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Co-benefit and Co-control studies in Norway

Presentation at the EFCA meeting in Strasbourg, 5 – 6 November 2008

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1 Introduction

NILU was invited to the meeting in Strasbourg in November 2008 to present the Norwegian approaches concerning cost/benefit and cost/control. The meeting was organised by IUAPPA (The International Union of Air Pollution Prevention Association) and EFCA (the European Federation of Clean Air).

To achieve the goal of the meetings IUAPPA/EFCA needed advice and help from colleagues in Eastern and South-Eastern Europe. As a first step they therefore invited a number of representatives from NGOs and other organisations from the Czech Republic, Poland, Lithuania, Norway, Bosnia, and Croatia to join for informal discussions at the conference in Strasbourg.

Participating in the discussions for IUAPPA and EFCA was Professor Giuseppe Fumarola, President of EFCA, and Richard Mills, Director-General of IUAPPA, and various members of the IUAPPA secretariat and the EFCA Board.

NILU was asked to present our comments and views, in particular on the following matters in respect of what is been done in Norway:

- What are likely to be the main environmental issues in Norway in the next few years?
- What in particular may be the key air pollution/climate issues in Norway for the next few years?
- What are the main non-governmental organisations (NGOs) or other associations in Norway that are involved with atmospheric pollution and environmental issues?
- How influential/important are these organisations?
- What are the constraints/problems these organisations face?

More generally we were asked whether NILU had any suggestions on ways in which IUAPPA and EFCA could develop to become more relevant to environmental issues and associated problems in Eastern and South Eastern Europe.

2 NILU presentation

As part of the country discussions NILU presented the relevant projects related to the co-benefit and co-control approaches. The presentation is shown in Appendix A.

2.1 Integrated studies

The integrated and co-ordinated projects where urban air quality planning included also greenhouse gas emissions and climate change issues was presented based on a discussion that NILU introduced in a seminar in The World Bank meeting in May 2006.

2.2 Scenarios Oslo

Studies have been performed in Oslo in order to evaluate the exposure to people for alternative scenarios identified in order to reduce the air pollution impacts.

2.3 Norwegian Climate Policy

The Norwegian Government is committed to develop Carbon Capture and Storage technologies, and hopefully contribute to make this technology commercially viable at a global scale.

As part of the goal of being carbon neutral the Government has pointed out that Norway:

- Undertake to reduce global greenhouse gas emissions by the equivalent of 30% of its own 1990 emissions by 2020
- Intends to cut the global emissions equivalent to 100 percent of its own emissions within 2030.

Carbon Capture and storage (CCS) programmes are already being undertaken in Western Norway. NILU has been working on the effects of local impacts from possible amine emissions. There may be several local negative effects of reducing compounds impacting global climate.

The consumption of energy used for the CO2 capture has also been a hot issue lately together with the emissions that comes from the production of this energy.

2.4 From fossil fuel to bio fuels

Moving from fossil based energy to more use of bio fuels may change the environmental challenges. The GHG emissions as CO_2 will be reduced, but emissions of PM, PAH and NOx may increase and give rise to more local air pollution.
Relative to a gas fired power plant with cleaning equipment a bio fuel based power plant at the same capacity will emit more pollutants.

2.5 Climate change and our Cultural Heritage

Traditionally our cultural heritage; monuments and buildings have been impacted by pollutants linked to local sources and compounds such as SO_2 and NOx. Combining these pollutants with greenhouse gases and climate change will

accelerate the impacts. It will speed up the deterioration and will require more maintenance.

2.6 NGO activities

Several of the NGOs are very active in the field of environment in Norway. They are concerned about the impact of pollution from traffic and especially due to emissions of GHG from oil activities and the building of the first fossil fired (gas) power plant in Norway.

Bellona has been working on CCS as a means to combat global warming since 1991. They claim to have played a key role in making the Norwegian government commit to CCS and even had a government overthrown on the way. Bellona is also closely working with CCS on the European level.

2.7 Norwegian funds to be used in Former Eastern Europe

NILU is together with the Romanian Ministry of Environment and Sustainable Development (MESD) applying for a project under the EØS funds handled by Innovation Norway.

The objectives of this Fund are to strengthen the civil society in Romania, and ensuring participation of NGOs in the reduction of social and economic disparities in the EEA countries. The Fund makes available 5 million Euros for supporting projects within certain thematic areas. One of them being climate change and health impact of air pollution.

The project prepared by NILU is "Development of an air pollution forecast and projection system for Romania". It includes:

- Evaluate actions for reducing health impacts
- Estimate GHG emissions (energy & industry)
- Identify cost effective GHG reduction actions
- The co-benefit of both actions

2.8 Co-control and co-benefit projects China

NILU also proposed a new project for China together with Norwegian institutions and CAI Asia developing a programme for co-control, including:

1. Policy evaluation and adaption
2. Case studies in 2 selected area
3. Training and institutional building

NILU also performed studies in China related to cost effectiveness (Guangzhou) and cost-benefit (three cities in Shanxi province). Comparisons of cost-benefits were performed for various identified control actions in order to reduce SO_2 and TSP exposure and health impacts in the three cities.

2.9 Areas of further development

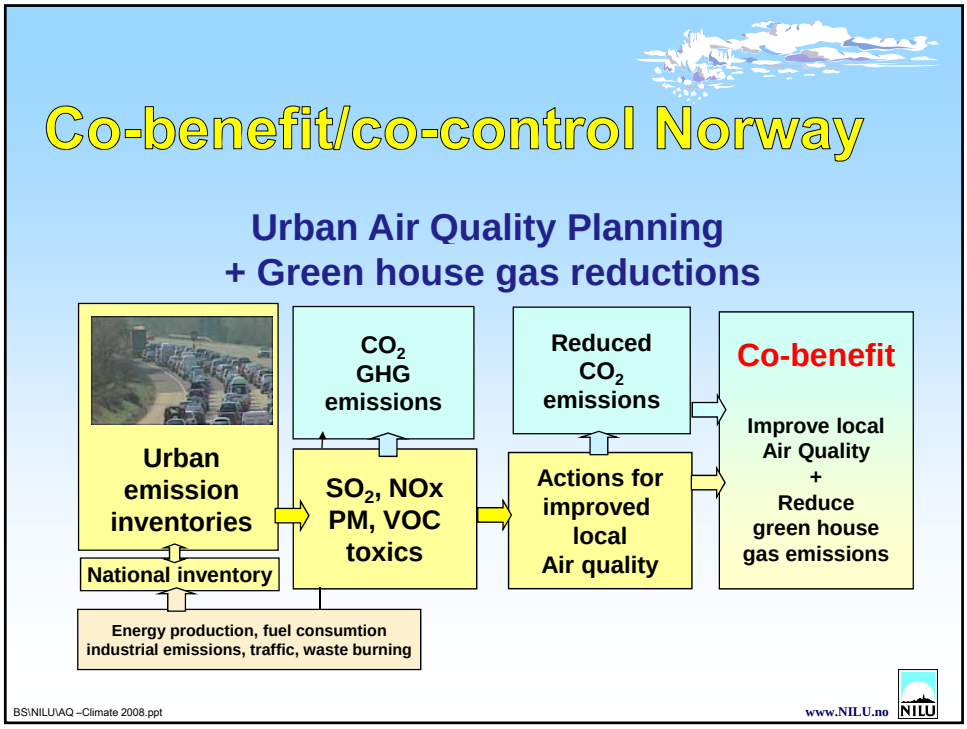
NILU have identified further needs for development in order to continue the work related to integrated assessment, co-benefit studies and co-ordination of climate change and local air pollution issues. Some of these issues are:

- Exposure-response on human health
- Local and regional influence of aerosols on climate forcing and weather patterns
- Development and application of combined integrated assessment at various scales
- This requires competence on:
  - Emission inventories, air quality and atmospheric science
  - Climate and pollution policies
  - Integrated assessment modelling, e.g. cost effectiveness / optimisation of abatement measures

The issue presented in this paper are important issues in order to improve the tools for integrated assessments, and this work will continue in Norway as well as at NILU.

Appendix A

Overhead pictures presented at the meeting


Co-benefit/co-control Norway
Urban Air Quality Planning
+ Green house gas reductions
Urban emission inventories
National inventory
Energy production, fuel consumtion industrial emissions, traffic, waste burning
CO2 GHG emissions
SO2, NOx PM, VOC toxics
Reduced CO2 emissions
Actions for improved local Air quality
Co-benefit
Improve local Air Quality + Reduce green house gas emissions
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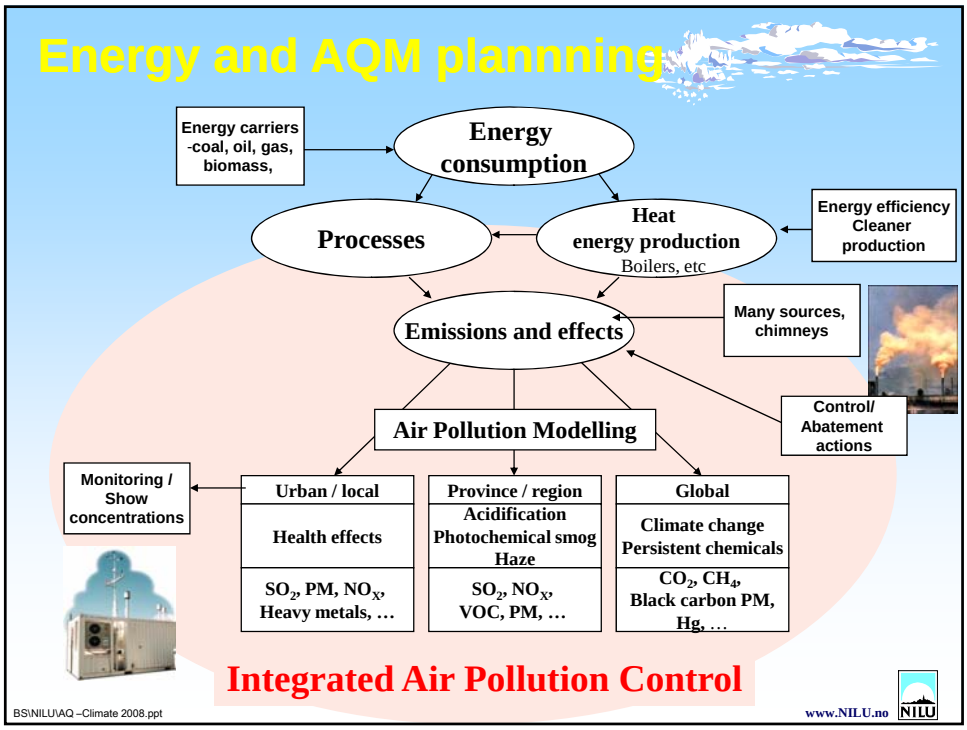
Energy and AQM plannning
Energy carriers -coal, oil, gas, biomass,
Energy consumption
Processes
Heat energy production
Boilers, etc
Energy efficiency Cleaner production
Emissions and effects
Many sources, chimneys
Control/ Abatement actions
Air Pollution Modelling
Monitoring / Show concentrations
Urban / local
Health effects
SO2, PM, NOX, Heavy metals, …
Province / region
Acidification Photochemical smog Haze
SO2, NOX, VOC, PM, …
Global
Climate change Persistent chemicals
CO2, CH4, Black carbon PM, Hg, …
Integrated Air Pollution Control
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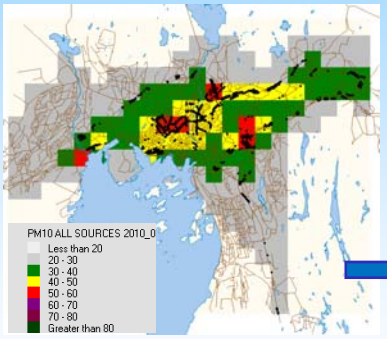
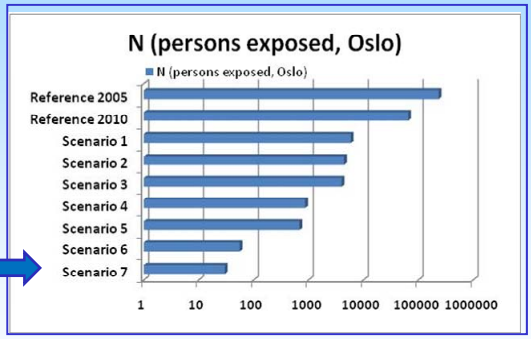
Exposure estimates, Oslo 2010

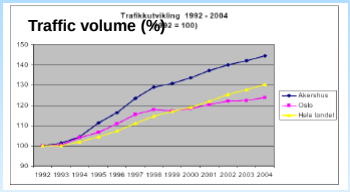


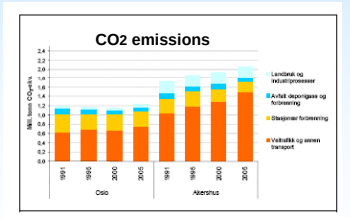


Projection of the 8th highest daily grid value (National Target) of PM_{10} ($\mu g/m^3$) for 2010.
The black dots are illustrating the building points where the 8th highest daily PM_{10} value is above limit value of 50 $\mu g/m^3$.

Reference years and 7 scenarios

Oslo study: GHG emissions & local AQ





Ref: CIVITAS: Oslopakke 3-KS-1

Air Quality improved in spite of traffic volume increase

Traffic volume increase 1990-2005
+ 3% increase in energy per car per km
⇒GHG increase 17 % (1991-2004)

GHG 2005: 1 % lower than 2005

Goal Oslo: Reduce GHG emissions 50% during 1990 - 2030

Norwegian Climate Policy

Norway will become a carbon neutral nation

- Norway intends to cut the global emissions equivalent to 100 percent of its own emissions within 2030.
- Norway will undertake to reduce global greenhouse gas emissions by the equivalent of 30% of its own 1990 emissions by 2020

Committed to develop Carbon Capture and Storage technologies, hopefully contribute to make this technology commercially viable at a global scale.

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The Norwegian Government has Ambitious Goals

Make widespread use of carbon capture and storage a reality

- The Norwegian Government intends to:
  - cooperate with the industry
  - provide public funding
- *"All new gas fired power plants shall be based on technology for CO_2 capture"*

Ministry of Petroleum and Energy www.mpe.dep.no

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Carbon Capture and Storage (CCS)

Global benefits, local ???

Several alternative methods

Absorption with amine solution most appropriate technology to take out CO2 from exit gas.

Test Center Mongstad will test the amin capture technology

NILU investigate the local impact of emissions of amines

Amines are in general caustic and corrosive and will therefore have a potential effect on the local environment.

Local impacts of CCS?

The amine group is a large group of chemical substances.

- ✓ **Long time exposure ; some of the amines can be carcinogenic.**
- ✓ **Vegetation impact of emissions – fertilization??**
- ✓ **Soil deposition: accumulation and degradation.**
- ✓ **Surface water: concentrations evaluated for accumulation in organisms**
- ✓ **The mass flux into the sea: investigate potential effects.**
- ✓ **Reactive amines may enter into the photochemistry of the atmosphere**
- ✓ **Odor problems: Amines have in general a strong and unpleasant smell.**

The consumption of energy used for the CO2 capture and the emissions that comes from the production of this energy should be estimated.

From fossil fuels to Bio fuel

Reduce: CO_2 : and GHG
SO_2 : Sulphur emissions

Increased: PM :
PAH :
NOx :

Bio fuel based power plant Finland emits annually 440 tons NOx.
Gas power plant at Kårstø Norway emits annually 150 tons NOx.
Same size (400 MW), and both are equipped with cleaning device

Norway: Bio fuels instead of fuel oil
reduces electricity consumption only 3-4 %

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Climate Change Threat to our Cultural Heritage

Traditionally local impacts From SO_2 and NOx

Combined pollutants +GHG speeding up deterioration, more maintenance

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Warmer and humid climate

Traditional deterioration due to SO_2 and NOx recently accelrated due to climate change

Noah's Ark (2008b) Global climate change impact on built heritage and cultural landscapes. URL: http://noahsark.isac.cnr.it /)

Reduce impacts of climate and air pollution

Ancient buildings were designed for a specific local climate.

Studies to protect buildings undertaken in Norway

UNESCO:

The impacts of Climate Change on World Heritage properties must be assessed through appropriate monitoring and vulnerability assessment processes.

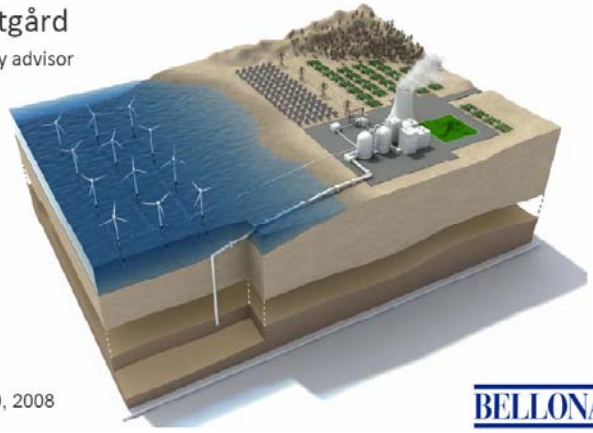
NGO activities

Carbon Capture and Storage:
an NGO's perspective

Bjørn Utgård

Energy policy advisor

Bellona

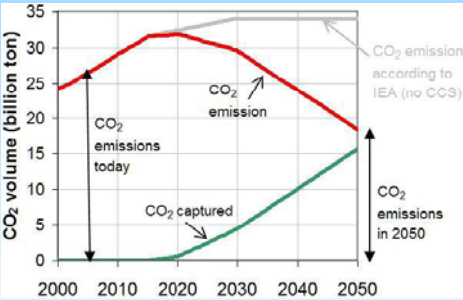


Natur og Ungdom
Naturvernforbundet
Etc..

Oslo
September 9, 2008

BELLONA

BELLONA and CCS



Worked on CCS as a means to combat global warming since 1991

- **Played a key role in making the Norwegian government commit to CCS –and even had a government overthrown on the way**
- **Closely working with CCS on the European level**

- **To enable fossil fuel power plants to have zero CO_2 emissions by 2020**
- **Recommendation: 10-12 large scale CCS demonstration projects (Flagship Programme) by 2015**
- **EU SET: ZEP Recommendations = EU Energy Policy**

BELLONA

The Romanian and Bulgarian NGO Funds launched this year.

H Sørensen State Secr
Ministry Env. Norway

Purpose of the Fund:

- ✓Strengthen the civil society in Romania,
- ✓Ensuring participation of NGOs in the reduction of social and economic disparities in the EEA countries.
- ✓The Fund makes available 5 million Euros for NGOs by supporting projects within certain thematic areas.
- ✓Climate change and pollution

GHG and air pollutant impacts in Romania

Develop and test
an air pollution forecasting model system
for local-to-regional air pollution
and green house gases in Romania

- Evaluate actions for reducing health impacts
- Estimate GHG emissions (energy & industry)
- Identify cost effective GHG reduction actions
- The co-benefit of both actions

Proposed Norwegian Project on Co-controls in China

NILU with inputs from other Norwegian organizations and CAI-Asia is developing a project to assist China in development and adoption of a co-control program:

COMPONENT A: Policy

1. National policy analysis based upon the economic planning tools of the DRC
2. Development of a policy package for MEP and the State Council
3. Policy guidelines for key sectors and policy concepts

COMPONENT B: City case studies

6. Detailed work plan for the 2 city demonstration studies, and output specification
7. Cities base case situation report
8. City demonstration study reports
9. City demonstration co-control action plans for integrated air quality and GHG control
10. Report on CDM activities

COMPONENT C: Training

11. Assessment of AQM and co-control capabilities in cities in Western China
12. AQM and co-control training for senior officials of provinces and cities in China
13. AQM and co-control for AQM professionals
14. Design of a Comprehensive AQM Training System

www.cleanairnet.org/caiasia

26 CAI-Asia Center

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费用效益分析 Cost benefit analysis

Shanxi, China

A comparison of cost-benefit of various control options for SO_2 and TSP in Taiyuan

Cost benefit analysis:

A comparison of cost-benefit of various control options for SO_2 and TSP in Taiyuan

A comparison of cost-benefits of various control options for SO2 in Taiyuan

	Emission Reduction (t)	Concentration reduction (μg/m³)	Cost-benefit ratio	Rank
Natural gas utilization	20400	19.79	-52	2
Desulfuration in power plants	18460	6.47	115	4
Centralized heating	30000	51.89	-424	1
Implementation of productivity policies	9280	5.75	2000	5
Clean coal technology	36600	6.24	-23	3

A comparison of cost-benefits of various control options for TSP in Taiyuan

	Emission Reduction (t)	Concentration reduction (μg/m³)	Cost-benefit ratio	Rank
Natural gas utilization	31900	16.7	-0.489	2
Centralized heating	69400	90.29	-1.601	1
Implementation of productivity policies	17000	18.57	3.711	5
Clean coal technology	47100	93.13	-0.008	3
Dust control		50	1.813	4

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Climate change - research cooperation with China

The **NORKLIMA** programme is announcing a total of NOK 20 million in funding for climate research conducted in cooperation with China.

The treatment of uncertainty and **risk** related to **climate change** in key areas of society, including the understanding of uncertainty in climate scenarios and socio-economic uncertainty

Areas for further development

- **Exposure-response on human health**
- **Local and regional influence of aerosols on climate forcing and weather patterns**
- **Development and application of combined integrated assessment at various scales**
- **This requires competence on:**
  - **Emission inventories, air quality and atmospheric science**
  - **Climate and pollution policies**
  - **Integrated assessment modelling, e.g. cost effectiveness / optimisation of abatement measures**

Climate change and air pollution speed up damages and increase costs

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