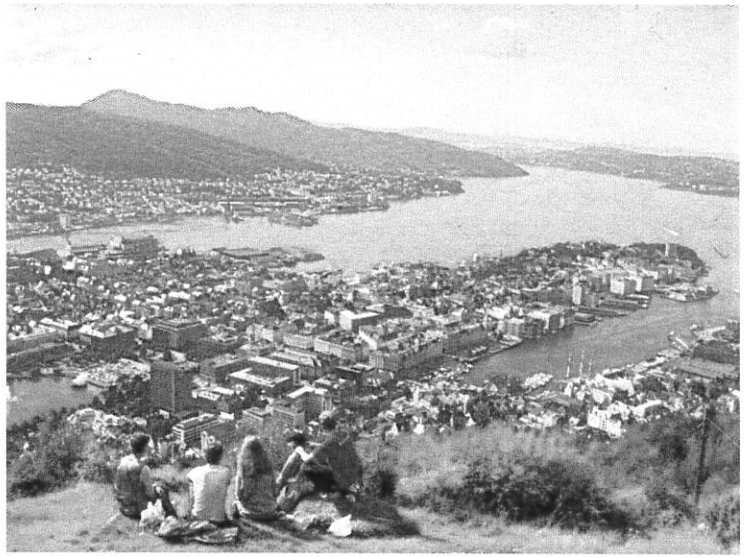
Adapting to climate change

Expected climate changes in Bergen:

- Precipitation is expected to increase,
  - Higher risk for flooding
- Sea level and high tide is expected to rise
  - Overflowing the wharf and World Heritage site Bryggen and lower parts of the city
- More strong winds

Risk and vulnerability
- extreme weather

Water, sewerage, waste – biogas plant, distant heating, waste collection system



- Historically, the whole existence of the city of Bergen has been based on water
- The 'Rain City' is our trademark and climate change means that we are facing the challenge of dealing with even more water – both from the sea and from the sky
- WATER is therefore a natural part of all our work, both as an attraction and as an essential component in improving the lives of citizens and visitors alike
- Bergen has conducted a risk and vulnerability analysis that is unique in Norway, and this knowledge has also played an important role in urban planning in the city

Cities of the Future - Norway

In 2008, the national authorities and the 13 largest cities joined forces in order to create Cities of the Future – cities with the lowest possible greenhouse gas emissions and a good urban environment. An important goal is to develop strategies to meet future climate change

Norwegian Directorate for Civil Protection coordinator for climate adaptation in the national program

The White Paper «adaptation to climate change in Norway» was presented May the 7th 2013; Norway gets warmer and wetter. Climate change will have major impacts on nature and society and planning must take this into account

FRAMTIDENS BYER

dsb Direktoratet for samfunnssikkerhet og beredskap

CITY OF BERGEN

Climate and Energy action plan - Goals and strategies

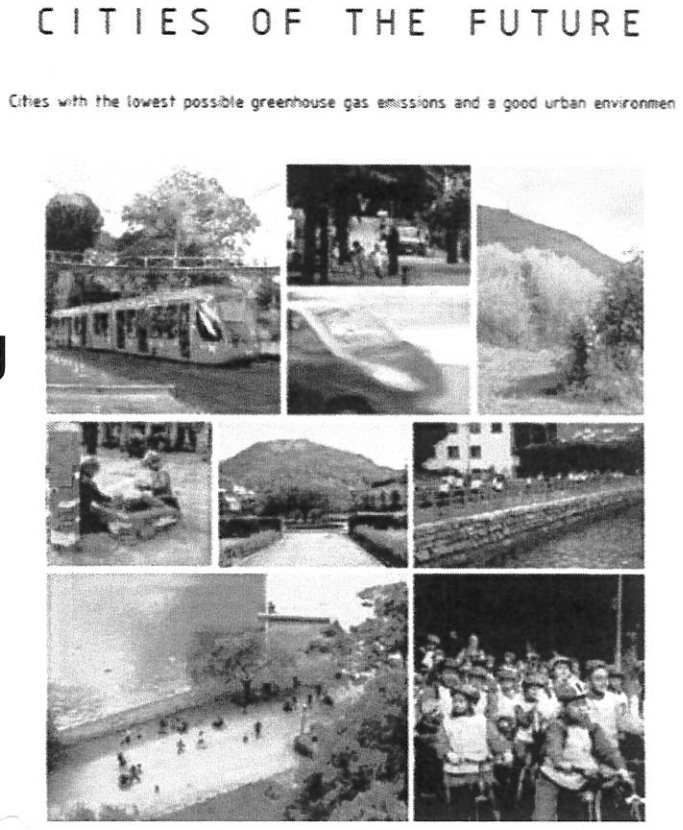
Bergen Smart City

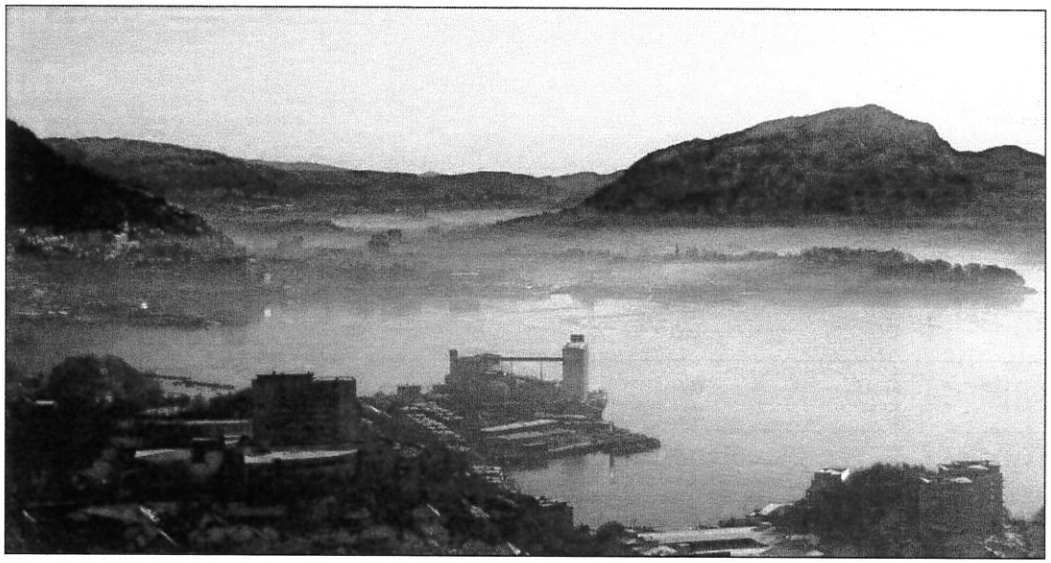
Smartere bruk av energi

Reduce greenhouse gas emissions:

- transport
- stationary energy
- consumption and waste
- strategies for climate change

Improve the urban environment regarding safety, health, air pollution





a major challenge:
local emissions

a major challenge:
global climate

Joint clean air and clean water strategy

Shoreside electricity in the city of Bergen

Kind of pollution	Potential for reduction	Reduction of
CO_2	50%	Global heating
NOx	97%	Health damage, global heating
PM	89%	Health damage
VOC	94%	Health damage

Landslides - conclusions

- Documented that many areas may be vulnerable to landslides
- Rockfall and landslides often constitute the greatest threat to buildings
- Prepared vulnerability map of the municipality's GIS system, with separate function button for avalanche
- For use by building permit officers and area planning officers

How we address climate adapation

- Standards and requirements for stormwater management

  - Local management, open solutions, standards are used in land use planning (area plan etc)

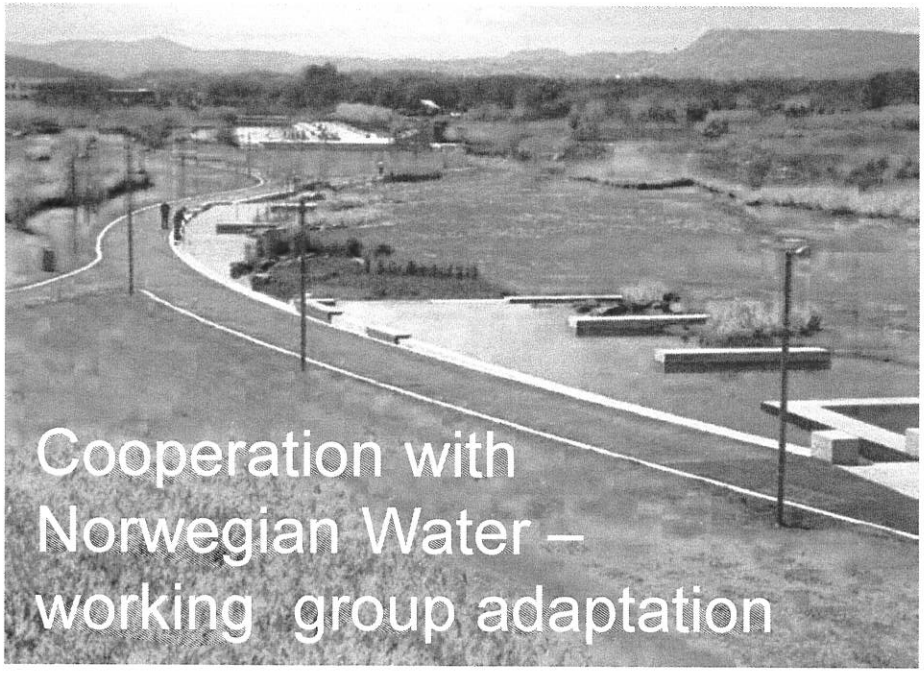
- MARE – EU-project
  - Adaptation Strategies and increased competence
  - Cities of the Future – Water in the city
  - Purification of surface water becomes more relevant
    Focus on Civil Protection – collaboration
    Cheaper to prevent than to repair
  - Safety and Emergency

Bergen`s learning alliance and cooperating organisations

- City of Bergen (partner)
- Bjerknes Centre for Climate Research
- Nansen Environmental and Remote Sensing Center (Research)
- University of Bergen
- Norwegian school of Economics
- Tryg (insurance company)
- Bergen Chamber of Commerce
- County - County Governor
- Regional climate council (politicians) and regional professional network
- Norwegian Water Resources and Energy Directorate
- Norwegian Directorate for Civil Protection
- Cities of the Future
- NORADAPT (research project) / Baltcica (Interreg project)
- NGOs

MARE

The Interreg IVB North Sea Region Programme



Norwegian Water BA is a national association of water and wastewater works. In Norway these works are mainly owned and operated by the municipalities, some are inter-municipal companies. The ambition is to organize cooperation between the Water and Wastewater Works in technical, economical and administrative matters and attend the joint interests of the works

- The water and wastewater sector faces major challenges in adapting to climate change
- More frequent and more powerful downpour sets the capacity of the sewage system to the test, and also leads to increased pollution of water sources
- Greater demands on our infrastructure - need to plan for more robust systems as a good way to cope with expected climate changes
- In addition to being expensive, water damage creates extra hassle for homeowners - can be caused by the downturn in the water and wastewater pipes so that sewage comes out of drain and surface water from entering the building from the ground
- Increased pollution of water sources could increase the need for purification of raw water

Changes in the past, present and future sea level with special focus on the western coast

a project conducted by the Nansen Environmental and Remote Sensing and UNI Reasearch, the Bjerknes Centre for Climate Research, and
funded by Department of Urban Development, Climate and Environmental Affairs

Bryggen - what will happen?

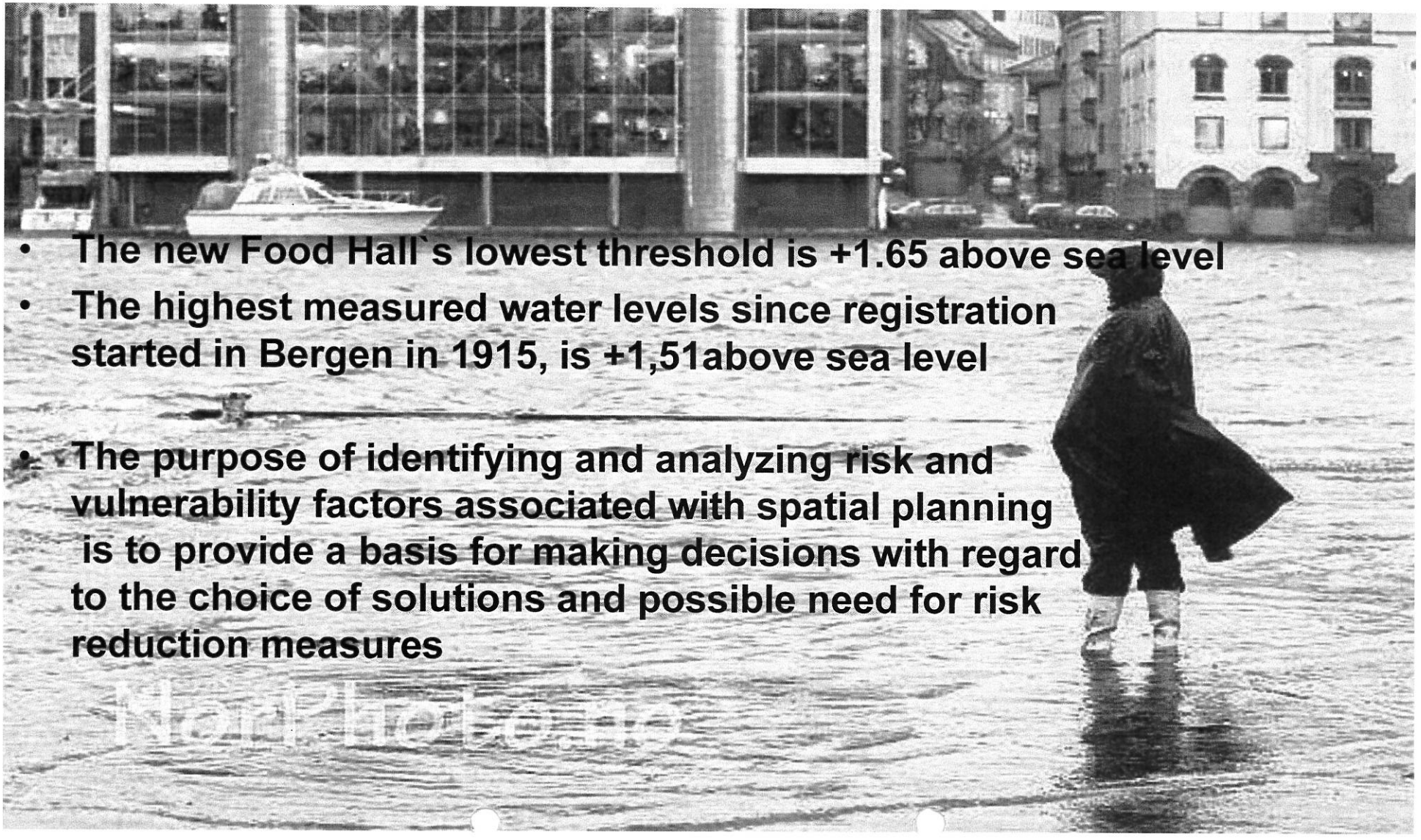
•Made a big effort with drainage systems - this has stopped the ongoing "surge" into the buildings

•Rising sea levels may pose a problem for large parts of Bergen - not only Bryggen

- Some of the buildings has restored foundations, this has resulted in the elevation of the building, and it has also added jacking point for future jacking up the building if it is needed
- SKINT project (INTERREG) is an international project which has studied water management and cultural heritage - and the experts there are also in a groundwater project at Bryggen - providing valuable experience in the water management

100 years ahead the sea-level will be more than half a meter above today's level - we need to prepare for the changes – and we need to reduce the emissions that cause the climate changes

Risk analysis - Sheltered Food court



- The new Food Hall`s lowest threshold is +1.65 above sea level
- The highest measured water levels since registration started in Bergen in 1915, is +1,51above sea level
- The purpose of identifying and analyzing risk and vulnerability factors associated with spatial planning is to provide a basis for making decisions with regard to the choice of solutions and possible need for risk reduction measures

Challenges

Which climate scenarios should be used?

-Best case?

-Worst?

-Something in between?

-Several scenarios?

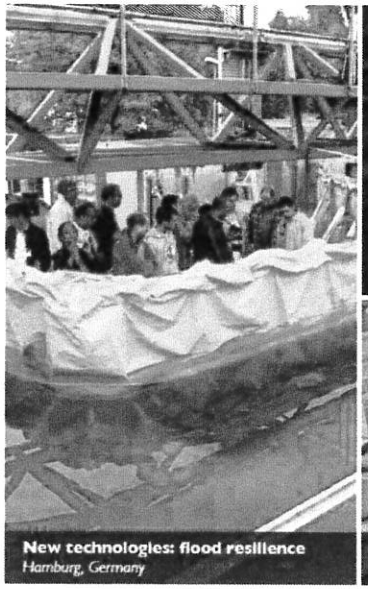
- - Ex: Rising sea level - Assess potential impacts and measures - or the regulations of the municipal area plan?

Make conscious choices although many questions

- Are the cities equipped for downpour?
- Blue and green structures in the city - how do they function as part of flood risk management?
- Stormwater Management and densification policies – which instruments do municipalities need?
- Small rivers and intense rainfall, water flow and water quality?

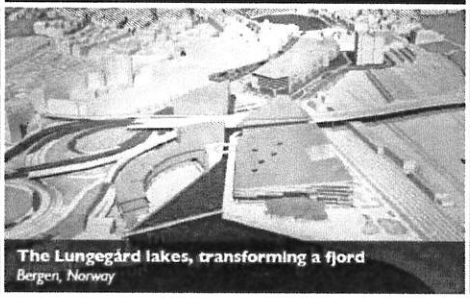
CAMINO

Climate Adaptation Mainstreaming Through Innovation



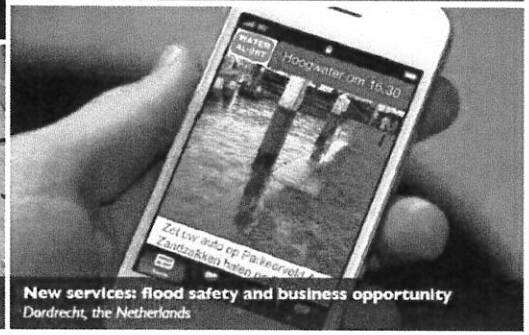
New technologies: flood resilience
Hamburg, Germany

Pilot project on flood protection at property level
Flanders, Belgium



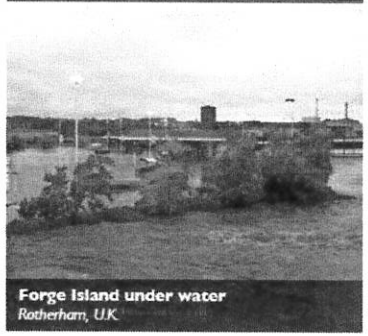
The Lungegård lakes, transforming a fjord
Bergen, Norway

New governance and collaborative models
In 6 Learning and Action Alliances



New services: flood safety and business opportunity
Dordrecht, the Netherlands

Developing DIY solutions to the market
Hollands Noorderkwartier, The Netherlands



Forge Island under water
Rotherham, U.K.

Background

The plans for protecting cities against any kind of flooding often foresee large-scale adaptation of infrastructure.

The current economic circumstances make such investments less feasible causing climate adaptation initiative to stall.

Aim

Participants from the Interreg projects MARE, SKINT, SAWA, FRC and BaltCICA try to overcome the technical, governmental and financial barriers by supporting the development of innovative products and services and financially feasible governance approaches.

Approach

Policy makers, industry and researchers collaborate to further develop innovative business cases and governance approaches in 3 steps:

- Mapping investments in infrastructure and maintenance to identify mainstreaming opportunities;
- Identifying synergic projects with climate adaptation;
- Identifying business cases

Results

CAMINO will help to mainstream climate adaptation by delivering:

- Pilots in six cities that showcase novel governance structures and the use of novel technologies
- Future perspectives describing the potential benefits and challenges for a large-scale uptake of solutions on a local, national and EU-level.

Impact

The partners work together to demonstrate approaches that reconcile climate adaptation and economic growth.

For other cities the solution could provide new routes to take up.

For involved business the solutions could provide new opportunities for business.

Interreg IVB Northsea
2013-2016
6
700 K EUR
380 K EUR
City of Dordrecht

Dordrecht
Vlaanderen
Rotherham
UNESCO-IHE Institute for Water Education
TUHH Technische Universität Hamburg-Harburg
Hollands Noorderkwartier
Bergen Kommune
Freie und Hansestadt Hamburg

The Interreg IVB North Sea Region Programme

Box & Willems Consulting Venturing

More precipitation and more intense rainfall in cities and towns

- The need for more knowledge about how different water solutions work: Rainbed, green roofs and walls, flooding roads, permeable surfaces, gravel, custom paving stones, important to take frost, clay and mountains into consideration ....

Bergen municipality cooperates with the Bjerknes Centre - new report on precipitation in Bergen - knowledge is used among others by the Water and Sewerage Works

Climate Service Office in Hordaland

- Establish a regional center on adaptation to climate change – support the municipalities, government agencies and private sector

- The center will benefit from experience and lessons learnt in MARE and BaltCica projects, particularly from the West precip research – global model for heavy precipitation

- Managed by the Norwegian Metereological Institute, Norwegian Water Resources and Energy Directorate, UniKlima and Bjerknes Centre for Climate Research

- LAA: The city, the county, national bodies, Tryg Insurance Company, Bergen Chamber and Commerce, Norwegian School of Economics, Power Company (BKK), Local agriculture department, fish farming companies

- Want to include Norwegian Public Roads Administration

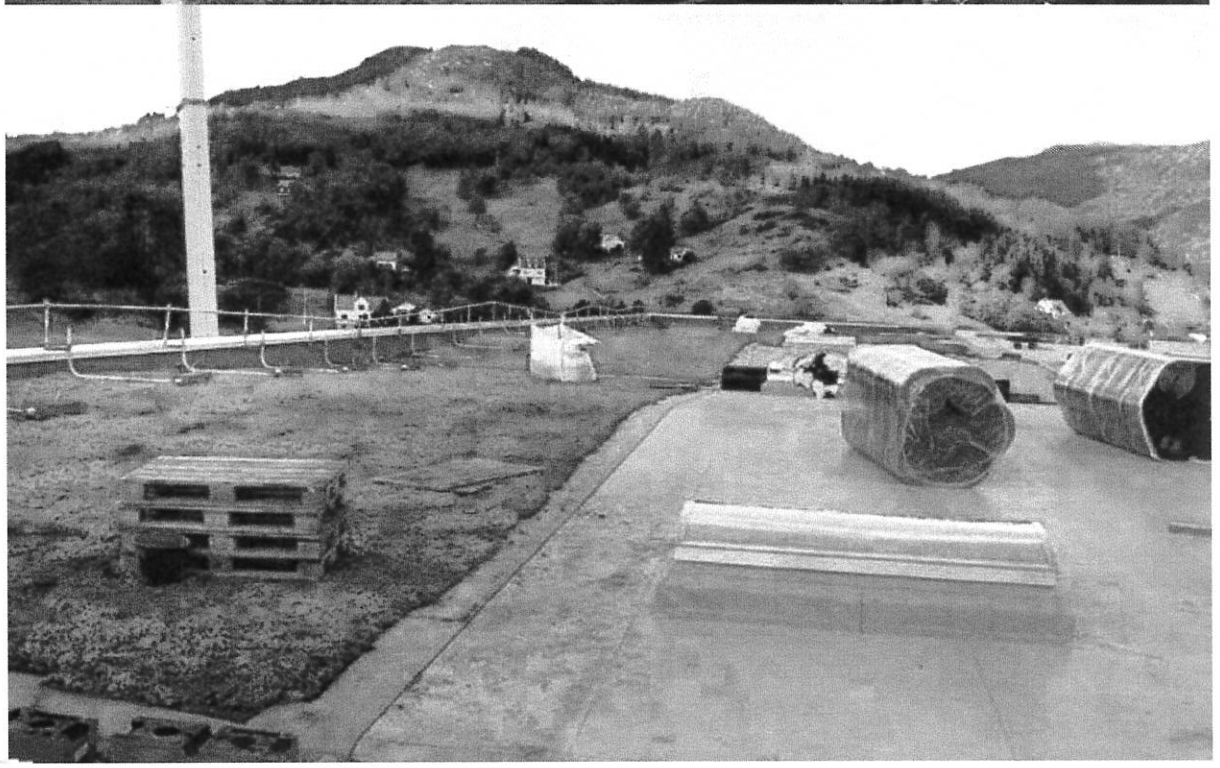
CAMIN

Climate Adaptation Mainstreaming through Innovation

Project on Green Roofs – that will work in a rainy city like Bergen

- Lessons learnt from the biggest green roof in Europe – the Ikea building in Åsane – the green roof did not survive the heavy rainfalls in Bergen – so we must find out more about construction and species of plants – what will be the best?
- Managed by the the municipality, a project in the Cities of the Future program, cooperation with private enterprises (building companies, landscape architects)
- LAA: The city, the county, national bodies, Tryg Insurance Company, Bergen Chamber and Commerce, Norwegian School of Economics, private enterprises

22000 square meters of sedum on the roof of new Ikea in Bergen



- Saves energy

- To be allowed to build a huge building like that they were forced to have a green roof to blend in

- Works as a great insulator and rain absorbtion system



Green structure



Annual climate festival and climate weeks with conferences, movies, concerts, competitions etc