

Chemicals in energy analysis

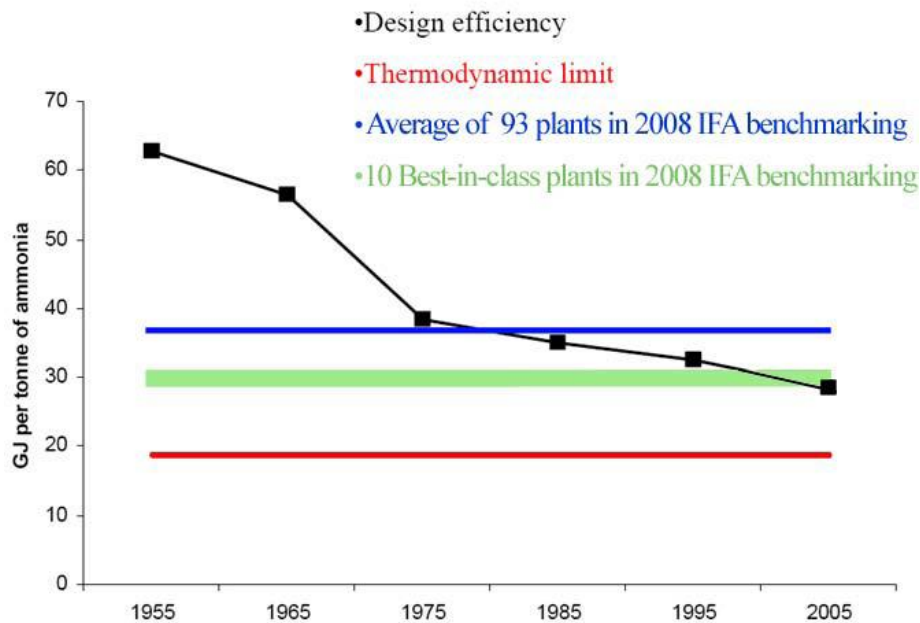
Chemicals to be considered:

- Fertilizers
- Lime
- Pesticides

Fertilizers are by far the most important.

Energy consumption in ammonia production

Improved energy performance



Source:
Energy Efficiency and CO2 Emissions
in Ammonia Production 2008-2009
*Summary Report. International
Fertilizer Industry Association.*

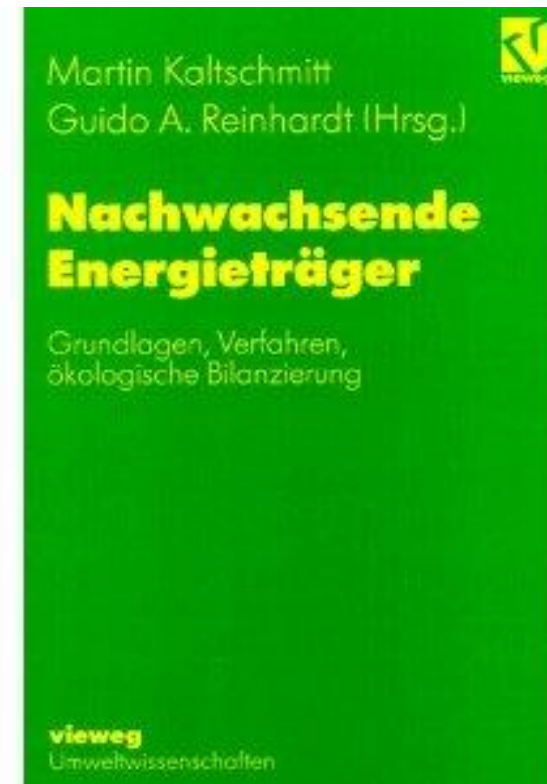
WTT Report uses modified energy costs and emissions of Kaltscmitt & Reinhardt (1997)

WELL-TO-WHEELS ANALYSIS OF
FUTURE AUTOMOTIVE FUELS AND
POWERTRAINS
IN THE EUROPEAN CONTEXT



WELL-to-TANK Report

Version 2b, May 2006



Code	Process	Assoc. processes	Input kg/ kg prod.	Expended energy			GHG emissions			
				As used MJ/ kg prod.	MJb/ MJ	Primary MJb/ kg prod.	g CO ₂ / kg prod.	g CH ₄ / kg prod.	g N ₂ O/ kg prod.	g CO ₂ eq/ kg prod.
AC1	Nitrogen Fertilizer Provision									
	Electricity (EU-mix, MV)	Z7a		0.6	2.83	1.78	74.8	0.18	0.0034	80.0
	Hard coal	KO1		3.9	1.09	4.32	405.8	1.51	0.0011	440.8
	Diesel	Z1		0.9	1.16	1.00	75.3	0.00	0.0000	75.3
	Heavy fuel oil	Z3		4.4	1.09	4.77	384.1	0.00	0.0000	384.1
	NG	Z6		33.0	1.13	37.31	2083.0	6.56	0.0008	2234.7
	N ₂ O from process								0.0300	
	Primary energy and emissions/kg					49.17	3022.0	8.27	0.0353	6085.3
AC2	P fertilizer provision									
	Electricity (EU-mix, MV)	Z7a		1.6	2.83	4.54	191.2	0.47	0.0086	204.5
	Hard coal	KO1		0.6	1.09	0.62	58.6	0.22	0.0002	63.6
	Diesel	Z1		1.1	1.16	1.30	98.1	0.00	0.0000	98.1
	Heavy fuel oil	Z3		5.0	1.09	5.44	438.3	0.00	0.0000	438.3
	NG	Z6		3.2	1.13	3.56	198.8	0.63	0.0001	213.3
		Primary energy and emissions/kg					15.47	085.0	1.31	0.0089
AC3	K fertilizer provision									
	Electricity (EU-mix, MV)	Z7a		0.2	2.83	0.62	26.2	0.06	0.0012	28.0
	Diesel	Z1		0.5	1.16	0.63	47.3	0.00	0.0000	47.3
	NG	Z6		7.5	1.13	8.48	473.4	1.50	0.0002	507.8
	Primary energy and emissions/kg					8.73	540.0	1.50	0.0014	583.2
AC4	CaO fertilizer provision (85%CaCO₃+15%CaO,Ca(OH)₂)									
	Electricity (EU-mix, MV)	Z7a		0.4	2.83	1.13	47.7	0.12	0.0022	51.0
	Coal	KO1		0.3	1.09	0.35	33.3	0.12	0.0001	36.2
	Diesel	Z1		0.2	1.16	0.21	16.2	0.00	0.0000	16.2
	NG	Z6		0.3	1.13	0.34	18.9	0.06	0.0000	20.3
	Primary energy and emissions/kg					2.04	110.1	0.30	0.0023	123.7
AC5	Pesticides (etc) provision									
	Electricity (EU-mix, MV)	Z7a		28.5	2.83	80.72	3398.9	8.29	0.1535	3635.0
	Hard coal	KO1		7.6	1.09	8.35	784.2	2.91	0.0021	851.9
	Diesel	Z1		58.1	1.16	67.40	5086.9	0.00	0.0000	5086.9
	Heavy fuel oil	Z3		32.5	1.09	35.37	2849.9	0.00	0.0000	2849.9
	NG	Z6		71.4	1.13	80.71	4505.9	14.24	0.0018	4834.0
	Primary energy and emissions/kg					272.55	10025.6	25.45	0.1573	17257.6

IPCC Reports could be used to define emissions from chemical industry

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CHAPTER 3

CHEMICAL INDUSTRY EMISSIONS

Yara has succeeded to cut emissions of ammonia production

- 2003 6.8 kg CO₂-eq/kg fertilizer-N (Jenssen and Kongshaug, 2003).
- 2.9 kg CO₂-eq/kg fertilizer-N based on data from Yara (Erlingsson, 2009).

Source: Ahlgren et al. 2009. Greenhouse gas emissions from cultivation of agricultural crops for biofuels and production of biogas from manure. SLU

Conclusions

- Energy costs and GHG emission are available in a wide range for Agricultural Chemicals.
- It is hard to evaluate which values are updated and reliable.
- Do we use the energy cost for production only or added with chemical energy content?