International Cooperation in Science, Technology and Innovation to Address Global Challenges

Focus: Food, Water, Energy and Community

October 5 2011; 10.00 – 16.00 at Lerchendal Gård, Trondheim, NTNU, The Norwegian University of Science and Technology

Organised by the NTNU Department of International Affairs, in cooperation with the Norwegian Ministry of Education and Research and The Norwegian Year of Science, and in association with the OECD STIG project

NTNU
Innovation and Creativity

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NORWEGIAN MINISTRY OF EDUCATION AND RESEARCH

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FORESIGHT AND INNOVATION WORKSHOP

SUMMARY – MORNING SESSION

1) Welcome by Vice Rector **Johan Hustad**, NTNU University.

Part 1: MACRO LEVEL

International governance of research and innovation collaboration.

2) **Per Koch**, Norwegian Ministry of Education and Research and Chair of the OECD STIG-project on STI and global challenges. On global challenges and international research and innovation policy.

"You need a systemic approach, eg. the infrastructure and mentality of people also need to be taken into consideration."

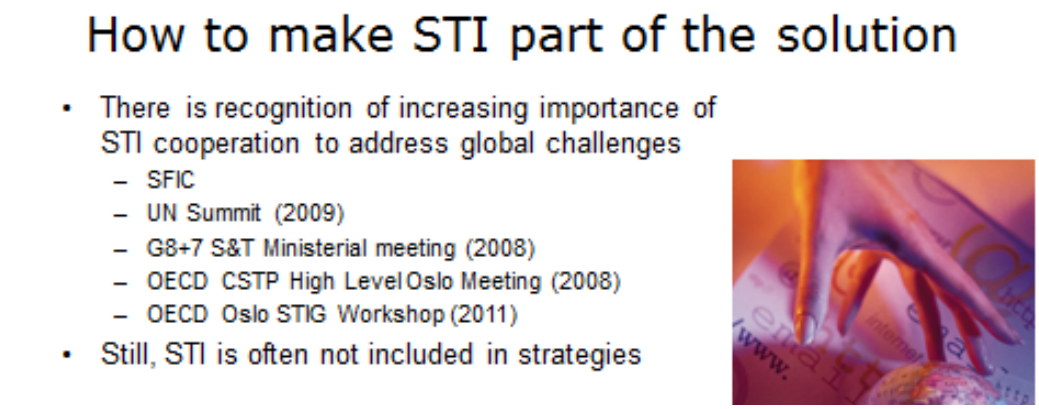
The role of science and innovation

- STI play a crucial role in
  - Understanding the impact chains underlying global challenges
  - Understanding the interaction between various factors framing global challenges
  - Developing solutions

But STI is also to blame for some of our problems..

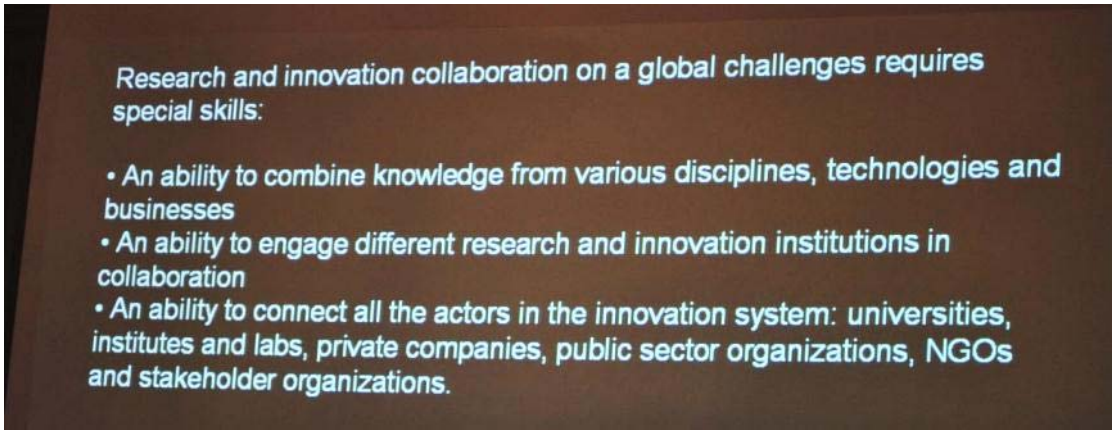
The Challenge

- Global challenges cannot be adequately addressed by single actors.
- We are all affected
- Problems caused by systemic failure consisting of social, economic, cultural, biological, technological and environmental factors.



Koch claims that here is no best practice model on how to carry out this kind of work, or clear knowledge of weaknesses and strengths of the different models.

Regarding research governance of STI, we have national and some regional models, but no international global ones agreed upon. No global government, framework or institution that takes responsibility for STI. We are facing a different type of social context, dynamics and problems that are not faced on a national level. There is not adequate reflection and policy development on this issue.



- Need for a focus on:
  - international governance skills
  - international policy development
  - the interaction between society and research and innovation
  - Within-science collaboration and cultural development

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STIG Governance Dimension Analysis

I	Outreach, Agenda and Priority Setting	- models to ensure optimal outreach of STI networking - decisions on agendas and priority setting - involvement of stakeholders (governments, academia, private sector, civil society)
II	Funding and Spending Arrangements	- how can funding be secured on the required scale - traditional vs. non-traditional funding schemes, public and private sources - efficient allocation of multilateral STI funds
III	Institutional Access Arrangements and IP sharing	- institutional arrangements - treatment, access and utilisation of knowledge generated through multilateral STI cooperation
IV	Putting Opportunities into Practice	- transferral of outcome of multilateral STI cooperation into practice by private and public actors - ways to address policy makers and stakeholders - adjusting to stakeholder demands and contexts
V	Technology transfer and capacity building	-STI cooperation and development, decision making, training and funding -timeliness of transfer

3) **Andreas Stamm**, lead researcher in the OECD STIG project. On the OECD STIG project and multinational STI collaboration in the areas of energy, water and food.

"We are the first generation facing the evidence of global change. It therefore falls upon us to change our relationship with the planet, in order to tip the scales towards a sustainable world for future generations."

3 rd Nobel Laureate Symposium on Global Sustainability
Transforming the World in an Era of Global Change
Stockholm, May 16-19, 2011

THE STOCKHOLM MEMORANDUM

Stamm explained that the way existing institutions are organized is not adequate for this urgent issue. He urged that border-crossing approach to STI is needed.

- We need to address global challenges through cooperation and collective action, empirical evidence shows that this can be done (banning of CFC).
- STI is a key factor in addressing global challenges. International cooperation in STI is the core of the STIG project: How can it be done to deliver fast and effective results
- Considering the scale of the challenges and the urgency to address them, the existing modes of governance are insufficient to deliver the required responses
  - example: Food security
  - example energy

There are several global challenges; some are neglected, although they need to be addressed simultaneously. Eg.

- Soil erosion.
- Fish stocks in danger of collapsing, especially affecting poor people as they generate income and provide protein intake.

International co-authorship has increased immensely, thus improved science collaboration. From 25 000 articles in 1985 in to 150 000 articles in 2006.

Global challenge Food Security

- World food production must rise by 50% by 2030 to meet the increasing demand (UN Secretary General, Ban Ki-moon, at a UN world food summit in June 2008)
- 78 % of the increase in crop production between 1961 and 1999 was attributable to yield increases, and 22 % to expansion of harvested area.
- Extensification may still contribute to crop production in Sub-Saharan Africa (27%) and Latin America (33%) but almost no additional land available in South/East Asia and Near East/North Africa

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Loose network of high class research institutes established CGIAR:

CGIAR as a driver of food security

- Established 1971 as joint initiative of World Bank, FAO, UNDP, Rockefeller and Ford Foundation
- Mission: Combine cutting-edge global research with practical local impact
- Linking up with local communities to harness local knowledge (traditional varieties, soil conditions, farming practice, social and dietary preferences)

CGIAR annual budget: US $ 550 mio. (Montesano annual research budget 1,2 bio..)
Every dollar invested gives 9-fold effect in developing countries.

- Without CGIAR
  - world food production 4-5% lower
  - world grain prices 18-21% higher
  - 13-15 million more children malnourished

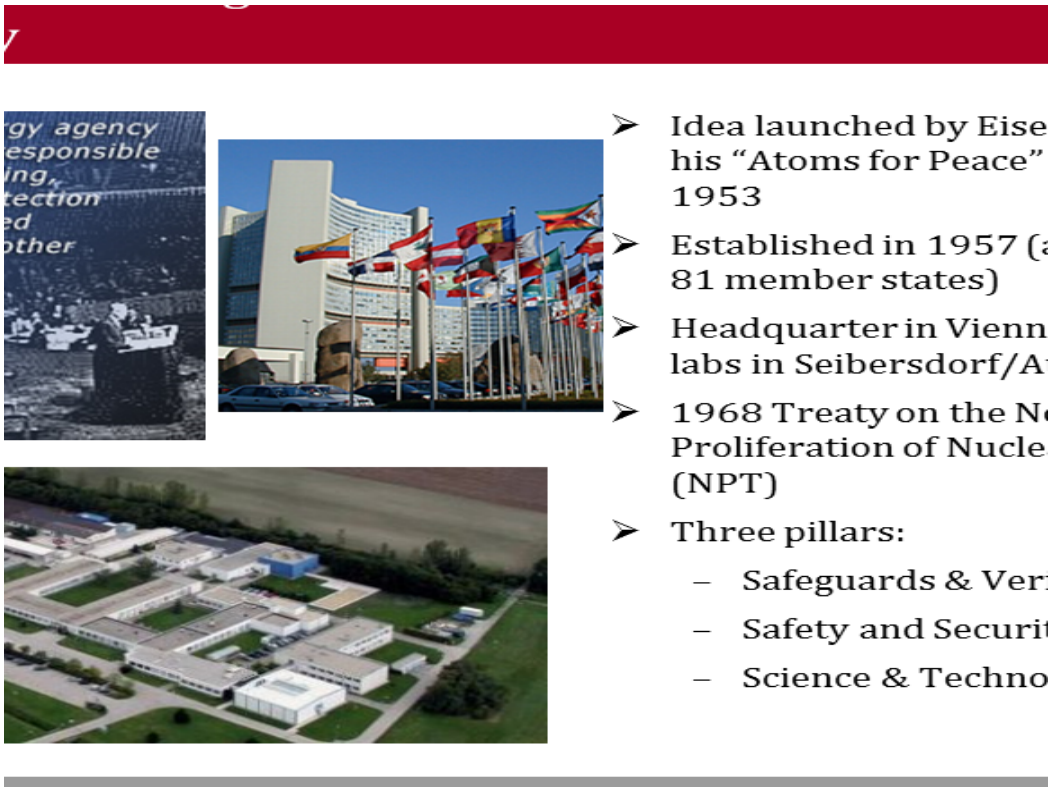
2007: CGIAR established a Global fund for research, a legal body with 8 mega-programmes. It is a more centralized governance to achieve higher impact – at the expense of bottom-up autonomous research.

THE ENERGY AND CLIMATE CHALLENGE

"No nation can face this challenge on its own. (Ban Ki-moon, 2007)

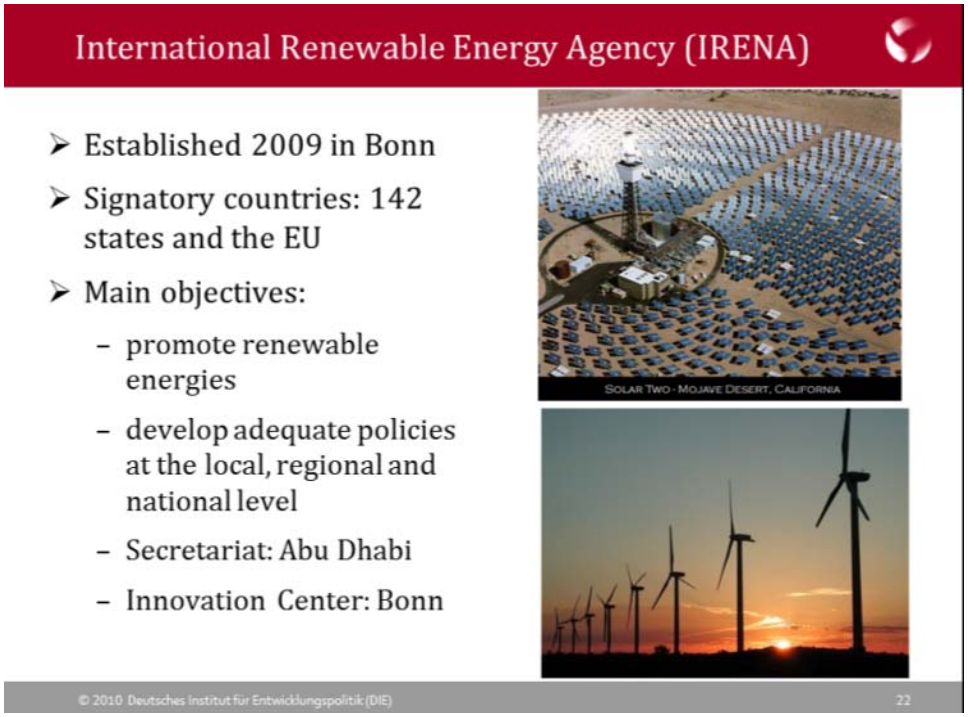
Energy has been one of the drivers of international collaboration and innovation.
Early example of international STI cooperation:
1951: European Steel and Coal Company (6 countries, start of the EU)
1957: Established European Atomic Energy Community (EURATOM)

During the Cold war there was collaboration to avoid nuclear arms race.



IEA: International Energy Agency

- Established in 1974 after the 1973 oil crisis
- Cost and task sharing
- R & D collaboration



Fragmentation of governance in international energy STI:

- Nuclear energy both seen as global **opportunity** and a **threat**
- Fossil, renewable, nuclear with conflicting interests
- Differences in assessment of risks and opportunities
- Hampers the development of strategies towards green energy economies

Fragmentation is difficult. We need coherent strategies!
(Eg. Carbon caption and storage (CCS) in Germany.)

- The required changes will lead to open or implicit conflicts
  - between vested interests (oil, coal, nuclear; meat or vegetarian etc.)
  - between people with varying assessments of risks and opportunities - we have to act under conditions of urgency and of imperfect information (CCS)
  - with people following the "NIMBY" ideas (not in my back yard) – they may have legitimate reasons for this
  - between generations (Brundtland definition of sustainability)

Final remarks (2): Social science informing policy making beyond "social engineering"

- Social sciences have to play an important role in the sustainability transition
  - … in understanding the social implications of the required transformation
  - … in understanding the structures of vested interests and related power relations
  - … in developing strategies for convincing and "buying in", not only, but including financial transfers
  - … etc.
- Complex interaction between natural, technical and social sciences

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DISCUSSION

There is a nice global program of 500 eco villages. Check it out.
Hustad: Food and land area are constricting, but how about the ocean?
Food from algea etc. -there is probably huge potential.
Stamm: Yes, but we need to consider the consumption habit and culture of people. We have to understand what they want.
Hustad: There is great potential in the role of universities and colleges, linking education and research. It is difficult to implement research, but young people/students will bring updated knowledge to the industries, through assignments and employment. Older people are more afraid. This link is important and imperative to diffuse research. NTNU has a course; mandatory to all students (2000 students every year) called Experts in teamwork, inter-disciplinary and next year the best team can go to Rio.
Stamm agrees that there is untapped potential, also with spin-offs from universities. We need to put more sustainable technologies into practice.




Andreas Stamm, Heine Kolltveit, NTNUs Hilde Skeie andVice Rector Hans Hustad

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Part 2: MICRO LEVEL – PRESENTING CASES

The development implementation of new competences and new technologies for clean water, energy and food.

Chair: Rita Westvik.

4) FEED (Food and Energy Eco Dynamics), Addressing increased food production and efficient (re)use of water and energy in closed environments.

Population is estimated to increase by 40% by 2030.
Agriculture is both a challenge and an opportunity.

Established aid agencies and NGO´s are trying their best to assist in resolving this current humanitarian crisis, but they only provide temporary solutions that do not take preventative and long term solutions. Food for today does not secure food for tomorrow.

FEED suggests a more permanent and sustainable solution, one that not only delivers food, but also creates employment and education, while empowering local community groups to take control of their future by creating local businesses and enterprise; in urban and rural areas, in both industrialized and developing countries.

5) **Bruce Edgar**, Phoenix Planning Design, urban planner. On increased food production in urban and arid areas. SolaRoof and AgriPOD.

Bruce Edgar and Anne Wirstad.

"We decided to develop our design and proof of concept while doing humanitarian work. It is an open source technology, and can be used in arid areas due to the recycled water in enclosed system"

Rio+20 sub-theme: (a)

"A green economy in the context of sustainable development and poverty eradication."

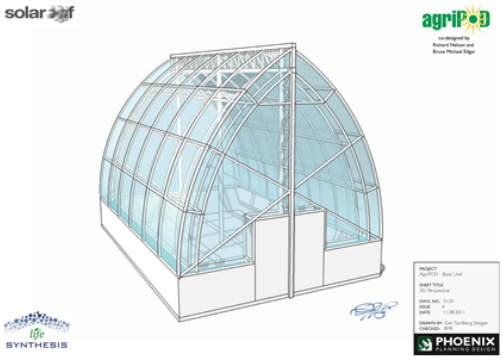
Background of innovative SolaRoof technolgy

- The AgriPOD uses SolaRoof liquid bubble technology developed by Canadian inventor, Richard Nelson over period of 25 years. A greenhouse in Ottawa, Canada using SolaRoof technology has just celebrated 10 years use.
- This innovative technology is at the forefront of new commercial solutions that will reduce global "Greenhouse Gas" emissions.
- The building system utilises solar energy in an enclosed environment and reduces the need for external heating and cooling by up to 80%. In addition, the amount of water required for raising crops is also reduced by up to 75%.

Development of AgriPOD

- A group of experienced professionals in Norway, associated with food production, sustainable development and community business, have joined together to form a hybrid project that aims to bring a sustainable solution to the issue of delivering food to urban areas and rural areas with poor soil or lack of water.

- The project is built around a specially designed closed environment installation known as the AgriPOD. It developed out studies to improve production and the environmental impact of existing greenhouses.



Mikrofinans NORGE | Global Consultancy | Prepared by PHOENIX PLANNING DESIGN | For Life SYNTHESIS

- Saving energy and water, controlled environment.
- The containers can be dropped and used anywhere.
- Car park-roofs, arid areas, Horn of Africa.
- Humanitarian work and research development.
- Algae, mushrooms ++
- Collaborate with the right Partners; NGOs, businesses, government officials.

Benefits of AgriPOD

AgriPOD is a closed growing system, with a number of benefits over and above traditional greenhouses, making it more environmentally friendly with a comparatively much smaller carbon footprint because it:

- recycles water normally lost in evaporation, thus using approximately 75% less water;

- improves yield by reducing impact caused by airbourne pests and deseases;

- can still use CO2 to increase food production;

- can be used for growing all year round with minimal heating and cooling costs;

SolaRoof gives people the opportunity to **take charge of their own lives and stay where they are** despite natural degradation and extreme climates.

SolaRoof enables high degree of sustainable living in form of **nutritious food, pure water, clean energy and DIY shelter in one system**.

An online community exchange knowledge and support via the online **SolaRoof Wiki** (solaroof.org) and SolaRoof **Yahoo Forum**.

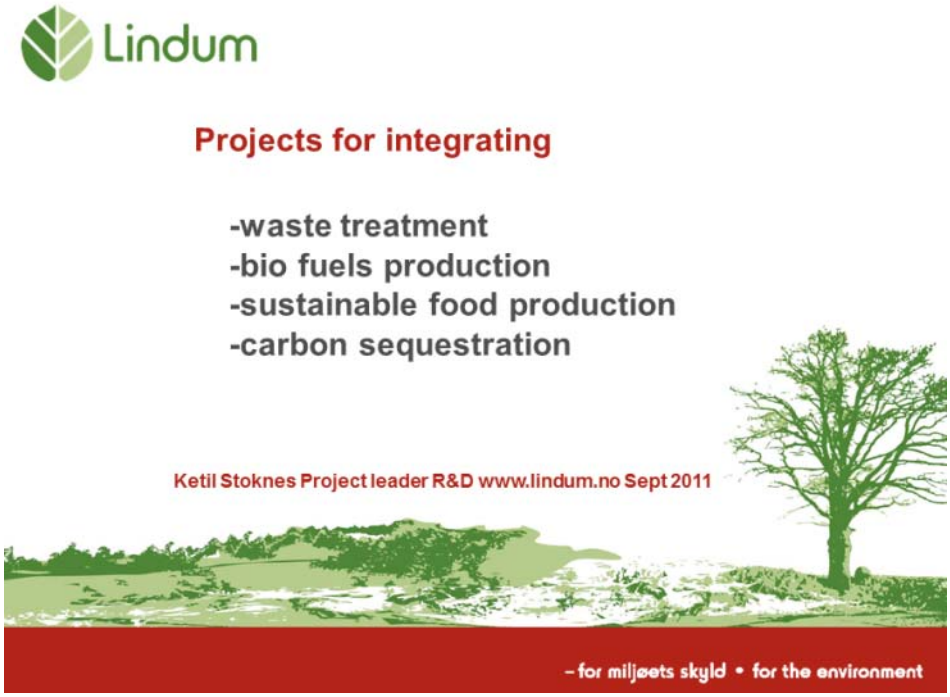
The SolaRoof SENet will spread knowledge by means of awareness and open manufacturing as well as supply products and services for **sustainable living, charitable purposes, global prosperity and abundance.**

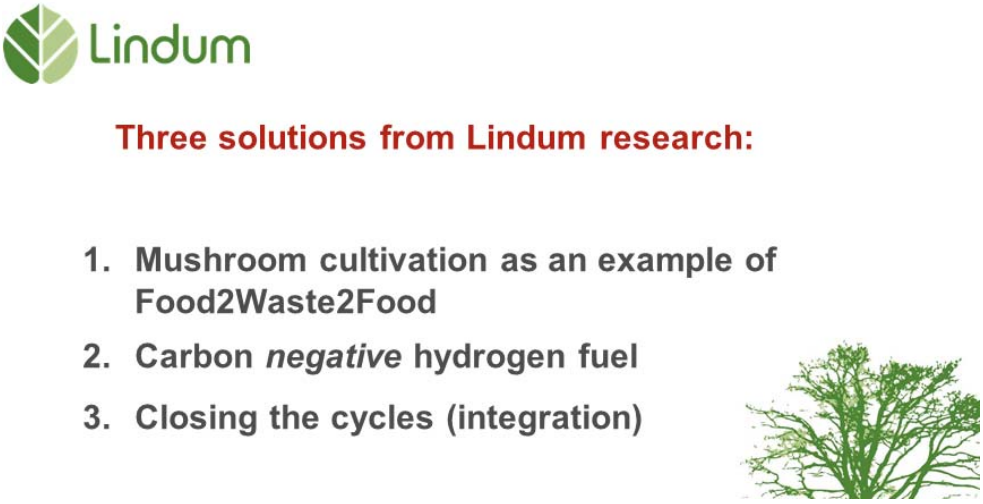
The SolaRoof Yahoo Forum has over 900 members and numerous projects at various stages all over the world.

SolaRoof is free for personal and humanitarian use.

Commercial users are obligated to make an honour payment of 10% of profit or 1% of related income to a **SolaRoof Foundation** for **Pay-It-Forward** projects.

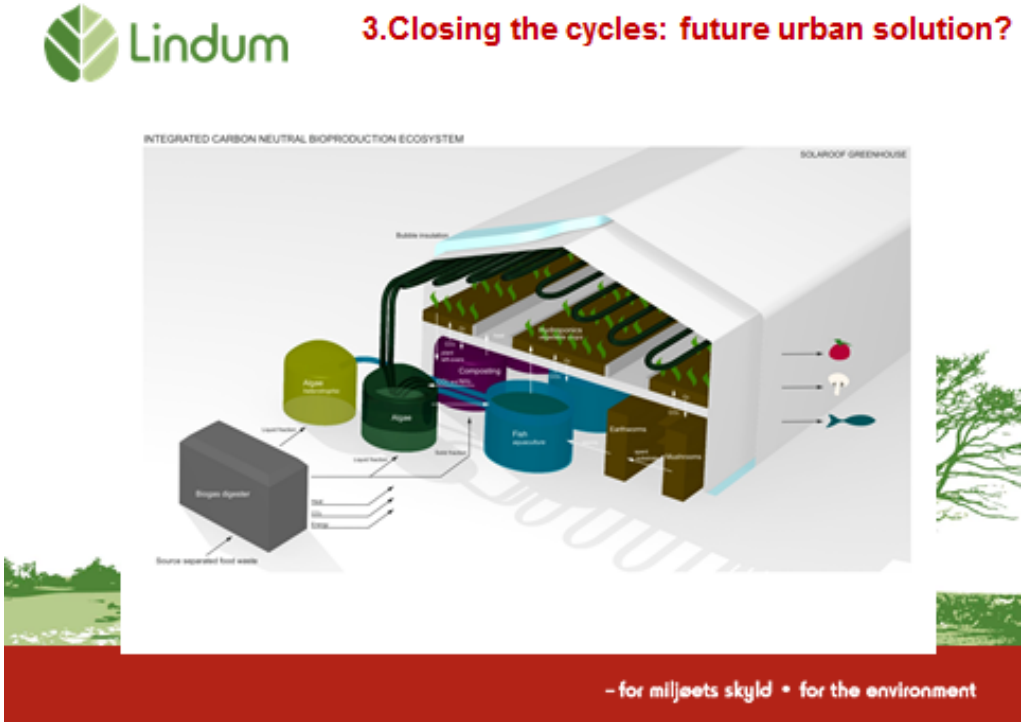
6) **Anne Wirstad** presented Lindum for **Ketil Stoknes** (UiO and Lindum). WASTE to ENERGY and FOOD





Closing the cycle creates an integrated system: WASTE to ENERGY and FOOD.

- Holland has an expensive system, which is not solution to the world.
- First demo in Europe, very exciting!
- Holistic system, no waste, just resources.
- Complete closed system, no CO2 emission, get 10 l drinkable water per m2, desalinate, waste treatment, fertilizer.
- Higher increase of yield. Leave nature, compact food production to smaller areas, multi-layer.
- Utilize the left-overs from kitchens etc /biomass.
- At Lindum we build a small scale demo. Greenhouse, mix of materials.
- Anyone can build it, low tech although high science.



1st fl: biogass digester (grey), algae (green), fish/aquaculture (blue), mushroom (brown).
2nd fl.: Hydroponics with vegetables.

Ecovillages are gaining global recognition for the innovative and practical tools they offer to simultaneously tackle the many social, environmental, cultural and economic challenges in the face of climate change.

In the context of development cooperation, the Global Ecovillage Network (GEN) is in an excellent position to establish partnerships between sustainable living projects in the North and South.

The good intentions and creativity of citizens, and their willingness to make a difference, is one of the most underutilised resources we have today.

The power of human communities to come together and co-design their own pathway into the future is seen as a major driving force for positive change.

Through sharing of best practices within the wider network, while honouring deep-rooted traditional knowledge and local cultures, we move towards a diverse yet shared pool of wisdom for sustainable living at a global scale.

- Eco village science network, Italy.
- 12 000 of local villages, labeled eco villages.
- Involve a lot of people to get where we need to be.

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DISCUSSION

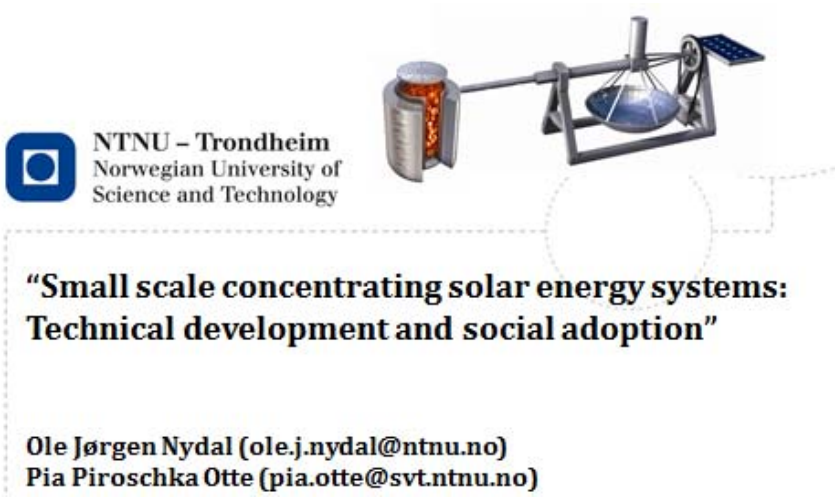
Koch: What about funding and dissemination, how do we do this globally? There's no global body, world innovation, world research org etc.

Edgar: Well, as an example there was a Business for the Environment Summit 2 weeks ago in London, including world leading people. You need to target your audience and chase the world organisations.
Edgar adds; another challenge is that social innovation often don't tick into ONE box. For instance innovation green fuel, if you don't fit into a clear category it is a problem. Politicians need to be more flexible in where they put their funding. What is problem/answer; not just green fuel, but feeding people, etc. If addressing several challenges at the same time you may end up not getting any funding.

Stamm: who is really the target group? If poor people, I have been to so many poor countries, with interesting technologies introduced by the rich world. But they remain stuck in the pilot phase, there is a lack of ownership..
One solution could be using a social business model including education and encouragement of ownership and inclusion during development phase.

An example is Tamera, a solar village in Portugal. Distribute technology to Africa and make it attractive.

7) **Pia Piroschka Otte**, phd student, NTNU. Small scale solar systems. She just came back from field work in Mozambique.



- University collaboration north-south.
- Small scale cooking system with solar power.
- Comparative analysis to map success factors

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- Injerra (Ethiopian local food), pancake needs high temperature (a challenge)
- Also want to be able to cook at night time, include heat storage, they also need energy after sunset
- Build something simpler.
- Interdisciplinary; students from tech, social science, natural science.
- NTNU hosts visitors 1-3 months.
- Social adoption; identification of cooking habits, energy patterns.
- System testing: Air based, Steam/oil, direct
- Don't have a finished prototype and cooking system doesn't reach high enough temperature.

Project concept: include heat storage
Energy available after sunset

Project Financing

- NUFU Solar project, NORGLOBAL, RENERGI program, Quota Program

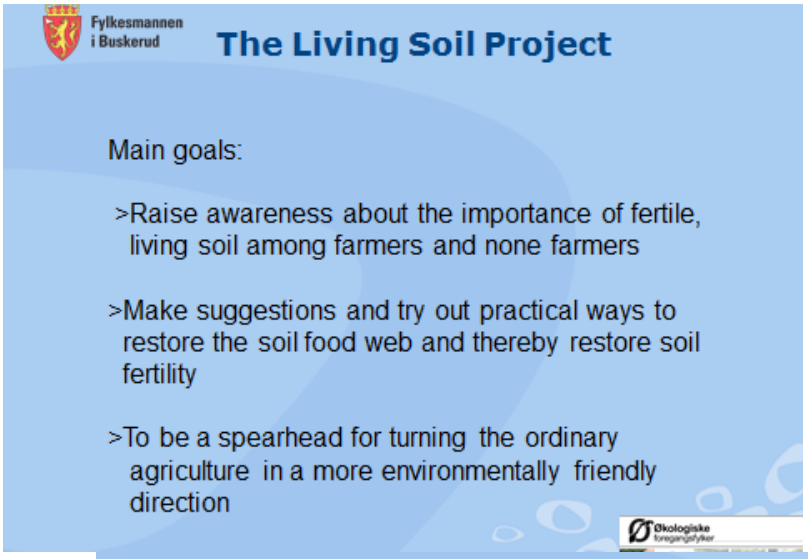
WE HAD AN ENJOYABLE LUNCH BREAK BEFORE AFTERNOON SESSION

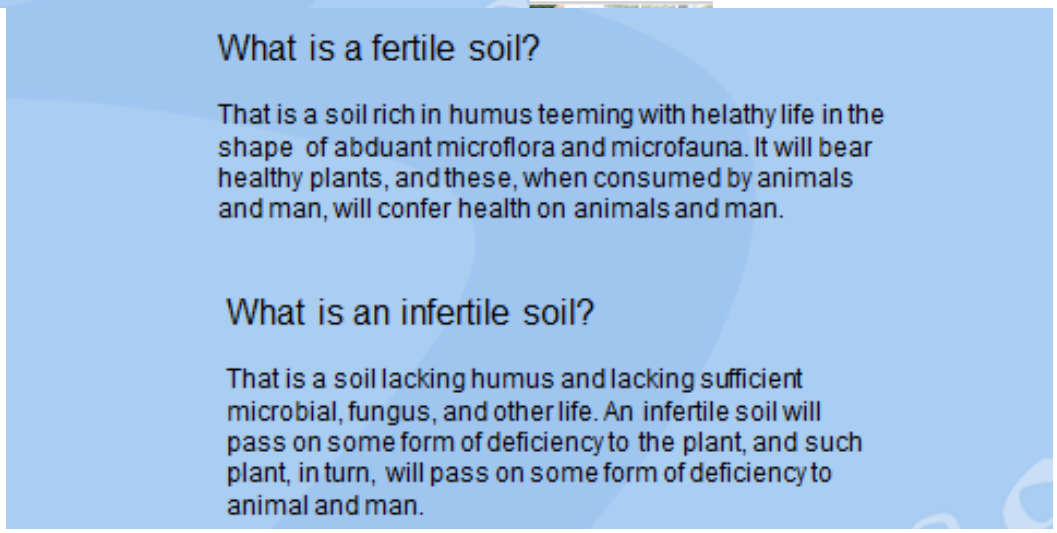
SUMMARY – AFTERNOON SESSION

5. **Øystein Haugerud,** The Living Soil Project, Director of Økologisk Spesialkorn, Skandinavia, Norway. Buskerud County.

"Our WELFARE is inextricably linked to the SOIL's welfare. Our DESTINY is inextricably linked to the fate of the SOIL."

- County Governor in Buskerud, Lindum, VitalAnalyse, Bioforsk organic.
- Small project, not much money. Small lab, two people.
- Ministry of Agriculture and Food, Norwegian Agriculture Authority
- It is practical, not research, but would like it to be picked up.
- Trying out methods that others have developed, esp in the USA.
- Oppland and Buskerud county.





Fylkesmannen i Buskerud

The Living Soil Project

It is estimated that about 75 billions tonnes of soil is lost annually with more than 80% of the world farming land is moderaterly or severe eroded....

Chronic soil mismanagement and over farming causing erosion, climate change and increasing populations is said to be blamed for the dramatic global decline in suitable farming soil.

The main characteristic of Nature`s farming can be summed up in few words:

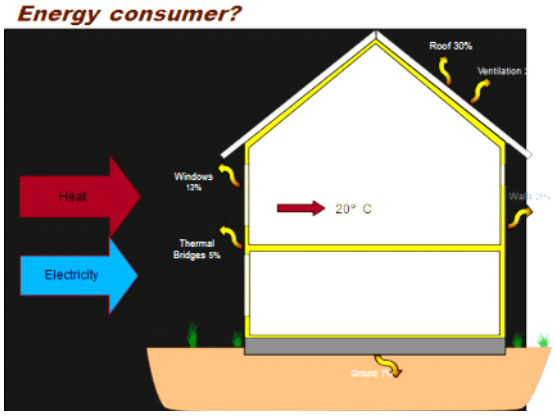
>Mother earth never attempts to farm without live stock
>She always raises mixed crops; great pains are taken to preserve the soil and to prevent erosion
>The mixed vegetable and animal wastes are converted into humus
>There is no waste; the prosess of growth and the prosess of decay balance each other
>Ample provision is made to maintain large reserves of fertility;
>The greatest care is taken to store rainfall
>Both plants and animals are left to protect themselves against disease

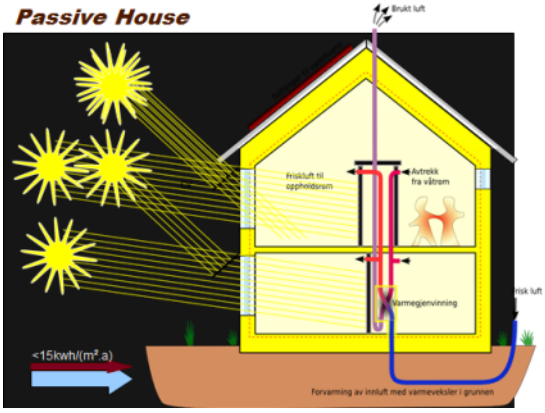
Økologiske foregangsfylker

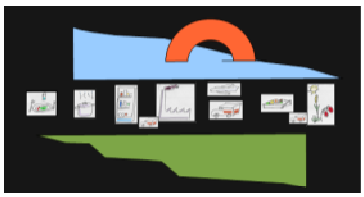
6. **Xavier Dequaire**, Oslo and Akershus University College of Applied Sciences.

The thermodynamics of Solar Buildings and the passive house designs

- More insulation, wall down to the ground, controlled air-exchanges, fresh air through the ground, energy of human activity is captured, heat demand + cooling.
- 60 % of the air leak normally.
- Both house for people and house for plants.
- Combine passive house with SolaRoof technology! ☺







Consider energy chain for food. Growth from house.

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7. Professor **Kjell Nilssen**, NTNU.

Aquaculture in poor rural areas, Nepal, rural areas, empower women.

- Scaling up – problem, lack of fish feed
- In the western world we tell them what their need is, instead of asking them about their need.
- Rural areas want it simplified.
- We don't do micro finance; don't want them to end up in large debt, especially if they get sick.
- DVD training, no need of expensive Norwegian technician around.
- Hydro power mitigation, collaboration.

8. **Hermann Helnes**, SINTEF's Clean Water Project

"Clean Water report to be finished in Dec 2011"

SINTEF's Clean Water Project: WHY?

3 good reasons

1. Because we are facing significant **global water challenges**: Population growth, urbanization, climate change, water scarcity, etc - with the need for more sustainable, more resource effective, less GHG-emitting and more climate-robust solutions
2. Because SINTEF's **unique combination of applied, end-user-oriented water activities and more basic competences** can "make the difference" towards integration of relevant R&D and Innovations
3. Because the **global water market** is huge – and rapidly growing SINTEF's vision "Technology for a better society" is valid also when it comes to water

SINTEF Technology for a better society 4

Goals: More Competence & More Innovations

→ More arenas where problem owners and problem solvers can meet!
→ More incentives and more motivation for multidisciplinary activities !
→ Mobilisation of our best researchers towards Water R&D!

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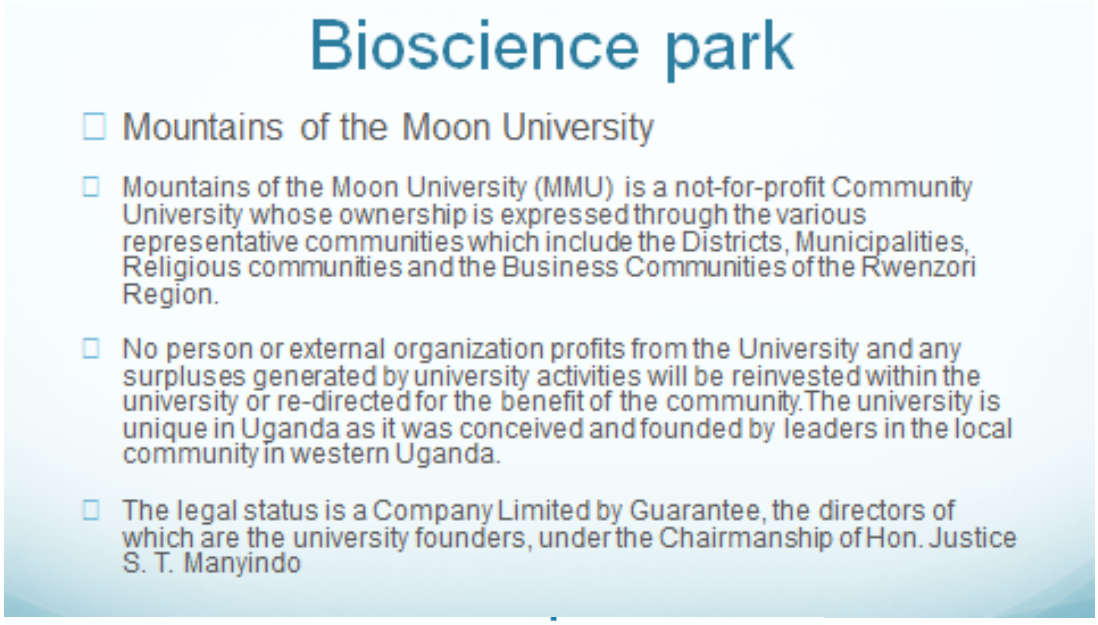
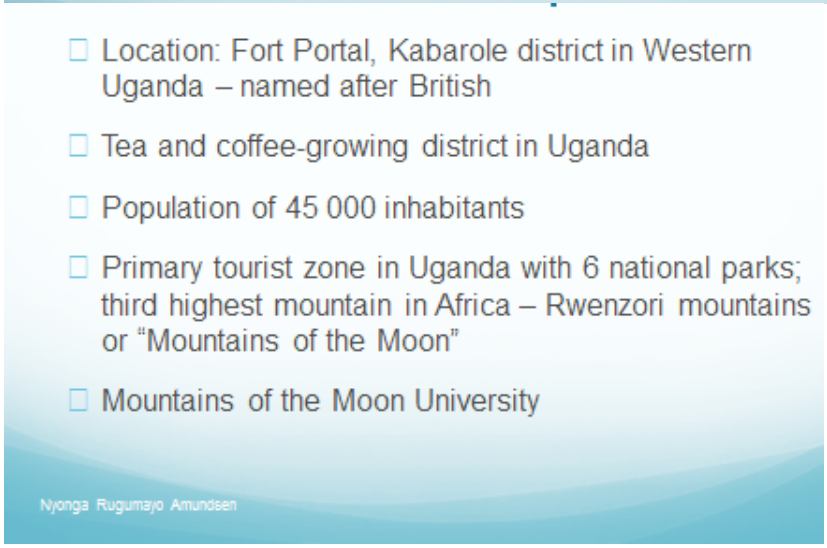
9. **Nyonga Rugumayo Amundsen** , Moon of the Mountains University, Bioscience Park, Uganda.

There is no bioscience park in the East Africa / Rift valley region. Why?

- Capacity building/ universities normally in urban areas, not rural.
- Need to take Technology to the people.
- Agro-pharmaceutical and wellness sector is imported, expensive
- MDG goals need attention, esp health.
- Preserve indigenous plants in the area

"Now there is a need of partners and funding"





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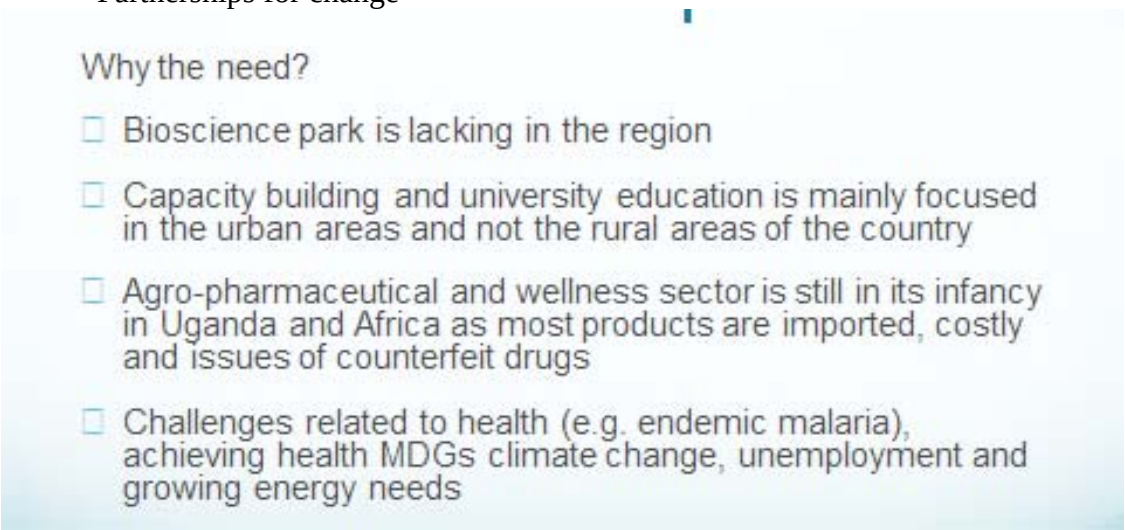
Key points:

- Mutual learning
- Competence building
- Technology transfer
- Job creation
- Partnerships for change



10. Research manager **Dr. Arne Lindseth Bygdås,** SINTEF.
    Lessons learned in knowledge sharing and creation

Greenfield projects and cross cultural management

Examples from a Norwegian based "global" company;

KUNNE Creole:
• Investigating the dynamics of international knowledge work
• Focus on cultural aspects of being successful internationally
• Integration and adaption of company standards to local settings

Arne Bygdås and Sintef were consulting Hydro, doing field work on their magnesium plant in China. The idea was to collect and disseminate learning from the China experience within the company.

- How can Hydro capture good practice from earlier projects, to avoid same pitfalls?
- Identify and describe good learning lessons and practices
- Develop tools and methods for better maneuvering in the future

CASE: China magnesium

- 1990: 2 % of world market. 2006: 72 % of world market
- The magnesium project was built on expected time, budget and quality.
- The human/soft side, however, connecting with the local context, was missing in the project discipline.

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Emergent dilemmas:

- Technology transfer; the Chinese feared leaking to competitors- rather wanted to use proven tech. from the 80ies. But the customers wanted state of the art.
- Secrecy; collective learning vs strategic secrecy.

Reverse culture crash:

- Chinese employees expected Scandinavian management style; democratic, participatory, open, close relationships
- Hydro chose "when in Rome, do as the Romans" – approach; command and control
- They had 4 general managers in 2 years, low performance, higt turn over - but THEN a successful one.

CONCLUSION

- Learning loop is really important!
- Close the gap – encourage bridge building! ☺

11. Researcher **Aina Landsverk Hagen**, SINTEF.

What drives ordinary good idea work?
www.ideawork.no

1. How does practices for idea work look at its best?
2. What can we learn if we compare practices for extraordinary idea work in all partner companies?
3. How can we support and/or accelerate processes for idea work in partner companies?

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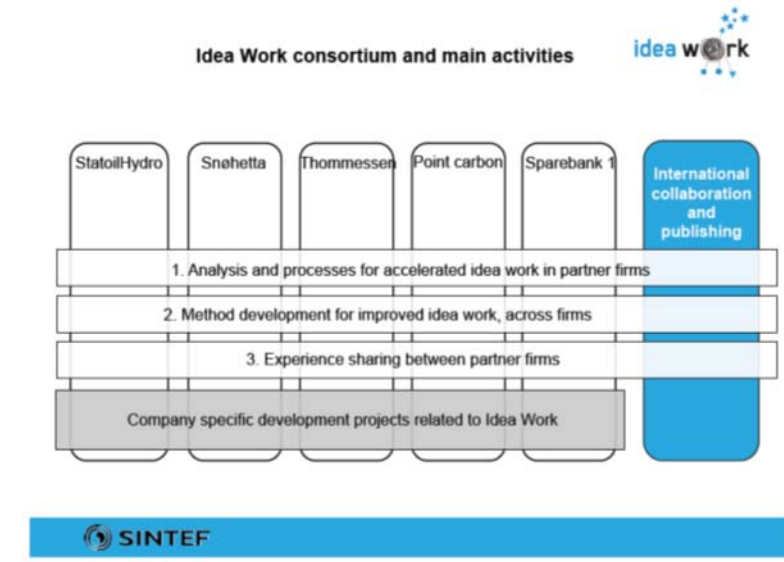

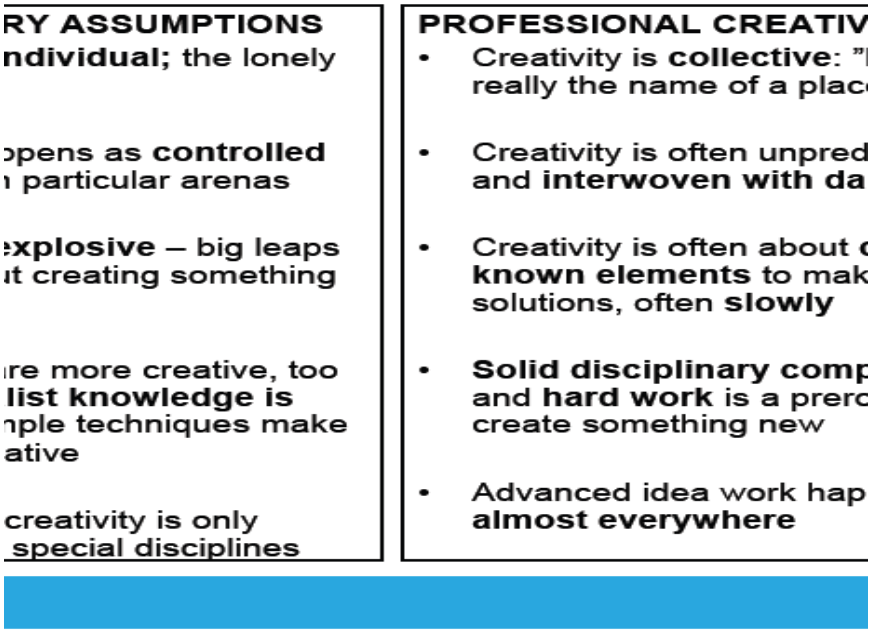

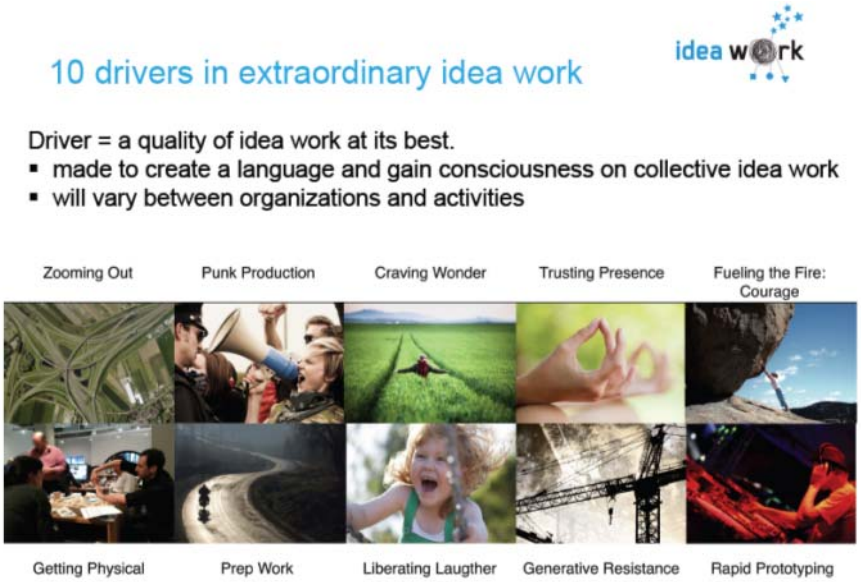

FORESIGHT AND INNOVATION WORKSHOP

Exampels from some of the DRIVERS:

Getting physical

- Snøhetta in NY, adapted/learned from the Norwegian Flat structure-culture.
- The energy in the room, when they are using their hands/moving, the ideas are popping.
- We are bodies, not only brains.
- Half the wall is pin-up with pictures etc.
- Embodied relationship with their ideas, sketches etc.
- Video conference, they hate it.. Lots of people do as you lose the physical closeness.
- Got physical with the technology, not used as meant to.
- Did a sketch and showed to the film camera.

Punk Production

- Ask your employers to break norms, make radical reforms.

- Iran 1979 and 2009 – feminist movement. 10 feminist magazines. (Aina's field work)
- Westerns have only ideas about hijabs.. But hey, let's talk about laws!
- Political non-written red line. Cross it just a little, sanctioned, but not severely.
- Human rights and woman rights taboo, like abortion. They wrote about medical abortion first. Babysteps.
- They are not one group, secular, muslim groups, they disagree on lots, but agree on SIDA policy implemented. New generation.

12. **Anne Wirstad**, Life Synthesis, has some concluding remarks:

Open source is known to the software industry, but can be used in all products and services.

"The good intentions and creativity of citizens, and their willingness to make a difference, is one of the most underutilized resources we have today."

FORESIGHT AND INNOVATION WORKSHOP

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15. Arne Bygdås, SINTEF
16. Bruce Edgar, Phoenix Planning Design
17. Anne Wirstad, Life Synthesis
18. The Living Soil Project, Øystein Haugerud,
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