



Biomass and CCS

IEAGHG Activities

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IEA GHG R&D Programme

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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



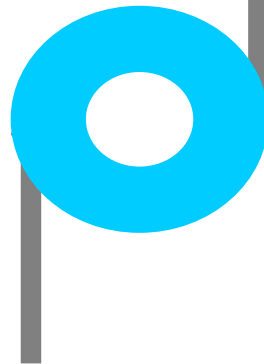
Fossil fuels

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 – allocates from AAUs and converts AAUs to ERUs for project – can work for biomass CCS
- Domestic offsets??



Carbon markets



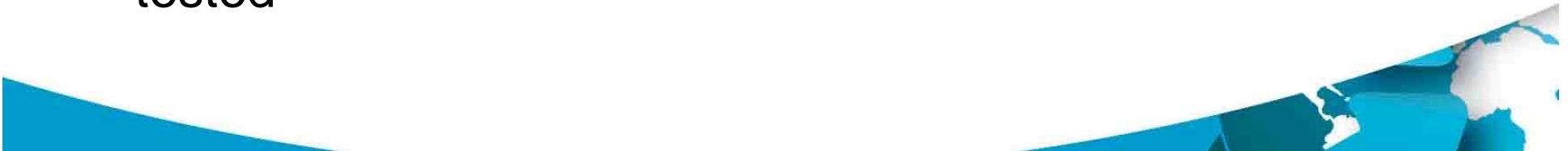
- CDM – CERs
- CERs allocated for emissions reductions below baseline – can work for biomass CCS, BUT CCS not yet recognised for CDM.
- Copenhagen CMP5 – invites new methodologies for net reduction technologies
- Sustainable development



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

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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

B
BG GROUP



CEZ GROUP



CIAB

VATTENFALL



ConocoPhillips



TOTAL



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Enel
L'ENERGIA CHE TI ASCOLTA.

Statoil



e-on

Schlumberger



EPRI

RWE
The energy to lead

REPSOL
YPF

JGC

GLOBAL
CCS
INSTITUTE

ExxonMobil