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The stony way to renewable energy - biophysics vs. metaphysics in planning for CO_2-neutral combustion of biomass

Contribution to 4th Nordic Geographers Meeting,
'Geography and Earth System Science'
Roskilde University
May 2011

DISPOSITION

0) The wood pellets boom

1) SOLAR FUELS and CLIMATE CHANGE

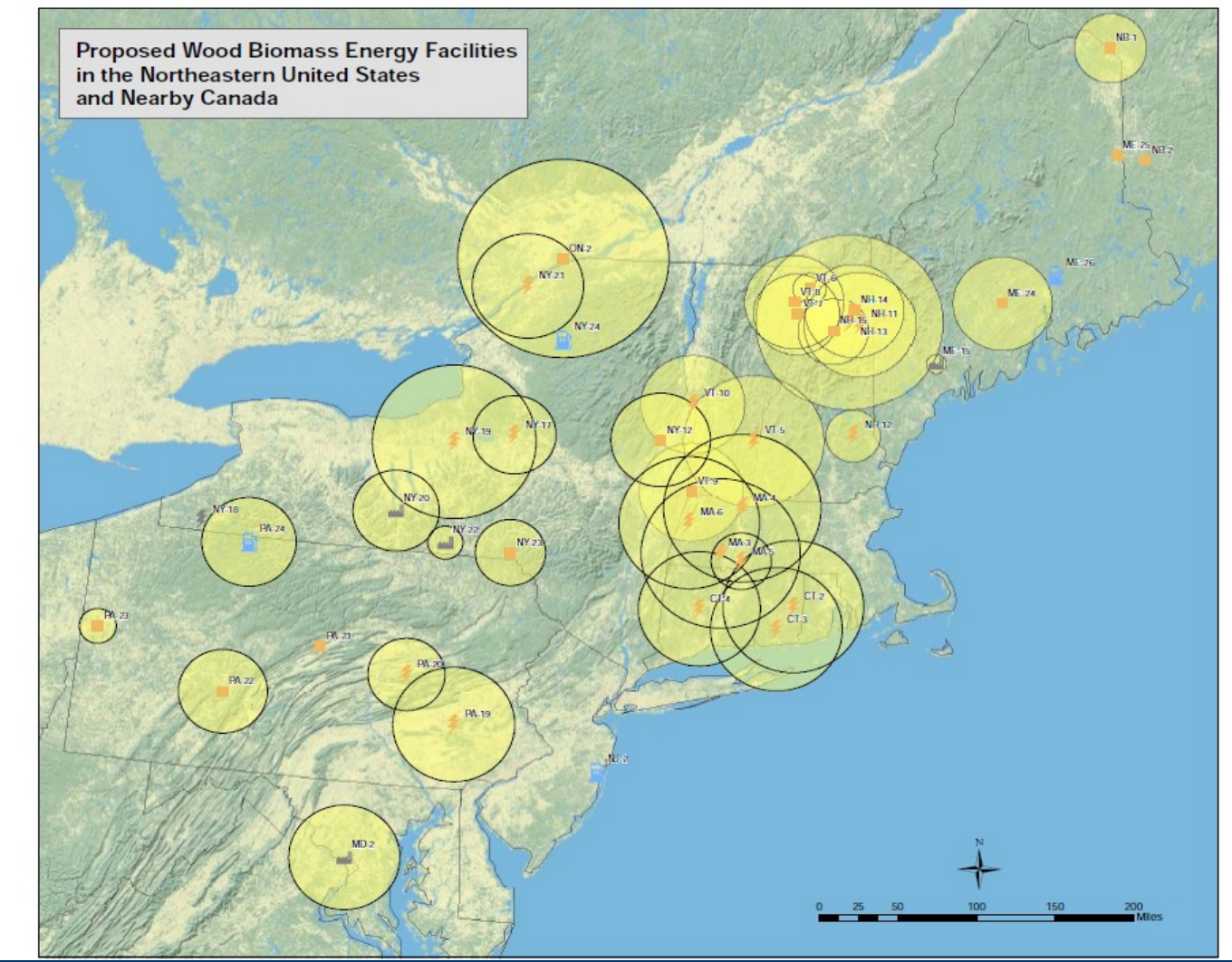
2) IMMEDIATE ABSORPTION OF CO_2 *?*

3) MODELLING THE PROCESSES OVER TIME

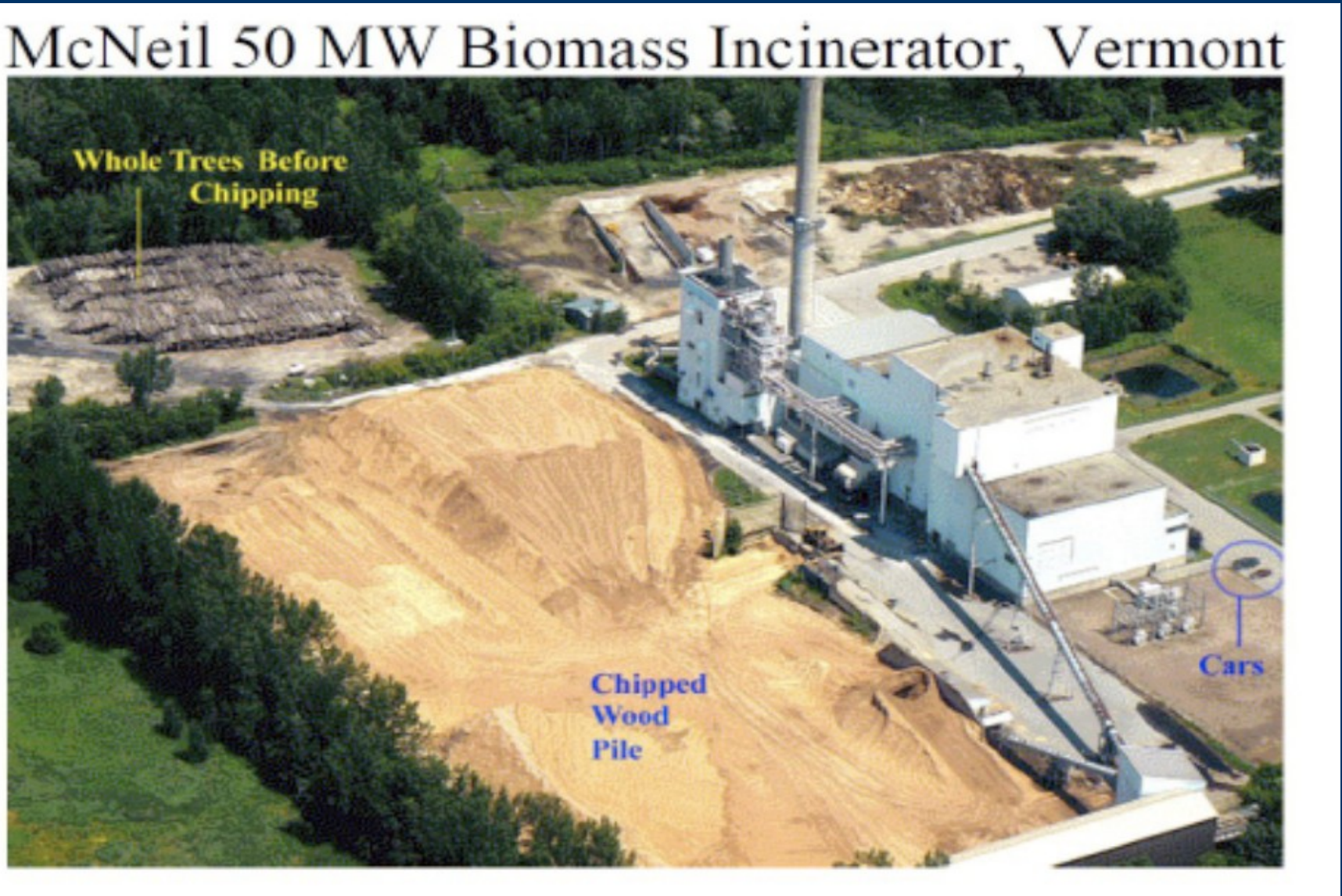
4) RECOGNITION IN THE POLITICAL REALM

5) Conclusions

PROPOSED FOREST POWER STATIONS IN NORTHEASTERN AMERICA...



BIOPIRACY FOR C CREDITS - ALSO BY EUROPEAN FIRMS



Bioenergy from 10% straw to 100% wood pellets: a climate progress ?

Studstrupværket:
10 % halm tilsatsfyres til kul

Avedøreværket:
100 % træpiller op til 70 % last

DONG energy

Before the climate crisis: SOLAR FUELS may do it

”The production of fuels from biomass fits nicely into the natural ecological cycles that support agriculture, and when burned, these fuels […] produce only water and carbon dioxide. And *SINCE THE CARBON DIOXIDE PRODUCED WHEN A SOLAR FUEL BURNS IS EXACTLY EQUAL TO THE AMOUNT ABSORBED*, this process does not contribute to the untoward environmental effects of rising levels of carbon dioxide in the atmosphere”

(Biologist Barry Commoner: *The Politics of Energy* New York 1979, p.57)

A COVERING LAW: IF – THEN ?

IF: ”THE CARBON DIOXIDE PRODUCED WHEN A SOLAR FUEL BURNS IS EXACTLY EQUAL TO THE AMOUNT ABSORBED...”

THEN: ”THIS PROCESS DOES NOT CONTRIBUTE TO [...] RISING CO_2 LEVELS IN THE ATMOSPHERE”

TEST: COVERS THIS LAW ALSO THE COMBUSTION OF FUEL WOOD?

DEDUCTIVE ANSWER (LOGIC OF SUBSUMTION)

YES,
BECAUSE WOOD SURELY IS A SUB-CATEGORY OF BIOMASS.

As Commoner reasoned in 1979: ”In forested areas, solar energy can be produced as a solid fuel (wood)” (p.54).

BUT: WOULD COMMONER SAY THIS TODAY, AFTER ACCELERATED GLOBAL WARMING?

A more specific answer introducing the time dimension ...

Physicist Bent Sørensen starts as Commoner:

“The carbon dioxide emissions during biomass combustion are balanced in magnitude by the net carbon dioxide assimilation in the plants, so that the atmospheric CO2 content is not affected...”,

but he then adds:

“...AT LEAST BY THE USE OF BIOMASS CROPS IN FAST ROTATION... ”

...with an important inductive specification

" ...However, the LAG TIME FOR TREES may be decades or centuries,

and in such case the temporary carbon dioxide imbalance

MAY CONTRIBUTE TO

CLIMATIC ALTERATIONS."

Bent Sørensen , 3d ed., 2004: Renewable Energy, Academic Press, p. 483

Sørensens method: Anti-metaphysical reversal of the time perspective

INSTEAD OF LOOKING BACKWARD
on GIVEN RESULTS:
...only emits what has been absorbed...
(WHICH ALSO APPLIES FOR FOSSIL FUELS)

HE CALCULATES FORWARD
FROM the PRESENT:
(1) IS THE AMOUNT EMITTED 'INSTANTLY'
ABSORBED AGAIN? (=> *CO_2-neutral)*

OR: (2) IF NOT: WHEN in the future may this break-even point be achieved? AND: HOW?

INTERIM CONCLUSION: wood power is A CLIMATE PROBLEM

(1) AGRICULTURAL RESIDUIES AS STRAW ARE REPRODUCED WITHIN A YEAR UNDER CONTROL OF THE FARMERS

– This can be called CO_2-*neutral.*

(2) THE COMBUSTION OF WOOD MAY ONLY BE *CO2-NEUTRAL* AFTER AN EXTENDED PERIOD OF TIME

– *This implies many uncertainties.*

Or: DOES IT ???

Official anti-thesis:

WHOLE AMOUNT of EMITTED CO_2 is INSTANTLY ABSORBED

Former Danish NERI Senior Advisor Jytte Illerup wrote in a book on Air Pollution:

"Wood, which is a renewable fuel, is considered to have an *EFFECTIVE EMISSION FACTOR* OF ZERO"

(Illerup 2009, 261).

Emission factors might be effective, real or fictive

When wood has an 'effective emission factor' of zero, this surely justifies the administrative decision in the Kyoto Protocol as well as EU ETS:

To declare the emissions from wood combustion – as from all other sources of biomass - to be ZERO.

'Effective' means: Although there is a smokestack emission, ANOTHER PROCESS outbalances it EFFECTLIVELY or: INSTANTLY.

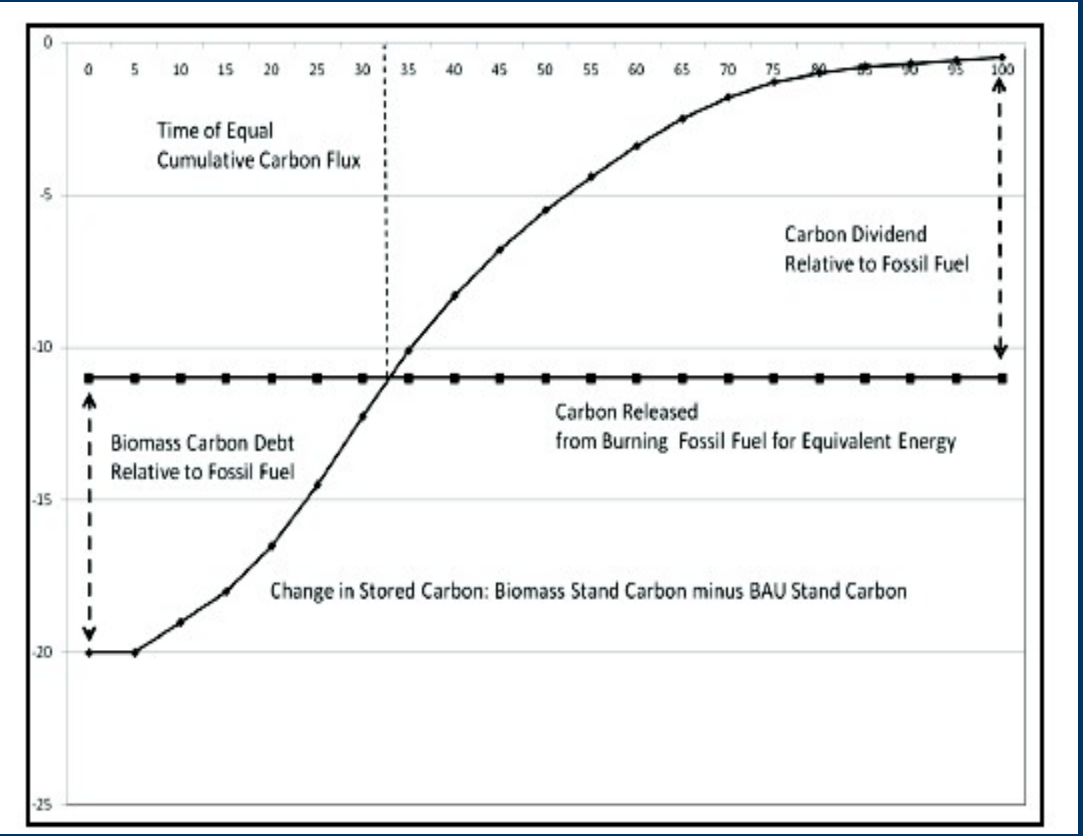
Under which conditions is there an effective emission of zero?

If the 'effective emission factor' shall not be completely fictive, it has to be shown

(1) HOW the NET BALANCE between the two opposite processes - emission and absorption - becomes ZERO;

(2) WHEN this break-even point is reached - starting from the extraction of wood products from forest areas and the associated carbon debt.

Estimated CO_2 emissions from wood power relative to fossil fuels (Manomet 2010, Massachussetts)

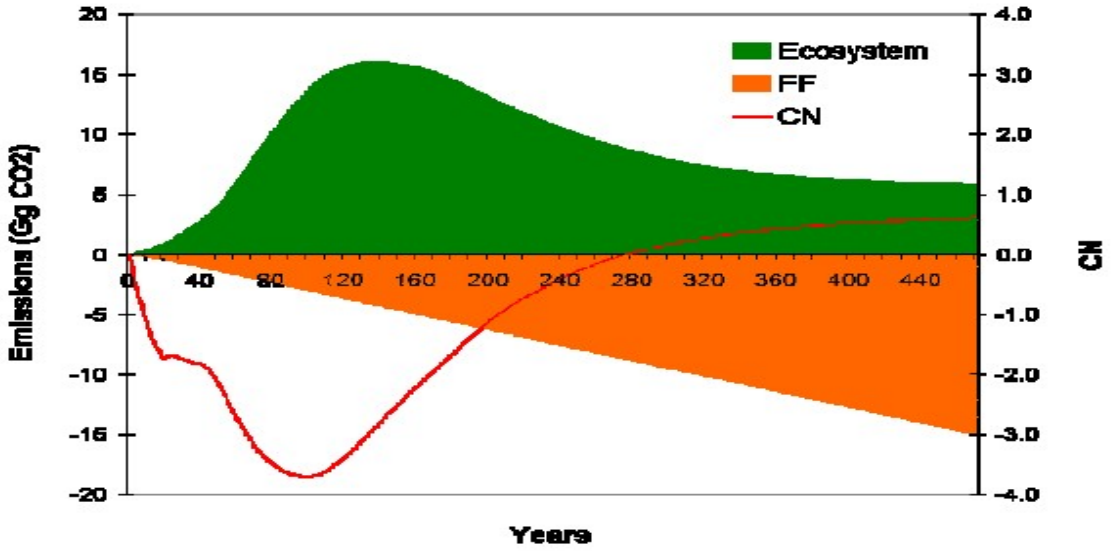


C debt and benefits from wood harvest + combustion as against fossil fuel use

JOANNEUM RESEARCH

Additional fellings from managed forests

In the short-medium term (20-50 years), additional fellings could produce more emissions in the atmosphere than a fossil fuel system (*CN<0*).



GHG profile of bioenergy when additional thinnings are introduced in a forest in Austria (60 hectares on rotation).

Minimum C debt:
Emissions of CO_2 from biomass and fossil fuels pr. unit of energy

Fuel	CO_2 [*kg/GJ*]
Coal	95
Gas oil / Diesel	74
Residual oil	78
Natural gas	57
Straw	102
Firewood	102
Biogas	83,6

Carbon neutrality factor dependent on time (Joanneum Research 2010)

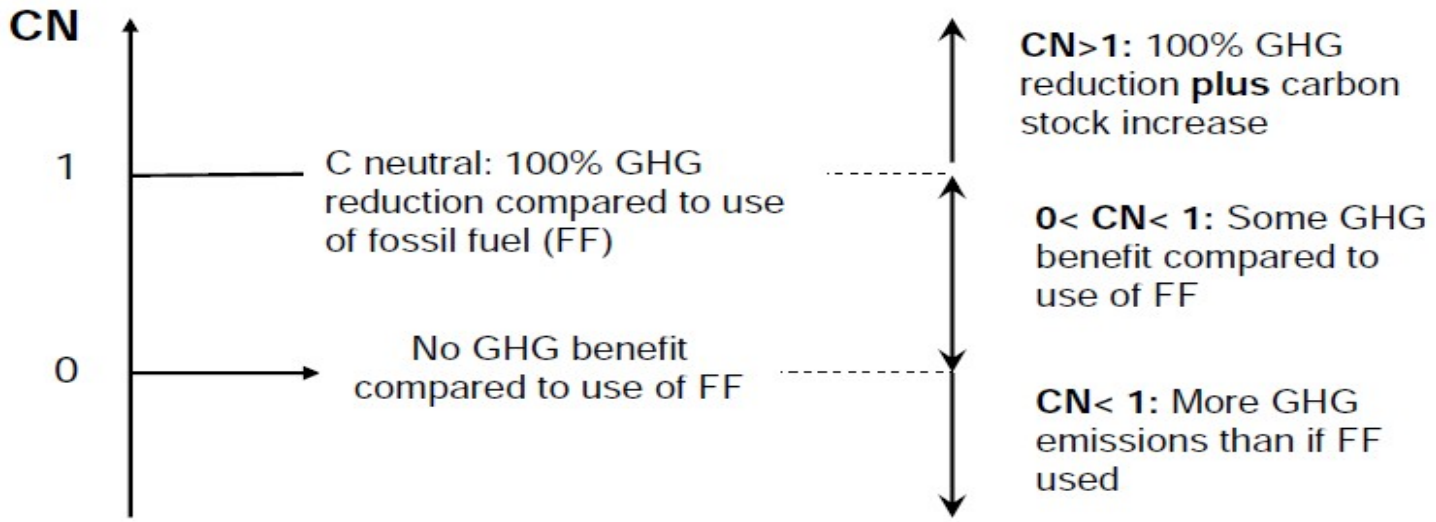
JOANNEUM RESEARCH

Carbon Neutrality factor (CN)

- The extent to which the use of bioenergy reduces GHG emission can be quantified with a CN factor (time dependent):

$$CN(t) = \frac{E_{FF}(t) - E_B(t)}{E_{FF}(t)} = 1 - \frac{E_B(t)}{E_{FF}(t)}$$

(Schlamadinger and Spitzer 1994)



Climate change impacts:

Forest sinks may become sources at + 2,5^{0} C global warming

”Professor Andreas Fischlin […] coordinating lead author with IPCC [...] pointed out the risk of LOSING THE CARBON SINK REGULATING SERVICE OF FORESTS beyond a global warming of 2.5°C...”

IUFRO Scientific Summary # 57 / 2009

CLIMATE POLITICS

IUFRO's AND FISCHLIN's message has not been fully recognized in connection with COP 15.
Presented at FOREST DAY 3
– an official side-event of COP 15 –
a representative of the EUROPEAN FOREST INDUSTRY condemned it as 'academic stuff'.

His lobby had a sure hold on the European Commission, he trusted.

May 2011: European Parliament warns against CN assumptions

”[It] expresses its commitment to […] the EU 2020 renewable energy target and the 2 degree Celsius climate-change target; is concerned however that the SHORT TIME-FRAMES used in the current greenhouse gas calculation methodology, and the resulting CARBON NEUTRALITY ASSUMPTION for woody biomass, could hinder their achievement.”

EP calls energy sector demand a threat for forests because C debt is ignored

”Energy sector demand for woody biomass is emerging as a threat for forests and traditional FBIs (Forest Based Industries).
The assumption of CARBON NEUTRALITY for woody biomass[2] neglects
EXTENDED TIMEFRAMES
needed to re-absorb the “carbon debt“ [3].

2 Renewable Energy Directive 2009/28 EC

3 Bird N., Pena N. & Zanchi J. (2010) The upfront carbon debt of bioenergy, Joanneum Research Institute, Graz

TECHNICAL CONCLUSION: CN factor to be applied in carbon crediting

If CN < 0: the negative amount, adding to the C debt, has to be compensated by buying C credits;

If 0 < CN < 1: a fraction of total emissions still adding to the C debt has to be compensated by buying C credits;

If CN >1: the amount of carbon sequestered may be converted into C credits.

POLITICAL CONCLUSION

BURDEN OF PROOF IN CASE OF CO_2
NEUTRALITY OF WOOD COMBUSTION
TO BE SHIFTED
FROM CRITICAL SCIENTISTS
TO PROJECTING AGENCIES -

THE FORMER HAVE TO OVERLOOK THE
IMPLEMENTATION OF CRITICAL INSIGHTS!

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Sørensen, Bent, 3rd ed., 2004 : Renewable energy. Its physics, engineering, environmental impacts, economics & planning. Academic Press

Zanchi, P., Pena, M. and N.Bird 2010: The upfront carbon debt of bioenergy. Joanneum Research

How the European Parliament came to adopt its CN-critical views at Strasbourg, 11.5.11

1) Joanneum Research presented its findings to the EP-Committee on the Environment, Public Health and Food Safety in June 2010

2) Together with 2 associated Committees (Agriculture+rural development; Industry,research + energy)
a comprehensive motion for a European Parliament resolution on a Commission White Paper on Forest Protection was formulated on April 1;

3) The motion was adopted by the EP on May, 11.