CO_2-Footprint of Getzner Werkstoffe GmbH PU products

The fundamental energy demand (approx. 99%) and therefore also the CO_2 emission results during the production (from crude oil to oil refinery to the raw material) of the primary raw materials (isocyanate and polyol). The production of the actual Getzner products amounts to 1% of the total energy demand.

During the production of plastic materials in average 2-3 kg CO_2 per kg finished product is generated during the entire production chain including the needed process energy. This value is approx. 30% higher for the high-quality Getzner polyurethanes which is compensated by an extraordinary longevity and functional life (up to 100 years).

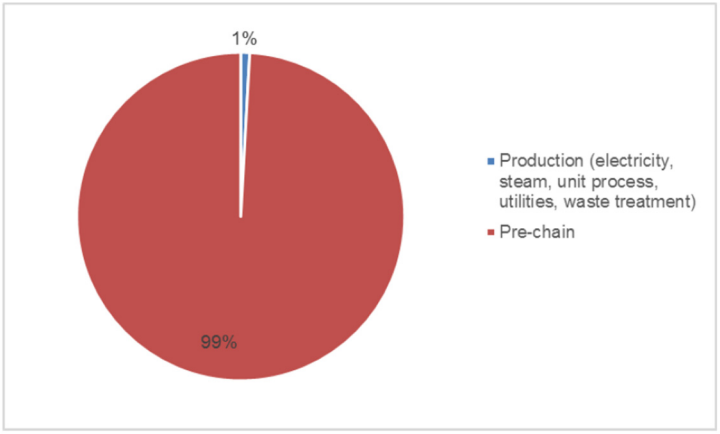

Fig 1: Distribution of primary energy demand (production, raw materials (pre chain))

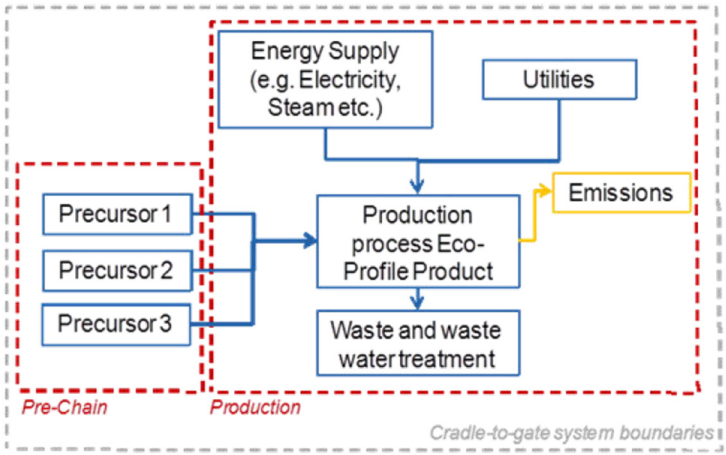

Fig 2: Energy contribution of polymerization process

Energy Input

The energy input at the site in Bürs is depicted in the following table, wherein the whole area is considered (heating, building, power requirement light, IT, a.s.o.).

Table 1: Energy input at production site Bürs

No	Energy	Quantity 2018	Conversion in kWh	Consumption in kWh			Share in %		
				2016	2017	2018	2016	2017	2018
1	Electricity [kWh]	3,768,299	x 1.0	2,502,278	3,069,511	3,768,299	58	60	66
2	Fuel oil [L]	0	x 10.0	90	0	0	0	0	0
3	Natural gas [Nm³]	127,894.4	x 10.0	1,330,870	1,516,662	1,278,944	31	30	22
4	Company cars [L] [1.)]	66,495	x 10.0	500,960	518,910	664,950	12	10	12
	TOTAL	---	---	**4,334,198**	**5,105,083**	**5,712,193**	**100**	**100**	**100**

[1.)] Determined by the kilometre list of the leasing cars and average fuel consumption 6.5 Ltr. / 100 km

As initially mentioned, the end production represents a minor factor regarding the CO_2 footprint. Mainly essential for this effect is the production of raw materials.

Therefore Getzner has set oneself the target to make the procedures as raw material efficient as possible and to reduce the production waste to a minimum, and also to recycle these waste products. Getzner is constantly investing in the optimization of new equipment and new procedures, as for instance granulation or production of moulded parts.

The display below shows the most essential production steps for the manufacturing of the raw materials polyol and isocyanate. These base products are extracted from fossil raw materials – natural gas and crude oil – via several process steps:

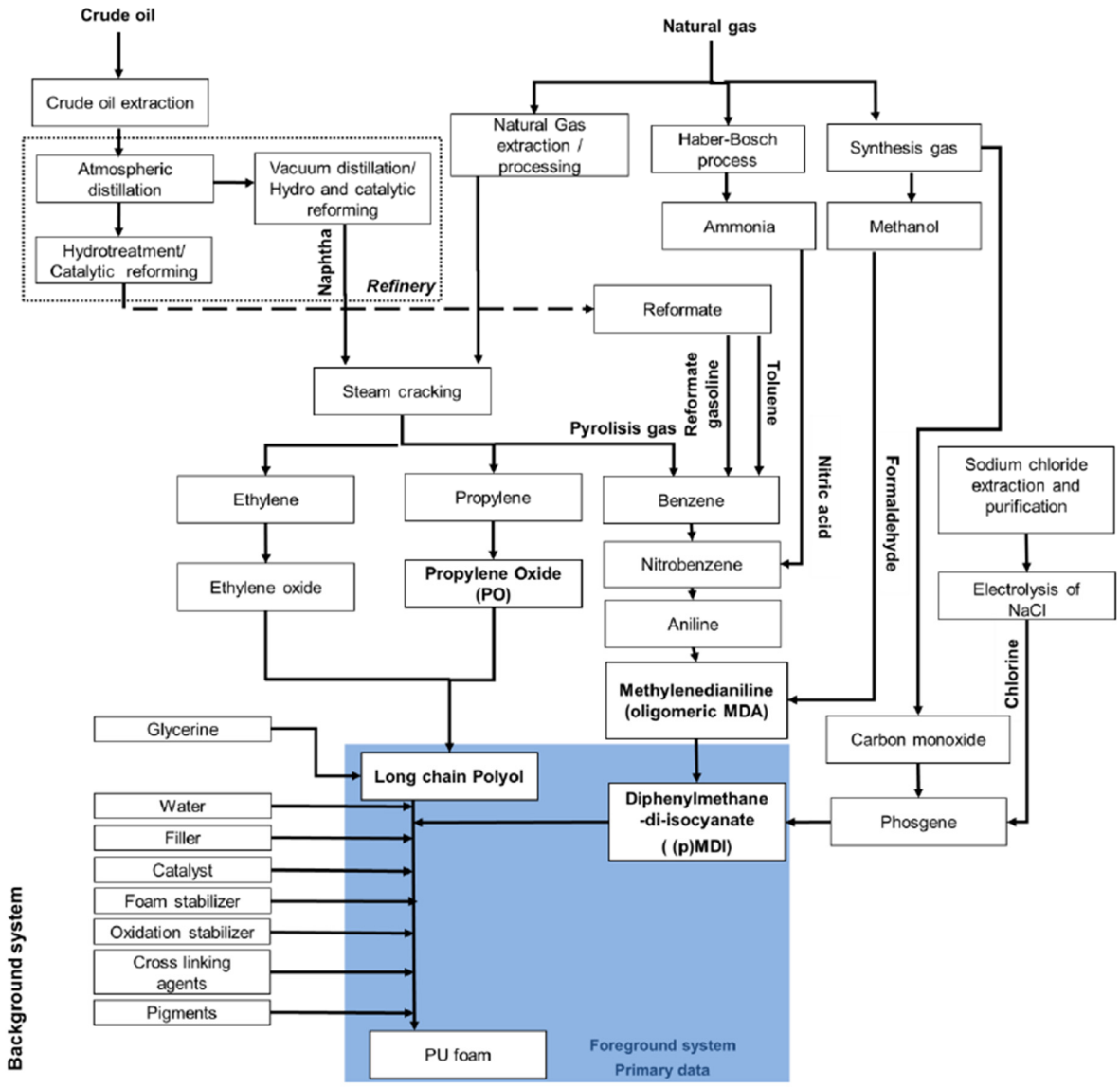

Fig.3: Process chart for the production of PU (MDI basis)

The following table shows the energy demand for the production of polyurethane foam. The demand is about 55 MJ/kg, whereupon 99% apply to the production of the base products.

Table 2: Primary energy demand for the production of 1 kg PU-foam

Primary Energy Demand	TDI-based PU foam without FR, density 35 to 40 kg/m³[MJ]	TDI-based PU foam without FR, density 18 to 25 kg/m³ [MJ]	TDI-based PU foam with FR, density 40 to 54 kg/m³ [MJ]	MDI-based vis-coelastic PU foam with-out FR, density 45 to 53 kg/m³ [MJ]
Energy content in polymer (energy recovery potential, quantified as gross calorific value of polymer)	33.47	33.47	33.47	33.47
Process energy (quantified as difference between primary energy demand and energy content of polymer)	58.97	55.84	64.10	55.24
Total primary energy demand	**88.67**	**85.54**	**93.80**	**84.94**

CO_2-Footprint per kg PU

The energy input regarding the produced PU quantity at the site in Bürs amounts to 2 MJ/kg (incl. heating, light, IT). This corresponds only to a share of 3.6% of the total required process energy (55 MJ/kg).

According to the study „Eco-Profiles and Environmental Product Declarations of the European Plastic Manufactures – Flexible Polyurethane (PU) Foam“ the CO_2 emission per kg PU foam is about 2.7 kg.

The following table shows selected emissions into the air:

Table 3: Selected air emissions during production of one kg PU (Getzner materials are MDI based)

Air emissions	TDI-based PU foam without FR, density 35 to 40 kg/m³ [kg]	TDI-based PU foam without FR, density 18 to 25 kg/m³ [kg]	TDI-based PU foam with FR, density 40 to 54 kg/m³ [kg]	MDI-based viscoelastic PU foam without FR, density 45 to 53 kg/m³ [kg]
Carbon dioxide, fossil (CO_2, fossil)	2.87	2.82	3.20	2.67
Carbon monoxide (CO)	1.77E-03	1.77E-03	2.19E-03	1.64E-03
Methane (CH_4)	8.38E-03	8.18E-03	9.25E-03	7.70E-03
Sulphur dioxide (SO_2)	3.16E-03	3.08E-03	3.66E-03	3.04E-03
Nitrogen oxides (NO_x)	4.37E-03	4.25E-03	5.03E-03	4.11E-03
Particulate matter ≤ 10 µm (PM 10)	2.66E-04	2.65E-04	4.77E-04	2.17E-04

The following global warming potential (GWP) is indicated.

Table 4: Global warming potential for the production of one kg PU (Getzner materials are MDI based)

Global Warming Potential (100 years) per 1 kg flexible PU foam

Climate change	TDI-based PU foam without FR, density 35 to 40 kg/m³	TDI-based PU foam without FR, density 18 to 25 kg/m³	TDI-based PU foam with FR, density 40 to 54 kg/m³	MDI-based viscoelastic PU foam with-out FR, density 45 to 53 kg/m³
Global Warming Potential (GWP) [kg CO2 eq.]	3.22	3.18	3.56	2.95

At the site in Bürs only approx. 0.1 kg CO_2 is used for the production of 1 kg PU with regard to the total PU production quantity (incl. heating administration building, lighting administration and production, IT, a.s.o).

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