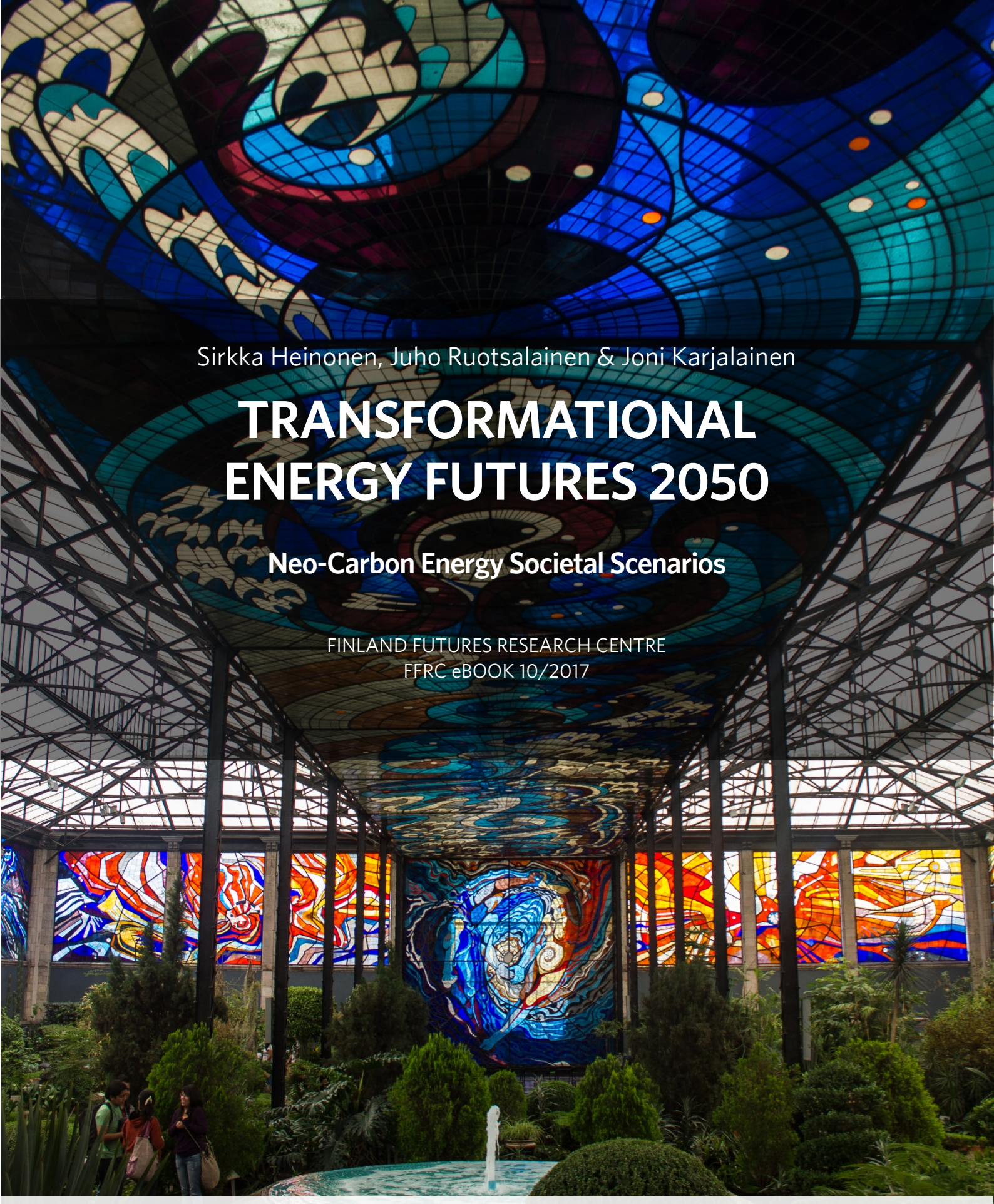

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TRANSFORMATIONAL ENERGY FUTURES 2050

Neo-Carbon Energy Societal Scenarios

FINLAND FUTURES RESEARCH CENTRE
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Turun yliopisto
University of Turku

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NEO
CARBON
ENERGY

The Neo-Carbon Energy project *(2014–2017) is one of the Tekes – the Finnish Funding Agency for Innovation – strategic research openings, which is carried out in cooperation jointly with VTT Technical Research Centre of Finland Ltd (co-ordinator), Lappeenranta University of Technology (LUT), and University of Turku, Finland Futures Research Centre (FFRC).*

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"The mission of a human being is to prove that human life is a valuable part of life in general; that life is richer and more precious with humans than without"

Pentti Malaska

CONTENTS

PREFACE

What will be? How will the world look in about 30 years from now? All the evidence from the past show that it will be markedly different from now. Not just a little bit. The world in 1988 was a very different world. What is more – new, unforeseen forces are at play. Never before has there been such investment on scientific research and new technologies. The other side of the coin is that never have we seen such threats looming on the horizon as there are now. These factors push our imagination to the edge. Because the world we are going to see in 2050 (and I wish I will be seeing that, at the age of 89), is the world with different energy system, different value structure, different geopolitical combination and so on. Different world altogether.

In this report, you are going to learn of future scenarios that may look quite wild at the first sight. Don't let this impression shy you away. By necessity, future in 2050 will be a wild thing. So get used to the idea that the world by then may have a very different outlook. None of the societal scenarios expressed in this report may be the accurate description of the future world. Yet we can anticipate that some of them may come rather close to what the world actually is by then. Surely, we don't know.

However, what we do know from history is that energy revolutions and large-scheme societal revolutions go hand in hand. Steam and hydro power became catapults of societal change 200 years ago, enabling the first major wave of industrialization. The more expansive use of the fossil fuels coincide with new mobility schemes in building a solid bottom for modern way of life. And so on.

Thus, in 2050, new energy systems will enable new social structures and behaviours to appear. This report describes how this may happen. Articulated In four distinctive scenarios, these possible transformative energy futures – embedded in societal change – are described in some detail.

As the era of oil and other fossil fuels is slowly coming to an end, something dramatically different will appear. But what now looks as "new" – solar energy systems, wind energy, geothermal technologies etc. – will appear as very different "new" in 2050. Likewise, societies, from institutions to individual aspirations, will have reinvented "the new" many times on the way to 2050.

The only way the future is really with us, is through expectations and intentions. The normative scenarios you find in this report are mirroring our innate desire to penetrate the future. To have a grasp of it before it actually happens. I hope you find them as thought-provoking and interesting as I do.

We may have to accept that the future, in its essence, is secret. But as with all secrets, this very aspect should feed our curiosity to explore the key contingencies of the future. The whole Neo-Carbon Energy project has made a great deal to unravel some of them.

Moreover, as the global time-bomb is ticking in terms of escalating climate change, we desperately are in need for new insights. This is what Neo-Carbon Energy project was set out to do and in this report you are seeing some of the fruits.

At the end of the day, we are not just asking what will be. We are asking, too, what should be? In this report you will find some definite propositions to that question. Enjoy your reading!

Helsinki 2nd March 2018

Markku Wilenius
Professor, UNESCO Chair
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ABSTRACT

This report presents a set of transformative Neo-Carbon Energy scenarios within a societal context. The scenarios describe how society – social relations, culture, values, economy etc. – may change in a renewable energy system. They depict four different avenues and vistas to the world in 2050 where the energy system is decentralised, based almost 100% on renewable energy and prosumeristic citizens play a central role in a peer-to-peer fashion. The scenarios have been constructed within a Tekes-funded research project Neo-Carbon Energy in co-operation with VTT Technical Research Centre of Finland, Lappeenranta University of Technology (LUT), and Finland Futures Research Centre (FFRC) at University of Turku. The foresight part of the research project explores the futures of an economy based on a new energy system and peer-to-peer society in 2050. The project is one of the strategic research openings of Tekes – the Finnish Funding Agency for Innovation.

The neo-carbon scenarios envision possible futures in which renewable energy is produced in a distributed manner, and in which energy is low-cost, or even no-cost. In each scenario energy is produced mainly by solar and wind and stored in batteries, synthetic methane, and other synthetic hydrocarbons. Renewable energy is used for economic activities, and carbon dioxide from the air is used as a source for plastics, chemicals and medicine. As a whole, this would transform the economy and change its energy system into one that is emissions-free, efficient, low-cost, and sustainable.

The scenarios have been formed using two axes and their extreme end values. The X axis is called “Peer-to-peer” and its end values are Corporate (“centralised”) peer-to-peer and Neo-Communal (distributed) peer-to-peer. The Y axis is called “Ecological awareness” and its end values are Pragmatic ecology and Deep ecology. The resulting four scenarios are called “Radical Startups”, “Value-Driven Techemoths”, “Green DIY Engineers” and “New Consciousness”. The scenarios have been tested through a process of five interactive futures cliniques, international surveys, workshops, focus group discussions, and interviews.

The report also provides a list of 10 key recommendations, as a reflection to the scenarios, for various stakeholders in order to prepare for the emerging renewable energy transformation – to proactively surf on the winning side in this futures turbulence. They can be used to support and test strategies and decision-making for the transition towards renewable energy world, as well as to identify game changers – transformative leadership and pioneering actors for making this transformation happen.

The Neo-Carbon Energy world is a radical transformation towards renewable energy and responsible lifestyles. It is a preferred future, empowered by foresight approach and proactive futures creation, resulting in robust futures resilience.

Key words: renewable energy, peer-to-peer society, transformation, scenarios, weak signals, pioneers

1. INTRODUCTION

"But what if I were to say to you that 25 years from now,
the bulk of the energy you use to heat your home and run your appliances,
power your business, drive your vehicle,
and operate every part of the global economy
will likewise be nearly free?"

Jeremy Rifkin

We are still prisoners of the oil era. Approximately 95% of industrial production is dependent on oil.[1] Oil is not used only as a source of energy, but also as a raw material for plastics, fertilisers, pharmaceuticals, dyes etc. With a very high EROEI value (energy return on energy investment), oil has been a necessary requirement, albeit an unsustainable one, for the whole modern way of life (Salminen & Vadén 2013). However, oil is found only in a relatively few places across the globe, its drilling and transportation is expensive, and its use requires complex technological systems. As a consequence, oil has accumulated power to a few companies and nation-states. If a less geographically and economically concentrated form of energy were to replace oil, it would imply an upheaval in power structures both between and within societies. A new geo-political world order would also follow.

As the history of oil shows, energy is not only a technological, economic and ecological question. Energy has implications for the whole of society – its culture, values, power structures, as well as economy, environment and technologies. Each culture is fundamentally based and dependent on its sources of energy – ancient Greek and Roman societies depended on the energy of slaves, and industrial societies are dependent on fossil fuels.

New energy technologies are not applied in isolation. They become embedded in the already existing, complex technological and social environments. In this report we highlight the connection between emerging renewable energy systems and the future of the information society. Renewable energy fits well in the present socio-economic culture built on networked information and communication technologies. Societies are becoming increasingly decentralised and bottom-up – although there are also counter-trends of a more centralised use of power - and production increasingly automated. A highly efficient Internet of Energy is needed to power such a society. Different combinations of energy and communication technologies drive history, and with the emerging energy system and maturing communication technologies we are at the brink of a historical transition. This is illustrated in Figure 1.

[1] http://peak-oil.com/download/Peak%20Oil.%20Sicherheitspolitische%20Implikationen%20knapper%20Ressourcen%2011082010.pdf

Figure 1. *Societal transitions. All social and economic transformations in human history are facilitated by new energy sources and means of communication. More energy enables more complex societies. New communication technologies are needed to organise the increased complexity.*

The societal Neo-Carbon Energy scenarios take a fresh look at the transition to renewable energy systems. Through four different futures they map out how society and economy could change by 2050 if they were powered by renewable energy. In other words, they are not energy scenarios as such. The new energy system is treated as *an enabler* of different societal futures.[2]

In all of these scenarios the energy system has the same basic elements: it is a distributed and decentralised, 100 % renewable energy system with solar and wind as the main sources of energy, and batteries and synthetic hydrocarbons as the main storage technologies. Energy is harvested from everywhere in the environment, and the energy system and individual technologies are highly energy efficient. This provides societies with more energy than before, and thus allows the development of societies.

Likewise, in all scenarios (except for one, which is a collapse scenario) mass-automation and large-scale use of artificial intelligence (AI) are in place. Societies are deeply and thoroughly networked by ubiquitous information and communication technologies. The costs of living and production have fallen due to low energy prices and highly developed technologies. Citizens have become energy prosumers – they produce some of the energy they use, and when there is surplus, feed energy into the grid.

This leads to the perhaps most important aspect of the scenarios: they anticipate different futures of a **peer-to-peer society**. This provides the first axis – *peer-to-peer* – for the scenario framework. Peer-to-peer refers to individuals and groups who act and self-organise outside traditional

[2] The scenarios were constructed as an earlier version to be elaborated during the project (Heinonen et al. 2016). This publication is the final scenario report of the Neo-Carbon Energy project. For the final report of the whole foresight part of the project, see Heinonen et al. 2017.

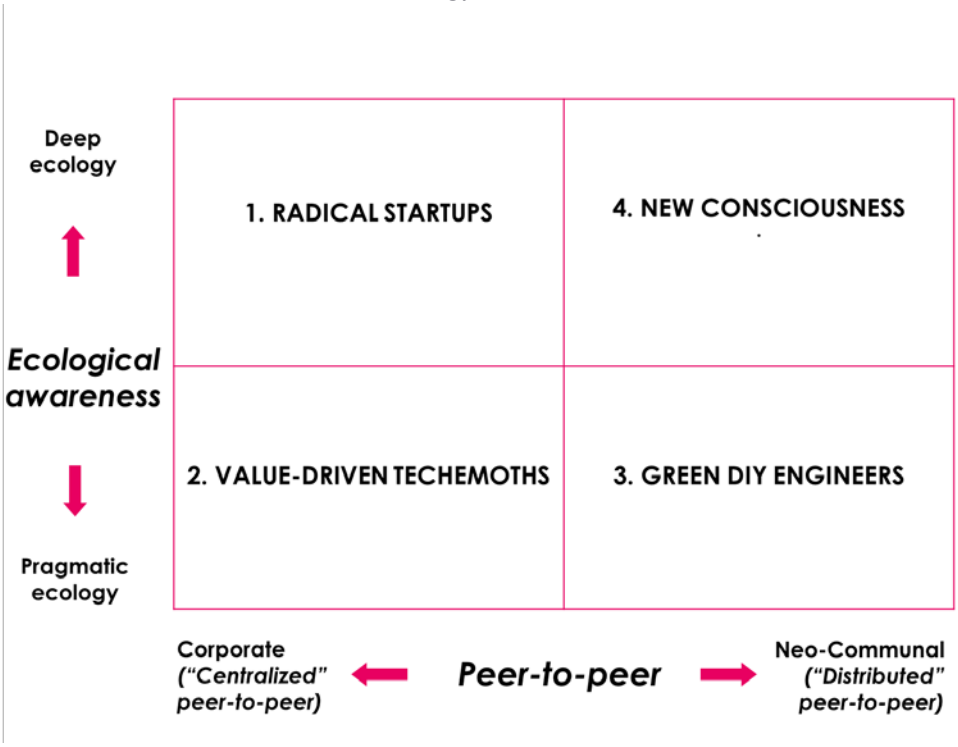
organisations – think of Wikipedia, open-source programming projects, or the distribution, consumption and commenting of journalism on social media platforms. The scenarios conceive renewable energy technologies among technologies that enable a future in which citizens increasingly operate by themselves within peer networks and communities. As an example, solar PVs with digital manufacturing technologies such as 3D printing could make possible small-scale, communal and "artisanal" industrial production with self-sufficient lifestyles. However, traditional companies and organisations would still probably have unparalleled financial, social and cultural capital, and know-how. They, too, would benefit from the decreasing costs of energy and technologies, and thus increase their capabilities. Thus, an "ideal type" peer-to-peer society in which traditional organisations have disappeared altogether is but one, and arguably quite improbable, possible future of peer-to-peer society. Thus the scenarios depict four different possible outcomes for peer-to-peer societies: in two of them citizens self-organise by themselves, and in the other two establish peer-networks within "traditional" organisations (see Table 1).

The other axis around which the scenarios are built is *ecological awareness.* In all scenarios ecological values and lifestyles have become the norm in society. In two of the scenarios *deep ecology* prevails: An ecological and environmental philosophy advocating the inherent worth of living beings regardless of their instrumental utility to human needs. The natural world is seen as a subtle balance of complex inter-relationships in which the existence of organisms is dependent on the existence of others within ecosystems. In two other scenarios *pragmatic ecology* is dominant. Pragmatic ecology acknowledges the great importance of environmental issues, but mainly in relation to human wellbeing and survival. Concrete results are prioritized, without necessarily any deeper worldview - except for utilitarianism - guiding actions. Nature is seen first and foremost as resources to be utilized by humans.

Besides the two axes, there are two main themes that vary between scenarios. First, the scenarios differ whether data is (more) open or (more closed). The very functioning of societies is increasingly based on data, and whether data is predominantly open or closed is more and more crucial – also to energy systems as data is used to monitor and optimise the use and production of energy. Data is dominantly open in Radical Startups and New Consciousness scenarios, and dominantly closed in Value-Driven Techemoths and Green DIY Engineers scenarios.

Second, the scenarios differ on the things that identities are based on. As societies and their economies change, the future of identity construction becomes paramount. Identities are the basis on which individuals find meaning in the world, make decisions, and engage in relationships with others. If we are to anticipate energy futures in a holistic, societal framework, changes in identities have to be taken into account.

Table 1. *Four societal Neo-Carbon Energy scenarios.*



1. **Radical Startups.** Renewables-powered peer-to-peer communities are realised in startup companies, which rule both economy and society. Startups are known for their culture, values, and bold aspirations. They are tribes of affinity, and part of complex networks, rather than companies in the traditional sense.
2. **Value-Driven Techemoths**. Inexpensive energy has empowered giant, global technology corporations, which have become state-like concentrations of power. Peer-to-peer models are practiced within these "techemoths". They represent the Silicon Valley vision of emancipation, freedom, creativity and open source, but at the same time seek to dominate economy and culture.
3. **Green DIY Engineers**. The world has faced an ecological collapse. Engineer-oriented citizens have organized themselves as local communities to survive. Environmental problems are solved and energy produced locally. Nation-states and national cultures have more or less withered away.
4. **New Consciousness**. Ubiquitous ICTs, renewable energy technologies, an ecological crisis, and the World War III of hybrid warfare have led to a new kind of consciousness. People do not conceive themselves as separate, self-profit seeking individuals, but deeply intertwined with other humans and nature. Societies are organised as open global collaboration and sharing of energy, resources and information.

The scenarios assume societal progress: they propose how societies could change for the better. Progress is defined as the degree of (ecologically sustainable) emancipation and autonomy of citizens and their communities. However, as progress also increases the complexity of societies, there will also be downsides which will be described in each scenario.

In addition to broad societal implications, changes in energy systems affect societies over long periods of time. Thus, energy should be studied from both socio-cultural and futures-oriented perspectives. The goals of energy policy often merely aim at meeting energy demand cost-efficiently and in an environmentally sustainable way. Cultural and social dimensions of changes in energy systems should not left unexpressed. Especially the relation between energy transitions, social change, and developments in other technologies should be increasingly studied – we need more socio-technical imaginaries or "fantasies" surrounding new energy systems and anticipating their outcomes.[3] The following four scenarios encourage more probing into the exciting futures we are heading towards. As a final remark it has to be noted that the scenarios are so called "transformation scenarios": they anticipate fundamental changes in society instead of a linear, incremental business-as-usual development path. Their purpose is not to make an exact forecast but to anticipate the fundamental ways in which societies *could* change under the new energy system.[4]

The following **Chapter 2** presents the four scenarios and then elaborates how the energy system differs from scenario to scenario. Storylines with a key critical event and two character narratives are given. **Chapter 3** opens up the used scenario methodology in more detail within the context of a wider description of scenario construction. **Chapter 4** provides key recommendations that are required and can be made for various stakeholders in order to prepare for the emerging renewable energy transformation and to proactively surf on the winning side in this futures turbulence.

The writers wish to warmly thank all the researchers, experts, editors, facilitators, steering group members, company representatives, public policy makers for their engagement, and Tekes – the Finnish Funding Agency for Innovation for enabling this research project.

[3] See Ruotsalainen et al. 2017.

[4] For scenario archetypes and Transformation category, see Dator 2009.

2. SCENARIOS WITH STORYLINES AND CHARACTER NARRATIVES

"There are many events in the womb of time that will be delivered"
William Shakespeare

This chapter presents the four transformational Neo-Carbon Energy scenarios and then elaborates how the energy system differs from scenario to scenario. Each scenario starts with a nutshell description, and highlighting of the identified key trends and some weak signals for the specific scenario, constructed as evidence-based foresight but with open-ended outcomes. Storylines with inherent thematics, internal causalities and a key critical event, as well as two character narratives are given.

2.1. Radical Startups as Scenario 1

Figure 2. *A common startup community-workspace in 2050, now pioneered by Amazon. (Image: Manuel Bahamondez, Flickr)*

In the Radical Startups scenario, peer-to-peer is realised in startup companies and their networks. Economy and society are driven by startups known for their culture, values, and bold aspirations. Startups are tribes of affinity and places for self-expression and self-organisation rather than companies in the traditional sense. They work to change society and the environment for the better, at least from their perspective. Environmental problems are solved foremost by businesses, which are also advocates of new, deep-ecologically oriented lifestyles.

Key trends in the present:

- In a networked economy small and medium enterprises are increasingly responsible for creating value and growth. Innovations often stem from startup enterprises.
- Consumers' needs are diversifying and fragmenting, and startups can often supply these niche markets better than large, rigid enterprises.
- Startups are vanguards of a new working culture, where expressing oneself through work becomes an important motivator – and possibly a threat to occupational well-being.
- *In an ecological transition where everything is to be transformed as ecologically smart, diverse ecosystems of startups are needed to make the change possible.*

Some weak signals in the present:

- Firms are increasingly emphasizing collaboration over competition, establishing so called business ecosystems where information is exchanged in an open manner[5]
- Open source is spreading outside software businesses – in the form of e.g. open patents[6]
- People are increasingly working as freelancers. This may indicate a change in work ethos, where person's identity is hard to distinguish from his or her work identity[7]
- Many startups are emphasizing other than mere economic values, driven by ethics[8]

The Startup Revolution

Company names like SitAtMyDesk, Chipps and Timber[9] are omnipresent – startups and their open networks reign in economy. Especially three factors have contributed to their rise, which has outmaneuvered technology giants like Amazon, Apple, Google, and Facebook. First, many technology companies, especially Google and Facebook, reached an almost-monopoly status already in the 2010's, and legislatives forced them to open their data to public use. This opened vast possibilities for smaller companies to develop products and services from the data. Second, both consumer demand and workers' preferences shifted to highly specialised niche products and intimate workplaces. Technology giants could not meet this demand as well as smaller and more nimble companies. Gradually innovative startups claimed markets from their big brother competitors. Thirdly, the decentralised renewable energy system provides clean energy with low costs, and this levels the playing field for small ventures.

[5] http://timreview.ca/article/807

[6] http://factor-tech.com/feature/open-source-surge-companies-may-ditch-patents-favour-open-tech-research

[7] http://www.fastcompany.com/3049532/the-future-of-work/heres-why-the-freelancer-economy-is-on-the-rise

[8] http://www.theguardian.com/sustainable-business/ethical-startups-taking-on-internet-giants; http://alusta.uta.fi/artikkelit/2014/12/16/pelkoa-ja-intoa-slush-suomessa.html

[9] http://www.businessinsider.com/real-or-fake-startup-2014-7

⋆ ⋆ ⋆

Critical Event: Giant technology companies were forced to open their data to public use in 2023.

⋆ ⋆ ⋆

Moreover, from the 2030's onwards, automation and ubiquitous artificial intelligences, powered by renewable energy, have taken care of a major part in production and economic value creation. Little by little this has transformed notions of work and economy, and the role and functions of companies, especially startup enterprises. When "original" startups aimed for rapid, exponential growth, today's startups operate in a world of economic abundance and thus have more moderate growth expectations. Startups are not mainly economic actors, but create first and foremost cultural and social value. As they did in previous times, they still seek to disrupt society and social practices, but not primarily with the aim for new possibilities for revenue. The "valuation" of startups is not based on their productivity and expectations of future profits, but on their reputation and the shared cultural and social value they create.

However, creating economic value is still important to some extent. Economy is a hybrid of monetary and sharing economy, and the production of both exchange and use value. Scarce products and services are still exchanged through money, but the abundant ones are shared more or less freely or with very low prices. Startups also still focus on offering new products and services, often for consumer niches. However, the novelties are not so much products sold on markets, but new ideas, values, cultural meanings, experiences, and practices. Startups are "radical" because they constantly seek to renew culture and forms of social interaction. Their success and "radicality" is measured by the novelty, effectiveness, and attractiveness of their ideas.

Another significant change has been the mainstreaming of open networks and the principles of open-source. In the early 2000s, during the first startup boom, successful startups were eventually either bought by big, established companies or became established companies themselves. As the startup ecosystem matured, startups were able to stand on their own. An essential factor in this emerging ecosystem was open cooperation between startups, along the lines of open-source principles.

Startups became increasingly powerful, and especially by the end of 2020's began to shape the values, culture and social relations of societies. During this gradual "startup revolution", the whole society became organized as horizontal peer-to-peer networks. Startups acted as promoters of peer-to-peer culture and practices, and were often the organising hubs around which peer-to-peer communities began to take form.

Owing to their openness, startups became community-like. In today's startups hierarchies are very flat and workers have lots of autonomy. Startups collectives have leveraged the Silicon Valley ethos of individual emancipation, creativity, communalism and networked practices as society's mainstream. "Disruption" has become an all-encompassing feature in society, affecting everything from politics to personal identities.

Startups dissolve the barriers between companies and the rest of society

Instead of traditional, hierarchical and bureaucratic firms aiming for mass-markets, startups embrace organisational egalitarianism and niche-markets[10]. Working in startups is often leisure-like, as workers are encouraged to bring their hobbies and free-time interests to work. Startups can be seen as communities that create business out of their way of life. In this way they are better able to create more compelling and innovative products and services. Small enterprises have become the places where people can express themselves best and do things that are meaningful to them. As hotspots of human and social capital startups can cultivate and enhance human potentials. This is not without its problems, though, as work and corporate interests easily claims too big a role in people's lives.

As it merged work with hobbies, the new corporate culture began to evaporate the division between companies and the rest of society by the end of 2020. Consumers demanded moral, aesthetic and value-related integrity from companies, just as they expected these virtues from each other. *Authenticity* became the guiding value for the new breed of startups. These new companies firmly stood behind what they believed in, instead of trying to please as many customers as possible. In many ways, today's startups resemble protest and citizen movements of the past[11]. "Doing good rather than doing well" is the slogan for many startup entrepreneurs.

The step away from narrow economics has sped up the adoption of new, holistic wellbeing metrics. Progress is measured especially by The Happy Planet Index (HPI) instead of Gross Domestic Product (GDP). HPI takes into account not only human well-being but also environmental impacts. The index was introduced by the New Economics Foundation (NEF) in July 2006. Since its introduction, the index has been modified to include political freedom, human rights and labour rights.

Postnormality, hacker ethos and the open source business model

Startups being a major driving force, society has become unstable and constantly changing – society can be described as *post-normal,* defined by chaos, complexity and contradictions[12]. In part the radicality of startups stems from this very uncertainty. Radical means something that affects the root causes of and basic assumptions on phenomena. With their forward-looking, change-driven and futures-oriented mindsets, startups have created a society that is in a constant state of flux, with few stable, sustaining structures. Their "business"[13] is in large part based on creating *expectations of a wholly new kind of future* (and related business/reputation opportunities), and in this way they keep society in constant change.

Change and disruption are being promoted by the hacker ethos of startup culture. At the heart of the hacker ethos is the aspiration to understand the workings of complex systems – whether they are computers, programming code, politics etc. – and thus being able to tinker, modify and improve them. This helps startups in setting established structures, practices and cognitive processes in motion, and is an essential driver of innovations and productivity.

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[10] See e.g. Yang et al. 2014: How unlearning affects radical innovation: The dynamics of social capital and slack resources, Technological Forecasting & Social Change 87 (2014) 152–163.

[11] http://alusta.uta.fi/artikkelit/2014/12/16/pelkoa-ja-intoa-slush-suomessa.html

[12] https://en.wikipedia.org/wiki/Postnormal_times

[13] The very concept of "business" has changed as startups are often primarily cultural and social actors.

Another pivotal part of the startup ecosystem are principles and practices of open source. Because there are usually a lot of people involved in open source projects, open source projects change constantly, and thus contribute to the changes in wider society. Open source began to realize its potential in 2010's, when companies such as Tesla[14], LinkedIn, Facebook[15] and Microsoft[16] adopted it as a part of their business and development models. Little by little, open source spread from the software world to all industries. One of the forerunners in generalized open source was Assembly[17], a startup which provided a platform for individuals to offer their expertise for open development projects. As a return for their contributions, individuals got a share of the future profits of the projects they were involved in.

Freelance economy and the new precariat

In society of constant change, precarity has become the new normal. Roughly a half of workers are employed by companies and other organisations, the other half are freelancers and contractors[18]. This means that fewer and fewer have the luxury of services, perks and the community provided by organisations. To deal with precarity, new platforms pair talents with businesses and thus aid freelancers in getting a steady income. Co-working spaces provide freelancers with community and with support and resources. Freelancers often establish their own micro businesses, employing only themselves or at maximum 10 others. Because of the dense network of highly specialised niche startups, the business ecosystem is vibrant.

New ways of coping with constant uncertainty and mitigating its effects have been developed to replace schemes advocated by labour unions[19]. The ecosystem of microbusinesses is kept vitalized by micro loans and crowdfunding. Everyone is also entitled to universal basic income. Thus establishing a new business or production line is relatively easy. For entrepreneurs and employees, income often comes from a broad palette of sources. This requires ample networking skills. Sharing economy makes the use of resources more efficient and affordable. People have also gotten used to uncertainty, and temporary unemployment or a failed business is not a big deal. Perhaps the most important thing in terms of coping with precarity, however, is that the costs of living and production are low due to highly efficient energy and production system, augmented and enhanced by robots and artificial intelligences.

Some startups manage the challenges of uncertainty and constant change through projects of long time-scales. As the success of startups is based on expectations of a "different kind of future", the most ambitious startups feed on expectations of very long time-scales – such as Jeff Bezos' "The Clock", an atomic clock designed to last for millennia[20]. Investors have a central role in ensuring longer time-

[14] http://factor-tech.com/feature/open-source-surge-companies-may-ditch-patents-favour-open-tech-research/

[15] http://readwrite.com/2014/02/04/open-source-5-companies-code-projects

[16] http://venturebeat.com/2014/10/20/microsoft-open-source/

[17] http://www.theverge.com/2014/11/21/7258667/assembly-collaborative-work-open-source

[18] http://www.fastcompany.com/3049532/the-future-of-work/heres-why-the-freelancer-economy-is-on-the-rise

[19] Some of these coping strategies were discussed in "The Fuzzy Futures of Neo-Carbon Work", the 2nd Futures Clinique of the Neo-Carbon Energy project, which was organised in April 2016 in Helsinki (Ruotsalainen et al. 2016).

[20] http://www.businessinsider.com/everything-you-need-to-know-about-jeff-bezos-amazing-10000-year-clock-2013-8?IR=T

scales than a few quarters. Individual companies may come and go, but investors committed to long-term efforts make sure the projects of long time-scales do not fall with failing companies.

Investment funds in general are crucial in creating stability in the fluxing environment. Traditional energy companies of the early 2000's have often adopted the role of investors. Funding companies have become platforms of sorts, managing allegiances, connections and information streams between individual companies. Angel investors have a much broader role than only providing investments: they are mentor-like figures, taking part in designing business plans, offering valuable information, etc.[21]

Deep ecology as a driver of societal change

By now, 2050, not only have ecological lifestyles become widespread, but most citizens have adopted the worldview of deep ecology. The wide spread of veganism on the 2010's was one of the first weak signals of deep ecology. Deep ecology is characterized by its advocacy of the inherent worth of living beings regardless of their instrumental utility to human needs. Deep ecology argues that the natural world is a subtle balance of complex inter-relationships in which the existence of organisms is dependent on the existence of other organisms within ecosystems.

Startups were among the original vanguards of deep ecological thinking. At first a marketing gimmick to gain credibility, authenticity and rigorous moral standing, deep ecology became little by little an integral part of the startup culture in the 2030s. Because startups are intertwined with the civil society and embrace openness in all aspects, practices and cultures developed in them scale up efficiently. Startups aren't withholding and guarding their social innovations, but try to spread them as wide as possible.

Startups of deep ecology are, however, only a symptom of deeper undercurrents in the zeitgeist. Especially from the 2010s onwards, many craved for deeper meaning in life and for new kind of spirituality. With the rising consciousness of the ecological crisis, ideas related to deep ecology began to gain ground. People felt they could be a part of something bigger than themselves by deeply engaging with nature and seeing nature as inherently valuable. This tendency was further enhanced by the constant communication with other people, which eroded the idea of bounded, autonomous individuals and emphasised networks and communities instead.

Deep ecological values have changed practices throughout society. Environmental externalities have been integrated into prices. This has led to a revolt in markets as investments are flowing to eco-savvy startups. Earlier in history, consumers chose environmentally sound products and services only if they were practical and cheap enough; ecology was not the first, second or even the third criteria for choosing a product over another. Now ecological sustainability is self-evidently the most important criteria of choosing a product instead of another.

Deep ecology affects everything, from business plans to aesthetics. For the new entrepreneurial generation, carbon neutrality emerged as a business standard. Design-oriented startups mainstreamed a new ecologically-savvy visual culture[22]. Energy plants are designed as architecturally distinguished

[21] http://www.nytimes.com/2015/04/02/business/dealbook/angel-investors-lend-expertise-as-well-as-cash.html

[22] In the early 2010s, visual interaction and information about ecology was still supplied by non-state actors such as WWF, see e.g.

sites. One of the forerunners of the new visual culture in energy sector was Amager Bakke, waste-to-power incinerator plant in Copenhagen[23]. The incinerator has a ski slope, its surface does not resemble conventional power plants, and as a curious detail, its chimney will blow a smoke ring every time a tonne of carbon dioxide has been released – a reminder to local residents of keep their extensive carbon footprint to a minimum.

Instead of a global scale, most startups operate locally and regionally. They provide for local needs and solve environmental problems on-site. This is, too, a consequence of new ecological consciousness, as people try to live as locally as possible. As medium-scale political entities, cities are the central political, cultural and economic units in society. Their success depends on how well they succeed in attracting innovative companies. Cities are relatively independent from national regulations. Most cities specialize in particular issues so that some attract businesses from the creative economy, others from the energy sector etc.

A world of neo-carbon startups

The gradual efficiency gains of renewable energy technologies continued throughout the early and the mid-21st Century. M-KOPA Solar popularized solar energy as a service to rural households in Kenya[24], and contributed to the rise of East African renewable energy startups[25]. But where a major frontier of competition for radical startups emerged was the energy storage sector. New companies were pushing with battery technologies, neo-carbon storage solutions, as well as artificial photosynthesis and energy harvesting[26]. The storage market expanded, costs declined and returns increased. This created opportunities for further specialization and also spun off a related services sector, providing items such as customizable storages. In 2050, the storage solutions link across numerous value chains and clusters where firms interact and generate combined increasing returns.

Penetration of small-scale, local energy solutions are driven by startups' rationalization with characteristics of local energy resources. The energy system is highly decentralised and consumers as prosumers self-produce a major part of their energy. Open data and advancements in industrial ecosystems support utilization of waste streams also in small scale companies. Ubiquitous ICT, advanced automation and smart pricing enable significant volumes of real-time energy trade even between small-scale consumers and producers.

As production is mainly local and regional, and as digitalised "smart solutions" are in wide use, the demands for transport of goods and people have reduced compared to the first decades of 2000. 3D printers have massively entered households, industries, and other sectors, allowing for a hyperlocal, specialised and efficient production. Smart city concepts enable modular shift of mobility towards public transport, walking and cycling, as well as vehicle sharing.

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http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/living_planet_report_graphics/lpi_interactive/

[23] http://www.theguardian.com/artanddesign/2014/nov/13/danish-architect-bjarke-ingels-battersea-power-station

[24] http://forbes.com/sites/tobyshapshak/2016/01/28/how-kenyas-m-kopa-brings-prepaid-solar-power-to-rural-africa/

[25] http://www.thecitizen.co.tz/magazine/soundliving/Promoting-clean-energy-in-Tanzania/1843780-3837758-tvwi5z/index.html

[26] FOCUS Issue 282, p. 20, #4 10 Discoveries that will shape the future.

Two character narratives of the Radical Startups scenario

The following narratives describe the Radical Startups scenario through the viewpoint of two characters.

Character 1: Sunshine Superman

To be spread freely on the U-net platforms.

I have grown tired and I'm leaving my post at *Sunshine Superman. Back in the 2020's, as an angst-ridden adolescent, I found startups totally preposterous and hypocritical. Startups touted they were going to change the world for the better, to save the world. They said they were nothing like companies in the past. They claimed to be revolutionary and radical. What they really delivered was food and cheap taxi drives to the urban creatives. They were revolutionary and radical in claiming huge market shares from the mundane and trivial, spreading an uber-efficient, hyper-competitive and over-masculine work culture, and squeezing creativity and critical thinking into post it –like formulas.*

I still find startups preposterous and hypocritical, albeit I am the head of one – although, I know, we are not called "heads" or "CEOs" anymore. Preposterousness and hypocrisy are just more veiled than before. We think we are egalitarian, but we are not. We think we are creative, but real creativity and innovativeness come from groups at the fringes of the startup ecosystem. Most damming is that we think startups have liberated work from the iron cage of capitalism and market exchange. In reality we have just replaced market competition with competition on Karma.

How I became the "leader" of this particular startup community is the usual story: because I had much more Karma than most people. I was among the world-leading contributors to open-source projects, I had provided some innovative grass-roots urban planning solutions, and I ran a very influential watch-dog blog. So, I wasn't chosen to any position, it just naturally fell to me to take the lead of this endeavour. Don't you think this is a bit suspicious? It goes unquestioned that those with more Karma than most are natural, benevolent and enlightened leaders. They are not. Our time is just so engulfed with the idea of "leaderless" networks that we turned a blind eye to the power discrepancies – and to the many downsides that come with them.

I believe it is wrong to call Sunshine Superman and other companies of our day communities. Yes, everything we do, from social services to creating Serendipitous, Totally Off-Guard, Blow-Your-Mind Multisensory Experiences, stems from and is inspired by our community. Still, everything in our community is instrumental. Its purpose is to collect Karma, not to do things for their own sake. And often anything that maximises the influx of Karma is just frivolous. I can't help but wonder how words like "authentic" and "passionate" are still used. Being too ambitious and sincere means you'll get ignored.

Life has become much more interesting, adventurous and free now that we have almost free energy, as different varieties of "robots" take care of many tasks, and as everyone is granted a universal income. The problem is that, perhaps with no better options in sight, we let startups take the lead in this new situation. The reign of techemoths seemed so threatening that we settled for what seemed a better option.

I think there is a better future for a post-scarcity world than these rows of "community workshop offices" with 3D printers and endless slogans. As many of you must have noticed, I have deleted my karma points, as well as all my profiles on the U-net. As a no-one I will now move to an undisclosed

*location to practice an ancient art: to work on curating t*exts for a publication, and to divide my time between living on the U-net and wandering in the forests.

Character 2: The Humming Electricity

Before I have even gotten my eyes open I smell the burning plastics. I love the smell of burning plastics in the morning. Once again M'ah and Kelly must have been up all night working on our new design prototype. Since we moved our camp of geodesic domes to the Northern Finland for the summer it has been hard to keep track of time. It is so peaceful here with the wilderness stretching as far as the eye can see. We like to change places a few times a year to keep the moss away – and to find new architectural forms the nature has to offer. With solar-powered, automated personal-mass transfer it is so effortless you barely notice the travel.

As self-taught architects we are so lucky the world is going through a construction boom. Many of the lavish and sleek buildings of the oil-era, especially in China, are being torn down, the materials recycled, and new ones built to replace them. The new post-carbon aesthetics is all over the place – especially the Asian 90's retro-zippies crave for it. When the industrial and post-industrial architecture sought to stand out and dominate the environment, albeit in an anonymous manner, the post-carbon architecture seeks to blend in with its environment. Still the buildings are highly varied and idiosyncratic, and express the personality of its users and inhabitants.

Thanks to the new, clean energy system artificial intelligences – which consume a hell of a lot of electricity – are in wide use. Luckily, they have not replaced the need for human labour but have instead augmented it. Our startup company was among the first to produce artificial intelligence assisted biomimicry architecture. The process starts with an AI gathering influences and making suggestions. Then we humans continue from there by adding a human touch to the designs.

As I watch the slick panels harvesting the Sun's energy I can't help but wonder how light the world has become. The era of oil was so heavy-duty, dirty, and alienated. Now everything is so elegant and intricate, almost as if everything is… somehow connected through the humming electricity. Which we have a lot. Since the first commercial modern oil well was established in 1859 in Pennsylvania27 and the first oil pipes began to distribute oil over long distances in the following decade, the world seemed to go crazy with the sudden speed and all the needs oil-powered industries could fulfil. Although now in 2050 humans have more energy available than ever, we have grown more mature and are more conscious about how to put it into good use.

[27] https://en.wikipedia.org/wiki/History_of_the_petroleum_industry

2.2. Value-Driven Techemoths as Scenario 2

Figure 3. *Corporations' headquarters provide facilities for peer-to-peer projects. They are often located outside cities and are self-sufficient (Image: Apple).*

In the Value-Driven Techemoths scenario, giant technology corporations rule the world. Peer-to-peer approaches are common, but they are practiced within these "tehcemoths". Techemoths represent the Silicon Valley vision of emancipation, creativity, and open source. However, at the same time they seek market domination, confine their employees tightly within corporate walls, and try to establish as firm a place in citizens' private lives as possible. Markets and utilisation of data take care of environmental issues. Techemoths invest in ambitious energy, technology and environmental projects.

Key trends in the present:

- Many technology giants have developed their headquarters as campuses offering all the basic amenities from housing to leisure to education.
- Technology giants are buying startups, which in the future could lead to an economy dominated by big enterprises.[28]
- The workplace cultures of big companies are changing as less hierarchical, as pioneered by Google's 20 % principle, which means that employees can spend 20 % of their working hours on their own projects.
- In 2017 Mark Zuckerberg, the CEO of Facebook, published a manifesto in which he defined Facebook not as a company but a "global community", and described the future role of Facebook as a public sector-like actor.[29]

Key weak signals in the present:

- Elon Musk started his own school for the kids of SpaceX employees[30]
- Samsung has its own "city", SamsungVillage. The city has for instance its own hospital, where medical care is offered not only to employees, but their spouses as well[31]
- The aim of Google's new headquarters is to create a self-sufficient workplace community[32]
- Tech giants are investing in bold science projects, including renewable energies[33]
- Inequalities are widening, indicating a society where those employed by big companies are well-off, and the rest have to cope by themselves[34]
- In this kind of future, the most original innovations could stem from the fringes of society[35]

[28] http://www.techrepublic.com/article/the-m-a-strategies-of-the-top-10-tech-companies/

[29] https://www.facebook.com/notes/mark-zuckerberg/building-global-community/10154544292806634/

[30] http://venturebeat.com/2015/05/23/elon-musk-didnt-like-his-kids-school-so-he-made-his-own-small-secretive-school-without-grade-levels/

[31] http://www.samsungvillage.com/blog/2014/11/13/sneak-peak-samsung-digital-city/

[32] http://www.newyorker.com/business/currency/googles-monastic-vision-for-the-future-of-work

[33] http://www.fastcompany.com/3028156/united-states-of-innovation/the-google-x-factor

[34] http://www.nybooks.com/articles/archives/2014/may/08/thomas-piketty-new-gilded-age/

[35] http://www.tested.com/art/makers/458552-anticonventional-objects-vs-successful-products/

The Rise of Techemoths

Giant, global technology corporations – "techemoths", as they are called – rule the world. With the rise of data economy they have spread to every industry and every crook and cranny of society – from industrial production and smart cities to education and leisure. Their profits have exceeded the GDPs of many nations for a long time already. Peer-to-peer models are common, as they work well in the creative and data-based economy, but they are practiced mostly within techemoths. Techemoths pose a dual attraction. They represent the Silicon Valley vision of emancipation, creativity and open source, and pour resources to realise these aspirations. At the same time they bring order and discipline to the world through their seer size and by their cutting-edge competence on data. Although beneficial for many, techemoths' unparalleled power is not at all without downsides. The "dark side" of techemoths is that they use their power and resources to dominate in economy and in culture.

The change in technology companies and their societal status began somewhere in the 2010's. New technology enterprises, many having their roots in the 1990's and the early 2000's, began to spread to all spheres of life, public and private – it was this all-encompassing nature that separated these big, multinational companies from those before them. They strived to get as close to citizens and organisations as possible in order to get detailed and intimate data on human behaviour and technological systems.

An efficient way to gather data was by becoming an invaluable part of people's lives and a benefactor for the common good. In February 2017, Mark Zuckerberg, the CEO of Facebook, posted a manifesto where he outlined the social mission of Facebook.[36] Facebook was to provide a "social infrastructure" for the world, with broad social and environmental goals:

> *"Today we are close to taking our next step. Our greatest opportunities are now global -- like spreading prosperity and freedom, promoting peace and understanding, lifting people out of poverty, and accelerating science. Our greatest challenges also need global responses -- like ending terrorism, fighting climate change, and preventing pandemics. Progress now requires humanity coming together not just as cities or nations, but also as a global community."*

Besides declaring a social mission, Zuckerberg's manifesto emphasised the role of communities within and outside Facebook. Whereas before Facebook encouraged as plentiful and open shares, updates, likes and comments as possible, now it changed its course to more intimate communities. Facebook communities were to spur physical communities and communication as well. By this vision statement Facebook positioned itself not only as a social media company but, as it declared, a "social infrastructure" company with a social consciousness. As other social media and technology companies adopted Facebook's emphasis on communities, nascent techemoths began to deeply influence and steer social relationships.

Around the same time, Amazon (which started as an online bookstore in the 1990's) already operated in wide-ranging industries[37]: online retail, groceries, cloud computing, voice-activated personal assistants, streaming of video, music and games, fashion, production studios, large-scale delivery, food delivery, and digital education services – among many others. Amazon also let anyone,

[36] https://www.facebook.com/notes/mark-zuckerberg/building-global-community/10154544292806634/

[37] https://www.nytimes.com/interactive/2017/06/16/technology/all-things-amazon-does.html?mcubz=0

for a price, sell just about anything through its platform and logistics infrastructure, nurturing a vibrant ecosystem of more grass-roots actors. [38] With its huge portfolio of industries, Amazon is now one of the leading and most all-pervasive of techemoths' – especially because of the cloud computing services it offers.

* * *

Critical Event: Technology companies used their huge profits to gear their R&D activities to clean technologies in the beginning of 2020s.

* * *

Google – or its parent company, Alphabet – was perhaps the most ambitious of technology giants. Its founders and executives were free to make the calls, insulated by the governance structure which gave only little power to shareholders. This enabled Google/Alphabet to involve in moon shot projects with a long time horizon, such as immortality, advanced robotics and new energy technologies. What Google/Alphabet especially specialised in, and is still a world leader in, was artificial intelligence. In 2017 Google/Alphabet changed its approach from mobile-first to AI-first[39]. Now its artificial intelligences are everywhere. On an individual level they are almost like a second, superhuman brain for most citizens, and economic production is inconceivable without the services artificial intelligences provide.

With their huge profits, techemoths began to invest in a wide-range of technologies and industries from self-driving cars to anti-aging solutions to space travel. As the world became more and more technologised, computerised, and "datafied" in the 2020's and 2030's, technology companies began to take care of many of the responsibilities previously looked after by the public sector and other, smaller companies. By now, 2050, for instance health care and related services (such as pre-emptive healthcare) is provided mainly by these companies. They are also significant scientific actors thanks to their extensive, bold and experimental science projects[40]. As their economic dominance[41] fortified little by little, techemoths have steered societies' values and culture to their liking. The mixture of efficiency and optimisation, pleasure and play, and surveillance and liberty is the prevailing ethos.

It has become clear that decentralised renewable energy systems and ICT technologies did not truly empower the grass-roots peer-to-peer networks as was still anticipated in the 2010's – the cyber-libertarian dream of the early Silicon Valley. As big companies had the most resources and data – and as tight ownership to data was granted to them by legislation – as well as social and cultural capital they had built over decades, they were overpowered to reap the benefits of cutting edge technologies and related social and cultural changes. With the aid of renewable energy and artificial intelligence technologies these Techemoths have become the new power centres of the world. Although peer-to-

[38] https://www.fastcompany.com/3067455/why-amazon-is-the-worlds-most-innovative-company-of-2017

[39]https://www.theguardian.com/technology/2017/may/18/google-assistant-iphone-ai-future-things-we-learned-at-io

[40] http://www.fastcompany.com/3028156/united-states-of-innovation/the-google-x-factor

[41] http://www.newscientist.com/article/mg21228354.500-revealed--the-capitalist-network-that-runs-the-world.html#.VG9xUmPTQWp

peer did not come out the way it was thought of at the beginning of the millennium, it is alive and kicking in the embrace of techemoths.

Peer-to-peer Goes Big

Peer-to-peer has been proved as the most efficient mode of creative and immaterial production. Techemoths see themselves as hubs for individuals' shared projects. They provide resources and facilities, and give their employees an almost full freedom – with, paradoxically, their comprehensive surveillance – to pursue their interests. Google's "20% time policy", which in the early 2000s allowed workers at Google to devote one fifth of their working hours to something that interests them personally[42], was a pioneer for this kind of company practice.

Techemoth "campuses" are designed as city-like[43], with often tens or even hundreds of thousands of inhabitants. This big a pool of "human capital" creates a fertile ground for self-organising peer-to-peer projects. Campuses are the new city-states with their own legislation, decision-making and governing procedures, public spaces, accommodation facilities, amenities, and recreational and leisure opportunities. That techemoths have become attractive for knowledge workers has contributed to their cultural and political domination. Citizens identify strongly to corporate cultures, just as they identified to national cultures before. Techemoths, and communities within them, provide individuals a solid basis for identity.

Unfortunately, corporate giants do not adhere to same democratic principles as nation states used to – despite their fairly democratic decision-making and administration practices. Companies track their employees' every move[44], and privacy is seen as a notion of the past. This is rarely big a deal for employees or "members" of the companies however, so committed they are to them.

From Nationalism to Cosmopolitanism

The markets as well as corporate cultures of techemoths are global. Their path to dominance has been paved partly by the global growing middle classes. Middle-classes value creativity, freedom and autonomy at work, but at the same time often seek stability and predictable future prospects. With their centralised peer-to-peer models, techemoths offer both. Their corporate cultures' have been a long-awaited solution to the demise of national cultures. People still seek for "grand narratives" and large collectives to provide meaning to their lives, and techemoths answer to this need.

Techemoths have influenced heavily national legislations, and the autonomy of national states has diminished. The 2010s forerunners à la Google, Facebook and Amazon, have created rules and practices along the way, and many of these have been incorporated in legislations. National industrial and technology policies have been especially favourable to emerging technologies, and companies' product development drives the regulation of technologies.

States still have a role, though. As "neutral actors" they still serve some important functions. They mitigate the power of techemoths by providing capital and sureties to newcomers, a model akin to affordable student loans. They also provide citizens with a basic income, funded by corporate taxes.

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[42] http://www.nytimes.com/2007/10/21/jobs/21pre.html?_r=1&

[43] http://www.spur.org/publications/article/2012-01-07/not-so-corporate-campus

[44] http://www.salon.com/2014/02/23/worse_than_wal_mart_amazons_sick_brutality_and_secret_history_of_ruthlessly_intimidating_workers/

States thus have an important role in keeping the economy – and the whole society – vibrant, vital and healthy, and in trying to inhibit excessively dominant monopolies. That being said, in the end they serve the interests of techemoths by providing a legal framework that serves them well, and by preventing usurps with the monopoly of violence. All in all, states are mostly night watches with mostly practical functions. They stay out of values, culture, and customs, which are cosmopolitan and corporate.

Global perspective applies to politics as well. In a business-oriented world, techemoths have become *de facto* global "government(s)". The United Nations (UN) has failed and become a minor player. As a result of the political-cultural power vacuum, the world has been "re-regionalised" as geographically scattered units of techemoths (techemoth campuses in different parts of the world bring "local colour" to the otherwise quite homogenous cosmopolitanism). Solar, wind and neo-carbon receive zero-tariffs in a world trade system – the WTO regime – which is favourable for these companies.

Electricity markets are globally integrated. Global electricity trade has brought efficiency into the markets and thus lowered energy prices. Cheap, ubiquitous energy has created an energy abundance, which paired with a growing global economy has led to a serious rebound effect: material production and consumption have increased significantly. Environmental policies concentrate on solving the overconsumption of natural resources.

Widening Inequalities

There still exists a free civil society – albeit small – which balances the dominance of techemoths. Those living, in one way or another, outside techemoths are often materially deprived – although poverty is relational, as almost all citizens live in relative abundance thanks to highly developed technology. Crowdfunding is an important tool for the civil society and its indie DIY projects, which are often used for different forms of cyber activism and "terrorism" (a word that techemoths like to use to describe anything that questions their power) aimed at harming global corporations.

Oddly enough, techemoths sometimes even fund these "outsider" projects due to their curious, experimental and ground-breaking nature – and naturally to hamper their revolutionary tendencies. Because their profits are dependent on disruptive technologies, the rich have become a technologically and culturally progressive force in society – but are somewhat dependent on the civil society's "innovator fringes", and thus foster progress mainly through funding. Tech billionaires[45] buy social and cultural status by investing in risky but bold and ground-breaking projects, and also in the arts and media. Through investments in culture and innovation the super-rich are buying their place in history as modern day Medicis. Funding from techemoths is usually shunned upon though, as it easily makes the development of communities dependent on corporate money and eventually ends up serving corporate interests. In any case, the innovator hubs outside techemoths are an important counter-force and an interesting weak signal whose influence remains to be seen.

Due to the dominance of the rich, income gaps are wide – the world has entered a new "gilded age" where wealth and societal stance are inherited[46] and where differences between the rich and the poor are stark. Workers' share of national income is at its all-time low[47], despite the fact that wealth is

[45] http://www.tni.org/sites/www.tni.org/files/download/state_of_power_hyperlinked_0.pdf

[46] http://www.nybooks.com/articles/archives/2014/may/08/thomas-piketty-new-gilded-age/

[47] https://www.technologyreview.com/s/608095/it-pays-to-be-smart/

distributed through universal income. This has led to the rebirth of the industrialisation era patrons, who provide welfare for their employees. This is one of the core paradoxes of the age: citizens and their communities are autonomous like never in history, but at the same time they are fundamentally at the mercy of their "patron saints".

Techemoths and the Energy Sector

Energy-wise, the first signs of a shift in investment patterns globally were observed in the mid-2010s[48]. Environmental companies started to gain a growing foothold in China[49]. In 2015, President Obama enabled North American companies to sign a USD 2 billion solar power deal in his historical visit to Nairobi[50]. Companies like Duke Energy[51] as well as the cluster based in Texas were amongst the first to seriously look into the energy storage sector. These signs pushed large companies to re-evaluate their business models and changed areas of R&D[52]. In the coming years, economic actors increasingly began to seek returns from low-carbon-type of solutions.

Due to the still unsolved climate and energy crisis, techemoths are deeply involved in energy technology research. Tech billionaires and their companies have funded such projects as space solar power. They specialize in aggregator concepts/products: full-service packages which tackle ecological problems, as for instance water availability and zero-waste processes. Storage products, electric vehicles (EVs) and geothermal systems are often provided by techemoths. They have largely replaced the business of old energy companies.

Energy products and services offered by techemoths are usually "free": people pay for them by giving away their personal data. Smart energy technologies harvest massive amounts of behaviour data, which is then sold to third parties[53]. On the other hand, behaviour data can be used to optimize energy use in large as well as micro-scales. Consumer profiles aid in tailoring energy services according to differing needs. Data gathering is especially used to optimize the energy use of the service sector – before "big data" there often was little data on the energy use in the service sector.

Demand for energy is relatively high, but smart technologies mitigate consumption. Corporation-scale neo-carbon systems neutralize emissions. However, sometimes infrastructure is in a relatively poor condition outside tech campuses, which causes waste of energy. "Smart technologies" are also unevenly distributed. The pragmatic thinking on ecology has its merits, but also faces its limits in situations where technology and data cannot properly provide the answer. Citizens are not committed "by heart" to energy: they rather assume energy issues are automated, taken care of by somewhere else. The citizenry embraces the significance of breakthroughs, but has a rather limited technical understanding about them.

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[48] http://globalinvestorcoalition.org/form-registry/

[49] http://www.chinadaily.com.cn/business/2017-10/16/content_33322921.htm

[50] http://www.businessdailyafrica.com/Kenya--SkyPower-sign-Sh220bn-solar-power-deal/-/539546/2809726/-/11xifp8/-/index.html

[51] http://blogs.scientificamerican.com/plugged-in/2014/06/23/welcome-to-texas-americas-energy-storage-laboratory/

[52] http://www.theguardian.com/environment/2014/dec/02/eons-switch-renewables-sign-of-things-to-come-say-experts

[53] https://nest.com/

Two character narratives of the Value-Driven Techemoths Scenario

The following narratives describe the Value-Driven Techemoths scenario through the viewpoint of two characters.

Character 1: Meditating the Edge of Siberia

At this very moment, as I lie on my synthetic futon – well, not exactly mine – staring at some mind-hacking mandalas and vast clouds gliding soothingly on the wall, and listening to my colleagues breathing heavily in their sleep, I feel at peace. I feel the speed of light within me.

It has not always been like this. Looking back the past seems utterly chaotic – for me personally, for my friends and acquaintances, and for societies throughout the world. After the "golden age" of capitalism, the building of the welfare state, and finally the end of Cold War, the world seemed to have lost its sense of meaning, purpose, and direction. The burgeoning "information age" was in its infancy, and although people were eager to see what the future has in it for them, at the moment the transition from the stability of industrial age to the porous networks felt like a passing phase that never seemed to reach anything sustainable. Eventually cultural and economic precarity was followed by political disruptions, of which the Trump presidency and the Britain exiting the EU were among the first major signs. A chain of unexpected events followed turning politics into a domino game.

These DeepMind premises in some Russian backwaters have a unique sense of organic togetherness and, yes, of purpose. DeepMind offers me everything I could ask for: resources, access to vast data banks, colleagues who are also my closest friends, living spaces, a school for my children, transportation… I rarely have to deal with the management as our team gets to decide on what, when and how we work. Everything in our little city functions like a dream, from our personal lives to work, to infrastructure and to social issues inside gated walls.

Yesterday I watched my children play in the middle of the street. Their movements were sweetly streamlined as the white surrounding buildings. A few magnetically levitating cars passed them by swiftly and smoothly; no doubt they passingly gathered data on the kids' behaviour. Vast solar panel fields gleamed in the fields surrounding G City. If a drone were to hover above it would certainly have got optimal measures on the air quality. Instead I saw three paramilitary drones surveil some rioter scum just outside city borders. They did not use their pacifiers; they just monitored. The rioters were once again some reality hackers who try to mess with G's social optimization. It is good that such insurgencies are analysed so that they can be later on be dealt with much more efficiently. I am glad I am not there.

Everything there is in the world is essentially data – from the structures of the universe to human behaviour and even mind. We at the G, along with a few our competitors, own and control the world's data. The lawmakers were wise enough to understand the laws of networks: that everyone benefited when we were granted a near-monopoly in the data economy. If we would have been forced to open up our data to the public, only chaos and inefficiency would have ensued. People used to think that companies are their enemies, or at least always acting in their self-interest. Now we are more like some utopian utilities that people take for granted: we provide them electricity, food, healthcare, education, entertainment, science… and a constantly renewing future they never could have hoped for. All the world's a Siberian steppe, and we are to cultivate and colonise it as benevolent steppenwolves.

Character 2: Calm, fitter, healthier and more productive[54]

Headache is an anomaly these days when all our problems and discomforts seem to be solved, but I sometimes get one when I become too conscious of all the data sent, received and analysed all around me. I guess all this measuring started with the quantified self -movement. It really broke loose, though, when the climate, energy and environmental crisis was at last taken seriously. Measuring and analysing was seen not only as a way to optimise different processes, but also to place checks and balances upon the incommensurable human desires.

Environmental concerns were also but only one cause for control through quantification. Encompassing measuring was understood as means to maximise the efficiency of virtually everything. It has become so common that it mostly goes unnoticed. As I have become more conscious about the machinery behind our daily lives it has started to increasingly bother me. Researching the genealogy of data gathering and analysis, I found a vision of smart cities by Siemens.[55] *It is from 2008, but prescient:*

"Several decades from now cities will have countless autonomous, intelligently functioning IT systems that will have perfect knowledge of users' habits and energy consumption, and provide optimum service […] The goal of such a city is to optimally regulate and control resources by means of autonomous IT systems."

It is a pleasure not to have to make decisions of my own. The routes I take to work and activities, the food and nutrients I eat, the media I consume, and the people I get close with are decided for me so effortlessly I hardly take notice. The price to pay is to let digital data mining reach to my dreams as well.

Yesterday somebody slipped a flyer under my door. It had a mark on a map, a date and a time. It read "You deserve better. All you need is to Walk Away."[56]

[54] https://www.youtube.com/watch?v=HimvFbossU8

[55] https://www.siemens.com/content/dam/internet/siemens-com/innovation/pictures-of-the-future/pof-archive/pof-fall-2008.pdf

[56] https://en.wikipedia.org/wiki/Walkaway_(Cory_Doctorow_novel)

2.3. Green DIY Engineers as Scenario 3

Figure 4. *Green DIY Engineers scenario.*
(http://jason.wells.me/wp-content/uploads/2012/05/burning_man_2002_Robotic_Rickshaw.jpg)

In the Green DIY Engineers scenario, the world has faced an ecological collapse. Engineer-oriented citizens have organized themselves as local communities to survive. Environmental problems are solved locally, with a practical mindset. Nation-states and national cultures have more or less withered away. Global trade has plummeted, so communities have to cope with mostly low-tech solutions.

Key trends in the present:

- If current trends continue, the effects of climate change will be dramatic. This can already be seen in the recent droughts in the U.S., which some believe could even lead to the "End of California"[57].
- Species extinction are accelerating, which if continued will cause severe collapses in ecosystems[58]
- Ecological values are becoming mainstream, as exemplified in Pope's climate change message[59] and Rwanda's decision to ban plastic bags[60]
- Communal living is a strengthening trend among the youth61. Global climate turmoil could bring about a world in which local communities increasingly cooperate to survive to avoid struggle

Key weak signals in the present:

- Even before an environmental crash, the early warning signs of the crisis could make a survivalist spirit an increasingly appealing choice[62].
- Climate change is already intensifying global conflicts, which could lead to a situation where nations and communities close their borders[63]
- Local Do It Yourself solutions could prove more agile than large-scale projects in a world of natural disasters[64]
- Some people already live so that they produce as little waste as possible[65]
- Some towns are already trying to get off-grid and produce their own energy[66]

[57] http://www.nytimes.com/2015/05/03/opinion/sunday/the-end-of-california.html?_r=0

[58] http://www.nature.com/nature/journal/v486/n7401/full/nature11118.html

[59] http://www.vox.com/2015/6/24/8834413/pope-climate-change-encyclical

[60] https://www.nytimes.com/2017/10/28/world/africa/rwanda-plastic-bags-banned.html

[61] http://www.nytimes.com/2015/08/02/realestate/the-millennial-commune.html

[62] http://www.metro.us/lifestyle/today-s-doomsday-preppers-a-closer-look-at-survivalist-culture/tmWnib---2eLoFtUHD4bk/

[63] http://www.scientificamerican.com/article/climate-change-hastened-the-syrian-war/

[64] http://www.technologyreview.com/view/537116/major-infrastructure-projects-are-fueling-new-opportunities-and-risks-for-the-global/

[65] http://www.mindbodygreen.com/0-16168/i-havent-made-any-trash-in-2-years-heres-what-my-life-is-like.html

[66] http://onestepoffthegrid.com.au/this-northern-nsw-town-could-be-first-to-decide-to-quit-the-grid/

Environmental Crisis has led to Thriving Local Communities

Due to low oil prices and the selfish and short-sighted policies of many nationalistically minded states, the world has failed to escape the fossil-fuel economy. After crossing many climatic tipping points, the feedback loops from global warming have led to an unforeseen world of severe environmental turmoil. The effects are more drastic than many scientific forecasts dared to predict[67]. Global temperatures have risen an average of 3 °C, and are approximately twice as high in the polar-regions. Besides human contribution to greenhouse gases, scientists found out that the sun is more active than in 8 millennia.[68]

Over the years, people have witnessed drastic changes in weather patterns, sea level rise, and loss of snow. Desolated city ruins are a common sight and part of the shared imagination of citizens across the globe. The situation is made even worse because of accelerating species extinctions, which are causing unexpected ecosystems collapses[69]. In turn, ecosystem catastrophes have led to disastrous shortages in food supplies, caused new epidemics and damaged forests. Many parts of the world have become inhabitable, and with tens of millions of climate refugees many areas that are still habitable are severely overpopulated. Global trade has plummeted and faced its most drastic depression to date. Consequently, most states and businesses have become paralyzed.

* * *

Critical Event: A global heat wave in 2027 took millions of lives. Suddenly people realised that even worse was yet to come.

* * *

In order to cope with the situation, citizens are relying on highly localized approaches. People live mostly in self-sufficient communities in the rural areas outside cities. Some do inhabit urban settings – urban jungles, where solar rooftops and vertical farming cater for energy and food. Usually communities are well connected to each other and cooperate in various ways, but some are off-grid and totally self-reliant. Communities are densely built with lots of shared public spaces. Lifestyles are localised. Travelling long distances is rare. Flight travel is almost non-existent.

The world is built bottom-up in a DIY (*do it yourself*) manner. The era of risky mega-infrastructure projects is essentially over[70]. Distributed, decentralised and resilient production is all the rage. Local interconnectedness is provided by mesh networking, an upgraded local, Bluetooth-like internet, highly resistant to external shocks[71]. The principles of the Australian permaculture – "*permanent agriculture"*

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[67] http://www.washingtonpost.com/news/wonkblog/wp/2014/10/30/climate-scientists-arent-too-alarmist-theyre-too-conservative/ . See also https://www.ucsusa.org/global_warming/science_and_impacts/impacts/early-warning-signs-of-global-6.html#.Wo1xuIMZ6M8 https://www.skepticalscience.com/heatwaves-past-global-warming-climate-change.htm

[68] https://www.mpg.de/research/sun-activity-high

[69] http://www.nature.com/nature/journal/v486/n7401/full/nature11118.html

[70] http://www.technologyreview.com/view/537116/major-infrastructure-projects-are-fueling-new-opportunities-and-risks-for-the-global/

[71] http://www.wired.com/2014/01/its-time-to-take-mesh-networks-seriously-and-not-just-for-the-reasons-you-think/

– have been lifted to the mainstream and utilised to the full. This system of agricultural principles and social design is based on simulating or directly utilizing the patterns and features observed in natural ecosystems.[72] Permaculture and biomimcs (technology and patterns simulating nature's structures and processes) have been fused to an agro-industrial paradigm.[73]

Within communities, smart scarcity is the driving principle. Everything is recycled with almost zero-waste[74]. Solar panels, windmills and other means of renewable energy harvesting provide communities with plenty of energy. Food is produced and consumed locally and according to seasons. DIY synthetic biology and bioengineering experiments have produced nutritious plants with very high yields. Biomaterials and synthetic hydrocarbons provide communities with plastics, chemicals, pharmaceuticals and construction materials, such as organic bricks[75]. Bioprospecting[76] provides revenues and livelihood for many. In the night time, artificial firefly light glows in the neighbourhood[77]. The DIY revolution has been partly enabled also by the widespread uptake of graphene in the 2030s, supermaterial that has supported a range of applications from bioproducts to energy storage[78].

All of this has dramatically reduced the marginal costs of production. After a product or solution is developed, its production is relatively cheap. Especially important in this regard is the extremely efficient recycling. New resources have to be extracted only occasionally. Materials and products are not only recycled but upcycled: the new products made from recycled materials are often better in quality and more desirable than the original one, thanks to the creative DIY ethos.

DIY Engineers Fix It

To survive the harsh conditions, engineering skills and a practical mindset are highly valued. Problems have often to be solved with what equipment and parts happen to be available. Formal institutional education is rare, but communities provide training in engineering skills. Learning by doing and peer-to-peer learning are main modes of education. Kids and youngsters jump on new technologies, and their playful imagination drives innovative energy solutions [79]. Ubiquitous DIY technology is a way of surviving, but also a form of art and amusement.

However dire the situation might seem, most communities are actually relatively well off. Ecological crisis has forced to develop practical, cheap and relatively simple technologies ranging from construction materials to medicine and to energy production. The sharing of goods and services maximize resource use. In the event of a disaster, biobots are helping to locate survivors[80]. Social

[72] David Holmgren and Bill Mollison (1991) are early advocates of permaculture – a systemic view where social aspects are integral to a truly sustainable system (agriculture closely tied to social design) through several layers and zones.

[73] An extreme minimalistic permaculture form is natural farming, developed by Masanobu Fukuoka (1978).

[74] http://www.mindbodygreen.com/0-16168/i-havent-made-any-trash-in-2-years-heres-what-my-life-is-like.html

[75] http://momaps1.org/yap/view/17

[76] Biodiversity bioprospecting refers to the systematic search for biochemical and genetic information in nature in order to develop commercially-valuable products for pharmaceutical, agricultural, cosmetic and other applications. http://www.undp.org/content/sdfinance/en/home/solutions/bioprospecting.html

[77] Focus, Issue 278, March 2015, p. 26, Ten discoveries that will change the world.

[78] http://www.graphenea.com/pages/graphene-uses-applications#.VdQ8nUbuHnQ

[79] http://www.bbc.com/future/story/20141113-an-energy-revolution-from-the-sun

[80] Focus, 276, Jan 2015, p. 24 Robo Rescue Roaches.

entrepreneurship serves identified societal needs. Often the highly localised solutions have appeal also elsewhere. There is some trade between communities as well as benchmarking for the exchange of best practices. Because everyone has his/her place in the community, unemployment is a phenomenon of the past.

As energy and materials are mostly renewable, people often live amidst relative abundance. A survivalist ethos brings excitement and exuberance in thriving despite the threatening environments. Communities own their energy sources. Houses have been retro-fitted against the unpredictable weather[81]. Nomadic "tribes" lead hazardous lives, but settled communities are almost like careless green oases, safe havens surrounded by hostile outside world.

Within their daily communal life, DIY people are highly mobile. This local mobility consumes little resources, and the energy of the movement is mostly recaptured[82] – an illuminating example of how thoughtful the use of resources is. Unlike in pre-modern rural communities, the present-era communities are not anchored to a plot of land. DIY people are communal nomads who constantly develop new projects while helping others. Together, people innovate, get feedback and achieve increasingly high environmental standards in the spirit of 'kaizen'[83], the philosophy of continuous improvement.

Amateur Artists Amuse

In spite of the practical ethos, the excited and curious amateur mind (*amator* meaning "lover" in Latin) merges practicality with beauty and joy. In the face of an apocalypse, aesthetic beauty and play remind of the sacredness of life. Homo faber[84] (*Man the Creator*) and Homo ludens (*Man the Player*) are treated as equal ideals. Everything fabricated is useful and functional, but provide for amusement, humour and leisure as well. Cultural symbols often express joy over new solutions and resilience against the harsh climate[85]. Technology is seen as art and culture, and also as an extension of human abilities and senses. Techno-cultural mind is perceived as a fruit of civilization.

African region, with its tradition of amateur tinkerers[86] has been a forerunner in DIY solutions and has therefore achieved a significant global political, economic and cultural role[87]. African culture has especially influenced the design of tools and other utility articles, as African art has throughout history emphasized sculpture instead of painting. African art artefacts often have a practical function, e.g. as part of a ceremony, which also has contributed to fusing art with tools.[88]

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[81] Focus, 277, Feb 2015, p. 60–65, Ten ways to beat the flood.

[82] Focus 269, July 2014, p. 68

[83] See eg. Bodek, Norman (2010). How to do Kaizen: A new path to innovation – Empowering everyone to be a problem solver. Vancouver, WA, US: PCS Press.

[84] Literally "blacksmith".

[85] http://www.fao.org/docrep/x5318e/x5318e02.htm

[86] http://www.bbc.com/future/story/20130625-africas-diy-aircraft-builders

[87] http://www.theguardian.com/global-development/2014/jan/31/i-have-dream-africa-nkosazana-dlamini-zuma

[88] https://www.britannica.com/art/African-art

Do-It-Yourself Empowered by Neo-Carbon Technologies

Energy is used as little as possible in the off-grid world of innumerable micro-grids. Facing extreme weather, large grids are too clumsy to operate. Lessons learned from the use of micro-grids earlier in African countries, Australian permaculture practices and remote areas have been thoroughly studied. Engineers tinker and optimize small-scale neo-carbon energy in open-source communities. Local democracy and information-sharing[89] enforce commitment to decisions concerning energy.

Energy technologies have to be built using local resources mainly. Technology production and development is conducted at a local level, by DIY engineer groups. Scarcity drives a diverse energy pallet, giving energy production cultural value as well, as it strengthens the identity of communities. Wasting energy and resources are taboos. Energy solutions vary greatly, as communities are geographically dispersed, and as energy solutions have to be tailored to local conditions, but are typically affordable. Local wind, solar & biomass are the main sources of energy. Extremely local waste-to-energy is employed even if recycling is so efficient that materials are rather reused. Household-sized residential energy storage is in use. Battery solutions are self-made[90], such as "DIY Tesla Walls" from recycled laptop batteries[91]. Energy efficiency strengthens resilience in the post-apocalyptic world. Pragmatic, local solutions ensure efficiency.

United We Survive

Following the dramatic effects of the climate change, the common mind-set slowly began to demand a better preparation for whatever was ahead. Throughout the 20th and 21st centuries, the media and public discussions, together with similar individual experiences of the world in turmoil, had led to a collective imaginary of disasters[92]. Alongside with the traditional institutional order collapsing, a shared survivalist ethos started to develop, as a practical response of self-organization in the middle of the chaotic happenings. By the time the ecological catastrophe became more and more drastic, people were both forced and able to take action in order to steer the future towards a better direction. Instead of falling into stasis, as governments, states and businesses did, a swift self-organization was necessary in order to endure.

The scarcity of resources and a renewed institutional order as it once was known force people into new ways of thinking in many areas. Global issues and minor threats are faced together utilizing individual skills and will. Moreover, survivalist ethos can be seen in everyday actions that express creativity and collaboration. *What if*s are constantly asked and the needed skills, props and knowledge are defined accordingly, individually and collectively. As the effort is communal, everyone can concentrate on utilising his or her own assets.

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[89] http://blogs.scientificamerican.com/plugged-in/with-wiki-energy-pecan-street-project-shares-the-largest-residential-energy-database-with-the-world/

[90] http://www.wired.co.uk/news/archive/2015-08/10/graphene-3d-printed-super-batteries

[91] https://motherboard.vice.com/en_us/article/kzz7zm/diy-powerwall-builders-are-using-recycled-laptop-batteries-to-power-their-homes

[92] Becerra Vidergar, A. (2013). *Fictions of Destruction: Post-1945 Narrative and Disaster in the Collective Imaginary.* Dissertations, Standford University. Retrieved 20 August 2015 from https://stacks.stanford.edu/file/druid:ct352yp0031/Fictions-of-Destruction_becerravidergar_FINAL-augmented.pdf

Next to engineering knowhow, outdoor skills and emergency training are highly valued and also taught through the mesh networks. Tinkering and modifying the surroundings with own crafted tools are common. Cottages are becoming popular hideouts, as people are moving towards inland areas. As long-distance travelling has become rare, families have moved closer to each other forming tight communities inside communities. Although individuals disconnected from the rest of the world and living off the grid in every sense of the concept exist, the common mind-set is not about positioning one against the rest. Instead the aim is to preserve and strengthen the surrounding community, group or a unit. As the resources are scarce, sharing them is seen as a better option than possible thievery and riots caused by privatisation. Thus survival of an individual is seen to have better changes when done together.

Two character narratives of the Green DIY Engineers Scenario

The following narratives describe the Green DIY Engineers scenario through the viewpoint of two characters.

Character 1: Post-Apocalypse Paradise

The sigil of our tribe is carved on the solar panels. We are feasting upon the Sun's energy – the Sun lavishes its beams on us, and we channel them to our own purposes. Even though something is always broken and has to be fixed, we are blessed to have all the energy we need. Like vigorous ants we build the world as our own image. With scavenged and recycled materials we have made our village wild and exciting.

Despite the constant hardships, a good thing in the post-apocalypse world is that now we are truly independent and autonomous. Everything we do is for ourselves, not commanded from above or optimised for some imagined customer or "market demand". And if a tribe does not please my taste, I can always scram for another community.

Hopefully Stu has managed to repair the coms-system so that we can contact the DEVs, our neighbouring tribe trading on rare materials. They are a strange bunch, but that's the way it is these days. With the decentralised energy and technology inherited from the pre-apocalypse past, the world is blooming with tribes competing on their originality and uniqueness – think of an all-year Burning Man popping up in the most unusual places. Jill needs some materials from the DEVs for the intricate bowls she works on. Yesterday she astonished the whole village by a composition she had made with a modular synthesiser, for which she had collected the circuits and other components from all over the world. Let's see what she is up to tomorrow.

I found a quote by some "K.M." on our local network that describes our lives quite accurately. It dates, I think, to the 19th century and depicts a then-utopian society in which people can "hunt in the morning, fish in the afternoon, rear cattle in the evening, criticise after dinner". Now that almost everything is done and happens within the borders of our village, we can use our different abilities and skills in balance. We can truly focus on and immerse ourselves in what we are doing, taking care of all the different phases instead of specialising on some narrow detail in the process. Many call the state of the world a total and disgraceful disaster, but for us it is closest to a utopia we have ever been.

Character 2: The Tower

Above two figures, conversing in muffled voices, rises a tall building of swirling organic shapes. It is called the Tower – an impressive, almost sublime sight, scraping the sky. A glass façade reveals a myriad of exotic plants, birds and animals inside. Someone singing Bob Dylan – probably the gardener. Yet the Tower's wonders cannot disguise the distress on the faces of the two whisperers.

- *The oil is running out, the Sun has not shown for days, the wind blows weak, and the batteries are low and worn out. The Tower has energy for maybe two days. What will we do then?*

- *I really don't know. But I do know we can blame only ourselves. We are really finding ourselves in dire straits. We should not have directed so much of our resources to that overtly ambitious project of Karen and Moz.*

- *Yes I know, but I also know the importance of Myth. These days only the fittest survive, and the fittest communities are those which have succeeded in creating shared stories, a shared way of life. It is five years since creation of The Tower, and we pressingly need new totems…*

- *Plus it is not only our resources and narratives. It seems nature itself has gone mental. If we manage to save the Tower now, we might have to deal with pesticides, and who knows what, next.*

- *Ama told he had heard of serious malnutrition in some nearby community. If it gets worse, we might not be safe anymore.*

- *Remember who insisted we keep our weaponry?*

- *I do. Luckily our walls are sturdy, and we have some rubber bullets left. Oh, and a few biochemical crackers.*

- *Pffft. I think I need to fill my lungs with fresh air in the Tower.*

As the two disappear in the depths of the Tower, a wind starts to blow, whirling pillars of sand in the air. A Watchman at the top of the Tower detects a vehicle approaching in the cold distance. Is it the Joker, the Vertigo or the Thief?

There's too much confusion I can't get no relief.

2.4. New Consciousness as Scenario 4

Figure 5. *New Consciousness Scenario (http://www.wired.com/2014/11/thierry-cohen-darkened-cities/).*

In the "New Consciousness" scenario, ubiquitous ICTs, a looming ecological crisis, and the World War III of numerous small hybrid warfare conflicts have led to a new kind of global consciousness and worldview. People do not conceive themselves as separate, self-profit seeking individuals, but deeply intertwined with other humans and with nature. Values of deep ecology have become the norm. Societies are organised as open global collaboration and shring of resources and information.

Key trends in the present

- People are increasingly aware of the drastic consequences if the climate change develops as it has thus far[93]
- 24% of US teens use social media "almost constantly"[94]
- On social media and messaging platforms identities are increasingly constructed "cooperatively"[95]
- The millennial generation (born between 1980 and 2000) are the are more tolerant, have more solidarity and are more oriented toward a cooperative foreign policy than their elders[96]
- Cyber attacks are becoming more and more common. Propaganda on the internet and on social media are a strengthening threat[97], as the discussions on the "post-truth" has revealed. Warfare is becoming a hybrid of numerous different means, and increasingly related to information[98].

Key weak signals in the present

- The use of ubiquitous ICTs can lead to a new notion of humanity, in which identity is not seen as a "possession" of an individual but as cybernetic and collectively constructed[99]
- Falling marginal costs are paving way for a production based on "collaborative commons"[100]
- New ICTs, such as virtual reality, could make digital representations of nature a part of everyday life and thus narrowing the mental gap humans see between themselves and nature. This in turn could increase environmental awareness[101]
- Robotisation could lead to a "fully automated luxury communism"[102]
- Systems thinking is gaining ground at the expense of the "traditional" scientific paradigm. If Newtonian science concentrates on the linear cause and effect relations of the parts in a system, systems thinking maps out the complex and nonlinear interactions between parts.[103] This could lead to a new worldview which sees "everything connected to everything else".

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[93] http://www.rollingstone.com/politics/news/the-point-of-no-return-climate-change-nightmares-are-already-here-20150805

[94] http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/

[95] https://www.ft.com/content/7c972e2e-a88f-11e7-ab55-27219df83c97?mhq5j=e6

[96] https://www.americanprogress.org/issues/progressive-movement/report/2009/05/13/6133/new-progressive-america-the-millennial-generation/

[97] https://www.buzzfeed.com/jamesball/a-suspected-network-of-13000-twitter-bots-pumped-out-pro

[98] This could lead to a situation where nations and peoples are forced to rethink their mutual relationships, as happened after the world wars of the 20th Century.

[99] http://faculty.georgetown.edu/irvinem/theory/Hayles-Posthuman-excerpts.pdf

[100] https://medium.com/basic-income/post-capitalism-rise-of-the-collaborative-commons-62b0160a7048

[101] http://aeon.co/magazine/health/can-we-get-all-the-nature-we-need-from-the-digital-world

[102] http://www.theguardian.com/sustainable-business/2015/mar/18/fully-automated-luxury-communism-robots-employment

[103] http://www.systems-thinking.org/systhink/systhink.htm

Existence within Networks

Although it would seem odd for people in the past, it is now taken as self-evident that people are not separate individuals but deeply intertwined – and on a very fundamental level as One with each other and the nature. Consciousness and identity are seen as not bounded by the body, but extending far wider to social, technological and natural environment[104], even to space. Humans have become posthuman[105] and cyborgs in both technological and metaphorical sense, as Donna Haraway suggested already in 1984[106].

The idea of a shared consciousness and identity is not mysticism or new age philosophy. Science has proven that "the self" is constantly recreated in a person's interactions with her environment – both immediate surroundings and virtual environments. Because especially virtual environments change and provide new information constantly, identities have become fundamentally fluid and porous. Constantly connected to global information flows, people's social identities are not defined by their immediate, relatively stable social and physical surroundings, but by myriad of influences all over the world.

The idea of an essential, unchanging self that is distinct from its environment is now understood not as universal but as a historical conception bound to the age of Enlightenment and the industrial era. The modern, industrial society with market economy was based on independent, self-profit seeking individuals. This idea of humans was a major factor behind economic growth in the industrial societies, but was also a major cause of the global environmental catastrophe, as individuals pursued constantly growing material wellbeing. Satisfying the needs of an individual was the unquestioned goal. In this sense, the environmental catastrophe was first and foremost a cultural phenomenon.

The transition to decentralised renewable energy contributed to the change in how being a human is conceived. Energy production is a communal, distributed and networked act. The renewable energy system highlights the importance of networked cooperation. As individual citizens take part in this basic function of society, their role and status in society has been elevated profoundly. At the same time they have become conscious of their personal responsibility as part of networks, and not only at local and regional level, but also on global scale.

Economy and economic values have also changed. Now that renewable energy powers a post-capitalist, creative economy of abundance, the selfish, independent individual has become dysfunctional and redundant. The immaterial economy calls for interaction, loosening the ego, being open to influences and stimulus. The more open one's personality is, the better she gets along. Automation and artificial intelligences have replaced many qualities and virtues traditionally thought as masculine – such as rationality and physical strength. Qualities and virtues traditionally conceived as feminine, such as empathy and emotional openness, have become the norm. Toxic masculinity[107] has to a large extent been disposed of.

The shift towards collective and shared consciousness began to accelerate in the second decade of the 21st century. Behind this profound change were two main causes, in addition to the above mentioned technological and economic phenomena: heightened awareness of the ecological crisis and "World War III" of escalated, numerous "hybrid warfare" conflicts. The strengthening sense of global

[104] https://aeon.co/ideas/the-mind-isn-t-locked-in-the-brain-but-extends-far-beyond-it

[105] https://en.wikipedia.org/wiki/N._Katherine_Hayles#Human_and_posthuman

[106] https://en.wikipedia.org/wiki/A_Cyborg_Manifesto

[107] https://en.wikipedia.org/wiki/Toxic_masculinity

climate catastrophe evoked a new sense of both local and global unity – a need to act together and to seek emotional shelter and comfort from other people. The cognitive, cultural, political and military chaos wreak by non-stop acts of information warfare from both states and non-state actors, in turn, heightened the sense that something needs to be done. Instead of retreating to nationalism, populism and different fractions people began to reach out to others across national and cultural borders.

World War 3 Ushers Technological and Cultural Changes

In the 2010's and 2020's the world was filled with various glocal (global & local) conflicts: the civil war in Syria, terrorist attacks by ISIS (Islamic State of Iraq and Syria), Russia-backed separatist movements in different countries, fake news and post-truth propaganda on social platforms, emerging cyber terrorist groups of white nationalists, China occupying new territories, financial struggles in African countries and consequent civil unrest[108], militarily weakened U.S. trying to reassert its power, cyber-attacks against states and corporations, among many others. All these spiced up with a global financial system crash, grander than ever before.

These conflicts led to a chaotic situation so severe it was eventually labelled the World War 3[109] in the late 2020's. In contrast to previous world wars, the WW3 was a hybrid war in which no nation declared war against another. Hybrid acts of war connected the "micro" with the "macro" level as many ordinary citizens were at least occasionally in one way or another fighting the war – e.g. through information warfare and cyber-attacks. Digital energy systems were among the most attacked targets. Zeitgeist became hostile and paranoid, and the world politics as well as global economy volatile.

As with all wars, the WW3 led to technological development and deep cultural changes. By the end of 2020's, accelerated by the war efforts, information and communication technologies had become even more pervasive and ubiquitous than they were before. Big data, AI and AR enhanced the potential of sophisticated GIS (geographical information systems) to control and manipulate. Everyone was literally constantly connected to networks of other individuals and organisations. It became increasingly difficult to separate public and private lives. On the other hand, people sought peace from the information chaos by turning to closed communities and chat groups of friends, where intimate details of personal lives were shared and discussed among peers[110]. Clear lines between individuals started to wither away. Identity began to be understood fundamentally as a person's interaction with his or her environment, and thus, as porous, deeply interactive and ever changing.

Paradoxically, the WW3 ended up increasing empathy through the ever more intense communication and the intimate virtual communities people belonged to. Millennials, born between 1980 and 2000, were a pioneering generation in the emerging "new empathy". Having used computers and the internet all their lives, the millennials are more tolerant, have more solidarity and are more oriented toward a cooperative foreign policy than their elders[111]. They were the first generation to truly value access over ownership, transparency over privacy, and collaborative co-creation over

[108] http://www.theguardian.com/business/2015/mar/28/rising-dollar-debt-fears-global-economic-crash

[109] http://www.theatlantic.com/magazine/archive/2014/08/yes-it-could-happen-again/373465/

[110] https://www.ft.com/content/2bb83842-5086-11e7-bfb8-997009366969?mhq5j=e6

[111] https://www.americanprogress.org/issues/progressive-movement/report/2009/05/13/6133/new-progressive-america-the-millennial-generation/

competition[112]. They were also the first generation that saw themselves equally as individuals and as parts of multitudes of collectives.

The generation following the Millennials (born after 2000) has been called the "post-generation" because they came of age after Obama, 9/11 and the digital revolution. They are such heterogenic cohort that it is hard to pinpoint any moments and events which could define a generation. They are less trusting of institutions and prefer do-it-yourself practices, and are even more collectively oriented than the Millennials. This "post-generation" is defined by the same connectedness as the internet: diversity, networked communication, globalism, personalization and choice, as well as equal rights and freedom that encompass not only race and gender, but extend to sexual orientation and recreational drug use. [113]

Internet, its practices and values, became to define physical reality as well as digital. Energy system is labelled the energy internet. Hypertext, the structure of links between web pages, became a metaphor for the whole culture. Information began to be seen as "the basic unit" of everything, unifying all life. Mitigating hostilities little by little, this change toward collective consciousness eventually ended the "ubiquitous war" of WW3. The situation was analogous to the proliferating worldwide peace movements after WW1[114].

Deep Ecology after the Ecological Turmoil

The effects of the climate change heightened social tensions, and this was one of the factors leading to the WW3. The consequences of the warming climate were realized much earlier and more dramatically than expected by the climate models of the early 2000s. The severe droughts in California in the mid-2010s[115] were the first indicators of this. Ecosystem catastrophes led to disastrous shortages in food supplies. Droughts caused new epidemics and damaged forests. In other places, floods and tsunamis wiped out whole communities. In 2035, global trade collapsed and faced its most drastic depression to date. States and businesses were paralyzed.

Markets began to react, and investment into renewables started to grow rapidly. Countries like Chile[116] and Saudi Arabia[117] acted determinedly. But it was understood that environmental and social problems were so huge and interconnected that partial, practical and technological solutions alone were nowhere enough to solve them[118]. It was also realized that people's relationship to nature, to each other and to themselves had to be completely rethought. The philosophy of deep ecology was found again. Deep ecology posits that nature has value in itself, and that in nature everything is connected. These ideas fitted well with the arising consciousness and cultural movement of

[112] https://medium.com/basic-income/post-capitalism-rise-of-the-collaborative-commons-62b0160a7048

[113] http://www.adweek.com/news/advertising-branding/who-will-succeed-millennials-let-s-call-them-post-generation-160545

[114] http://www.gwu.edu/~erpapers/teachinger/glossary/world-war-1.cfm

[115] http://www.nytimes.com/2015/04/05/us/california-drought-tests-history-of-endless-growth.html

[116] https://www.nytimes.com/2017/08/12/world/americas/chile-green-energy-geothermal.html

[117] https://www.bloomberg.com/news/articles/2018-01-16/saudi-arabia-plans-up-to-7-billion-of-renewables-this-year

[118] See e.g. van den Bergh 2013, Environmental and climate innovation: Limitations, policies and prices, Technological Forecasting & Social Change 80, 11–23.

connectedness. The ideas and values of deep ecology spread quickly through all-encompassing digital networks.

As ecological consciousness spread, people began to see themselves as not only an inseparable part of their environments but also of the nature, and the nature as entitled to the same kind of universal rights as humans. Everything that exists is understood as life manifesting itself, and people inherently *biophilic*. Biophilia is a concept originally coined by a German social psychologist Eric Fromm and later popularised by an American biologist E.O. Wilson (1984). Biophilia means humans' psychological orientation towards nature and an innate tendency to focus on life and lifelike processes. Empirical proof for inherent biophilia has been found in various experiments[119], showing health benefits of exposure to nature, such as faster recovery from surgery[120], lowered blood pressure and stress reduction.

In the new worldview, the distinction between technology and nature was understood artificial as well. Experiments showed that people responded to virtual representations of nature in the very same fashion as to real nature itself[121]. Furthermore, since the dawn of computers, people have used biological and nature-related metaphors in describing computers and computer-related stuff, such as stream, mouse, cloud, meme, memory, viral, virus, worm and surfing. Even DNA itself is a digital code[122].

Through this similarity between life and computers, digital communication technologies became the Great Unifier of people to each other and to nature. Instead of keeping the virtual and the natural worlds separate – turning off our machines, taking e-sabbaticals, or undergoing digital detoxes, in order to connect with nature – people began to think about them all as integrated elements of a single life in a single world[123].

Spirituality has re-entered societies' mainstream. Spirituality in its current form does not mean religiosity or belief in the supernatural, as it has previously often been, but is a logical consequence of the principle "*everything is connected*". In its broadest definition, *spiritual* is the experience of merging with something much greater than oneself and transcending the limitations of the self. Buddhism has become the leading world religion, although most do not follow any religious practices but treat Buddhism more as a philosophy and a worldview instead.

[119] http://www.ncbi.nlm.nih.gov/pubmed/6391137

[120] https://mdc.mo.gov/sites/default/files/resources/2012/10/ulrich.pdf

[121] http://aeon.co/magazine/health/can-we-get-all-the-nature-we-need-from-the-digital-world/

[122] http://www.nature.com/nature/journal/v421/n6921/full/nature01410.html

[123] http://aeon.co/magazine/health/can-we-get-all-the-nature-we-need-from-the-digital-world/

* * *

Critical Event: Artificial general intelligence and a new human consciousness merged in 2035 to vanish old competitive ways of 'being'.

* * *

New values changed behaviours thoroughly, which led to drastically more efficient improvements in the state of the environment and social relations than technical or political solutions alone could ever have achieved. World economy became healthy again, and by the end of 2030's renewables were the self-evident source of energy. The decentralised renewable energy system was seen not only as a technical system but as a metaphor for the whole new era. As an example of its manifestation, SolarCoins were taken into use as the new global currency[124].

As clean energy enabled highly moving lifestyles, societies have become fundamentally global, a "global village" which was already dreamt of in the 1960's. Virtual and physical realities have become inseparable due to highly developed virtual reality (VR) technologies, and society in this respect "placeless". VR is not only visual, but simulates all senses authentically. However, as high-fidelity VR requires vast amounts of processing power, the energy consumption of data centres is massive.

United Biophilic Intelligences have replaced the United Nations. The global government is elected in global elections. The political system is a mix of direct and representative democracy. Owing to the global system, different functions can be optimized on a global scale. Energy is produced where and when it is the most cost-efficient, and information processing done at those data centres where it consumes the least energy at certain moment. Shared ownership of physical goods and resources enables the optimal use of them as well.

The Era of Post-Capitalism

Due to the technological, political and spiritual changes, the world of ours is often seen as a kind of a Star Trek utopia or "socialism that works". An almost perfect democracy has been achieved. As military spending is needed much less than before, investments can be used in other areas such as poverty reduction and R&D. Not only are the basic need well satisfied for all, but society can be described as "fully automated luxury communism"[125]. Highly sophisticated robots and artificial intelligences take care of most of economic production. Freed from the constraints of work, people are free to pursuit whatever interests them. Leisure and work have merged so that "work" in the industrial sense is no more.[126] In this post-work world people allocate a big proportion of their time to "spiritual" activities such as meditation.

As "work" or "economy" in the traditional sense have lost their meaning, entrepreneurship is also seen as an anachronism. Instead of traditional entrepreneurship, people form productive

[124] http://thinkprogress.org/climate/2014/02/21/3282131/solar-coin-global-currency/

[125] http://www.theguardian.com/sustainable-business/2015/mar/18/fully-automated-luxury-communism-robots-employment

[126] https://www.theguardian.com/news/2018/jan/19/post-work-the-radical-idea-of-a-world-without-jobs

communities without direct economic goals or incentives. Members of these communities gain great pleasure from solving complex tasks and immersing themselves in creative endeavours.

Despite society being a "global village", people live mostly in hyper-local communities. Because most of property is owned collectively, people can change their residence according to needs, and across the globe. Interaction through long distances is usually done in virtual reality, and in this respect there is seldom need for physical travel. However, as the globe is tightly interconnected, cosmopolite citizens travel significantly more than in previous eras. Algae are used to produce fuel for airplanes, and aviation is also carbon free. Universal, high-quality health services, education and evenly distributed wealth have mostly solved the dilemma of unhindered population growth.

For a "utopia" like this to work production and economy have to be highly efficient. Production gets more and more efficient all the time, thanks to automation and still functioning Moore's Law[127]. As all human production is immaterial, the added-value is high. Immaterial production does not consume nearly as much energy and materials as material economy.

A Neocarbonized New Consciousness

Decisions about energy futures are openly discussed by all parties affected[128], i.e. citizens regardless of their social status, especially taking into account the long time horizon of those decisions. Inclusiveness in decision-making leads to a coherent and predictable pathway. Citizens are extremely committed to energy decisions and related policies. It is taken as self-evident that energy is a deeply personal issue. Energy is even seen as "sacred", source of all life.

Solar and wind are in place on a very local level - energy is harvested from everywhere where people are living. Biomass is used as little as possible for energy, and de-forestation has stopped globally. Biomass is however used to produce materials – including synthetic biomass. Technology development and technology industries are funded and conducted by global joint efforts. Knowledge on newest energy innovations spreads quickly across the globe.

Energy demand is high, although energy efficiency is high as well. The main reason for high energy consumption is the global interconnectedness, which involves transportation, travelling and highly sophisticated virtual realities. Ubiquitous artificial intelligences also use a lot of energy. However, citizens are aware of their energy consumption, and do not consume energy in excess. Although the energy system is free of carbon emissions, extravagant energy consumption causes environmental rebound effects.

[127] http://www.theguardian.com/technology/2015/jul/21/limit-law-scientists-molecule-sized-transistors-atoms-chips

[128] M. Nilsson et al., Futures 43 (2011), 1117–1128.

Two character narratives of the New Consciousness Scenario

The following narratives describe the New Consciousness scenario through the viewpoint of two characters.

Character 1: The Post-Man Age

What oil is: black, greasy and poisonous. Filling our seas and blood with trash. What the Sun is: yellow, radiant, pure energy. Lavishing its unrestrained energy on Life on Earth. Our entire way of life was once built on oil and its demands. What will we be like now that we are free of oil? At least we are free of guilt, and it is liberating. I can travel to the other side of the world in no time, and with a good conscience. We have become free in a way we are only beginning to fathom. The Start Trek utopia is closer day by day.

The citizens of the oil-era missed one obvious point about the future powered by renewable electricity: that the new machines and artificial intelligences would render obsolete traits and features traditionally conceived as masculine. As the guiding values of our times, strict rationalism has been superseded by emotion, affect and creativity, (physical) power by empathy and nurturing, and the heroic individual by collaboration and caring. The post-oil era turned out as a Post-Man era as well. An Ego Self has been subverted by an Eco Self. The extent of how the ecological values "embedded" in the networked renewable energy technologies have spread to society at large is quite fascinating.

What I really like about our age is the fact that new ideas spread much more rapidly and are adopted with so much more thought than before. With no ego in the way, people are very responsive to new ideas. There is so much less friction and self-delusion as the vulnerable Man-Ego is out of the way. With new ideas comes progress and an unforeseen spectrum of possibilities. Time freed from necessary labour has been well-invested indeed. Resource allocation has changed in a much broader scale as well: as renewable energy is evenly distributed, there are much fewer geopolitical conflicts and power-struggles over resources than before. The Post-Man era is now a Humane era where gender equality is parallel with equal access to renewable energy.

Character 2: The First Mover

A crowd of people and other beings are gathered in an algorithmically generated shrine of digitally enhanced ambience. The place has alien aesthetics, but it is deeply comforting. The geometric shapes seem universal, and not only for Earthers. I'd assume any sentient being would find them pleasant – whether human, animal, plant, cyborg, microbe, AI. It's a post-human world and I like it.

The people sitting on the floor are information patterns, like the shrine itself, and the saint the shrine is dedicated to. Goddess is patterned information, I guess. Every pattern is holy. Exploiting nature is the greatest sin as it creates Chaos and shatters Order. Slowly but steadily we are moving past the Anthropocene and restoring balance. Ahimsa!

Creating and maintaining patterns require energy. With the solar panels on our roofs and coatings on our windows and clothes we are constantly aware of the First Mover of our existence. The Sun is the Holy Spirit who sheds the light of the gospel of Goddess. Nirvana is the realisation of the world in all of its vastness, infusing one's own patterns to the information streams.

In the shrine people are without any devices or wearable computing. It is for contemplation, for meditating all the received information, and creating new patterns. Mental prayer beads. Electromagnetic configurations and telepathic wavelengths. The sound of the gong often still resonates in me when I am back in my 75th floor apartment, spreading the waves of joy and peacefulness.

After the service Lev taps me on the shoulder. She wants to show me something. Did you know there is a lookout post at the top of the shrine? We walk narrow stairs to the top. The sun is setting. Nearby forest is beginning its nightly rumpus. A thin haze hangs above the city, colouring the air purple. Lev takes my hand as we stand silent and still. I feel moved and peaceful in a way I cannot explain. The air is so pure, and we are in good hands.

3. METHODOLOGICAL REFLECTIONS ON SCENARIOS – CORE OF FUTURES STUDIES

"We are called to be architects of the future, not its victims."
Buckminster Fuller

Scenario thinking and construction is a core sphere in futures studies. This chapter provides methodological reflections on scenarios. It describes and discusses in brief the concept, aims, types, construction and use of scenarios in futures processes.

3.1. Introduction

This text can be used as a reader's guide for two purposes. Firstly, scenarios play a central role in futures studies and it is important to position them as a focal futures work element and to perceive the variety of different types of them. Secondly, this chapter explains the logic and rational for a special type of scenario construction and application – how the Neo-Carbon Energy *transformational* scenarios were created and why.

We start by a presentation and definitions of scenarios in general – what they are and what they are not. The mission and role of scenarios is also briefly discussed. Then the reader will get examples of various scenario types. **The most important part of this chapter – section 3.4 – is the display and argumentation of the specific logic and rationale for the construction of transformational Neo-Carbon Energy scenarios**, presented in the previous main chapter. Finally, some reflections and recommendations are given on the use of these scenarios. The recommendations can also be perceived as a kind of backcasting steps – they are necessary requirements before the preferred scenario worlds are feasible to attain.

3.2. Definitions and role of scenarios

Scenarios play a crucial role in futures studies. Ever since the beginning of the field of futures research and studies in early 1950s, the method of scenario construction has been applied. The scenario method was introduced in Dutch Shell and RAND companies, used and developed by such major actors as Pierre Wack and Herman Kahn (Schwartz 1996), and by Gaston Berger in France. Kahn borrowed the term "scenario" from the theatre world and drama – it consists of a stage, plot, actors, sequence of action, for military and strategic purposes. Vuokko Jarva (2018) has even developed a specific scenario drama method – *scenarizing in dialogue* – where the narrative is first and foremost a means of communication and aims at collective mobilization. In his definition of scenarios Kahn (1967) perceives them as "hypothetical sequence of events constructed for the purpose of focusing attention on causal processes and decision points". Thus he emphasized causality and impact on decision-making. Jantsch and Wiener (1967) likewise refer to scenarios as "attempts to set up a logical sequence of events in

order to show how, starting from the present situation, they may evolve step by step". Eleonora Masini (1993) takes scenarios as educational and informative policy tools – as "instruments which aid decision-makers by providing a context for planning and programming, lowering the level of uncertainty and raising the level of knowledge". Vervoort et al. (2015, 62-63) perceive scenarios within a "worldmaking framework" for envisioning and pursuing better worlds. They propose scenarios as "worlds", instead of just narratives – and instead of reducing uncertainty, it should be embraced through diverse, contrasting futures. Scenarios and futures studies help us to navigate in the uncertain world. It is necessary to embrace even unpleasant alternatives – otherwise one is ill prepared and unable to react when something unexpected happens (Wilenius 2017).

Glenn (2009) defines a scenario as "a story with plausible cause and effect links that connects a future condition with the present, while illustrating key decisions, events, and consequences throughout the narrative". A scenario presents a narrative, highlighting actors, events, implications – alternative worlds with embedded causality. Amer et al. (2013) describe scenarios as "a valuable tool that helps organizations to prepare for possible eventualities". Accordingly, scenarios are alternative ways of imagining the futures as futures preparedness. Other benefits that scenarios provide for organizational strategies is interconnectedness, causality, flexibility, and innovativeness. However, the core aim and benefit is **futures preparedness** – systematic and open (in a sense of various alternatives) futures capacity building. Miller's (2007, 343) concept of *futures literacy* encourages us to use the potential of the present more effectively, to develop the capacity for more imaginative storytelling required for scenarios in order to realise our aspirations.

Scenarios are manuscripts of the future. Moreover, they are coherent manuscripts of various, alternative futures. Scenario thinking means basically **thinking in alternatives**. It also means anticipatory thinking in different ways, not just following linear trajectories. Scenarios have a generic role of opening up imagination when stepping into the futures. They also have a special role in paving the way to stakeholders to prepare themselves to tomorrow's worlds, by giving support to decision-making. Scenarios are themselves comprehensive futures processes (not just a method) – implemented as scenario thinking, scenario planning (esp. Ralston & Wilson 2006), and scenario construction exercises. They are also, in an ideal case, part of a larger futures process for any organization, company or country, which involves vision making, scenario construction, strategy process, and subsequent policy recommendations and measures to be taken (please see Chapter 4 for the recommendations given on the basis of Neo-Carbon Energy scenarios).

Scenarios can be directly linked with innovation processes within organisations. de Smedt et al. (2013, 439) emphasise that scenario processes can inspire innovation and they encourage us to think "how we can learn from using and developing scenarios to assist in the orientation of innovation systems". The scenarios can be constructed as a one-time project, or as a regular ongoing iterative process. Duration and scale of scenarios can vary a lot. A thorough scenario process in a company may take as long as 18 months (Schwartz 1996).[129] The number of scenarios generated also varies a great deal. A set of three scenarios is frequently used. However, in the case of three scenarios there is a tendency to create one positive, one negative, and one business-as-usual scenario, resulting often in

[129] Ideally scenarios are made as a continuous futures process. Ramirez and Wilkinson (2016, 17) point out that a scenario planning intervention can work best iteratively, instead of being applied as a one-off project. As Gladden (2017, 219) reminds, a thorough scenario analysis is a time-consuming process requiring much research and debate. Wide skill-sets are also required depending on the scenario type, from mathematical (esp. if used in connection with budgeting) to managerial and to subject matter.

rather formulaic and unimaginative set of scenarios. A high numbered set of scenarios, on the other hand, becomes difficult to handle and grasp. Therefore, an ideal number for a set of scenarios is between four and six (see e.g. Amer et al. 2013, 31–34).

It is also important to bear in mind what the scenarios are not. Especially, scenarios are not predictions, forecasts, utopias, nor monolithic linear extrapolations of the present. They are not variations around a trend. Instead, they are well-grounded, logical stories about the futures, different from each other, and different from the present state of things (Ralston & Wilson 2006, 121). They are challenging and meaningful images of the futures, with built-in logic, causality and eventualities and narratives.[130] They aim at informing stakeholders about future possibilities, risks and pathways. At their best, scenarios function as versatile testbeds, to be used for "futures reality checking" in light of organizational strategies (e.g. Van der Heijden 2005, 118).

3.3. Scenario typologies

Scenario is probably by far the most frequently used technique, at least the best known one, in futures studies. For Sohail Inayatullah (2008, 15) scenarios are the "tool *par excellence* of futures studies". They open up the present, outline the range of uncertainty, and offer alternatives. Inayatullah recommends scenarios to be applied in his six pillars process for creating alternative futures. Of course, there are several caveats for scenario processes (see e.g. Schwartz 1996), as with any other specific method.[131] Inayatullah (2009) lists such doubting arguments as most scenarios reinforce what participants already know, and they are useful only if they create new conversations on the new desired future.

However, a crucial thing to remember about scenarios is that there is no such thing as a single scenario method. Instead, there is a scenario mindset and approach, as well as a scenario technique toolbox, full of various types of scenarios and scenario processes. For various typologies, see e.g. Van Notten et al. (2003). Scenarios differ from images of the future (Polak 1961) in their structure. Scenarios must include pathways to their end state, whereas images of the future may remain as still crosscut descriptions of a future state or world. de Smedt et al. (2013, 432) describe this relation aptly: "Scenarios are not equivalent to images of the future, but they consist of images of the future".

However, scenarios resemble images of the future in the sense that the nature of their storylines and narratives is threefold (Amara 1981): possible futures, probable futures, and preferred futures. All scenario types should follow the first category, though, – that of possible futures.[132] Multiple scenario methods include such types as single-variable, double-variable, multi-variable, archetypes, organizational, and integrated (Inayatullah 2008).

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[130] For detailed instructions for writing vivid storylines, see e.g. Ralston & Wilson 2006, ch. 18.

[131] Criticizing views on the use of scenarios have been presented by e.g. Molitor 2009.

[132] In futures studies, there is also an approach of antithetical and counterfactual futures – futures images and scenarios that are counter to dominant worldview, facts or paradigms, of what we know that has been. Even this approach is recommended as an interesting exercise to follow up avenues that could have developed (in history). Booth et al. (2009) consider scenarios and counterfactuals as two types of modal narrative. Modal narratives are concerned with contingency and determinism: with questions of possibility and necessity. While scenarios are future-oriented, focused on what might yet be, counterfactuals are narratives of what might have been. We propose that counterfactuals can also be projected into the future. Therein, the relevant question is to look at futures that could open up even though at the present no foresight evidence or factual potentialities exists for them. Ossip K. Flechtheim proposed this niche for futures studies, and Pentti Malaska (in Malaska & Virtanen 2017) continued that as philosophical reflections.

Only a few of these possible futures/scenarios will fall into the category of probable futures or preferred futures. A scenario process may be constructed so that first a set of alternative scenarios is made, and only *a posteriori* assessment of their probability and desirability are being made. Gordon & Glenn (2018) even claim that no scenario is ever seen as probable. The measure of a good scenario is not its accuracy, but instead: plausibility i.e. "telling the story about getting from here to there", internal self-consistency, as well as usefulness in decision-making. Needless to say, the desirability of scenarios may vary hugely according to the stakeholders' interests and views. Let us now look at other scenario typologies.

Besides possible, probable and preferred futures, two main categories for scenario construction exist – scenarios can be explorative or normative. The **exploratory** type of scenarios aims at probing future worlds and making manuscripts for their unfolding as openly as possible. It is a plausible description of what might happen. The exploratory type of scenarios is also close to what is called descriptive scenarios. Instead, the **normative** type of scenarios is focused on those narratives that fit into an expressed goal or mission. It is a plausible narrative of what is hoped for. Proponents of different scenario types can also been classified as the positivist or "probability" camp and the constructivist or "plausibility" camp (Vervoort et al. 2015).

Yet another two category set of scenarios is: quantitative or qualitative. A combination of both is recently being applied in many scenario projects, and we can also call them hybrid scenarios. Examples of two recent scenario sets are Shell's *New Lens Scenarios* "Mountains and Oceans" and Millennium Project's *Global Future of Work/Technology 2050 Scenarios* (Glenn et al. 2017). The Shell scenarios depict two possible ways the 21st century could unfold, with dramatically different implications for society and the world's energy system. The Millennium Project scenarios are generated as a result of a Delphi survey and collective intelligence process resulting in three scenarios: 1) Its Complicated – a mixed bag, 2) Political Turmoil – future despair, and 3) If humans were free – the self-actualising economy. These scenarios contain positive or negative trajectories, or their combination. A key point in using these kinds of scenarios is to investigate the scenario contents and narratives further. The three Millennium Project scenarios, for instance, can be reflected in national workshops to enquire what implications such scenarios would have in the national level.[133] Consequently, the "users" of the scenarios can come up with relevant recommendations for necessary measures to be taken.

One way of looking at different kinds of scenario categories is in *meta* terms "scenario archetypes". Dator (2009) claims that all scenarios that so far have been or ever will be made fall into one of the four scenario types: growth, collapse, discipline, and transformation. *Growth* futures assume that current conditions and trends are enhanced: there are more production, consumption, population, and technology, more of everything. *Collapse* futures results from the failure of continued growth and numerous conflicts and contradictions: between the economy and nature, between men and women, between technology and culture. *Disciplined* (or steady-state) futures are close to sustainability – efforts are made to slow down growth and to seek balance in the economy and with nature, in order to have a softer and fairer society with human values on top. *Transformation* is the most radically changed future, going beyond the basic assumptions of the other three archetypes:

[133] These Millennium Project scenarios were used at a preliminary stage as drafts and background material in one of the Neo-Carbon Energy Futures Cliniques, specifically focusing on the futures or work (Ruotsalainen et al. 2016).

transformation arising either through dramatic technological change or through spiritual change, and often through the combination of radical technological and spiritual changes.[134]

Any set of scenarios should be different from each other. The scenarios should cover the *amoeba of uncertainty* as well as what is possible (Ralston & Wilson 2006). In other words, the set of scenarios must reach all corners of future *scenario space* (Gordon & Glenn 2018).

3.4. Special Case of Transformative Neo-Carbon Energy scenarios

There are several specific characteristics and experimental features adopted in the construction of Neo-Carbon Energy scenarios. By nature they are all possible, and to a varying degree probable, even though the probability of any scenario ever being realized is "vanishingly small" as Gordon and Glenn (2018) remind us. Three of them can be considered even preferred scenarios, though not evenly. All the four scenarios are transformational as defined by Dator (2009): they describe fundamental, radical changes in technologies, values, culture and social relations. One of the scenarios, the Green DIY Engineers, can also be defined as a collapse scenario of an ecological catastrophe.

They are hybrid scenarios, combining normative and explorative approach as well as forecasting and backcasting features. All of these scenarios are normative, since they aim at manifesting an emission-free world based entirely on renewable energy technologies in 2050. They embody elements of both backcasting and forecasting. Backcasting, in the sense of steps relevant for particular types of futures to be realized, explicit in recommendations in Chapter 4, and forecasting of drivers – megatrends, trends and weak signals – already shaping the world that we live in today. Their interplay may explain how the normative goal could open up in various ways. This scenario technique could be called semi-backcasting. Within the frames of such normative goals, all the four scenarios themselves are also explorative – openly bringing forth innovative and bold elements.

The construction of these scenarios was experimental in various ways, since first of all it was decided at the early stage to choose the **category of transformation** for all the four scenarios under construction and hence reframe the question of how a future energy system might look like. *Re*-framing the research topic is a key to transformation. Ramírez and Wilkinson (2016, 218 – 219) accentuate the importance of reframing, which as an approach is similar to consideration of alternative imageries of futures. They consider the conventional framing as "a lens, device, or type of filter that both includes and excludes". The Neo-Carbon Energy scenarios reframe a) energy systems by describing a transformation in the energy system itself – from their current state to a 100 % renewable and decentralised system – and b) a transformation in social relationships from the current state to relatively autonomous and self-sufficient peer-to-peer communities. In the scenarios, the renewable energy system has enabled and empowered these peer-to-peer communities. On the other hand, the ideal of self-organising communities is one of the drivers for why a decentralised energy system has become desirable in the first place. This was because reaching to genuinely transformative scenarios would require elements of radical and thorough change and thus also radically new angles concerning the change.

Secondly, the energy scenarios were **societal energy scenarios**, paying major attention to values and lifestyle changes. They describe how a change towards a decentralised renewable energy system,

[134] For various scenario types see more in Inayatullah (2006), and, for example, for "surprise-free" scenarios, "challenge scenarios", and "phantom scenarios" in Van der Heijden (2005, 270-272).

of declining costs of both energy and technologies, promotes a decentralised society, as described above. In the world of quantitative energy modelling and scenario-building, there are only initial approaches towards including societal aspects into them (Ernst et al. 2018; Breyer et al. 2016). Computational modelling is very different from qualitative social scenario construction, and both have their strengths and weaknesses (Kuusi 2017). Combining socio-economic storylines and energy modeling could increase the robustness of energy scenario development, and their use for decision-making (Fortes et al. 2015). Two of the quality criteria for futures studies proposed by Kuusi et al. (2015) focus on the usefulness of futures studies requiring that "Many kinds of users are able to understand and use it", as well as that "Key customers are able to understand and benefit from the Map". These Neo-Carbon Energy scenarios have therefore been presented and communicated in various platforms and events to make them understandable for users.

Thirdly, an **incremental participatory approach** was adopted to open up the platform of scenario construction process to interaction with various stakeholders (Ernst et al. 2018).

The tentative Neo-Carbon Energy scenarios were subjected to several types of testing during the project.

- The process of five futures cliniques conducted were a fruitful source for inputs, insights, and continuous feedback to the scenarios. The total of over 160 participants from different backgrounds attended these cliniques. (See e.g. Ruotsalainen et al. 2016).
- The scenarios were being tested by running a CLA game on them (Heinonen et al. 2017d; Heinonen et al. 2015)
- The scenarios were also "x-rayed" in various case countries through an international survey and workshops in order to contextualize them in different geo-political, socio-technical or socio-cultural conditions, and in order to identify pioneers for the depicted scenario futures. (Lang et al. 2016; Karjalainen & Heinonen 2017; Heinonen at al. 2017e; Heinonen at al. 2016b; Heinonen 2017)
- The scenarios were also tested by "bombarding" them with black swans in the last of the five futures cliniques. The results were further deepened through a cross-impact analysis the day after the clinique in a small expert workshop (Heinonen et al. 2017b; 2017c).

Thus, new inputs and feedback were incrementally accumulated for and by the research team. Gordon & Glenn (2018) advocate these kind of **interactive scenarios** as becoming the mainstream in future scenario construction. The scenarios will be built and tested with various interactive techniques. Rowe et al. (2017) even propose differentiating scenario planning and horizon scanning methodologies, and enhancing the latter by utilizing pre-developed scenarios.[135] Wright and Cairns (2011, 24) consider it a guiding principle in scenario construction that new ideas can be added at any stage of the process.

Data gathering for scenario processes was made by using horizon scanning, identifying driving forces and looking at uncertainties. Special attention was being paid to identification and analysis of weak signals. Such peripheral vision (Day & Schoemaker 2006) was adopted in order to find phenomena that otherwise would have been overlooked. Megatrends were naturally included in the process, but

[135] The Neo-Carbon Energy scenarios were developed at an early stage of the project (Heinonen et al. 2016). Thus, they could be dynamically elaborated throughout the research process.

not at the expense of neglecting weak signal scanning. Results from horizon scanning were used in the research team for choosing the axes for the scenarios. The creation of scenarios more or less followed the Intuitive-Logics Approach developed at the Stanford Research Institute (see Ralston & Wilson 2006). The 2 axes scenario framework was created after assessment of the possible impacts and uncertainties of the gathered material of driving forces (gathered, analysed, and elaborated by the project team). The conventional impact/uncertainty matrix was not used as such. Instead, a comprehensive process of using several futures studies methods such as futures wheel, futures table, futures window, futures manifests was built up to identify weak signals and black swans/ wild cards.

The created scenarios represent evidence-based foresight. This means that during the scenario construction and testing process, horizon scanning for evidence took place as a continuous process, not as a one-shot exercise. Interaction with the scenarios was attempted through various means as described above. Imagination allowed various participants to "bridge the gap between present realities and future possibilities" (Vervoort et al. 2015). Narratives were intentionally written as rather "open", to leave room for diverse interpretations – as a challenge for users to exercise their imagination (Ibid., 66). According to Ramirez and Wilkinson (2016, 44) effective narratives are "open stories", helping their readers to generate meaning while they use them.

3.5. Power of scenarios and narratives to catalyse action

Power of scenarios is manifold. Ramirez and Wilkinson (2016) perceive scenario planning as a "process of knowledge acquisition around the problematic situation". It involves exploration and learning in an iterative process to map out possible futures. Scenarios can be taken as "temporary, resilient and disposable learning devices" (ibid.).

Accordingly, making scenarios, reading them, and using them for policy-making is a learning process. They serve their purpose if they lead into action. Masini (2006, 1166) advocates us to "learn to live with the future" through systematic futures thinking, directed to visioning and consequent acting. This means, not in the sense of passively adjusting to the future, but of steering it into the direction we responsibly choose. She sees futures projects as "political and ethical positions that lead to action". In a similar vein, Gordon & Glenn (2018) judge the best scenarios as describing plausible means for improvement as well as means for eliminating roadblocks to a desirable future, by providing better understanding of future risks and uncertainties.

Ringland (1998, 190) considers scenarios as a good management tool for creating novelty, i.e. new ideas and identifying opportunities presented by the new environment – as in the case of the Neo-Carbon Energy scenarios, the new energy infrastructure. She emphasizes the importance of communicating the scenarios in order to engage the individual or group. "Thinking inside" the scenarios cannot start before such communication. It is only by working with the scenarios that learning becomes possible. Accordingly, creating models of the future – scenarios – and trying to understand and experience them from inside is a "way of rehearsing change" (ibid., 49).

We live in a VUCA world (volatility, uncertainty, complexity, and ambiguity, see Heinonen et al 2017b; 2017c). A similar description is given how we live in a TUNA world (turbulence, uncertainty, novelty, and ambiguity) by Ramirez & Wilkinson (2016). High rate of change combined with high complexity generates turbulence. The Neo-Carbon Energy scenarios probe a future VUCA/TUNA world by imagining how increased energy supply increases the rate of change and complexity in the world. In

a VUCA/TUNA world, one's experience of actual change (or the expectation of it) transforms the situation in ways that overwhelm one's capacity to act. Scenario planning helps engage with turbulent contexts and brings uncertainty "out there" closer to mental models, thus catalyzing action. We need tools and support to survive in these futures turbulences. Scenarios may assist in not eliminating all uncertainties, but what is of critical importance, in understanding, addressing and alleviating them.

Ringland (1998, 163) claims that the application of scenarios as means for developing recommendations for public policy has proved useful. One of the reasons for this is that by providing a range of plausible futures, the impact of actions can be made explicit in a non-threatening way. Miller (2007, 345;360) rightfully reminds us of the difficulty of using elaborate scenarios for decision-making. Nevertheless, he declares that "advocating change is a moral imperative". In fact – scenarios are all about change, through narratives and vivid descriptions they enable us to experience and immerse in alternative futures beforehand, and subsequently to deliberate on choices and action to be made today. Masini (2006, 1166) calls for rethinking futures studies – the whole field must according to her turn into "acting for the future".

Here, it is worthwhile to highlight that the value of scenarios is, instead of their accuracy, embedded in their emancipatory power, usability and influence. Then again, the desirability and usability of scenarios may vary hugely according to the stakeholders' interests and views – whose futures? Whose scenarios?

Our view of scenarios displays them as alternative ways of imagining the futures as part of futures literacy – as integral instruments for serious but transformative futures preparedness and mobilizing futures emancipation. The end result will be **futures resilience** – capacity to survive and even succeed in turbulent futures through collective learning based futures literacy and action-orientated futures consciousness.

4. RECOMMENDATIONS FOR VARIOUS STAKEHOLDERS

"Your future depends on what you do today"
Mahatma Gandhi

The purpose of the concluding chapter is to discuss how these transformational Neo-Carbon Energy scenarios may be used practically in organisations – small and large, and what some of their messages may imply more broadly, and they should be paid attention to. Energy transitions are long-term processes (Sovacool 2016). So are change patterns in public policy, which unfold in an evolutionary manner, accumulating as an effect of forces driving change. An idea can be shaped into an innovation, and through growing awareness, public debate, selected jurisdictions spearhead change and propose legal interventions (Molitor 2018). Scenarios, as a narrative body of future oriented evidence, provide a rich field of enquiry for policy making efforts that seek to understand or drive future changes. They also illustrate climate change as a complex global problem of political, economic and socio-cultural ingredients. They discuss and open up a number of looming changes as novel opportunities and concerns, to be anticipated and reflected in future decision-making.

The use of Neo-Carbon Energy scenarios in policy-making

Neo-Carbon Energy scenarios, as socio-cultural scenarios, can be considered as test-beds of an interactive research process that was deepened and enhanced throughout the research. Scenarios, as a final outcome of this research work, are evidence-based futures knowledge presented as narratives. To improve the quality of future decisions, evidence-based policy making is important. These scenarios were constructed through a collection of a large body of future relevant evidence.

They consist of a continuous monitoring of data about the future – megatrends, trends, drivers, and weak signals – which has been reflected against the research question(s): What could these changes imply for the society, or societies, as a whole? And, how can society shape the transformation towards the uptake of a renewable energy system? Therefore, the purpose of these scenarios, rather than remain as isolated scientific documents, is to inform and stimulate future decisions. Their relevance is very much determined by the process of societal engagement and interaction with other social, economic and political processes.

The aim in the conclusion is to propose a set of recommendations, which aim to act as a guardrail concerning long-term energy transformations. The following set of recommendations is targeted to stimulate public policy formulation, and is based on a thematic review of the key discoveries throughout the research process. This list has been reflected against the Neo-Carbon Energy scenarios and recent changes in the global energy landscape.

The recommendations have been formulated into a list of 10 strategic principles, as follows:

1. Create emancipatory long-term strategies
2. Craft future-oriented and co-creative collaborations
3. Open up the window for pioneers to spark changes
4. Expect surprises – ups and downs are inevitable!
5. Create benefits for the many – politics cannot be avoided
6. Prepare for radical technological change
7. Observe how planning assumptions could change
8. Reflect on value and lifestyles changes
9. Regulate with an ethical stance for a circular economy
10. Anticipate ahead to ensure future resilience

These should be interpreted as a set of principles, to be reflected, rather than a strict guideline, adapted when new knowledge is gained. These recommendations can be used for debates in local, national or global settings, such as parliamentary or public debates, local workshops – or by anyone seeking to reflect what these changes could signify, in their respective settings.

4.1. Create emancipatory long-term strategies

Historically, energy policy in the energy sector has supported 'centralised' actors. A bottleneck for the scenarios, still in many countries, is the structure of the energy sector (Lang et al. 2016). But policy makers can pay attention to the fact how renewable energy can not only power, but empower citizens. As illustrated in the scenarios, the peer-to-peer practices are already in use in the civic and private sector sphere. In contrast to upholding status quo, the state could act as a partner to the transition, and even include elements of peer-to-peer and grassroots benefit-sharing in its strategies. This would make the state responsive, acting as a "wiki-state"[136] to support the transition.

Governmental programmes and policies may have to be more radical and emancipatory than before[137] – in the light of limit global warming and the urge to meet Paris COP21 commitments – while still ensuring predictability, minimizing financial or political risk. After all, states do not need to just fix the markets, but they can help actively create them (Mazzucato 2016). To shape markets, policy-makers can mobilize a range of hard and/or soft policy tools, or policy mixes. The 'hard' measures consist of taxes, subsidies, grants, and loans as financial measures, and laws, standards and targets as regulatory measures. The 'soft' measures include network nurturing, funding small-scale pilots and demonstration projects, conducting foresight exercises and roadmaps as well as organising debates

[136] https://blog.p2pfoundation.net/artificial-abundance-and-artificial-scarcity/2016/02/21

[137] http://www.unrisd.org/80256B3C005BCCF9/search/6456C5E375AEE153C1258176003FBF05?OpenDocument

and consultations – to engage citizens and stakeholders to the energy transition. The way such tools are used can shape transition pathways and influence perceptions about the forthcoming changes.

4.2. Open up the window for pioneers to spark changes

Typically, only a few pioneers are needed to spark change. But because change is necessary in multiple levels, systemic interventions and niche nurturing is necessary. This way, many can act as pioneers and harness their entrepreneurial spirit in the spirit of visionary and transformational leadership. Changemakers have to deal with complex knowledge, in order to navigate amidst technological change, expectations by citizens, markets, and the state. Then, if the environment and culture is enabling and supportive, their solutions may be picked up and spread (Lang et al. 2016, Similä et al. 2017). The focus in international climate technology policy is shifting to climate relevant innovation-system builders (Ockwell and Byrne 2015). Innovation activities are not only about technology and business, but local innovators need to be motivated, their innovation capabilities nurtured, and their networks supported.

The role of entrepreneurs is important, but they are hardly the only pioneers. Civil society groups' conservation efforts and campaigns urge the society to act. Grassroots initiatives and small-scale experiments exist equally in local neighbourhoods, workplaces or as scientific pilot projects. The role of the entrepreneurs, startups and technology firms, then, is to identify market gaps in light of the future trends, to create new services. New fourth sector[138] models are crossing artificial, organizational boundaries. Working in incubators, and with the aid of investors, their efforts may be scaled up, in order to increase the impact when working to resolve global challenges. The issue that decision-makers will have to reflect is how they are nurturing these pioneering actors and their initiatives?

4.3. Craft future-oriented and co-creative collaborations

Innovation, itself, is transforming towards inclusiveness and sustainability (Yunus 2011, Leach 2012, Chataway et al. 2014). Leading firms already innovate under a co-creative and social mindset, and use value creation strategies that involve grassroots communities and citizens to meet social and ecological goals. Thinking in terms of alternatives – of several futures – is intrinsically connected and beneficial for innovation. Renewable energy technologies are increasingly promoted through the lens of innovation[139]. Such changes should be reflected also in innovation policy, which seeks to pursue transformations.

Innovation is also a growing buzzword for developing and emerging economies, where the transition is not only about development impacts, but also an economic opportunity. Problematically, entrepreneurs and firms from advanced economies tend to enjoy competitive advantage and higher innovation capabilities initially (Bell and Figueiredo 2012). Therefore, when the "radical startups" and "techemoths" drive the uptake of novel solutions, especially in emerging markets, ensuring maximal learning outcomes is important (Behnam et al. 2018) for catalysing positive spillover effects. Tesla in

[138] The fourth sector refers to organizational models that merge financial, social and environmental impacts to deliver value for multiple stakeholders. Read more at: https://www.weforum.org/agenda/2016/01/what-does-the-fourth-industrial-revolution-mean-for-civil-society/

[139] http://www.opusenergyblog.com/2018-whats-happening-year-renewable-energy-innovation/

the U.S., for instance, donated away some of its patents – for free. In contrast, the platform economy, which largely harnesses peer-to-peer principles, has been questioned because of the justification of their profits and what makes for a fair taxation locally[140]. If the renewable energy niche matures, distributing the economic gains equitably may warrant even further attention.

4.4. Expect surprises – ups and downs are inevitable!

Making visions a reality, or implementing public policy, is not a linear, but a temporal process. Efforts to drive change will face drawbacks, delays, criticism, and failures, but also accumulate successes. South Africa's auction scheme for renewable energy, established in 2011, has become hailed as a landmark public-private partnership to add renewable energy capacity. Even still, its enactment has been subject to delays by resistance from incumbents[141]. Germany's Energiewende has provided a policy environment that has transformed the global energy landscape, permanently. Even still, despite remarkable achievements, shifts in political mood and a failure to achieve rapid emissions reductions have eroded public confidence.

Unforeseen changes are inevitable along the way. Positive changes may take place relatively rapidly, as illustrated by China's uptake of renewable energy technologies and the rise of supportive industries[142]. And, rapid turning points can also happen to counter the envisioned development. It took decades of efforts to agree on the global Paris Climate Change Agreement, after which it was challenged only a year later following the outcome of the U.S. Presidential Elections in 2016 (and, again a year later, the U.S. suggests that it considers renewed commitment). Predictability of the policy environment is to be longed for, but could be more of a technocratic dream than political reality. Change is happening, but likely at uneven pace and driven in different locations.

4.5. Create benefits for the many – politics cannot be avoided

Major changes in the energy landscape are hardly an exercise of decision makers and technocrats. The uptake of renewable energy is locally situated – and socially and culturally contested – not devoid of meanings and shared practices (Sarrica et al. 2016). Contestations are an inevitable part of the political process – in democratic societies. Governance for the long haul is, in part, about having a vision and a relevant policy framework, but it also has to withhold political changes of governmental terms, regional and sub-national elections. The politics of green transformations are impossible to ignore, not least because technological change may destabilize incumbent power (Scoones et al. 2015). One of the twists in the U.S. Presidential Elections 2016 concerned the jobs of coal workers of Ohio, with the losing candidate failing to gain traction with her clean transition proposals[143].

[140] https://techcrunch.com/2017/10/04/europe-hits-ireland-over-15b-in-unpaid-apple-taxes-luxembourg-liable-for-294m-in-amazon-taxes/

[141] http://www.energy.org.za/news/eskom-delays-on-ipp-signatures-are-costing-jobs

[142] https://www.eniday.com/en/sparks_en/chinas-renewables-revolution/

[143] With other priorities capturing the election agenda, few, if any, voters acknowledged. https://www.scientificamerican.com/article/hillary-clinton-vows-to-make-u-s-a-clean-energy-superpower/

New ideas must gain legitimacy, and win over the support of various groups and stakeholders, all of whom have a political vote, and uneven shares of power. Parts of the achievements of the energy transition in Denmark, Germany[144] and South Africa owes to an active civil society. In Bangladesh[145], China and India, vocational training has provided skilled workforce and driven their solar PV industries. Transparency of new initiatives, and communication of their key elements can enable a process of continuous and collective learning. Each actor needs to feel significant in playing a role in tackling climate change, or if certain groups are left outside, potential enemies are made. The roar of the people has to be heard (Wilenius 2017, ch 5).

4.6. Prepare for radical technological change

It seems unlikely that technological change would halt, on the contrary. Rather, it is claimed that the radical character and speed of technological change will only expedite[146], to shape future societies in unpredictable ways. In terms of energy, the potential and technical feasibility for a renewable-based future is largely in place, and is gaining growing recognition in society. Global investment to clean energy technologies already reached USD 333.5 billion in 2017 (BNEF 2018). Off-grid solutions are expediting tackling energy poverty, and solar could emerge as the dominant source of electricity in the future in Sub-Saharan Africa. Globally, renewable energy could be increasingly aplenty, inexpensive and clean. This would provide potential for novel, clean industrial solutions, such as synthetic fuels made from air, and challenge existing modes of production.

Considering such energy related changes is highly relevant for any countries, but the transformation of the energy sector will hardly be the only technological driver that shapes future societies[147]. Artificial intelligence (AI), robotisation, big data, synthetic biology and novel environmental technologies all may have a significant role in shaping daily life, jobs, commuting, and what renewable energy will be used for. Some renewable energy solutions already make use of these changes. Leading solar firms in East Africa use machine-to-machine-communications, the Internet of Things, and even artificial intelligence, to optimize their services for customers[148]. Harnessing the principles of peer-to-peer from the mobile to the energy have even encouraged the use of words such as “leapfrogging” – surpassing polluting developmental phases. The key point is that the future, and its energy solutions, partly owing to social values, partly to technological change, needs not to be more of the same, but can be more of the new.

[144] https://www.theguardian.com/public-leaders-network/2015/oct/02/energy-cooperatives-uk-germany-denmark-community

[145] https://www.theatlantic.com/technology/archive/2014/05/why-a-green-jobs-boom-is-under-way-in-bangladesh/362087/

[146] https://singularityhub.com/2016/03/22/technology-feels-like-its-accelerating-because-it-actually-is/

[147] https://www.eduskunta.fi/FI/tietoaeduskunnasta/julkaisut/Documents/tuvj_11+2014.pdf

[148] https://venturebeat.com/2017/04/09/behind-azuri-technologies-push-to-bring-solar-power-into-rural-african-homes/

4.7. Observe how planning assumptions could change

One of the key tasks of public policy is the allocation of scarce resources. Certain economic trends are worthy of attention. Technological change has also signified declining costs of information and technology. In turn, the declining prices of renewable energy around the world – as illustrated by the power auctions in Saudi Arabia, India[149], Mexico[150], Chile or South Africa – exemplify unexpectedly rapid changes in economics in the energy landscape. Such processes did not happen overnight, but are an outcome of long-term developments. Some of the effects are already felt, and others will manifest later. Assumptions in energy planning and public policy could have an entirely different outlook[151]. The use of many fossil fuel technologies in place today could be severely regulated or their use in society might have turned uneconomical because of market and political risk.

New events and new policies can make scenarios shift, and alternative trajectories change the "business-as-usual" predictions of energy outlooks. According to some estimates, a future energy system, based on solar and wind, could provide carbon-free power at up to 50 % lower generation costs than competing low-carbon energy alternatives, new nuclear and carbon capture and storage (CCS). A reliable power system based on wind, solar and sustainable gas balancing could be even 20 % less costly than a system of new nuclear power plants combined with gas (Agora Energiewende 2014). Not only will expert debate likely be fierce, but such developments will also challenge current expertise, energy modelling and planning tools. Such developments may also shape future investment behaviour and risk perceptions. A renewable energy based system also implies changes in the market design, even if the effects are not yet entirely clear (Weiss et al. 2017).

4.8. Reflect on value and lifestyles changes

As the world changes, old identities are questioned, new risks emerge, and citizens seek for sources of trust. A major cultural issue concerns the tensions between the 'the new' and 'the old' – of nationalism versus globalism, and liberalism versus conservatism. Certain social and economic tendencies are fuelling both views. The rupture of hierarchies allows more actors to have a say in how society should be organised. Some cultures become more pluralistic, and potentially, more prone to change. Others will resist change more strongly. Digital interconnectivity allows new peer-to-peer communities to be formed, but creates also new filter bubbles. Amidst these pressures of change, people still typically prefer to live and work in communities of like-minded individuals (Heinonen et al. 2017; Ruotsalainen et al. 2017).

What kinds of social issues are there to deal with in the future? Is the world as a whole moving to an increasingly immaterial, creative and automated economy? Even if the role of cultural change is largely absent in energy debates or expert modelling, it surely shapes expectations. Whichever the social constellations of the future, long-term energy transformations will have to accommodate both the fluctuating and the rigid, and to find meaningful connection points with a diversity of communities. One evident source of discontent seems to be new kinds of inequalities. How the world is perceived

[149] https://www.ft.com/content/4dca7f72-b31d-11e7-a398-73d59db9e399

[150] https://electrek.co/2017/11/16/cheapest-electricity-on-the-planet-mexican-solar-power/

[151] https://www.economist.com/news/briefing/21717365-wind-and-solar-energy-are-disrupting-century-old-model-providing-electricity-what-will

and what is valued affects how we allocate resources, and what kinds of futures we expect and hope for – as individuals and as collectives. In times of rapid change and increasing social complexity, searching, developing and realising oneself, and one's identity, becomes even more important than today.

4.9. Regulate with an ethical stance for a circular economy

The vision of a renewable energy based society, as an electrified, resilient and secure society, is an ecological one. The rise of an environmental economy by 2050 may have changed societies much more than we can conceive today. Almost no waste would be produced and all materials could be recycled. Multiple new energy technologies and sources could imply that energy is harvested everywhere. A new, second "great electrification" of societies, glimpses of it epitomized in the car industry's shift to electric cars[152], could lead to multiple intertwined environmental, health and economic benefits, and even signify an End to the Burning Age.

On the other hand, keeping the system running sustainably is immensely complex. Circular economy must be organised to deal with waste from microplastics (Steensgaard et al. 2017) to the full re-use of materials across value chains. Ubiquitous information and communication technologies, and digital manufacturing technologies will use increasing amounts of energy. Competing land use issues will have to be minimized. New issues and risks will emerge, such as ensuring data privacy in peer-to-peer energy services (Bisaga et al. 2017). An environmental economy is better than a fossil fuel one for evident reasons, but it is still an economy, with material inputs and outputs. Despite social and ecological objectives, novel energy technologies, and the structures enabling them, will be subject to ethical judgment and risk – like any new discoveries and innovations.

4.10. Anticipate ahead to ensure future resilience

Risk management is an intricate part of the energy sector. Even so, conventional energy security analysis has not yet seriously studied the potential of renewable energy based scenarios, and those that have, struggle to capture the true complexity to reach or sustain such a future society. Anticipation, in turn, may offer faster adaptivity in dynamic environments. Uncertainty can be tackled through reflection and planning, and even enhance the chances of survival. It is of critical importance to pay attention not only to present megatrends or trends, but also to discontinuities, weak signals, and even unexpected or peripheral events – to counter the impact of the highly improbable. After all, emerging technologies and social changes are expected to transform tomorrow's world in unforeseen ways!

Foresight elements can be incorporated into planning and decision-making processes in a systematic way. Selected public and private organisations nationally and globally[153] have incorporated foresight into their work (Söderlund & Heinonen 2016). Actually, anticipating change is useful for

[152] https://www.theguardian.com/rethinking-business-with-ing/2017/nov/06/the-history-and-promising-future-of-electric-vehicles-in-four-charts

[153] The Millennium Project is a global futures think tank, which conducts studies about future change in a range of fields: www.millennium-project.org/millennium/overview.html

anyone willing to enhance their futures consciousness. For the purpose of discovering energy futures, looking ahead can improve resilience, as the resistance of a system to shocks and disasters, and its recovery ability. Anticipation can help conceptualising how energy services are provided in a future society that uses renewable energy, even in the event of disruptions (Annarelli and Nonino 2016; Erker et al. 2017). The absence of foresight practice by the key actors involved, in turn, can lead to the omission of future considerations as strategic alternatives. Scenarios are a safe way to test living in possible transformational futures, experience and "rehearse" coming futures in advance, and gain as insights from them for examining implications, drawing conclusions and planning next appropriate strategic steps (van der Heijden 2005, 292).

5. EPILOGUE: GUARDRAIL FOR THE FUTURE – A REASON FOR HOPE?

"We are free to change the world and start something new in it."
Hannah Arendt

Change begins in niches, on the fringes of existing regimes. Over time, they may evolve, and emerge to disrupt the status quo, reflected as novel norms, rules and policies. These evolutionary changes will also shape public policy, shaped by policy cycles and multiple political interests and agendas. In order to understand long-term energy transformations, and develop policy for guiding them towards more socially just outcomes, decision-makers need to understand and treat renewable energy holistically. Shared visions and new narratives need not be utopian. Envisioned large-scale changes can inspire people – and be framed as opportunities that can deliver positive outcomes. A renewable energy system can change the society as a whole – and, vice versa, individuals and groups will shape the future trajectories of energy transitions. Therefore, all actors should be aware of their potential as agents of future creation.

The Neo-Carbon Energy scenarios and this set of 10 recommendations, as presented in the previous chapter, act as a reminder and a guardrail for future policy making efforts, seeking to be reflexive of changes. The future is informed by scenarios as evidence about tomorrow, but it is shaped by decisions taken now by actors in the present.

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