Scanning for emerging science and technology issues

Project funded under the Socio-economic Sciences and Humanities

SESTI Emerging Issues: Results from Horizon Scanning and Policy Workshops

Effie Amanatidou, Maurits Butter, **Vicente Carabias**, Totti Könnölä, Miriam Leis, Ozcan Saritas, Petra Schaper-Rinkel, **Victor van Rij**

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The SESTI project is funded under the European FP7 and researches the application of weak signals and emerging issues for improving the anticipatory intelligence of the European Commission and the EU Member States on future developments and issues

Objectives of the SESTI project

- Researching the added value of early warning signal scanning to identify emerging issues (including surprising ones)
- Assessing the pro's and con's of exploratory and issue-centred scanning methods and tools
- Identifying ways to connect scanning to the policy-making community

Definition and criteria emerging issue

Emerging issues are storylines (**Future Narratives**) with:

- High impact (on society, economy, ecology and the domain)
- Plausible storyline (including factual basis – reliable sources)
- Novelty (is the issue described really new for the policy-makers)
- Emotional aspects and critical aspects (does the issue appeal or concern emotional and or ethical legal aspects)
- Interests at stake (commonalities and or conflicts)
- Changeability (Can the story or its impact be altered by human action)
- Policy relevance (does the issue relate to present day decision-making and action on different levels)

Content orientation of SESTI

1. Focus on functional aspects of the innovation system
2. Focus on content

	Healthcare	Energy	To be chosen
Organizational changes	X	X	X
Science and technology developments	X	X	X
Public perception	X	X	X

Definition and criteria wild cards

Special kind of issue:

- An event or serie (cascade) of events (with seemingly **low probability**?)
- changing the settings of our world completely (causing highly impredictable and **high impact** shocks/disruptions)
- Which we hardly see or we do not want to see coming(**surprising** many)
- **Earth quakes** of the mental landscape (Karlheinz Steinmuller), black swans (Nassim Nicholas Taleb)
- When they occurs it is hard to see how they will (r)evolve, period of **high uncertainty**

Types of wild cards

- That have happened
- That may happen : **Imagined** (by author ---------- by imagination process)or search for potential wild cards (i-Know, Far horizon)

- Nature caused (volcano, earthquake etc)
- Human caused (non intentionally, panic in the crowd , berlin wall , **intentionally**, terrorist attack)

Imagined wild cards

- **Narratives** with Facts , Impacts, Novelty, Plausibility, interests, desires (wish , fear , ideal, lobby cards)
- Instruments to **shape or shake future to desire/ideal/interests of card initiator**, sometimes deliberately opposite to desire (evoking fear)
- **Strength of a card not only facts**> Assessment should look at , facts , logics, but also who is initiating the signals, what are the interests and values that are at stake, who is relaying, supporting, who is blocking or opposing, what is the message doing with emotions of the receivers etc

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- **(SESTI) Searching** Published Imagined Wild cards (initiators action) or **(Far Horizon, i-Know)** Wild cards **creating** on demand

Types of wild cards

- Tension building - almost invisible trends or sequence of events (Arab spring, suppose: long term effect of UMTS causes infertility)
- Sudden (un)expected events with a known very low or unknown probability but which we know will happen on basis of historical Evidence (large earthquakes, breakthrough medicine), where when and how????
- Sudden unexpected events wich may never occur but can be imagined and which if they happen have an unavoidable character (aliens landing)
- The unimaginable (the real black swan?) ??????

SESTI - Early warning signals

- Primary signal : someone pushes or asks for attention by placing (scientific) article(s) or video's with more or less full description of a wild cards (large breakthrough, opportunity, threat, sniping dangerous trends usually with large impact and even policy suggestions)

- Secundary signals: opposing or confirming (scientific) articles , reactions, discussion with arguments and links (blogs),

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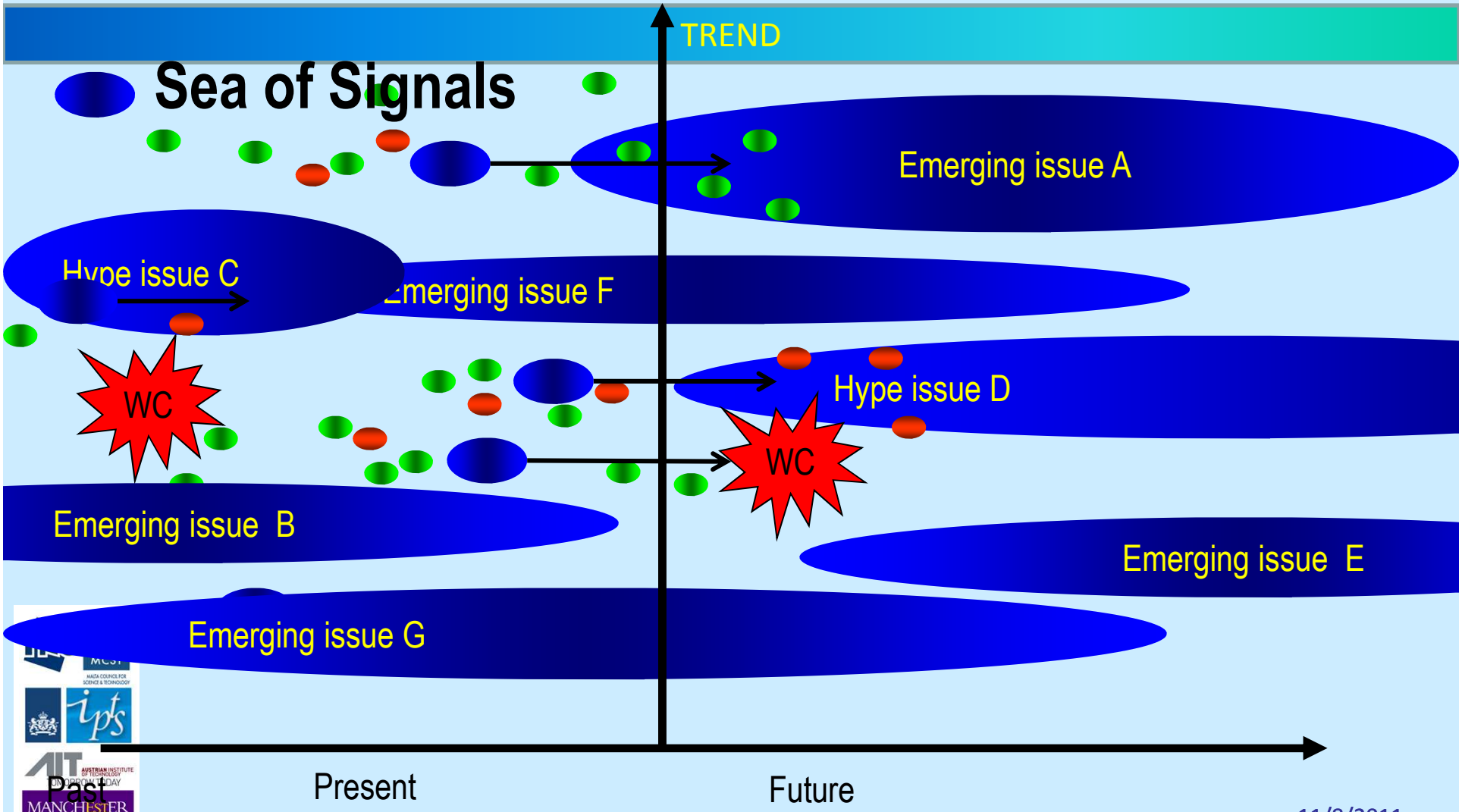
SESTI Thinking model



Issue dimensions

IMPACT : Issues that may have great or less great impact on what we see as important (size of impact)

CERTAINTY,PROBABILITY & PLAUSIBILITY : Issues that are certain or less certain but still plausible (probability and plausibility)

DESIRABILITY : Issues that are desirable or not desirable for society (desirability, common or opposed values)

CHANGEABILITY : Issues that are not changeable or changeable by human action (changeability)

TIME : moment of observation , interaction, dynamics

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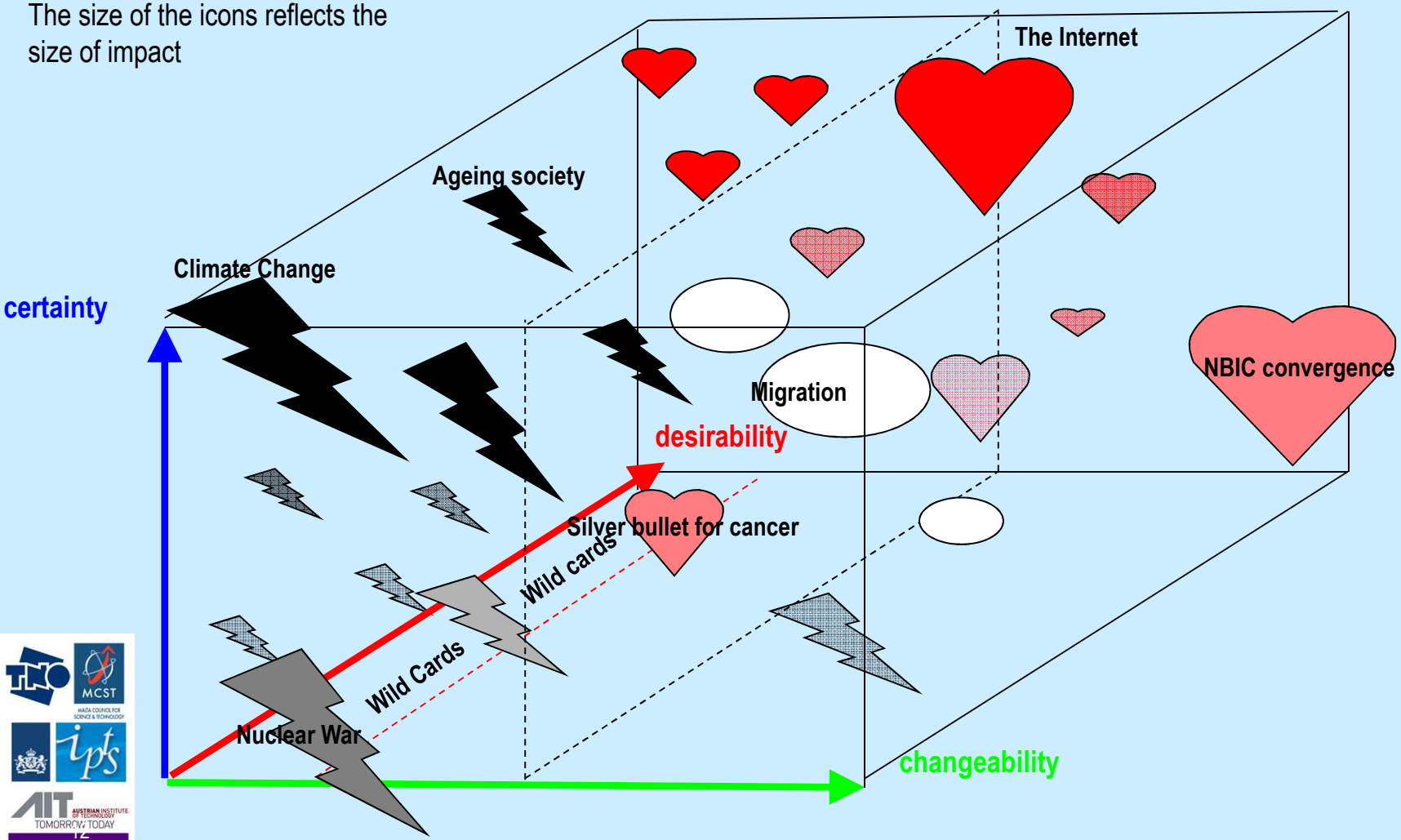
The size of the icons reflects the size of impact



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Your choices will lead my stories

- Rebalancing the greenhouse in prosperity! Nourishing mother earth!
- LNER! Cheap , abundant and clean energy, right now !
- Hybrid nuclear energy, box of Pandora or salvation !

- Re-prioritising health research? Prevention vs. Cure
- Mental health in an ageing society
- Obesity, a global epidemic marches (lifestyles and unhealthy markets)

- Influencing and reading brains
- Influencing embryonic and evolutionary cognitive development of humans
- ICT-enhanced learning systems

EUROPEAN COMMISSION
SEVENTH FRAMEWORK PROGRAMME
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Rebalancing the greenhouse- by re-greening earth & enhancing the carbon cycle

- **WW policy** Expanding and enhance the green space for energy, food, carbon products and sequestration
- Using desert land to catch the sun through irrigation (in DESERTEC like arrangements or by salt water use(tallophytes or cyanobacteria) or even artificial vegetation (start with PV heath solar end with biomass increase)
- Improve the efficiency of total photo synthetic production of natual vegetation , forest and agricultural areas (by ecomanagement, crop selection , biotechnology - C4 plants)
- Further future : development of artificial photosynthesis to sequestrate Carbon and to produce fuel

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20 % of the land is desert

http://emden-weinert.de/Namibia/intro.html

Most of the land is not very productive

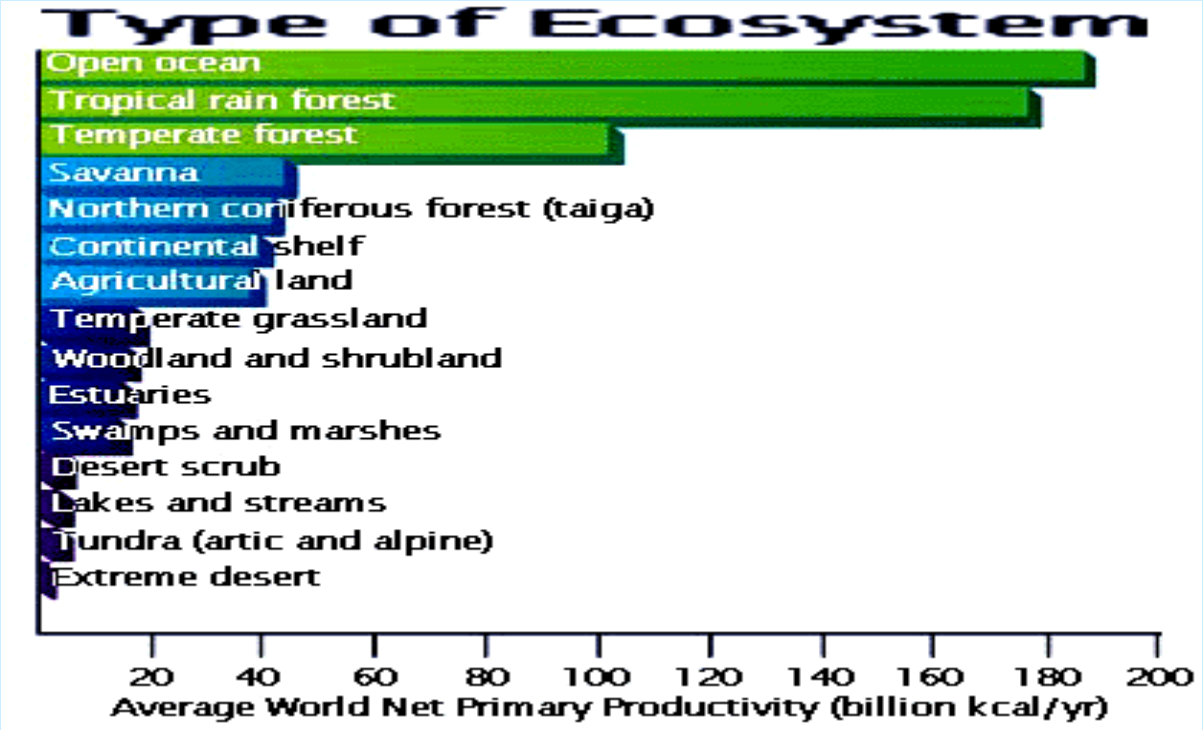
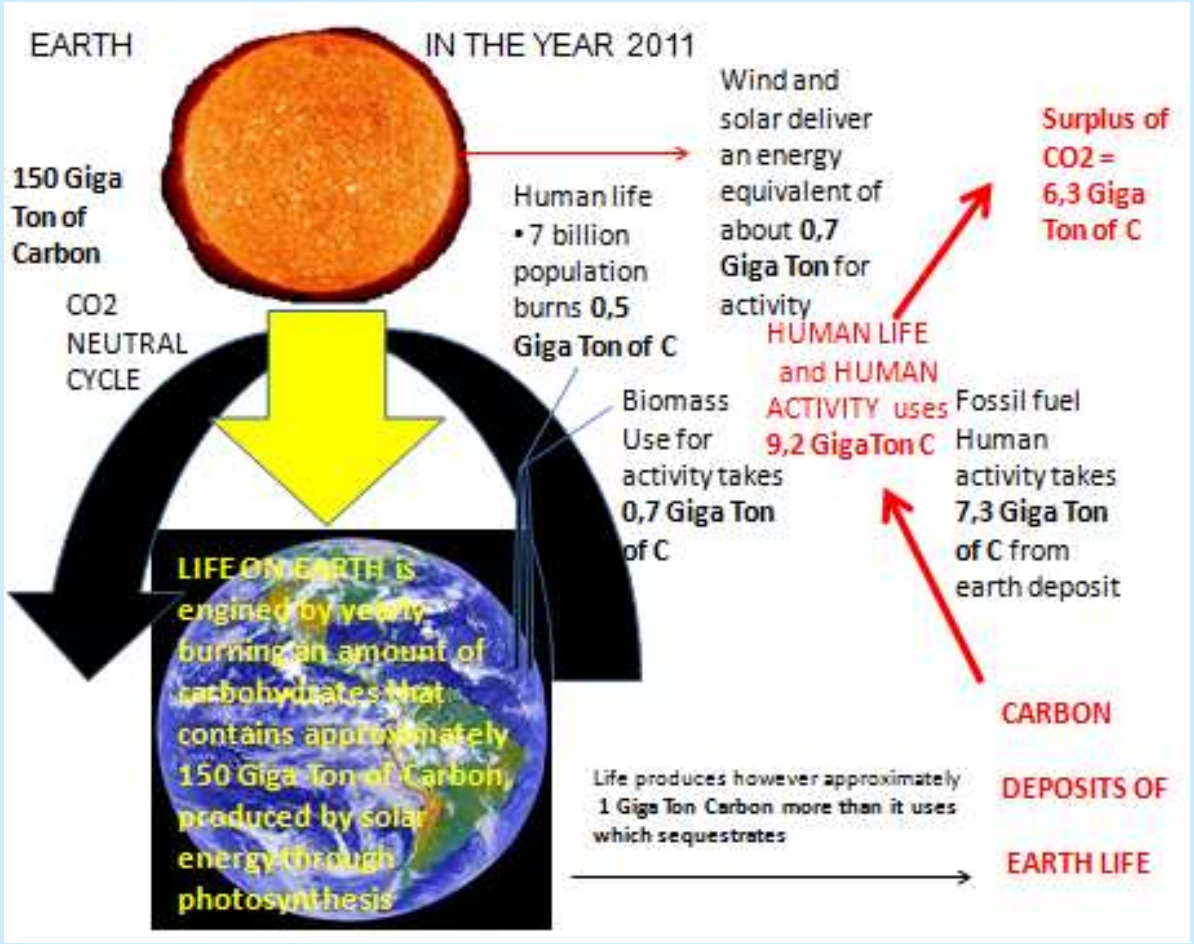
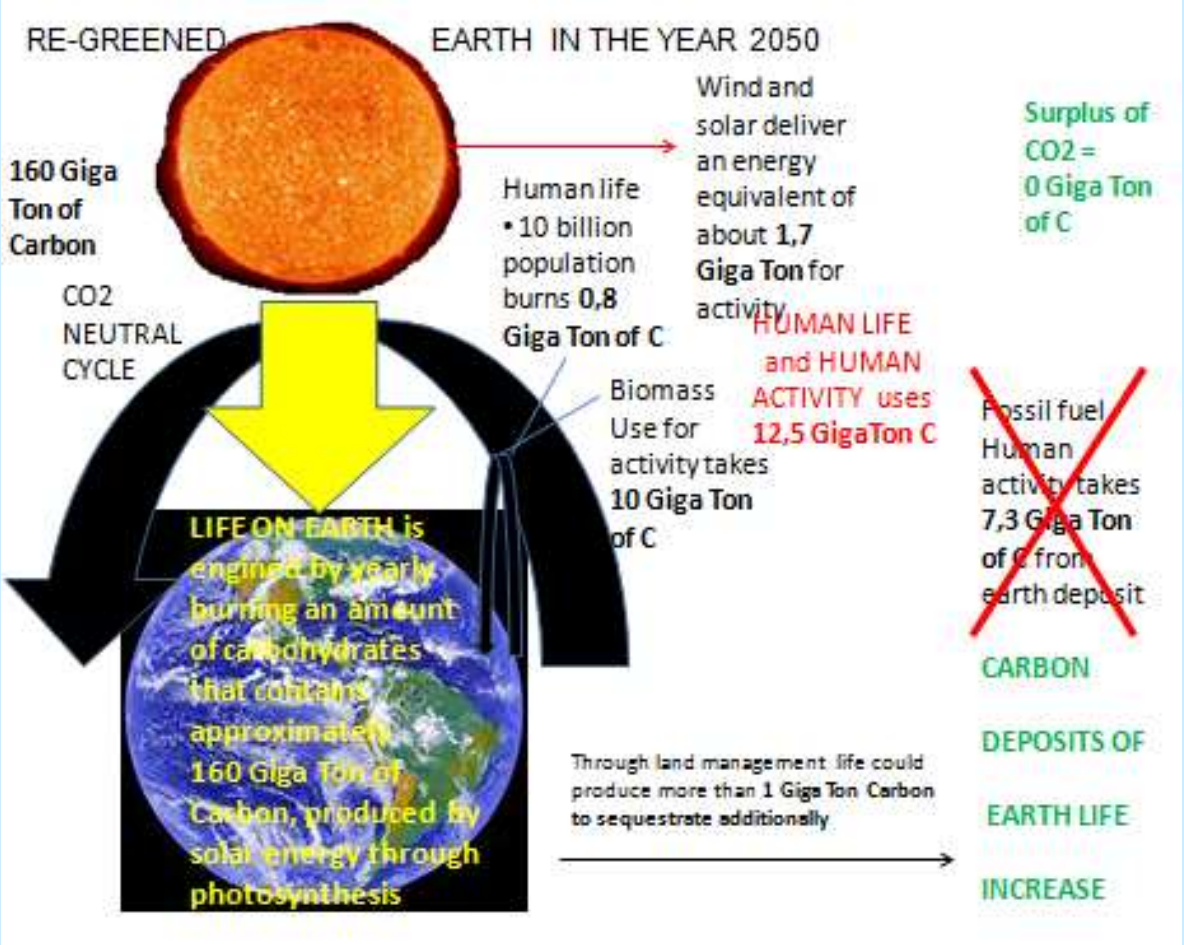


Figure 5. Average world net primary production of various ecosystems.

The solar fueled-carboncycle 2011



Re-greened earth – 10 Giga Ton extra will do



Re-greening the earth

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The signals

- p1. Biomimics articles , the ideal solar cells transforms sunlight into fuel, based on imitation of biological systems
- p2. Desertec using desertland (in North Africa) to create electricity through solar powerplants – creating agricultural conditions and exporting electricity with High Voltage DC technique to Europe at the same time
- s3. Articles on Artificial photosynthesis to sequestrate and to make fuel
- s4. Articles on biotech improving photosynthetic efficiency in crops and efficienvy competition of plants and PV cells
- s5. NASA brainstorm (use tallophyta and salt water cyanobacteria culture on land to prodcuce energy)
- S6. US-Forestry techniques to sequestrate more carbon/Germany wooden mills

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Impacts

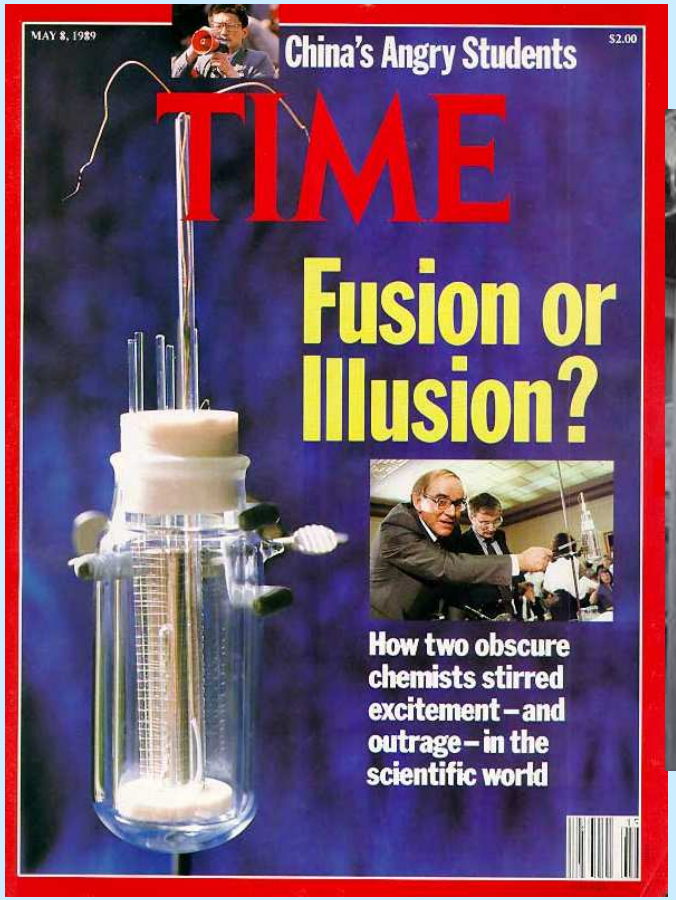
- Nearly sustainable, local and central energy provisions possible gradual sequestration of atmospheric overdose of CO2
- Almost no need for materials that may be scarce or polluting
- Land use (countries have different expanding possibilities), agricultural and forestry policy (is also about energy) , carbon pricing
- Fuel versus electricity (competition or cohesion between “bio” and other “tech”) – artificial still long time to go
- Possible loss of Biodiversity (Desert land species)
- Nutrient cycle stress, earth radiance balance

Increase of photosynthesis other aspects

- Concentrated inter disciplinary research needed to increase photosynthetic activity in existing eco-agricultural production and in non productive areas (deserts)
- Spatial planning focus on food an energy
- Research to sequestration balances
- Need for thought on type of fuel (ethanol, hydrogen?), planning of land use
- Line of thought to produce energy with CO2 sequestrated material deserves more attention (wooden mills)

1 MW unit will go online later in October

Very cheap and abundant "clean" energy



Rossi's 1 MW Cold Fusion E-Cat Reactor

Test on 28th of October 2011

Low temperature Nuclear Fusion without radiation

- Recent developments indicate that clean "nuclear fusion" will be available within the coming decade without the special and expensive requirements that were foreseen in the Nuclear fusion Inertial confinement and plasma fusion projects (like ITER and NIF) that still need 40 to 50 years before any application.
- After the scientific community felt over the announcement of Fleischman and Pons that they had discovered a simple way to create cold fusion, no one considered to put his career at stake by retrying the experiments that many already tried before in vain
- The contradiction of "low temperature induced" nuclear fusion with many basic findings of nuclear physics and the bad reproducibility of the experiments, caused an almost complete "forbidden"area of science.
- Still some groups went on , amongst them the SPAWAR lab and later on other, gradually creating more reproducible "anomalous" results, leading to a strong interest of US military in 2006 and renewed attention of NASA in 2009 and finally the claim of an Italian that he can create energy form hydrogen and nickel in 2010

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Signals

- P1. In 2004 cold fusion was mentioned in the Dutch horizon scan (continuous stream of underground results with anomalous heat – SPAWAR reports(2002)
- S1.Increasing number of a variety of experiments in different countries (with other cathodes, gas in stead of liquid environment, anomalous heat but also transmutation of elements, Iwamuri , Mitsubishu) – hiding under LNER, CANR
- S2.American chemical society and American Physical society start to put cold fusion results on the agenda of their regular worskhops
- S3.+8 Interest of the Military in US (nov 2009 Defence Analysis Report, 12 dec 2006 DTRA workshop)
- S4. Japanese public demonstration of excess heat electrolytic device
- S5.Italian nickel-hydrogen gas device, Focardi/Piantelli claims high repeatable anomalous heat output (2005) , test CERN (unclear outcome), test NASA (confirms anomalous heat)
- P 2 2010 Josephson (former Nobel prize winner) and Bushnell (science director) at NASA speak out the expectation that cold fusion will revolutionizethe energy domain
- Both seeing theory of Widom and Larsen as hypotheses that may fit within the slowly evolving nuclear physics paradigm
- S7. Rossi claims his 1 megawatt test after public demonstrations of 4 – 12 kilo watt devices (based on Focardi device)

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IMPACT

- Cold nuclear fusion will be very cheap (10 times cheaper than oil) , it is simply to produce and leaves no radioactive waste, 1 kg of nickel and 17 gram of hydrogen produce 1 megawatt heat a year , which is tranformed into steam this equals the burning of 1200 Ton of Charcoal
- Small and large units (back to steam engines) , usefull for heating, and producing kinetic energy and electricity production , water may be a limiting problem for small mobile applications
- Enormous shift in energy global production, total disruption, but much quicker to reduction of green house gases
- Threat to projects as ITER, but also for renewable developers and investors as well as fossil energy investors
- Shifts in power of energy producers (companies , countries)
- Many new questions for Physics (can the paradigm hold)
- Conflicts on patents
- Search for safety and environmental risk

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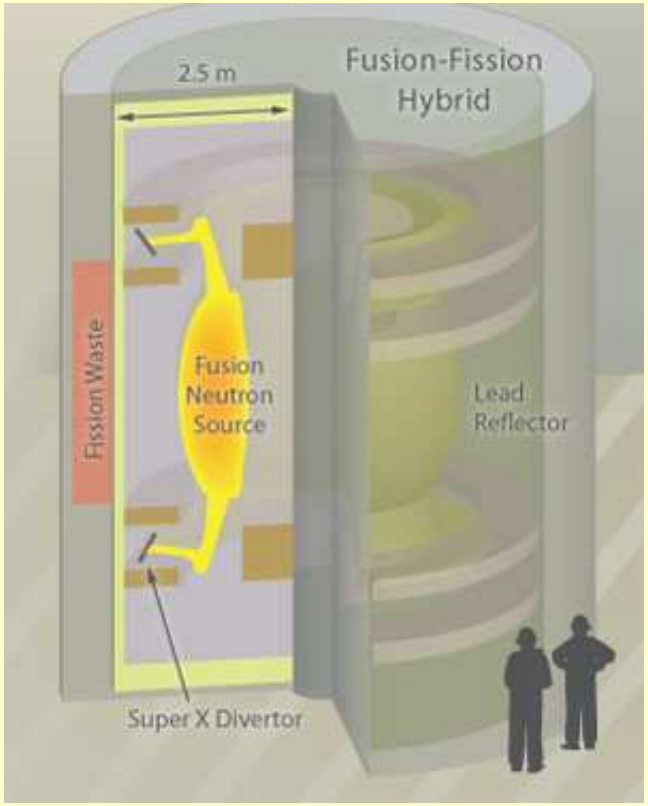
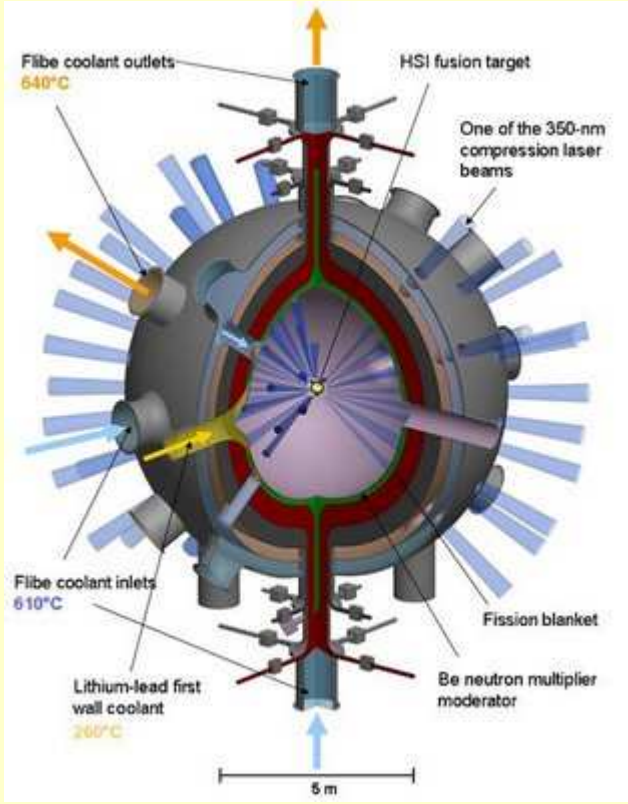
Hybrid nuclear energy, box of Pandora or salvation





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Hybrid nuclear energy
The Story

- Hybrids may be feasible in 20 yrs
- Nuclear fusion 20-30 yrs earlier than expected
- Getting rid of nuclear waste and arms
- 30 % to 60 % of US electricity nuclear in 2100
- Prolonging existing fission reactors

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Hybrid nuclear energy
Other aspects

- Feasibility, Accidents and safety (MIT critics)
- Fear for invisible threat
- Prolonging existing fission reactors
- Centralized energy production
- Interests , the present nuclears, military, the greens?

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Hybrid nuclear energy, policy aspects

- New research development spin off to real fusion
- Safety seems key
- Investment choices
- Public debate

Issue: Re-prioritising health research? Prevention vs. cure

It is a fact that a number of simple preventive measures such as consumption of nutritious foods, better personal hygiene, and sanitation both when handling food and during medical treatment have contributed significantly to improved levels of health. Nevertheless, most medical research funding is channelled into ways of treating disorders rather then to methods of preventing disease.

Issue: Re-prioritising health research? Prevention vs. cure

- Is prevention better than cure?
- Personalised medical treatment: Luxury health vs basic health?
- Deepening the gap between health services?
- Diversification in medicine; early detection of cancer what is it good for if we cannot heal? Drugs for long-time (ageing)?
  (Think in this respect about rising health costs caused by technology push in crisis time while also ageing health demand is increasing)
- Results of the voting: Impact from reprioritising health research for an ageing society is considered as (very) large. Plausibility of reprioritising health research is considered as rather strong. Novelty of reprioritising health research is considered ambiguously, however most think it is known only to some individuals. The participants think that reprioritising health research has quite many policy impacts. The general assessment of the strength of the issue as new emerging is considered as neutral.

Issue: Mental health in an ageing society

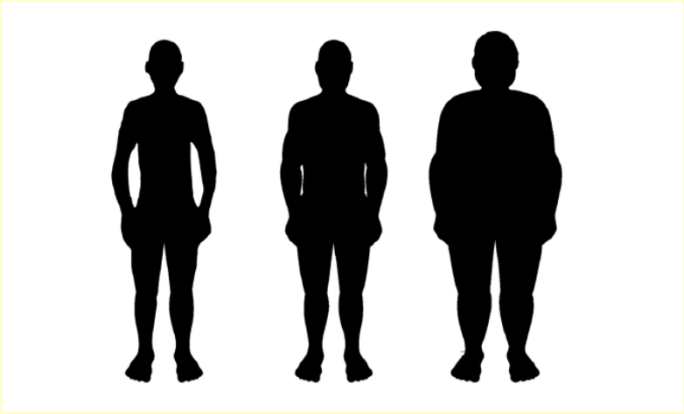
Advances in medicine mean that humans are living longer than ever before. However, the quality of life of the elderly is often compromised due to frailty, reduced mobility, dependence on medication, financial limitations and loneliness in the twilight years. One in four older adults lives with depression, anxiety, or other significant mental health disorders. In many EU Member States the suicide rate among the elderly is higher than that for any other age group.

Issue: Mental health in an ageing society

- Increasing incidence of mental health problems among the elderly could have a significant impact both in terms of demand on medical services, as well as in a wider social context, it may very well also affect the mental health of younger people.
- Early detection of cancer what is it good for if we cannot heal? Drugs for long-time (ageing)?
- Results of the voting: Impact from mental health in ageing society is considered as quite large. Plausibility is considered as (very) strong. It is considered ambiguously, but more as not novel anymore. The participants think that mental health in ageing society has quite some policy impacts. The general assessment of the strength of the issue as new emerging is considered as relatively strong.

Issue: Obesity, a global epidemic marches on

It is estimated that in excess of one billion adults are overweight, and that at least 300 million of them are clinically obese. Obesity has reached epidemic proportions and is a major contributor to the global burden of chronic disease and disability. Within Europe, obesity affects 20-30% of adults, and a cause of particular concern is the increase in obesity rates among the young.



Issue: Obesity, a global epidemic marches on

- Rising obesity is the result of a combination of factors – increasing affluence leading to abundance of food, poor consumption habits due to a hectic routine, and a sedentary lifestyle. To combat obesity we need to recognize and address these realities.
- Need to promote healthier lifestyles. Deal with unhealthy markets.
- Results of the voting: Impact from obesity is considered rather large. Plausibility of obesity is considered as (very) strong. It is considered as less novel, known to most of them who should know. The participants think that obesity has quite many policy impacts. The general assessment of the strength of the issue as new emerging is considered as neutral.

Workshop on Cognitive Enhancement Issues

Cognitive Enhancement is related to **Human Enhancement** and may be defined as *the amplification or extension of core capacities of the mind through improvement or augmentation of internal or external information processing systems*.

Cognitive Enhancement Issues

- **Issue: Influencing and reading brains**
  Use of neural implants as a possible means of unconsciously influencing thinking and emotions, commercial and military interest (neuromarketing), recent discoveries in invasive and non-invasive reading of brain activity helping disables & diseased with impairments.
- **Issue: Influencing biological cognitive development of humans**
  Possible deployment of developmental drugs influencing the neuro-cognitive embryological and later development.
- **Issue: ICT-enhanced learning systems**
  to be almost ripe for very promising tools for learning complex and cognitive motor tasks.

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Search for our cognitive genes

Continuous genetic research on the cognitive genes that distinguish us from apes and other higher mammalians lead to the escape of a highly intelligent cat observed as taxi driver in the city of NY. A new congress committee now has abandoned this kind of research (Σ 485 - Σ 444 - Σ 485)

TECHNOLOGY and SCIENCE

ICT makes difficult tasks so easy, do we still have to learn them ourselves?

ICT, augmented reality and robotics helps us to perform every task with less or even no effort. After development of wiki-based and self learning translation programmes we can translate everything spoken and written through the internet. Learning other languages at school is therefore nonsense (Σ 418)

TECHNOLOGY and SCIENCE

Workshop on Cognitive Enhancement Issues

- **Results of workshop discussions:**
  It seems to be important to discuss the terms in use in emerging areas such as *human enhancement* and *cognitive enhancement* and to encourage public engagement in these areas. While cognitive enhancement is not a new phenomenon, the way in which different phenomena are discussed under the two umbrella terms attract attention. There are new drivers, especially the introduction of new technologies and techniques, that justify particular attention to it. As the topic is fluid and evolving, the debates about it should remain open.

Workshop on Energy Issues

SUMMARY OF VOTING RESULTS	Impact	Plausibility	Novelty	Policy Implications	Strength of an emerging issue
Hybrid nuclear energy	↘	↘	↗	↑	↘
Desert renewables	↑	↑	↘	↗	↑
Bio-mimics	↗	↑	↗	↗	↑
Hydrogen economy	↗	↗	↑	↗	↗
Deep drilling	↑	↗	↓	↗	→