

COPPER TRADE & PRICE FUNDAMENTALS

Copper in 2016 Q4 : Physical fundamentals improve markedly. Investors, conventional speculators and high-frequency traders raise their long positions sharply

LME cash copper prices have soared from a monthly average of \$4,630 in June this year to an average of \$5,825 month-to-date so far in December, an increase of 25%. Traditional 'industrial raw material' style fundamentals of copper started to improve during the third quarter, but this was not evident at the time, being hidden by large-scale relocation of stock from China to LME warehouses.

Chinese copper consumption is heading for a full-year increase of around 6% (possibly 1-2% more), with grid infrastructure spending up more than 20%, auto output up 14% and housing starts up 8%. Countries outside China enjoyed copper consumption growth too, possibly of 3% or above, though there are problems with the trade and thus apparent consumption data for the World ex-China.

Comparing production, consumption and export data for Chile, implied stocks of refined seem to have declined this year by 150-200kt, but back-calculated stock change figures are always worrying : whether they are right or wrong, they never seem able to be confirmed. BME normally only believes them if they show an in-

crease then a decrease, which is the case for Chile, but still - worries remain.

There is a directly reported producer stock series for Iran (a Member of the ICSG) which shows a post-sanctions stock decline of 25-50 kt there, which we are inclined to believe. Exchange stocks are set for a 50 kt decline this year (all in the fourth quarter incidentally), though given the level of cancelled warrants on the LME, the fall there may yet turn out to be a little greater.

In early 2016, the Chinese State Reserve (SRB) is said to have bought 150 kt of copper. If you bring together the SRB stock change with commercial stock change for 2016, you *either* get an implied small shortfall of production against consumption - if you believe the back-calculated Chilean stock change - *or* a small production surplus, if you do not believe in the Chilean stock change.

Improved fundamentals for copper and for commodities generally have brought investors back to the sector in China and the west. Institutional and retail commodity Assets Under Management fell from around \$550bn at end 2010 to around \$250 bn at end 2015, but have since recovered to between \$350-400 bn, partly from cash inflows and partly from higher prices of the assets held.

1. Global refined balance	2014	2015	2016	2017	2. Global stocks & st. change	2014	2015	2016	2017
Primary refined prod.	18454	18947	19671	20288	Prod, cons, dom. Trans	1671	1650	1304	1443
Secondary refined prod.	3250	3008	2964	3195	LME stocks	177	236	225	230
Total refined production	21704	21955	22635	23482	Comex stocks	24	63	60	65
Appt. cons. by country	21631	21891	22699	23388	SHFE stocks	106	183	155	190
EU-15 cons correction	141	75	125	125	Assumed SRB & Ch. Bond.	1905	2209	2327	2332
Ex-EU-15 correction	-400	-325	-150	-150	In international transit	529	483	614	545
Adjusted refined cons.	21372	21642	22674	23363	Total of the above	4412	4825	4685	4805
Prod. / adj. cons. Balance	332	313	-39	120	Refined stock change	332	413	-139	120
3. China refined balance	2014	2015	2016	2017	4. Chile refined balance	2014	2015	2016	2017
Refined production	6925	7275	7942	8297	Refined production	2710	2575	2485	2475
Assumed cons.	9900	10300	10900	11275	Refined consumption	95	79	90	90
Refined imports	3590	3678	3752	3325	Refined exports	2484	2618	2609	2289
Refined exports	266	212	703	300	Balance	131	-122	-214	96
Balance	349	441	91	47					
Producer & cons stocks	286	322	321	338	Stocks at prods & cons	39	38	39	42
In domestic transit	81	105	106	96	In transit road & rail	49	50	49	42
SHFE stocks	106	183	155	190	Assumed port stocks	376	255	40	140
Assumed SRB & bond	1905	2209	2327	2332	Total	464	342	128	224
Total refined stocks	2377	2819	2910	2956	Refined stock change	131	-122	-214	96
Refined stock change	349	441	91	47					

Note : Chilean port stock change is back-calculated.

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On the LME and Comex, the long positions in copper of money managers and their equivalents have risen to very high levels since 1st November. It all seems rather reminiscent of the situation that began at end-2004 for crude oil and mid-2005 for copper, though in those days the driving force was prospective years of double-digit annual demand growth from China for industrial raw materials.

On balance, BME is inclined to believe that there was a bigish fall in Chilean stocks in the first half of 2016 and our statistical analysis assumes this, but even without it, a small net stock increase this year would still be a great improvement on the 300 ktpy stock increases seen over the four years 2012, 2013, 2014 and 2015. Those surpluses ended up in the SRB, but still drove prices downwards.

According to CHR Economics' superb "Global Industrial Production Watch" and the statistics behind it, global industrial activity was largely stagnant for the two years to May 2016, with a double bottom to index levels and year-on-year growth, in December 2015 and May 2016. Growth resumed from June 2016 for non-OECD countries overall and from August for OECD countries in aggregate.

Looking forward, growth seems likely to accelerate a little, with fiscal policy increasingly expansionary, particularly in the USA, but also in China, Japan and Canada. BME's forecast of global year-on-year industrial production growth is for a gradual increase

to a peak around end-2017 then a slowing to growth (though not a fall in absolute index levels) through 2018.

BME's assumptions for crude oil prices are for a rise to around \$60 / bbl from mid-2017 through mid-2018, then a fall back into the \$50s /bbl for late 2018. That is based on the belief that oil price changes are fundamentally driven by changes in the rate of demand growth, but constrained by a floor around \$40 / bbl beneath which shale gas economics deteriorate drastically and an OPEC-influenced ceiling (nowadays) around \$60 / bbl, above which shale gas supply would soar.

Regarding copper production costs, BME tends not to consider too closely the usual deciles and quartiles to C1 costs of mine production, but rather to think of the primary cost curve as having (i) a main part with low- and medium-cost producers then an abrupt upwards turn into (ii) a 'high-cost tail'. The high-cost tail began at around \$6,000 in 2012 but today is around \$4,500. That figure will now rise as producer currencies strengthen.

[Incidentally, how much production there is from the 'high-cost tail' is price determined. This then strongly influences where the cost quartiles and deciles fall, and so they are largely driven by prices, not drivers of prices, which is why BME tends to pay them less attention than most others do]

5. Countries Ex-China, refined	2014	2015	2016	2017
Production	14779	14680	14693	15186
Consumption	11472	11342	11774	12088
Exports	8657	9191	9537	9183
Imports (corrected)	5540	5860	6281	6209
Balance	190	7	-337	124
Cons. growth (kt)	76	-130	432	314
Cons growth (%)	0.7	-1.1	3.8	2.7
Share of World cons (%)	53.7	52.4	51.9	51.7

7. Blister trade - kt Cu	2014	2015	2016	2017
Annual balances :				
Blister exports	1141	1181	1125	1169
Blister imports	1164	1189	1078	1168
Blister trade bal.	-23	-8	47	0
In transit :				
Assumed max. afloat	80	83	79	82
Assumed min. afloat	57	59	56	58
Assumed variation	23	24	22	23

6. Refined trade bal.	2014	2015	2016	2017
Refined exports	8923	9403	10240	9483
Refined imps (corrected)	9130	9538	10033	9534
Refined trade balance*	-207	-135	207	-51
In transit :				
Assumed max. afloat	625	658	717	664
Assumed min. afloat	446	470	512	474
Assumed variation	178	188	205	190

*trade bal. should = change in transit and in LME warehouses.

8. Copper in concs trade	2014	2015	2016	2017
Annual balances :				
Copper in concs exports	7565	8092	8621	8961
Copper in concs imports	7593	8028	8612	8926
Copper in concs trade bal.	-29	64	10	35
In transit				
Assumed max. afloat	530	566	603	627
Assumed min. afloat	378	405	431	448
Assumed variation	151	162	172	179

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Mine production growth was around 3.5% in 2015 and has risen to around 4.4% in 2016, with increases from new mines and expansions in Peru and Mexico more than outweighing price-driven production cut-backs and closures in the African Copperbelt, Canada, Australia, USA, and elsewhere. In 2016, refined production from scrap is at or below 3 Mtpy, down from 3.5 Mtpy in 2011-2012.

In 2017, with firm physical demand for copper and investment demand for futures and derivatives, we expect prices mostly in the \$5,500-6,000 range. That would be enough to trigger some mine reactivations on the Copperbelt and elsewhere and boost scrap-based production by around 250 kt. We expect refined production to be roughly 100 kt higher than consumption next year (and in 2018).

In sum, in late 2016, better fundamentals (either a physical deficit or at least a much smaller surplus) have driven prices higher, drawing in investment and speculative buyers as well (including high frequency traders). In 2017 we expect continuing inflows of investment money to buoy prices a little above physical

market equilibrium, causing us to forecast a small up-trend in physical stocks.

A historical 400-475 ktpy puzzle in the published statistics

There is a significant puzzle within the published copper statistics. The problem can be seen both in (i) a simple look at the ICSG's bottom line production-consumption balances and stock change figures and in (ii) the intricate, multi-stage country-by-country and global trade balances that BME constructs in order to cross check consumption figures for each country and globally. This is not caused by the double-counting of Chinese refined production as this passes straight through into the apparent consumption figure and, although it has to be corrected for (to get global growth rates right), does not create any mis-match between calculated balance and calculated stock change.

Starting with the historical ICSG numbers, their refined balance figures (adjusted for Chinese bonded stock change) were for deficits of 583 kt in 2013, 421 kt in 2014 and 256 kt : 1,260 kt of cumulative

9. Mining hotspots Kt Cu	2014	2015	2016	2017
Congo D.R. prod.	915	910	870	900
Zambia production	715	715	735	825
Mongolia prod.	268	332	358	362
Mexico production	527	595	775	885
Brazil production	294	346	335	335
Peru production	1380	1701	2308	2405
Total of above	4098	4599	5380	5712
Other	14182	14318	14377	14795
Global mine prod.	18280	18917	19757	20507
Growth (kt Cu)	267	637	840	750
Growth (%)	1.5	3.5	4.4	3.8

11. Refined prod. hotspots	2014	2015	2016	2017
Congo D.R. prod.	750	760	695	715
Zambia production	499	496	470	525
India production	766	792	670	700
Iran production	198	187	245	320
China production	6925	7275	7942	8297
Mexico production	398	434	510	550
Total of above	9536	9944	10533	11106
Other	12168	12011	12102	12376
Global refined prod.	21704	21955	22635	23482
Growth (kt Cu)	811	251	680	847
Growth (%)	3.9	1.2	3.1	3.7

10. Concs export hotspots	2014	2015	2016	2017
Eritrea concs exports	88	62	45	21
Mongolia concs exports	299	330	355	360
Chile concs exports	2728	2725	2685	2742
Mexico concs exports	171	226	320	407
Brazil concs exports	240	304	294	290
Peru concs exports	1036	1323	1938	2004
Total of above	4561	4971	5638	5824
Other	3004	3121	2983	3138
Global Cu-in-concs exp.	7565	8092	8621	8961
Growth (kt Cu)	449	528	529	340
Growth (%)	6.3	7.0	6.5	3.9

12. Ref. export hotspots	2014	2015	2016	2017
Congo D.R. exports	746	760	697	714
Zambia exports	482	478	446	504
Russian Fed. Exports	284	557	555	592
India exports	362	341	205	197
Mexico exports	107	138	186	184
Iran exports	48	23	154	155
Total of above	2028	2296	2243	2346
Other	6894	7106	7998	7137
Total refined exports	8923	9403	10240	9483
Growth (kt Cu)	-194	480	838	-757
Growth (%)	-2.1	5.4	8.9	-7.4

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deficit in three years. Given that it is not within the ICSG's remit to estimate SRB purchases, the latter get counted by them in their apparent consumption numbers as if consumed. Thus the ICSG's balance figures above are actually commercial balances, not production-consumption balances. That calculated 1,260 kt cumulative deficit looks very anomalous given the price declines over the period.

Such commercial balances should approximately equal exchange stock changes plus estimated producer stock changes (consumer stocks normally vary very little). Yet between end-2012 (thus also the start of 2013) and end-2015 total exchange stocks fell only by 107 kt, whilst the ICSG's back-calculated Chilean producer stock figures show an increase of 216 kt and reported Iranian producer stocks showed an increase of 52 kt. If one accepts the ICSG's back-calculated Chilean stock figure, the anomaly is between a calculated balance of -1,260 kt and a stock increase of +161 kt : a 1,421 kt cumulative anomaly over three years (averaging 474 ktpy). Or if one discounts the back-calculated Chilean stock figures the anomaly is 1,205 kt over three years (averaging 402 ktpy).

The *prima facie* case is for a mis-match of production and exports relative to consumption and imports, of between 400-475 ktpy over 2012-2015. BME believes

that to be represent an over-count of consumption.

To try to sort such issues out, BME always produces a trial balance of imports versus exports country-by-country and globally. That involves a long series of calculations and back-calculations, which in isolation would be worrying, but which in fact generally comes to similar conclusion to the much simpler comparison of published balance versus published stock change.

For a few producing countries which do not publish up-to-date trade figures, one has to back-calculate exports. And for a few consuming countries one has to back-calculate imports. And within NAFTA and the EU, one needs to correct for internal trade data anomalies.

In the USA, survey-based refined copper consumption is reckoned by the experts to be essentially correct and the big and highly variable difference between it and apparent consumption is caused by intra-NAFTA trade data errors. Thus the analyst ought *not only* to use the survey-based consumption figures *but also* to correct the USA's net trade figures. Certainly, BME does both.

Within the EU, the ICSG publishes country-by-country consumption figures, many of which we understand to be survey-based by countries concerned.

13. Ref. cons. hotspots	2014	2015	2016	2017	14. Ref. imp. hotspots	2014	2015	2016	2017
China consumption	9900	10300	10900	11275	China imports	3590	3678	3752	3325
Thailand	255	270	350	400	Thailand	259	274	354	405
United Arab Em.	350	380	380	380	United Arab Em.	350	381	380	380
Turkey	440	455	470	485	Turkey	364	386	408	430
Vietnam	130	150	205	220	Vietnam	130	151	207	220
Total of above	11075	11555	12305	12760	Total of above	4693	4870	5100	4760
All others	10556	10336	10394	10628	All others	4696	4918	4958	4800
EU-15 & Ex-EU-15 corr.	-259	-250	-25	-25	EU-15 & Ex-EU-15 corr.	-259	-250	-25	-25
Total cons. (corrected)	21372	21642	22674	23363	Total imps. (corrected)	9130	9538	10033	9534
Growth (kt Cu)	776	270	1032	689	Growth (kt Cu)	56	408	495	-499
Growth (%)	3.8	1.3	4.8	3.0	Growth (%)	0.6	4.5	5.2	-5.0
15. Price indicators	2014	2015	2016	2017	16. Copper prices	2014	2015	2016	2017
Cons. growth (%)	3.8	1.3	4.8	3.0	LME cash (\$/tonne)	6862	5494	4876	5750
Production - cons. bal.	332	313	-39	120	Comex 1st posit. (\$/t eq.)	6879	5524	4856	5750
LME & Comex stocks	201	299	285	295	Comex 1st posit. (c/b)	312	250	220	261
SHFE stocks	106	183	155	190	Shanghai cash (\$/t eq.)	7980	6544	5741	6728
Total exchange stocks	306	482	440	485	SHFE cash / LME cash	1.16	1.19	1.18	1.17

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But in its global balance calculations the ICSG uses net trade figures for the EU-15 to calculate regional consumption. BME accepts that but also carries through the correction into net trade, which is equally important.

There are a few countries with up-to-date trade data for which the copper balance calculations seem nevertheless very problematic to BME, including Indonesia, Philippines, Pakistan and Bulgaria. More worrying is the assumed or reported consumption of around 900 ktpy of refined copper by four countries with erratically published or absent trade data : UAE, Saudi Arabia, Egypt and Vietnam. Some of these seem to be based on apparently very accurate production data for semi-manufactures. But in the absence of import figures one has to worry how much of the feedstock was cathode. For instance, in 2013 and 2014, there was understood to have been large scale re-melting and re-casting of poor quality imported wirerod to make high quality wirerod : double counting.

Lastly, within the apparent consumption figures for countries with LME warehouses, no one else seems to question the fact that the trade data supposedly exclude flows into and out of LME warehouses. Yet a close look at the monthly figures for Singapore suggest that this is not true for all countries. Singapore has no consumption, but that is not the issue : if one is going to compare global imports with exports, one has to be sure about this even where there is no consumption. We have the same worries about LME stocks and trade data for Malaysia, where there is consumption.

When BME puts all this together, we are left with historical consumption estimates for each country and a figure by which we have to reduce the global total to make exports match imports, adjusted for estimated changes in material in international transit and in LME warehouses. That bottom-line adjustment is much less than the anomaly in the raw data : it is a downwards adjustment of around 200 ktpy to global consumption : a 200 ktpy apparent over-count of imports versus exports.

Here the problem with the 2016 Chilean figures appears again, in a different form. The bottom-line ad-

justment to consumption currently looks to have fallen sharply in 2016 to very roughly 25 kt. It is at least possible that this is because of an over-count of Chilean exports this year, which would have shrunk the mis-match between global import and export data. If so, then our base-case database may have over-estimated consumption ex-China by this year's back-calculated fall in Chilean stocks.

Thus we come back to the same conclusions on 2016's market balance as at the start of the editorial : if one believes the Chilean export figures and the implied Chilean de-stocking, then there was a small deficit in 2016, and if one thinks the Chilean export data wrong, then there was a small surplus. At worst any excess of production over consumption in 2016 is much less than in 2012, 2013, 2014 or 2015. Which towards year-end is what the price has been telling us.

Peter Hollands, 11th December 2016

Acknowledgement : the historical figures in the tables draw on the excellent work of the ICSG and WBMS. Production forecasts draw in part on the ICSG's very comprehensive Directory of Copper Mines and Plants.

The Author is Peter Hollands (e-mail ph@bloomsburyminerals.com). His background in copper market analysis can be found on his LinkedIn profile.

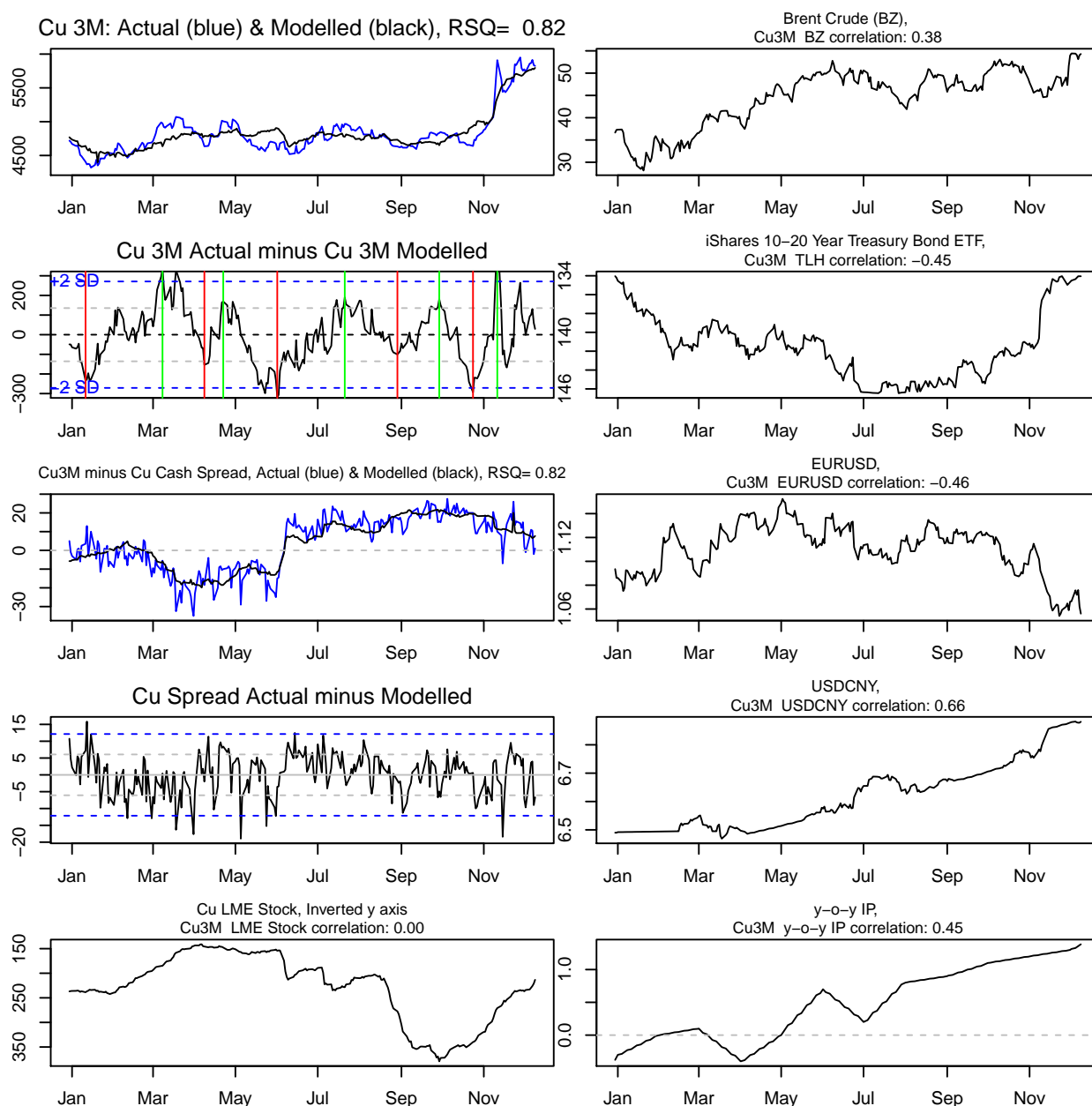
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Extract from Metal Price Analytics Limited (MPA) Daily LME Metals Price Spreads Report : Copper Charts

Copper: data to 09 December 2016. Last Cu3M price: \$5825. Daily % change: -0.19%.



The LME metal prices are influenced by a number of fundamental drivers and these are used to construct a model of the Cash and Three Month prices over the last 250 days. The model is recalculated and updated daily. The Price Drivers used by MPA for the daily model are i) LME Stocks, ii) the rate of global industrial production growth (source CHR's Global IP watch), iii) Euro Dollar Exchange rate (EURUSD), iv) Dollar CNY exchange rate (USDCNY), v) the price of Brent Crude Oil (BZ) and the iShares 10-20 Year Treasury Bond ETF. The LME metal prices and stocks used are those reported on the LME website www.lme.com

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17. Refined production (kt)	2014	2015	2016	2017	18. Refined exports (kt)	2014	2015	2016	2017
Congo D.R.	750	760	695	715	Congo D.R.	746	760	697	714
South Africa	70	71	60	40	South Africa	18	31	40	20
Zambia	499	496	470	525	Zambia	482	478	446	504
Other	12	23	28	29	Other	7	18	24	26
Total Africa	1332	1349	1254	1309	Total Africa	1253	1287	1207	1263
Total China	6925	7275	7942	8297	Total China	266	212	703	300
India	766	792	670	700	India	362	341	205	197
Indonesia	233	198	246	230	Indonesia	110	87	122	90
Iran	198	187	245	320	Iran	48	23	154	155
Japan	1554	1483	1475	1510	Japan	506	541	545	550
Kazakhstan	265	300	335	365	Kazakhstan	211	240	274	305
Korean Republic	602	650	663	682	Korean Republic	191	282	250	300
Laos	88	89	80	90	Laos	80	79	70	80
Myanmar	33	47	60	125	Malaysia	98	88	50	31
North Korea	15	15	15	15	Myanmar	25	36	50	113
Oman	12	12	12	12	Philippines	85	86	99	115
Philippines	120	120	135	150	Singapore	10	36	108	20
Uzbekistan	100	100	100	100	Uzbekistan	55	55	52	50
Vietnam	8	8	8	8	Vietnam	8	8	8	8
Other	6	4	4	4	Other	12	11	15	12
Total Asia ex-China	4000	4006	4048	4312	Total Asia ex-China	1799	1912	2002	2024
Austria	83	103	103	103	Austria	68	105	113	88
Belgium - Lux.	387	379	360	380	Belgium - Lux.	190	184	177	193
Bulgaria	234	230	214	256	Bulgaria	217	207	185	216
Finland	136	132	135	135	Finland	119	122	130	120
Germany	674	678	680	690	Germany	167	152	129	112
Norway	36	36	30	30	Norway	36	35	30	30
Poland	577	575	550	550	Poland	308	298	275	270
Russian Fed.	895	875	870	915	Russian Fed.	284	557	555	592
Serbia	33	50	65	65	Spain	113	122	104	105
Spain	418	415	420	420	Other	368	319	546	440
Sweden	217	206	205	210	Total Europe	1870	2101	2244	2167
Turkey	76	72	65	66	Canada	204	225	243	242
Other	26	24	24	28	Mexico	107	138	186	184
Total Europe	3793	3773	3721	3848	USA	127	86	140	130
Canada	326	331	340	345	Total North America	438	450	569	556
Mexico	398	434	510	550	Brazil	42	103	129	104
USA	1095	1141	1205	1215	Chile	2484	2618	2609	2289
Total North America	1819	1906	2055	2110	Peru	283	293	290	300
Brazil	240	241	260	260	Other	1	2	13	13
Chile	2710	2575	2485	2475	Total South America	2811	3016	3041	2707
Peru	347	353	350	360	Total Oceania	486	425	474	466
Other	28	29	29	29	Total World	8923	9403	10240	9483
Total South America	3325	3199	3124	3124	Growth (%)	-2.1	5.4	8.9	-7.4
Total Oceania	509	447	491	482					
Total World	21704	21955	22635	23482					
Growth (%)	3.9	1.2	3.1	3.7					

Draws on ICSG & WBMS historical data.

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19. Refined imports (kt)	2014	2015	2016	2017	20. Refined consumption (kt)	2014	2015	2016	2017
Egypt	128	151	145	149	Egypt	135	150	145	150
Other	12	24	19	20	Other	90	89	64	63
Total Africa	140	175	164	169	Total Africa	225	238	209	213
Total China	3590	3678	3752	3325	Total China	9900	10300	10900	11275
India	31	40	35	40	India	430	485	510	540
Indonesia	110	117	104	100	Indonesia	235	229	230	240
Japan	69	38	38	40	Iran	130	150	155	165
Korean Republic	347	383	321	388	Japan	1075	1005	975	985
Malaysia	259	353	257	296	Kazakhstan	55	60	60	60
North Korea	15	15	15	15	Korean Republic	755	735	750	770
Pakistan	10	10	10	10	Malaysia	200	225	245	265
Saudi Arabia	190	190	180	185	Philippines	43	42	45	45
Singapore	8	38	134	19	Saudi Arabia	190	190	180	185
Thailand	259	274	354	405	Thailand	255	270	350	400
Taiwan	465	472	473	469	Taiwan	460	470	470	475
UAE	350	381	380	380	United Arab Em.	350	380	380	380
Vietnam	130	151	207	220	Vietnam	130	150	205	220
Other	18	18	20	20	Other	122	125	127	130
Total Asia ex-China	2262	2478	2527	2587	Total Asia ex-China	4430	4516	4682	4860
Austria	10	29	35	10	Austria	25	25	25	25
Belgium - Lux.	50	70	71	70	Belgium - Lux.	247	265	255	255
Finland	5	12	15	5	Bulgaria	30	35	37	40
France	222	193	228	216	Finland	22	22	20	20
Germany	665	686	746	723	France	190	185	178	175
Italy	582	580	572	571	Germany	1163	1221	1295	1300
Poland	6	4	10	10	Italy	575	580	560	560
Serbia	4	1	4	4	Poland	275	281	285	290
Spain	44	55	58	40	Russian Fed.	610	320	320	325
Turkey	364	386	408	430	Spain	348	348	350	355
United Kingdom	16	19	39	22	Sweden	109	130	135	140
Other	281	310	417	333	Turkey	440	455	470	485
Total Europe	2249	2346	2603	2433	Other	119	128	129	136
Canada	43	61	68	60	Total Europe	4154	3995	4060	4106
Mexico	76	84	75	50	Canada	165	165	165	165
USA	826	767	714	786	Mexico	360	380	400	415
Total North America	945	913	857	896	USA	1780	1775	1800	1860
Brazil	190	183	149	143	Total North America	2305	2320	2365	2440
Other	89	99	81	56	Brazil	390	320	285	295
Total South America	279	282	230	199	Chile	95	79	90	90
Total Oceania	0	0	0	0	Other	107	102	93	93
Total World : uncorrected	9389	9787	10058	9559	Total South America	592	501	468	478
Intra-EU-15 correction	141	75	125	125	Total Oceania	26	20	15	15
Ex-EU-15 correction	-400	-325	-150	-150	Total World (uncorrected)	21631	21891	22699	23388
Total World : corrected	9130	9538	10033	9534	Intra-EU-15 correction	141	75	125	125
Growth (%) : corrected	0.6	4.5	5.2	-5.0	Ex-EU-15 correction	-400	-325	-150	-150
					Total World (corrected)	21372	21642	22674	23363
					Growth (%)	3.8	1.3	4.8	3.0

Draws on ICSG & WBMS historical data.

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21. Concs. Prod. (kt Cu)	2014	2015	2016	2017	22. Concs exports (kt Cu)	2014	2015	2016	2017
Botswana	48	22	18	15	Botswana	33	9	2	0
Congo D.R.	145	130	155	165	Congo D.R.	146	131	154	165
Eritrea	89	62	45	20	Eritrea	88	62	45	21
Morocco	18	18	18	18	Morocco	18	18	18	18
South Africa	79	77	45	35	South Africa	7	6	0	0
Zambia	515	555	590	665	Zambia	10	8	10	10
Other	13	11	8	8	Total Africa	302	234	229	213
Total Africa	907	876	878	926					
Total China	1675	1575	1600	1650	Total China	0	0	0	0
Armenia	51	83	95	95	Armenia	41	70	81	81
India	27	30	31	55	Georgia	7	7	7	7
Indonesia	377	577	610	650	India	4	0	14	14
Iran	204	233	280	285	Indonesia	156	404	387	438
Kazakhstan	425	425	465	530	Iran	48	68	51	12
Laos	71	78	85	90	Kazakhstan	186	149	146	203
Mongolia	265	330	355	360	Laos	71	78	85	90
North Korea	19	20	24	24	Mongolia	299	330	355	360
Philippines	90	85	90	90	Philippines	80	80	60	60
Uzbekistan	80	80	80	80	Vietnam	8	10	10	10
Others	69	69	80	86	Others	48	59	62	68
Total Asia ex-China	1678	2011	2195	2345	Total Asia ex-China	948	1255	1257	1342
Bulgaria	110	110	110	110	Bulgaria	49	78	44	44
Finland	43	41	45	45	Germany	15	12	14	14
Poland	421	426	425	425	Macedonia	8	9	8	8
Portugal	75	82	78	80	Portugal	75	82	78	80
Russian Fed.	681	696	680	700	Spain	228	238	220	220
Serbia	36	33	33	35	Turkey	91	82	88	88
Spain	35	42	49	54	Others	24	33	19	21
Sweden	79	76	80	81	Total Europe	491	533	471	475
Turkey	122	125	125	125	Canada	444	486	496	515
Others	22	22	18	20	Mexico	171	226	320	407
Total Europe	1624	1652	1644	1675	USA	434	302	285	280
Canada	695	697	745	750	Total North America				
Mexico	338	379	500	575	Argentina	103	62	76	80
USA	871	827	835	850	Brazil	240	304	294	290
Total North America	1904	1903	2080	2175	Chile	2728	2725	2685	2742
Argentina	103	62	75	80	Peru	1036	1323	1938	2004
Brazil	293	346	335	335	Other	12	13	13	13
Chile	3906	3986	3880	3925	Total South America	4118	4427	5006	5129
Peru	1296	1628	2235	2335	Australia	535	575	530	600
Other	12	13	13	13	Papua New Guinea	111	49	26	0
Total South America	5609	6034	6538	6688	Total Oceania	646	624	556	600
Australia	928	925	951	1035	Total World	7565	8092	8621	8961
Papua New Guinea	76	48	25	0	Growth (%)	6.3	7.0	6.5	3.9
Total Oceania	1003	972	976	1035					
Total World	14400	15023	15911	16494					
Growth (%)	1.0	4.3	5.9	3.7					

Draws on ICSG & WBMS historical data.

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23. Concs imports (kt Cu)	2014	2015	2016	2017	24. Smelter prod. (kt Cu)	2014	2015	2016	2017
Namibia	32	33	36	36	Botswana*	15	14	15	15
South Africa	0	0	14	4	Congo D.R.**	55	55	55	55
Zambia	84	83	84	80	Namibia	36	36	36	36
Total Africa	116	116	134	120	South Africa	72	72	60	40
Total China	3306	3722	4404	4620	Zambia**	645	673	706	770
India	559	540	460	500	Zimbabwe*	8	8	8	8
Indonesia	5	20	0	0	Total Africa	831	858	880	924
Japan	1302	1352	1345	1335	Total China	6148	6689	7355	7698
Korean Republic	443	514	490	525	Armenia	10	11	14	14
Philippines	109	110	108	117	India	755	707	556	607
Uzbekistan	20	20	20	20	Indonesia	229	190	226	212
Other	22	16	18	18	Iran	192	185	238	283
Total Asia ex-China	2460	2572	2441	2515	Japan	1422	1470	1477	1512
Bulgaria	228	237	179	250	Kazakhstan	243	279	320	331
Finland	99	88	104	90	Korean Republic	496	554	536	563
Germany	333	325	328	340	North Korea	15	15	15	15
Poland	49	60	52	48	Oman	12	12	12	12
Russia	147	66	110	80	Pakistan	20	20	20	20
Spain	492	481	470	468	Philippines	119	117	137	147
Sweden	68	74	75	80	Uzbekistan	100	100	100	100
Other	4	4	4	4	Vietnam	8	8	8	8
Total Europe	1420	1336	1322	1359	Total Asia ex-China	3621	3669	3659	3825
Canada	13	35	35	35	Austria	57	61	70	72
Mexico	7	45	20	20	Belgium - Lux.	143	141	142	140
USA	87	0	0	0	Bulgaria	351	345	278	373
Total North America	107	80	55	55	Finland	140	138	151	141
Brazil	139	139	172	177	Germany	529	521	515	525
Chile	45	27	26	20	Italy***	15	14	14	16
Total South America	184	165	198	197	Poland	565	556	518	553
Total Oceania	0	12	28	30	Russian Fed.	901	860	880	910
Total World	7593	8028	8612	8926	Serbia	33	56	64	66
Growth (%)	6.1	5.7	7.3	3.7	Spain	337	337	333	342
Draws on ICSG & WBMS historical data.					Sweden	212	192	197	198
					Turkey	46	50	50	50
					Ukraine	14	12	12	15
					Total Europe	3342	3286	3224	3400
					Canada	292	272	314	301
					Mexico	191	217	229	218
					USA	522	527	551	569
					Total North America	1005	1015	1093	1088
					Brazil	234	226	254	261
					Chile	1362	1304	1225	1200
					Peru	260	289	289	301
					Total South America	1856	1819	1767	1762
					Total Oceania	393	361	448	461
					Total World	17196	17696	18426	19157
					Growth (%)	4.4	2.9	4.1	4.0

* matte furnaces ** low-grade electrowon *** usually described as a fire refinery but since Italy regularly exports blister-grade, we treat it as a smelter-refinery

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25. Scrap to Smelt. & Ref.	2014	2015	2016	2017	26. Blister exports (kt Cu)	2014	2015	2016	2017
Total Africa	4	4	4	4	Botswana*	15	14	15	15
Total China	1565	1375	1479	1546	Congo D.R.**	20	20	20	20
India	97	97	74	69	Namibia	36	36	36	36
Japan	100	94	128	182	South Africa	0	3	1	2
Korean Republic	92	102	79	87	Zambia**	282	320	322	361
North Korea	5	6	6	6	Other	0	0	0	0
Total Asia except China	293	299	288	344	Total Africa	352	393	394	434
Austria	57	61	70	72	Total China	3	6	2	2
Belgium	240	241	222	201	Armenia	10	11	14	14
Bulgaria	60	75	33	59	India	0	0	0	0
Finland	4	4	4	4	Indonesia	0	0	0	0
Germany	319	317	322	312	Iran	46	52	27	15
Italy	15	14	14	16	Japan	1	0	2	10
Poland	104	72	40	80	Kazakhstan	0	0	0	0
Russian Federation	82	109	96	136	Korean Republic	2	3	3	3
Serbia	1	3	0	1	Pakistan	20	20	20	20
Spain	105	104	73	87	Other	3	3	3	3
Sweden	65	42	42	37	Total Asia outside China	82	89	69	65
Turkey	46	26	29	28	Belgium - Luxembourg	25	21	25	30
Ukraine	16	14	14	17	Bulgaria	116	119	66	110
Total Europe	1112	1082	960	1050	Finland	1	6	13	8
Canada	29	29	30	31	Germany	10	4	4	8
Mexico	26	45	41	48	Italy	7	8	6	6
USA	72	44	45	51	Poland	0	0	0	0
Total North America	127	118	116	130	Russian Federation	0	0	0	0
Argentina	16	16	16	16	Spain	42	28	42	40
Brazil	48	43	43	40	Sweden	0	0	0	0
Other	10	10	10	10	Turkey	0	0	0	0
Total South America	74	69	69	66	Other	20	24	24	24
Total Oceania	0	0	0	0	Total Europe	222	211	181	226
Total World	3250	3008	2964	3195	Canada*	16	16	16	16
Growth (%)	-5.7	-7.4	-1.5	7.8	Mexico	0	0	0	0
					USA	12	11	10	10
					Total North America	28	27	26	26
					Chile	450	452	443	400
					Peru	3	3	10	10
					Other	0	0	0	5
					Total South America	453	455	453	415
					Total Oceania	0	0	0	1
					Total World	1141	1181	1125	1169
					Growth (%)	-6.6	3.5	-4.7	3.9

* copper in matte ** low-grade electrowon

Draws on ICSG & WBMS historical data.

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27. Blister imports (kt Cu)					28. Refined production (kt)				
	2014	2015	2016	2017		2014	2015	2016	2017
Total Africa	0	0	0	0	Congo D.R.	750	760	695	715
					South Africa	70	71	60	40
					Zambia	499	496	470	525
Total China	585	530	465	525	Other	12	23	28	29
					Total Africa	1332	1349	1254	1309
India	38	83	100	100	Total China	6925	7275	7942	8297
Indonesia	0	0	0	0	India	766	792	670	700
Japan	5	3	7	10	Indonesia	233	198	246	230
Korean Republic	72	66	100	100	Iran	198	187	245	320
Pakistan	0	0	0	0	Japan	1554	1483	1475	1510
Philippines	0	0	4	4	Kazakhstan	265	300	335	365
Other	3	3	3	3	Korean Republic	602	650	663	682
Total Asia outside China	119	156	215	217	Laos	88	89	80	90
					Myanmar	33	47	60	125
Austria	27	41	34	35	North Korea	15	15	15	15
Belgium - Luxembourg	173	174	164	197	Oman	12	12	12	12
Germany	51	54	49	60	Philippines	120	120	135	150
Italy	1	0	0	0	Uzbekistan	100	100	100	100
Norway*	36	33	29	33	Vietnam	8	8	8	8
Poland	14	18	19	6	Other	6	4	4	4
Spain	0	0	0	0	Total Asia ex-China	4000	4006	4048	4312
Sweden	7	7	15	12	Austria	83	103	103	103
Turkey	0	1	0	0	Belgium - Lux.	387	379	360	380
Other	20	25	25	24	Bulgaria	234	230	214	256
Total Europe	328	352	336	368	Finland	136	132	135	135
					Germany	674	678	680	690
Canada	50	82	40	52	Norway	36	36	30	30
Mexico	9	0	1	1	Poland	577	575	550	550
USA	0	3	0	1	Russian Fed.	895	875	870	915
Total North America	59	85	41	54	Serbia	33	50	65	65
					Spain	418	415	420	420
Brazil	6	15	10	4	Sweden	217	206	205	210
Other	0	0	0	0	Turkey	76	72	65	66
Total South America	6	15	10	4	Other	26	24	24	28
					Total Europe	3793	3773	3721	3848
Total Oceania	68	51	11	0	Canada	326	331	340	345
					Mexico	398	434	510	550
Total World	1164	1189	1078	1168	USA	1095	1141	1205	1215
Growth (%)	-6.9	2.1	-9.3	8.4	Total North America	1819	1906	2055	2110
Draws on ICSG & WBMS historical data. *In matte					Brazil	240	241	260	260
					Chile	2710	2575	2485	2475
					Peru	347	353	350	360
					Other	28	29	29	29
					Total South America	3325	3199	3124	3124
					Total Oceania	509	447	491	482
					Total World	21704	21955	22635	23482
					Growth (%)	3.9	1.2	3.1	3.7

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29. Mine prod. EW (Kt)	2014	2015	2016	2017	30. Mine Prod. (kt Cu)	2014	2015	2016	2017
Congo D.R.	770	780	715	735	Botswana	48	22	18	15
Zambia	200	160	145	160	Congo, D.R.	915	910	870	900
Total Africa	970	940	860	895	Eritrea	89	62	45	20
Total China	40	40	45	50	South Africa	79	77	45	35
Indonesia	1	1	8	14	Zambia	715	715	735	825
Iran	13	13	14	14	Other	31	40	42	44
Kazakhstan	12	15	22	29	Total Africa	1877	1826	1755	1838
Laos	88	89	80	90	Total China	1715	1615	1645	1700
Mongolia	2	3	3	2	Armenia	51	83	95	95
Myanmar	33	47	60	125	India	27	30	31	55
Other	3	2	2	2	Indonesia	379	578	618	664
Total Asia ex-China	154	170	188	276	Iran	217	246	294	299
Russian Fed.	2	2	2	2	Kazakhstan	438	440	487	559
Spain	71	70	72	72	Laos	160	168	164	180
Total Europe	73	72	74	74	Mongolia	268	332	358	362
Canada	1	0	0	0	Myanmar	33	47	60	125
Mexico	188	216	275	310	Oman	15	8	0	0
USA	514	589	610	610	Philippines	90	85	90	90
Total North America	703	805	885	920	Uzbekistan	80	80	80	80
Brazil	1	0	0	0	Other	92	91	106	112
Chile	1809	1738	1670	1675	Total Asia ex-China	1847	2188	2382	2621
Peru	84	73	72	70	Bulgaria	110	110	110	110
Other	2	3	3	3	Finland	43	41	45	45
Total South America	1895	1815	1745	1748	Poland	421	426	425	425
Total Oceania	43	39	30	30	Portugal	75	82	78	80
Total World	3879	3894	3846	4013	Russian Fed.	683	698	682	702
Growth (%)	3.3	0.4	-1.2	4.3	Serbia	36	33	33	35
Draws on ICSG & WBMS historical data.					Spain	106	112	122	126
					Sweden	79	76	80	81
					Turkey	122	125	125	125
					Other	24	24	20	22
					Total Europe	1699	1727	1720	1750
					Canada	696	697	745	750
					Mexico	527	595	775	885
					USA	1385	1416	1445	1460
					Total North America	2607	2708	2965	3095
					Argentina	103	62	75	80
					Brazil	294	346	335	335
					Chile	5715	5724	5550	5600
					Peru	1380	1701	2308	2405
					Other	13	16	16	16
					South America	7504	7849	8284	8436
					Australia	970	964	981	1066
					Papua New Guinea	76	48	25	0
					Total Oceania	1046	1011	1006	1066
					World Total	18280	18917	19757	20507
					Growth (%)	1.5	3.5	4.4	3.8