

Bioenergy and climate

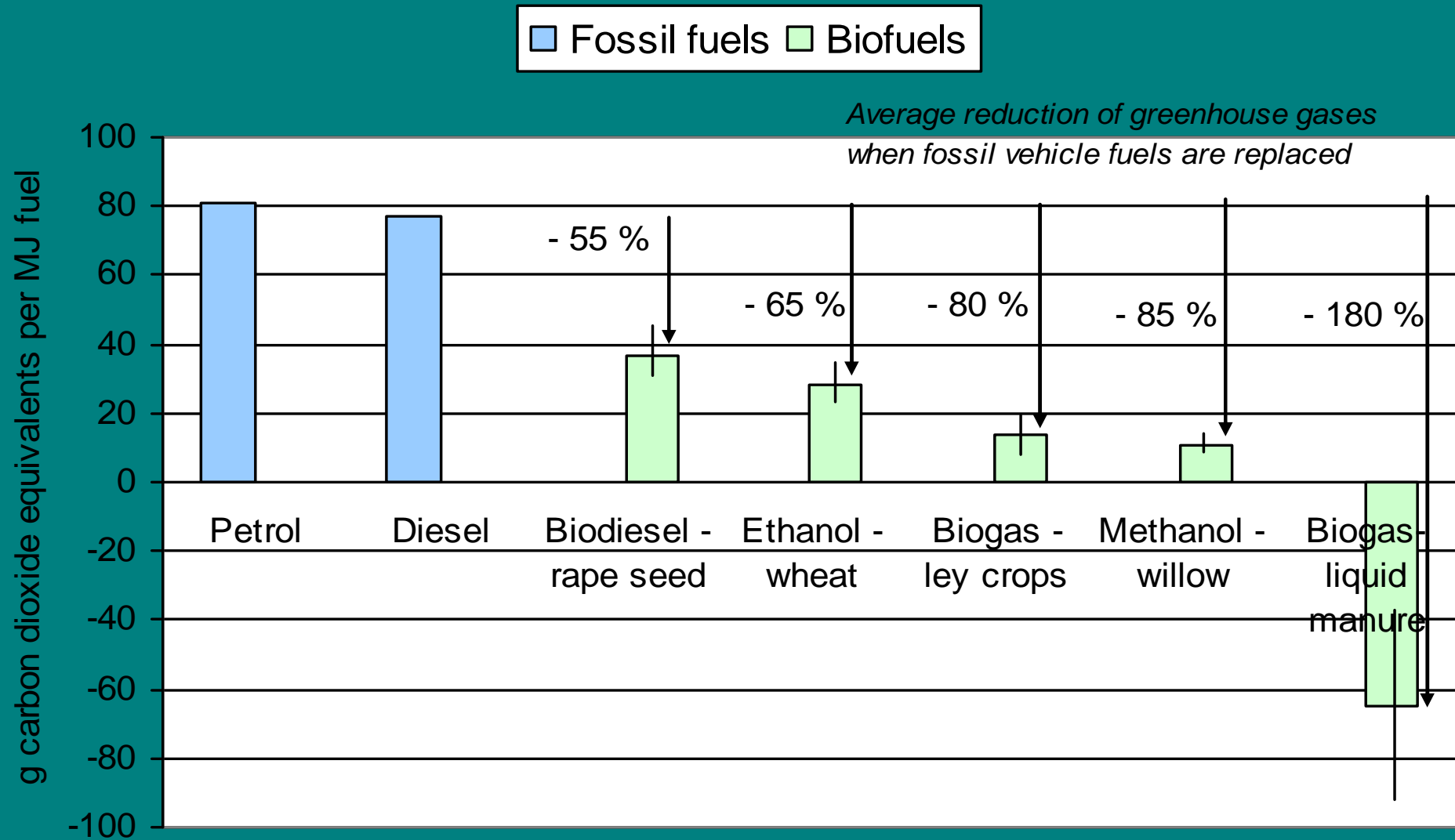
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Net effect on climate depends upon:

- GHG emissions at production and transportation
 - CO₂, N₂O, CH₄
- Effects on carbon stocks in soils and biomass
 - What pay-back time is acceptable?

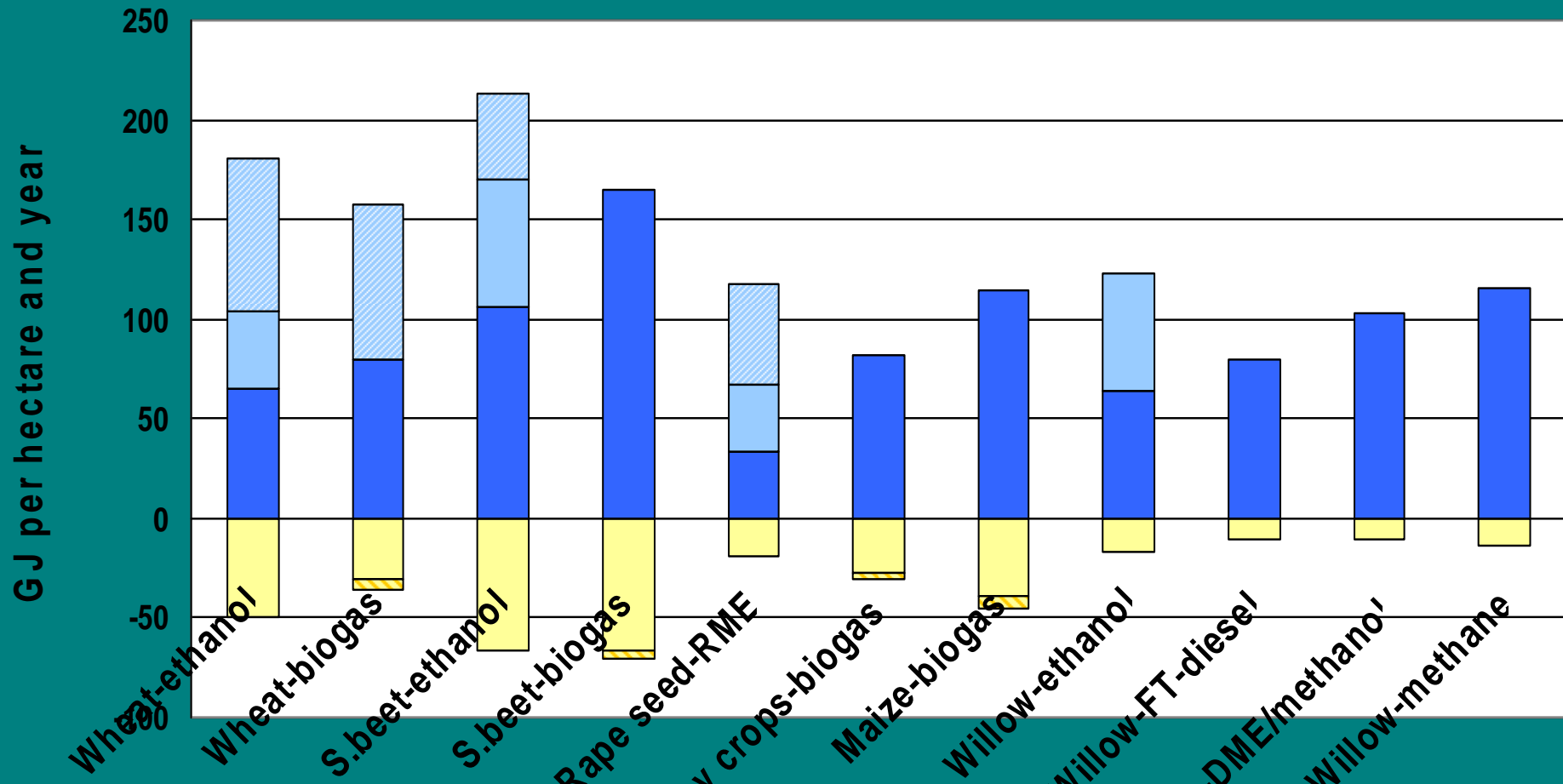
Climate efficiency of transport fuels



Av: Pål Börjesson, Lunds universitet

How to limit systems?

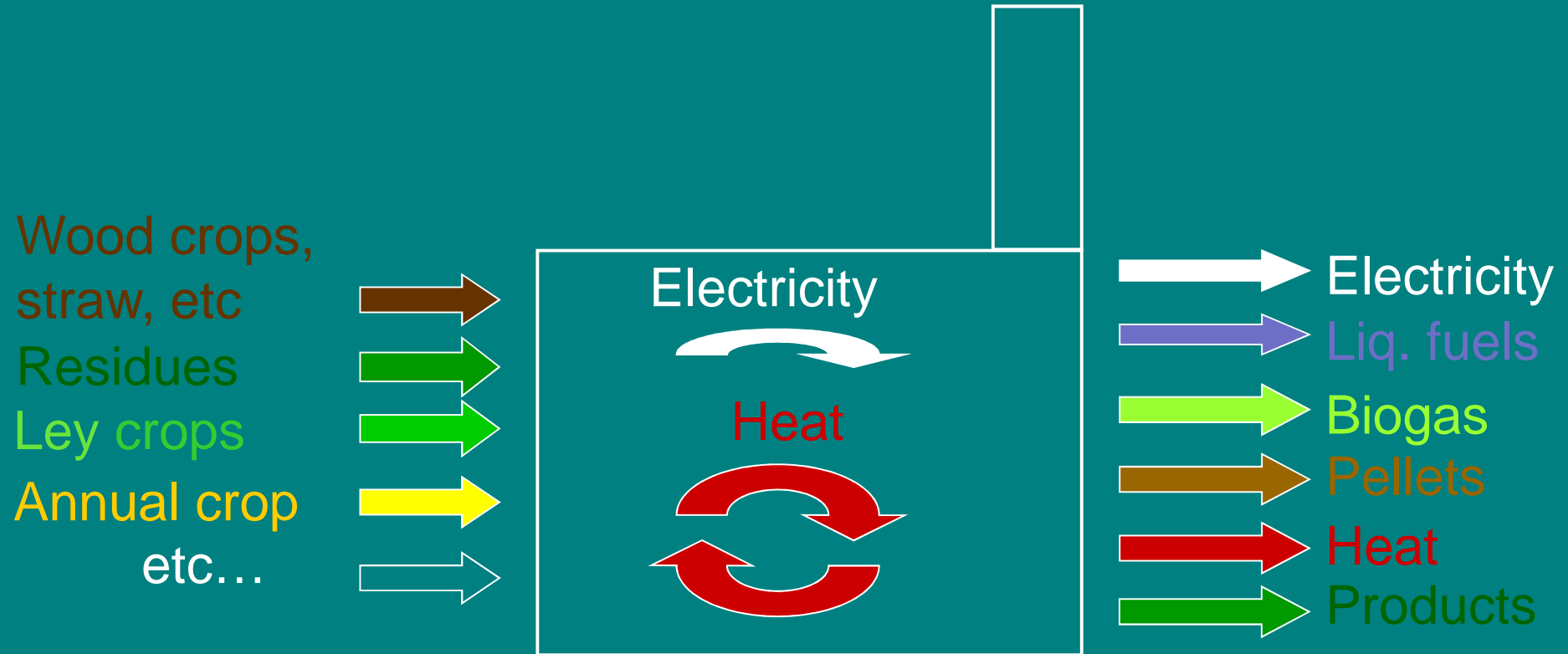
■ Biofuels
 ■ By-products-process
 ■ By-products-cultivation
 ■ Energy input
 ■ Credit of digestate



(Cultivation in northern Europe on average arable land)

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The future = "Optimized bio-refinery"!



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Suggestion

- Criteria on climate efficiency in prod/transp:
 - Biofuels for transportation should have at the most 50 % of the emissions of petrol or diesel

Effects on carbon stock

- Ex forest is being converted to Salix:
 - Minus 35 ton C in biomass and c. 10 ton C in soil = 45 ton C/ha
 - Coal substitution: 3-6 ton C/ha/yr
 - = 8-15 yrs payback time

Ex roundwood for energy:

- Coal substitution in 50 yrs: 80 ton C/ha
- Carbon stock after 50 yrs: minus 20 ton C/ha

Suggestion

- Criteria for initial C stock losses:
- Land conversion should not result in losses larger than 30 % of substitution gain in 50 yrs time

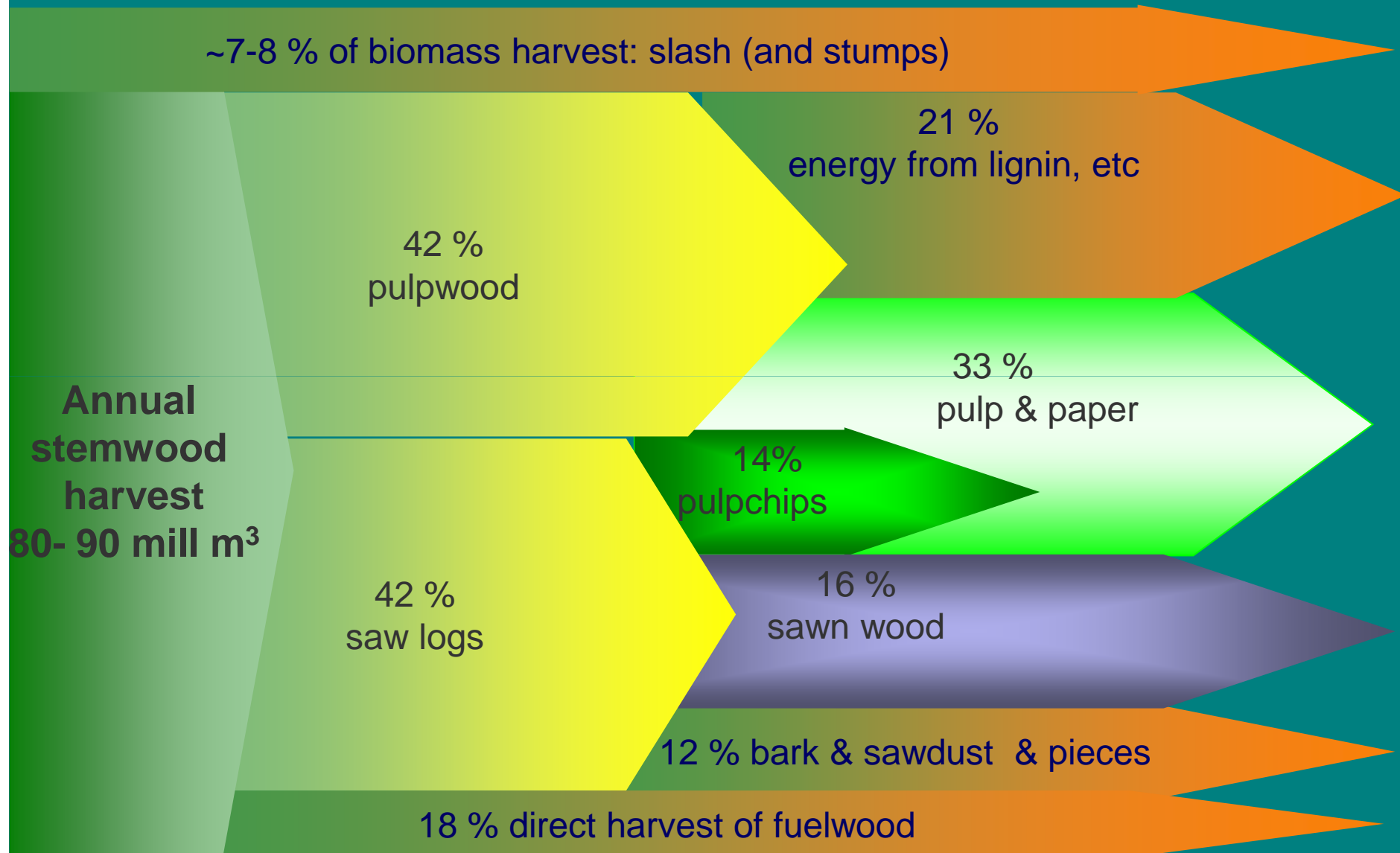
Risk for N₂O emissions following intensive fertilisation

- Substitution gain of 1 m³: 0.2 ton CO₂-C
- Can be offset by 1,5 kg N released as N₂O
- In Swedish forestry: 150 kg N typically gives +15 m³ (=>10 kg / m³)
- Higher doses are being discussed
- What happens after harvest and in outflow areas?

Suggestion

- Criterion N fertilisation:
 - Unless research show risks are minor - only compensatory doses of N should be applied

Biomass use in the Swedish forest sector



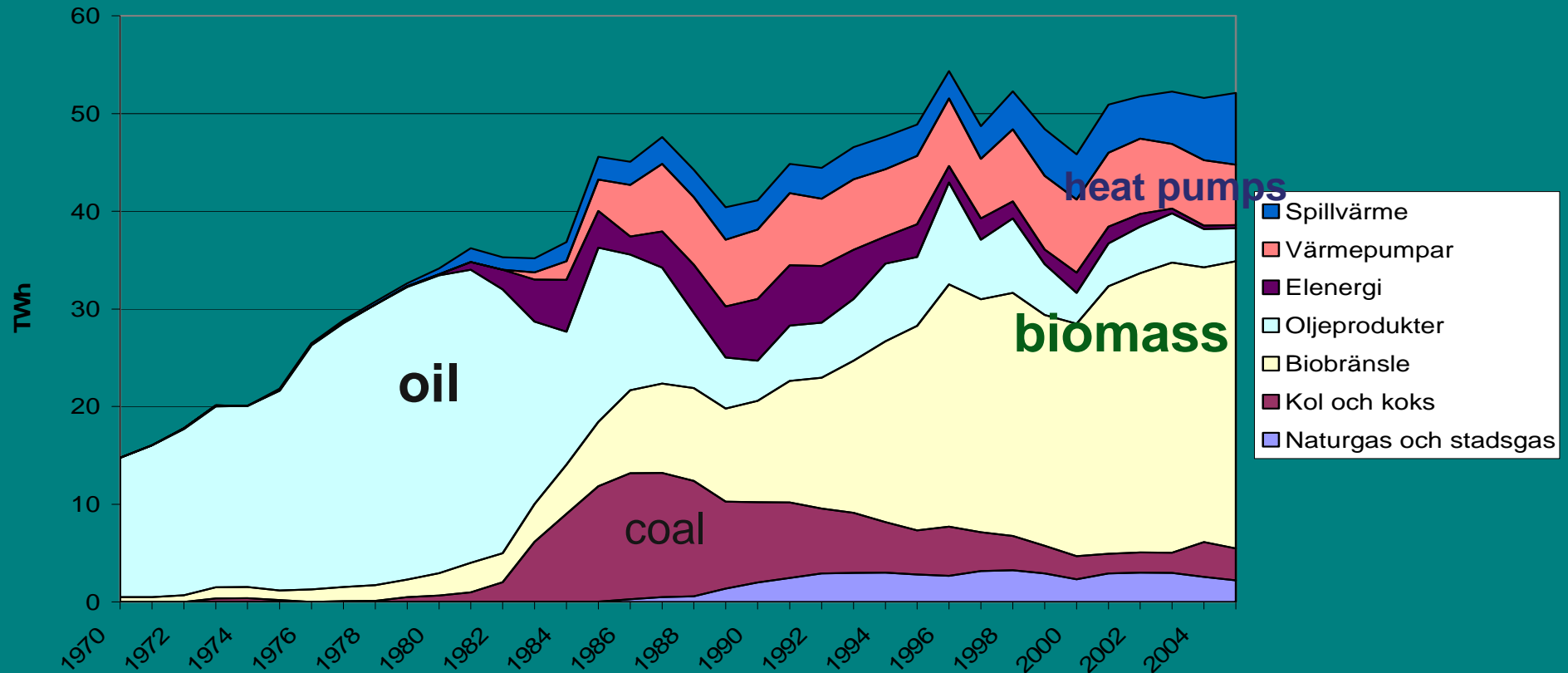
Source: Rolf Björheden, SkogForsk and Official Statistics of Sweden

Imported trspt fuels

- Sugar cane ethanol (certain C stock loss, high clim eff)
=good
- Corn ethanol (high fossil input energy = low clim eff, ineffective byproduct)
= quite bad
- Biodiesel from palm oil plantations on drained/burned peatland (extremely high C stock loss, OK clim eff)
= really bad

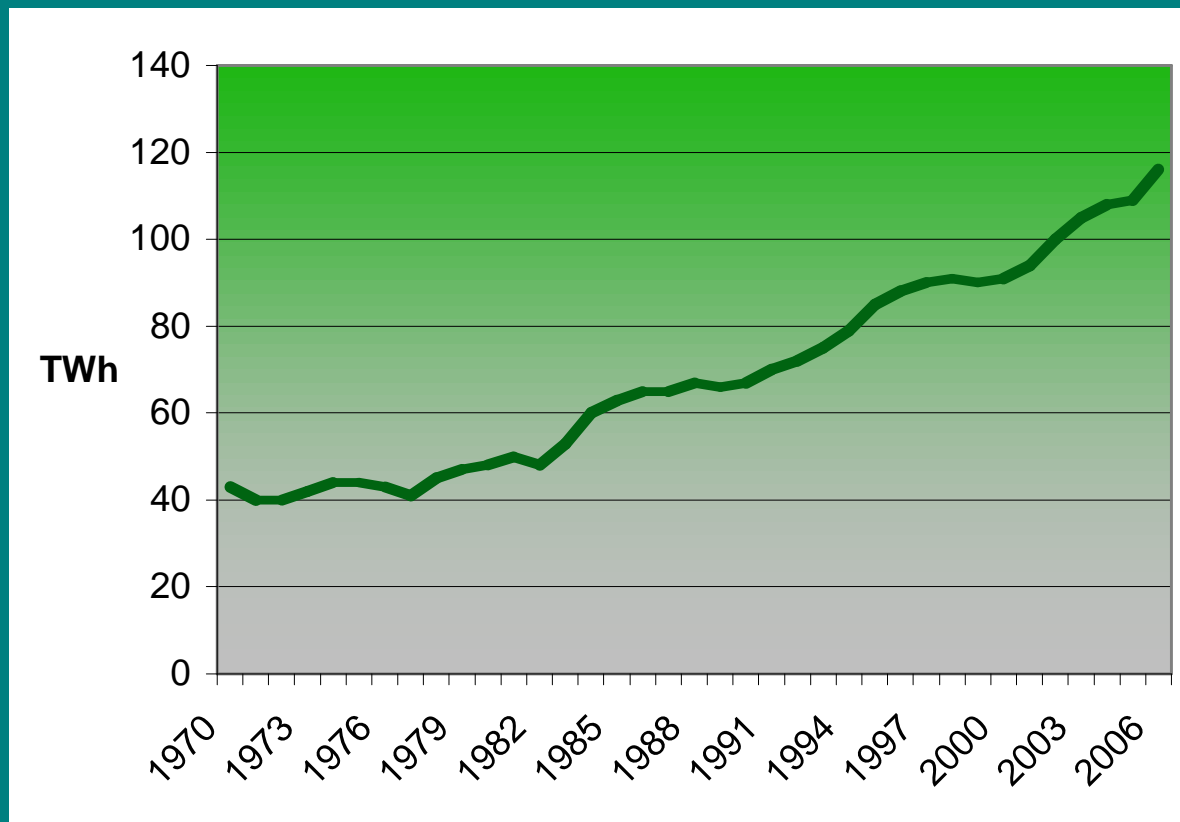
Energy mix in district heating 1970-2005

E. Totalt tillförd energi för fjärrvärmeproduktion fördelad på olika energibärare



Bioenergy development in Sweden 1970-2005

The bioenergy share of the total energy use



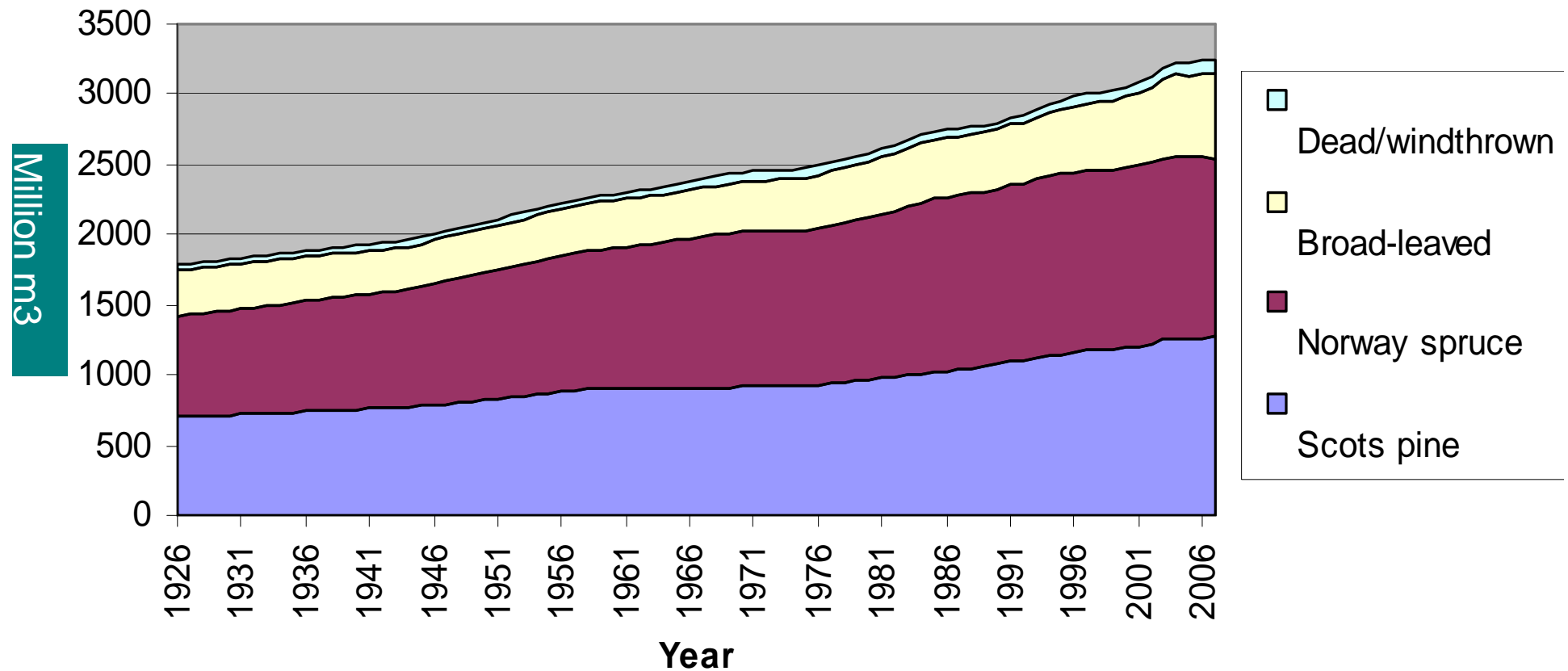
- 1970: 9%
- 1980: 11%
- 1990: 15%
- 2000: 20%
- 2010: 30%

Demand for bioenergy – further effects on C stock

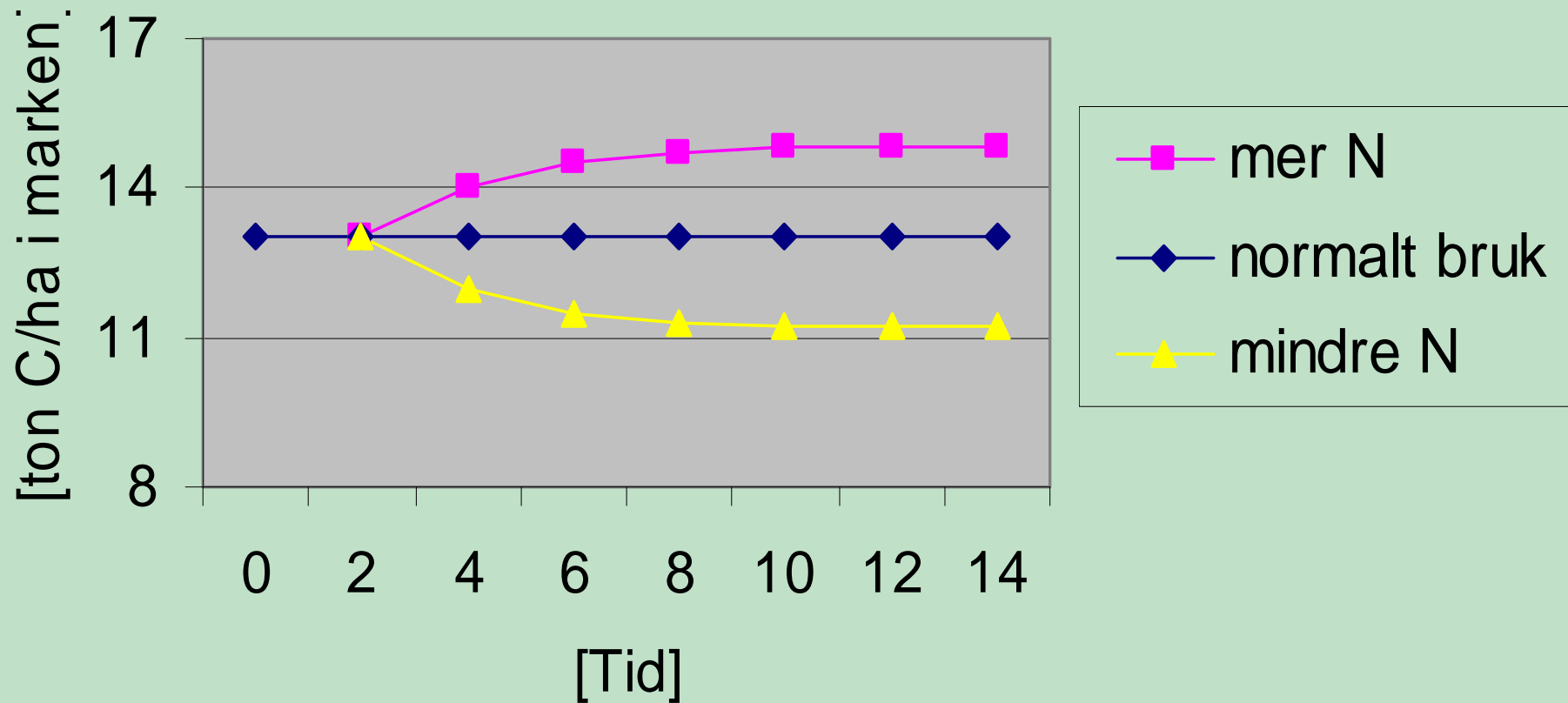
- If large demands of wood:
 - Improved afforestation/reforestation ambitions
 - Improved forest legislation (SFA)
 - Improved silviculture for high biomass production
 - Biomass is harvested before natural disasters happens



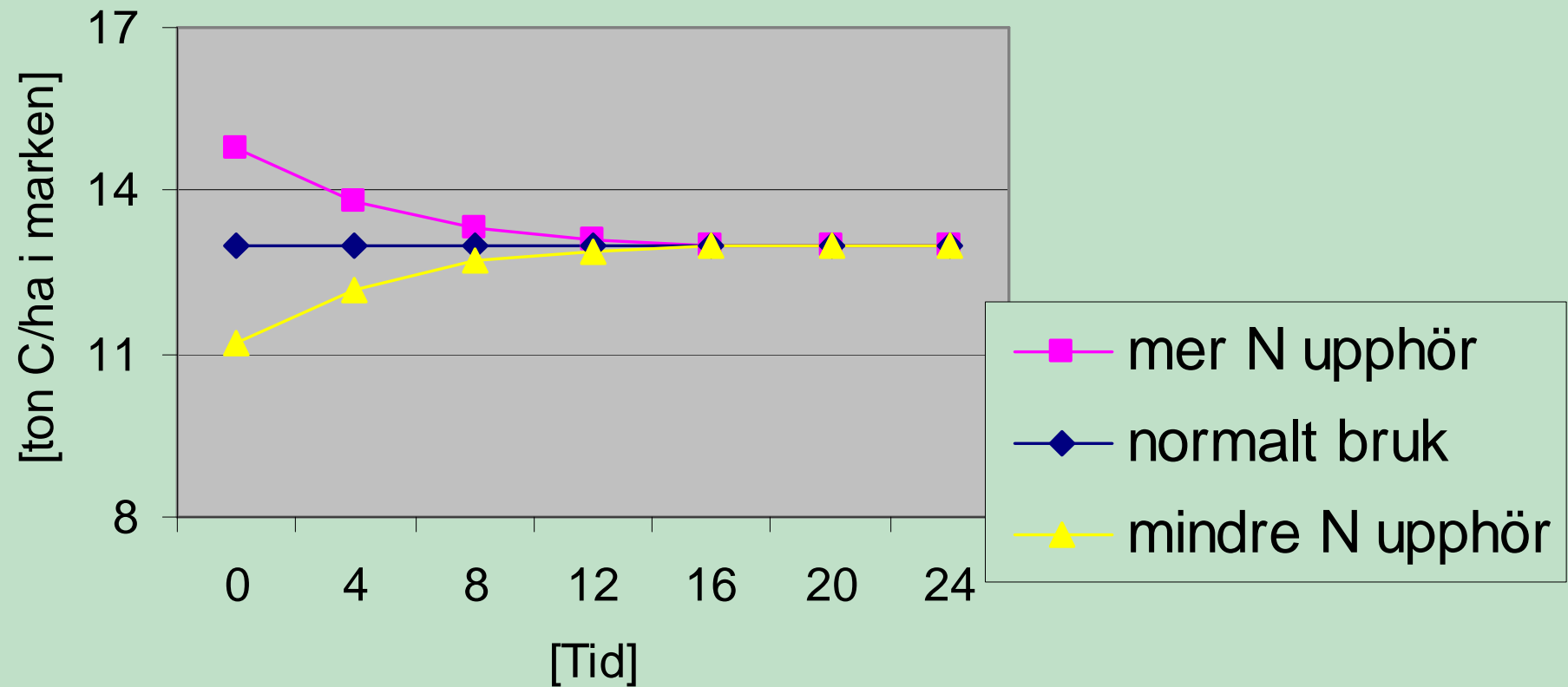
Total tree volume development 1926-2007



C stock = f(management system)



Going back...



Conclusions

- In 20 yrs we need to reach far in reducing fossil fuel consumption
- A too narrow time perspective for C stock losses - contraproductive for climate mitigation
 - Suggestion: C stock loss < 30 % of 50 yrs substitution gain = OK
- With sound incentives (fossil fuel suppression), high fossil fuel use for prod/transp will be too expensive