Surprise As the New Normal
Implications for Energy Security

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www.neocarbonenergy.fi
https://www.utu.fi/en/units/ffrc/research/projects/energy/Pages/neo-fore.aspx
Outline of Our Presentation

1. We study **energy transformations** – how to reach a 100% renewable energy society by 2050?

2. **VUCA world** – discontinuities, surprises, and unexpected events

3. Implications of surprises for energy security? Testing the resilience and anti-fragility of transformative scenarios – using results from a Futures Clinique
1. ENERGY TRANSFORMATIONS
ENERGY TRANSFORMATIONS

• **Climate change**: ’push’ for infrastructure *and* societal change.

• **Energy literature** typically focuses on techno-economic aspects of energy systems, less on socio-cultural aspects. However, technological and social change are intertwined.

• Many **proposals for ’energy transformations’** (carbon capture & storage, nuclear, *renewable energy system*)
What Is Neo-Carbon Energy Project?

How to reach a 100% renewable energy system by 2050?

One of the Tekes strategy research openings (2014-2017), in cooperation with the
- Technical Research Centre of Finland VTT
- Lappeenranta University of Technology LUT
- Finland Futures Research Centre FFRC

Prof Christian Breyer, LUT
Jerome Glenn, Director of the Millennium Project
Dr Pasi Vainikka, VTT, Project Coordinator

- Horizon scanning/weak signals
- Futures Cliniques
- Transformational Scenarios on Neo-Carbon Energy Futures 2050
- Pioneer analysis
- Discontinuities & Black Swans

Business, government and NGOs

Prof Sirkka Heinonen
FFRC, Future of Energy Innovations
Dr José Cordeiro, MP, Singularity University;

Dr Karlheinz Steinmüller
(Z_punkt /Millennium Project)
In the neo-carbon world, everything is produced emissions-free with solar, wind, and other renewables. Energy stored in batteries, smart grids, and synthetic hydrocarbons. Synthetic processes replace fossil-fuel based processes.

In the 20th century, infrastructure was centralized. In the 21st century decentralization proceeds and drives peer-to-peer society.
Great Electrification Generated by RE

- Aimed at electrification of society
  (electric vehicles, heating & cooling)
- With synthetic hydrocarbons the sectors which are difficult to run with electricity
  (e.g. aviation and freight transport) can be made emission-free

https://www.tesla.com/gigafactory
Energy and societal change

• Societal and cultural aspects of energy also matter

• Energy is not only a technological and ecological issue, but has implications for the whole society – its power relations, politics, culture, values, economy and production
1. RADICAL STARTUPS

3. GREEN DIY ENGINEERS

2. VALUE-DRIVEN TECHEMOTHS

4. NEW CONSCIOUSNESS

FOUR TRANSFORMATIONAL SCENARIOS 2050

http://www.theprofessionalcreative.com/wp-content/uploads/2014/10/apple-campus-2.jpg

http://mizzouwire.missouri.edu/stories/2008/green-engineering/

http://mizzouwire.missouri.edu/stories/2008/green-engineering/

http://www.wired.com/2014/11/thierry-cohen-darkened-cities/

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• Together with other technological developments, such as automation and AI, increases in (renewable) energy supply and decreases in energy price could steer our world into unknown futures.

• That is why it is increasingly crucial to anticipate emerging discontinuities and surprises in different sectors of society.
2. VUCA WORLD
WHAT DOES VUCA MEAN?

- **V** for ‘volatile’ that means ever changing
- **U** for ‘uncertain’, you have always problems to predict
- **C** for ‘complexity’ that means many factors interacting and
- **A** for ‘ambiguity’ that means that you have difficulties to make sense of it.

Interview of Karlheinz Steinmüller on VUCA World and Black Swans by Sirkka Heinonen at FFRC 18th May 2017
https://www.youtube.com/watch?v=IGOPmM5zGtQ
Discontinuities, Disruptions and Black Swans

Black Swans = sudden, improbable events with dramatic impacts
Change Everywhere

*Household Robots*

- Renewable Energy
- Natural Hazards
- Vertical Agriculture
- Blobitectur
- Global Connectivity

*What Surprises are Possible?*
... and Increase Vulnerabilities

WHAT ARE THE THREATS?

TEN GENERIC THREATS

EXTERNAL TENSIONS

PEER POLITICS

DELIBERATE DAMAGE

ECONOMIC BASE

INHERENT STRAIN

Y2K WALL STREET 2009

STUXNET 2010, NORWAY 2010,
GEORGIA 2008, ESTONIA 2007
NATO 1999

POLITICAL

FUNCTIONAL

DOMESTIC TENSIONS / STAGNATION

STRUCTURAL STABILITY

NO TUNNEL VISION

ECOSTRESS

ECOSTRESS

OIL PRICES
SOLAR STORMS
COST OF DISASTERS

ECOLOGICAL

DESECRIFICATION
FOOD PRICES

NATURAL RESOURCES

HABITAT

DEPLETION

DISRUPTION

DEGRADATION

Ries: Workshop Global Europe 2030/2050, Nov. 2010

Dr. Karlheinz Steinmüller
Z_punkt The Foresight Company
... and Increase Uncertainties ...

Foresight / Futures Research: Extrapolation. Speculation, Vision

Utopias (Hopes, Fears; Philosophy of History Science Fiction ...)

Predetermination

Foresight is Ignorance Management

Dr. Karlheinz Steinmüller
Z_punkt The Foresight Company
TRAP OF LINEAR THINKING

- The future is often anticipated through trends – through things that exist today and are familiar to us.

- Trends are a useful way to anticipate development. We know e.g. with relative certainty the size of global population in 2050.
FUTURE IS NOT EXTENSION OF PRESENT

• Such events that break the conventional linear development paths constantly occur.

• E.g. some surprising chain of events could accelerate the growth of the African economy
  
  ➢ Overcoming disease burden
  ➢ Enhanced gender balance
  ➢ Rapid and widescale adoption of ICTs
  ➢ International dynamics beyond colonial ties
  ➢ Increasing intra-African trade
  ➢ Slowdown of population growth
  ➢ Uptake of emerging technologies
Surprises and new directions can be anticipated beforehand by identifying and analysing weak signals (initial signs of change, new phenomena).

Sometimes they are launched by a black swan (sudden, surprising, unanticipated events with radical consequences).
• Weak signals and black swans are rather "uncertain" in anticipation.

• Instead, we can first pay attention to and analyse discontinuities.

• They are not individual phenomena or sudden events, but gradual, long-term and deep change processes consisting of different interlinking trends, weak signals (or new phenomena), and also black swans

-> “discontinuity clusters”
• Issues that create a discontinuous development process often come from different fields.

• E.g. for the iPhone Apple combined existing technologies in innovative ways rather than invented a new technology as such.

• Machine learning and AI bring about changes only when combined with other technologies and fields, such as financing, journalism, or diagnostics in medicine.
Trends and Their Impacts

Continuity

steady

Trends

low

Uncertainty

high

Primary Trend Impacts

& Interactions

Higher Trend Impacts & Interactions

Black Swans

disruptive
• The present rise of renewable energy and especially solar PVs is an example of discontinuity without black swan events.

• No longer than 10 years ago almost no one anticipated the rapid fall in cost of solar PVs.

• A major cause for the discontinuity in the price was China - the first country to mass-produce and offer cheap solar PV panels.

• Many other trends, converged to tip the solar development off its linear slow path.
Transformation needed, on its way

-> Need to understand the change
-> Need to understand and anticipate non-linearities
3. Implications of Surprises on Energy Security
As the world increasingly seeks to move towards a renewable energy based society, what implications can surprises have for energy security?
Black Swans Futures Clinique

Discontinuities were anticipated in five thematic fields.
These were chosen because of their significance in society & potential for surprises.

1) Politics: nation-states, governments, geopolitics, new ideologies
2) Corporations and economy
3) Civil society & peer-to-peer practices
4) Robotisation & artificial intelligence (AI)
5) New lifestyles

• Groups were free to explore these fields and their possible futures.
Thinking of discontinuities

- What are the latest emerging phenomena on your topic?

- What kinds of impacts could they have?

- The most interesting suggestions were clustered into 3-5 groups ("discontinuity clusters")
PESTEC Table method

- Chosen 3-5 clusters were then further worked

- What kinds of impacts could emerge from these discontinuities?

- What black swans could emerge?

- How do these impact renewable energy world?
| GROUP | BLACK SWANS | RENEWABLE ENERGY |
|-------|-------------|-----------------|
| 1) Politics: nation-states, governments, geopolitics, new ideologies | 1) Mega deaths; Giving up capitalism; Fossil fuel industry revenge + Total industrial revolution; New winner technology: Reformed UN; World fills with junk | 1) More off-grid energy; Smart political planning possible; Human rights case on clean energy |
| 2) Corporations and economy | 2) Internet or powergrid collapse; Super-zika epidemic; Collapse of a major state + Regional military conflict; Failed innovations; Blind leaders; Political shutdown of capitalist system; Forced regionalism; Electricity allergy | 2) Significant delays in development; Manual mode for all systems; Economic slow-down; Military mode; Death of the old worlds |
| 3) Civil society & peer-to-peer practices | 3) Global communality; Nation states disappear; Climate refugees; Virtual civil war | 3) Everyone has panels on the roof, but a big corporation owns them; Significantly advanced renewables; Self-sufficient energy |
| 4) Robotisation & artificial intelligence (AI) | 4) Humans revolt – go medieval; Robots revolt; Cyborgs; Weaponization of civil robots; Benevolent global government | 4) Saviour of people? Friend of robotic enemies? |
| 5) New lifestyles | 5) Limit no. of people (kill the wise, keep the stupid); Philosopher king; “Human container” for marginalised ones; New caste system; Direct democracy; Stimulation of nucleus accumbens; | 5) Decision to cut down consumption; National energy budgets (limited); Energy from space |
CROSS IMPACT ANALYSIS
BRAINSTORMING SESSION:
QUAN AND QUAL
ORGANISED at FFRC AFTER THE FUTURES CLINIQUE
### Post Black Swans Cross Impact Analysis

#### Impacts

| Transformational Scenarios 2050 | Radical Startups | Value-Driven Techemoths | Do-It-Yourself Engineers | New Consciousness |
|---------------------------------|------------------|--------------------------|--------------------------|-------------------|
| Society is organised around startups, which serve social and cultural goals besides economic ones. | Large technology companies, with a peer-to-peer ethos, have become “states within states”. | Citizens have organised as local communities to survive and ecological collapse. | Shared identities replace individualism. Robotisation and AI have enabled a self-actualizing economy. |

**Black Swan 1**
- Quantitative Qualitative

**Black Swan 2**
- Quantitative Qualitative

**Black Swan 3**
- Quantitative Qualitative

**Black Swan 4**

**HYBRID METHOD EXPERIMENT**

Scenarios – black swans – cross-impact
| Black swan | Radical Startups 2050 | Techemoths 2050 | Green DIY 2050 | New Consciousness 2050 |
|------------|-----------------------|----------------|---------------|-----------------------|
| Total Industrial Revolution (bio or 3D). | QUAN: ↑↑↑ QUAL: Boosts the Startups. Startups 3D print their renewables solutions. Fits small scale. Standardization problem. Problems because a big pool of data does not exist. | QUAN: ↑ QUAL: Monopolisation of 3D could stagnate economy. Further polarization. 3D print skyscrapers. | QUAN: ↑ QUAL: Recyclable 3D materials. Self-made 3D printers. | QUAN: ↑↑ QUAL: Open source of 3D, open ownership |
| Collapse of the United States of America | QUAN: ↑ QUAL: Exodus of US scientists and Silicon Valley. Radical startups in other countries. | QUAN: ↑↓ QUAL: Asian techemoths in China and India. Strong company power. US techemoths fall, Asian rise. | QUAN: ↑↑ QUAL: Multiple DIY communities especially in the US. Rejuvenation of the USA. | QUAN: ↓↓ QUAL: Security, US mercenaries. World of fear of other ‘failed states’. Vulnerable. Militant Buddhism. |
| Mass Deaths due to Climate Change such as ‘methane bomb’ | QUAN: ↑ QUAL: innovations/solutions to help or prevent. Changes ethos of startups profoundly. Or “we told you so”. Anti-fragility. | QUAN: ↑↑ QUAL: police-state like techemoths. Techemoths called to help, safe havens for survivors. Gov’t cannot help. | QUAN: ↑↓? QUAL: Survival of the fittest. Closed self-sufficient communities. Gov’t cannot help. | QUAN: First ↓↓, then ↑↑ QUAL: Empathy. First shock, then rethinking collective action. |
| Revenge of the Fossil Fuel Industry | QUAN: ↓ QUAL: Commercial, cyber warfare against RE startups. Some countries abandon Paris agreement. Finance fake news. | QUAN: ↓↓ QUAL: Old money vs. new money. Large oil companies warfare against RE techemoths. RE finance bubble blown by fossil companies. Dumping of the oil price. | QUAN: ↓↓ QUAL: DIY Engineers (and hobby technologies) criminalized and sanctioned. Execute activists. | QUAN: First ↓↓↓, then ↑↑↑ QUAL: Evangelisation of fossil thinking. Missionaries of the old world. Fake consciousness. But mostly revenge fails. |
| Digital Anarchy as “Virtual civil war” | QUAN: ↑ QUAL: Drone terrorism with facial recognition. Russia and North Korea as terrorist states. Hacked robots/IoT used in attacks. | QUAN: ↓↓ QUAL: Outside hackers as a counterforce. Very vulnerable. | QUAN: ↑ QUAL: Life without Internet is “normal”. Neo-luddites Internet-free. Back to analog tools / ways of produce. Back to handmade world. | QUAN: ↓↓, then ↑ QUAL: Vulnerable online life. Carbon capture. Diabolization of fossil thinking. |
Discontinuities emerge from complex interconnections of different developments, issues, technologies etc. – which may at first seem unrelated and insignificant, thus not easily recognised.

As the world is complex, discontinuities increase and the world becomes more volatile and surprise is the new normal.

When the world is seeking a transformation towards high shares of renewable energy (a 100% renewable energy society), anticipating vulnerabilities and unexpected events can improve energy security of the future.
Thank You!
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https://www.utu.fi/en/units/ffrc/research/projects/energy/Pages/neo-fore.aspx
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NEO-CARBON Energy project is one of the Tekes strategic research openings and the project is carried out in cooperation with Technical Research Centre of Finland VTT Ltd, Lappeenranta University of Technology LUT and University of Turku, Finland Futures Research Centre FFRC.

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