



Biomass and CCS

IEAGHG Activities

Tim Dixon
IEA GHG R&D Programme

SBSTA33/COP16/CMP6 Cancun, 1 Dec 2010

IEAGHG R&D Programme



- A collaborative research programme founded in 1991 as an IEA Implementing Agreement financed by its members
- Aim: Provide definitive information on the role that technology can play in reducing greenhouse gas emissions.
- Producing information that is:
 - Objective, trustworthy, independent
 - Policy relevant but NOT policy prescriptive
 - Reviewed by external Expert Reviewers
- Focuses on Carbon Dioxide Capture and Storage (CCS)
- **Activities:** Studies and reports (>120); International Research Networks : Wells, Risk, Monitoring, Modelling, Oxy, Capture, Solid Looping, Social Research; Communications (GHGT conferences, IJGGC, etc); facilitating demonstration activities; peer reviews.
- Collaborate with IEA, Global CCS Institute, CSLF, ZEP, IPAC, CO2GEONET, UNFCCC



**Techno-economic assessment
of capture**

Regulation and Incentives

Global Potential

Why Biomass and CCS - the net carbon balance



Positive



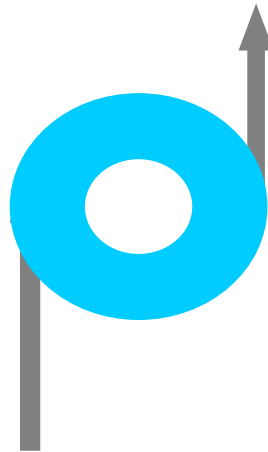
Fossil fuels

Less positive



Fossil fuels
with CCS

Neutral to
slightly
positive



Renewable
energy

Neutral to
slightly
positive



Bio-energy

Neutral to
negative



Bio-energy
with CCS

Need for Biomass CCS



- Deployment of current emissions reduction technologies may not be enough for climate stabilisation - future emission scenarios (IPCC 4th AR) may require negative emissions
- Only one technology option large-scale and near-market – biomass and CCS
- Highlighted in GHGT9 conclusions, and starting to be recognised, but no assessment of realistic potential, issues, limitations etc.
- Implications uncertain, possibly large, not reflected in climate policy (Rhodes & Keith 2008) – due to lack of information
- IEA CCS Roadmap
- **IEAGHG Study with ECOFYS – assessment of global potential, and issues**



**TECHNO-ECONOMIC
EVALUATION OF POST
COMBUSTION CAPTURE ON
BIOMASS POWER PLANT**

Techno-Economic Evaluation of Biomass Power Plant with Post Combustion Capture



- IEAGHG Report 2009/9 , Foster Wheeler Italy
- Scope - PF and CFBC – dedicated and co-fired, EU context
- Findings
 - Efficiency drops significantly for dedicated
 - Capital cost increases 63%-126% (highest for dedicated - due to capture plant and flue gas cleaning)
 - COE increases 50%-100% (highest for dedicated)
 - Requires ETS price 48-76 Euro tCO₂



Biomass CCS Economic Incentives using Carbon Markets

Carbon markets



- EU ETS – EUAs
- JI – ERUs
- CDM – CERs
- IPCC GHG Guidelines - AAUs

Carbon markets



- EU ETS Directive 2009
- Art 10a – free allocation can be given to biomass CCS, but not to any electricity production
- Industrial operations OK? use of benchmarks
- Annex 1.1 – 100% biomass combustion not covered by Directive
- Article 24a – EUAs can be given to activities reducing GHGs outside ETS, given not in respect of emissions. Needs host gov to apply.
- Creates uncertainty, needs clarification

Carbon markets



- JI-ERUs
- Bilateral offset projects in co-operation with host gov'n – allocates from AAUs and converts AAUs to ERUs for project – can work for biomass CCS
- Domestic offsets??

Carbon markets



- CDM – CERs
- CERs allocated for emissions reductions below baseline – can work for biomass CCS, BUT CCS not yet recognised for CDM.
- Copenhagen CMP5 – invites new methodologies for net reduction technologies
- Sustainable development

Carbon markets



- IPCC GHG Guidelines (2006)
- CCS Chapter 5.3 – “Negative emissions may arise.....if CO₂ generated by biomass combustion is captured. This is a correct procedure and negative emissions should be reported as such.”
- However in practice – limitations, uncertainty, lack of being tested



Global Potential



Global Potential for Biomass and CCS

- ECOFYS, NL (Joris Koornneef et al)
- Report Draft out for peer review
- Scope
 - Full biomass chain and CCS chain
 - Technical, realisable and economic potential
 - 2030 and 2050
 - Dedicated and co-firing
- Initial findings: -

Conclusions



- Technical potential BE-CCS options is large in 2050
 - Up to -10 Gt in power sector (33% of global electricity demand), **or**;
 - Up to -5 Gt in bio-fuel sector (31% of global fuel demand)
 - Biomass potential is limiting factor
- Realisable potential BE-CCS options is smaller in 2050
 - Up to almost -3 Gt (biomass share ~10% of global electricity demand)
 - Co-firing installed capacity + CCS retrofit is largest
 - Biofuels up to -1 Gt (5% of global fuel demand = conservative estimate)

Conclusions



- Economic potential with CO₂ price of 50 €/ton
 - Up to -3 Gt in both power and bio-fuel sector
- Early BE-CCS opportunities with bio-ethanol most likely exist in US and Brazil

Policy, Incentives, Regulation?



- Policy, regulations, incentives developed generally without Biomass CCS in mind
- Policy makers need to decide.....
- To decide – need to be
 - 1st - aware
 - 2nd – informed

ALSTOM

B&W
power generation group

BG GROUP



CEZ GROUP



CIAB

VATTENFALL



ConocoPhillips



TOTAL



ieaghg



Enel
L'ENERGIA CHE TI ASCOLTA.



Statoil



e.on

Schlumberger



EPRI

RWE
The energy to lead

REPSOL YPF

JGC

GLOBAL CCS INSTITUTE

ExxonMobil