Attributív és konzekvens LCA, a mezőgazdaságban használt biológiai eredetű, talajtakaró műanyag fóliára

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XVI. LCA Konferencia

“Életciklus elemzéssel a fenntartható társadalom felé”

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Élelmiszerigény alakulása

ARTICLES
https://doi.org/10.1038/s43016-021-00322-9
nature food
Check for updates

A meta-analysis of projected global food demand and population at risk of hunger for the period 2010–2050

Michiel van Dijk[1,2]✉, Tom Morley[1], Marie Luise Rau[1] and Yashar Saghai[3,4]

Quantified global scenarios and projections are used to assess long-term future global food security under a range of socio-economic and climate change scenarios. Here, we conducted a systematic literature review and meta-analysis to assess the range of future global food security projections to 2050. We reviewed 57 global food security projection and quantitative scenario studies that have been published in the past two decades and discussed the methods, underlying drivers, indicators and projections. Across five representative scenarios that span divergent but plausible socio-economic futures, the total global food demand is expected to increase by 35% to 56% between 2010 and 2050, while population at risk of hunger is expected to change by −91% to +8% over the same period. If climate change is taken into account, the ranges change slightly (+30% to +62% for total food demand and −91% to +30% for population at risk of hunger) but with no statistical differences overall. The results of our review can be used to benchmark new global food security projections and quantitative scenario studies and inform policy analysis and the public debate on the future of food.

Műanyag a mezőgazdaságban (talajtakarás)

sustainability

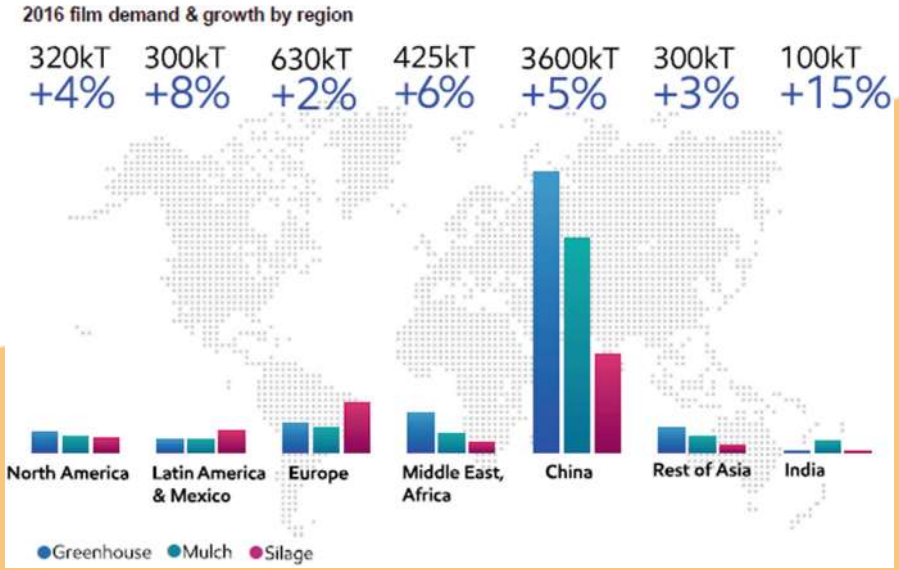
MDPI

Article

The Effects of Biodegradable Mulch Film on the Growth, Yield, and Water Use Efficiency of Cotton and Maize in an Arid Region

Lu Deng [1,2,3], Yang Yu [1,*], Haiyan Zhang [1], Qian Wang [1] and Ruide Yu [1,4]

Through field experiments, we found that film mulching increased the crop yield by about 70% in an arid region. The three mulch films significantly increased plant height, stalk diameter, leaf area,

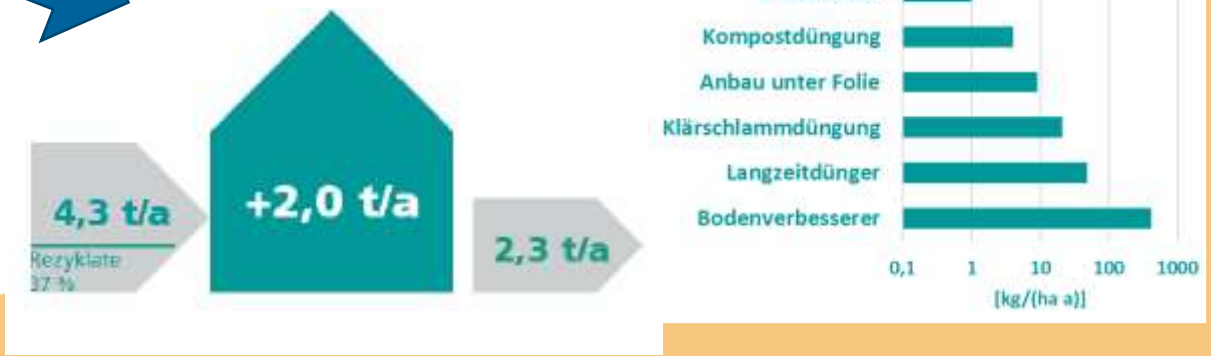


Guerrini et al. (2019) Agronomical Overview of Mulch Film Systems

Műanyag a mezőgazdaságban (talajtakarás)

Müanyag körforgása a mezögazdaságban (elvi séma): Comité International des Plastiques en Agriculture

CO2-Ekvivalens emisszió:
Gyártás: 1.5-3.5 kg CO2-ekv/kg
Hulladékégetés: 1.4-3.5 kg CO2-ekv/k



Bertling et al. (2021) Kunststoffe in der Umwelt

Műanyag a mezőgazdaságban (polimerfajták)

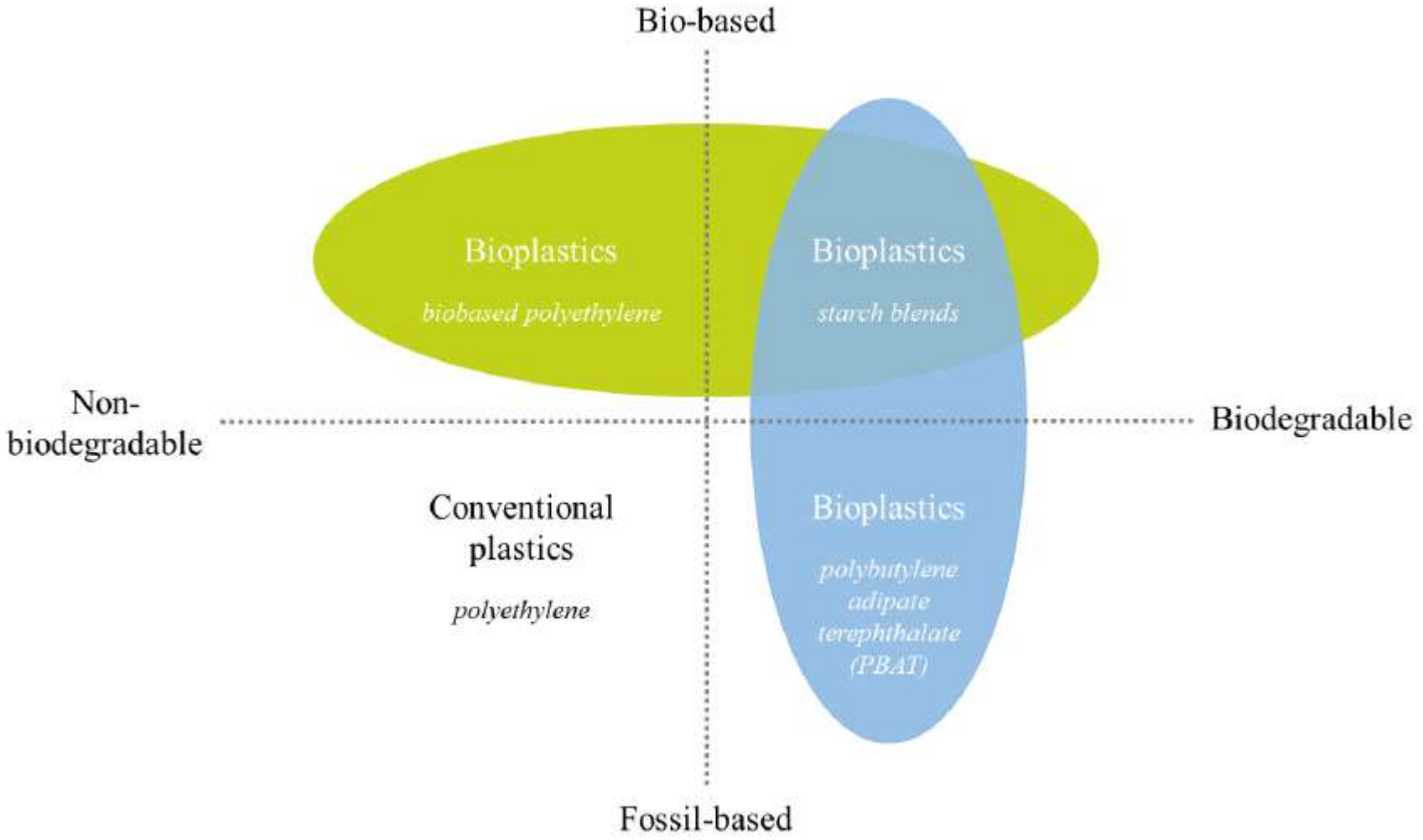


Figure 2.1: Coordination system for plastics with examples (European Bioplastics, 2018)

Műanyag a mezőgazdaságban (“bio-műanyagok”)

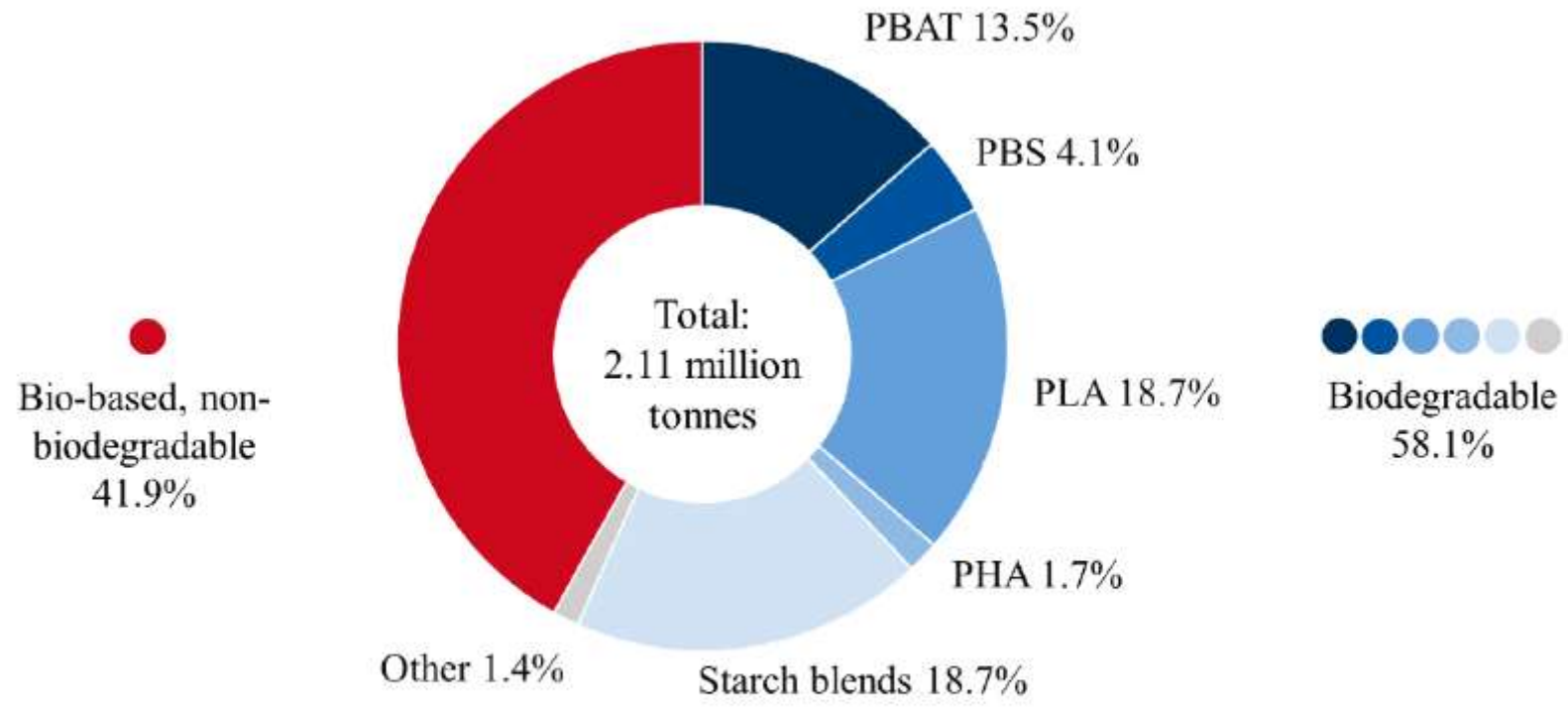


Figure 2.2: Production capacities of bioplastics 2020 by material type (European Bioplastics, 2020a)

Funkcionális Egység

functional units

aLCA

1. “providing LDPE mulch films required in German agriculture for one year” and

2. “providing starch-based mulch films required in German agriculture for one year”

cLCA

3. “providing the annually re-quired amount of mulch films in German agriculture with starch-based mulch films instead of LDPE mulch films”

Rendszerhatárok

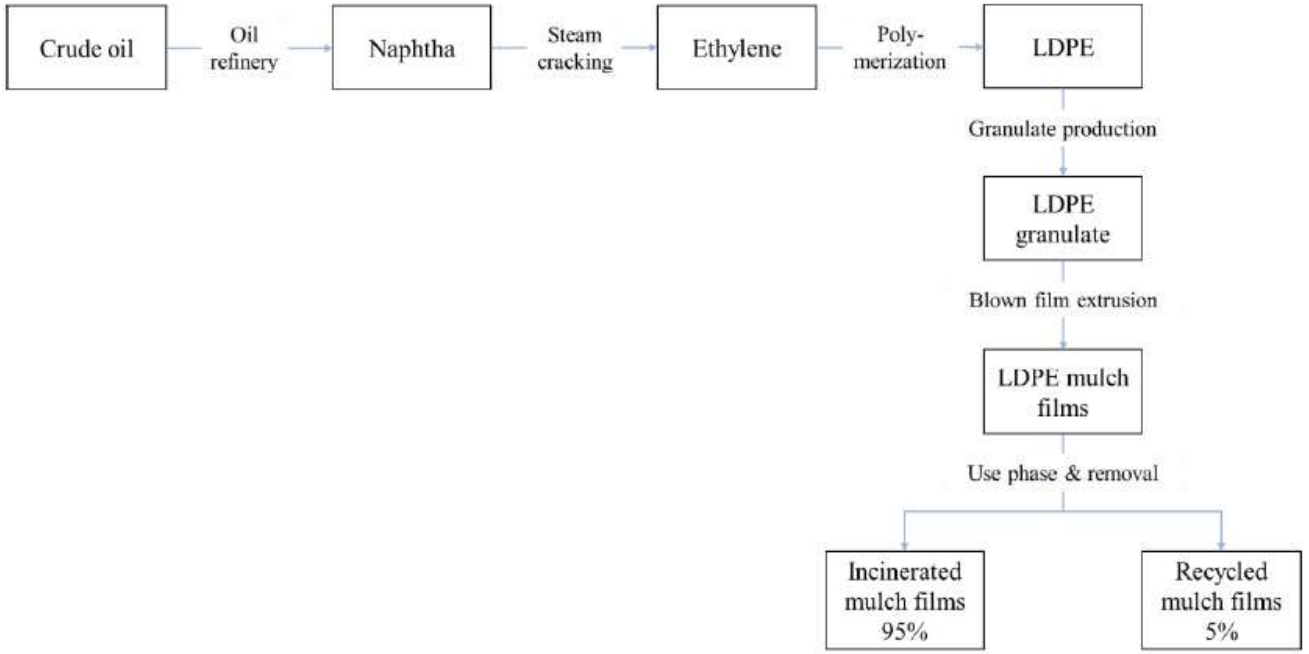


Figure 4.1: Flowchart of LDPE mulch films

Product system	Target amount used for reference flow [in t]
LDPE mulch films on the field	4,600
LDPE mulch films incinerated	4,370
LDPE mulch films recycled	217

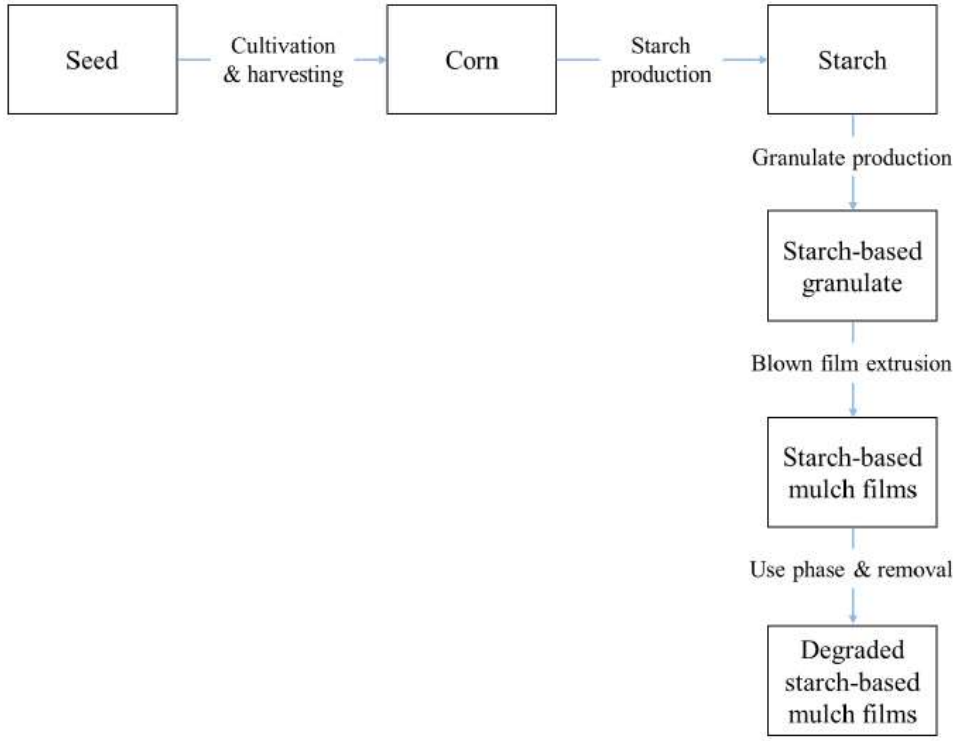


Figure 4.2: Flowchart of starch-based mulch films

Product system	Target amount used for reference flow [in t]
Starch-based mulch films	2,738

Hatásértékelés

For this purpose, the midpoint impact categories

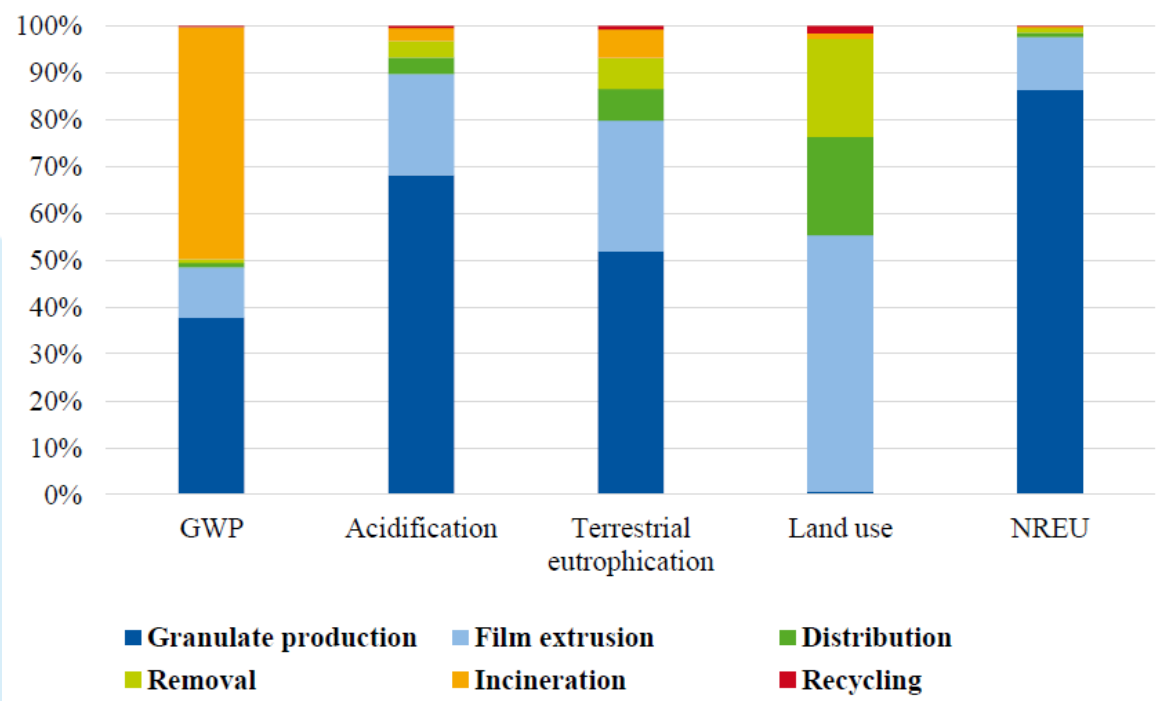
- global warming potential (GWP),
- acidification,
- terrestrial eutrophication,
- land use, and
- use of non-renewable, fossil energy resources (NREU)

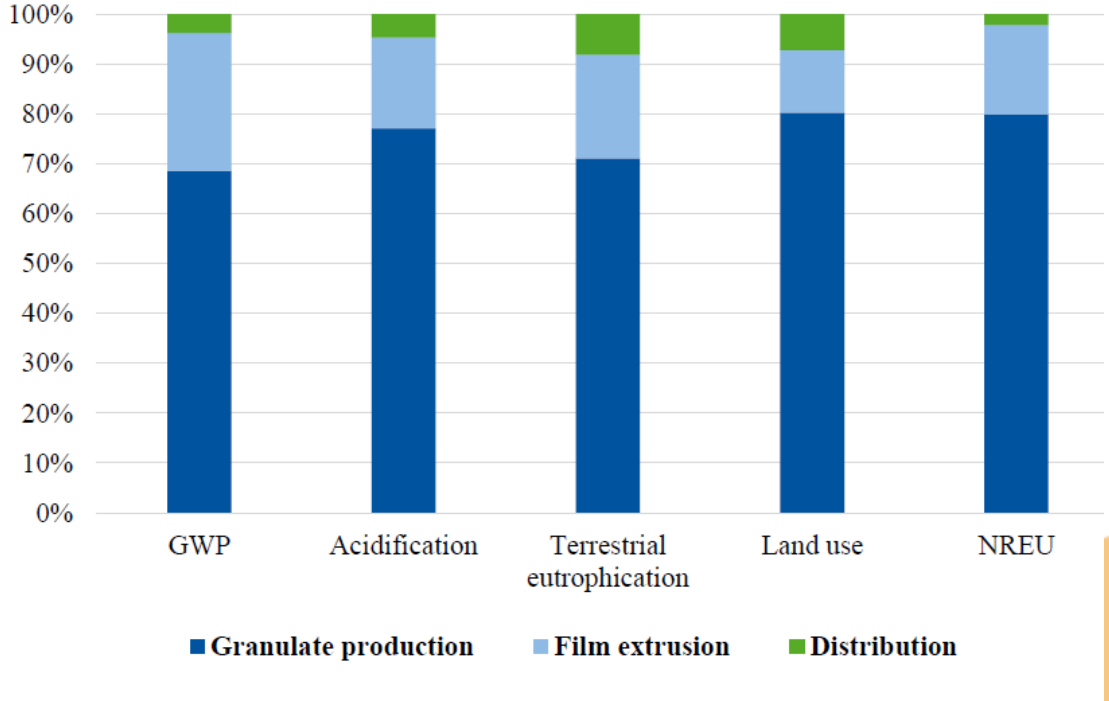
were used.

Impact category	Unit	Impact assessment method
Global warming potential (100a)	kg CO_2-eq.	IPCC 2013 GWP 100a
Acidification	kg SO_2-eq.	ILCD 2011 Midpoint
Terrestrial eutrophication	mol N-eq.	ILCD 2011 Midpoint
Land use	kg C deficit	ILCD 2011 Midpoint
Non-renewable energy use (fossil)	MJ	Cumulative Energy Demand

Hatásértékelés

Attributional LCA: LDPE talajtakaró és lebomló talajtakaró

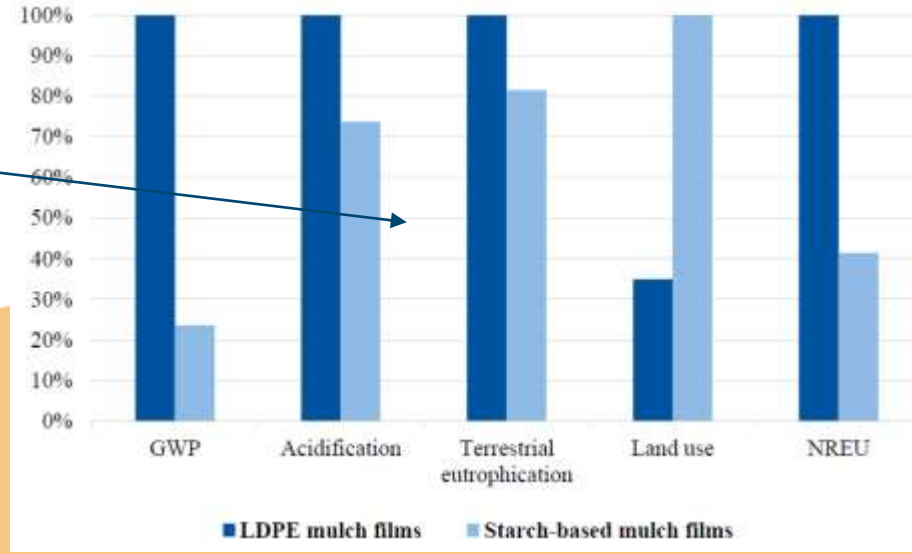




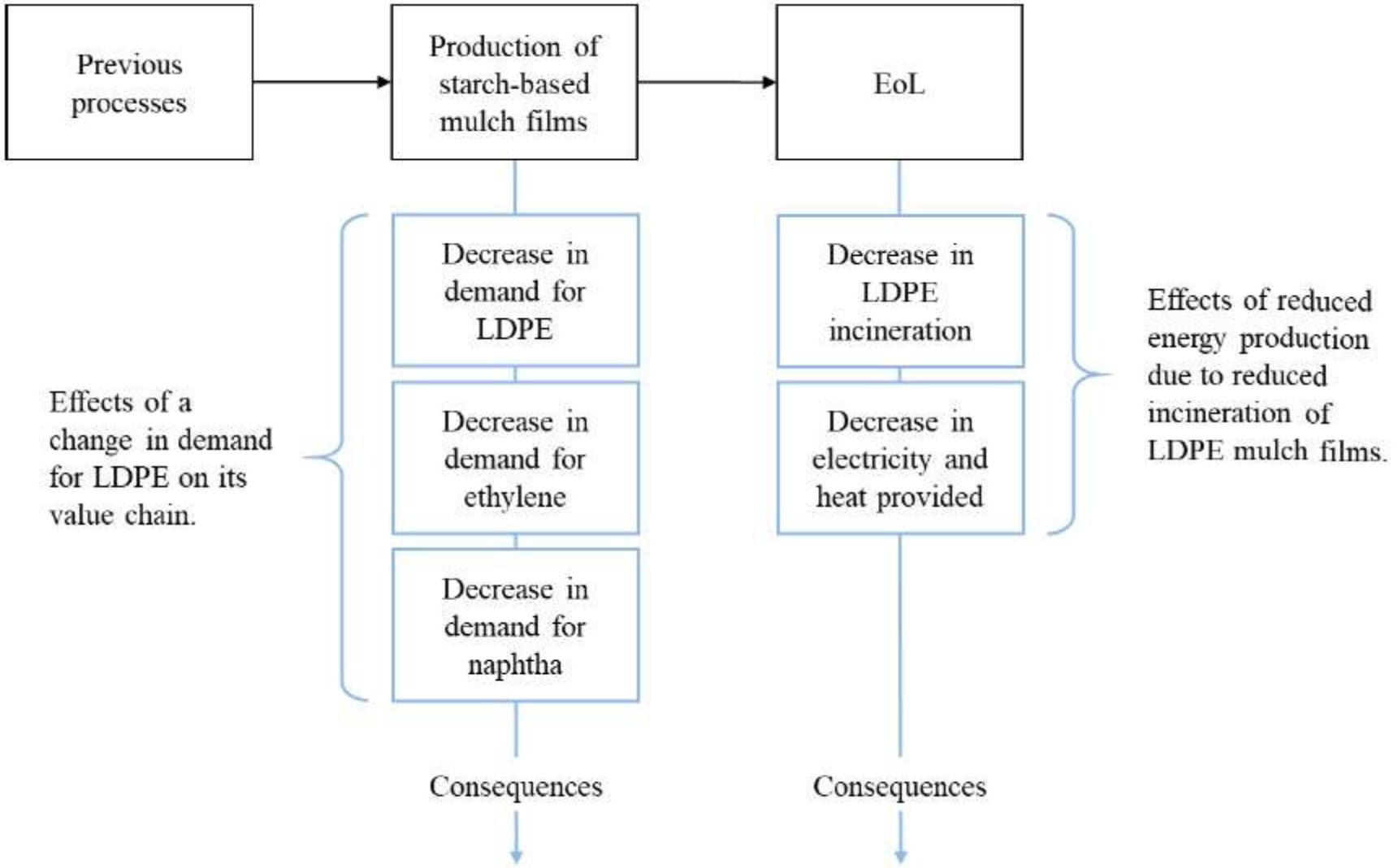
Hatásértékelés

Impact category	Starch-based mulch films	LDPE mulch film	Difference	Unit
Global warming potential (100a)	6,286,181	26,694,288	-20,408,107	kg CO_2-eq.
Acidification	46,970	63,682	-16,712	kg SO_2-eq.
Terrestrial eutrophication	117,415	144,005	-26,590	mol N-eq.
Land use	36,523,392	12,746,525	23,776,868	kg C deficit
Non-renewable energy use (fossil)	155,860,977	376,580,526	-220,719,549	MJ

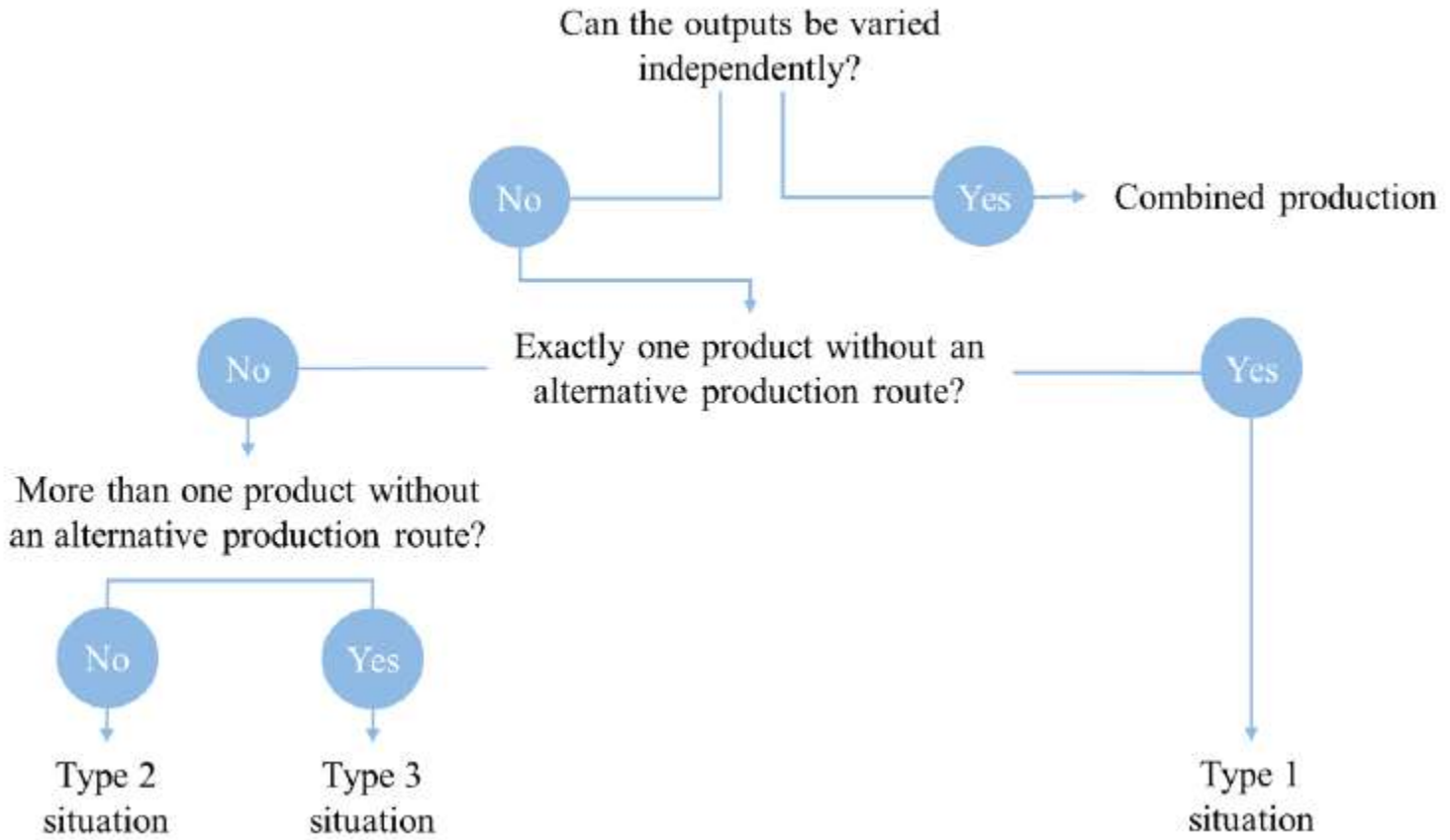
lower amount needed to cover the same area



A rendszerváltozás lehetséges hatásai



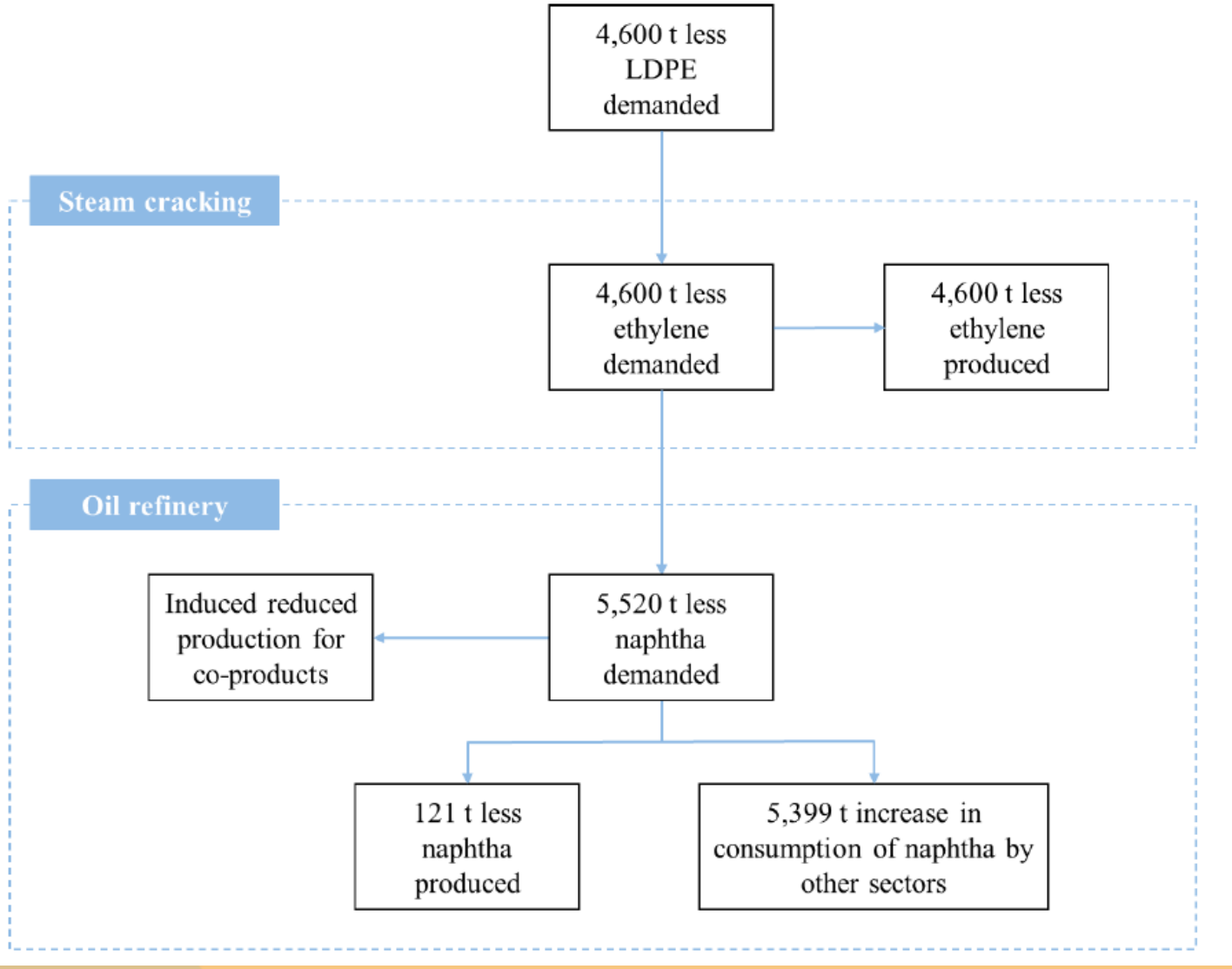
A meghatározó termék definiálása



Type 1: Ethylen from Steam cracking

Type 3: Refinery

LDPE fogyasztás csökkenésének hatása a rendszerre



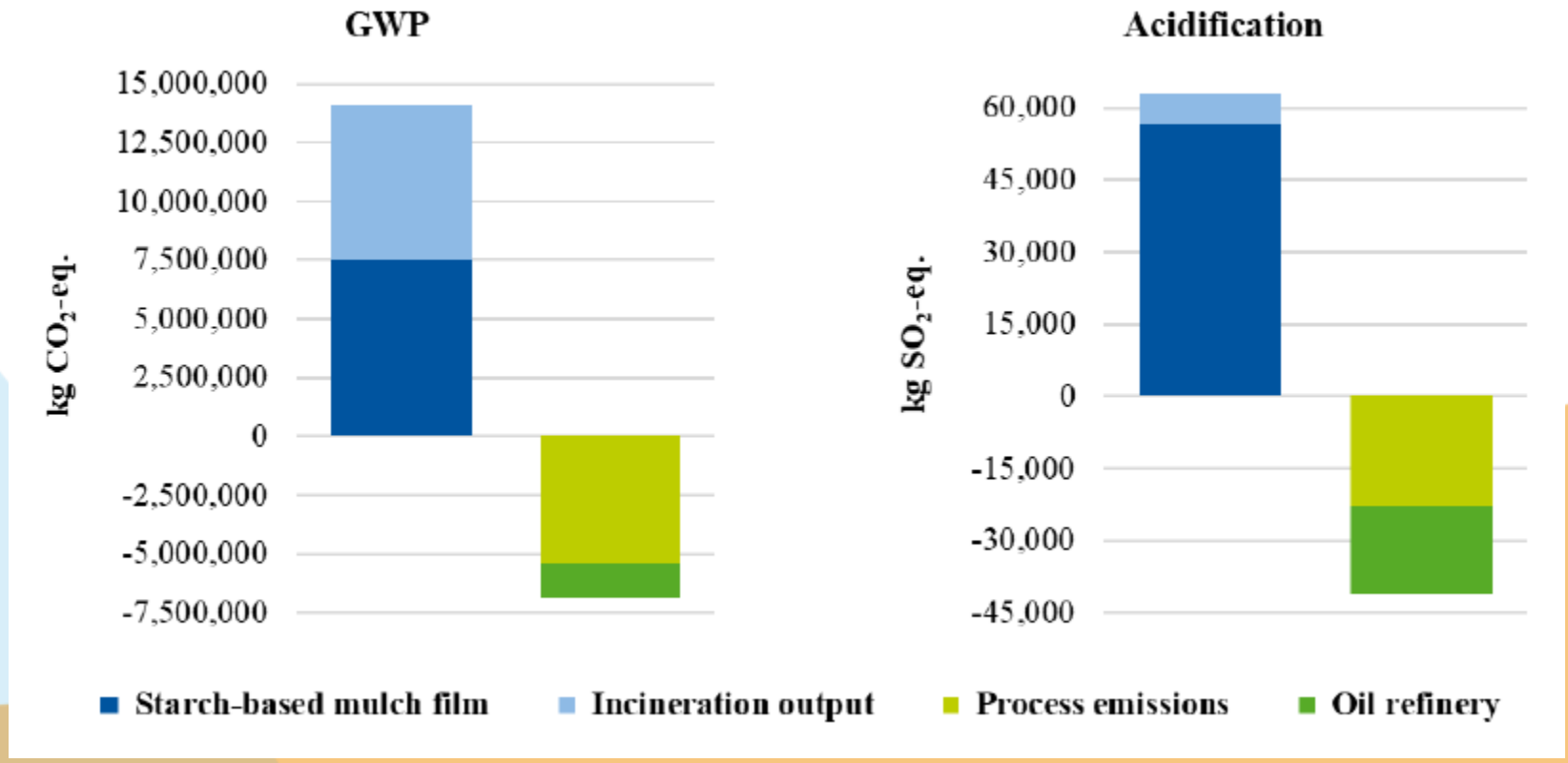
Finomító termeléscsökkenése alacsonyabb LDPE igény miatt

Table 4.9: Induced production reduction of oil refinery products applied to German agriculture (demanding 5,520 t (=7,360,000 l) less naphtha)

Products of oil refinery	Induced production reduction [in l]	Density [in t/l]	Induced production reduction [in t]
Diesel	952,471	0.000840	800
Gasoline	435,755	0.000750	327
Fuel oil	304,791	0.000100	305
Kerosene	204,781	0.000795	163
LPG	66,673	0.000493	33
Naphtha	161,920	0.000750	121

Hatásértékelés
consequential LCA

Replacing LDPE mulch films requires starch-based mulch films as substitutes, **decreases oil refinery** product production, avoids **process emissions**, and requires **additional electrical and thermal energy** generation



Hatásértékelés
LDPE versus Lebomló talajtakaró bevezetése

$$environmental\ impact = starch\text{-}based\ mulch\ films + incineration\ ouput - process\ emissions - oil\ refinery$$

Váltás lebomló fóliára

[LDPE éves k.hatása]

Impact category	Scenario starch-based mulch film	Scenario LDPE mulch film	Difference	Unit
Global warming potential (100a)	7,248,709	26,694,288	-19,445,579	kg CO_2-eq.
Acidification	21,591	63,682	-42,091	kg SO_2-eq.
Terrestrial eutrophication	69,586	144,005	-74,419	mol N-eq.
Land use	11,888,467	12,746,525	-858,057	kg C deficit
Non-renewable energy use (fossil)	28,531,036	376,580,526	-348,049,489	MJ

Kérdéses pontok

- Fólia talajszennyezettsége és annak hatása az EoL szakaszra (3 kg talaj/kg fólia)
- Mikroplasztik hiányzó hatáselemzése ill. Hiányzó indikátorok (bármely kategóriában)
- ALCA és CLCA összehasonlíthatósága
- Szektorokon átívelő hatások (pl. fólia égetés, kukorica alapú termékek - táp)
- Steam cracking termékek alternatív technológiái
- Más lebomló műanyagok – Land use allokáció
- Avioding by substitution → referencia rendszer – új rendszer

Conclusions and “take-home”

- Lebomló fólia a vizsgált hatáskategóriák túlnyomó részeben jobban teljesít mint az LDPE
- Land Use az egyetlen vizsgált h.kategória amiben LDPE kedvezőbb képet mutat
- CLCA rendszerexpanziója a lebomló műanyagokat előnyben részesíti minden h.kategóriában
- Szubtituciós potenciál interpretációja igen fontos a eredmények értelmezésében

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