

TUNGSTEN

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For the first time since the price spike in 1994/95, the tungsten market became buoyant. The first half of 2000 saw an erosion in price levels after the slight gains of 1999 but, in July, a resurgence occurred which was maintained for the rest of the year.

The key factors in the tungsten industry in 2000 were:

- In May, the Chinese Government imposed a licensing system to restrict exports (ferro-tungsten is excluded)
- Consumers are concerned about future supplies
- Alternative sources of supply are being investigated by Western world mining companies in conjunction with consumers. How long will it take such sources to come on stream?
- The CIS may increase production and exports
- How will China react to the possibility of its share of the market being eroded?

Whilst China's licence restrictions came into place in 2000 and some consumers engaged in a campaign to ensure future supplies, the real impact will be on tonnages available in 2001. (NB. In the following tables, all tonnages are expressed in metal content).

Production

Production of concentrate in countries other than China and the CIS rose slightly in 2000 to 2,900 t. Austria and Portugal are the only notable producers left within the established market economy countries (EMEC), and material from assorted producer stocks in these countries continues to decline. Of total production, the Mittersill mine in Austria produced around 1,400 t but all the concentrate is used as part of an integrated operation and none of it is exported. Western

producers have been awaiting the chance to return to the scene, either by increasing existing production or developing resources. In both cases (particularly the latter), a sustainable price improvement has to be envisaged.

Production of concentrate in China has been calculated at 29,800 t in 1999 and 32,550 t in 2000 in order to match worldwide demand for tungsten. The figures in recent years are higher than those reported officially and included in previous reports, and alternative scenarios might include an overstatement of China's domestic consumption or supply from stocks; production may even be higher than these new estimates.

With regard to the CIS, no data are available but production is estimated at 2,500 t in 1999, possibly increasing in 2000 to 3,000 t. The Lermontov and Primorsky mines in Russia are the major producers, with additional material perhaps being sourced from the Tyrnyauz region, and from Kazakhstan and Uzbekistan. All production is consumed domestically.

Mine Production			
		1999	2000
(s)	Austria	1,350	1,400
(w)	Bolivia	300	400
(w)	Mongolia	50	50
(w)	Myanmar	100	50
(w)	Peru	50	50
(w)	Portugal	450	750
(w)	Rwanda/Uganda	50	100
(s/w)	Thailand	200	50
(s/w)	Other	-	50
	EMEC Sub Total:	2,550	2,900
(s/w)	China	29,800	32,550
(s/w)	CIS	2,500	3,000
	Total:	34,850	38,450

s/w = scheelite/wolframite

Sources of Supply				
	1999		2000	
China	31,050	75%	33,050	75%
CIS	5,450	13%	5,350	12%
EMEC production	2,550	6%	2,900	6.5%
DLA	1,900	4%	2,600	6%
Other	750	2%	300	0.5%
Total	41,700		44,200	

The further decline in the CIS market share may be explained either by the unavailability of material or (more likely) by the fact that US consumers are taking the alternative route of purchasing more concentrates from the US stockpile.

Reported exports from China totalled 23,050 t compared with 21,050 t in 1999. The figure is 1,000 t higher than China's recorded exports but account has to be taken of different reporting times. Over the years, there has been a good match between China's export statistics and the data gathered by the ITIA from importing countries.

It is notable that ferro-tungsten (FeW) exports have increased dramatically over the past four years (from 501 t in 1996 to 3,900 t in 2000), despite the tendency in the West towards substituting molybdenum for tungsten in specialty steels. Also, as China continues its aim to export more downstream products, exports of tungsten and tungsten carbide powders have risen by over 70% during the same period. Supplies continue from CIS stockpiles. To end 2000, from 1992 when CIS exports first hit the market, some 44,000 t of tungsten have been exported and the guessing game continues as to the size of remaining stocks and government policy regarding sales. Exports in terms of quantity of different products in 2000 were:

Concentrates	1,800 t
Oxides	1,500 t
Tungstates	650 t
W & WC	400 t
FeW	1,000 t
Total	5,350 t

As reported last year, the US National Defense Logistics Agency (DLA) stockpile has been authorised to sell its entire stock of tungsten, which stood at 37,330 t at the end of June 1999. No sales had been made since 1989 and the stockpile mainly comprises concentrate, the quality of which is uncertain (the same is true of tungsten and tungsten carbide). Sales took place in 2000, of some 2,600 t in accordance with the DLA's annual materials plan (AMT), revised upwards by 33% early in the year, entirely to US companies. The following quantities remain:

Ore and concentrates	31,900 t
W powder	150 t
WC powder	550 t
FeW	200 t
Total	32,800 t

Whilst authorisation has been given to sell, the DLA has a mandate not to disrupt markets and consultation takes place with industry on a regular basis with regard to tonnages and prices. With such a large amount of tungsten at its disposal (the original tonnage represented nearly one year's global demand), the DLA has a difficult game to play in reconciling the various and different interests of a fragile industry.

Demand

Tungsten consumption is dependent on a healthy industrial climate, with its main uses being in cemented carbides, alloyed steels, super alloys, electrical and electronic products, and armaments.

Tungsten is a metal of many superlatives. It has not only the highest melting point of all elements except carbon – sources in scientific literature vary between 3,387°C and 3,422°C – but also excellent high-temperature mechanical properties and the lowest expansion coefficient of all metals. A temperature of about 5,700°C is needed to bring tungsten to the boil, which corresponds approximately to the temperature of the sun's surface. Tungsten is also among the heaviest

Estimated Consumption by End-Use Sectors

	W Europe	Japan	US	China
Hardmetals	62%	51%	60%	45%
Steels / Superalloys	24%	21%	21%	36%
Mill products	6%	8%	15%	7%
Other	8%	20%	4%	12%

metals. Its electrical conductivity at 0°C is about 28% of that of silver, which itself has the highest conductivity of all metals.

Tungsten is an essential commodity whose unusual properties make an important contribution, through its use in cemented carbide and high speed steel tools, to the achievement of high productivity levels in metal and wood-working, construction, mining and wear protection, on which the world's economic well-being depends. In the household, tungsten is used in light bulbs, television sets, magnetrons for microwave ovens and other electrical consumer products. Other applications include chemical uses, mainly in the form of catalysts.

Demand reflects the supply of the raw material to the market in a specified period, whether purchased for consumption or stocks. Actual consumption, which includes trade between the EMECs in intermediate products and recycled material, is much more difficult to assess. Demand for virgin tungsten was 44,200 t in 2000 compared with 41,700 t in 1999. No statistics regarding the use of recycled material are available but it is high, especially in Western Europe and the US, and an average figure of 25-30% on top of consumption of virgin material is a generally adopted guide.

In Western Europe, as always, the statistics remain opaque in terms of real consumption but demand for the raw material increased from 11,750 t in 1999 to 12,350 t in 2000. There was no difference in tonnages purchased between the first and second halves of the year, being divided equally, so the response by

Europe to rising prices appears to have been muted.

In Japan, import statistics for the first half of 2000 indicated a slight recovery in demand. In the second half, however, there was a massive rise in imports resulting in a 45% increase in demand for the whole year (5,550 t in 1999 to 8,000 t in 2000). Real consumption in the IT/electronics and auto industries has seen some growth, but it is not possible to assess to what extent demand has been influenced by consumption or procurement for stocks in the face of rising prices. In view of the fragile state of Japan's economy, the latter scenario is more likely.

In the US, demand declined marginally from 9,300 t in 1999 to 8,950 t in 2000, no doubt as stocks were employed from the high levels of demand from the previous three years. The continuing strength of the US economy has maintained real consumption and the US Geological Survey (December 2000) reported net production of intermediate products 11% higher in 2000 than in 1999, with consumption 3% higher. In the second half of 2000, however, there was undoubtedly

Demand for Virgin Tungsten (t)

	1999	2000	%
Western Europe	11,750	12,350	28
Japan	5,550	8,000	18
US	9,300	8,950	20
Other MECs	4,000	4,500	10
Sub-Total	30,600	33,800	
China – domestic consumption	10,000	10,000	-
- imports of concentrates	1,000	300	24
Other	100	100	-
Total	41,700	44,200	

- Consumption in the CIS and DPR Korea is not known and is excluded.
- 'Other' includes exports of products by China and Eastern Europe and DPR Korea.

concern amongst US consumers about rising prices and future sources of supply, with rumours abounding in the market. Such rumours were given credence early in 2001 when the largest US consumer in conjunction with one of the major European consumers announced discussions with North American Tungsten. The latter company is the owner of the Canada tungsten mine (Cantung - on care-and-maintenance since 1986) and other substantial deposits which have been explored but are as yet undeveloped.

Interest continues in the 'green bullet' programme which aims to eliminate toxic/hazardous materials in small-calibre ammunition by using tungsten as a replacement. A forecast for the increased use of tungsten has been made from near zero in 2000 to some 1,000 t by 2005. In a small market like tungsten, every new usage counts and spin-offs may result (other countries, further substitution) to benefit the market for a material which is non-toxic.

Elsewhere, demand continues to rise: in 2000 compared with 1999 by over 12% in countries such as Republic of Korea, South Africa, India, Israel, Taiwan, etc. (4,000 t to 4,500 t).

Chinese and CIS consumption figures are imponderables. A figure of 10,000 t has been used for China based on a domestic industry estimate some years ago. A more recent estimate suggests that 8,000 t/y may be more accurate but, for the sake of continuity in the statistical records, the original figures have been used. In terms of the overall supply/demand picture, the difference probably implies that there are stocks of concentrate in China. No

estimates are given for the CIS where it is assumed that local production is consumed internally but, given rising prices, it remains to be seen whether increased production (if it occurs) will be absorbed, or whether more supplies will be available for export. DPR Korea is also an unknown factor but imports of concentrates and ferro-tungsten have been reported by China, so a tungsten industry must exist.

The *Metal Bulletin* quotations for APT, which are the best reflection of the market, rose by 50% during 2000. Only ferro-tungsten had not responded by the year-end because excess concentrate production can be used for its manufacture as exports of the material fall outside the licensing system.

Comment

In writing about the year 2000, the changes which have occurred between the first and the second halves of the year have been emphasised and there is a temptation to comment on the market in 2001 as so much which happened in the past six months of 2000, particularly in China, is having an on-going effect, despite an initial scepticism about China's intentions. This scepticism was shared even by *China Nonferrous Metals News* (August 29, 2000) which remarked that this was the fourth government decree on tungsten in the past two years. A summary of the three latest policies recorded in that article follows:

- a restriction on exports at 17,000 t in 2000 and 2001 (excluding FeW). Exports of downstream products should be substantially increased and primary products decreased
- reorganise and strengthen the administration of the tungsten industry
- establish integrated controls over the industry, operated by regional governments and supervised by the central government.

Metal Bulletin Quotations

	US\$ per	6 Jan 2000	29 Dec 2000
Concentrate	mtu WO ₃	38 – 48	50 - 55
APT (US)	mtu	58 – 61	88 - 90
APT (Europe)	mtu	51 – 55	82 - 86
FeW (Rotterdam)	kg of W	5.70 – 5.90	5.50 – 5.80

Note: The US ammonia paratungstate (APT) quotation has been converted from short ton units to metric tonne units (mtu) for comparison purposes.

There is no space in this article either to cover details of the licensing system or the reorganisation of China's tungsten industry. The effects were, however, more or less immediate in terms of prices and a general sense of upheaval. Although China's industry petitioned the government to take action, it remains to be seen whether the country's competitive domestic plants will be content with the individual allocation of export quotas.

Suppliers are not always happy to see long-standing customers looking elsewhere for material when it is available in-house, yet government legislation prohibits sales.

The ITIA's 9th International Tungsten Symposium will be hosted by Kennametal Inc. in Pittsburgh from September 30 to October 4, 2002