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Radical Transformation in a Distributed Society – Neo-Carbon Energy Scenarios 2050

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PREFACE

The target of the Neo-Carbon Energy project, when it kicked off in 2014, was two-fold: firstly, to establish a feasible design for an emission-free renewable energy system. Secondly, to understand that energy is subject to how society develops. Therefore, energy transition should be studied in a multidisciplinary way. In the heart of the project is so called neo-carbonisation. This means the replacement of fossil carbon and fuels, with those produced from carbon dioxide, water and electricity. We can call this the *'neo-carbon era'*.

The first target has already been achieved; the project researchers have shown it is possible to build an emission free renewable energy system – now. What is lacking is political will. This underlines that energy is not about energy, it is about politics. The second target became an official global target with the Paris climate agreement in December 2015. The Neo-Carbon Energy scenarios, as presented in this working paper, aim to open up horizons for various futures of how an emission-free society will look like.

I would like to draw attention to three simultaneous disruptions taking place that make the research in energy transition difficult, but also very interesting:

The disruption of the current energy system seems to lead to a *'great electrification'* and the establishment of *the Internet of Energy*. Energy system disruption takes place both at the level of individual technologies – and at the systemic level. The roll-out of mass-produced renewable electricity generation technologies such as solar photovoltaic plants results in electricity taking the role of a source of primary energy. It replaces the current centralised power plants that were based on the combustion of fuels. Simultaneously, the future decentralised renewable energy system is enabled by *the Internet of Things*. Decentralised electricity production units, electronic devices, vehicles and energy storages will all be connected to the internet, where electricity will be traded in real time. This 'great electrification' brings about major improvements in energy efficiency.

Future energy security is cyber security. In the post-COP21 world the present role of oil, coal and gas markets will diminish, as energy independence is enabled by decentralised renewable energy. Therefore, a global transition to renewables disrupts the current inter-dependencies and power balance between nations and regions. The global economy is re-shaped, as the revenue flows from fossil fuels are disassembled, which will cause political unrest. In this respect, I assume we have difficult times ahead. In the Internet of Energy, energy security becomes primarily a cyber-security challenge. In the cyber world conflicts are not declared, they just begin.

Electricity market is the energy market of the future. Fossil fuels, particularly oil, cannot set the benchmark for energy prices in the post-COP21 world, when fossil fuels are phased out. Energy markets need to reinvent how the price of energy is formed. The future energy market is an electricity market where only production of renewable energy capacity has a cost. Therefore, the cost of the production capacity is finally dependent on the financial market, and what the cost of capital is. This makes a secure access to capital more critical than access to oil and gas resources. In this project, we will make proposals how such energy markets could work.

The future is shaped by the choices we make.

Pasi Vainikka
Co-ordinator of the Neo-Carbon Energy Project
Helsinki June 2016

EXECUTIVE SUMMARY

This working paper presents four transformative scenarios of Neo-Carbon Energy, a research project exploring 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 opposite 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 consist of three different components: a scenario narrative, the role of energy in the scenario and a pathway for Finland until the year 2050. The energy solutions and business practices can vary from scenario to scenario, and also the neo-carbon system itself can be realized in different ways.

Radical Startups. Economy is driven by networks of startup enterprises. Startups are usually communities-cum-companies, and there are no clear lines between work and leisure, and between different startups. Energy production is highly distributed, and many startups have specialised in energy – and especially in energy services.

Value-Driven Techemoths. Economy is dominated by a few technology giants or "techemoths", which offer resources, facilities, and platforms for self-organising employees, as well as all the basic amenities from housing to leisure to education. Techemoths have invested in bold R&D projects, especially in energy, and have a central role in developing the energy infrastructure.

Green DIY Engineers. Society is organized around thriving local communities to survive an ecological collapse. Do-It-Yourself economy and practical mindsets flourish, and smart

scarcity have ensured many communities a relative abundance. Energy is produced mostly locally and communities are largely self-sufficient.

New Consciousness. Robotisation and ubiquitous ICTs have developed the farthest. Society is organized as global collaboration through open sharing of resources and information. Humans share a collective tech-enabled consciousness through omnipresent communications, virtual reality, and rudimentary brain-to-brain communication. Energy systems are both distributed and centralized.

These four scenarios provide a holistic framework that describes the Neo-Carbon Energy world in 2050. As so-called metascenarios, this framework can be further utilised to make more detailed observations of alternative futures on the themes of renewable energy and peer-to-peer systems from different viewpoints, to address several, more specific questions. Therefore, scenarios are specific testbeds for future worlds. These Neo-Carbon Energy scenarios are tested through futures cliniques and other workshops, such as a gaming session that utilised the causal layered analysis (CLA) method.[1] The potential of futures based on neo-carbon energy is also intended to be explored in the context of the case countries of this project.[2]

The aim of scenario construction is to support decision-making. The relevance and usability of scenarios is dependent on how the pathways envisioned in them are translated to experts across fields, policy-makers, and ordinary citizens. It is also important to identify pioneering actors in the scenarios that can actually make them to be realised. For this purpose, a related actor analysis has been conducted (Similä et al. 2016). As socio-cultural scenarios about energy, their significance to economy and the energy landscape is further reflected in an analysis about future electricity markets (Salovaara et al. 2016). Transformative foresight characterizes the different future alternatives envisioned in these scenarios. As a tool of science-communication, they explore possible futures and related changes, that are radically different from the present, influenced by technology and the choices we make, as actors in our society.

Moving towards a neo-carbonized world provides room for businesses to innovate. Emerging needs, some of which are outlined in the scenarios, result from values and lifestyles that are changing, the falling costs of renewable energy, and the emergence of novel technologies. New products and services, not to forget social practices, can span from

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[1] A gaming session on the neo-carbon energy scenarios, inspired by Sohail Inayatullah's CLA methodology, was organised in the World Conference of Futures Research "Futures Studies Tackling Wicked Problems" in Turku, Finland in June 2015
[2] Case country reports are forthcoming on African countries (Kenya, Tanzania, South Africa), China, Argentina and Chile.

simple ideas to complex solutions. Space for new opportunities is created, and as a consequence, entirely new industrial structures could emerge to transform the economy.

CONTENTS

1. INTRODUCTION TO NEO-CARBON ENERGY SCENARIOS

Perhaps the widest known and most applied futures research method is scenarios. However, there is no single scenario method but instead a myriad of different scenario techniques. The scenarios may vastly differ by nature – there are for example mission scenarios, surprise scenarios, dystopic scenarios, business-as-usual (BAU) scenarios and backcasting scenarios. They all share a common characteristic, required to feature as a scenario. The scenarios are manuscripts of the future, they are vivid descriptions of what the future may look like and of logical pathways leading there. It is equally important to know what they are not. The scenarios are not predictions, nor utopias. The scenarios are made to support decision-ma

king. Scenario thinking essentially is about seeing the future as several alternatives – as diverse futures. Wright & Cairns (2011) demystify the expertise in scenario construction and view human beings as *natural* scenario thinkers. On scenario planning and construction, see Ralston & Wilson (2006); Schwarz (1998); Chermack (2011). In our complex world of discontinuities and disruptions, scenarios are used as part of strategic planning processes – both at corporate and government levels. Van der Hejden (2005) advocates scenarios as an art of strategic conversation. Indeed, scenarios are built through a futures dialogue among several stakeholders in an interactive process. The scenarios themselves are meant to instigate conversation about the relevant choices to be made.

This working paper presents four societal scenarios of the Neo-Carbon Energy research project. The project explores the futures of an economy based on a new renewable neo-carbon system and peer-to-peer society. Neo-Carbon Energy is one of the strategic research openings of Tekes – the Finnish Funding Agency for Innovation. It is conducted by Technical Research Centre of Finland VTT Ltd, Lappeenranta University of Technology (LUT) and Finland Futures Research Centre (FFRC) at the University of Turku. Work package 1 (WP1) of the project is titled "Neo-Carbon Enabling Neo-Growth Society – Transformative Energy Futures 2050". The contents of WP1 are crystallised as transformative scenario sketches and as input for other WPs (e.g. through the process of Futures Cliniques).

These scenarios are constructed and clustered on the basis of preceding horizon scanning, especially of weak signals, emerging issues and changes in lifestyles and industrial structure (Day & Schoemaker 2006). We label the scenarios as *metascenarios*. By this we mean that the scenarios provide a holistic framework describing the Neo-Carbon Energy world in 2050. This framework can be further utilised for more detailed observations of alternative futures

connected to the theme of renewable energy from different viewpoints, and to address various specific questions. The scenarios can be used as a platform, from which relevant parts are utilised to reflect i.e. local energy-related issues, a specific corporate strategic question, or decision-making processes. The scenarios will be assessed and elaborated before their finalised publication. Dator (2009) claims that all the scenarios can be classified into four categories: growth scenario, collapse scenario, discipline scenario, and transformative scenario. What is experimental and innovative in our Neo-Carbon Energy project is that we chose to make four scenarios that all belong to the category of transformation. This is because we want to test boldly different scenarios that manifest the on-going transformation in our society as well as in the energy sector. The transformation depicted in the four scenarios is interconnected with the transformative nature of the axes that we chose for the scenarios. Therefore, these scenarios represent transformative foresight.

Scenarios are also a tool of science-communication. According to Bell (1997), the purpose of scenarios is to advocate a specific futures image. These scenarios share a common normative assumption of the neo-carbon energy system, and open up different pathways towards such futures. Discussing alternatives is necessary because choices about energy influence the entire society, economy and our environment (Sheikh et al. 2016). What is more, citizens' values underpin choices that concern sustainability, as pointed out by Tibbs (2011). For such reasons, the significance of socio-cultural and participatory approaches to energy-related scenario-making about has recently been emphasized, see Sarrica et al. (2016); Upham (2016); Miller et al. (2015). Energy debates include even ethical considerations in many respects, and are too valuable to be left for experts alone.

The scenarios study possible futures in which renewable energy is produced in a distributed manner – citizens producing energy and feeding the surplus into the grid, infrastructure laden with solar panels & wind turbines, devices capturing energy from the environment et cetera – and in which energy is low-cost or even no-cost. The premise of the scenarios is that **distributed, low-cost energy provides a central infrastructural element for a peer-to-peer society**. In such a future, power stems from the grassroots and old hierarchies are replaced by increasingly egalitarian social structures. In each scenario energy is produced mainly by wind and solar and stored in synthetic methane, other synthetic hydrocarbons, and batteries. However, the **energy solutions and business practices can vary from scenario to scenario**, **and the neo-carbon (wind, solar, methane, power-to-X) system can be realized in different ways**.

The scenarios have been formed using two axes and their opposite values (see table 1). 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**. Out of these two axis and their opposite values four initial scenarios have been formed. The scenarios are summarized in the fourfold table below (table 1).

Next the logic of the scenarios are introduced. This is followed by a presentation of each of the **four transformative scenarios** that are called **"Radical Startups", "Value-Driven Techemoths", "Green DIY Engineers" and "New Consciousness"**. The scenarios consist of three different components: **a scenario narrative**, **the role of energy in the scenario** and **a pathway for Finland until the year 2050**.

This working paper presents the scenarios as constructed within the first phase of the project. WP1 of the project was in charge of making these scenarios, and they have been constructed in close co-operation with the research teams from VTT and LUT. Further working papers on the scenarios, provided by VTT (Similä et al. 2016) and LUT (Salovaara et al. 2016) dig deeper in actor analysis and electricity markets framework, accordingly. The energy elements and implications have been integrated into the report by LUT researchers Samuli Honkapuro and Kaisa Salovaara and VTT Researchers Tiina Koljonen and Lassi Similä. Amos Taylor, Marjukka Parkkinen and Nicolas Balcom Raleigh have also contributed to this document. Global pathways for each transformative scenario are attached as an Appendix to the document. The scenarios have also been elaborated in three futures workshops. The main workshop was held on the 6th of May 2015 at Sitra, and it was called Neo-Carbon Futures Clinique I: Towards the Third Industrial Revolution (Heinonen et al. 2015). Ideas from the workshops are included in the scenario texts, as text that has been bolded. The scenarios are a result of on-going research work, which is constantly upgraded and elaborated through different methods such as futures workshops, expert interviews and meetings as well as literature review. In the following pages, the **four scenarios** of Neo-Carbon world in 2050 are presented. The aim of these four scenarios is **transformativeness**. Each of the scenarios provides insights of how a future, neo-carbonized world might be realized **in ways that differ radically from the present**.

Table 1. Four transformative scenarios 2050 for Neo-Carbon Energy.

Deep ecology ↑	**RADICAL STARTUPS** Society is business-oriented, but economy is driven by a multitude of small-scale startups known for their "radical" values and approaches. Environmental problems are solved commercially. Businesses are drivers of new, ecologically oriented lifestyles. Peer-to-peer approaches take place within startups and their networks.	**NEW CONSCIOUSNESS** Threat of an ecological collapse and ubiquitous information&communication technologies have led to a new kind of consciousness. Human beings are deeply intertwined with nature and with each other. Environmental problems are not seen as practical issues but called for deeper changes in values and mindsets.
Ecological awareness	**VALUE-DRIVEN TECHEMOTHS** Peer-to-peer approaches are practiced within global technology giants called "techemoths". Techemoths provide solutions for environmental issues and are developers of cutting-edge energy technologies. Markets take care of environmental issues.	**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 locally, with a practical mindset.
Pragmatic ecology ↓		

Corporate ("Centralized" peer-to-peer) ← *Peer-to-peer* → Neo-Communal (Distributed peer-to-peer)

Axes of the scenarios – setting the stage

Peer-to-peer refers to models of organisation where equal individuals arrange their joint efforts in cooperation without involment of hierarchical structures such as governmental organisations or companies. In other words it is an bottom-up, grassroots approach as compared to up-bottom, bureaucratic approach.

In practice peer-to-peer can mean for instance social media networks, open source programming communities, grassroots political movements and citizen activism, consumer movements and co-working spaces. A central concept related to peer-to-peer is *prosumerism* (producer + consumer), which refers to consumers/citizens turned to active (free-time) producers.

Internet is basically a peer-to-peer infrastructure: It is a network of networks and doesn't have a governing centre. Different actors are at least in principle equal power-wise, and for instance in social media individuals often have more power than large companies. Internet consists of individuals linked to each other; its social mode can be called *networked individualism*.

It is often assumed that the more dominant and pervasive internet becomes in society, the more prevalent and common peer-to-peer approaches grow – this is called the *network society*. In a network society basically everything is in one way or another organised around peer-to-peer networks.

Traditionally the energy sector has been a very centralised business. Non-renewable energy sources are not evenly distributed and their harnessing and utilization has required notable resources. However, renewable energies, especially solar and wind, are relatively evenly distributed and their harnessing and utilization is also relatively cheap – and the costs are decreasing fast.

The combination of solar, wind and smart electricity grids allow an distributed energy system, where energy is produced peer-to-peer, and where traditional energy companies lose their stance. Because energy is such a fundamental sector in society, peer-to-peer energy production would a central part for the foundation of a peer-to-peer (network) society – it could steer societal values heavily towards grassroots approaches in general.

In the 2050 societal scenarios of the Neo-Carbon Energy project, peer-to-peer is assumed two opposite variants (=extreme ends of scenario axis)

- Corporate peer-to-peer ("centralised"): people self-organise freely, but **within large organisations**. Organisations are **enabling platforms** for individuals' peer-to-peer formations, **providing resources and facilities**. Hierarchic structures have been replaced with egalitarian ones.

- Neo-communal peer-to-peer (distributed): People organise their joint efforts independently. They form grassroots communities, **based on shared values and interests**. Often these communities develop into businesses. Peer-to-peer formations are more numerous and widely distributed than in the corporate peer-to-peer model.

Ecological awareness axis refers to a situation where ecological values and lifestyles have become the norm in society. Ecological values mean values that acknowledge the primality of the wellbeing of ecosystems.

In the 2050 societal scenarios of the Neo-Carbon Energy project, this axis is assumed two opposite variants

- Deep ecology: 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.[3]

- Pragmatic ecology: Acknowledges the great importance 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 – nature is seen as valuable because of the benefits it offers to humans**.

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[3] The concept of deep ecology was coined by the Norwegian philosopher Arne Næss in 1973. In its original form it advocated a "back to nature" lifestyle and was suspicious about technological development and the effects of human civilization on natural ecosystems. In the Neo-Carbon scenarios, however, deep ecology does not refer to such luddite viewpoints, but combines hi-tech living with holistic conceptions of nature and humans' place in it.

2. NEO-CARBON ENERGY SCENARIOS 2050

2.1 Radical Startups

(Corporate peer-to-peer & Deep ecology)

In the Radical Startups scenario <u>society is business-oriented</u>, but economy is driven by a multitude of small-scale startups known for their radical values and approaches. Peer-to-peer is realised in startup networks. Their selling point is promising to do societal and environmental good, and offering workers opportunities for self-expression. Environmental problems are solved first and foremost commercially. Businesses are drivers of new, <u>deep-ecologically oriented lifestyles</u>.

Key trends in the present:

- In a networked economy small and medium enterprises are increasingly responsible for creating value and growth. Innovations 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.
- *In an ecological transition where everything is to be transformed as ecologically smart, diverse ecosystems of startups are needed to make the change possible.*

Key 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 (http://timreview.ca/article/807)*
- *Open source is spreading outside software businesses – meaning e.g. open patents (http://factor-tech.com/feature/open-source-surge-companies-may-ditch-patents-favour-open-tech-research/)*
- *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 (http://www.fastcompany.com/3049532/the-future-of-work/heres-why-the-freelancer-economy-is-on-the-rise)*
- *Many startups are emphasizing other than mere economic values, driven by ethics (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)*

The startup revolution

In the 2010's, innovation and economic growth began to increasingly stem from startup enterprises. Startups offer new products and services, often for niche markets. They aim for exponential growth instead of linear. Their value is not based not so much on their productivity than on expectations for future profits. They thus aim to "disrupt" society and its practices, as disruption opens up new possibilities for revenue. Most of startups fail to redeem the expectations, but the successful ones bring enough profits to investors so that investing in startups makes economic sense.

In 2000–2010, during the first phase of the startup boom, those startups which succeeded were either bought by big, established companies or became established companies themselves. However, as the startup ecosystem became more powerful, startups were able to stand on their own. An essential factor in this ecosystem is open cooperation between startups, along the lines of open-source principles.

After the startup revolution, the whole society became organized as horizontal peer-to-peer networks of startups. Due to their openness, startups became community-like. 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, 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[4]. Working in startups is often leisure-like, as workers are encouraged to bring their hobbies and free-time interests to work. In this way they are 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 it merged work with hobbies, the new corporate culture began to evaporate the division between companies and the rest of society. Consumers demanded moral, aesthetic and

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[4] 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.

value-related integrity from companies, just as they expected these virtues from each other. *Authenticity* became the leading 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.

As a result of their blending with the rest of society, startups don't define themselves solely in economic terms. On the contrary, their identity is based on *stepping outside the sphere of economy*. In many ways, startups resemble protest and citizen movements even more than traditional companies. "**Doing good rather than doing well**" is the slogan for many startup entrepreneurs. In this sense, startups can be seen as communities which create business out of their way of life. Creating expectations and telling compelling stories is especially crucial for **manufacturing companies**, which lure investments by not only promising efficient solutions to practical problems but also by placing themselves and their products in broader cultural context.

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.

Startup culture, the hacker ethos and open source as a business model

Startups being a major driving force, society has become unstable and constantly changing. Radicality of the startups as well as that of the whole society stems from this very uncertainty. Radical means something that affects the roots and basic assumptions of action. Startups have created a society that is in a constant state of flux, i.e. with few stable, sustaining structures. Their business is in large part based on creating *expectations* of a wholly new kind of future (and related business opportunities), and in this way they keep society in constant change.

Change and disruption are being promoted by the hacker ethos of the 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. Previously, the divide in power was between well-organised, active insiders versus passive outsiders with too little knowledge to really have

power. Hackers open up what is hidden, and thus disperse power. This ability to set established structures, practices and cognitive processes in motion is an essential driver of innovations and productivity.

A pivotal part of the startup ecosystem are principles and practices of open source. Open source began to realize its potential in 2010's, when companies such as Tesla[5], LinkedIn, Facebook[6] and Microsoft[7] adopted it as a part of their business and development models. Little by little, open source spread from the software world to all productive sectors. One of the forerunners in generalized open source was Assembly[8], 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 half of workers are employed by companies and other organisations, the other half are freelancers and contractors[9]. This means that fewer and fewer have the luxury of services and 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.

Entrepreneurship being the dominant form of economic activity, labour unions have lost their societal significance. Most of the working population are either entrepreneurs, "quasi-entrepreneurs" (**workers own shares of the startups they are working in**) or as freelancers define themselves through features often attached to entrepreneurs (such as autonomy, self-expression).

New ways of coping with the constant uncertainty and mitigating its effects have been developed to replace schemes advocated by labour unions times ago[10]. The ecosystem of

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

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

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

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

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

[10] 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

microbusinesses is kept vitalized by **micro loans** and crowdfunding. 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**. Basic income for all is guaranteed by the state. 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.

There are also other means beside distributed collaboration to cope with the uncertainty. Some startups manage the challenges of uncertainty and constant change through **projects of long time-scales**. As startups are based on expectations of future profits, 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[11]. Investors have a central role in ensuring longer time-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 don't fall with failing companies.

Investment companies in general are crucial in creating stability in the fluxing environment. They have become platforms of sorts, creating 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, et cetera[12]. **Traditional energy companies of the early 2000's have often adopted the role of investors**.

Digital-native media companies as forerunners of mainstream deep ecology

The first pioneers of the new corporate culture arose from the ashes of the media crisis of the early 2000's and 2010's. As media consumers had grown accustomed to the equally individualistic and collectivist ethos of the internet, media companies had to rethink their journalistic practices which earlier had sported an objective and neutral tone. Many new media startups allowed much greater independence to their reporters than before[13]. One of the first major successes from this field was *Vice Media*. Founded in 1994, Vice became

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[11] http://www.businessinsider.com/everything-you-need-to-know-about-jeff-bezos-amazing-10000-year-clock-2013-8?IR=T
[12] http://www.nytimes.com/2015/04/02/business/dealbook/angel-investors-lend-expertise-as-well-as-cash.html
[13] http://www.salon.com/about/

known for its provocative, politically incorrect and fiercely independent content. In its initial years the magazine wrote mainly about lifestyle and pop culture, but later began to cover more serious topics as well, especially various conflicts and wars. In the third quarter of 2014 Vice Media's market valuation was 2,5 billion dollars[14], leaving The New York Times with market valuation of 950 million dollars[15] far behind.

As the 2010's proceeded, the looming climate crisis became increasingly topical, and consequently many media startups began to specialize in environmental[16] and energy-related reporting[17]. The uncompromising environmental responsibility of media startups spread to other startup companies as well, and new companies became, perhaps a bit surprisingly, vanguards of deep ecological thinking. 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 others within ecosystems. Media startups propagated their ecological views, which due to their rigorous moral standing and popularity among the young generations gained prominent credibility. This was a major factor why little by little the philosophy of deep ecology became the dominant worldview in society.

Deep ecology as a driver of societal change

Startups are intertwined with the civil society, so practices and cultures developed in them scale up efficiently. In line with the open-source movement, startups aren't withholding and guarding their social innovations, but try to spread them as wide as possible.

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. Rapidly growing urban areas in the emerging

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[14] http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/digital-media/11074572/Vice-Media-valued-at-more-than-2.5bn-after-500m-cash-injection.html

[15] http://thenextweb.com/insider/2012/04/09/at-a-market-cap-of-950-million-the-new-york-times-is-worth-less-than-instagram/

[16] http://qz.com/on/energy-shocks/

[17] http://motherboard.vice.com/en_us/tag/earth?trk_source=nav

markets where city congestion was a massive problem has halted thanks to entrepreneurial endeavours previously deemed commercially unviable[18].

Figure 2. Ski slope at Amager Bakke, a waste-to-power incinerator.

For the new entrepreneurial generation, carbon neutrality emerged as a business standard. Design-oriented startups mainstreamed a new ecologically-savvy visual culture[19]. For instance, energy plants are designed as architecturally distinguished sites. One of the forerunners of the new visual culture in energy sector was Amager Bakke, waste-to-power incinerator plant in Copenhagen[20]. 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 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

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[18] http://www.scidev.net/global/engineering/news/uganda-hybrid-cars-low-polluting-kiira.html
[19] In early 2010s, visual interaction and information about ecology was still supplied by non-state actors such as WWF, see e.g.
http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/living_planet_report_graphics/lpi_interactive/
[20] http://www.theguardian.com/artanddesign/2014/nov/13/danish-architect-bjarke-ingels-battersea-power-station

success depends on how well they succeed in attracting innovative companies. Cities are distinct units and relatively independent from national regulations. Most cities specialize in particular issues so that some cities 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. 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[21]. 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.

Energy in Radical Startups

In Radical Startups scenario the industrial structure changes radically from the existing, acting as a driver for development of the energy sector. In line with the move towards innovative local and regional production, the production volumes of bulk products decrease due to increased challenges in the global markets. Instead, new value added products and related services increase the productivity of industries.

Technology development shows dispersed nature – it is not driven by one-fits-for all but tailored solutions according to local circumstances.

Energy technology development is driven by startup-originated innovative high tech small-scale solutions. Penetration of local energy solutions are driven by startup companies' rationalization with characteristics of local energy resources. Energy systems move towards distributed and prosumer type of behavior, where consumers self-produce a major part of their energy.

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

Electricity transmission between areas is interconnected but with limitations. This supports development of smart distribution infrastructure and demand response. Integration of solar and wind with smart utilization of heating/cooling and transportation sectors increase their economically feasible potential. Thanks to these developments, solar and wind power production reaches high levels. As urbanization advances, utility-scale PV solutions appear particularly interesting in many urban areas

Power-to-gas and other energy storage technology breakthrough is led by small and medium scale solutions. Biomass use is consumer-driven and can be characterized as "small and medium scale circular economy". That is, as solar and wind reach high levels, biomass is increasingly available for customer products compared to highly industrial-oriented usage in developed countries today.

Steps forward in 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.

In a world of regional production, digitalization and ubiquitous ICT, the demands for transport of goods and people reduce compared to the current trend. 3D printers enter in households, industries, and other sectors. Smart city concepts enable modular shift of mobility towards public transport, walking and cycling.

Private houses become 0-energy and in the longer term plus energy buildings. The energy efficiency for heating increases while buildings become higher and the urban density increases making low temperature district heating cost efficient. Solar and other renewables are the major primary sources of energy.

Pathway to Radical Startups Finland 2050

2050 The new business environment has matured, and the state has stepped out of the way to leave businesses operate on their own. Finland has become more or less a libertarian state, as have most other countries.

2045 Inequality and work-related stress have increased. People find it hard to wind up or do things for their own purpose, without calculating the profit for business and work. Public schools have almost disappeared, private schools and self-learning communities provide education. Rural areas have become desolate. Most Finns live in large cities.

2040 The emphasis on pragmatism and engineer-like rationalism has stepped aside to give room for more value-oriented approaches. Following the example of startups, values of deep ecology have penetrated throughout the Finnish culture.

2035 Finland's traditionally very narrow production structure is diversified significantly. Services, ICT, cleantech and the cultural sector become the new economic leaders.

2030 A new culture of experiments emerges. Finland opens to the rest of the world, especially due to translation technologies which have made language barriers obsolete.

2025 The goal is set that Finland would become carbon-neutral by 2050. Road tolls are introduced. Business funding is modified to enable startups taking more risks. Social security is renewed to support startup entrepreneurs after failure.

2021 The government defines ecosystems of startups, especially cleantech and environmental businesses, as the new backbone of the Finnish economy.

2020 Open source becomes increasingly prominent as a business model. Finnish startups become forerunners of open source practices.

2019 Liberal parties win the elections of 2019. The Green Party and the National Coalition Party form the backbone of the new government.

2015 Austerity policies of the new government and Western sanctions on Russia deepen the recession in Finland.

RADICAL STARTUPS FINLAND 2015–2050

2015–2020

The centre-right government of the Centre Party, National Coalition Party and the Finns Party deepens the recession by its austerity policies, conservative initiatives, and regional policies emphasizing rural areas over the metropolitan area. The Western sanctions on Russia add to the economic slump. However, new investments on cleantech and the environmental sector, and also creation of new service business targeted to both private citizens and companies, bring about some growth[22].

Despite some green investments, the government's policies turn out as catastrophic. The structural problems of the Finnish economy are not solved, and economy continues to grow at a low annual rate of 1%. Policy measures other than more cuts and state support for traditional industries are out of the government's ideology and toolbox.

Towards the end of the government's term, progressive, liberal forces become unprecedentedly popular. In the Parliament elections of 2019 the Green Party almost doubles its seats and gets 15% of the votes. The National Coalition Party regains its position as the leading party by 22% of the votes. However, the NCP has gone through an internal renewal as social-liberal fraction has become dominant in the party. The change reflects a sea change in international economic institutions: The World Bank[23] and OECD[24] have become advocates of narrowing income differences, and IMF[25] is warning about the economic drawbacks of austerity policies.

Another economic revolution is well on its way. In the mid 2010's, open source becomes increasingly common as a business practice. In 2015, for instance the media startup Buzzfeed, together with General Electronics, established an open R&D laboratory, which

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[22] http://yle.fi/uutiset/sipila_hallitusneuvotteluissa_sovittu_16_miljardin_investointiohjelmasta/8014193
[23]
http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTPROGRAMS/EXTPOVRES/0,,contentMDK:23022308~menuPK:8322745~pagePK:64168182~piPK:64168060~theSitePK:477894,00.html
[24] http://www.oecd-ilibrary.org/social-issues-migration-health/trends-in-income-inequality-and-its-impact-on-economic-growth_5jxrjncwxv6j-en
[25] http://www.washingtonpost.com/blogs/wonkblog/wp/2012/10/12/imf-austerity-is-much-worse-for-the-economy-than-we-thought/

developed new technologies and media tools[26]. All the innovations and products developed at the lab would be open to be used and further developed.

Encouraged by the international examples, especially by the decision of Tesla Motors to open its patents, Finnish startups begin to build their products and practices increasingly on principles of open source. This helps significantly in creating a collaborative and open startup ecosystem.

Energy landscape

- **Development towards market-oriented energy sector development** takes a leap – restructuring of support schemes, development in energy market deregulation e.g. in the EU

- Despite international climate agreement, level of ambition in international politics remains modest. **There is still a clear lack of urgency**. As a result, the EU selects less ambitious climate policies for 2020-2030 than expected.

2020–2030

The new government defines ecosystems of startups, **especially cleantech and environmental businesses**, as the new backbone of the Finnish economy and starts aiding their growth in different ways. Abandoning austerity, **the government helps the nascent sector by establishing Renewable Energy Development Zones (REDZ) throughout the country, and stimulates cleantech markets for them**.

The goal is set that **Finland would become carbon-neutral by 2050**. **Road tolls are introduced**. **Business funding is modified to enable startups taking more risks. Social security is renewed to back up startup entrepreneurs after failure**. Different **support services and infrastructure are provided. Bureaucracy related to starting and conducting business is made more lean and efficient. Administrative protocols and processes have thus become user-friendly. Academic research is steered towards business development**; however, this narrows the freedom and societal functions of the academy and hinders critical public discussion. **Education is made more agile and dynamic and more responsive to business**

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needs. **External costs are included in consumer prices, which offers startups competitive advantages in relation to traditional, less green businesses**. For instance, **it is very expensive to produce non-renewable waste, which creates incentives for circular economy**.

The new policies are in line with an overall change in culture and values. Finland becomes significantly more business-friendly than it was before. **Citizens are bolder and less risk-averse than before. Failure is not considered as shameful and a stigma anymore**. In an environment of thriving startups and SMEs, **society becomes increasingly cooperative. Fluid collaboration between education, government and businesses allows a constant 'bubbling' of entrepreneurial innovation, much of which is based around new uses of energy. Inter- and cross-disciplinary innovation by startups manifests a new spirit of collaboration beyond borders. Services are provided by an ecosystem of multitude of actors: municipalities, small- and medium-sized enterprises (SMEs), the third sector and voluntary work**.

New culture of trust is reached, and instead of being cautious and conservative, **a culture of experiments emerges**. Finland opens to the rest of the world, especially thanks to **translation technologies which are making language barriers obsolete. The most talented people will choose to join and seek their passion in small startups. The share of traditional wage work continues to decrease – entrepreneurship has become the norm.** To better represent dominant values, **organisations are characterised by flat organisational models. Startups form village-types of communities**. As for citizens, **with the introduction of basic income nationally**, autonomy is increased and they can steer their efforts to meaningful projects.

Energy landscape

- Technological and/or economic and/or political circumstances supporting the envisaged development, e.g.

- Breakthrough of new technologies (batteries, power-to-gas, solar PV, wind, etc.)

- **Large scale industrial/energy sector does not attract investors** (e.g. due to risk profiles)

- Weakening conditions for conventional alternatives (competiveness of fossil due to stricter emission limits and CO_2 trade, political decisions regarding certain technologies (e.g. nuclear)…)

2030–2050

By 2030 Finland has reached a point where its traditionally very narrow production structure has diversified significantly making the Finnish economy more versatile and agile – and not as vulnerable to economic upheavals as before. Services, ICT, cleantech and the cultural sector are the new economic leaders. Services that offer solutions to mitigate the effects of the climate change are a particularly prominent sector.

As startups are more connected to the rest of society than traditional Finnish companies, the emphasis on pragmatism and engineer-like rationalism has dissolved to give room for more value-oriented approaches. As startups brand themselves as movements and causes, values of deep ecology have penetrated the Finnish culture.

The state had a central role as an initiator of the transformation. However, as the new business environment matured, the state gradually stepped out of the way to leave businesses operate on their own. Finland has become more or less a libertarian state, as have most other countries. Public schools have almost disappeared, and education is provided by private schools and self-learning communities. Rural areas have become desolate and almost all Finns are living in large cities.

This has led to growing inequality. Work-related stress has increased as well. The separation of work and leisure has disappeared altogether, and people find it increasingly hard to wind up or do things for their own purpose – without calculating their benefits for business and work.

Energy landscape

- Novel technologies and startup companies **take a larger and larger share of the markets** and show more and more visible effects

- Tailored, flexible, local production increases. This results in more diverse palettes of energy production.

- Volatility in electricity and other commodity prices increases

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Energy implications in Radical Startups
from the workshop "Futures Clinique I: Towards the Third Industrial Revolution (6.5.2015)"

- Energy would be mobile, and it would be harnessed by a mobile infrastructure: in addition to fuel cells, there are wearable clothing harnessing solar energy and pocket-sized batteries.
- Village-size storage and production of synthetic gas would be realized in tanks owned by the locals.
- Mobile electricity for summer houses is provided with synthetic natural gas (SNG) and fuel cells. In the transport sector, energy innovations have reduced the fuel import bill of Finland, which in 2015 still stood at EUR 8 billion.
- In order to renovate energy through a culture of startups an agile and dynamic education system will be a crucial enabler. Behind this supportive education is a lean bureaucracy, a system where legislation is modified so that it enables startups to grow creating and facilitating a market platform limiting the barriers.

2.2 Value-Driven Techemoths

(Corporate peer-to-peer & Pragmatic ecology)

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

In the Value-Driven Techemoths scenario, <u>peer-to-peer approaches</u> are common, but they <u>are practiced within large technology corporations</u>. These "techemoths" represent the Silicon Valley vision of emancipation, freedom, creativity and open source. The vision is, however, somewhat self-contradictory. Techemoths cherish the "libertarian" hacker ethos, but at the same time confine their employees tightly within corporate walls. In this scenario, <u>markets take care of environmental issues</u>. Techemoths invest in ambitious energy, technology and environmental projects.

Key trends in the present:

- **Many technology giants are developing 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 (**http://www.techrepublic.com/article/the-m-a-strategies-of-the-top-10-tech-companies/**).**
- **However, the workplace cultures of big companies are changing as less hierarchical, as manifested in Google's 20 % principle, which means that employees can spend 20 % of their working hours on their own projects.**

Key weak signals in the present:

- **Elon Musk started his own school for the kids of SpaceX employees (**http://venturebeat.com/2015/05/23/elon-musk-didnt-like-his-kids-school-so-he-made-his-own-small-secretive-school-without-grade-levels/**)**
- **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 (**http://www.samsungvillage.com/blog/2014/11/13/sneak-peak-samsung-digital-city/**)**
- **The aim of Google's new headquarters is to create a self-sufficient workplace community (**http://www.newyorker.com/business/currency/googles-monastic-vision-for-the-future-of-work**)**
- **Tech giants are investing in bold science projects, including renewable energies (**http://www.fastcompany.com/3028156/united-states-of-innovation/the-google-x-factor,**)**
- **Inequalities are widening, indicating a society where those employed by big companies are well-off, and the rest have to cope by themselves (**http://www.nybooks.com/articles/archives/2014/may/08/thomas-piketty-new-gilded-age/**)**
- **In this kind of future, the most original innovations could stem from the fringes of society (**http://www.tested.com/art/makers/458552-anticonventional-objects-vs-successful-products/**)**

The Rise of Techemoths

The construction of Burj Khalifa, a skyscraper in Dubai and at the time of its construction the world's tallest building, was finished in 2009. The main contractor for the project was Samsung Engineering and Construction Company. From 2018 onwards, Samsung went on to build, maintain and administer whole "smart cities" of its own. The first "Samsung Cities" were pioneered in Kenya and China. Around the same time, technology company Apple began to have revenues exceeding significantly the GDPs of many nations. These weak signals quickly exploded into megatrends. In the 2020s, internet and consumer electronic "techemoths" such as Google, Facebook, Apple and Samsung became dominant actors in society. They cast the model for not only companies to come, but for the whole society. As their economic dominance grew[27], little by little they steered society's values and culture to their liking.

Technology companies also began to take care of many of the responsibilities previously looked after by the public sector and other companies. Proper health care, for instance, is provided mainly by these companies. They are also significant scientific actors thanks to their extensive, bold and experimental science projects[28].

Techemoths of the Neo-Carbon era

Meanwhile, the first signs of a shift in investment patterns globally were observed in mid-2010s[29]. In 2015, President Obama enabled North American companies to sign a USD 2 billion solar power deal in his historical visit to Nairobi[30]. Companies like Duke Energy[31] 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**[32]. In the coming years, economic actors increasingly began to seek returns from low-carbon-type of solutions.

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[27] http://www.newscientist.com/article/mg21228354.500-revealed--the-capitalist-network-that-runs-the-world.html#.VG9xUmPTQWp
[28] http://www.fastcompany.com/3028156/united-states-of-innovation/the-google-x-factor
[29] http://globalinvestorcoalition.org/form-registry/
[30] http://www.businessdailyafrica.com/Kenya--SkyPower-sign-Sh220bn-solar-power-deal/-/539546/2809726/-/11xifp8/-/index.html
[31] http://blogs.scientificamerican.com/plugged-in/2014/06/23/welcome-to-texas-americas-energy-storage-laboratory/
[32] http://www.theguardian.com/environment/2014/dec/02/eons-switch-renewables-sign-of-things-to-come-say-experts

Due to the still unsolved climate and energy crisis, techemoths are especially 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, e.g. water availability and zero-waste processes. **Storage products, electric vehicles (EVs) and geothermal systems** are provided by the techemoths. These large companies 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 information. Smart energy technologies harvest massive amounts of behaviour data, which is then sold to third parties[33]. **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**.

Peer-to-peer Goes Big

Technology-enabled peer-to-peer organisation models take usually place within big companies. This is because large corporations have the resources often lacking from smaller companies and peer-to-peer ventures of individuals. Companies act as hubs for individuals' shared projects. They provide resources and facilities, and give their employees full freedom to pursue their interests. Google's "20% time policy", which in early 2000s allowed the workers at Google to devote one fifth of their working hours to something that interests them personally[34] was a pioneer for this kind of company practice.

As they have become attractive for networked individuals, these corporations have grown even larger than before. The company headquarters, built in 2010s and expanding constantly, were designed as city-like[35]. They are the new city-states with their own legislation, democratic decision-making and governing procedures, accommodation facilities, amenities, recreational and leisure opportunities etc. Citizens associate strongly to corporate cultures, just as they associated to national cultures before.

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[33] https://nest.com/
[34] http://www.nytimes.com/2007/10/21/jobs/21pre.html?_r=1&
[35] http://www.spur.org/publications/article/2012-01-07/not-so-corporate-campus

Due to this cultural bond, people have started to form allegiances to tech companies in the same way they did to nation states during the industrial period. 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, for instance, track their employees every move[36], and privacy is seen as a notion of the past. This is rarely big a deal for employees or "members" of the companies though, so committed they are to their companies.

From Nation States to Global Corporations

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 they often seek stability and predictable future prospects. Techemoths offer both. Techemoths corporate cultures' have been a major solution for the demise of national cultures and the nearly lost human-nature bond. People still seek for "grand narratives" and large collectives to provide meaning to their lives, and techemoths as relatively closed communities answer to this need. By visualizing the health of the environment to all citizens[37], companies strengthen the affection of their employees.

Global perspective applies to politics as well. In a business-oriented world, techemoths have become de-facto global "government(s)". Nation states turned out as a project tied entirely to the first two industrial periods. **The United Nations (UN) has failed** and become a minor player, especially as a credible global agreement to cut CO2 emissions wasn't achieved in the 2010s. As a result of the political-cultural power vacuum, the world has been "**re-regionalised**" as geographically scattered units of techemoths. The **2010s forerunners (Google etc.) have created rules along the way**. National industrial and technology policies have been especially favourable to emerging technologies. **Companies' product development also drives global regulation**. Solar, wind and neo-carbon receive zero-tariffs in a world trade system – the WTO regime – which is favourable for these companies.

36
http://www.salon.com/2014/02/23/worse_than_wal_mart_amazons_sick_brutality_and_secret_history_of_ruthlessly_intimidating_workers/
37 http://www.scidev.net/global/policy/news/african-policymakers-lack-environmental-data--1.html

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 has increased significantly.

States have not vanished entirely, though. As "neutral actors" they still have some important functions. They for instance mitigate the power of the largest corporations by providing **capital and sureties to newcomers, a model akin to affordable student loans**. States thus have an important role in keeping the economy – and the whole society – vibrant and vital and trying to inhibit excessively dominant monopolies.

Civil Society and Outsiders Fight Back

Besides states, there still exists a free civil society which also balances the dominance of techemoths. **Crowdfunding** is an important tool especially for the civil society. **Techemoths sometimes even fund** these "outsider" projects due to their curious, experimental and "artistic" nature. Funding from techemoths is often shun upon though, as it tends to make the development communities dependent on the corporate money and ends up serving their interests. In any case, the few innovator hubs outside techemoths are an important counter-force and an interesting weak signal whose influence remains to be seen.

The "free movements" of civil society are specialised in designing DIY "anti-conventional objects"[38], which are buildable (with DIY tools) and desirable, but not necessarily profitable – in other words, they are experimental objects. Conventional or successful objects, on the contrary, are buildable, desirable and also profitable – they are often not very experimental. There are also anti-conventional objects which are buildable and profitable, but not necessarily desirable. These are often illegal, such as DIY surveillance or hacking devices, and they are often used as tools for cyber activism aimed at harming global corporations.

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

Widening Inequalities

Because their profits are dependent on disruptive technologies, the rich have become a technologically and culturally progressive force in society. However, they are often dependent on the civil society's "innovator fringes" outside their immediate reach. Thus their main role in fostering progress lays in funding. Tech billionaires[39] buy social and cultural status by investing in risky but bold and ground-breaking projects. The cultural sector, especially arts and media, are popular investment objects amongst the elites. Through investments in culture the super-rich can buy their stance in history as modern day Medicis.

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[40]. This has led to the **rebirth of the industrialisation era patrons, who provided welfare for their employees. It is a world of inequality and stark differences between the rich and the poor.**

Citizens perceive energy issues as "automated"

Demand for energy is relatively high, but ubiquitous smart technologies mitigate consumption. **Corporation-scale neo-carbon system neutralizes emissions.** Inequalities cause waste of energy, e.g. as energy education is provided mainly by tech companies. Inefficient **urban form also causes waste of energy** as infrastructure is often in a relatively poor condition outside tech campuses. **"Smart technologies" are unevenly distributed.** 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 rather limited technical understanding about them.

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[39] http://www.tni.org/sites/www.tni.org/files/download/state_of_power_hyperlinked_0.pdf
[40] http://www.nybooks.com/articles/archives/2014/may/08/thomas-piketty-new-gilded-age/

Energy in Value-Driven Techemoths

"Techemoths", large technology companies operating in many business areas, are dominant actors in society. They cast the model for not only companies to come, but for the whole society. Large companies exploit economies of scale in production, leading to material intensive production.

Development in societies is largely market-driven: there is a global CO2 agreement, and price of CO2 is high. Furthermore, CO2 price is included in the price of end-user products and services. Innovations and technology development are highly industry-driven. The development can be characterized being of high technological level, business-driven "big" solutions.

Energy services are included in corporations other products and services (e.g. electric vehicle is sold/leased with electricity included). Energy platforms are company specific, so buying product and energy in bundle is typically only option. Hence, traditional energy companies, such as electricity retailers, do not exist anymore in larger scale.

Electricity generation is mainly based on solar and wind, and hence energy storage and intelligent control of the demand are in essential role in energy system. Because of that, companies are eager to sell/lease products and their energy as a bundle, so that they have possibilities to control energy usage and energy storages of these devices (e.g. electric vehicle with corporate controlled smart charging and discharging). Eventually, energy issues are more and more invisible for end users. PVs are everywhere in cities as standard rooftop and wall material. However, they are mostly owned by big companies.

Energy storage system is centralized. There are centralized power-to-gas (P2G) systems in cities. In addition, batteries of electric vehicles are used as distributed, but centralized controlled energy storages.

Transmission system operators' (TSOs) role is weaker than today, as Techemoths have started to construct their own transmission lines for their own use. However, transmission networks connecting different regions are strong.

Price of energy is significantly higher in rural than urban areas, while quality of supply in public infra is quite low. Spot pricing in electricity distribution (uniform price, which is not depending on geographical location of customer, similar as postal stamp tariff system) does not exist anymore.

Some people are outside of the Techemoths' energy services (some of them due to their own decision not to give away their personal information to corporations). As electricity

price for them is high and quality low, these people have incentives to develop their own DIY solutions for energy generation.

In a world of large enterprises and material intensive production, there is an increasing demand for transport of goods between areas.

Buildings are highly energy efficient in urbanized areas that are dense but relatively uncompact.

Pathway to Value-Driven Techemoths

Finland 2050

2050 Inequalities have widened between those employed by techemoths and those working and living outside them. The well-off are more informed on energy and environmental issues, and are able to make smarter – and "cooler" – choices on energy and the environment.

2045 Techemoths' large resources have enabled the transition to a sustainable society and renewable energy system, but the problem is that energy solutions are tied to companies providing them.

2040 Conflicts between techemoths and society begin to emerge. Companies, especially international ones, are so powerful that their interests often clash with the interests of general public.
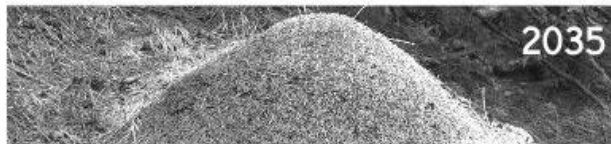
2035 The whole Finnish society has become deeply dependent on techemoths. Everything from politics to lifestyles revolves around them.

2030 Little by little the Finnish management culture became more democratic. Employees were given more power than what was used to. Cooperative-like practices were implemented in most of the Finnish techemoths.

2025 Engineer-minded HR management proved dysfunctional in techemoth settings.
Management was to be rethought.

2021 Many Finnish companies turned to techemoth organization models.
The lives of many Finns began to revolve around their workplaces.

2020 The first Finnish techemoth was established out of the small and medium-sized companies of the company ecosystem formed around Nokia.
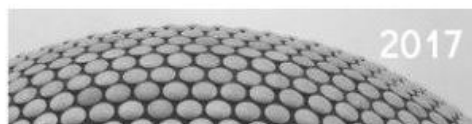
2017 Finnish companies began to look for new organization models.
They were especially attracted by the experiments of Google, Facebook and other technology behemoths.

2015 Elon Musk established a private school for Space X employees, representing one of the first moves towards community-like companies.

VALUE-DRIVEN TECHEMOTHS FINLAND 2015–2050

2015–2020

In 2015 Elon Musk, the CEO of Tesla Motors and SpaceX, established a private school for SpaceX employees[41]. The new headquarters of Google and Apple still in the planning phase, this was the first concrete step towards self-sufficient companies that offer all the basic amenities for their workers, from housing to leisure activities to "public" space to in-house healthcare and education. Harvard students rallied[42] and investors began to seek ways to avoid "carbon lock-in" with their investments.

Meanwhile, Finland was in a transition phase looking for new economic as well as societal direction in the still continuing aftermath of the decline of Nokia. Finland has had a long tradition of strong industrial and ICT companies, as well as a relatively homogenous national culture. This turned out increasingly troublesome a heritage, as the developed economies relied on services, immaterial production and creative industries, and as cultures diversified and national cultures became a relic from the past. To oppose these global trends, the conservative government of The Centre Party, The National Coalition Party and The Finns Party embraced traditional Finnish culture to emphasize the uniformity of values and the role of strong leaders.

The Silicon Valley trend of self-sufficient campuses of large technology enterprises with strong corporate cultures offered a promising solution for the Finnish economy and its production structure, and a compromise between the new world of shattered values and the traditional Finnish culture of uniformity. The Finns, generally speaking, favor cooperation, consensus, and strong social bonds, and strong leaders representing shared values. They are good with designing and producing technology. Thus the reformers of the Finnish economy and society reached over the Atlantic for a new model for businesses as well as the whole society.

Companies began to experiment with large, relatively closed units. They began to build strong corporate cultures together with employees. They began to offer various services to their employees, modelling the pioneers of Silicon Valley tech companies. One of the early Finnish techemoths arose from the production chain initially built around Nokia. The new

[41] http://venturebeat.com/2015/05/23/elon-musk-didnt-like-his-kids-school-so-he-made-his-own-small-secretive-school-without-grade-levels/
[42] http://www.democracynow.org/2015/4/16/harvard_students_expand_blockade_calling_for

company was a success, especially as the corporate culture could be formed from a scratch, bottom-up.

Energy landscape

- **New players (e.g. ICT companies) expand their business into energy sector** also. This increases competition and introduces novel business innovations into energy sector.

- Apple buys Tesla as it has been rumored for a while (http://chicagoinno.streetwise.co/2015/05/06/apple-buying-tesla-rumors-of-apple-tesla-acquisition-continue/), and becomes major actor also in vehicle and energy sector with electric vehicles and household energy storage technologies.

- Some energy companies, as well as oil producing countries, face **economic problems as oil price remains at a low level** for several years (http://www.eia.gov/petroleum/weekly/)

2020–2030

More and more Finnish companies started to follow the promising examples pioneering techemoths. As the model became increasingly popular, it hit an obstacle: poor human resources management[43]. As people spent more and more of their time within company campuses, the traditional top-down, engineer-minded HR management still prevailing in companies became increasingly dysfunctional, often turning out disastrous. Stark **conflicts between the management and employees were common**. Little by little the Finnish management culture became more democratic, and employees were given much more power than what was used to. **Cooperative-like practices** were implemented in most of the techemoths.

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[43] http://www.kauppalehti.fi/uutiset/suomi-yha-takapajula-henkilostojohtamisessa/VGRgyx3K

Energy landscape

- Electricity price remains at low level, and hence e.g. **new nuclear power plants are unprofitable for owners**. Demand for re-evaluation of the nuclear waste disposal strategy increase the costs and challenges with nuclear energy (http://yle.fi/uutiset/ikirouta_ulottuu_olkiluodon_ydinjateonkaloon__vaikutukset_ydinjatteiden_loppusijoitukseen_arvioitava_uudelleen/8065833).

- Above mentioned issues are harmful for the traditional energy companies, and improve the possibilities of energy sector newcomers (ICT techemoths), which are taking more market share in energy sector also.

- Due to the strict immigration policy in 2010s and HR management problems, **Finnish companies have serious problems to recruit world-class experts** and some global companies are moving abroad.

2030–2050

Techemoths have become an invaluable part of the Finnish economy. The whole Finnish society is deeply dependent on them, and everything from politics to lifestyles revolves around a few of the most successful techemoths. They are attractive to many, as they offer a community many Finns long for. Companies have developed as "tribe-like", even resembling religious movements. So deeply are citizens absorbed in corporate cultures that a person's company can be seen at a glimpse. These company-types are often referred to as "**homo Google**" etc.

Although the internal conflicts of companies have mostly been solved, there are often still **serious conflicts between techemoths and the rest of society**. Companies, especially international ones, are so powerful that their interests often clash with the interests of general public. **Techemoths' large resources have enabled the transition to a sustainable society and renewable energy system**, but the problem is that **energy solutions are tied to companies providing them**. Companies often provide **an ecosystem of services** – from gadgets to transportation to housing. **Energy and energy services are then offered on top of them**. This ensures seamless functioning between different technologies and services, but ties consumers tightly to certain few companies.

Energy services and solutions are being provided by companies other than traditional energy companies, and energy has become a part of their brand. The "**cool factor**" determines energy choices as any other consumer choice. **Energy has become an inseparable part of lifestyle and status**. **People share their environmental and energy data** with other personal information on social media. Inequalities have widened between those employed by techemoths and those living outside them. **The well-off are more informed on energy and environmental issues**, and are able to make smarter – and "cooler" – choices on energy and the environment. Although the allure of techemoth-style companies initially stemmed from their match with the Finnish longing for conformity and shared values, in practice they have widened cultural differences in the Finnish society. For instance, as each techemoth company has its **own schools and education services**, the education system has fragmented tremendously compared to the education provided by the state.

Energy landscape

- Role of the energy sector market players has changed, **they have moved from energy providers to service providers**, and energy is only a small part of the whole business.

- **Saudi-Arabia phases out fossil fuels** and becomes world leader in renewable energy production (http://www.theguardian.com/commentisfree/2015/jun/04/saudi-arabia-ally-renewable-energy-oil-rich). It becomes also one of the major shareholders of several techemoths.

- Some large energy companies face economic problems due to the **high investments in such novel energy technologies**, which turn out to be unsuccessful, such as fusion energy or harvesting solar energy from space (http://www.alternative-energy-news.info/japan-solar-energy-from-space/)

Energy implications in Value-Driven Techemoths
from the workshop "Futures Clinique I: Towards the Third Industrial Revolution (6.5.2015)"

- Should all vehicles have electric engines? - Cars recycle their energy from motions. Automatic energy is produced on the spot - even thinking generates energy to use

- Everything in a circular economy

- Companies are investing in new energy innovations, creating new products, services and systems in the energy field. Finland is exporting new storage solutions.[44] Focus is on urban energy storage and transportation possibilities.

- Along with the Internet of Things, also energy comes from an ecosystem cloud. Big corporation resources are systematically harnessed in order to make the transformation happen and the regulations that make experiments possible support the transformation. This cloud enables everyone to be an energy producer. Energy is also a brand and a service.

- A company or an individual can get paid as they "download" energy into the cloud. Choosing a certain techemoth ecosystem also defines choosing other products. Buying a certain type of energy results buying a compatible phone, car, services and a house. The competition results in oligopoly of energy platforms, where only a few competing systems exist. Thus a situation, where there is only one winner, is possible. Also an intermediate state was suggested as a phase of a one single techemoth ecosystem, preceding an enernet phase, where several techemots could exist simultaneously.

- A lot of the group's discussion revolved around the power relations between big corporations, individuals and other instances; will there be many techemots and competition of platforms, or one winner? Will an individual find suitable solutions within the platforms offered?

- Coal plants could be converted to neo-carbon plants in EU[45]

- Ships are navigating across solar farms at sea, owned by large companies[46]

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[44] It is interesting to consider further, which neo-carbon energy related niches exactly make Finland's competitive advantage. For instance in the manufacturing of solar panels particular countries in the world are leading actors

[45] FOCUS, Issue 281, June 2015 p. 9, http://www.kacperkowalski.pl/gallery/toxic-beauty

[46] FOCUS 276, Jan 2015, p. 57

2.3 Green DIY Engineers

(Neo-Communal peer-to-peer & Pragmatic ecology)

Figure 4. Green DIY Engineers scenario.

(http://jason.wells.me/wp-content/uploads/2012/05/burning_man_2002_Robotic_Rickshaw.jpg)

The world has faced an ecological collapse. Engineer-oriented <u>citizens have organized themselves as local communities</u> to survive. Environmental problems are solved locally, with <u>a practical mindset</u>. 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"** (http://www.nytimes.com/2015/05/03/opinion/sunday/the-end-of-california.html?_r=0)**.**
- **Species extinction are accelerating, which if continued will cause severe collapses in ecosystems** (http://www.nature.com/nature/journal/v486/n7401/full/nature11118.html)
- **Ecological values are becoming mainstream, as exemplified in Pope's climate change message** (http://www.vox.com/2015/6/24/8834413/pope-climate-change-encyclical)
- **Communal living is a strengthening trend among the youth** (http://www.nytimes.com/2015/08/02/realestate/the-millennial-commune.html)**. 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** (http://www.metro.us/lifestyle/today-s-doomsday-preppers-a-closer-look-at-survivalist-culture/tmWnib---2eLoFtUHD4bk/)**.**
- **Climate change is already intensifying global conflicts, which could lead to a situation where nations and communities close their borders** (http://www.scientificamerican.com/article/climate-change-hastened-the-syrian-war/)
- **Local Do It Yourself solutions could prove more agile than large-scale projects in a world of natural disasters** (http://www.technologyreview.com/view/537116/major-infrastructure-projects-are-fueling-new-opportunities-and-risks-for-the-global/)
- **Some people already live so that they produce as little waste as possible** (http://www.mindbodygreen.com/0-16168/i-havent-made-any-trash-in-2-years-heres-what-my-life-is-like.html)
- **Some towns are already trying to get off-grid and produce their own energy** (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

Countries have failed to escape the fossil-fuel economy. After crossing climatic tipping points, the feedback loops from global warming have caused an unprecedented world. The effects are more drastic than scientific forecasts dared to predict[47]. 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 in the atmosphere, scientists found out that the sun is more active than in 8 millennia.[48] The climate catastrophe has caused severe environmental turmoil. Over the years, people have witnessed considerable changes in weather patterns, sea level rise, and loss of snow where it was before. The situation is made even worse because of accelerating species extinctions, which are causing unexpected ecosystems collapses[49]. In turn, ecosystem catastrophes have led to disastrous shortages in food supplies, caused new epidemics and damaged forests. Global trade has plummeted and faced its most drastic depression to date. Consequently, states and businesses are paralyzed.

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, 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**.

In the DIY world, the world is built bottom-up. The **era of risky mega-infrastructure projects is essentially over**[50]. There are no barriers that inhibit distributed generation. Local interconnectedness is provided by mesh networking, an upgraded local Internet without a central regulating authority, highly resistant to external shocks[51]. The principles of the Australian permaculture (permanent agriculture) have been lifted to the mainstream and

[47] http://www.washingtonpost.com/news/wonkblog/wp/2014/10/30/climate-scientists-arent-too-alarmist-theyre-too-conservative/
[48] https://www.mpg.de/research/sun-activity-high
[49] http://www.nature.com/nature/journal/v486/n7401/full/nature11118.html
[50] http://www.technologyreview.com/view/537116/major-infrastructure-projects-are-fueling-new-opportunities-and-risks-for-the-global/
[51] http://www.wired.com/2014/01/its-time-to-take-mesh-networks-seriously-and-not-just-for-the-reasons-you-think/

utilised to the full. This system of agricultural and social design principles is based on simulating or directly utilizing the patterns and features observed in natural ecosystems.[52]

Within communities, **smart scarcity** is the driving principle. Everything is recycled with almost zero-waste[53]. **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 provide communities with bioplastics, chemicals, pharmaceuticals and construction materials, such as organic bricks[54]. In the night time, artificial firefly light glows in the neighbourhood[55]. The DIY revolution has been enabled by the widespread uptake of graphene in the 2030s, supermaterial that has supported a range of applications from bioproducts to energy storage[56].

All of this has dramatically **lowered 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 in 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. For these reasons, *do-it-yourself* (DIY) is the most common breed of engineers. Kids and youngsters jump on new technologies, and their playful imagination drives inspirational energy solutions [57].

However dire the situation might seem, most communities are actually pretty well off. Ecological crisis has forced to develop practical, cheap and relatively simple technologies ranging from construction materials to medicine and to energy production. In the event of

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[52] 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.
[53] http://www.mindbodygreen.com/0-16168/i-havent-made-any-trash-in-2-years-heres-what-my-life-is-like.html
[54] http://momaps1.org/yap/view/17
[55] Focus, Issue 278, March 2015, p. 26
[56] http://www.graphenea.com/pages/graphene-uses-applications#.VdQ8nUbuHnQ
[57] http://www.bbc.com/future/story/20141113-an-energy-revolution-from-the-sun

a disaster, biobots are helping to locate survivor[58]. Social entrepreneurship serves identified societal needs. Value creation in general is mostly local, providing for local needs. Often these highly specialised solutions have appeal also elsewhere. Consequently 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 themselves own their energy sources. Houses have been retro-fitted against the unpredictable weather[59]. Settled communities are careless green oases, safe havens surrounded by hostile outside world where sharing-based goods and services maximize resource use.

Within their daily communal life, DIY people are highly mobile. This local mobility consumes little resources, and some, if not all, of the energy of the movement is recaptured[60]. Unlike in pre-modern rural communities, they are not merely 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'**[61], the philosophy of continuous improvement. Local builders serve local energy infrastructure.

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 (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[62].

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[58] Focus, 276, Jan 2015, p. 24 Robo Rescue Roaches
[59] Focus, 277, Feb 2015, p. 60-65
[60] Focus 269, July 2014, p. 68
[61] 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.
[62] http://www.fao.org/docrep/x5318e/x5318e02.htm

Technology is seen as art and culture, and also as an extension of human abilities and senses.

African region, with its tradition of amateur tinkerers[63] has been a forerunner in DIY solutions and has therefore achieved a significant global political, economic and cultural role[64]. African culture has especially influenced the design of tools and other utility articles, as African art has 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.

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[65] enforce commitment to decisions concerning energy.

Energy technologies have to be built using local resources mainly. Technology production and development is conducted at local level, by DIY engineer groups. Scarcity drives a diverse energy pallet[66]. The 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. Energy efficiency strengthens resilience in the post-apocalyptic world. Pragmatic, local solutions ensure efficiency.

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[63] http://www.bbc.com/future/story/20130625-africas-diy-aircraft-builders
[64] http://www.theguardian.com/global-development/2014/jan/31/i-have-dream-africa-nkosazana-dlamini-zuma
[65] http://blogs.scientificamerican.com/plugged-in/with-wiki-energy-pecan-street-project-shares-the-largest-residential-energy-database-with-the-world/
[66] More diverse energy pallet than in other scenarios. Are these low-tech energy technologies?

United we survive

Following the drastic effects of climate change, the common mind-set slowly began to demand a better preparation for whatever was ahead. Throughout the 20th and 21st centuries, the cultural media and public discussions together with similar individual experiences of the world in turmoil had led to a collective imaginary of disasters[67]. 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 occurred, 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 sudden 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.

Next to engineering knowhow, outdoor skills and emergency training are highly valued and also taught through mesh networks – local, Bluetooth-like 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 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.

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[67] 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

Energy in Green DIY Engineers

In the Green DIY engineers' world global trade has plummeted, leaving communities to cope with mostly low-tech solutions. Efficient use of resources and recycling are key drivers for enabling communities to thrive.

The level of technological advancement is dependent on the knowhow of the community. Lots of innovative, but actually low-cost low-tech energy efficiency solutions are in use (e.g. earth architecture, simple biomaterials). Needed technology is produced and developed in communities by groups of engineers. People use barter economy, open source and 3D printing to help reduce the gap to those who are in the technical frontier. With the help of 3D printing people can get personalized energy solutions[68] and store energy in self-made batteries[69]. Low cost, portable energy solutions are used in the rare instances when travelling[70].

Prosumers are busy with wind, solar and biomass energy solutions conceived from available resources. Energy is produced by the people, for the people making energy systems widely scattered. Relative scarcity of resources drives towards more diverse energy pallet giving energy production cultural value as well, as it strengthens the identity of communities. Wasting energy and resources are a taboo and people thrive when consuming as little energy as possible.

Waste is not a problem but a resource for recycling and upcycling. However, waste can also be seen as an energy resource, and hence, there is sometimes a disagreement over the primary use of the waste.

Interconnections between communities are weak and some of the communities are off-grid and totally self-reliant. Investments in energy infrastructure are community-based, energy is produced and used on site.

Energy storage comes in different sizes and cost, there is a personalized solution for every need, including small-scale and off-grid P2G systems.

Harsh environment means pragmatic solutions in ensuring energy efficiency. In a survivalist ethos people are willing to endure quality shortcomings in electricity supply. Readily available energy storages for different uses mitigate the intermittent electricity supply and quality fluctuations.

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[68] http://mic.com/articles/123650/3d-printing-is-changing-the-future-of-energy
[69] http://www.wired.co.uk/news/archive/2015-08/10/graphene-3d-printed-super-batteries
[70] http://www.sciencedaily.com/releases/2015/06/150610111036.htm

Due to local production, trading of goods has been replaced by trading of knowledge. Because of localized living and manufacturing, the energy demand of transportation sector is very low.

There are lots of shared public spaces, which offer also shared public electricity, generated for instance by innovative energy harvesting solutions[71]. Buildings have been retro-fitted against the unpredictable weather making them energy efficient or even 0-energy houses.

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[71] http://etn.fi/index.php?option=com_content&view=article&id=944

Pathway to DIY Engineers Finland 2050

2050 The isolation of Finland proves in more and more occasions a two-sided sword. As the global situation becomes increasingly chaotic, allies across borders are welcomed warmly. New global order begins to emerge, but Finland continues its cosy isolation ("impivaaralaisuus").

2045 In Finland the pull towards self-sufficient communities is lifestyle- and value-driven, whereas in many parts of the world tight communities are necessary for surviving the climate change. While elsewhere localisation of communities often leads to isolation and fragmentation, the Finns still share a common, national identity.

2040 Finns live mostly in self-sufficient small cities and communities and are well-prepared for whatever the global situation might turn into. Unemployment is rare, which eases social tensions and frees resources.

2035 People start to migrate away from the Southern Finland to the inland.

2030 Warming climate causes unrest across the globe. Finns become increasingly isolated and try to stay away of global conflicts. A survivalist mentality gains ground, and local communities try to become self-sufficient.

2025 Local economies and communities thrive once again in every nook and cranny of Finland. The warming climate is beneficial for the bio economy, as growing seasons are longer than before.

2021 Traditional wood and paper industry has transformed into a biomaterials industry. Almost everything can be manufactured with biomaterials.

2020 Education, especially that of engineers, is steered towards bio economy and sustainable solutions. Digital services are used increasingly to enable collaboration and distributed practices.

2017 The Finnish government led by the Center Party invests on bio economy, creating jobs all around the country.

2015 The first dramatic effects of the climate change are seen in the Western countries. In Finland the effects are not yet really visibly felt, but preparing for the changing climate is taken more seriously than before.

GREEN DIY ENGINEERS FINLAND 2015–2050

2015–2020

The first dramatic effects of the climate change are seen in the Western countries. The drought in California is the most alarming example[72]. In Finland the situation the effects are not yet felt, but preparing for the changing climate is taken more seriously than before. The first early adopters are already preparing for a fossil-free future[73]. The government led by the Center Party invests on bio-economy, which creates jobs all around the country[74]. Education, especially that of engineers, is steered towards bio-economy and sustainable solutions. **Digital services are used increasingly to enable collaboration and distributed practices**.

Energy landscape

- People get more aware of their electricity consumption, its costs and environmental impacts, as more accurate measurement data from households is available (e.g. from smart meters and home automation systems), and there are also **popular applications that innovatively combine data from different sources (combinations of open and private data)**.

2020–2030

The bio-sector has become the new backbone for the Finnish economy. Traditional wood and paper industry has transformed into a full-blown biomaterials industry, which provides viable alternatives to non-renewable materials from construction to energy to chemicals – almost everything can be manufactured using[75] biomaterials[76]. The new economic and industrial direction is warmly welcomed by the Centre Party – still the biggest party in Finland

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[72] http://www.nytimes.com/2015/04/05/us/california-drought-tests-history-of-endless-growth.html?_r=0

[73] 100% Renewable Community, http://www.go100percent.org/cms/index.php?id=70&tx_ttnews[tt_news]=129

[74] http://www.hs.fi/paivanlehti/27052015/a1432615523459

[75] http://biomaterials.storaenso.com/

[76] http://www.forestcluster.fi/sites/www.forestcluster.fi/files/Forestcluster_FuBio_Report_Reader.pdf

– as it goes in line with the Centre Party's regional policies. Local economies and communities thrive once again in every nook and cranny of Finland. The warming climate is beneficial for the bio-economy, as growing seasons are longer than before. **Taxation is removed from renewable energy**, which drives the national energy transformation. **Legislation in general is tuned to promote and enable environmentally friendly solutions**. **Technologies of energy storage are invested on, as they are seen essential for energy security**.

Towards the end of 2020s, the warming climate causes unrest across the globe. Finland is geographically far from these conflicts, but the worried Finns try to stay away of troubling global affairs and become increasingly isolated. A survivalist mentality gains ground, and local communities try to become self-sufficient. **Local sharing of resources is seen as central for security and resilience. Shared values – a common mindset for Finns – lower the barriers of local collaboration and sharing. Local energy production enforces the shared culture and values – citizens feel empowered to master their own energy**. Citizens **produce their own food**, and food production is extremely efficient and requires much less land than before especially due **to vertical farming**. All **waste is recycled** locally. **Nature is not seen as resources only, but equally having a cultural and refreshment value**. Engineer-minded citizens turn to **open source** DIY practices, and begin to build their own solar panels and 3D printed products using bio fibers as the raw material[77]. **Manufacturing becomes a form of self-expression, and products are seen as much as art as functional objects. Experiments can be piloted on a local scale, and the best practices spread nationally**.

Energy landscape

- As **some of the customers start to form energy self-sufficient off-grid communities**, the network fees of the remaining on-grid customers increase (costs of the network operation and maintenance remain the same while there are less customers to pay the bill). Eventually, **more and more customers will disconnect from grid** due to such snowball effect.

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[77]
http://www.designnews.com/author.asp?section_id=1392&doc_id=274876&dfpPParams=ind_183,industry_auto,industry_aero,industry_consumer,industry_machinery,bid_27,aid_274876&dfpLayout=blog

2030–2050

By 2050, global temperatures on average have risen almost 3 degrees Celsius, and 5 degrees Celsius in Finland[78]. Sea levels have risen, and people have started to move away from Southern Finland to inland. Finns live mostly in self-sufficient small cities and communities and are well-prepared for whatever the global situation might turn into. **Unemployment is rare**, which eases social tensions and frees resources. Energy production is distributed and based on a mix of bioenergy, solar and wind. The Finnish situation reflects global trends, as more and more turn to live in local communities. In Finland the pull towards self-sufficient communities is rather lifestyle- and value-driven, whereas in many parts of the world tightly-knit communities are a necessity – as they provide the best means to survive the changing climate. Whereas elsewhere localisation of communities often leads to **isolation and fragmentation**, the Finns still share a common, national identity.

Toward the end of the century, as temperatures continue to rise, the isolation of Finland proves increasingly often a double-edged sword. As the global situation becomes increasingly chaotic, allies across borders are welcomed warmly. While Finland continues its cosy isolation ("impivaaralaisuus"), a new global order begins to emerge. The world is about to explode, and the Finns only have themselves.

Energy landscape

- Off-grid microgrid is in many cases cheaper option than grid connection, and because of such development, distribution network does not exist in "every nook and cranny" anymore.

- **Highly innovative, but eventually low-cost and low-tech solutions enable self-sufficiency of isolated energy communities**. One example of such solution is electrical bacteria (https://www.newscientist.com/article/dn25894-meet-the-electric-life-forms-that-live-on-pure-energy/), which turn out to be simple and cheap local solution to produce for instance fresh water and food from electricity. Hence, these are actually one solution for storing wind and solar energy.

- **Cross-border transmission of electricity is minimal**

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[78] https://www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html

Energy implications for Green DIY Engineers
from the workshop "Futures Clinique I: Towards the Third Industrial Revolution (6.5.2015)"

- Clearing roles and responsibilities for the removal of any barriers that inhibit distributed generation
- How do we transmit energy in the future?
- Net metering
- Very energy efficient system
- Community-based energy hubs (or perhaps each household is producing energy themselves, and storage organised communally)? – Suggestion of trade or credit systems
- Personal hydroelectric power stations charge gadgets from flowing water[79]
- Wearable chargers for phones or tablets[80]
- Personal Energy, Fuel Cell, Gas-to-Power[81] → Energy storage (accumulators instead of transmission) – more important than in other scenarios + molecules called Dihydroazulene-Vinylheptafulvene that stores solar energy by changing shape[82]
- Community-based investments in energy infrastructure
- No import of fossils (we have enough of DIY energy, self-sufficient society)
- Enernet (interconnected energy -> easier to sell to others)
- Variable price of electricity for all (prices vary due to many producers)

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[79] You just drop the turbine [in the water] and secure the power station to the ground. One hour in the water gives your phone a whopping 10 hours of power.

[80] Solar-powered shrimp: solar cells from chitin and chitosans (chemicals found in the shells of crustaceans)

[81] http://hellokraftwerk.com/

[82] Focus Issue 282 - July 2015, p. 20

2.4 New Consciousness

(Distributed/Neo-Communal Peer-to-peer & Deep ecology)

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

In the "New Consciousness" scenario, a looming ecological crisis, "World War III" of numerous small hybrid warfare conflicts, and ubiquitous ICTs have led to a new kind of consciousness and worldview altogether. Values of <u>deep ecology</u> have become the norm. People do not conceive themselves as separate, self-profit seeking individuals, but deeply intertwined with other humans and with nature. Phenomena are conceptualized and understood from a systems-oriented worldview, which sees <u>"everything connected to everything else"</u> – as parts of a single, global system. Society is organised as open global collaboration and sharing 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 (*http://www.rollingstone.com/politics/news/the-point-of-no-return-climate-change-nightmares-are-already-here-20150805*)*

- *24 % of US teens use social media "almost constantly"*
  *(*http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/*)*

- *On social media identities are increasingly constructed "cooperatively", which in the long run may undermine the notion of self-interest seeking individuals.*

- *Cyber attacks are becoming more and more common. Propaganda on the internet and social media are increasingly essential. War is becoming in a sense boundless and thus ubiquitous. This could lead to a situation where peoples are forced to rethink their relationships, as has happened after the previous world wars.*

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** (http://faculty.georgetown.edu/irvinem/theory/Hayles-Posthuman-excerpts.pdf)

- **The millennial generation (born between 1980 and 2000) are the millennials are more tolerant, have more solidarity and are more oriented toward a cooperative foreign policy than their elders (**https://www.americanprogress.org/issues/progressive-movement/report/2009/05/13/6133/new-progressive-america-the-millennial-generation/**)**

- **Falling marginal costs are paving way for a production based on "collaborative commons"** (https://medium.com/basic-income/post-capitalism-rise-of-the-collaborative-commons-62b0160a7048)

- **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.**
  (http://aeon.co/magazine/health/can-we-get-all-the-nature-we-need-from-the-digital-world)

- **Robotization could lead to a "fully automated luxury communism"**
  (http://www.theguardian.com/sustainable-business/2015/mar/18/fully-automated-luxury-communism-robots-employment)

- **Systems thinking is gaining ground at the expense of the "traditional" scientific paradigm. If Newtonian science concentrates on separate parts and their linear cause and effect relations, systems thinking maps out the complex connections between parts.** (http://www.systems-thinking.org/systhink/systhink.htm)**.This could lead to a new worldview which sees "everything connected to everything else".**

Ecological catastrophe as a cultural bias

The modern, industrial society with market economy was based on independent, self-profit seeking individuals. This worldview and conception of humans was a major factor behind the global environmental catastrophe, as individuals pursued constantly increasing material wellbeing. Satisfying various needs of individuals was the guiding ethos of the era. In this sense, the environmental catastrophe was first and foremost a *cultural* phenomenon.

However, collective consciousness began to transform radically in the second decade of the 21st century. Behind this profound change were three main reasons: awareness of the ecological crisis beginning to manifest itself in various areas, "**World War III**" (of escalated, numerous conflicts of "hybrid warfare") and ubiquitous ICTs. Together they pointed a way to correct the bias in culture. The strengthening sense of global catastrophe evoked a new sense of belonging across borders and a need to seek emotional shelter and comfort from other people.

Furthermore, the ecological crisis, WW3 and ubiquitous ICTs shared one common feature: they are systemic and networked in nature. They are systems of a multitude of interconnected parts, which affect each other in a very complicated manner. Because traditional linear thinking could not grasp them, new concepts and models of thought were needed.

World War 3

Various glocal (global+local) conflicts, such as the civil war in Syria and the spread of the terrorist group ISIS (Islamic State of Iraq and Syria), Russia-backed separatist movements in different countries, China occupying new territories, especially in Asia, financial struggles in African countries leading to civil unrest[83], relative decrease of the US military power, cyber attacks against states and corporations, and numerous other such relatively small conflicts led eventually to a de facto World War 3[84].

In contrast to previous world wars, WW3 was a "hybrid war" in which no nation declared war against another. Hybrid acts of war connected "macro" level directly with the "micro" level as virtually every citizen was at least occasionally fighting the war – e.g. through

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[83] http://www.theguardian.com/business/2015/mar/28/rising-dollar-debt-fears-global-economic-crash
[84] http://www.theatlantic.com/magazine/archive/2014/08/yes-it-could-happen-again/373465/

information warfare and cyber attacks. Zeitgeist became hostile and paranoid, and world politics as well as global economy unstable.

Ubiquitous ICTs, collective identities and a "post-generation"

From the 2010's onwards, and accelerated by the war efforts, information and communication technologies became pervasive and ubiquitous. Even with national interests to control information, the global wireless Internet emerged as an intermediary step. Everyone was constantly connected to networks of other individuals and organisations. It became increasingly difficult to separate public and private lives. Clear lines between individuals started to wither away. Identity began to be understood as a person's interaction with his or her environment, and thus, as porous, deeply interactive and ever changing.

Millennials, the generation born between 1980s and early 2000s were a pioneering generation. Using 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[85]. They were the first generation to truly value access over ownership, transparency over privacy, and collaborative co-creation over competition[86]. They saw themselves equally as individuals and as parts of multitudes of collectives (Boyd 2014, 49).

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 chaotic multitudeness and 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 even recreational drug use. [87]

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

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

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

Internet, its practices and values, became to define physical reality as well as digital. Hypertext, the structure of links between web pages, became a metaphor for the whole culture. Information began to be seen as "the basic unit" 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 proliferated worldwide peace movements after WW1[88].

The ecological turmoil and the consciousness of deep ecology

Underpinned by the climate change effects and the gradual loss of livelihoods – heightened social tensions were a major factor for the chaos, and the eventual war like conditions. 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[89] were the first indicators of this. Ecosystem catastrophes led to disastrous shortages in food supplies. Droughts caused new epidemics and damaged forests. In 2035, global trade collapsed and faced its most drastic depression to date. States and businesses were paralyzed.

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[90]. It was also realized that humans' relationship to nature, to each other and to themselves had to be completely rethought. The ideas of deep ecology were found again. This new awareness spread quickly through all-encompassing digital networks.

As ecological consciousness spread and ubiquitous ICTs became commonplace and sophisticated, people began to see themselves as an inseparable part of their environments and nature, and nature as entitled to same kind of universal rights as humans. 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. SolarCoins were taken into use as the new global currency[91].

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[88] http://www.gwu.edu/~erpapers/teachinger/glossary/world-war-1.cfm
[89] http://www.nytimes.com/2015/04/05/us/california-drought-tests-history-of-endless-growth.html
[90] See e.g. van den Bergh 2013, Environmental and climate innovation: Limitations, policies and prices, Technological Forecasting & Social Change 80, 11–23.
[91] http://thinkprogress.org/climate/2014/02/21/3282131/solar-coin-global-currency/

The world of Unity

Societies have become fundamentally global, a "world village". Virtual and physical realities have become inseparable due to highly developed virtual reality (VR) technologies, and society in this respect "placeless". **VR simulates all senses authentically**. However, as high-fidelity VR requires vast amounts of processing power, the energy consumption of data centres is massive.

A **Global Union** has replaced the United Nations. The global government is elected in global elections. The political system is a mix of direct and representative democracy, although the emphasis is on the first. Due to the global system, **functions and measures 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 centers where it consumes energy the least at certain moment**. **Shared ownership of physical goods and resources enables the optimal use of them as well**.

Resulting from the ecological consciousness and ubiquitous ICTs, the shared worldview has changed deeply. Everything is seen as part of nature, and the separation between nature and humans artificial, as already suggested by an American 20th century deep ecologist Gary Snyder[92]. 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. 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[93] showing health benefits of exposure to nature, such as faster recovery from surgery[94], 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[95]. 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, viral, virus, worm and surfing. Even DNA itself is a digital code[96].

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[92] http://en.wikipedia.org/wiki/Gary_Snyder
[93] http://www.ncbi.nlm.nih.gov/pubmed/6391137
[94] https://mdc.mo.gov/sites/default/files/resources/2012/10/ulrich.pdf
[95] http://aeon.co/magazine/health/can-we-get-all-the-nature-we-need-from-the-digital-world/
[96] http://www.nature.com/nature/journal/v421/n6921/full/nature01410.html

The founder of the famous Wired magazine Kevin Kelly drew a parallel between technology and nature by claiming that technology "wants" same things as nature does:

"*Technology wants what life wants: Increasing efficiency; Increasing opportunity; Increasing emergence; Increasing complexity; Increasing diversity; Increasing specialization; Increasing ubiquity; Increasing freedom; Increasing mutualism; Increasing beauty; Increasing sentience; Increasing structure; Increasing evolvability.*"

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*[97].

From reductionism to systems thinking

As a consequence of the new worldview, new environmental thinking and new conceptions of the self, the *reductionist model*, prevalent since the Enlightenment and the scientific revolution, begun to crumble. In the reductionist model the world is explained by reducing wholes to their parts and then examining the mechanistic, deterministic, linear and one-direction relationships of the parts. The reductionist model turned out as insufficient as it did not take into account the relationships between different systems and multi-directionality of cause-and-effect relations, which are much more complicated than the reductionist, Newtonian model suggested. What emerged in replacement was a worldview drawing from the **systems theory**, which sees *everything as connected to everything else*.

Although the premises of systems theory are kind of self-evident – it is common knowledge that in reality an array of variables affects each other in complex ways instead of simple, linear and one-way cause-and-effect -relations – systems-oriented approaches began to change every process in society. One of the most significant changes was the already mentioned formation of a global government [98] – issues, problems and challenges do not abide by state borders, so neither should decisions.

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[97] http://aeon.co/magazine/health/can-we-get-all-the-nature-we-need-from-the-digital-world/
[98] OR (milder version):
a renewed engagement on global governance with purpose http://www.bbc.com/news/world-asia-china-30015545

However, the most profound consequence of systems thinking has been the re-entrance of *spirituality* to society's mainstream. Spirituality in its current form doesn't 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.

As people see themselves as deeply interconnected with nature and other humans, spirituality has become the normal state of mind. The modern notion of the self-absorbed individual has more or less vanished. 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.

The Era of Post-capitalism

Due to the technological, political and "spiritual" changes, the world of New Consciousness is a kind of a **Star Trek utopia** or **working socialism**. Almost **perfect democracy** has been achieved. **As military spending is needed no more, investments can be used in other areas such as poverty reduction and R&D. Not only basic needs of all** are well satisfied, but society can be described as "fully automated luxury communism"[99]. Highly developed robots and algorithms take care of most of the production. Freed from the constraints of work, people are free to pursuit whatever pleases them. Leisure and work have merged so that "work" in the industrial sense has met its end. People allocate a big proportion of their time to "spiritual" activities such as meditation and "mindfulness".

As "work" or "economy" in the traditional sense are no more, entrepreneurship is also seen as an anachronism. Instead of traditional entrepreneurship, people form productive communities without economic goals or incentives. Members of these communities gain great pleasure from solving complex tasks – such as philosophical dilemmas – together.

Despite the society being a "global village", people live mostly in **close-proximity communities. Because most of property is owned collectively, people change their residence according to needs and across the globe**. Interaction through long distances is usually dealt with virtual reality technologies, and in this respect there is seldom need for physical travel. However, as the globe is tightly interconnected, cosmopolite citizens travel

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

significantly more than in previous eras. **Algae are used to produce fuel for airplanes**, and aviating is carbon free. Universal, high-quality **health services and evenly distributed wealth have solved population growth.**

For a "utopia" like this to work, however, **production and economy have to be highly efficient**. Automated production gets more productive all the time, thanks to still potent Moore's Law[100]. As **all human production is immaterial, value-addition is high**. Self-evidently, immaterial production doesn't consume as much energy and materials as material economy.

A "neocarbonized" new consciousness

Decisions about energy futures are openly discussed by all parties affected[101] i.e. citizens regardless of their social status, especially taking into account the long time horizon of those decisions, leading to a coherent and predictable pathway. Energy is seen as "sacred", source of all life. Energy solutions are different in large cities vs. local communities, they are tailored to fit local conditions in an optimal way. Citizens are extremely committed to energy decisions & related policies. It is taken as self-evident that energy is a deeply personal issue.

Solar & 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 deforestation 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.

Demand for energy is high. The main reasons for high energy consumption are the global scale of interconnectedness, which involves transportation, travelling and highly sophisticated virtual realities. 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. Global interconnectedness of grids may even reflect the development of fully wireless transmission of energy[102] akin to Nikola Tesla's dream.

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[100] http://www.theguardian.com/technology/2015/jul/21/limit-law-scientists-molecule-sized-transistors-atoms-chips
[101] M. Nilsson et al. / Futures 43 (2011), 1117–1128.
[102] Japan space scientists make wireless energy breakthrough, AFP 12.3.2015
http://phys.org/news/2015-03-japan-space-scientists-wireless-energy.html and

Energy in New Consciousness

New consciousness society is organized as open global collaboration and sharing of resources and information. Structures of industries and the whole economy move towards knowledge intensive production, radically different than today. Global circular economy with high recycling rates increases resource efficiency of economies.

Technology development is boosted by a society-wide commitment towards renewable options. This radiates into giving large-scale, capital intensive solutions relatively high importance in the energy system.

Energy systems move to a direction showing characteristics of both distributed and centralized nature. That is, advanced integration of grids and information exchange guarantee tempting conditions for efficient large-scale production (with e.g. concentrated solar power as a promising option). On the other hand, small-scale solutions are driven by citizens' commitments towards efficient utilization of local energy resources. The development reflects to utilization of different type of storage technologies

Power-to-gas technology breakthrough has led to employment of   P2G solutions in several scales, and there a variety of P2G solutions are in use in societies.

Advanced automation utilizing ubiquitous ICT helps integrating renewable electricity in the system.

Solar and wind power production reaches high or even very high levels as solutions in all scales develop favourably and they can be efficiently integrated to global energy markets.

Transmission networks are strong with only few bottlenecks.

Transportation volumes face a pressure upwards due to globalised world with wide opportunities for trade of goods and mobility of people. However, resource efficient production, as well as virtual reality and advanced public transportation have the potential for dampening the trend. Both electricity and gas driven vehicles largely replace conventional ICE vehicles.

Buildings are largely "plus-energy-buildings" as smart energy systems enable solar and other renewable energy integration.

2014 Wireless electricity? It's here. CNN
http://edition.cnn.com/2014/03/14/tech/innovation/wireless-electricity/

Pathway to New Consciousness

Finland 2050

Germs of the new, shared consciousness begin to sprout throughout the globe. Anxiety-ridden self that tries to secure social status, pride, prestige and power starts to evaporate, and humans are finally finding a peace with themselves, each other and the nature.
(2050)

Stable and equal Finland is seen as a safe-haven amidst global chaos. As early adopters of sharing technologies involving e.g. brain-to-brain communication, Finns become forerunners of the "New Consciousness" practices and mindsets, paving the way out of the global turmoil.
(2045)

The atmosphere of warfare is ubiquitous as "soft" means of warfare reach citizens' minds. Enemies are using very clever ways of sowing paranoia and distrust among civilians.
*(2040)*
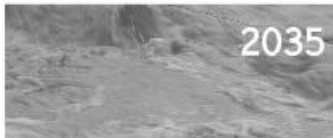
Environmental problems cause conflicts around the globe. New global superpowers, especially China, are using global instability to spread their geopolitical stance. Cyberattacks and grassroots propaganda are used as well as traditional means of war.
(2035)

Finland is still a relatively equal country in terms of distribution of wealth and education. Finland decides to tap the potential, and begins promoting politics and economics of good life.
(2030)

A new global contradiction is arising. Sharing, collaboration and altruism are seen as the path to progress. Unfortunately, in many countries inequalities between citizens are a serious blockade to a harmonious, collaborative society.
(2025)
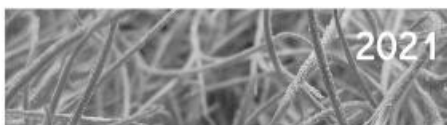
The downfall of traditional Finnish industries has left an economic vacuum to be filled. A multitude of economic invaders - often from open source and collective urban movements - emerge to fill the void.
(2021)

The Finnish economy is still dominated by manufacturing and industrial production, while most of the developed countries rely on services. Due to this lag in development, Finland continues falling behind its reference countries both culturally and economically.
(2020)

Finland is adapting to the "connectedness" development more slowly than many other countries. This is manifested in the use of media, which in Finland is still dominated by traditional media companies.
(2017)

People have become much more connected than before. Social media with its emphasis on sharing, communities and collaboration is becoming the norm in "real life" as well.
(2015)

NEW CONSCIOUSNESS FINLAND 2015–2050

2015–2020

In 2014, there were 3.8 billion internet users in the world – a 39% population penetration. 2.08 billion people had a smartphone globally. Of Americans, 64% had a smartphone (as compared to 18% in 2009). 87 % of Americans aged 14–25 said that their smartphone never leaves their side, day or night, and 80 % said that the first thing when they wake up is to reach their smartphone. 34% of American millennials (born between 1980 and 2000) prefer to collaborate online at work as opposed to in-person or via phone (vs. 19% for older generations). At the same time, more and more people work outside organisations. 38 % of the American workforce was freelancers. Online platforms and marketplaces grew rapidly, creating new work opportunities for individuals. (Meeker 2015.[103])

All of this data indicates that by mid 2010s, people have become much more connected than before. All the more, people are increasingly connected directly to each other, without mediating organisations. Social media with its emphasis on sharing, communities and collaboration is becoming the norm in "real life" as well.

Finland, however, is adapting to this development more slowly than many other countries. This is manifested in the use of media, which in Finland is still dominated by traditional media companies. Although Finns use digital media a lot, media consumption concentrates on digital contents provided by the traditional media. The role of social media and new digital media companies in news consumption is less significant than in most reference countries.[104]

Another hindering factor is the economic structure of Finland. The Finnish economy is still dominated by manufacturing and industrial production. Despite services being increasingly important in material production, the Finnish economy is still largely based on the production of tangible goods[105]. While sharing, collaboration and free flows of information are central in intangible production (including R&D on physical goods)[106], traditional industrial production tends to prefer more closed practices.

Due to this lag in development, Finland continues falling behind its reference countries both culturally and economically. However, some undercurrent developments are on their way.

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[103] http://www.kpcb.com/internet-trends
[104] http://www.digitalnewsreport.org/survey/2015/finland-2015/
[105] http://www.vatt.fi/file/policybrief/vatt_policybrief_12014.pdf
[106] , http://bits.blogs.nytimes.com/2015/03/29/open-sourcing-cars-and-computers

In 2015, Nokia announces a camera for filming and constructing virtual reality environments. Mindfield Games, a Helsinki-based startup company, is among the first companies to develop a virtual reality computer game.[107] New forms of urban communality are emerging.

Energy landscape

- **It is realized that a major shift is needed in energy sector** if functions and measures are to be optimized on a global scale such as envisaged in the scenario. A successful global climate agreement presents a first step in such a process, which will ensure that the EU will follow its **ambitious climate policies and put large efforts on clean technology development and deployment**.

- Free trade agreements are concluded with the EU and the major economies outside the EU

2020–2030

The downfall of traditional Finnish industries has left an economic vacuum to be filled. A multitude of **economic invaders** emerge to fill the void. Their unorthodox thinking and nonconventional approaches are bringing new life into the Finnish economy. The "invaders" often have their roots in the collaborative software development scene of the 1990's and early 2000 as well as the new collective urban movements of 2010's. Their example is giving a whole new perspective for many Finns used to avoid contacts with strangers.

Globally a new contradiction is raising its head. It is widely understood that the notion of separate, self-profit seeking individuals is an obstacle to development. Sharing, collaboration and altruism are seen as the path to a new progress. Unfortunately, in many countries **inequalities between citizens are a serious blockade to a harmonious and collective society**. Despite widening gaps between citizens, Finland is still a relatively equal country in terms of distribution of wealth and education. Finland decides to tap the potential, and begins promoting a **politics of good life.** Its long-term goal is to **redefine**

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[107] http://www.taloussanomat.fi/yrittaja/2015/08/04/suomalaiset-iskevat-150-miljardin-dollarin-bisnekseen-tulevaisuus-on-taalla/20159774/137

economy as means to achieve "good living" – not seen as a goal in itself. In line with the new thinking, **debt is seen as a positive issue** instead of to be avoided as much as possible. Attitudes towards debt are loosened, and new opportunities open up as a healthy level of debt enables new investments.

Energy landscape

- Giant leap in productivity of economy, also in energy production. **Technological development and clean technology deployment are very fast**. New business and service concepts enter in the markets along with intelligent energy systems.

- **Technological and/or economic and/or political circumstances support** the envisaged development, for example:

- Breakthrough of new technologies penetrating from all parts of society (both small and large scale, consumer and industry-driven innovations: batteries, power-to-gas, solar PV, wind…)

- **Weakening conditions for conventional alternatives** (competiveness of fossil due to stricter emission limits and CO2 trade, political decisions regarding certain technologies (e.g. nuclear)…)

- Energy related political development and international collaboration must take very radical steps compared to current.

2030–2050

Although most countries' energy production is based on renewables, climate is still warming due to the emissions of previous decades. Droughts, floods and other environmental problems cause conflicts around the globe. New global superpowers, especially China, are using global instability to spread their geopolitical stance. Armed conflicts are common, but cyberattacks and grassroots propaganda are used as well.

Only very few are involved in armed conflicts, but the atmosphere of warfare is ubiquitous as "soft" means of warfare reach citizens' minds. Enemies are using very clever ways of sowing paranoia and distrust among civilians. Psychosis caused by a neural attack through neural internet implants is one of the more extreme new "cyber" weapons.

Finland turns out as a safe-haven amidst global chaos. The relative stability and equality provides a solid basis for a cooperative society. Just as the Finns eagerly adopted the mobile phone back in the 1990's, the Finns are early adopters of high-end sharing technologies, often involving brain-to-brain communication. The Finns become global forerunners of the "New Consciousness" of collective practices and mindsets, paving the way out of the global turmoil.

Germs of the new, shared consciousness begin to sprout in numerous nodes throughout the globe. Anxiety-ridden self that tries to secure social status, pride, prestige and power starts to evaporate. The revelation of the intimacy with all that exists brings about a global relief, and humans are finally finding a peace with themselves, each other and the nature.

Energy landscape

- **The economic and industrial system works on fundamentally different foundation than that of today**. To enable this, large expectations are set on energy and technology companies or public organizations for developing technology.

- However, as logic of market economy seems not to be the main driver, there is a high demand for incentives coming somewhere else.

- Automation, effectiveness, ubiquitous information and communication technologies (ICTs), and globalized production all have an **impact in both the consumption and production of energy**. As an efficient and easily transportable energy carrier, electricity possesses clear advantages.

Energy Implications for New Consciousness
from the workshop "Futures Clinique I: Towards the Third Industrial Revolution (6.5.2015)"

Personal energy: Thin, flexible devices harvest energy from body movements + effective storage of power in a small space.

- Personalized energy systems
- Small scale and ad hoc production
- Wearable autonomous systems allow people to produce energy wherever they are
- Solar, wind, biofuel, by-produced hydrocarbons (renewable)
- Sustainable bio-energy from agricultural forest industry by-products
- 100% waste-free circular economy
- Electricity as currency (people exchange their excess, personally produced energy)
- Energy cooperatives (sharing economy)

Energy-wise, the system is based on solar + wind + global grid + storage. Storage technologies are divided roughly in two: households and small organisations rely on batteries (well-designed, aesthetic "iBatteries") whereas large organisations use synthetic methane. Overall the aesthetics of energy infrastructure is emphasized, and energy technologies are a desirable part of citizens' "everyday environment". Energy consumption is "active" meaning that consumers are aware of their energy consumption. Each has a personal greenhouse emissions account, which cannot be exceeded, but the surplus can be sold. Along with active consumers, energy efficiency is ensured "passively" through automated energy optimization.

3.   CONCLUDING REMARKS

Four societal scenarios describing alternative renewable energy-based futures in 2050 were presented in this paper. As metascenarios, all four scenarios describe possible futures, where economy is based on a neo-carbon system of producing and storing energy, as well as different modes of peer-to-peer society. The scenarios have been constructed in the foresight part of Neo-Carbon Energy research project, and they are continuously demonstrated and tested through different futures research methods such as futures workshops and expert interviews. The focus of these radical futures is to examine the interconnections of renewable energy, societal, economic, ecological and cultural change in a holistic manner. These scenarios will be elaborated and finalised in the course of the project, based on on-going research, feedback, and the deepening of scenarios through country case studies.

How to use these scenarios? There are several recommended ways of utilisation. As Chermack (2011) points out it is important to provide clear guidance for possible applications. These four metascenarios function as a holistic framework that describe possible alternative neo-carbon energy futures in 2050. The scenarios in this form are a platform for further, more detailed investigation of different specific topics related to the futures of renewable energy. For example, any organisation may use these scenarios as a framework for exploring futures from a viewpoint relevant for their strategic thinking. The metascenarios can also be applied to a localised context, for example by drafting national pathways similar to our four pathways for Finland within each scenario. In doing this, it has to be borne in mind, though, that these scenarios on purpose represent transformational futures that may differ radically from the present.

Finally it is hoped that these scenarios open up thinking and discussion on different alternative futures, related pathways and their potential game-changers. As stated earlier, scenario process relies on co-operative effort and dialogue of various experts. However, it is crucial to remember that this scenario work does not aim to predict the future, but to widen the horizon of possibilities instead. Accordingly, to deepen the insights even further, we warmly welcome your contributions and comments.

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APPENDIX 1: Four Transformative Neo-Carbon Global Pathways 2050

Pathway to Global Radical Start-ups 2050

Deep ecological startups are the new global driving force in an emissions-free world. Convening in virtual reality from India, Chile and across African countries, these networked nomads are driving a lean, decentralized industrial revolution.

2050 — Extremely deep ecological and automatized carbon neutral economies.

2045 — Startups themselves work in virtual reality.

2040 — 100% access to clean energy in 75% of developing countries.

2035 — Moratorium on fossil fuels. Other environmental externalities integrated into prices. Indian solar applications drive and thrive in the global economy.

2030 — OPEC countries establish a binding timeline to give up oil production. Over 50% of CEOs in top African digital startups are now women. Third industrial revolution kicks off in African countries.

2025 — All startups publish a financial and emissions balance sheet. Taobao - of Chinese Alibaba Group - is the no. 1 marketplace for digital renewable energy services in emerging economies.

2020 — Realization of limits in global carbon budget. A Finnish startup announces an aim to commercialize world's 1st digital power-to-gas service. Global price is set on carbon.

2015 — Crowdfunding and environment-themed venture capitalists increasingly fund startups.

Pathway to Global Value-Driven Techemoths 2050

Chinese state-owned enterprises and the communist party joined into one, gigantic techemoth. Older generations reminisce about the fossil fuel times in nostalgy. The Death of Old Energy Mammoths is the global virtual reality game #1.

2050

Techemoths' service brands produce 100% energy with solar and wind-powered synthetic chemicals, gases, oils, and materials, which they sell to customers.

2045

African billionaires invest and own African renewable energy giants.

2040

Those outside techemoths with no renewable energy or social innovation skills struggle to make ends meet. Average life expectancy in African countries is already over 70 years.

2035

Australian and South Africa's major coal companies are in serious trouble. Neo-carbon derived solutions undermine oil companies' profitability.

2030

Circular economy drastically reduces resource extraction. Techemoths collaborate across several industries to re-use raw materials and rare earths.

2025

In Saudi-Arabia, the prince uses money from the Saudi oil fund into building a solar empire and slashes oil subsidies. China and India quit the use of coal.

2020

Chinese companies invest in wind and solar energy ventures in Argentina. Google begins to sell renewable energy in the entire East Africa.

2015

Facebook invests USD 500 million to a data center in Texas powered 100% with RE. Mark Zuckerberg moves 99% of his wealth to a limited liability company.

Pathway to Global Green DIY Engineers 2050

Arctic is all but melted. Stories of resilient African villages and Australian permaculture off-grid towns attract Northerners to move south. Life in those latitudes is not easy because of heat and biodiversity loss - not to mention cultural misunderstandings.

2050 Self-sufficient off-grid renewable energy communities use personalized low-tech and local synthetic natural gas storages.

2045 *Severe global turmoil. Global migration.*

2040 Ecological crisis. Critical climate change tipping points are crossed. A domino-like effect of interconnected ecological collapses. A global food crisis erupts. Weather unpredictability.

2035 People start seeking shelter from local communities.

2030 Mass immigration undermines the power of nation states. Controlling borders is difficult. Australia welcomes citizens all across the world.

2025 Climate change effects add costs to public sector. Enhancement of national grid is seen as more costly than smaller mini-grids.

2020 Solar mini-grid businesses prosper in selected African countries.

2015 Thousands of people annually around the world visit a self-sufficient renewable energy community called Feldheim in Germany.

Pathway to Global New Consciousness 2050

Clean energy is cherished. It is transferred wirelessly or in a supergrid, with the power of thought. Latin American movements inspired the transformation of the mind. Coal, natural gas and oil are plentiful but kept underground.
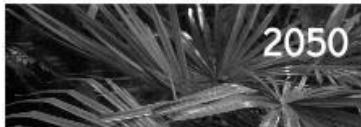
2050 — *All the people in the world are connected and form "a global brain". SolarCoins are exchanged as the new global currency.*

2045 — *Wireless energy transmission is controlled by power of thought.*

2040 — *Collapse of digitalized global economy due to intense information warfare and multiple cyber-attacks. Ecological catastrophes.*

2035 — *Energy cloud and global supergrid with superconductors balance intermittency to connect all continents. Construction of a large-scale neo-carbon energy system begins. Paper money is no more used for transactions.*

2030 — *Consciousness - ancestral African wisdom, artificial intelligence and yoga - is taught in primary schools. Already having quit coal, the world plans an exit from natural gas..*

2025 — *Clean energy is declared a human right. Fossil fuel subsidies are eradicated in the Western world. Deep ecological concern unites liberals and conservatives.*
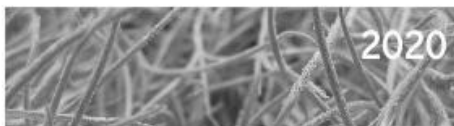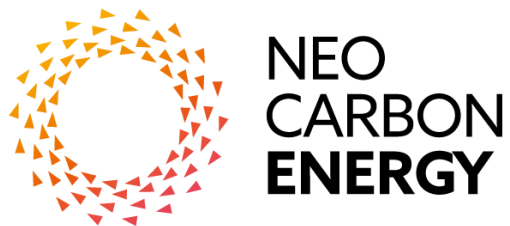
2020 — *Solar-produced electricity becomes the most cost-effective choice in the Mediterranean. Fears of Andes melting heighten. Renewable energy movement rallies across Latin America.*

2015 — *Paris #COP21 Summit and first global agreement. Middle East power vacuum threatens global security.*

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