European Association of Geosynthetic product Manufacturers

COMPARATIVE LCA OF GEOSYNTHETICS versus CONVENTIONAL CONSTRUCTION MATERIALS
CASE 3: LANDFILL CONSTRUCTION

Katja Werth– NAUE GmbH & Co. KG (on behalf of EAGM)
Rolf Dieter Böttcher – Colbond bv (on behalf of EAGM)

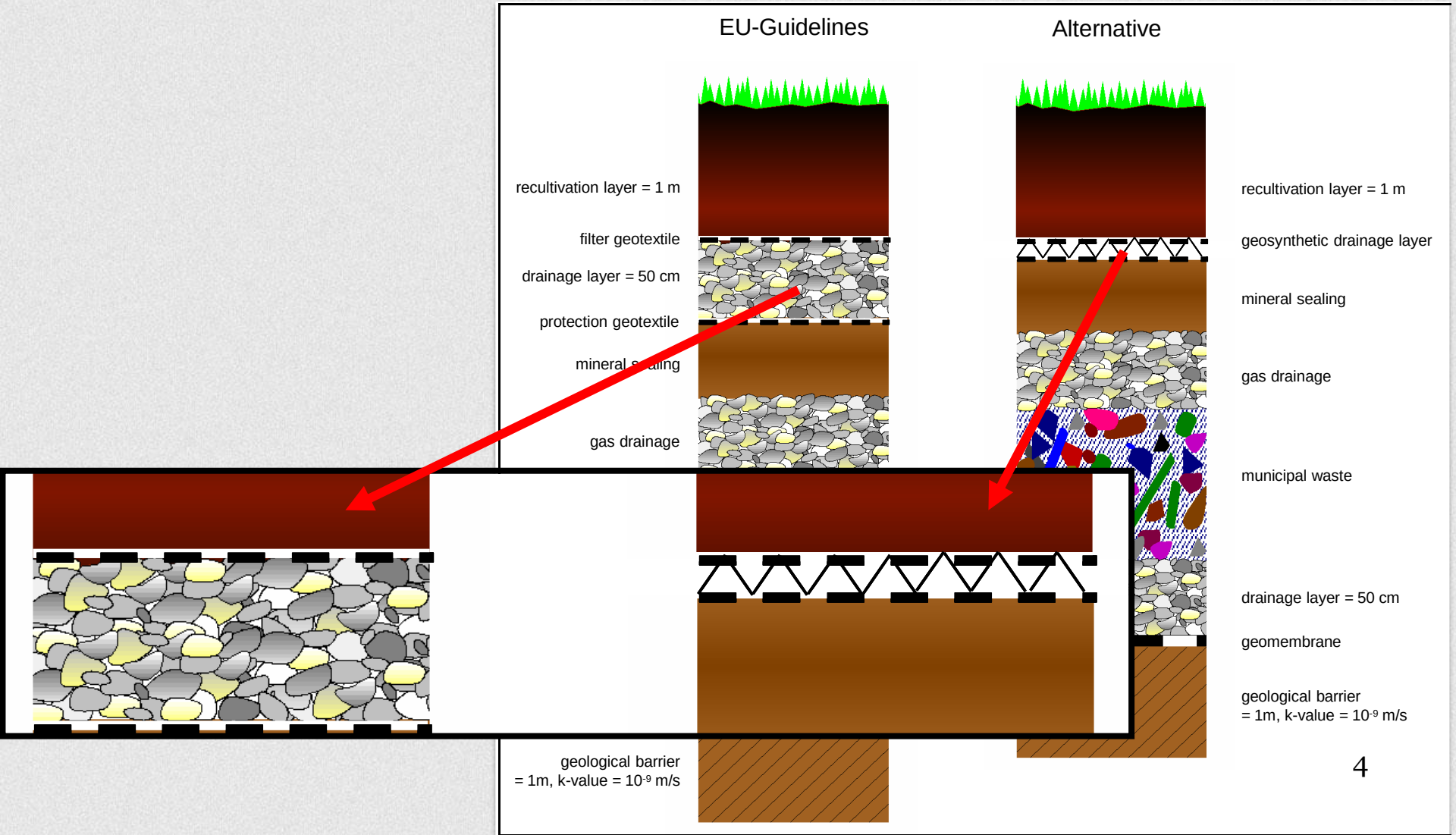
The E.A.G.M. commissioned ETH Zürich and ESU-services Ltd. to quantify the environmental performance of commonly applied construction materials. A comparison was undertaken between:

- conventional materials like concrete, cement, lime or gravel
- geosynthetic materials

A set of Comparative Life Cycle Assessment studies are carried out concentrating on various civil application cases, namely:

- filtration (case 1)
- foundation stabilised road (case 2)
- ***landfill construction (case 3)***
- slope retention retaining structures (case 4)

CHARACTERISATION OF ALTERNATIVES



CHARACTERISATION OF ALTERNATIVES

- No protection or filtration geosynthetic are calculated in the comparison
- Gravel with a uniform grain size of 16-32mm and a layer thickness of 50cm is used in case 3A (according to 1999/31/EC).
- In Case 3B the average of 2 types of different geosynthetics are used to represent its performance:
  - drainage nets
  - drainage 3D filament

(Data collected from EAGM Members 2010)

- Polypropylene or polyethylene granulates are used as basic material in case 3B
- The average weight of the drainage polymer is 500g/m²
- Estimated life time ≥100 years

INDICATORS INVESTIGATED:

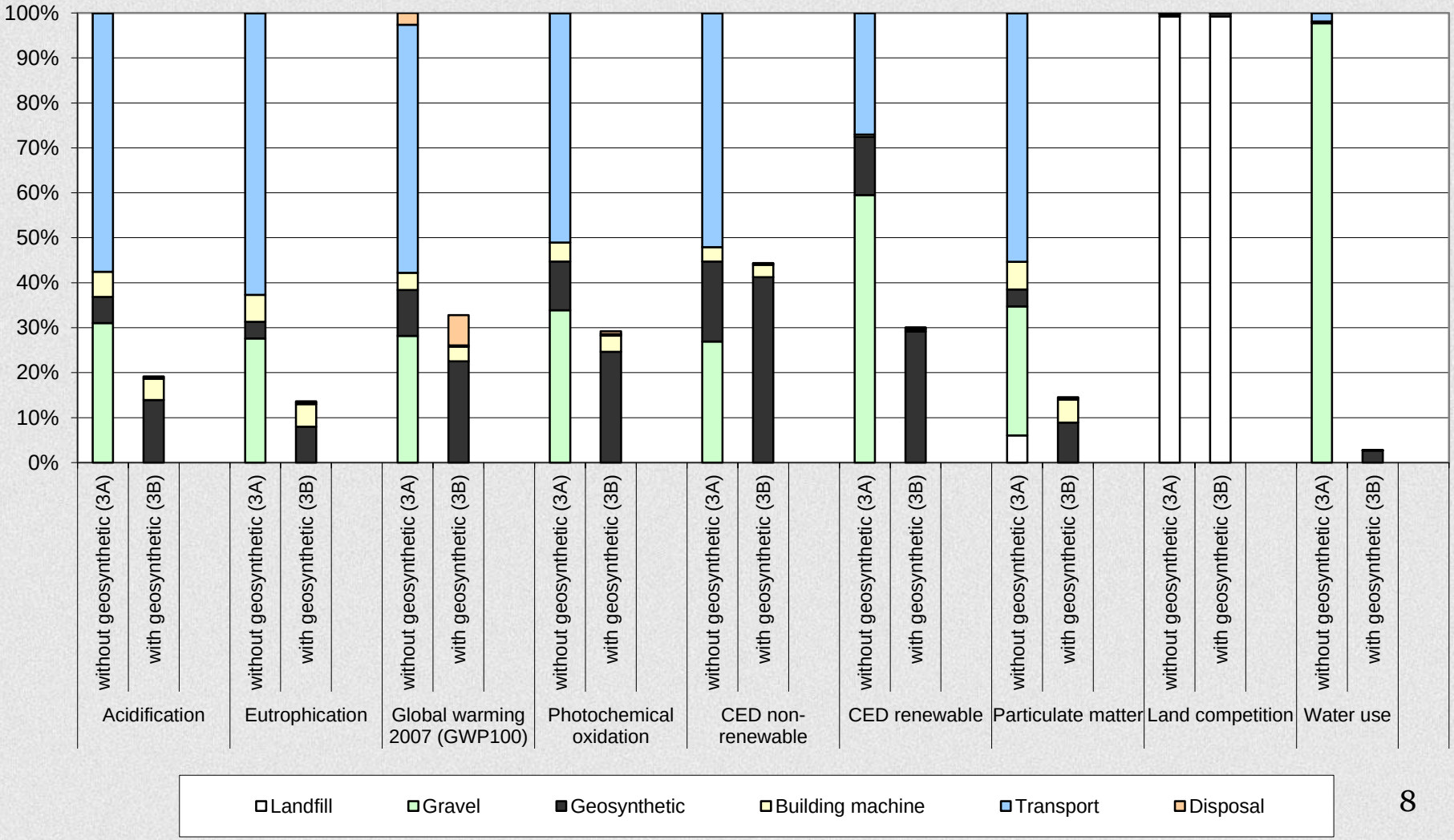
1. Cumulative Energy Demand [CED]
2. Climate Change [Global Warming Potential, GWP100]
3. Photochemical Ozone Formation [also known under “summer smog”],
4. Particulate Formation [PM, causes health problems as it reaches the upper part of the airways and lungs when inhaled]
5. Acidification [major acidifying substances are NOX, NH3, and SO2]
6. Eutrophication [nutrient enrichment of the aquatic environment]
7. Land competition
8. Water use

Selected key figures referring to the construction of one square meter of a case 3A and case 3B drainage layer with a hydraulic conductivity of at least 1 mm/s

	Unit	Case 3A	Case 3B
Gravel	t/m2	0.90	-
Geosynthetic drainage core	m^2/m^2	-	1
Diesel used in building machines	MJ/m^2	4.5	3.8
Transport, lorry	tkm/m^2	45.1	0.2
Transport, freight, rail	tkm/m^2	0.1	0.3
Land use	m^2/m^2	1	1
Particulates, > 10 mm	g/m	6.3	-
Particulates, > 2.5 mm & < 10 mm	g/m	1.7	-

Indicators investigated: Acidification, Eutrophication, Global Warming, Photochemical oxidation, CED non-renewable, CED renewable, Particulate matter, Land competition & Water use

Environmental impacts of the life cycle of 1m² mineral drainage layer (case 3A) and a geosynthetic drainage layer (case 3B)



THIS STUDY SHOWS

The use of geosynthetics leads to:

- **lower environmental impacts in all impact categories considered , except land competition which is about the same in both cases**

- **220 tons CO2-eq saving on a landfill with an area of 30,000m²**

The whole study including the results of the critical reviews is available on:
http://www.eagm.eu/