drive cars without purposefully wanting to pollute the planet, enjoying the ride as it is; we eat meat for the sake of enjoying an adequate meal, whilst being existentially detached from any concern for cows, carbon emissions, water supplies, or plastic residues. Now, it was, indeed, precisely this being absorbed in everyday economic processes, this experienced (innocent or ignorant) independence (from ecological constitution) that is highly problematic, as it causes us humans to forget about the indirect impact of our behaviour.

This chapter thus consists in a detailed discussion of the human tendency to control and optimise enjoyment, to have its inefficient instant readily available at all times, the *desire* to extract pleasure out of thin air, as it were (e.g., cigarettes, burning coal). Because the concept of enjoyment entails precisely something that cannot be stored or extracted, this gesture already poses a contradiction. Enjoyment cannot be instrumentalised in itself, yet seems to fuel a very human, ambivalent addiction to entertainment and pleasure.

The insight that is eventually reached is that enjoyment expresses the same twofold structure that we have repeatedly seen to be at stake in the current climate crisis: the paradox between growth and sustainability, the juxtaposition of control and uncontrollability, the discrepancy between our direct, everyday sensibility and its harmful consequences. Enjoyment is located precisely on this *verge*, exactly amidst the contradictory structures of our time. A fundamental connection is explored

between the two major concepts that have been consistently at stake in these first two chapters, between *il y a* and enjoyment. There is existence (*il y a*), rather than there is not. Enjoyment, then, poses the possibility of experiencing this very life: *I exist*, as opposed to not existing. This principal connection can also be concretely experienced, for example when staring into the ocean and in this aesthetic instant both feeling alive and feeling connected to the vast, elementary realm of nature whence one emerged.

Moreover, the relation between *il y a* and enjoyment could enable a fundamental shift in attention: I exist, if I want to keep existing and if I want human existence to continue, I should behave sustainably. Behaving sustainably means acknowledging nature's uncontrollable force, the invisible *il y a*. Once one sees, feels, or lives this transcendence – e.g., when suddenly touched by absolute beauty or profound injustice – one might acquire a genuine, aesthetic glimpse of the nourishing world behind our everyday activities, the ecological conditions enabling them, and the possible destruction of the biosphere. Such phenomenological awareness – located amidst the experience of the very quality of life and the elementary, infinitely distant nature enabling this life – could, ultimately, reunite our behaviour with its consequences. Experiencing enjoyment, i.e., life, might be the quickest way to develop an awareness of the invisible realm of ecosystems so essential for human existence. For behind the free market dream of infinite, limitless growth with its stubborn tendency to control lies the human condition, partaking in the infinity of life. Also, staring into the ocean is just a much more sustainable mode of entertainment than festivals, monster-trucks, fireworks and so on are. In conclusion, this chapter states that future bioeconomies should reserve structural room for explicit appreciation of nature as an uncontrollable realm and of human beings as more than eco-efficient labourers.

The Desire-Based Economy

The fourth chapter is called '*The Limits of the Bio-Based Economy within a System of Technologically Modified Short-term Desires'* and marks a thematic demarcation in the context of the dissertation as a whole. Whereas the focus had, up until here, been on the topics of nature in general (bios) and the role of the individual consumer immersed in both ecologic and economic systems, now a different kind of questioning emerges. In the previous chapters it became clear that the economic realm dominates and dictates the ecologic realm. The analyses of core concepts led to a confrontational ambivalence in the way in which humans currently deal with the biosphere and offered possible alternative conceptualisations of this relation. Yet, the question as to *why* humans crave enjoyment so much that they pay the price of a long-lasting future for a mere moment of pleasure has therewith not been answered. How has humanity ended up in this situation? Continuing the core question after individual maleficent intent or responsibility, the question here becomes: why are we the way that we are? How did we get here? Why do we keep failing to become a sustainable race, neatly existing within the biosphere's limits? If a coherent strategy of transition into a sustainable era is ever to be made, these questions must be answered. Philosophically, this shift in modes of questioning is accompanied by moving on from the thought of Levinas to that of Bernard Stiegler.

The main question of this research is still: *How can the idea of a bioeconomy be conceptualized to inspire economic practice that operates within the carrying capacity of the biosphere?* However, this question will from here on be approached from a slightly different angle, focusing on explaining humanity's collective failure to become genuinely sustainable and literally base economics upon

ecological principles. As such, the main question of the second half of this dissertation (which is still a sub-question of the aforementioned main question) is: *what explains the dominance of ecomodernism in BBE-strategies and what critique of it would be required for a transition into a sustainable system?*

Along with these new questions comes a focus on a fundamental pair of concepts in the context of biobased economies: the dialectic between techno-optimist *ecomodernism* on the one hand versus the moderate, plant-based *degrowth* theory on the other hand. These are the two major paradigms in which current literature divides biobased practice. However, it is also the case that virtually all current biobased practice proceeds according to the logic of ecomodernism and virtually no biobased practice exists that aligns with the ideals of degrowth theory. As such, there appears to exist only a theoretical opposition to ecomodernist biobased strategies. This is striking, as it does not go without discussion that ecomodernism is the most suitable mindset to accomplish future sustainability. In short, ecomodernism argues humankind should continue living as it does, practicing commercial, industrial economy to generate energy and wealth and to progress technological innovation. The implicit hope, dream or desire of this perspective is that one day, some sustainable innovation will be made that solves the climate crisis for us – a belief which is commonly referred to as the 'techno-fix'. Framed this way, most people currently living might hold ecomodernist convictions, as this is what many humans implicitly hope for or even rely on. Philosophically, however, there is plenty of theory involved here that should be critically examined. Thus, the main question of this chapter is: what explains the dominance of ecomodernism in BBE-strategies and what critique of it would be required for a transition into a sustainable system?

The chapter begins by analysing several answers that have already been provided in the literature. The biorefinery is discussed as a significant example of current biobased practice. Critical research from the discipline of STS is referred to in order to show that biorefineries are in no way isolated artefacts but, rather, inherently connected to all kinds of cultural, societal and political processes. It is argued that the technological potential of a bioeconomy is an insufficient condition for an encompassing transition, which also requires democratic consensus on the broad development and wide application of this technological potential. Accordingly, it is shown that the ideology of ecomodernism, by being overly focused on technological solutions, falls short of providing a fundamental perspective to make sense of the relations between humanity, technology and nature. The STS analyses raise legitimate criticisms and are correct in stating that a social element is lacking from current bioeconomy-strategies. The contemporary BBE framework is insufficiently inclusive and as such too narrow to do justice to societal reality.

The analysis continues by stating that the overly narrow framework of the BBE not only lacks a social, but also an *existential* dimension. If it is to be made clear why humanity is collectively failing to transit into a sustainable bioeconomy, this existential dimension should also be addressed. It is therefore hypothesised that a corrupted, collective mode of human desire is at the very basis of the existential problematics involved. A philosophical concept useful to analyse this suggestion is put forward in the form of Bernard Stiegler's theory of the *libidinal economy.*

The theory of the libidinal economy is then explained. It holds that human, unconscious desires (libido, mortido, anxiety, greed, aggression, obsession, etc.) have been shaped over time by technological structures that select specific knowledge, praxis and behaviour over multiple generations of human lives. To explain this idea, the way in which Stiegler understands technology is elaborated upon. It will here be summarised how this analysis proceeds, but it must also be directly admitted that Stiegler's

theory holds so many difficult, interrelated concepts that are all relevant, that it is impossible to summarise it without cutting corners and simplifying matters. First, it is argued technology forms a tertiary memory system, besides the two natural memories of individual remembrance and genetic genealogy. Technological artifacts serve as intergenerational memory carriers by surviving individual's lifespans, being used by decedents of the original innovators and adapted, improved upon, revised, updated and carried over again to the following generation. This is why it is still possible to read Plato nowadays, why we have wheels, fire, agriculture, combustion engines, airplanes, internet, and so on. Each new individual born within this ever-particularising infrastructure of technologies is instantly immersed in it, existing in a constant reciprocity with these technologies and so being shaped according to them. This can be made quite concrete by looking at children today who use smartphones already more fluently than many of their elders. Second, it is argued how this intergenerational, technological memory system adapts humans in their very being, in their existence as such.

The technologies of the Industrial Revolution automated physical labour. But the technologies of the twentieth century, culminating in ICT, automate cognition. Around the time of the World Wars it was discovered through the new means of mass media such as radio that propaganda worked and, moreover, that it worked even more successfully in times of peace. This is the discovery of psycho-technologies, which have not disappeared since then but only made more effective and ever-present. These technologies, as a tertiary memory system, shape both individual and collective processes of individuation. In order to manifest an identity, a person or a group has nowadays no choice but to pass through the technological infrastructure of attention-modifying equipment. *Cognition* and *desire* are then formed into *libidinal circuits* that are no longer able to orient themselves on long-term, deep future investments because they are no longer occupied with matters of infinity such as beauty, truth and morality but are concerned more and more with short-term desires such as commodities, entertainment and money.

On the one hand, then, industrial technology is raising the roof of production from the level of material limitations to the level of anybody's wildest imagination. On the other hand is consumption; once it was discovered that the psychotechnologies of mass media marketing could shape the very attention of the masses, anything could always be sold to anybody. People started buying things they did not strictly need but things that they wanted, desired, craved, almost as an addiction. Both production and consumption thus rose above all measures previously seen. Once, around the eighties, it was discovered that this manner of economics indeed encounters significant limitations, it was too late. The limit of the biosphere has been consistently crossed ever since because the *libidinal limit* had been royally exceeded before that; people's attentions, desires, indeed their very consciousnesses, had already been shaped into the mode of constantly consuming users caught up in short-term, drive-based desires instead of long-term, structural investments.

Having laid out Stiegler's theory of the libidinal economy, the dominance of ecomodernism and technofixism can be explained from it, which answers the first part of the main question. The libidinal economy encompasses the entire economic system, including any biobased production. This whole system is libidinally corrupted, in the sense of being aimed at short-term, addiction-like profit cycles. However, the specific consequences this critique of contemporary technofixism *as* a critique of libidinal economy are numerous and significant. Therefore, in the next chapter, these specific consequences will be elaborated upon. This entails indicating concretely how a biorefinery is ruled by the libidinal economy, adding to the debate between ecomodernism and degrowth, and reflecting on

the paradigm of natural energy as fuel in which the current BBE remains framed completely. These three aims constitute the research objective of the next chapter.

The Technology-Based Economy

In the fifth Chapter, entitled '*Ecomodernism and the libidinal economy: towards a critical conception of technology in the Bio-Based Economy (part 2)*', Stiegler's theory of the libidinal economy is extrapolated to the situation of the Bio-Based Economy. As Chapter 3 consisted in a direct continuation of Chapter 2, so Chapter 5 is a direct continuation of Chapter 4. Having introduced the empirical situation of biobased practice in biorefineries and the conceptual situation of the theoretical opposition between ecomodernism and degrowth, as well as the philosophical notion of the libidinal economy as the critical addition of an existential dimension, the task of this chapter is to bring these three elements together into a consistent critique of the BBE. In the context of this dissertation as a whole, this analysis finally brings together the grand concepts of nature, economy, humanity and technology and as such forms the core analysis of the complete research.

Because the final analysis of the BBE, revealing it this time as a Technology-based Economy (TBE), depends on a multitude of philosophical concepts used by Stiegler, it will again be difficult to adequately or non-reductively summarise it here. The relevant concepts are: intentional consciousness, protentions, tertiary retentions, individuation processes, libidinal circuits and, finally, the opposition between short-term drive-based urges focused on finite commodities on the one hand versus long-term motivational desires focused on infinite improvement on the other. To understand the exact relations between these concepts, Chapter 4 should be read in total.

The main question being pursued here is: what explains the dominance of ecomodernism in BBE-strategies and *what critique of it would be required for a transition into a sustainable system*? The first part was answered before, this chapter focuses on the final part, here indicated in cursive. Related to this second part of the main question is the question why our species is collectively failing to have any real sustainable impact.

Stiegler's theory of the libidinal economy introduces a new idea here. This idea is that the main challenge is not that of inventing the best innovations to solve environmental problems, nor even a matter of individual or collective responsibility or action. Rather, it becomes a matter of the very mode of human existence being adapted and modified over generations due to the very systems of economy and technology surrounding and conditioning human being on an intentional and libidinal level (i.e. of consciousness, attention, desire). What has changed in the mode of existence of humans that is primarily relevant here, is that human attention-systems over time are becoming more and more oriented on short-term, finite, instant gratification and less and less on long-term, structural investments into an infinite future. Within such a short-circuited, corrupted libidinal economy, long-term sustainability will not be accomplished. As long as the BBE essentially remains caught up in traditional economic practices such as constant innovation, meeting targets of energy production and competing with other energy producers, the drive to efficiency and short-term results in a fuel and growth-focussed paradigm of economics still completely determines the workings of the system. Within this configuration, because neither the BBE nor the biorefinery even discuss such long circuits of desire, it is implausible that long libidinal circuits will emerge from it.

Even without complex philosophical analyses, it can be partially demonstrated how a degraded mode of desire is principally at play in current bioeconomic practice. In the case of the biorefinery, it is just another institution of production. Energy output must hit certain levels for stakeholders to remain interested, the refinery must deliver more resources than it uses each financial quarter, employees must be paid, and so on. A biorefinery that is sustainable but not economically viable goes bankrupt. Just like all other institutions of production operating on the free market, the biorefinery has to deliver on short-term goals, come up with innovative developments and guarantee financial growth in the foreseeable future in order to keep running at all. These short-term economically pragmatic necessities suggest that the economy is not so much *based on* the biosphere but, vice versa, the biosphere continues to be exploited in the service of economy.

Next, we discussed the notions of Schumpeter's creative destruction and Jevons's paradox, to clarify the techno-economic situation also from classical literature. These two examples make clear how technological innovation is the driving force of the current (Western, capitalist) economic system and how this industrial production model leads not to an equilibrium of supply and demand on the open market, but to the paradoxical situation of an increase of both production and consumption. This techno-economic situation of chronic innovation is then connected to Stiegler's theory of the libidinal economy, yielding additional insights here by involving the existential dimension.

The addition of the existential dimension in the conceptualisation of a successful bioeconomy also offers a third option in the classification of types of bioeconomy. Currently, there are two categories that are generally posed as being mutually exclusive, *ecomodernism* and *degrowth*. But these two options have in common that both frame the problem of and the solution to climatic instability in terms of *natural energy,* i.e. fuel. Ecomodernism argues we should continue using our technologies to obtain plenty of energy so that we might innovate ourselves into a sustainable future one day. Degrowth theory argues we should abandon many energy-consuming processes and focus all resources on long-term survival, meanwhile living less energy-hungry lives. But this binary framing of the BBE excludes a third possibility. On the basis of the theory of the libidinal economy, it can be argued that the true problem of energy*,* today, is not so much one of replacing our fossil fuel based energy production systems by renewable energy production systems. Rather, it might be one of restoring or renewing *libidinal energy*, which is being destroyed and decomposed into drives. Because, within a corrupted libidinal economy, replacing fossil fuels with renewables will never lead to sustainability because the economic system at large is still growth-oriented and will always continue to exhaust resources for short-term gain.

Human beings have been shaped by the inventions of their ancestors for centuries and centuries. In this process, specific knowledge and behaviours are selected and carried over, such as efficiency, profit-orientation, focus on the short-term, etc. Human attention as such co-evolved with the technologies from the techno-fixated market economy. This provides an answer as to why humans cannot just 'turn around' their entire economy, as degrowth seems to suggest; the very techno-economic infrastructure is merged with humanity's existential structures (retention, protention, intentional consciousness, attention). The current, natural fuel-oriented bioeconomy is caught up completely in this problematic libidinal situation of technofixism and ecomodernism. This framing in terms of fuel is a perpetuation of the past paradigm of limitless growth – which is precisely unfit for what should be the overarching, normative ideal of a truly sustainable BBE.

With this, we received an answer to our main research question. A *libidinal* critique is required to work beyond the current economic paradigm and towards a genuinely sustainable society. The theory of the libidinal economy explains the dominance of ecomodernism, because it is based on short-term, drive-based desires. The alternative of degrowth theory is in need of including the libidinal dimension if its conceptuality is to transcend the framing of the paradigm of economic growth and natural energy. The analysis in general shows that what is needed is a departure away from short-circuit-based natural energy and towards a long-circuit economy of libidinal energy. Whatever shape such an undertaking might take, sustainability should from the outset function as a normative principle, inspiring long libidinal circuits for a future economic system.

Finally, a central question of the first part of this dissertation was whether or not it is inherent (natural/inborn/necessary) to the human metabolic-economic system to overcome and exploit its natural surroundings in order to be able to enjoy life at all. In the beginning of this second part, then, it was discovered that the adjective 'inherent (natural/inborn/necessary)' in this question requires nuance. That many human societies have existed and still exist in which a certain equilibrium between economy and ecology is self-evidently maintained (which is a concrete example of a successful version of an actually biobased economy in the sense of operating within the limits of the biosphere) is in itself evidence enough that it cannot be a *universal* human condition that is inherently hostile towards its environment. In the current research, too, it was found that it must indeed be a contingent condition that is inherently disruptive of nature. It is a specific variant of humanity that has escaped the planet's carrying capacity. A specific variant, modified over generations through a co-evolution with specific technologies. These technologies have adapted modern, Western humans (that live everywhere on the globe currently) in their very being. There is no such thing as a universal human condition, as nature continuously changes. Yet, many humans today are conditioned in very specific ways by specific technologies from the past. The corrupted libidinal condition of contemporary humanity is therefore contingent, yet older than any human individual and as such still necessary or fundamental. This ambivalence cannot be reduced to a plain, singular answer but still requires extensive philosophical reflection about the status of technology: is it ontic, or ontological?

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WASS Completed Training and Supervision Plan

Roel Veraart

Wageningen School of Social Sciences (WASS)

Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*

A) Project related competences

'Enjoying life within a Biobased Economy?' *Research Visit*	OZSW, University of Groningen	2018	1
'Sustainable transition: Bio- or Technology-based economy?' *Research Visit*	DesignLab: Human-Tech Relations, Twente University	2018	1
'Anthropocene matters' *Research Visit*	OZSW, University of Amsterdam	2019	1
'The relation between the biosphere and the economic sphere' *Research Visit*	University of Hohenheim	2019	1
'The normative dimension of the Bio-Based Economy' *Research Proposal*	Wageningen University and Research	2019	6
WASS Introduction course	WASS	2021	1

B) General research related competences

Study Group PHI (Paper discussions, state of the art literature, presenting research)	PHI (WUR)	2019-2023	2
Study Group Philosophy of Innovation/ Philosophy of Technology	PHI (WUR)	2019-2023	2
PhD course Continental Philosophy of TechnoScience	Radboud University Nijmegen	2019	6
PhD course Responsible Innovation	4TU	2021	5
Local Case Manager & Editor (technology & ethics)	4TU.Ethics (SURF)	2020-2021	4
New Media Literacy Module Co-developer	4TU.Ethics	2021-2022	4

C) Career related competences/personal development

Editor in Chief – Digital Literacy (technology and ethics)	Go21 (EDU Omnia B.V.)	2019-2022	4
Teaching: 'Philosophy and Ethics of Management, Economics, and Consumer Behaviour'	CPT (38306)	2019	1
Teaching: 'Biology and Philosophy: Exploring Open Questions'	CPT (10303)	2019	1
Teaching: 'Philosophy and Ethics of Management, Economics, and Consumer Behaviour'	CPT (38306)	2020	1
Teaching: 'Biology and Philosophy: Exploring Open Questions'	CPT (10303)	2020	1
Total			**43**

***One credit according to ECTS is on average equivalent to 28 hours of study load

Author Information

Roeland Christiaan Veraart (1994) is currently working in the Philosophy Group at Wageningen University as a postdoc researcher. As a member of the project Data4Food2030, he is collaborating with a group of 70 expert researchers from various scientific disciplines to help conceive of a more sustainable and equitable economic system of agricultural data.

Roel obtained his Bachelor's in philosophy at Leiden University, specialising in continental philosophy with a particular interest in existential phenomenology. Accordingly, Roel excelled in the Research Master's programme of metaphysics at Radboud University Nijmegen, graduating with honours. Roel's specialization within fundamental philosophy centres on the two interrelated themes of sustainability and technology. This led to a PhD project about the bioeconomy, Europe's major strategy to answer to the climate crisis.

Next to this research project, Roel has worked for years as a developer of educational modules, both in an academic context working for 4TU.ethics and in a commercial context working for Go21. Because of his background in ethics and technology and his critical view on the digital era, Roel became Editor-in-Chief at Go21 and fulfilled that function passionately for two years.

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