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NEW GREAT ELECTRIFICATION AS CULTURAL TRANSFORMATION FOR POST-OIL ERA – Everybody on Board!

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Cover Photo

Sirkka Heinonen, wall mural from Montevideo, Uruguay (December 2017)

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PREFACE

New great electrification as Cultural Transformation for post-oil era – Everybody on board! was a Special Millennium Project Workshop organized in Tampere June 14, 2018, as part of the conference "Energizing Futures – Sustainable Development and Energy in Transition" (FFRC Futures Conference 2018). The session was planned and organised together with and for Finland Futures Academy (FFA). Keynote speech was given by Jerome Glenn, director of the Millennium Project. The session formed part of a new science-communication project called "Great Electrification in Peer-to-Peer Society" (SÄVÄYS), which is funded by STEK ry, Sitra – the Finnish Innovation Fund and the University of Turku. The results of the Special Millennium Project Workshop are summarized in this working paper. Warm thanks are due to all those who participated in and contributed to the session and this report!

The readers are encouraged to use the ideas presented in this report and elaborate on them in their own activities. The question how renewable energy, circular economy and peer-to-peer society will interact needs serious, thorough, innovative and open-minded futures reflections.

Sirkka Heinonen

Head of the SÄVÄYS Project

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Tervik 19th August 2018

ABSTRACT

The point of discussing renewable energy technologies in the context of cultural transformation is to highlight culture as a game changer and catalyst for change. Too often only economic, technological and political dimensions are taken as key drivers for change. This working paper presents the results of the workshop session "New great electrification as Cultural Transformation for post-oil era – Everybody on board!" that was organised as a Special Millennium Project Workshop in Tampere June 14, 2018, within the conference "Energizing Futures – Sustainable Development and Energy in Transition". In his keynote speech Jerome Glenn opened up vistas for how it is widely understood that the applications of artificial narrow intelligence (ANI) to all elements of the industrial production processes and service industries (The Fourth Industrial Revolution) will have a great impact on energy, employment, and the economy. However, it is less well understood that the applications of artificial general intelligence (AGI) and synergies among next technologies will generate far more profound changes than ANI and could create the **Self-Actualization Economy and Culture**. The starting point for the workshop was to explore futures of an economy, based on a new, entirely renewable energy based energy system in a peer-to-peer society 2050. The key question addressed was ***how to organise a circular economy with renewable energy and peer-to-peer principles?*** Five moderated small groups tackled this issue as follows. One group chose **mobility and equality** as their special focus and discussed how they could be achieved in the envisioned society. They came up with the entity of **"Mobility, equality, and distributing aspirational dreams as personal simulations".** The second group chose as their topic the nexus of **skills, education-to-employment, and inequalities**, asking what kinds of education and skills are needed to achieve such a society, overcome national and global inequalities, and what kinds of new jobs will be available in that kind of a society? They crystallized their reflexions to "**Peer-to-peer learning – aided by robotisation and AI or not?"** The third group selected **health** as their focal issue, especially the connection between food and health. They questioned the concepts of control, and what is natural/artificial and envisioned **"Farewell to hospitals: decentralised, multi-technology health care"**. The fourth group concentrated on **new risks** for individual members of such a society. They identified a number of compelling competences for individuals to make the most of a peer-to-peer environment. They envisioned their results into "**AI-Enabled Empathy Exchange"**. The fifth group took **leisure** as their topic and discussed how leisure is organised in the envisioned society and what the tools are that constitute the sphere of leisure. They created a vision of **"Self-Actualization for leisure (and work) in virtual reality"**.

1. Introduction to the Neo-Carbon Energy Scenarios

Neo-carbon society 2050 and its renewable energy system

The aim of the Neo-Carbon Energy project was to study and develop a neo-carbon energy system, as a form of **a 100% renewable energy based energy system**. Especially solar and wind energy are increasingly used to produce electricity, and energy storages balance the intermittency of variable renewable energy. With the so-called power-to-X technologies, electricity that is generated from renewables is transformed into new applications and end products such as synthetic chemicals, gases, and liquids. ***Transforming societies into one where energy – not only electricity – is emission-free, cost-effective and independent, based on (increasingly decentralised) renewable energy, can be called "neo-carbonisation"*** (Breyer 2016, Breyer et al. 2015). The concept of **neo-carbonisation** (a new relation to carbon – not as emission of CO_2 but rather as raw material for other processes) builds on the rethinking of the concept of growth as neo-growth. Malaska (2010) launched the idea of neo-growth as growth that is much based on services, immaterial growth and not wasting resources[1]. Four transformational meta-scenarios have been constructed on neo-carbon societies until 2050 (Heinonen, Karjalainen and Ruotsalainen 2017). These scenarios were made in the foresight part of the Tekes funded Neo-Carbon Energy Project.[2] The scenarios were constructed on the basis of a horizon scanning phase where special emphasis was paid to emerging issues and weak signals. According to Lesca & Lesca (2014), *weak signals are at the heart of anticipation. They can be conceived as first signs or symptoms of coming change. They are seeds of change, present today* (Heinonen & Hiltunen 2012). The two axes that underpin all these four transformative scenarios are ecological awareness (x-axis) and the manifestation of the peer-to-peer ethos (y-axis). This idea of ***increasing peer-to-peer activities and their implications and interconnections with renewable energy sources merits closer inspection***, as discussed in this working paper.

[1] See also the most recent report to the Club of Rome where the necessity and urgency of transformation for climate change combatting society is highlighted (von Weizsäcker & Wijkman 2018).

[2] The Neo-Carbon Energy project (2014-2017) was conducted by VTT (co-ordinator), Lappeenranta University of Technology LUT, and Finland Futures Research Centre FFRC, University of Turku. The foresight part (WP1) of the Neo-Carbon Energy Project was headed by Prof. Sirkka Heinonen at Finland Futures Research Centre (FFRC) in co-operation with VTT and LUT during the years 2014-2017. For more information, see webpages www.neocarbonenergy.fi and www.utu.fi/en/units/ffrc/research/projects/energy/Pages/neo-fore.aspx

2. Peer-to-peer principles and electrification are shaping renewable energy pathways

The session started with a "Provocation for peer-to-peer energy culture", a joint presentation by professor Sirkka Heinonen and researcher Joni Karjalainen from the University of Turku, Finland Futures Research Centre (FFRC). The presentation began with an introduction to the research topic, the full electrification of society, shaped by the uptake of renewable energy technologies and the adoption of the new models and principles of peer-to-peer society. It was explained that the specific objective of the session was to address the following question: ***"How to organise a circular economy with renewable energy and peer-to-peer principles?"***

Figure 1. Vision of renewable energy in peer-to-peer society presented by Sirkka Heinonen and Joni Karjalainen to provoke bold futures thinking.

The session was part of an on-going science-communication project called SÄVÄYS (In English: Great Electrification in Peer-to-Peer Society) that probes the novel and innovative discoveries of the Neo-Carbon Energy (2014-2017) project, which was funded by Tekes – the Finnish Funding Agency for Innovation (now: Business Finland). In the research project, several futures research methodologies were used to study a transition into a renewable

energy based energy system. These included Transformative Scenarios 2050, Causal Layered Analysis (CLA), Pioneer Analysis, Futures Cliniques and Futures Workshops, as well as identification of weak signals and imagining of black swans amongst others[3]. The SÄVÄYS project was created to further communicate the results from the Neo-Carbon Energy project. By using the key findings of the research project, ***the science-communication work aims to address a gap between futures research, policy-making and new types of energy practise*** to open up a space for future stakeholder actions and commitments.

In the presentation as a provocative introduction to the session work, ***a vision was opened of a future, which will be powered by renewable energy technologies***. Citizens will act as energy prosumers[4] in a peer-to-peer society: they will upload their surplus energy into a smart grid and download energy when needed. They can also produce their energy entirely autonomously. Low-cost energy, cheap and renewable raw materials, artificial intelligences, and platforms that match supply and demand will further help the emancipation of citizens as responsible producers.

"By 2050 energy will be emission free, almost entirely renewable, and used much more efficiently than today. We will thereby have a wealth of inexpensive, clean energy in use. An internet of energy will empower an electrified, resilient and secure society, and inspire its networked and autonomous citizens", is **the vision** presented.

This vision is technologically feasible and can be achieved in the forthcoming decades, but only if decisive actions are taken.

As a starting point to this vision, it has to be recognised that the magnitude in the challenge of changing the global energy mix is a massive one. At the moment, renewable energy only makes a small contribution to global energy use. However, in spite of a modest starting point, if one looks at the trends over the recent years, it seems like renewable energy is emerging – with new capacity and renewable energy projects around the world. There are numerous drivers that underpin these trends. The mitigation for climate change is an evident factor that in places has already begun to influence energy related decision-making and

[3] These methods are presented in the new Futures Research Methods Book "How Do We Explore Futures? Methods of Futures Research. (Eds.) Sirkka Heinonen, Osmo Kuusi and Hazel Salminen", now available also in English (Acta Futura Fennica 10). The book comprises of 20 leading Finnish futurists revealing their practical and theoretical knowledge of futures studies. The texts are a cross-section of twenty years of futures research: the writers present methods and their practical applications, demonstrating various interactions between futures research and other fields of science.

The book can be ordered from the Finnish Society of Futures Studies (Tulevaisuuden tutkimuksen seura ry). Read more at: www.tutuseura.fi/julkaisut/julkaisusarjat/aff/aff10 *and* https://www.tiedekirja.fi/default/how-do-we-explore-our-futures.html

[4] Prosumer = Consumer + Producer

investment behaviour. Over the years, the legal and policy environment around the world have also gradually evolved. There has been particular excitement (and subsequent drawbacks) with Germany's Energiewende. Plans and political targets to reach 100% Renewable Energy in the future have been announced, such as those in California. Other promising initiatives include renewable energy auction mechanisms, which have helped to rapidly increase the installed capacity of renewable energy, as exemplified by the Renewable Energy Independent Power Producer Programme (RE IPPPP) in South Africa. From an economic standpoint, ***the production costs of solar and wind energy are falling down every year.*** In recent years, the evolution of the Chinese solar photovoltaics sector helped world prices of solar energy fall by 80% between 2008 and 2013. In 2017, Saudi Arabia auctioned solar energy for less than US 2 cents per kilowatt-hour, and soon after wind power emerged as the cheapest electricity in the planet, following the auctions in Mexico to install new electricity generation capacity.

In an energy system that is based on renewable energy, the majority of all generated energy will be from solar and wind power and the electricity that they generate. The energy system i.e. different energy-consuming sectors would be enabled by renewable energy production, intelligent systems, an Internet of Energy (cf. beyond smart grids), energy storage, flexible energy use, and bridging technologies that convert the electricity generated with renewable energy into synthetic fuels and products. Therefore, ***100% renewable energy system would also imply electrification of most of the sectors in society.*** Compared to other low-carbon alternatives, carbon dioxide from the air could be used as a source material and fed it into production processes. This technique is called carbon capture and utilization (CCU), which is different from carbon capture and storage (CCS), because carbon is used, not stored. Using carbon as a source material for novel purposes means that an entirely new point of view has to be taken into energy planning. Furthermore, it is also an invitation to think of entirely new ways to think of economic activities and how to organize production processes.

In the long-term future, humanity could extensively harness the potential of sustainable, renewable energy sources, especially solar and wind energy. In addition to a sustainable re-use of carbon in the energy system, ***ubiquitous energy harvesting could prevail***. Solar-accessible roofs and many non-used land areas such as highway shoulders would be covered with solar cells, wind turbines and other energy production means. Clothing, devices, gadgets, vehicles, and building envelopes would gather energy in its many forms from the environment. Energy would even be produced by cyborg plants and trees with artificial photosynthesis.

The abovementioned shifts would take place in a **peer-to-peer society**. In a peer-to-peer society, citizens cooperate with each other in a non-hierarchical way. Its organisation model can be described as open collaboration of self-organising communities. Peer-to-peer has already irrevocably shaped how we perceive our societies to function, owing to information and communications technologies. Peer-to-peer principles, based on informal social relations, also apply to peer-to-peer production. The falling marginal costs of production and information have paved the way for the activities of grassroots actors and levelled the playing field when they act, or even compete in the markets, with large-scale actors.

Figure 2. Peers do not only produce information but also products and energy to each other.

Such changes, which have already shaped the rest of the society, are gradually beginning to shape the energy landscape as well. In the energy sector, prosumers are adopting and pushing for the principles of the peer-to-peer society. In the future, there will no longer be only energy consumers and producers, but instead energy prosumers will operate in constantly changing roles in interaction in a smart grid. At the same time, it should be noted that off-grid and micro-grid models are also becoming more and more conducive. This is even changing other sectors in society. In the transport sector, major car manufacturers have recently announced that in the future they will focus only in electric vehicles. **A "new" great electrification** ***signifies that a growing number of sectors where energy is used will be electrified. This would even imply the electrification of sectors that are more difficult to electrify***, such as freight transport. Just imagine the introduction of electric trucks – and

eventually the aviation sector, in which case also synthetic fuels could be used. All these pressures imply massive pressures in the energy landscape, including a new, changing role for traditional energy companies.

Such a future is, it could be said, ***a vision of a peer-to-peer industrial revolution***. It places alongside some other recently heralded principles, such as "Data as the New Oil", "Artificial Intelligence (AI) as the New Electricity", and the deepening penetration of robotisation and automatisation, which are shaping a more integrated human-machine interface. Futurist Ray Kurzweil talks of ***technological singularity***, a future point in time when machine intelligence, or artificial superintelligence (ASI) will surpass human intelligence, and trigger unforeseen changes in human civilization. Such a future state, however, could be a dystopia without ***human singularity*** (Heinonen 2018). Human singularity implies the educated awareness of human beings where information and knowledge are used consciously for ethical goals and objectives. In this sense, the potential of any type of technological change should be integrated and aligned with social principles and values, such as the nurturing of an ***ecological do-it-yourself culture and the pursuit for meaningfulness***.

In the light of these aspirations, there are possibilities that even an energy system based on renewable energy could be misused. What if a possible future peer-to-peer industrial revolution in a renewable energy based economy merely increases consumption and the amount of plastic waste? After all, the amount of plastic (and other types of waste) circulating in world's oceans is already surpassing the limits of sustainability. In the future, ***smart systems would have to follow the principles of cradle-to-cradle thinking and circular economy***. If the amount of waste is not minimized, self-production could actually make the amount of waste explode. In a neo-carbon based circular economy, not only would carbon dioxide (CO_2) be used as a source for materials, but all material flows would be identified, materials and components would be re-used, and production would run in closed loops. Of course, even such massive shifts in production patterns might not alone be enough to halt climate change or to sustain human societies within planetary boundaries, considering the already massive human-environment pressures.

Amidst such global pressures and the efforts to mitigate them, local pioneers are observing what is happening and refusing to stand by. Pioneers are pushing for changes locally to achieve global change. Such ***pioneering acts may start as something seemingly small, but if they prosper, they may begin to challenge prevailing norms and institutions***. The potential embedded in pioneers is mighty because they may introduce radical innovations and while they may prosper or fail, in the process they create room for the emergence of new, disruptive social practices. In the energy sector, there are currently – numerous pioneers

from individuals, activists and non-governmental organisations (NGOs) to small and large companies (D.light, Strauss Energy, GoiEner, Sustentator, Tesla, Google, M-KOPA, Mobisol). Even entire socio-political movements and ideologies are attempting to address the climate change dilemma (Karjalainen and Heinonen 2018).

The present benefits of fossil fuel based energy sources have for a long time outweighed their negative impacts. Therefore, it is necessary to think of the positive impacts that an energy system based on renewable energy production and electrification would bring. ***Electrification would generate broader societal benefits, such as improve energy security, human well-being and environmental health***. Enhanced self-sufficiency over energy production could reduce the vulnerability of some polities to energy imports. Reliance on global energy commodities, such as oil, makes countries typically suspect to sudden price spikes. This has undermined efforts for sustainable economic and energy planning in many countries (Dannreuther 2018). The way the economy of Venezuela was hit in the 2010s, after the price of oil fell down, is merely one example. From a government standpoint, the improvement of air quality would produce savings in healthcare costs. Electrification, and the harnessing of renewable energy technologies in large scale could, overall, enhance the efforts to halt global warming at most at +2□ C degrees (and preferably below). Of course, these efforts would be greatly aided, if markets supported this mission. It is anticipated and hoped that in the future, the price of economic externalities is reflected more accurately. If carbon, for instance, would have a fair price in the markets, this could incentivise economic actors to re-think their relationship with carbon-intensive economic models. (Note: The price of carbon would also shape the profitability of business models where carbon is re-used.)

Overall, the presented vision is conducive and technologically feasible, and therefore an invitation to think how the use of fossil fuels could ultimately be halted over time. This would mean that novel industrial and production processes would substitute most of those presently in use. In spite of optimism about this desired vision, it seems evident that ***progress towards such desired aims will not be linear, and instead multiple surprises will surface along the way***. As a recent example, during the Presidency of Donald Trump in the United States, the U.S. has drastically changed its geopolitical position, global trade and energy strategy, and has vigorously attempted to save domestic coal industry jobs[5]. An unforeseen introduction of trade barriers has angered the US traditional trade partners, and also harmed the U.S. solar industry, as billions of solar projects have recently been shelved[6]. This

[5] In stark contrast, one of the agendas of Presidential Candidate Hillary Clinton's campaign was to make the U.S. "the Clean Energy Superpower of the 21st Century"

[6] https://www.reuters.com/article/us-trump-effect-solar-insight/billions-in-u-s-solar-projects-shelved-after-trump-panel-tariff-idUSKCN1J30CT

has happened despite the fact that the solar industry in the U.S. already employs more people than the coal industry.

While more autonomous, empowered and interconnected citizens will depend less on hierarchies, they will be guided by numerous types of different values and value systems. In imagining future peer-to-peer societies, it should be considered that ***societies around the world at present are both liberal and authoritarian***. Hence, these conditions will also shape the surfacing of peer-to-peer cultures of the future. It seems plausible that even in a robust vision that addresses the complex energy/climate change dilemma, and where many past problems can be resolved, the world will still not be a utopia. Consequently, there might not be uniform transformations, but the novel technological and societal principles might be introduced in different ways.

As a reminder for future changes, it should be remembered that all societal and economic transformations in history have been enabled by the harnessing of new energy sources and means of communication. ***More energy enables more complex societies, and new communication technologies are needed to organise increased complexity***. Hunter-gatherer societies domesticated fire, cooked meat, invented spoken language and worked as organised tribes. Agricultural societies domesticated plants and animals, invented written language and organised as chiefdoms, kingdoms, city-states, empires and early nation-states. Industrial societies brought about fossil fuels, the steam engine, the combustion engine, electricity and nuclear energy. Information began to circulate with the printed press, mass media (radio and television), and later, the Internet. The emergence of the nation-state spread models of democracy, in some places a welfare state, and eventually an information society in an increasingly globalised world where nation-states now have to increasingly come to terms with challenges of global nature.

For the future, a new societal phase could be imagined: namely one of ***fourth industrial revolution and "a global brain" of global interconnectedness***. In line with the presented vision, all energy would be produced with renewable energy technologies with the aid of an Internet of Energy. Communication in such an increasingly complex society would be organised with the Internet of Things, and later supported by artificial intelligences (AI). Society would be organised as a peer-to-peer society, aligning with the peer-to-peer principles, which would enable the lives of networked citizens who are experiencing and living amidst largely automated forms of material and immaterial production.

3. Fourth industrial revolution and artificial intelligence (AI) shaping energy futures

In his keynote, Jerome Glenn, the Director of Millennium Project, a global futures think tank[7], discussed the role of technological change, and how it is interconnected to the anticipated fourth industrial revolution and the surge of renewable energy technologies.

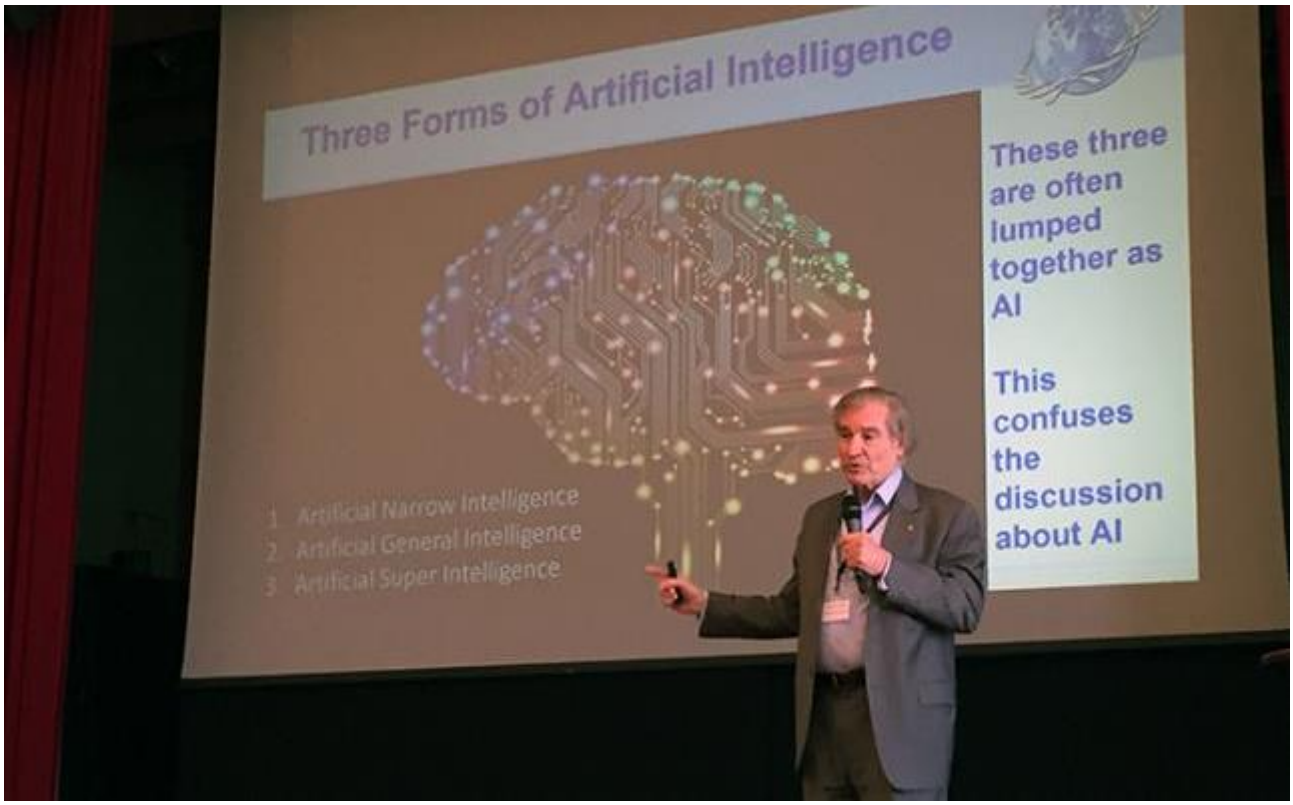


Figure 3. Jerome Glenn's keynote addressed next technologies based on self-actualization that penetrates economy and culture.

The aspiration is that future synergies among artificial intelligence (AI) with robotics, synthetic biology, computational science, cloud & big data analytics, artificial & augmented reality,

[7] Millennium Project is a global participatory think tank connecting 63 Nodes around the world that identify long-range challenges and strategies, and initiate and conduct foresight studies, workshops, symposiums, and advanced training. Its mission is to improve thinking about the future and make it available through a variety of media for feedback to accumulate wisdom about the future for better decisions today. It produces the *State of the Future* reports, the *Futures Research Methodology* series, the *Global Futures Intelligence System* (GFIS), and special studies. Over 4,500 futurists, scholars, business planners, and policy makers who work for international organizations, governments, corporations, NGOs, and universities have participated in The Millennium Project's research, since its inception, in 1992 and founding in 1996. The Millennium Project was selected among the top ten think tanks in the world for new ideas and paradigms by the 2013 and 2014 University of Pennsylvania's GoTo Think Tank Index, and 2012 Computerworld Honors Laureate for its contributions to collective intelligence systems.

nanotechnology, Internet of Things & Tele-Everything, semantic web, quantum computing, tele-presence & holographic communications, intelligence augmentation, collective intelligence, blockchain, 3D/4D printing materials and biology, drones and other driverless vehicles, conscious-technology will greatly improve energy efficiencies and what we think is possible for the future of civilization.

According to Glenn (2018), it is widely understood that the applications of artificial narrow intelligence (ANI) to all elements of the industrial production processes and service industries (The Fourth Industrial Revolution) will have a great impact on energy, employment, and the economy. However, it is less well understood, that the applications of artificial general intelligence (AGI) and synergies among next technologies will make far more change than ANI and could create the **Self-Actualization Economy and Culture**. The three forms of AI (i.e. artificial narrow intelligence, artificial general intelligence, and artificial superintelligence) are often lumped together as AI. This much confuses the ongoing discussion about AI. Glenn presented the alternative Future of Work/Technology 2050 global scenarios created within the Millennium Project (Glenn & Florescu 2018): 1) It's Complicated – A Mixed Bag; 2) Political/Economic Turmoil – Future Despair, and 3) If Humans Were Free – The Self-Actualizing Economy. He highlighted the third scenario and depicted its contents in a nutshell as follows:

- Collaborate with whom you want, rather than those you have to in a job, work-at-home, tele-work, more energy efficient
- Create your own sharing economy – Peer-to-Peer: what would you like to share?
- Free to pursue what you think gives meaning to life, self-actualization, not forced to compete for same status; hence, less social conflict (which wastes energy)
- What environmental/other caucuses do you want to pursue?
- DIY products from community sharing 3D Printers, design and build your own environment, shoes, etc.

In relation to climate change and CO2 emissions he also highlighted some aspects such as:

- Meat production produces more GHGs than transportation (FAO 2006)
- Meat without growing animals (Pure Meat)
- Not only do we have to cut GHG emission, but we have to take some out of the atmosphere.
- Saltwater agriculture takes CO2 out, no rain needed, produces food for humans and animals, produces biofuels, shrimp, pulp for paper (reducing need to cut trees), reduces water demand for fresh water agriculture

Glenn's presentation was aimed at providing input and inspiration to the small group discussions.

4. How to organise a circular economy with renewable energy and peer-to-peer principles? (Group Work)

After the Futures Provocation by Heinonen and Karjalainen as well as the Keynote Speech by Jerome Glenn, five groups were formed for working. Each group was moderated by a member or affiliate of the FFRC Staff to discuss the question ***"How to organise a circular economy with renewable energy and peer-to-peer principles?"*** The groups were formed randomly by colour "lottery".[8] This was in order to have groups representing different backgrounds and thus diversity of views.[9]

Each group was first asked to select the perspective and topic from which they would address the above mentioned key question, such as housing, mobility, leisure, production, security, health, equality, new risks, or any other theme they wished to choose. For instance, if the group chose leisure as their theme, they would discuss the question "How is leisure organized in a circular economy that is powered by renewable energy and has adopted peer-to-peer principles?" The groups discussed freely, creating and brainstorming new ideas. The groups were also asked to think of concrete examples related to their chosen topic, such as kinds of new products, innovations, new ways of working, or new risks could exist or emerge.

The groups were then also asked to think what would happen, if a future technology (e.g. Artificial Intelligence / Big Data / Blockchain / Internet of Things / 3D Printing / Robotized Services / Nanotechnology) was combined to their topic. E.g. a group would ask: "How is leisure changed in a circular economy that is powered by renewable energy and has adopted peer-to-peer principles, when *robotized services* become mainstream?"

The groups discussed their chosen topics independently and wrote down their ideas on post-its and flipcharts, assisted by their moderators. The groups were asked to produce three main ideas of their work. This is a futuring method called "three crowns", invented by professor Pentti Malaska.[10] The most important idea of each group was in the final stage of

[8] The groups were represented by colours (red, green, yellow, orange and blue). Each participant would draw a card where the colour indicated the group selection.
[9] This objective is one of the key elements in innovative futures workshops and futures cliniques, especially (for futures workshop methods see more in Heinonen & Ruotsalainen 2013).
[10] The core idea of this method is to come up with a huge amount of innovative ideas by a group, then to be filtered out into three core ideas that the group finds most valuable and interesting. Due

the session presented for direct feedback from Jerome Glenn and for the other workshop participants (see the following chapters).[11] Sirkka Heinonen and Jerome Glenn also circulated visiting in all groups during the group work process.

The participation design aimed at effectiveness. The lightweight structure placed emphasis on the group talking freely together about their ideas - first to form them, then to re-think them from a new frame. In this general and abstracted mode, the moderated approach used was to combine creativity and criticality - generating ideas, and then going further with them by taking some new angle on them. (Balcom Raleigh & Heinonen 2018).

In the following, the results of the groups' work is presented (in alphabetical order of the moderator's names). Nicolas Balcom Raleigh, Joni Karjalainen and Hazel Salminen are project researchers at Finland Futures Research Centre (FFRC), Morgan Shaw is from the Master's Programme in Futures Studies, and Svenja van Vugt is an intern at FFRC.

to time constraints, out of these three core "crowns" of ideation, one was chosen for presentation, while all three were documented and possibly elaborated later on.

[11] Discussion and results reported by each group moderator accordingly, with the exception of Svenja van Vugt's group work being reported by Joni Karjalainen. Svenja moved directly after the conference to project work in the Mekong Region and was therefore unable to make the group reporting.

4.1 Mobility, equality, and distributing aspirational dreams as personal simulations (Nicolas Balcom Raleigh)

Group members: Kirsi Jansa, Asta Kurhila, Miki Kuriyabashi, Sheba Nair, Aleksej Nareiko, Martyn Richards, Nicolas Balcom Raleigh (moderator)

This group chose *mobility* and *equality* as their topics. They worked together to answer the question ***"How could mobility and equality be achieved in a circular economy powered by peer-to-peer renewable energy?"*** Group members took a moment to think individually about the question, paying attention to what new products, innovations, new way of workings, and risks would exist or emerge. They then took turns sharing their thoughts and ideas. All group members highlighted some key characteristics and critical variables of such a future. Many also described a future product or service that could contribute to mobility and equality in society.

The group's ideas were innovative and plausible. For instance, there would be a high cost to develop and install new technology and infrastructure required to have a peer-to-peer 100% renewable energy system and widely available and affordable mobility. ***Mobility in a 100% renewable energy world would run on technologies such as biofuels, ride sharing, electric vehicles, and alternative sources of energy***. While the world has decided to run on 100% renewable energy, new international laws may be required to prevent some countries from attempting to 'get ahead' by using fossil fuels known to exist within their borders. To pay for this transformation, a new taxation system might be required that touches any material or asset, even currency itself, to support infrastructure development and the equal distribution of mobility services. It was noted that some future mobility systems, such as self-driving taxis, would cause a loss of jobs which would negatively impact equality. ***A positive impact on equality might come from technologies that allow people and vehicles generating surplus energy while in motion that could be shared and distributed.*** Going further, our brains could contribute to the ***circular economy of energy***. Since ***brains consume part of the energy we need – how could 'mindpower' be literally harnessed?*** A new product could emerge that is capable of capturing this mind energy.

New real-time mobility data could be used to monitor the mobility system for how well it is currently supporting equality in society. Policy measures could support people in making mobility choices that are better for their health and well-being. For example, high-speed modes of mobility may be perceived to have a detrimental effect on well-being and would be discouraged through economic mechanisms that incentivize people to choose 'healthier' slower modes of mobility.

Environmental and energy costs of travel could be reduced as virtual projection technologies enable people to attend conferences and meeting without physically traveling some distance. ***Virtual projection would be the main mode of 'transportation.'*** Meanwhile, community-owned fleets of drones would be used by people to move physical objects around their neighborhoods, towns, and cities. The motivation for virtual projection and these fleets of 'hauling drones' is to reduce the energy required for moving around, which would thereby equalize access to mobility.

A key issue for promoting equality is to societally learn how to transition from the competitive worldview dominating today to seeing each other as equals. ***Equality lenses could help us change our perspective, so we no longer see winners and losers.*** Furthermore, there could be some form of mind training to help people see each other as equals and reduce competition.

A critical issue for equality is sharing and how best to share resources among people. Would it be driven by regulations or some other basis? If it were easy for individuals to see what people need, perhaps it could be voluntary. A philosophical point was raised as well. Equality can be seen in different ways: are we equal when we share everything equally at the beginning? Or at the end, when we see someone needs something more? Terms like equality and well-being are challenging to define – are they some material distribution or some other dimension? And are there alternatives to evaluating thinking of beginning and an end state or could there be more processual models. What would allow people to be equal on a moment-to-moment basis?

Technological focus

For the second phase of the conversation, the group added some radical technologies to the mix to see how their ideas changed. ***The group added 3D Printing, Mixed Reality, Synthetic Biology, and Artificial General Intelligence (AGI)***. These technologies added new dimensions to the previous ideas. For example, instead of virtual projection, we might 3D print replicas of ourselves, parts of ourselves, or objects that represent some characteristic of our being to interact with others. AGI could be used by individuals to run virtual tests or simulations of various actions in their environment. A person's simulation would emulate their way of thinking and include the same environment and social situation. ***You could ask, 'If I do this action, how would I feel?"***

Mixed Reality would make virtual projection much more interesting as companies, organizations or everyday people could meet anywhere and create exotic locations. The concept could be called ***shared consciousness space***. Mixed reality technology would be easy to use through simple and widely available devices. 3D Printing could be used to

address the material resource costs of infrastructure development – ***for instance tram lines could be 3D printed using recycled material and when an infrastructure is taken down, its material could be reused for the next infrastructure that is printed.*** To help people evolve from our competitive selves, something like a nicotine patch could be developed that eliminates bias and prejudice in people's thinking – by manipulating enzymes and such, it could shape our perceptions. This patch would help humans stop being 'competitive monsters' and learn how to be compassionate collaborators. A provocative idea, based on the assumption that these radical technologies could prolong lifespans, was that ***there may need to be maximum lifespans to help equalize how much time everyone gets to be alive***.

The group selected their three most interesting ideas, with a goal of eventually settling on one most interesting and important idea to present. As the group engaged in this process their combinative creativity continued as their network of ideas continued mingling. For example, ***"the equality patch" combined with "the shared consciousness space" – so the beings we send there would be more compassionate than we are***. As the group discussed the personal simulator, they questioned how it related to mobility and equality. The answer they came to is that the simulator would help people not only avoid bad consequences for themselves, but for society as a whole, leading to improvements for all. Furthermore, the simulator could equalize the availability of aspirations. People dream of different actions and goals they can do depending on where they were born and their life situations – so the personal simulator could help distribute more equally what kinds of aspirations and goals people can have.

The most important idea

For the plenary session, the group presented its idea for a personal futures simulator. The simulator would allow an individual to test daily decisions and learn which choices were best for their well-being and promoting equality in society. The system would include a model of the individual as an actor and take into consideration society and the wider environment. The personal futures simulator would also help distribute personal aspirations, helping people in disadvantaged situations to encounter and identify dreams of people with greater privilege. For example, a person in a developing nation could share and feel empowered to pursue a dream held by a privileged person in a developed country. Glenn commented that if this personal simulator concept were a business, it would sell quite well. He encouraged the group to pursue a patent and assemble a smart team to get started building it right away.

Group facilitator Balcom Raleigh interprets some additional dimensions to the group's personal simulator concept. As a future image, it points to ***actions that could be taken today to more equally distribute access to dreams and aspirations***. For example, education is a key way people today expand their personal capacities and awareness of their personal potentials. A person's access to education involves many factors – such as the availability and quality of an education system, mobility to travel physically to and from an education facility, and virtual connectivity and device know-how to take part in an educational process from a distance. Engaging in educational processes to maximum benefit requires self-reflection, critical thinking, and creativity while entering various 'shared consciousness space' to mingle, stretch, challenge, grow, and transform one's thinking. Human mind, when properly respected and nurtured by individuals, personal networks, and larger society, can serve as a personal choice simulators and dream generator. In other words, if we focus our social systems, political power, and money on maximizing learning among people, great equalities in human potential could be achieved.

To summarize some of the main themes from this group: As new technologies bring humanity greater capacities for simulating, analysing, and making decisions, big and small, it would be ideal for these capacities to focus on the fair and equal distribution of value (e.g. mobility) among people.

4.2 Peer-to-peer learning – aided by robotisation and AI or not? (Joni Karjalainen)

Group members: Pascale van Doren, Minna-Riitta Nummelin, Pieter Vullers, Katriina Siivonen, Moeketsi Mpholo, Joni Karjalainen (moderator)

The group chose as their topic the nexus of skills, education-to-employment, and inequalities. Consequently, their main questions were: ***"What kinds of education and skills are needed to overcome inequalities in a circular economy that adopts peer-to-peer principles and is powered by renewable energy? And what kinds of new jobs will be available in that kind of a society?"***

The group started their discussion by conceptualizing how education and learning are expected to respond to changing societal circumstances. What kinds of education and novel skills will be needed? Who will be in charge of delivering education and skills in a peer-to-peer society? Adopting peer-to-peer principles means that learning becomes even more horizontal, and far less hierarchical than what it is today. Overall, ***old values will disappear – and the world will move from a vertical organization to increasingly horizontal modes of interaction***. In a learning-by-doing mode, each individual would be able to teach their peers. Citizens could trade their knowledge in exchange for the knowledge of others. If there are personal energy coaches, perhaps these ***energy coaches do not teach in a traditional top-down mode but energy learning is rather based on peer-learning***.

The knowledge of all individuals would be valuable because while no one knows everything, everyone knows something. ***Even children could be experts in this world!*** In the past, children have often adopted new practices ahead of their parents in environmental issues, such as recycling. In terms of knowledge generation and dissemination, an arising question was that if schools teach children, and they in turn teach their parents, ***who educates the children's educators, and according to which principles?*** This raised interesting debates on what kinds of schools will exist in the future, and whether there will be schools in the future at all. Alternatively, artificial intelligence (AI) could perhaps be harnessed to educate individuals and inform them of their daily learning goals. Again, in this technology-aided scenario, the resulting question is ***who will be in charge of programming the artificial intelligence?*** There seemed to be a contrast: Will artificial intelligence tell individuals 'what to do' or will artificial intelligence be used as an aid for citizens to help them explore 'what they want to do'?

A more complex world implies a pronounced need for ***the endorsement of systemic thinking and the valuation of nature and ecosystems services, in recognition of complexity to avoid reductionism, and the linkages between the economy, society and the Earth***. The food-

water-energy nexus also has implications for the agricultural sector. Even in a circular economy, there will be energy and material flows, as energy will flow in and out of the circular economy. Education will be necessary to translate such macro-level concepts in a practical way to change the actions of individuals and companies and to inform decision-makers. These principles of learning would be applied for the scaling up of the circular economy and the self-production of renewable energy.

If energy was produced everywhere, this would create new types of interactions. Self-producing energy nurtures a mode of ***"me producing energy to you"***. From a technological standpoint, the micro-production of energy would mean that an ordinary person could be able to go jogging, generate energy for instance through movement, and this generated energy could then be transferred and used by a neighbour for different energy needs, such as lighting or heating. This would imply the adoption of the principles of a sharing economy. New peer-to-peer producer networks between individuals would be created and this would also allow co-creation. In terms of physical arrangements, there would be local peer-to-peer networks and global interconnectedness would be aided through artificial intelligences. Consequently, ***networks would be 'glocal' by nature***.

As a critical point, it was asked how different parts of the world would benefit from such envisioned changes, and whether social cohesion could be improved. To begin with, all societies would not start from the same circumstances. Even if the world has become 'smaller', life conditions and regional circumstances are different around the world and even within continents. In what is labelled as the Global South – Asian countries are different from one another and largely different from African countries – whereas Western countries have also their particularities. A pessimistic scenario would envision an even more divided world and deepening inequalities. In principle, a peer-to-peer ethos was however expected to improve the chances of enhancing social cohesion globally.

The group discussed how ***in the 1970s, it was thought that automatization of routine tasks would bring people with more leisure time, but this did not really happen***[12]. Perhaps in the future people are freer to think about what they wish to do for their life and career. It was argued that the diversity of skills would be important for resilience. Furthermore, cultures themselves, which provide people's lives with meaning by structuring them, are increasingly fluid. Perhaps in some societies, fighting inequalities will be more pronounced than in others. Global inequalities would also have to be taken into account, when thinking of the

[12] The increasing penetration of automatized technologies has also fuelled fears of joblessness. However, similar fears prevailed in the past, and technological change did not result in mass unemployment.

emergence of the diffusion of these principles. The material and technological basis could be a factor to be taken into account in the design of the delivery of peer-to-peer based skills and education.

Technological focus

As the technology that could alter their future, the group then chose to examine the impact of robotisation in peer-to-peer learning. The group began to discuss whether robotisation, artificial intelligences (AI), and algorithms could be harnessed to accelerate self-learning, the acquisition of new skills and knowledge for renewable energy and a circular economy at all levels of society. Again, a question about power was repeated, namely: ***"Who is programming these robots?"*** If education and learning would be peer-based, so would be the programming of robots. Just like anyone could teach their friend, colleague or family – robots could be programmed and coded in open source mode – like with Linux. Even still, if algorithms were able to expedite learning, it would mean that there would have to be ***sets of rules and principles that guide programming and teaching contents***. Filters would perhaps be needed because a likely weakness also in peer-based learning is the circulation of "rubbish" information. In the case of social media, groups and platforms such as 4chan have also expanded the diffusion of hateful and disturbing contents. It seems that even in the peer-to-peer based future, ***science-based information and knowledge as well as values such as solidarity and democracy will still have an important role***. These remarks highlight the dynamics of how knowledge in a peer-to-peer society is diffused.

In addition, the group members considered ***synthetic biology and genomics*** to be an interesting theme, but at the same time these topics were found to be too difficult to be discussed in this session without prior information of their potential impacts.

The most important idea

As the most important idea of the group, the group raised the role of robotization and artificial intelligence in peer-to-peer based learning. It was debated whether using them could expedite learning and awareness-building for building a circular economy and adopting renewable energy technologies faster. The group also proposed to endorse more carefully the principles of systemic thinking. The key questions seemed to be: who is in charge of the learning contents, and who programmes the robots and the artificial intelligences? As a response to the group, Jerome Glenn commented that ***an immersive learning environment with augmented reality could actually be a more impactful means for peer-to-peer based learning experiences than the use of robotization and AI***. At least in the present, when robots have been harnessed to teach languages, the outcomes have been found to be rather clumsy and expensive.

4.3 Farewell to hospitals: decentralised, multi-technology health care (Hazel Salminen)

Group members: Teija Ahlholm, Mikko Dufva, Päivi Holopainen, Michael Jackson, Erik F. Øverland, Hazel Salminen (moderator)

At the outset of the process, the group chose 'health' as the focal topic of the discussion. The question arose as to what the time frame for the discussion was, and the group settled on roughly 20 years, i.e. looking at the year 2040. The group then proceeded to brainstorming on ***topics related to trends we are now seeing in the health sector and that could change how we think about health (as well as health care, disease, and well-being)***.

One of the very first trends discussed was ***the lessening need for centralised hospital buildings***, as the technology, i.e. devices, is becoming smaller and increasingly interconnected, which means the services can be operated from a distance and the systems can be decentralised. In a few years, we may not even need hospitals – at least not in the form of the buildings and centralised care centres that exist today! Doctors can treat patients over an Internet connection, and self-treatment becomes more common.

In this line, the group found that also ***preventive health care*** will become increasingly common. Self-tracking, self-diagnosing, and biohacking are already a trend amongst the tech-oriented self-improvers out there, and the development of DNA diagnostics will also be used. However, also "old" methods like exercise and eating healthily will continue to be important, but increasingly intertwined with new technological developments and devices.

The ***connection between food and health*** was also believed to increase in importance. The more is known about nutrition and our individual well-being, the more optimally we can be guided to preventive measures, and the longer and healthier we could live. However, human beings are not known to quite fully realise that our short-term behaviour can be detrimental to our long-term well-being. One beer here and a dessert there, and finding new excuses not to go to the gym… This is where the support from technology comes in. There are already systems in place for example in cars where there is a sensor monitoring the speed and petrol use. They can tell you "You are now driving too fast – if you continue, you will use more petrol." These kinds of technologies can help us think long-term, also about our own health. If the system recognises that you are not eating healthily or exercising enough, it can tell you "If you continue in this way, in 10 years' time, you will have a big health problem." Hopefully this can help us see our actions in a longer perspective.

In general, these developments seemed to contain lots of positive aspects: preventive care is efficient, as diseases can be found earlier than in our current symptom-based health care system, experts' knowledge can be used more widely due to the use of video connections, and the technologies used to treat diseases are becoming more precise, e.g. cancer treatments will only attack the cancer cells, not the surrounding tissue. Knowing what to eat in order to support our health and wellbeing is certainly a good thing.

However, the group also soon identified several negative developments that could become important issues and even cause societal unrest, if realised. Firstly, not everyone will have access to this technologized health and preventive care, which will strengthen the current development of a ***division of the population into the "haves" and the "have-nots"***. What happens to those who cannot afford the preventive technology, or are not able to use it? The group found that instead of focusing on the individual – as self-tracking and self-diagnosing does – perhaps society could be shifting towards the community? So, as a response to the inequality differences in access could be that a new sense of community emerges, a ***community where peers take care of each other***. Due to the restricted time for the exercise, this idea was unfortunately not explored further.

Secondly, the constant tracking and monitoring of our bodies is not risk-free, either. Will this self-monitoring be by choice or enforced? A plausible scenario was seen as the continuation of a situation that already exists: in some countries, if you have a pre-existing condition, you might not be eligible for health insurance. ***What happens if "the system" knows all about you*** – not only the measured activity of your body, but also your DNA information? The system also knows what you have been eating, or if you have been smoking, which can affect your access to health care, or at least how much you have to pay for it. We may also start to censor our actions because the authorities are likely to have or be able to gain access to our locations and actions. This is both a political and psychological discussion to be had.

The discussion then went deeper into DNA diagnostics and its repercussions on how health/disease as well as human beings will be treated in the future. ***The more we understand our DNA, the better we can for example foresee people's diseases*** – even before birth! A member of the group pointed out that DNA tests can already scan for hereditary diseases, and the results will only become more exact in the years to come. The knowledge of medical drugs will also improve, so that when administered, the beneficial effects as well as the side effects will be known, and the patient can make a decision based on them both. ***DNA profiling*** might lead to the whole population being profiled. For better and worse, simulation could be used to assess which individuals have a higher risk of e.g.

cancer, and this information could be used to help people stay healthier—or, as mentioned earlier, exclude them from health insurance because of their predisposition. Are we under risk of creating a system of genetic discrimination?

The group found that this continuing ***technologisation of our society may lead to counter reactions***, e.g. in the form of a ***"naturals" movement***, bringing together people who are opposed to the constant tracking, testing, and profiling of our bodies. Already today we are seeing a similar movement that is critical of vaccines, and it may well grow to encompass the distrust in other health technologies and treatments, as well. Perhaps there will be a ***growing trust in peers, not in the "system"***? People in our immediate surroundings, people whose knowledge we trust because of personal relationships, as well as our own personal, anecdotal experiences, may be seen as more reliable than the official information—which depending on how the society is run can be based either on objective, scientific knowledge, or on politically coloured information. Indeed, in this so-called "post-truth" world, it is becoming more difficult to distinguish facts from opinions.

Much of the conversation related to the counter movements centred on ***what is seen as "natural" and what is not***. Are gene therapy treatments natural? The same discussions are also taking place e.g. in the environmental field: is nuclear energy natural? And, is natural necessarily good and unnatural bad? One member of the group was very concerned about the conceptualisation of "natural" and "unnatural", because it highly directs people's reactions to and willingness to use various emerging technologies. They believed that, at the moment, with all the new developments, we are challenging the concept of what is natural. It is also the focus of some political movements. In a few decades, we might not focus on natural and naturalness as much anymore, as we are moving beyond it. This will change our understanding of reality in a fundamental way, as well as our ***conception of what is artificial***. In the end, the group found, we must discuss and try to find out where the good balance between nature and technology is. And, is technology necessarily non-natural, i.e. artificial?

Technological focus

In the following phase of the exercise, the group was supposed to choose one technology that could affect the future of their chosen topic. However, the group felt that picking just one did not make sense since technologies are interconnected, and ***everything will also be connected to the Internet***. Technology will be systemic. For major technological change, many technologies usually have to come together. In the discussion about possible new products or services, the above-mentioned concerns about how we humans function, as

well as the reality of many technologies coming together, sparked the following suggestions:

- As blood tests etc. are becoming cheaper, easier to do, and quicker to analyse, they could become a constant in our lives: perhaps, on a daily or weekly basis, we would do a home test to confirm that we are on the right track, and if not, have our diet and exercise routines tweaked?
- The new technology could also help humans become significantly more powerful (physically and mentally), e.g. through biohacking technologies. This would mean monitoring everything exactly and then optimising nutrition in order to make one's body and brain the best they can be. This can start already in the womb and go on for a person's entire life span.
- Instant gratification was seen as a reason why we eat unhealthy food, why we smoke and drink – because it feels nice right now. However, if we look 20 years down the line, we ***know*** it is not good for us. A product was suggested to work similarly to the bad-tasting nail polish that is used to keep children (and grown-ups) from biting their nails. When they bite their nails, the polish tastes so bad that, over time, it deters them from doing it again. In a similar way, we could have a product, a pill etc., which would make ice cream or any "junk food" taste so horrible that we never want to eat it again.

These examples were met with some scepticism or even cringing from the group. Why would we want products like this? How terrible would it be not to be able to enjoy things that are delicious or relaxing, even if they are not contributing to our best, most optimal health! Also, even if the technology would tell us what you ***should*** do, will we follow? This would make us a little robot-like, one group member commented. Where is our free choice? ***Is it our duty to be in perfect health?*** Instead, it is perhaps more plausible that technologies and products will be developed that enable us to keep our "bad" habits and still stay healthy, or even extend our life. It was suggested that, by 2040, a product in the form of a cocktail of drugs and DNA could be available that restores your body back to a youthful person. This sparked a conversation about extended life, which was seen as not necessarily being so far away.

The most important idea

After deliberating on possible counter movements, the natural-artificial divide, and extended life, the group finally returned to one of the first ideas discussed: the ***"No Hospitals"*** trend, and decided to present it as its most important idea for an aspect that would change by the year 2040 in the field of health. Here, it is specifically the combination of stable and

secure online connections (video conference with the medical doctor) and new diagnostics and treatment technologies that will bring with it the most change. So the most significant "technology" is the continued merging and collaboration through old and emerging technologies.

As human beings, we will surely continue to fall ill (albeit to a lesser degree due to increasing preventive health care and DNA diagnostics), but the actual spaces and structures of health care need not be like the hospitals we have today. Just a few years from now, we may not even consider planning and building these massive structures, such as hospitals and health care centres, anymore. The example shared with the whole workshop group was that when you feel unwell, ***you can be treated in your own bathroom, through a video connection to a doctor based anywhere in the world.*** There would be a small camera, no larger than a pill, which you would swallow, and based on the filmed material, the doctor could make the diagnosis. Then, you could use a 3-D printer to print the necessary pill that you take, which will go to your heart and fix whatever is wrong with it, or find the cancer cells and destroy them.

The group chose this idea because of its simplicity but also because it had certain shock value. ***What will happen to the entire infrastructure of health care, to the way we educate health care professionals***, etc.? Jerome Glenn found the idea quite probable and noted that Phillips are already working on a product where you can take a cocktail of cameras and drugs. The doctor will direct the pills and camera down to where e.g. the cancer is, and, like a Trojan horse, they will fool the cancer into thinking they are "friendly" cancer cells. Once in, they will turn into an enemy and destroy the cancer – and you won't need to have any invasive surgery.

Perhaps this development, with its increased effectiveness and decreased number of invasive surgeries, will also contribute to societal resources being used to care for a larger number of people? The risk is, however, that this efficient technology will only be available for a small number of well-off people, and that the share of have-nots will become more substantial. ***Technology is rarely the answer to societal problems*** – it usually fits into the existing power structures and supports those who are already privileged. In a field as crucial as health care, with accelerating technological change, we should work to ensure that this is not the direction we are moving in.

4.4 AI-Enabled Empathy Exchange (Morgan Shaw)

Group members: Jyri Karhapää, Emilia Kuuskoski, Carlos Pena, Saara Suurla, Zak Thamae, Morgan Shaw (moderator)

After brief initial deliberations, the group chose to focus on the question of "new risks" that might be present in a society organized around a "circular economy with renewable energy and peer-to-peer principles." The group began brainstorming around what kind of new risks these might be, narrowing the topic to new risks for individual members of such a society.

In the ensuing discussion, a number of competences were identified that would be necessary for future individuals to make the most of a peer-to-peer environment, all of which could create problems or limitations for an individual if they were absent or under-developed. ***Successful "peers"*** would have to be ***creative***; ***possess a high degree of self-knowledge*** in order to work effectively toward self-actualization (as one participant put it, "Because you can be anything, you could end up being nothing"); ***be extremely effective at separating signal from noise*** in order to focus and prioritize amidst a vast number of stimuli, to which they must be constantly attuned in order to avoid missing valuable but fleeting opportunities; ***quick to grasp and take advantage of new technologies***, which might be highly complex or require technical knowledge beyond that possessed by an average person; ***tolerant of instability*** in a fractured landscape of work and income; and ***able to cope with the stress of "impossible standards"***, especially in cases where performance could be highly quantified, and any apparent shortcomings would be highly visible and have a measured, seemingly "objective" quality. This is a particular danger where technologies like social media allow you to constantly compare yourself to the entire world's best examples of a particular skill or attribute.

Some anxiety was expressed by the group about the pressure placed on individuals in this kind of society, where they would bear a strong responsibility for actively engaging in continuous acts of self-determination. While this might be an exciting opportunity for many, others might instead feel overwhelmed, uninformed, or otherwise inadequate to this socially and psychologically demanding task. This could lead to them "falling through the cracks" or "out of the society," resulting in a failure of the peer-to-peer society to become an open and inclusive one. In addition, disruptive events such as personal bankruptcy would likely strain even those who had previously been able to manage these conditions effectively. As a result, the main question the group gravitated toward was: ***"What happens when individuals do not feel capable of managing new opportunities for autonomy?"***

The discussion repeatedly returned to the issue of interdependency, highlighting the way in which many people are currently able to deal with the lack of particular skills by relying on the abilities and goodwill of friends, family or members of work teams to help them fill in the gaps. The group questioned how forms of human interaction might change in the future, how they would be mediated through technology, and if trends like teleworking would lead to fewer opportunities for meaningful social interaction, which might produce negative consequences for mental health.

An important point that began to guide the rest of the discussion was the articulation by one member of the group of the ***"ABC of basic human needs"***, three fundamental values human beings pursue in their relationships to their societies: ***autonomy***, ***belonging***, and ***competence***. It was pointed out that while all three are necessary, each can also become detrimental to individuals if taken to an extreme. Individuals that become too autonomous risk isolation; those that find too strong a sense of belonging can see their own personal identity subsumed; and the overly competent can become unyielding perfectionists unable to appreciate what may be "good enough" in a particular context. Therefore, a balance must be struck that allows individuals to remain in a suitable place on the spectrum. In light of these values and the central question under consideration, the discussion then turned to potential future developments that could help to mitigate these risks.

The group discussed the desire to create a ***transparent trust economy*** built upon ***peer-to-peer data validation***. It was pointed out that the "hunter-gatherer brain" still responds to emotionally-resonant stories, but that this can be harmful if the data we are using to create these stories are fractured or incomplete. Stories should instead be built around holistic, trustworthy data sets. The metaphor of having your own personal "truth paint," a filter to assist in decision-making guided by AI markers "painted" onto useful and trustworthy circulating data in accordance with your specific criteria, was seen as appealing despite the risk that it might create further polarization.

Another proposal made during the discussion was for ***empathy as a new form of money***, as the group suggested that the economic system of a peer-to-peer circular economy renewable energy society might move away from the role that money currently plays. Forbes might begin publishing a "Most Empathetic" list highlighting those people who have contributed most to enhancing the common good. One group member's question of "How does empathy put bread on the table?" led to consideration of how this might occur through the ***ability to buy services with services*** (possibly on a blockchain), thereby creating a way to exchange your most highly-valued skills. The group identified the challenges

inherent in determining how are these services would be valued and preventing bubbles, since as with anything else skills can be over- or underrated.

Technological focus

As the technology that could have an impact on such a future, the group chose to explore the question of what robotized services might contribute to the lives of future individuals in such a society. The main outcome of this was a proposal for a ***Personal AI manager*** that both challenges you to reach more ambitious goals and comforts you when you struggle, building on its growing knowledge of you to help make you grow into the person you want to be. The "real-time measurement of freedom," would lead this AI to offer constant feedback about the impacts our choices have on social and environmental goals, hopefully leading to improved progress in ambitious collective undertakings. At the same time, it could also become another impossible standard leading an individual to ask more of themselves than they are capable of. An important undercurrent of this discussion is that ***AI cannot value things or create meaning, it can only reflect and help coordinate what people choose to see as valuable***.

The group seemed to agree that it is desirable to articulate positive, inspiring futures rather than producing change by inciting fear or panic. More powerful and generalized AI should aim to help bring people together more effectively and meaningfully, rather than isolate or replace them. Development of AI such ensure that it is empathetic as well as intelligent or can be used to strengthen human empathy in productive ways.

The most important idea

As the Most Important Idea produced, the group presented its three interconnected propositions for empathy-based approaches to countering the new risks discussed: the super-AI "Mother Earth," which coordinates human values toward greater environmental and social sustainability; an empathy-based currency; and the "Human Firewall" of social connections, possibly facilitated by new technologies, that protect the values of autonomy, belonging, and competence and enable people to engage with driving forces they may not entirely understand without fear.

In his feedback to this group, Glenn seized on the ***importance of empathy*** and commented that it is a necessary complement to intelligence if that intelligence is not to become ruthless and driven to reach its goals at any cost. This is something that should be of concern in any future efforts at human genetic enhancement and is also a crucial factor in developing future artificial intelligences.

4.5 Self-Actualization for Leisure (and Work) in Virtual Reality! (Svenja van Vugt)

Group members: Kirsi Maaria Forsell, Liisa Haapanen, Richard Hanna, Heikki Turtiainen, Svenja van Vugt (moderator)

The group chose ***leisure*** as their topic. Consequently, the group started discussions the following questions: ***"How leisure is organised in a future based on circular economy with renewable energy and peer-to-peer principles? What are the tools that constitute the sphere of leisure?"***

The group noted how owning, "growth for growth's sake" and "having more" might become less relevant in the future. Harnessing renewable energy in an electrified society that employs peer-to-peer principles, in turn, could mean that there would be different types of toys to play with, they could be even cheaper – and people could have more time to travel. In the future, ***travelling could be just one aspect of the leisure industry***. Travelling could take place more by boats and vehicles of different types rather than aviation. For instance boats, which are very expensive today, could be "timeshared" in a peer-to-peer manner and in line with the principles of ***circular economics***. E-bikes, gearing gadgets, and stuff to do things with would also ensure there is a physical dimension to leisure even when infrastructures change. Leisure industry would also provide more services.

One risk of self-organization and peer-to-peer principles could be the further blurring of work and leisure. How to strike a balance between work and leisure might be important, when no one from the outside can command the other to work "an X amount of hours". Some might end up working too much because one can work in any situation, at any time, from anywhere in the world. Others would prefer merely enjoying their abundant leisure time. In both extreme ends, mental health defects could increase. On the other hand, ***if a correct balance was struck, this would create an immense opportunity to ensure self-actualization***. If people were freer to choose what they want to do, they would be more likely to be willing to contribute. The introduction of basic income would pose a question of how much individuals are generally willing to do? Individuals could be assumed to have different needs and wants, some might want to do more, some less. As an ethical question, for those who want to do less, should there be a cost to ensure that everyone feels that they are contributing in an equal manner to the functioning to the welfare society – and if so, what would that cost be?

Technological focus

As a technology that could alter the future of leisure, ***the group mainly focused on the role of virtual reality***. Virtual reality would allow travelling to exotic locations, the Andes mountain tops or the Maldives islands, without travelling to faraway places, such as climbing mountains. A robot, a drone or a the AI could fetch experiences, such as climb to Mount Everest, on behalf of human beings. Then again, "real" travelling could still be preferred, due to it being more authentic and immersive than virtual travelling. Either virtual or real, the experience of locality would be valuable. ***Local economies and cultures might re-emerge in a globalized world thanks to the value of them being able to offer authentic and localized experiences***.

Then again, to make virtual travelling truly peer-to-peer, the aspect of sharing would be truly important. Eco-travelling could be organized amongst friends who agree that they travel jointly and meet local people. Villages or towns could have "travel huts" as hubs where people go together to serve as the point of departure. ***Drones could be community-owned, like shared cars, so that all individuals do not need to own everything***. Time travelling – to history or the future – would be truly revolutionary! Gaming industry, and games like Second Life (see: http://secondlife.com/), have already pioneered this. Escaping reality – perhaps bad when taken to the extreme – is after all what most people with hard daily jobs want. Could escapes from reality be made accessible even to low-income subsistence farmers around the world?

How far could the virtual reality immersion be taken – could people spend their entire lives there? Is it possible that in a faraway future, entire human lives will become digital or virtual without any physical element?[13] Ensuring basic needs, eating and physical exercise would still be needed for the human species. Perhaps work, seminars, conferences and business travel could also be transmitted into virtual reality! Recently, Facebook founder Mark Zuckerberg and an American woman organized a virtual reality meeting, which was taking place in a Caribbean Island.

As critical issues, it was pointed out that without energy production shifting to renewable energy, ***virtual reality travelling would merely substitute the carbon footprint of transport to emissions deriving from data storage, data services and data centres***. In contrast, if all energy was produced with renewable energy, even these emissions could be mitigated. To

[13] This reminds very much the dystopian future depicted in the movie Matrix (1999) where humans are plugged into machines and living in an alternative virtual reality.

make data centres energy-efficient, ***the waste heat emitted by the data centres could be used for heating***.

The future of work and jobs would frame the concept of leisure. In a self-actualized economy, leisure time would no longer be a reward. ***A guiding question for human lives would be: how is time used?*** The sense of belonging and finding meaning would surely remain as important elements. As a critical concern, a question was raised whether all people are ready for these self-organized lives without the aid of an external, hierarchical structures? Some people might feel that they are necessary. ***Perhaps the role of designers, organisers and planners could help the pragmatic realization of the principles of self-actualization***.

As the Most Important Ideas of the group, the group chose:

1) Virtual Travelling provided by peer-to-peer networks
2) The threat of losing (and the opportunity of finding) the work-life balance between (a) work and leisure and (b) reality vs. virtual reality
3) The mission of self-actualization, which is re-defining leisure and work

The most important idea

The group presented then their idea of ***Virtual Travelling provided by Peer-to-Peer Networks and from Tech Hubs Near the Travellers***. In such a future, the VR travel destinations range across the entire virtual reality. For instance, people living at the Andes would have provided the VR environment to provide an immersive and authentic experience for that particular destination. Glenn commented the group's thoughts by noting how ***leisure has changed its definition through time***. Initially, leisure meant something that is conducted in one's own time, according to one's own schedule. In the past, "a gentleman of leisure" was someone[14] with extra-income and able to set their own agendas. Glenn also liked the group's idea of doing something in leisure in digital environments that leads to self-actualization.

[14] Writers' comment: presumably also at those historical times, more often male than female.

5. Conclusions

The Millennium Project Special Session Group Work on "New great electrification as Cultural Transformation for post-oil era – Everybody on board!" raised a richness of varied views and ideas concerning the presented neo-carbon vision for the year 2050. This meant reflections of the futures of an economy that harnesses a new renewable energy system, and specific considerations were paid to how a circular economy could be organised with renewable energy in line with the peer-to-peer principles. Culture was highlighted as a game changer and catalyst for change in the context of cultural transformation besides economic, technological and political arena.

In his keynote speech Jerome Glenn opened up vistas for how it is widely understood that the applications of artificial narrow intelligence (ANI) to all elements of the industrial production processes and service industries (The Fourth Industrial Revolution) will have a great impact on energy, employment, and the economy, and how it is less well understood that the applications of artificial general intelligence (AGI) and synergies among next technologies will make far more change than ANI and could create the **Self-Actualization Economy and Culture**.

In consideration to the starting point for the workshop, the key question addressed in the workshop was ***"How to organise a circular economy with renewable energy and peer-to-peer principles?"*** Five moderated small groups tackled this issue as follows.

One group chose **mobility and equality** as their special focus and discussed how they could be achieved in the envisioned society. Virtual projection was considered to be the main mode of "transportation". A positive impact on equality might come from technologies that allow people and vehicles generating surplus energy while in motion that could be shared and distributed. The group raised philosophical issues as well: Are we equal when we share everything equally at the beginning? Or at the end, when we see someone needs something more? As technological focus, they added 3D printing, mixed reality, synthetic biology, artificial general intelligence to their reflections. A concept of shared consciousness space was created. For example, tram lines could be 3D printed using recycled material and when an infrastructure is taken down, its material could be reused for the next infrastructure that is printed. As the most important idea from their group a personal futures simulator was proposed. It would allow an individual to test daily decisions and learn which choices were best for their wellbeing and promoting equality in society. This group came

up with the entity of **Mobility, equality, and distributing aspirational dreams as personal simulations.**

The second group chose as their topic the nexus of **skills, education-to-employment, and inequalities**, asking what kinds of education and skills are needed to overcome and what kinds of new jobs will be available in that kind of a society? Personal energy coaches do not teach in traditional top-down mode but energy learning is instead based on peer learning. The knowledge of all individuals would be valuable because while no one knows everything, everyone knows something. A fundamental question was raised of who educates the children's educators, and according to which principles? When AI is harnessed for education, a core question is: who will be in charge of programming the AI? To go deeper in technological landscape the group chose to address the impact of robotisation in peer-to-peer learning. Robots could be programmed and coded in open source Linux-like mode. Sets of rules and principles to guide programming and teaching contents are needed. As the most important idea the group selected the role of robotisation and artificial intelligence in peer-to-peer based learning. An immersive learning environment with augmented reality could actually be a more impactful means for peer-to-peer learning experiences than the use and robotisation and AI. This group crystallized their reflexions to **Peer-to-peer learning – aided by robotisation and AI or not?**

The third group selected **health** as their focal issue, especially the connection between food and health. They highlighted the preventive health care. The current development of a division of population into the "haves" and "have-nots" may be strengthened with different access to technologized health preventive care. A community where peers take care of each other may arise, though. Constant monitoring creates problems, too. What happens if "the system" knows all about you? DNA profiling and technologisation of our society may lead to counter reactions, for example in the form of "naturals" movement. This group questioned the concepts of control, and what is natural/artificial. As technological focus, they emphasised interconnectedness and everything being connected to the Internet, as well as merging of old and new technologies. The most important idea is "no hospitals" as a result of stable and secure online connections, resulting in a future image of **Farewell to hospitals: decentralised, multi-technology health care**.

The fourth group concentrated on **new risks** for individual members of such a society. They identified a number of competences necessary for future individuals to make most of a peer-to-peer environment. Successful peers would have to be creative, possess a high degree of self-knowledge in order to work effectively towards self-actualisation, be able to separate signal from noise, grasp and take advantage of new technologies quickly, be

able to cope with the stress of "impossible standards". If such competences were lacking or under-developed, problems would be created for an individual. A critical question emerged: "What happens when individuals do not feel capable of managing new opportunities?" Three fundamental values – autonomy, belonging, and competence – were seen quintessential for human beings in their relationships to society. The group discussed the desire to create a transparent trust economy built upon peer-to-peer data validation. Empathy emerged as a new form of money, and services can be bought with services. As technological focus, the group chose to explore what robotised services might contribute to the lives of individuals. The main outcome from this was seen to be a Personal AI manager. As the most important idea the group gave its three interconnected propositions for empathy-based approaches to countering new risks: the super-AI "Mother earth", empathy-based currency, and the "Human Firewall" of social connections. Thus, the group envisioned their results into ***AI-Enabled Empathy Exchange***.

The fifth group took **leisure** as their topic and discussed how leisure is organised in the envisioned society and what the tools are that constitute the sphere of leisure. Owning might become less relevant in the future, and travelling could be just one aspect of leisure industry. In line with the principles of circular economy, for example now expensive boats could be "time-shared". Leisure industry would also provide more services. One risk of self-organisation and peer-to-peer principles could be further blurring of work and leisure. If a correct balance were struck, however, this would create an immense opportunity to ensure self-actualisation. As technological focus, the group mainly emphasised the role of virtual reality (VR). It would allow travelling to exotic locations, from the Andes Mountain tops to the Maldives islands. A robot, a drone or a the AI could fetch experiences, such as climb to Mount Everest, on behalf of human beings. Local economies and cultures might re-emerge in a globalized world offering authentic and localized experiences.

To make virtual travelling truly peer-to-peer, the aspect of sharing would be crucial. Eco-travelling could be organized amongst friends who agree that they travel jointly and meet local people. Villages or towns could have "travel huts" as hubs where people go together to serve as the point of departure. Drones could be community-owned, like shared cars, so that all individuals do not need to own everything. How far could the virtual reality immersion be taken – could people spend their entire lives there? On the other hand, without renewable energy production, virtual reality travelling would merely substitute the carbon footprint of transport to emissions deriving from data storage, data services and data centres. If all energy were produced with renewable energy, even these emissions could be mitigated. The waste heat emitted by the data centres could be used for heating.

As the most important idea the group presented Virtual Travelling provided by Peer-to-Peer Networks and from Tech Hubs Near the Travellers. They created a vision of **Self-Actualization for leisure (and work) in virtual reality**.

Overall, the following key issues can be noted in reflection of the workshop procedures. The themes chosen by the five groups were rather different and cover multiple spheres of life. Therefore, the results exemplify various points of view to emerging lifestyles and sources of change. In the phase, when the groups reflected the role of emerging technologies, artificial intelligences and robotisation received considerable emphasis. This can be viewed as a natural outcome of the exercise, bearing in mind the considerable attention that these topics have recently achieved in literature, media and citizen debates. Despite such interest, little is known of the exact impacts of these technologies or how their emergence could be expected to shape different spheres of life. There ***is both excitement and doubts of the potential of AI, robotisation and other emerging technologies***. Discussion in the several groups reflected a healthy balance between these two extremes: opportunities and risks. This reflects the pertinence of ethical considerations amidst anticipated technological change.

In summary, when thinking of the possible realisation of a circular economy with renewable energy, framed by peer-to-peer principles and practices, the discussion opened up a range of technological and social viewpoints that should be better taken into account in the future. ***Despite being given a rather challenging task, the groups managed to analyse anticipated changes in a systemic way***: the different relations of anticipated societal change (towards peer-to-peer), technological change (renewable energy & multiple emerging technologies) and ecological change (environmental pressures and climate change). Shaping social and business practice to serve ecological sustainability, when taking into account multi-faceted technological change, is a complex endeavour. This opens up room for interesting further debates on defining ecological sustainability in the future as well as the realization of genuinely sustainable practices.

A lively debate emerged on the hidden potential embedded in such envisioned changes. The majority of the most important ideas and innovations generated in the exercise were novel types of services. Many such ideas can be deemed rather radical and transformative by nature. Such ideas imply changes that challenge present infrastructure, organisational models and practices, harnessing of emerging technologies as well as underlying values. In order for these services to become widely adopted as social practices or commercially viable in the future, considerable changes must first take place. In addition, ***it should be even more carefully analysed, how the proposed new ideas align with the principles of***

circular economy and neo-carbonisation. In this sense, the discussion seems like an appropriate and insightful reflection of the claimed transformative potential of peer-to-peer and renewable energy technologies.

These debates open up a further question on leadership and implementation: ***who will take initiative, carry forward and shape the presented ideas for them to become reality?*** We need both pioneers at the company and grassroots level as well as transformative leadership.

REFERENCES

Neo-Carbon Energy research project (2014-2017): Key Results. https://urly.fi/WDs

* * *

Balcom Raleigh, Nicolas & Heinonen, Sirkka (2018) Entangling and enhancing creativity and criticality in transformative futuring processes. Accepted for publication in World Futures Review.

Bauwens, Michel (2005) The political economy of peer production. CTheory J. http://www.ctheory.net/articles.aspx?id=499 (Downloaded 21.9.2016)

Bauwens, Michel (2007) The Peer To Peer Manifesto: The Emergence of P2P Civilization and Political Economy. http://www.masternewmedia.org/news/2007/11/03/the_peer_to_peer_manifesto.htm

Benkler, Yochai (2017) Peer production, the commons, and the future of the firm, *Strat. Org.* 15 (2), 264–274.

Benyus, Janine M. (1997) *Biomimicry: Innovation Inspired by Nature*. HarperCollins, 288 p.

Bloomberg (2016a) Solar Sold in Chile at Lowest Ever, Half Price of Coal. (Ed.) Vanessa Dezem. Bloomberg 19.8.2016 http://www.bloomberg.com/news/articles/2016-08-19/solar-sells-in-chile-for-cheapest-ever-at-half-the-price-of-coal

Bogdanov, D. & Breyer, C. (2016) North-East Asian Super Grid for 100% Renewable Energy supply: Optimal mix of energy technologies for electricity, gas and heat supply options, *Energy Conversion and Management*, 112: 176–190.

Breyer, C. (2016) Launch: The Global Internet of Energy Model, Presentation at Seminar: Emission Free Future – Now. Energia 2016 – The Energy Event of Finland Tampere, October 2, 2016. http://www.neocarbonenergy.fi/wp-content/uploads/2015/03/Breyer.pdf

Breyer, C. – Heinonen, S. & Ruotsalainen, J. (2017) New consciousness: A societal and energetic vision for rebalancing humankind within the limits of planet Earth. *Technological Forecasting and Social Change*, 114: 7–15. http://dx.doi.org/10.1016/j.techfore.2016.06.029

Breyer, C. – Tsupari E. – Tikka V. & Vainikka P. (2015) Power-to-Gas as an emerging profitable business through creating an integrated value chain, *Energy Procedia*, 73, 182–189.

Dannreuther, Roland (2017) *Energy Security*. Polity Press

Dator, J. (2009) Alternative Futures at the Manoa School. *Journal of Futures Studies*, 14(2): 1–18.

Fattah, H.M. (2002) *P2P: How Peer-to-Peer Technology is Revolutionizing the Way We Do Business*. Chicago: Dearborn Trade Publishing, a Kaplan Professional Company.

Gladwell, M. (2000) *The Tipping Point: How Little Things Can Make a Big Difference*. Boston: Little, Brown.

Glenn, Jerome (2018) Future Self-Actualization Economy for sustainable and energy efficient society. Special keynote at FFRC conference Tampere, 14th June,16 ppt slides. https://futuresconference2018.files.wordpress.com/2018/06/jerome_glenn_future_self-actualisation_economy_for_sustainable_and_energy_sufficiency_society.pdf

Glenn, Jerome & Florescu, Elizabeth & MP nodes (2018) State of the Future. V 19.1. http://www.millennium-project.org/state-of-the-future-version-19-1/

Heinonen, Sirkka (2018) Scenarios as Stairways to Resilient Futures. Blog text at Finland Futures Research Centre Blog, 27th April. https://ffrc.wordpress.com/tag/resilience/

Heinonen, Sirkka (2018) Commentary speech to Michael Jackson's keynote on Artificial Intelligence. FFRC Conference, 13th June. Tampere, 17 ppt slides. https://futuresconference2018.files.wordpress.com/2018/06/heinonen_commentary.pdf

Heinonen, Sirkka & Karjalainen, Joni (2018) Futures Provocation for peer-to-peer energy culture. Presentation at FFRC Conference 14th June, 28 ppt slides. https://futuresconference2018.files.wordpress.com/2018/06/sirkka_heinonen_and_joni_karjalainen.pdf

Heinonen, Sirkka & Karjalainen, Joni (2017) Hybridimetodi tulevaisuuden energiamurroksen luotaamiseksi – heikkojen signaalien ja transformatiivisten skenaarioiden pohjalta tehty edelläkävijäanalyysi. *Futura* 3/2017: 18–42.

Heinonen, S., Karjalainen, J., Ruotsalainen, J. & Steinmüller, K. (2017) Surprise as the New Normal – Implications for Energy Security. *European Journal of Futures Research* 5: 12. https://doi.org/10.1007/s40309-017-0117-5

Heinonen, S., Kuusi, O., Salminen, H. (eds.) (2017) *How Do We Explore Our Futures?* Somero: Acta Futura Fennica 10.

Heinonen, Sirkka (2017) Pioneer analysis and international cultural changes. Application of positrend and negatrend analysis in the identification of cultural change. In: Heinonen, S., Kuusi, O & Salminen, H. (eds): *How do we explore futures?* Acta Futura Fennica nro 10, Helsinki, p. 241–251.

Heinonen, Sirkka, Ruotsalainen, Juho & Karjalainen, Joni (2017) Transformational Energy Futures 2050. Neo-Carbon Energy Societal Scenarios. FFRC eBOOK10/2017. Finland Futures Research Centre, University of Turku. 69 p. ISBN 978-952-249-495-5, ISSN 1797-1322. http://www.utu.fi/fi/yksikot/ffrc/julkaisut/e-tutu/Documents/eBook_10-2017.pdf

Heinonen, S. – Balcom Raleigh, N. – Karjalainen, J. – Minkkinen, M. – Parkkinen, M. & Ruotsalainen, J. (2015) CLA Game Report. Causal Layered Analysis Game on Neo-Carbon Energy Scenarios. FFRC eBOOK 12/2015. Finland Futures Research Centre, University of

Turku. 112 p. ISBN 978-952-249-403-0, ISSN 1797-1322. https://www.utu.fi/fi/yksikot/ffrc/julkaisut/e-tutu/Documents/eBook_12-2015.pdf

Heinonen, S. & Ruotsalainen, J. (2013) Futures Clinique – method for promoting futures learning and provoking radical futures. *European Journal of Futures Research* 15:7, DOI 10.1007/s40309-013-0007-4, 11 p. http://link.springer.com/article/10.1007%2Fs40309-013-0007-4.

Hiltunen, E. & Heinonen, S. (2012) Creative Foresight Space and the Futures Window: Using Visual Weak Signals to Enhance Anticipation and Innovation. *Futures* 44, 248–256.

Hiltunen, E. (2013) *Foresight and Innovation – How Companies Are Coping with the Future?* Palgrave Macmillan, UK.

Hiltunen, E. (2010) *Weak Signals in Organizational Futures Learning*, Doctoral dissertation. Helsinki: Aalto University School of Economics. http://epub.lib.aalto.fi/fi/diss/?cmd=show&dissid=400

Karjalainen, Joni & Heinonen, Sirkka (2018) The Pioneers of Renewable Energy are Around the World – What Can We Learn from Them? *Journal of Futures Studies* 22 (4): 83-100. DOI:10.6531/JFS.201806.22(4).0006 http://jfsdigital.org/wp-content/uploads/2018/06/06n-Glocal-Insights-Karjalainen-Heinonen.pdf

Kurzweil, Raymond (2005) *The Singularity is Near: When Humans Transcend Biology*. Viking Books: New York, 652 p.

Lesca, H. & Lesca N. (2014) *Strategic Decisions and Weak Signals: : Anticipation for Decision-Making.* John Wiley et Sons. New Jersey, 144 p.

Malaska, P. (2010) A more innovative direction has been ignored. In: *Understanding Neo-Growth. An Invitation to Sustainable Productivity*. TeliaSonera Finland Plc. Helsinki, p. 200–210. http://www.sonera.fi/media/13069ab55806de22e8955bc2a3f1afeab17b28bd/Understanding_Neogrowth.pdf

Mazzucato, M. (2015) The Green Entrepreneurial State, in *The Politics of Green Transformations*, Edited by: Scoones, Ian, Leach, Melissa and Newell, Peter (eds.), pp. 134–152. London and New York: Routledge

Neo-Carbon Energy – Internet of Energy Simulation Tool. www.neocarbonenergy.fi/internetofenergy/

De Souza Noel Simas Barbosa, L. – Orozco, J. F. – Bogdanov, D. – Vainikka, P. & Breyer, C. (2016) Hydropower and Power-to-gas Storage Options: The Brazilian Energy System Case Article, *Energy Procedia* 99: 89–107. http://dx.doi.org/10.1016/j.egypro.2016.10.101

Robertson, R. (1995) "Glocalization: Time-space and homogeneity-heterogeneity". In *Global modernities*, Edited by: Featherstone, M. – Lash, S. & Robertson, R., 25–44. London: Sage.

Rogers, E. M. (1962) *Diffusion of Innovations*, Glencoe: Free Press.

Ruotsalainen, Juho – Karjalainen, Joni – Child, Michael & Heinonen, Sirkka (2017) Culture, values, lifestyles, and power in energy futures: A critical peer-to-peer vision for renewable energy. *Energy Research & Social Science* 34: 231–239. http://www.sciencedirect.com/science/article/pii/S2214629617302402

Scholten, D. & Bosman, R. (2016) The geopolitics of renewables; exploring the political implications of renewable energy systems. *Technological Forecasting & Social Change* 103, pp. 273–283.

Similä, L. – Koljonen, T. & Forsström, J. (2016) Towards actor-based Neo-Carbon scenarios. *Neo-Carbon Energy Working Paper* 2/2016. VTT Technical Research Centre of Finland.

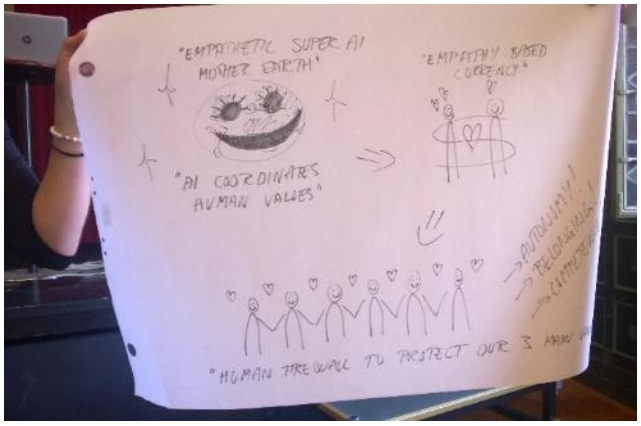
Wangel, J. (2011a) Exploring social structures and agency in backcasting studies for sustainable development. *Technological Forecasting & Social Change* 78, pp. 872–882.

Wangel, J. (2011b) Change by whom? Four ways of adding actors and governance in backcasting studies. *Futures* 43, 880–889.

Weaver, J. F. (ed.) (2017) Updated: Cheapest electricity on the planet is Mexican (actually) wind power at 1.77¢/kWh. Electrek Blog. https://electrek.co/2017/11/16/cheapest-electricity-on-the-planet-mexican-solar-power/

Von Weizsäcker, Ernst & Wijkman, Anders (2018) *Come On! Capitalism, Short-termism, Population and the Destruction of the Planet*. A report to the Club of Rome. Berlin.

APPENDIX 1. Photo stream from the Special Millennium Project Session (by Joni Karjalainen & Sirkka Heinonen)



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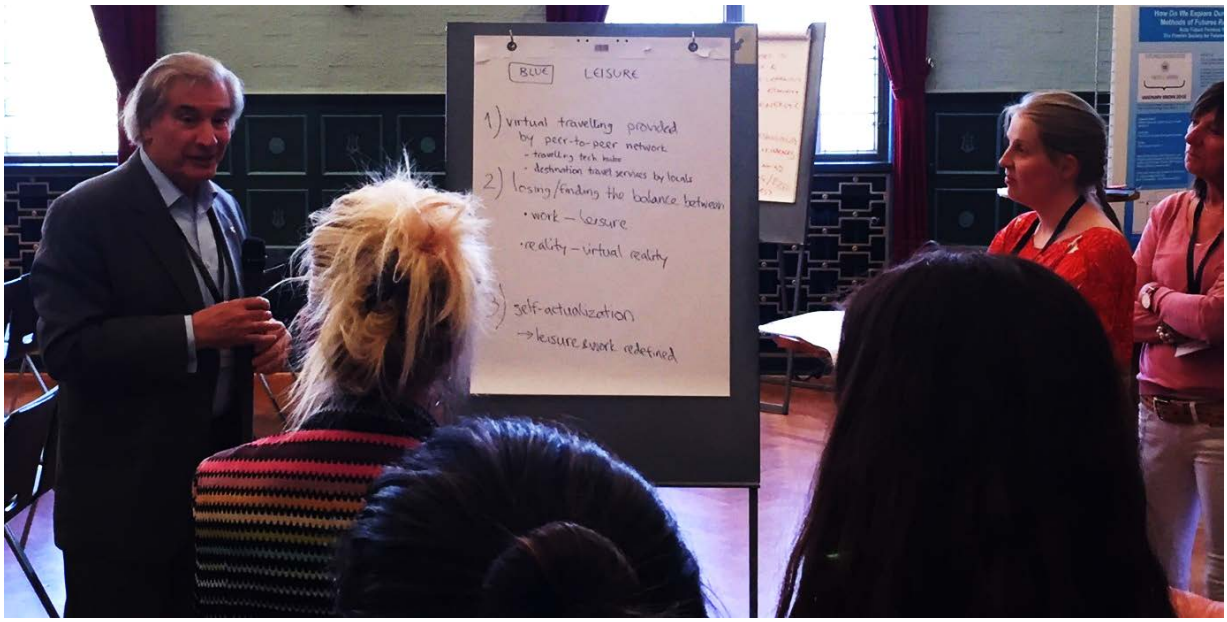
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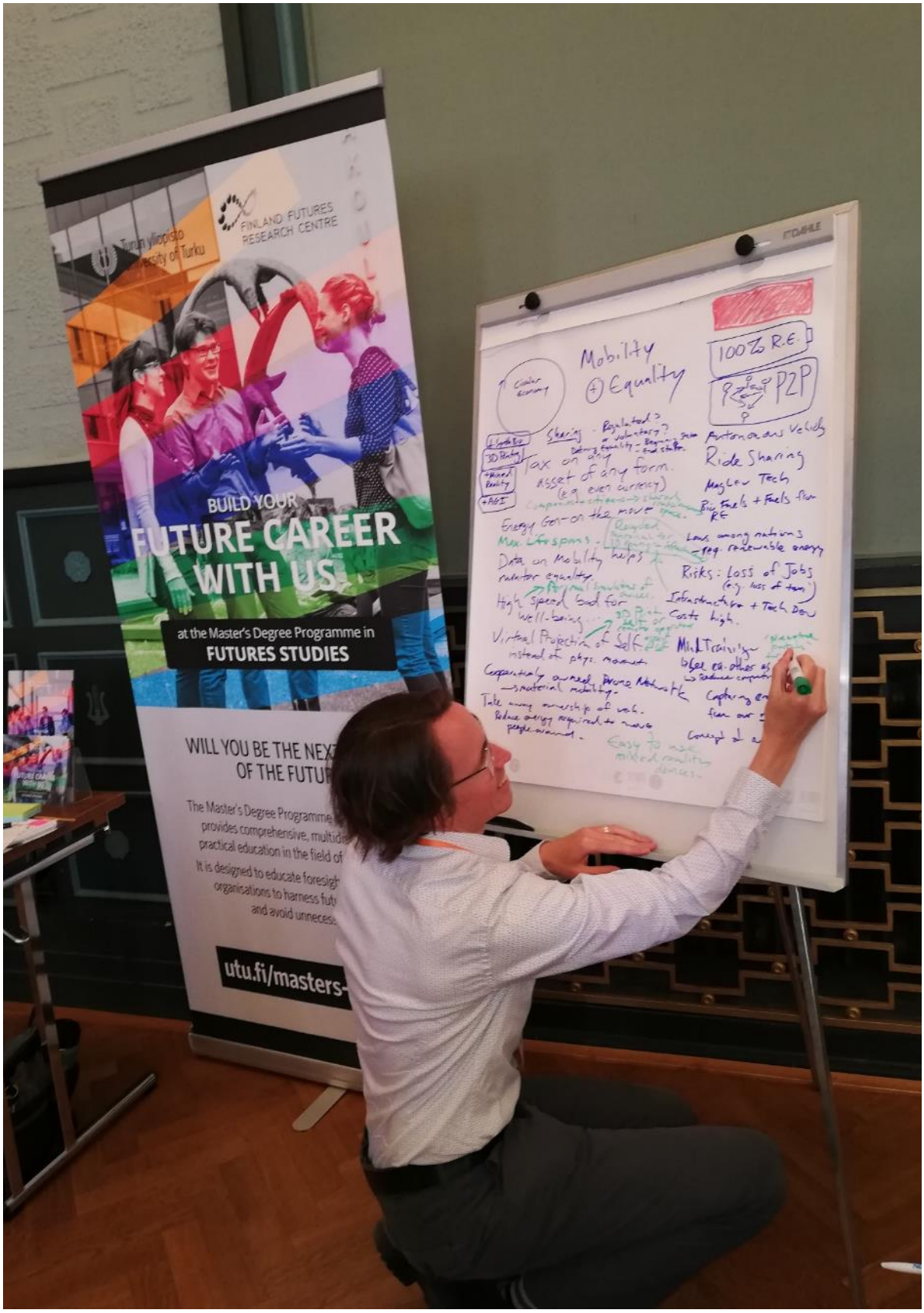
LEISURE
1) virtual travelling provided by peer-to-peer network
- travelling tech trade
- destination travel services by locals
2) losing/finding the balance between
• work – leisure
• reality – virtual reality
3) self-actualization
→ leisure & work redefined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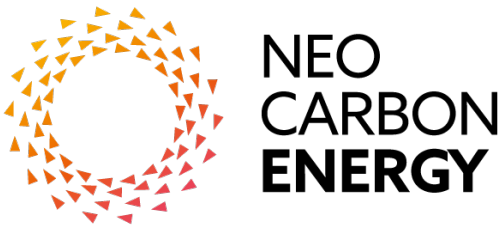

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