

***Rolf Czeskleba-Dupont, M.Sc., Ph.D.***  
***Social Science Basic Studies***  
***Roskilde University***

The stony way to renewable energy -  
biophysics vs. metaphysics in planning  
for CO<sub>2</sub>-neutral combustion of biomass

Contribution to 4<sup>th</sup> 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*

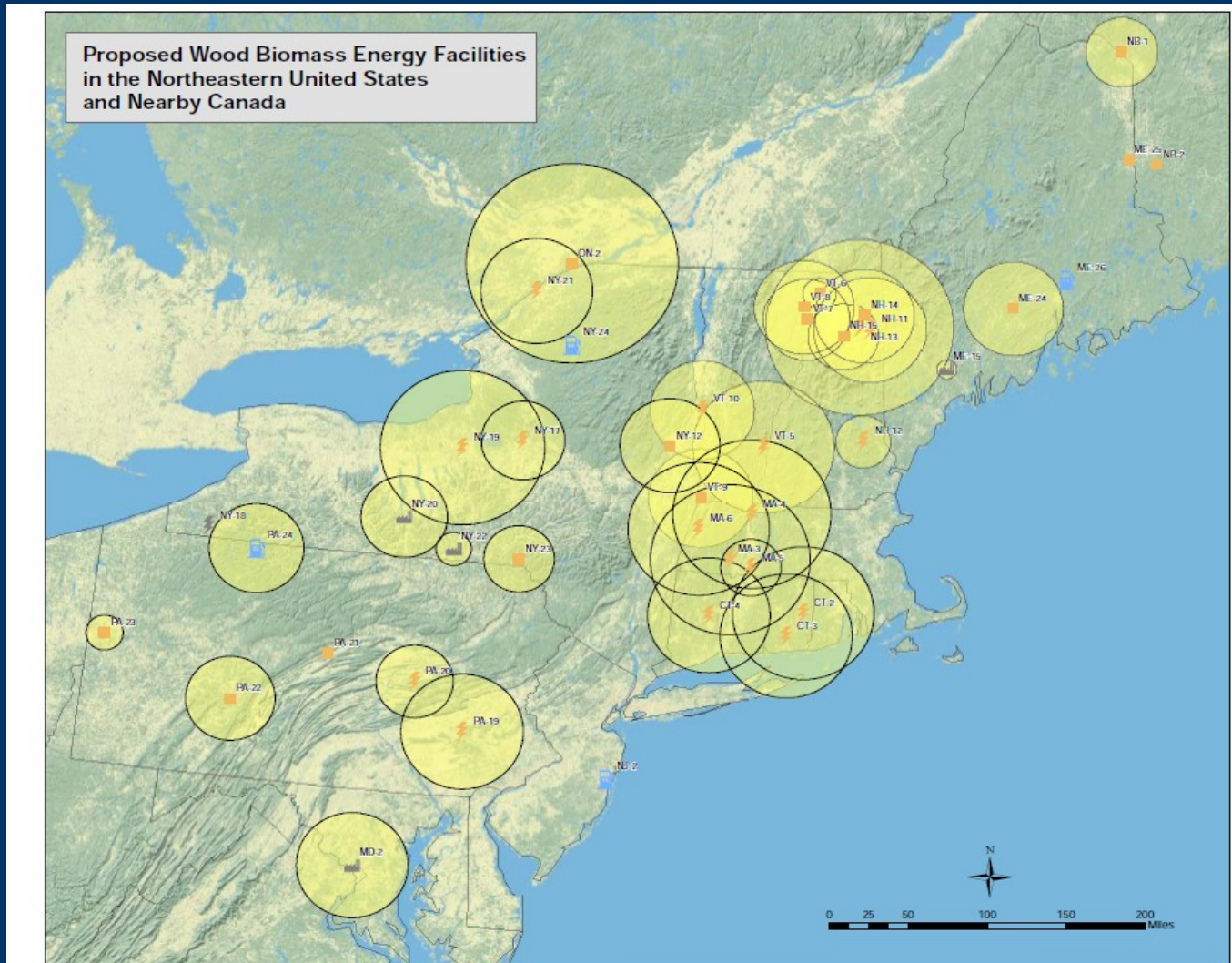
4) *RECOGNITION IN THE POLITICAL REALM*

5) *Conclusions*

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# PROPOSED FOREST POWER STATIONS IN NORTHEASTERN AMERICA...





# ***BIOPIRACY FOR C CREDITS - ALSO BY EUROPEAN FIRMS***

McNeil 50 MW Biomass Incinerator, Vermont





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



Studstrupværket:  
10 % halm tilsatsfyres til kul



Avedøreværket:  
100 % træpiller op til 70 % last

# *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<sub>2</sub> LEVELS IN THE ATMOSPHERE"*

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

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# *DEDUCTIVE ANSWER (LOGIC OF SUBSUMPTION)*

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?

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# *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 CO<sub>2</sub> 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.”*

# *Sørensen's 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? ( $\Rightarrow$   $CO_2$ -neutral)

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

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***INTERIM CONCLUSION:  
wood power is  
A CLIMATE PROBLEM***

(1) AGRICULTURAL RESIDUES 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 ???

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*Official anti-thesis:*

*WHOLE AMOUNT of EMITTED  
CO<sub>2</sub> 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).

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# *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.

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# *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

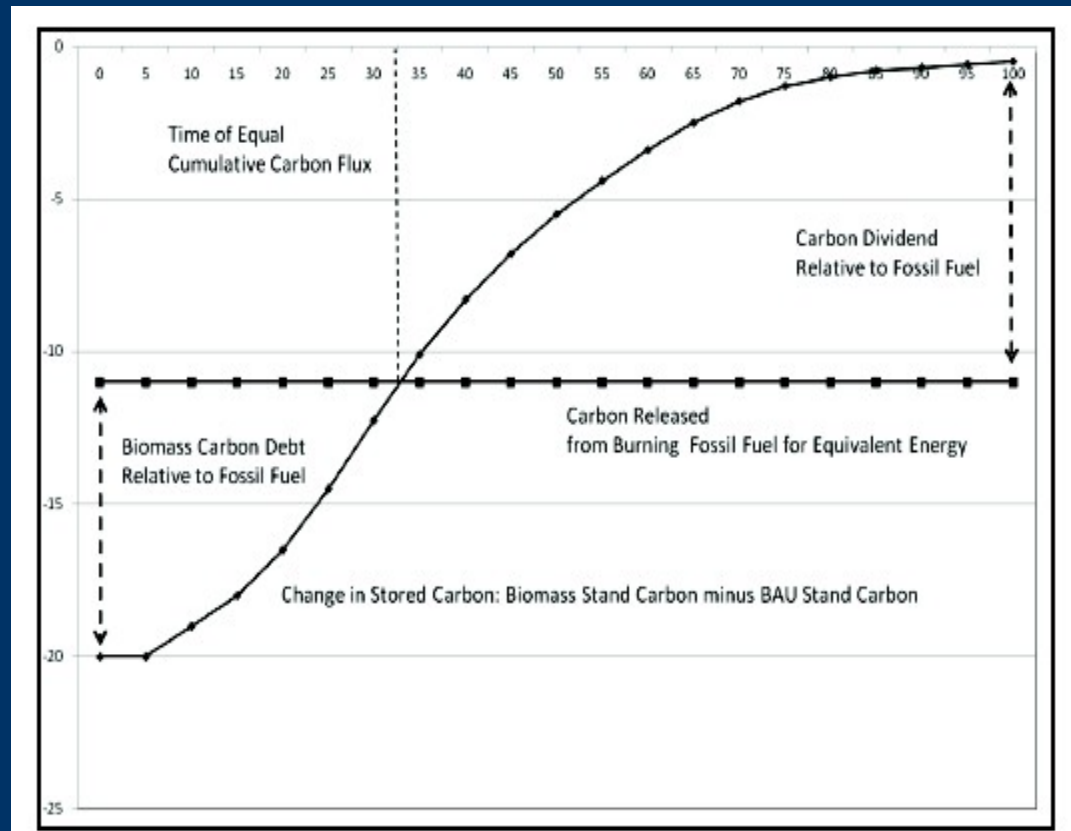
(1) HOW the NET BALANCE between the two opposite processes - emission and absorption - becomes ZERO;

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

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# Estimated CO<sub>2</sub> emissions from wood power relative to fossil fuels (Manomet 2010, Massachusetts)

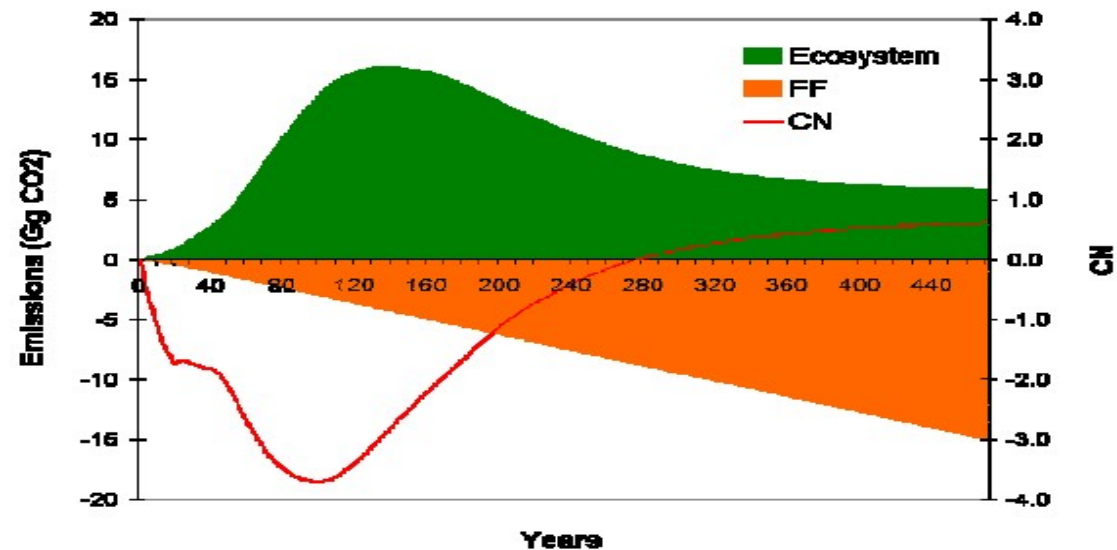




# C debt and benefits from wood harvest + combustion as against fossil fuel use

## 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<sub>2</sub> from biomass and fossil fuels pr. unit of energy*

<u>Fuel</u>	<u>CO<sub>2</sub> [ kg/GJ ]</u>
Coal	95
Gas oil / Diesel	74
Residual oil	78
Natural gas	57
Straw	102
Firewood	102
Biogas	83,6

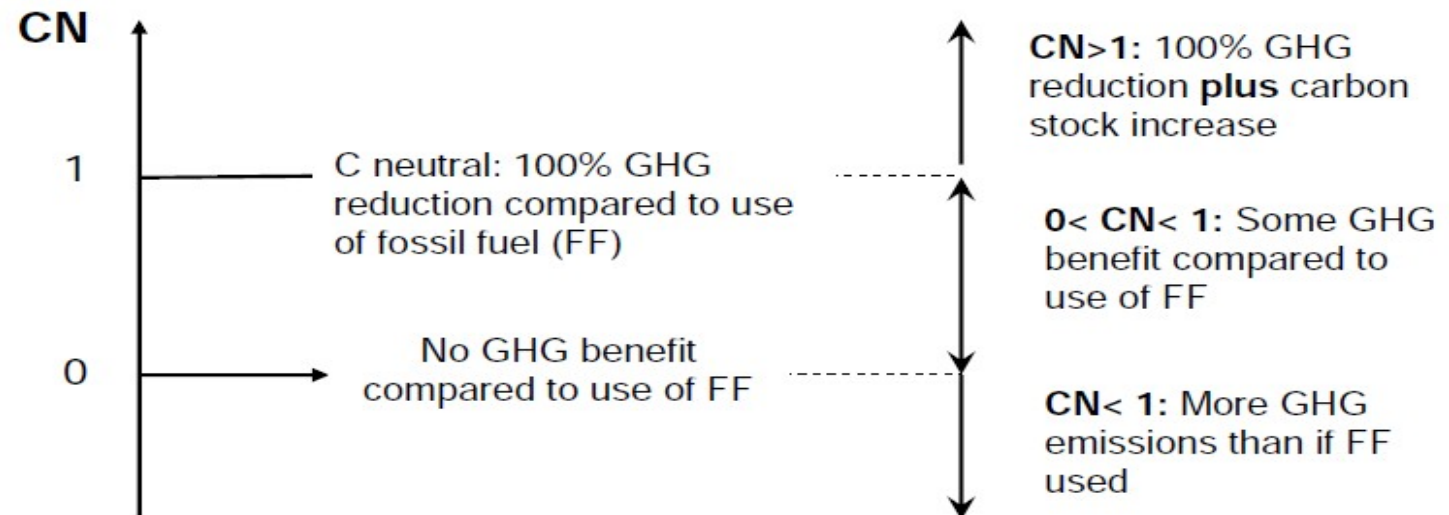
# Carbon neutrality factor dependent on time (Joanneum Research 2010)

## 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<sup>0</sup> 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

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# 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.

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# *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.”

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# *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<sup>2</sup> neglects EXTENDED TIMEFRAMES needed to re-absorb the “carbon debt“<sup>3</sup>.

<sup>2</sup> Renewable Energy Directive 2009/28 EC

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

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# ***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.

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# *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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European Parliament, Committee on the environment, public health and food safety 2010: Report on the Commission Green Paper on forest protection and information in the EU: preparing forests for climate change (A7-0113/2011)

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# *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.

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