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Bundesverband Baustoffe – Steine und Erden e.V.
German Building Materials Association

SST
DIW BERLIN

The Demand for Primary and Secondary Raw Materials in the Mineral and Building Materials Industry in Germany up to 2035

The German Building Materials Association (bbs) has published a study on the long-term demand for raw materials up to 2035. The study is the update of an assessment published in 2011.

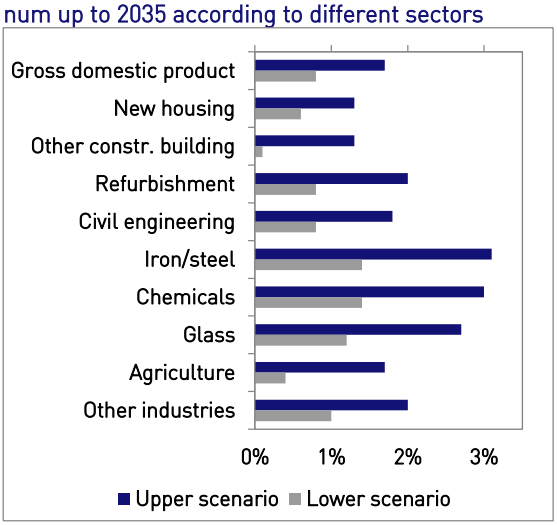
In the study the future demand for building materials and industrial minerals in Germany was estimated, based on two scenarios of the economic development in the downstream business sectors and taking the substitution potential through secondary raw materials into account. The political backgrounds for the quantitative analysis were the raw material strategies at European and national level, including the securing of the domestic raw materials supply and the debate on enhancing resource efficiency. The study was commissioned by the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung, DIW) Berlin and the SST Ingenieurgesellschaft Aachen.

METHODOLOGY

The quantities of minerals[1] extracted by bbs sectors in 2010 and their distribution among the various branches[2] served as the basis for estimating their future demand. The data used in the survey is based mainly on statistics provided by the bbs member associations.

To assess future developments in the various business sectors – based on assumptions made regarding demographic changes, labour supplies and progress in productivity - two scenarios (upper and lower scenario) of the overall economic developments were formulated. Depending on the scenario, the average economic growth up to 2035 will be 0.8% or 1.7% per annum (Figure 1).

Figure 1: Assessment of average real growth per annum up to 2035 according to different sectors



Source: DIW

Conclusions regarding the demand for the individual raw materials can be drawn from the future developments on the various market segments. Mass flow diagrams were therefore created for all relevant raw materials and then summarized in a calculation matrix.

The calculations also take into account that future production is estimated on the basis of monetary factors. A direct comparison to the required volume of raw material extraction in tonnes would not be appropriate: Monetary production growth is not based solely on increasing volumes but, for example, also on selling higher-quality products. Increases in value are often based on structural changes without generating any additional consumption of raw materials. Adjustment factors were therefore developed for the growth in the demand segments of the mineral and building materials industry,

[1] In this survey the following primary and secondary raw materials were considered: **Primary raw materials:** sand and gravel, special gravel/sand, natural stone, ashlar, limestone, clay and kaolin, plaster. **Secondary raw materials:** recycling building materials (RC building materials), slags, ashes, FGD gypsum/ spray absorption product, fluoroanhydrite, used foundry sand.

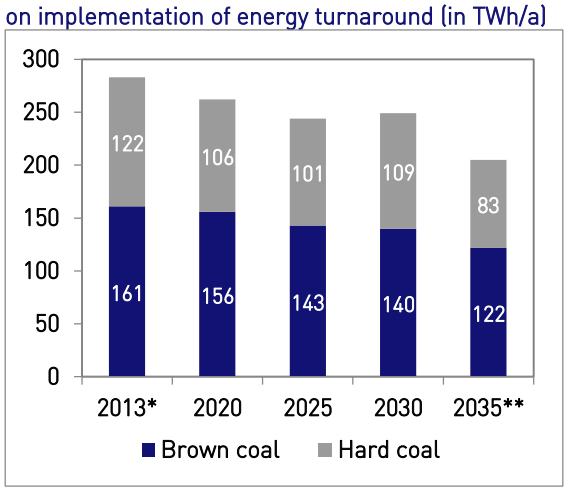
[2] Relevant **downstream consumer sectors** of the mineral and buildings materials industry which were considered in this study: new housing, other building construction (new), improvements of the existing building stock, civil engineering, cement manufacture, asphalt manufacture, iron and steel industry, chemical industry (incl. paint and glosses), agriculture, glass production, as well as other customers in particular from industry and export.

which inter alia reflect past empirical developments and should be offset against the annual monetary production growth.

The use of secondary raw materials is a key contribution for substituting primary raw materials and thus plays an active role in conserving resources. However, the supply of secondary raw materials is not directly coupled to their demand[3]. Thus, for example, the volume of RC building materials is primarily determined by demolition activities which in turn are determined by the intensity of new construction activities. The latter varies depending on the assumptions made in the upper and lower scenario. Another determining factor for the volume of secondary raw materials is the prospective structure of the industry. The energy turnaround ("Energiewende") in Germany will play a key role in this process as it will significantly change the electricity production mix. The decline in coal-fired power generation (Figure 2) will reduce the volume of secondary raw materials produced by this method, in particular FGD gypsum and hard coal fly ash. At the same time it will directly and indirectly influence the demand for the corresponding primary raw materials. On the one hand, the demand for primary raw materials would fall due to the reduced consumption of limestone to flue gas desulfurization. On the other hand the demand for certain primary raw materials would increase to compensate the falling supply of secondary raw materials, e.g. gypsum as a replacement for FGD gypsum.

At present more than 90% of the annual mineral building waste incurred in Germany is recycled respectively recovered in an environmentally compatible way. Regarding this only a slight increase of the already high recycling/recovery rate of building waste materials would be possible. Industrial by-products are also widely used in the mineral and building materials industry.

Figure 2: Coal-fired electricity production up to 2035 on implementation of energy turnaround (in TWh/a)



Sources: Federal government, "Energiereferenzprognose" (Prognos 2014); * Federal Ministry for Economic Affairs and Energy; ** Calculation based on "Energiereferenzprognose"

RESULTS

The study shows that if the economy continues to develop at a relatively slow rate (GDP: +0.8% per annum) the demand for primary raw materials in the bbs sectors would decrease slightly (2013: 544 million t, 2035: 523 million t; change 2035/13: -3.8%). This is especially due to the weaker building activity as compared to the upper growth scenario.

Should economic growth be stronger (GDP: +1.7% per annum), the demand for primary raw materials would be 650 million t (change 2035/13: +19.5%). In this scenario the need to catch up in the construction sector and production expectations in the various industrial business sectors, such as the chemical, glass and steel industries, would push the demand for the raw materials. Nevertheless, the high level of the nineties - sometimes well above 700 million t - would no longer be achieved. The trend towards decoupling raw material extraction and growth continues: As growth is involved in product innovation and structural change, the rise in demand for raw materials (volume) would be less than the increase in production (value).

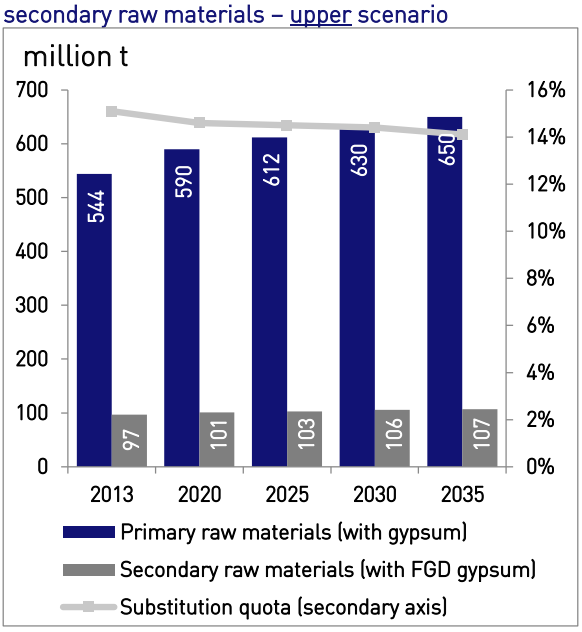
[3] The related processes are independent; this means the demand for secondary raw materials cannot influence those production processes. A gap in supplies could only be filled by using primary raw materials.

In the upper scenario, the volume of secondary raw materials would increase from 97 million t in 2013 to 107 million t in 2035, whereby the supply of FGD gypsum and hard coal fly ash would fall significantly due to the decline in coal-fired power as a result of the energy turnaround. At the same time the volume of RC building materials would increase as an effect of the dynamic construction sector assumed in this scenario. So a (small) part of the additional demand for primary raw materials would be a consequence of the gap in power-plant by-product supplies. This must be compensated by a drop in the corresponding exports of especially FDG gypsum and a higher extraction of gypsum and limestone as well as sand and gravel. These shifts mean that if natural and FGD gypsum are included, the substitution ratio[4] of 15.1% in 2013 would fall to 14.1% in 2035.

In the lower scenario, the volume of secondary raw materials (incl. FGD gypsum) of 97 million t in 2013 would drop to 92 million t in 2035. While the volume of RC building materials would remain stable, the energy turnaround would probably cause a significant drop in the volume of power-station by-products as in the upper scenario. By including natural gypsum and FGD gypsum in this scenario the substitution ratio would remain approximately at the level of 2013 (2013: 15.1%, 2035: 15.0%). The relative significance of secondary raw materials would thus be slightly greater than in the upper scenario as the demand for raw materials would be lower overall. It should be taken into account that in both scenarios the recycling rate remains very high. So only a marginal further increase would be possible.

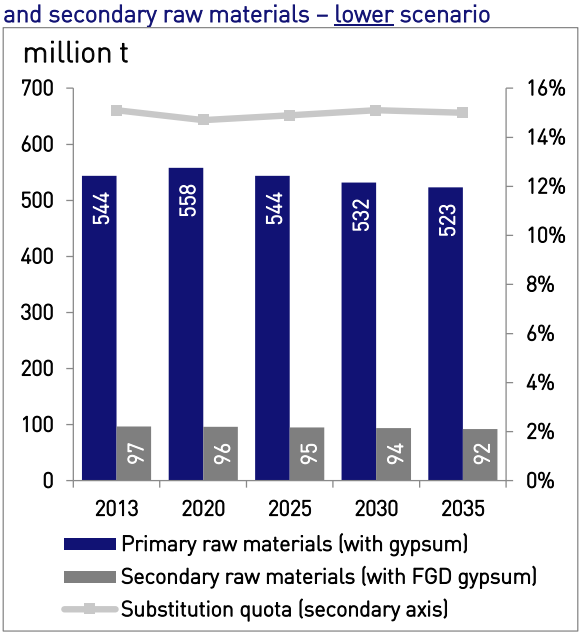
The complete version of this study can be found in German under *www.baustoffindustrie.de › Downloads.*

Figure 3: Development of the volumes of primary and secondary raw materials – upper scenario



Source: Calculations SST

Figure 4: Development of the volumes of primary and secondary raw materials – lower scenario



Source: Calculations SST

[4] The substitution ratio is the relationship between secondary raw materials which could be re-used in production and the overall use of materials (= volume of secondary raw materials / (volume of primary raw materials + volume of secondary raw materials) x 100).

Table: Summary of the primary and secondary raw material volumes calculated (million t)

	Status-quo													Upper scenario				Lower scenario			
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2020	2025	2030	2035	2020	2025	2030	2035
Sand and gravel	313.0	292.0	286.0	267.0	252.0	266.0	252.0	238.0	227.0	229.0	253.0	235.0	236.0	255.9	265.0	272.2	279.9	242.3	236.4	231.6	228.1
Special gravel/sand	11.5	11.4	11.3	11.6	11.0	11.0	11.4	11.1	8.7	9.8	10.5	10.1	9.7	10.6	11.1	11.3	11.6	10.0	9.7	9.4	9.0
Natural stone	220.0	210.0	195.0	190.0	181.0	190.0	215.0	218.0	216.0	208.0	229.0	211.0	207.0	224.6	233.1	241.5	250.0	212.5	206.2	201.3	197.9
Ashlar	0.47	0.43	0.38	0.36	0.38	0.42	0.40	0.38	1.10	1.20	1.40	1.40	1.30	1.41	1.47	1.50	1.55	1.33	1.29	1.26	1.24
Limestone overall	63.2	61.6	64.2	66.7	60.4	63.8	65.6	66.2	54.7	60.0	63.3	61.7	60.9	66.2	68.3	69.7	71.7	62.7	61.0	59.6	58.2
- For cement	39.9	37.6	40.0	41.0	37.1	38.6	40.2	42.1	34.6	37.5	40.4	39.1	37.2	41.2	42.6	43.7	45.3	38.8	38.0	37.2	37.0
- Fired	9.5	11.5	12.3	13.9	12.4	14.0	13.1	12.9	10.1	11.6	11.8	11.4	11.8	12.5	12.9	13.1	13.1	12.0	11.5	11.3	10.7
- Unfired	13.8	12.5	11.9	11.8	10.9	11.2	12.3	11.2	10.0	10.9	11.1	11.2	11.9	12.5	12.7	13.0	12.7	11.9	11.5	11.1	10.5
Brick clay	15.7	14.3	14.2	14.5	12.5	13.7	13.5	11.5	9.7	10.8	11.6	11.5	11.3	13.1	13.5	13.6	13.8	12.2	12.0	11.7	11.5
Special clays. kaolin	14.9	13.3	13.2	14.9	14.0	15.2	15.2	13.9	13.1	14.6	13.9	13.9	13.3	14.0	14.4	14.7	15.0	13.5	13.3	13.1	12.7
Gypsum										4.7			4.5	4.3	5.4	5.7	7.1	3.7	4.0	3.9	4.7
Primary raw materials	638.8	603.0	584.3	565.1	531.3	560.1	573.1	559.1	530.3	538.1	582.7	544.6	544.0	590.0	612.2	630.3	650.1	558.2	543.8	531.7	523.3
RC construction materials	55.0	51.1	50.0	49.6	48.0	55.4	55.0	57.7	63.0	65.0	69.0	66.2	65.6	68.8	71.2	73.4	75.7	65.6	65.6	65.6	65.6
Blast-furnace slag	7.3	7.2	7.3	7.4	7.4	7.7	8.3	7.9	5.5	7.6	7.7	7.4	7.6	8.4	8.9	8.9	8.9	7.8	7.5	7.1	6.7
Steel-mill slag	5.6	6.0	6.0	6.2	6.3	6.8	6.5	6.3	4.5	5.9	6.1	5.8	5.6	6.2	6.5	6.6	6.6	5.8	5.5	5.2	4.9
Hard coal fly ash	4.1	4.1	4.5	4.5	4.3	4.4	4.2	3.9	3.5	3.2	3.2	3.1	3.2	2.8	2.7	2.9	2.2	2.8	2.7	2.9	2.2
Other ashes	4.6	4.2	4.5	3.3	4.0	4.6	4.6	4.7	5.0	5.0	5.3	5.4	5.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Used foundry sand	1.5	1.3	1.2	1.8	1.6	2.0	2.0	2.2	1.3	1.6	1.9	1.6	1.6	2.3	2.3	2.3	2.3	1.7	1.7	1.7	1.7
FGD gypsum	6.8	7.1	7.7	7.7	7.6	7.5	7.1	6.9	6.6	6.3	6.8	7.0	7.2	6.8	6.3	6.3	5.3	6.8	6.3	6.3	5.3
Spray absorption product	0.38	0.38	0.33	0.28	0.34	0.32	0.26	0.25	0.17	0.25	0.24	0.24	0.31	0.27	0.26	0.28	0.21	0.27	0.26	0.28	0.21
Fluoroanhydrite	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Secondary raw materials	85.7	81.8	82.0	81.2	80.0	89.2	88.4	90.3	90.0	95.3	100.7	97.1	97.1	100.9	103.5	106.0	106.6	96.1	94.9	94.5	92.1
Substitution ratio (%)	11.8	11.9	12.3	12.6	13.1	13.7	13.4	13.9	14.5	15.0	14.7	15.1	15.1	14.6	14.5	14.4	14.1	14.7	14.9	15.1	15.0

Source: Calculations SST

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