



Life cycle assessment of photovoltaic power production using the hybrid methodology

Moritz Nill

Institute for Energy and Environment, Leipzig

- Introduction
- Methodology
- System Definitions
- Results
- Conclusions



Hybrid approach

- Input-Output-Table of Germany 1993, 58 sectors
- Sector specific emissions extrapolated to 2000
- System boundaries: complete life cycle without the costs of financing
- Calculation of the depreciation, estimation of the net value added and sector assignment of the unknown commodity inputs, as described by /Marheineke 2002/

See the presentation of T. Marheineke (16th LCA Forum
Lausanne , 2002)

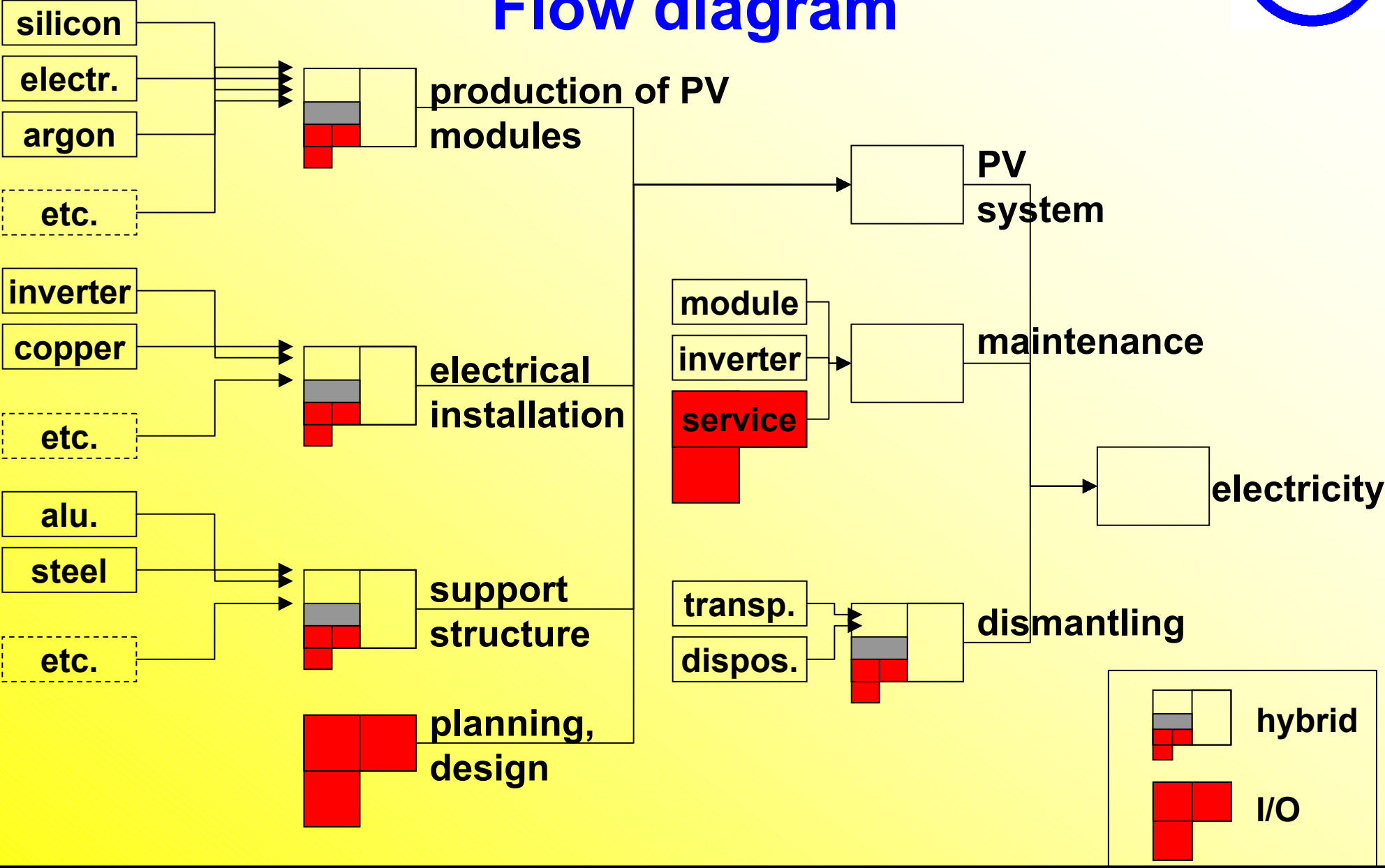


PV system

- PV-System: 5 kW_p, rooftop, grid-connected
- Lifetime: 30 years
- Cell-efficiency: (STC) 15%
- Insolation: 800 kWh/(kW_p a)
- German electricity mix
- No recycling of PV-modules after operation

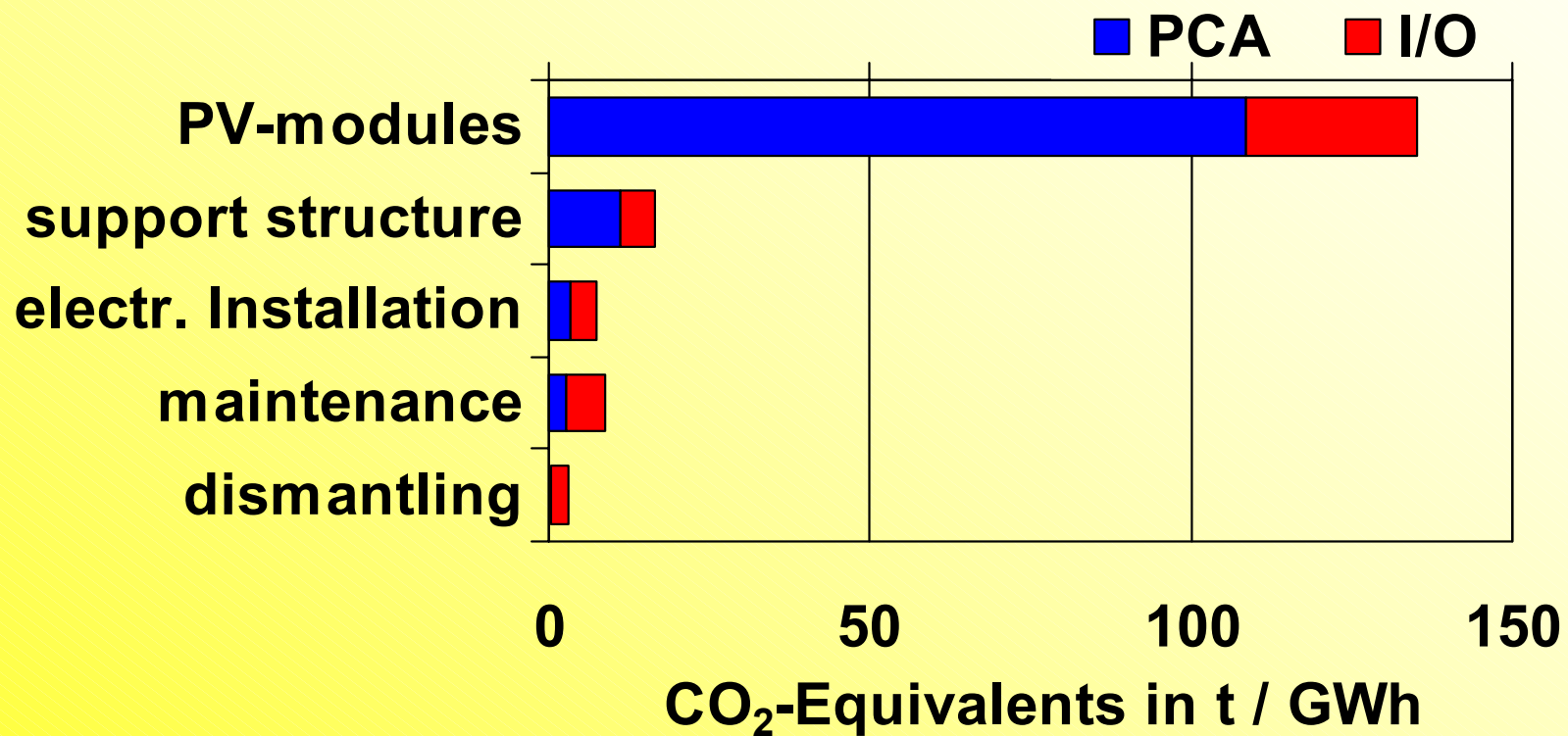


Flow diagram





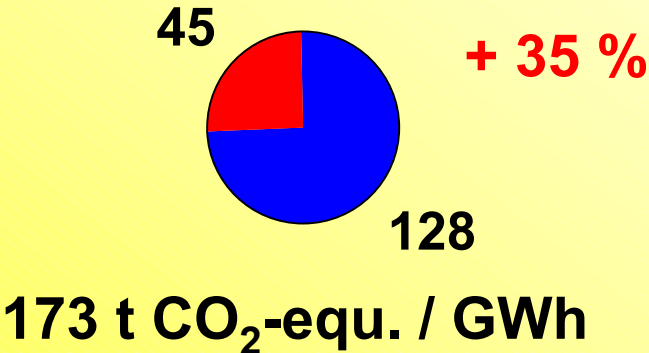
Results I



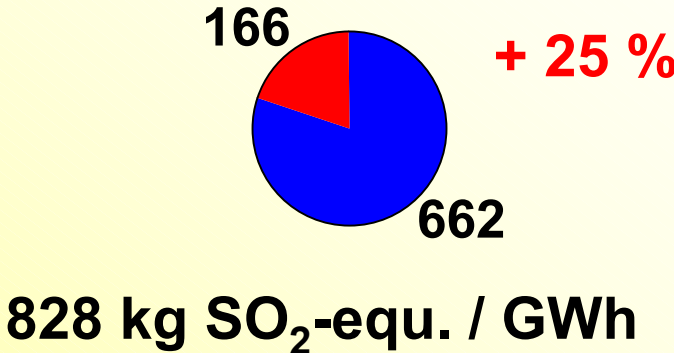


Results II

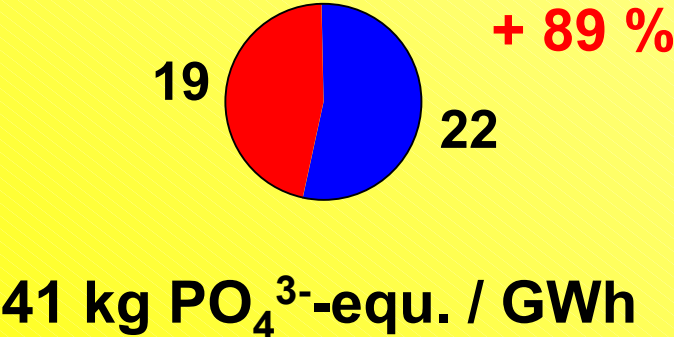
Global Warming



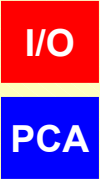
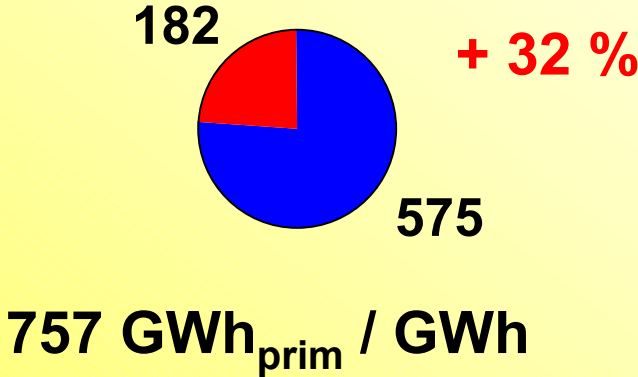
Acidification



Nutrification



Primary Energy Consumption

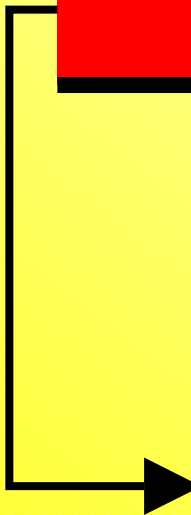




Monetary balance of the PV module production

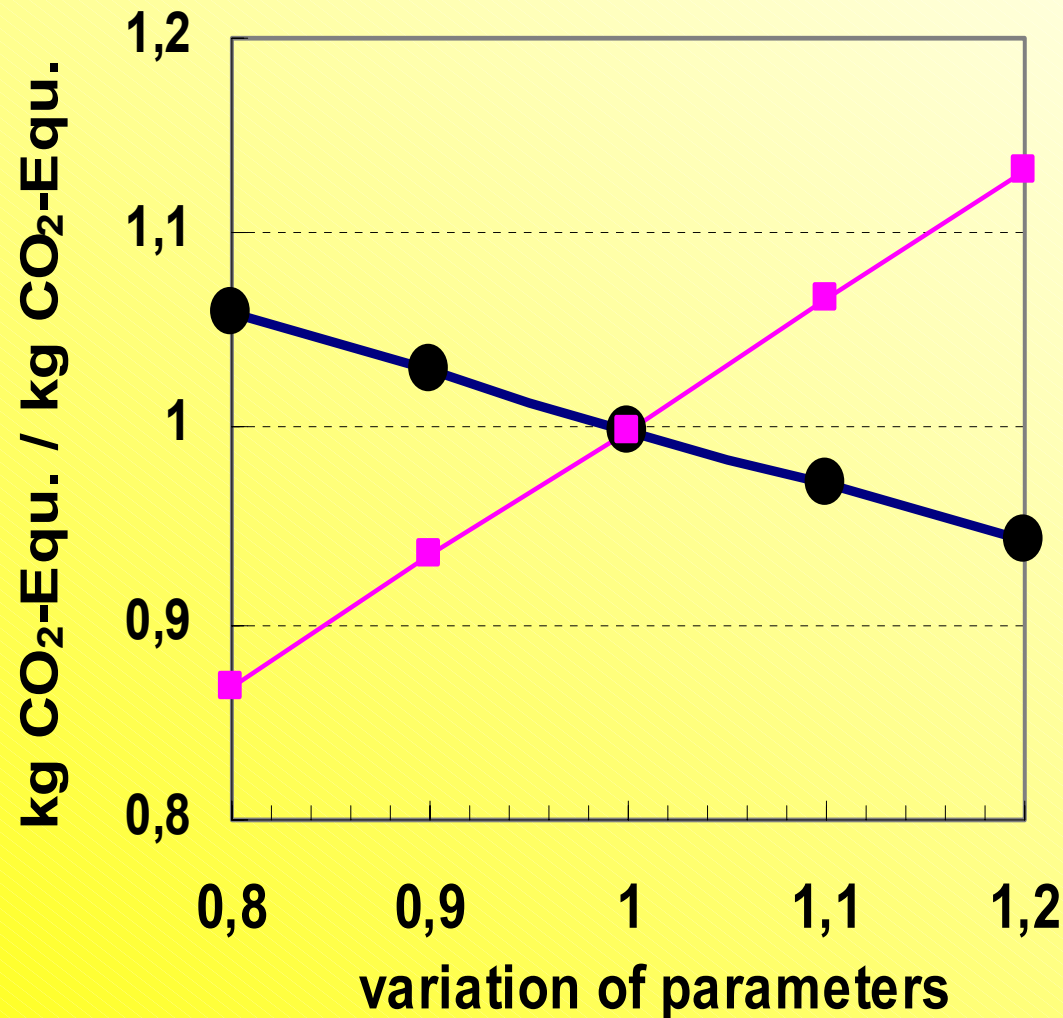
Input Modules	134 €		
Value Added	180 €	400 €	PV module (100 W_p)
Input Sector	86 €		
Total	400 €	400 €	Total

Other services	37 €
Depreciation	15 €
Services of trade etc.	14 €
Production of plastics	11 €
Mechanical engineering	8 €
...	...





Sensitivity analysis



- net value added
(100% = 180 €)
- price (100% = 400 €)

Based on the CO₂-
Equivalent-
Emissions of the
production of a
100 W_p PV-module



Summary

- Hybrid methodology gives results for the impact factors for global warming, acidification and primary energy consumption about a third above normal process chain analysis, for nutrification even more (+ 90%)
- The additional contribution accounts mainly for services and depreciation (machines, buildings)
- Results are quite sensitive to outputprices, less to the net value added
- Normal LCA based on PCA can underestimate the environmental burdens by PV power production