

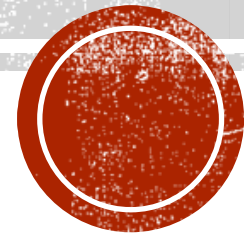
CHALLENGES FOR BIO-ECONOMY RESEARCH IN THE ANTHROPOCENE

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Professor Bjørnar Sæther

Department of Sociology and Human Geography

University of Oslo bjornar.sather@sosgeo.uio.no



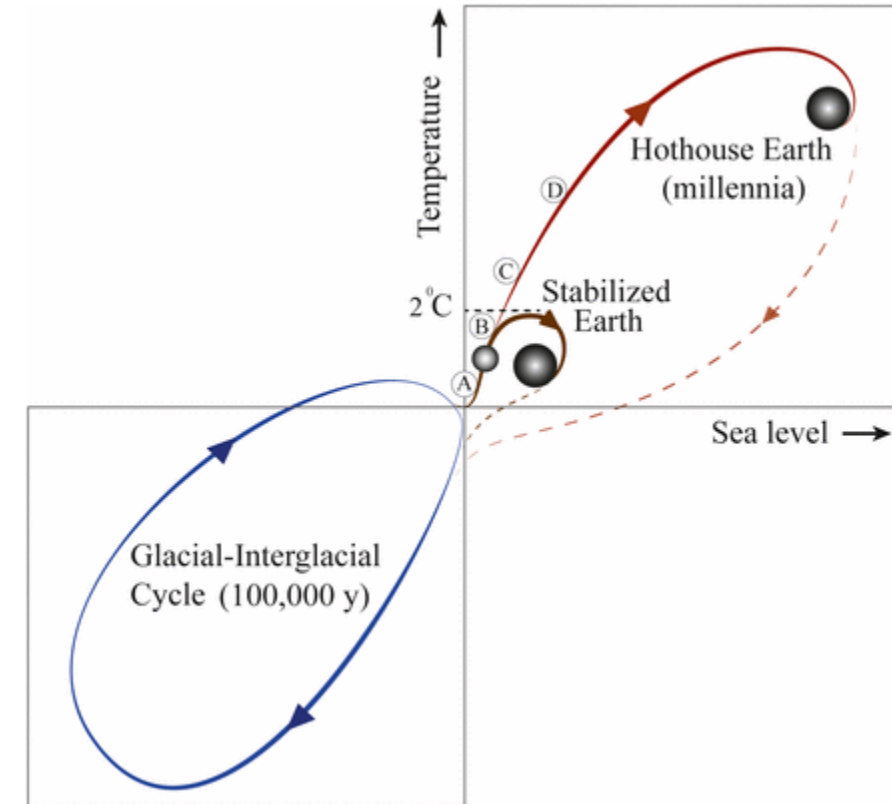
OUTLINE

- Responsible research in the age of the Anthropocene
- Researching material transitions
- Bioeconomy visions
- The geography of the Multi Level Perspective
- Example from the Norwegian forest industry sector



CLIMATE CHANGE

- The future of nature and society as we know it is at immediate risk at a global scale, according to the IPCC, October 8, 2018
- Earth has left its stable climate pathway in the glacial-interglacial cycle (Steffen et al. 2018)
- Self-enforcing feedbacks could push toward planetary thresholds where it is no longer possible to stabilize the climate at an intermediate temperature rise
- Steffen et al. (2018) call for immediate action where interaction between nature and society is *designed* to support a transition to a state coined “Stabilized Earth”, where the most severe consequences of climate change still can be avoided



THE ANTHROPOCENE AND PRODUCTION OF NATURE

- According to geologists (Steffen et al. 2015);
- In the age of Anthropocene (following Holocene) change has reached the planetary level, not only through accumulation of environmental problems, but also through the accelerating emergence of systemic symptoms of high magnitude and notable simultaneity and synchronicity
- According to the geographer Neil Smith (1984);
- Capital stalks the earth in search of material resources, transforming nature into an appendage of the production process leaving no original relation with nature unaltered, no living thing unaffected



RESEARCH IN THE ANTHROPOCENE

- The Anthropocene raises questions concerning what sort of science is needed (X. Bai et al. 2016)
- Exploring transformative changes towards sustainability has been identified as a key research challenge
- The complexity and uncertainties of the Anthropocene however, encounter the cognitive limits of human beings
- When considering the future there is no single outcome that can serve as focus for a narrative – alternative scenarios are the best that can be done
- Disciplinary, institutional and financial boundaries are barriers towards future-oriented thinking
- Responsible research and innovation according to the Norwegian Research Council's guidelines seems to be a pragmatic response to the challenges raised
 - To be forward looking in our research is a good advice



HÄGERSTRAND ON MATERIALITY

- Human Geographer Torstein Hägerstrand once argued that the social sciences were indifferent to the materiality of our existence (Hägerstrand 1993, 13).
 - Human existence was veiled behind conceptualization of materiality - the volume, weight and form of a machine were covered by the concept “machine”.
- Hägerstrand asked us to remind ourselves (as social scientists) that we lift what we talk about out of its material neighborhood. This makes it easy to place the object in other contexts without considering the frictions and side effects incurred.
- It is difficult to understand the conditions and consequences of these side effects since they have been defined out of the conceptualization.
- Discussions on environmental problems are an imperfect attempt to regain what has been lost and can lead to incantations rather than real insight (Hägerstrand 1993, 17).
- What does this mean to us today? As researchers we can not stop to conceptualize – however, if we care about environmental problems we should be more careful in leaving materiality out of our conceptualizations



A MATERIAL WORLD

- Better ways to investigate relations between materiality, economy and society are needed
- The position taken is that “...we live in a material world in which “the economy” is fundamentally (although not exclusively) a process of material transformation through which natural resources are converted into a vast array of commodities and by-product wastes” (Bridge 2009, 1218).
- The laws of thermodynamics are nature imposed limits of material transformations:
 - Energy is neither created or destroyed, but might take other physical forms
 - Total mass of inputs is equal to total mass of outputs
 - As energy passes through successive transformations it becomes progressively less available for human use as the entropy increases



MATERIAL FLOWS

- <http://sk.sagepub.com/books/economic-geographies/n3.xml>
- According to Ray Hudson (2003); “it remains an open question as to whether any form of economy, any set of social relations of production, can develop effective regulatory mechanisms to contain the consequences of human intervention into the cycles of natural processes over the long term.”



BIOECONOMY VISIONS

- Based on bibliometric analysis of 453 papers on bioeconomy published 2005-2015, Bugge et al (2016) have identified what they call visions of the bioeconomy:
- *A bio-technology vision* that emphasizes the importance of bio-technology research and application and commercialization of bio-technology in different sectors
- *A bio-resource vision* focusing on the role of R&D related to biological raw materials in sectors such as agriculture, marine, forestry and bioenergy. This vision emphasises the potentials in upgrading and conversion of biological raw materials
- *A bio-ecology vision* highlighting ecological processes optimizing the use of energy and nutrients, promote biodiversity, avoiding monocultures and soil degradation. Emphasises regionally concentrated circular integrated processes.



WHO, WHAT, WHERE?

- A high share of research on bioeconomy is taking place within biotechnology, microbiology, energy, environmental sciences and chemistry
- Less than 8 of 453 published papers are within the social sciences
- A few universities together with the US Department of agriculture have leading positions in bioeconomy research; Wageningen, Iowa State University, Ghent, Utrecht and Lund



KEY CHARACTERISTICS

(SOURCE: BUGGE ET AL 2016)

	The Bio-Technology vision	The Bio-Resource vision	The Bio-Ecology vision
Aims & objectives	Economic growth & job creation	Economic growth and sustainability	Sustainability, biodiversity, conservation of ecosystems
Value creation	Application of biotechnology, commercialization of research and technology	Conversion and upgrading of bio-resources	Development of integrated production systems and products with territorial identity
Drivers and mediators of innovation	R&D, patents, research councils (science push – linear model)	Interdisciplinary, optimization of land use, waste management	Favorable agro-ecological practices, ethics, risk, circular production mode
Global clusters, central regions	Global clusters, central regions	Rural regions	Rural regions



REFLECTIONS

- Bioeconomy research is dominated by the physical sciences and a few leading universities
- What sort of possibilities and challenges do this raise for social scientists?
 - The line of bioeconomy research following the bio-tech vision seems to be another attempt at a quick technological fix within a ecological modernization governance structure
 - The bio-resource and bio-ecology visions contains elements of upgrading of bio-resources that seems more promising
 - These two visions see rural areas as important in developing the new solutions. Since rural areas are lagging behind urban areas in knowledge intensity and production this is problematic.

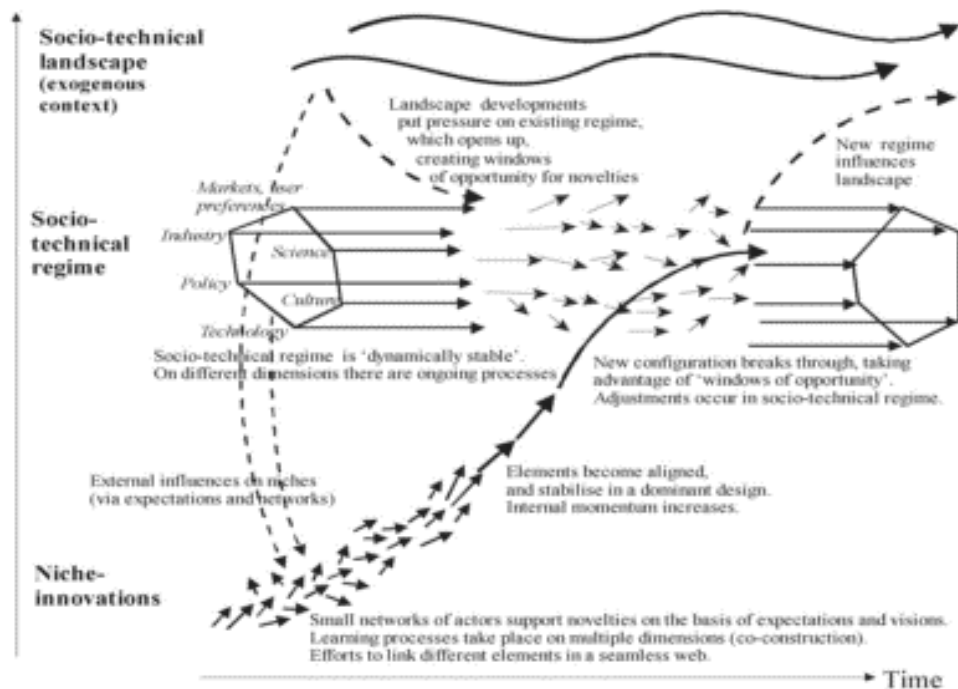


TRANSITIONS

- As is well known transition studies has grown into a important approach concerning how society evolves, or not, in the direction of sustainability
- Based on initial contributions by Kemp (1992) on niche management and the history of technological change (Schot) the Multi-Level-Approach evolved (Geels and Schot 2002)
- Geography have been overlooked within the MLP, including:
 - The places where transitions actually take place
 - The socio-spatial relations where transitions evolve
 - The spatial context of case analysis are neglected, making comparative studies more difficult

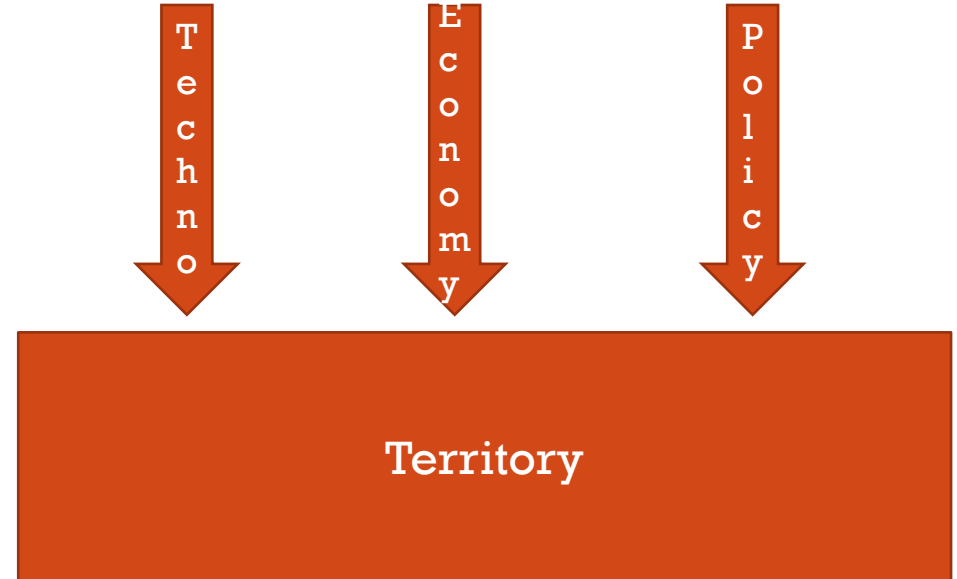


Increasing structuration
of activities in local practices



FUNCTIONAL VS. TERRITORIAL

- Technological, economic and policy change occurs across space
 - Internet and the mobile phone influences most people in most places
- But each place experience such changes different
 - Since Steve Jobs and Apple introduced iPhone 1 in 2007, appr. 20.000++(??) jobs were lost in Finland
 - Many more jobs where created in California and China
 - Territorial combinations of technology, economy and policy are keys to understand change



WHAT ARE WE SEARCHING FOR?

- Analytical approaches enabling research on sustainability transformations that:
- Takes seriously the role of time-space, ie. transitions are evolving in a time-space context (Coenen et. al 2012)
- Takes seriously the social-geographical dialectics – the double interaction between the social and the geographical
- Recognizes the roles of structures, institutions and human agency
- Recognizes that sustainability transformation processes are open ended
- Recognizes the role of materiality



SCALED TRANSITIONS

- Sustainability transitions are multi-scalar
- Some actors are more powerful with capacity to draw on resources across multiple scales
- The geography of the networks are those which fit actors
- Scales are actively constructed through socio-spatial struggles by actors seeking to achieve their ends
- Following spatial relationships allows interpretation of how small niches can influence larger regimes



POSSIBLE EMPIRICAL STARTERS

- We should not be afraid to normative – in the sense that social science is a scarce resource that should contribute to make the world a (environmentally) safer place
- This implies choosing research objectives that can support green transformations, however once objects are decided upon we should strive for objectivity
- For economic geographers this can mean:
 - To research technologies/industries with products with a well documented positive effect on environmental problems – and ask how could such technologies/industries play a larger role? How can these products replace less env. friendly products, and at the same time stimulate the regional economy?
 - Include demand side conditions
 - In regions with economic dependence on industries with a well documented negative effect on the environment (such as oil and coal)– start to investigate alternative pathways. What conditions have to be met in a particular locality, such as Western Norway, to establish green regional dev. paths?



A SECTORIAL APPROACH

- Materials from nature are transformed into products that is then further transformed.
- Important material transformations take place within sectors of the economy, such as the oil, mining and forest sectors.
- A sectorial approach reduces some of the *cognitive* complexity of material transformations
- This makes it possible to include vernacular knowledge on questions concerning environmental sustainability at the level of sectors
- Some sectors have an overly positive impact on the environment such as the emerging solar energy sector
- Two sectors, coal and oil, are leaders in the “war on the climate”
- Other sectors have much more complicated nature-society relations, such as agriculture and food.

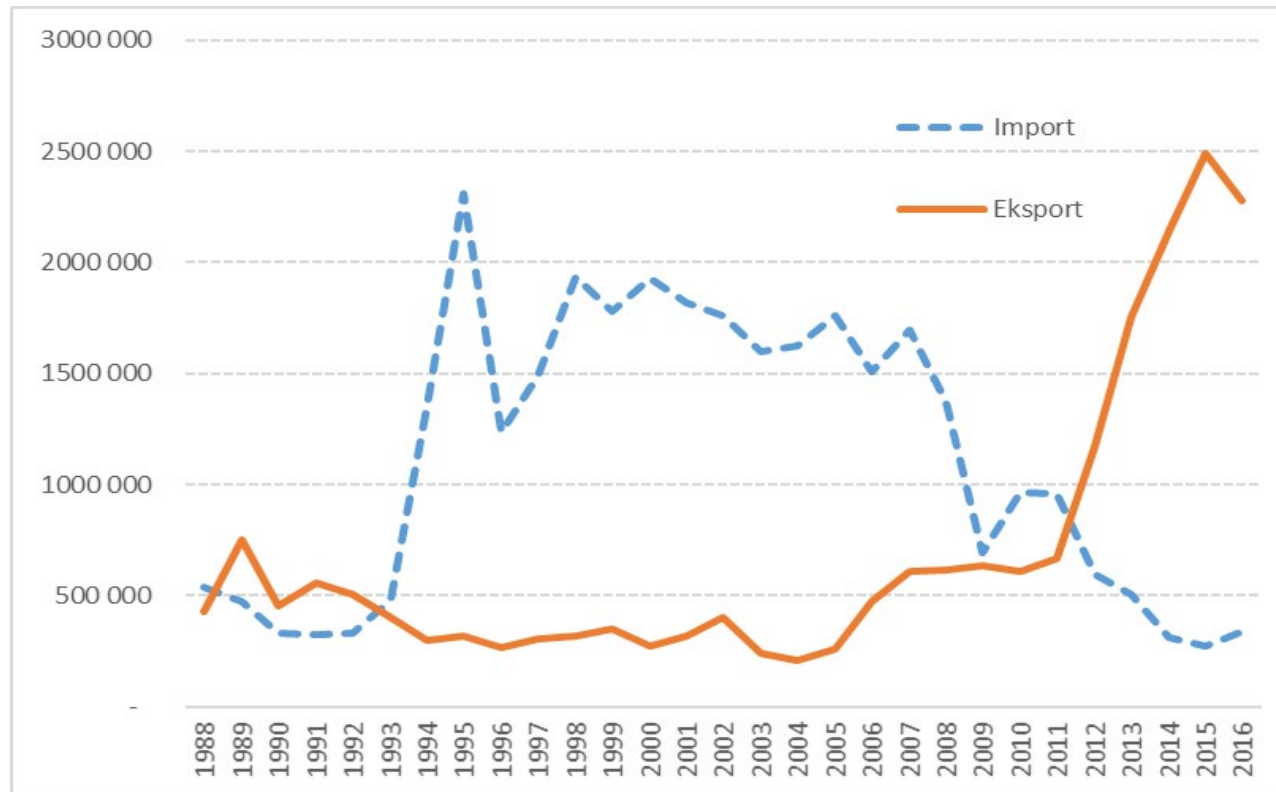


EXAMPLE: THE NORWEGIAN FOREST INDUSTRIES

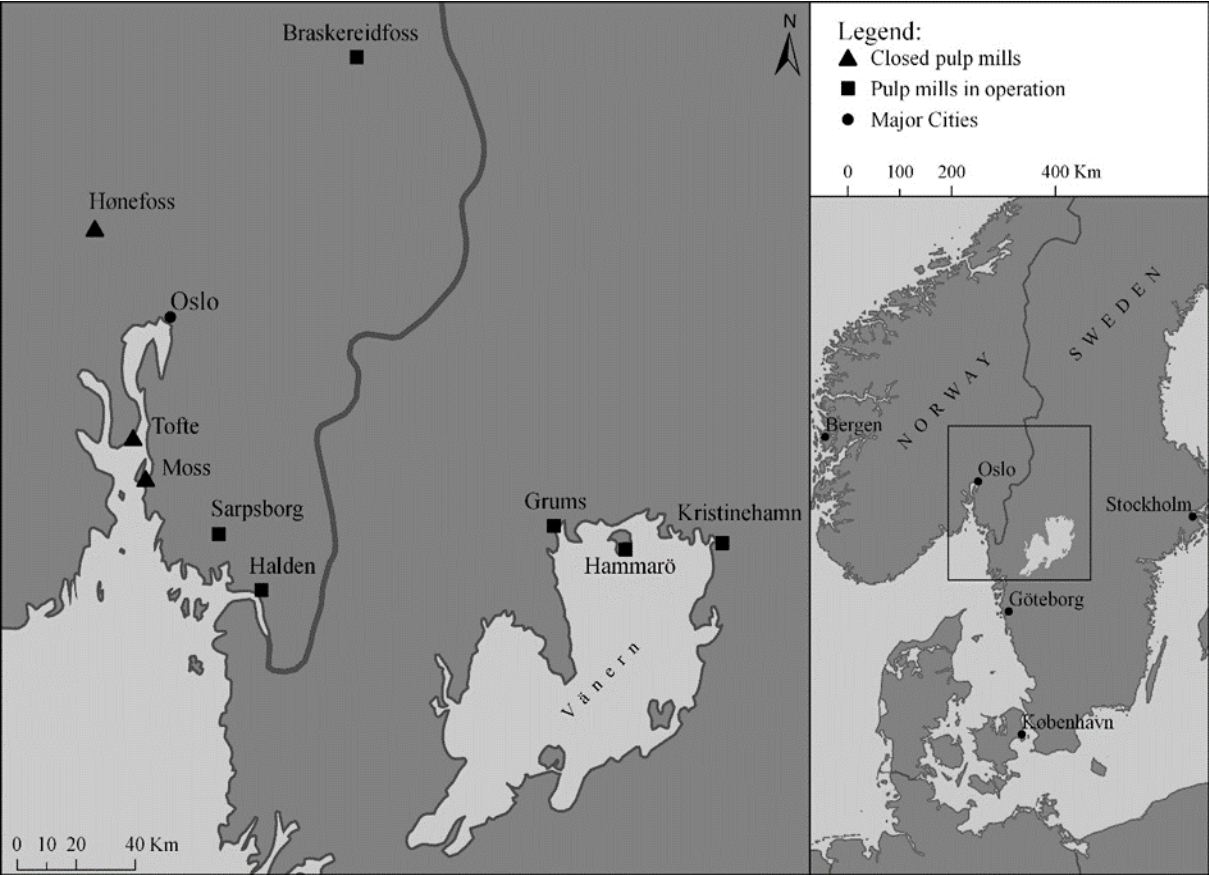
- Products from wisely managed forests in Scandinavia can play a larger role in transformations to green regional development by substituting other less sustainable products such as concrete, steel, plastics etc.
- Forests are nature's way of carbon capture and storage, 1m³ of wood stores 800 kg CO₂ through its lifetime. Burning 1m³ of crude oil releases 2700 kg CO₂
- Norw. forest industry – an industry in long time decline
- Newsprint was most important product – but collapse of market
- Huge export of logs to Sweden and elsewhere, increased import of finished products
- Huge need for forest industrial path renewal



NORWEGIAN TRADE IN PULP WOOD



PULP MILLS IN EASTERN NORWAY AND WESTERN SWEDEN 2018



NORWEGIAN EXPORT BY SECTOR

	Value in billion € jan-aug 2018	Change 2017-2018
Crude oil	17,3	17,2 %
Natural gas	16,6	23,5%
Fish	6,1	3,9%
Export from off-shore activities	40,0	
Forest products	0,9	
Food	0,22	
Other on-shore activities	28,68	
Export from on-shore activities	29,8	9,3%
Expected annual capital income from on-shore activities	34	



THE NORWEGIAN GOVERNMENT PENSION FUND GLOBAL

- According to The Government Pension Fund Global web-page the fund; “is saving for future generations in Norway. One day the oil will run out, but the return on the fund will continue to benefit the Norwegian population.”
- The fund owns 1% of all publicly traded shares globally, including in the range of 5-7% of the shares in StoraEnso and UPMKymene
- At present the value of the fund is in the range of 850 billion €
- Annual return has been 4% since startup in 1996
- 4% of 850 billion = 34 billion € as expected annual income for the government
- Some of this money is spent in the annual budgets
- One scenario is that the Norwegian economy makes a transition from a fossile economy to an economy based on huge capital income
- The bioeconomy, except from fisheries, is of little importance to the national economy
- The bioeconomy is however important for some regional economies, mainly Eastern and Mid-Norway



RESEARCH PROPOSAL

- Identify conditions for nationally increased value creation based on forest resources
- Evaluate the role of business strategy, knowledge and innovation in new product development
- Develop scenarios of the forest sector and assess the economic and environmental impact on the bio-economy (with the Norwegian University of Life Sciences)
- Identify conditions for increased acceptance of forest based products in the market
- Develop policy means to increase the use of forest based products, particularly as CO₂ storage.



AN ANSWER TO THE CHALLENGES?

- Is this research proposal an answer to the challenges research meets in the Anthropocene?
- The current proposal is in line with the bio-resource vision proposing to upgrade use of bio resources to promote growth and sustainability
- Some critical questions:
 - What about the Nordic forests in the future – will they adjust to a changing climate, or will their health decline?
 - What if wood replaced concrete and steel on a large scale, how much would this reduce Norway's annual Co2 emissions – my guess is 0,5-1 mill tons annually, only 1-2% of total emissions
 - Using wooden in urban housing and other applications as carbon storage is only one in a range of efforts to reduce CO2 emission



CARBON CAPTURE AND STORAGE.....

- Stave Church western Norway
ca.1200



- Apartment building Bergen 2016

