

Tungsten

Tungsten – 2011 Annual Review and Outlook

- Introduction
- Canadian Developments
- World Production and Use
- Outlook

Statistical Tables

- Tariffs
- Table 1. Canada, Tungsten Production and Trade, 2011
- Table 2. Canada, Tungsten, Advanced Development Projects
- Table 3. World Tungsten Mine Production, 2009-11

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INTRODUCTION

Tungsten is a whitish grey metal with many unique properties, including a very high density, the highest melting point of any metal, a low co-efficient of thermal expansion, high tensile strength at elevated temperatures, good thermal and electrical conductivity, and hardness. Tungsten metal is the hardest of the refractory metals and tungsten carbide is one of the hardest substances.

Tungsten is used in a wide range of applications, the largest of which is cemented carbides used by the metal-working, mining, and construction industries. Tungsten is also used to make heavy metal alloys for armaments, heat sinks, and high-density applications such as weights and counterweights, super alloys for turbine blades, tool steels, and wear-resistant alloy parts and coatings. Tungsten is also used in lighting, electronic, electrical, heating, and welding applications, and tungsten chemical compounds are used in catalysts, inorganic pigments, and high-temperature lubricants.

CANADIAN DEVELOPMENTS

One mine in Canada produced tungsten concentrate in 2011. A further five projects were at the pre-feasibility or feasibility stage of development as of December 2012.

The Cantung mine, located in the Nahanni area of the western Northwest Territories, is Canada's sole primary tungsten mine. It is owned and operated by Canadian-based North American Tungsten Corporation Ltd. The mine has been in operation since 1962, with suspensions in 1963 (due to low prices), 1966 (mill destroyed by fire), and 2009 (low prices). The mine was placed on care and maintenance from October 2009 until October 2010.

In 2011 the mine produced 2480 tonnes (t) of tungsten trioxide (WO_3)¹ contained in concentrates. Capital expenditures in 2011 and 2012 focused on development to access new orebodies below the 3700 level and the underground portion below the old pit where drilling has indicated higher ore grades. In addition, upgrades to the mill were performed to increase recoveries and a new ventilation infrastructure was developed to allow for increased ventilation throughout the mine and to allow for access to the deeper sections of the mine.

Tungsten concentrates produced at the Cantung mine are trucked to Watson Lake in the Yukon where they are shipped by rail to Vancouver for shipment to Asia or for onward rail transport to Montréal for shipment to European customers.

North American Tungsten is also developing the Mactung project located in the Yukon approximately 8 kilometres (km) northwest of Macmillan Pass in the Selwyn Mountain Range. A feasibility study completed in 2009 outlined a 2000 tonne-per-day (t/d) underground operation using conventional along-hole plus cut-and-fill mining methods. The ore would be processed into both a premium gravity concentrate (67% WO_3) and a flotation concentrate (55% WO_3). The expected mine life is 11 years with a potential to expand by a further 17 years. Planned annual throughput in the first five years is 7500 t of contained WO_3 . In October 2012, North American Tungsten completed the Draft Screening Report by the Yukon Environmental and Socio Economic Assessment Board. The company is currently seeking quartz mining and water licences.

In addition to the Mactung project, several other advanced-stage exploration projects could result in a significant increase in Canadian tungsten production by 2016. Largo Resources Ltd. is developing the Northern Dancer tungsten-molybdenum project in the Yukon. In New Brunswick, three tungsten and molybdenum projects are in development, the most advanced of which is Sisson, being developed by Northcliff Resources Ltd. with joint-venture partner Geodex Minerals Ltd.

Details of these and other advanced-stage projects are shown in Table 2.

WORLD PRODUCTION AND USE

Based on data available from the U.S. Geological Survey (USGS), world mined tungsten production in 2011 was 71 300 t, up 6.3% from 2010 output of 68 800 t.

World tungsten supply is dominated by Chinese production. In 2011, China produced 61 800 t, which represents 83% of total world production. Canada was the third largest producer after Russia. A breakdown of world tungsten production by country is shown in Table 3.

China is also the largest consumer of tungsten in the world. China has in place a number of measures to ensure adequate domestic supply and to stabilize the prices, including production and export quotas on tungsten concentrates and prohibitions on foreign investment in tungsten exploration and mining.

The leading end use of tungsten is as tungsten carbide in cemented carbide products such as tools and wear-resistant materials used in automotive and aircraft production, construction, electronics manufacturing, general manufacturing, large equipment manufacturing, mining, and oil and gas drilling. Tungsten carbide is produced by the chemical combination of tungsten metal powder and finely divided carbon. Cemented carbides are then manufactured by mixing tungsten carbide powders with a binder metal, usually cobalt or nickel, and then compacting them in a die and sintering them in a furnace. Cemented carbides account for 60% of global tungsten use and this end-use market is the main driver of tungsten demand. Note that molybdenum is also used in some cemented carbides, but tungsten is the principal component.

As an alloy, tungsten is used primarily in the production of high-speed tool and die steels. This application accounts for 17% of the world use of tungsten.

Tungsten use is strongly influenced by general economic conditions. Tungsten demand in cemented carbides, the largest end-use sector, is tied to the automotive and aircraft products industry, construction, electronics manufacturing, large equipment manufacturing, and oil and gas drilling.

OUTLOOK

World tungsten supply will continue to be dominated by China's actions to regulate its domestic market. As reported by the USGS, the Chinese tungsten concentrate production quota for 2011 was increased by 9% to 87 000 t (65% WO₃). Export licences for 2011 were limited to 15 700 t for all tungsten products, a 2% decrease from the previous year's quota. Reduced Chinese exports is expected to spur increased supply from previously producing mines or new deposits in Asia, Australia, Europe, and North America, including Canada.

¹WO₃ is tungsten trioxide (containing 79.33% tungsten [or W]), a compound of tungsten and oxygen.

Notes: (1) For definitions and valuation of mineral production, shipments, and trade, please refer to the document entitled "Definitions and Valuation: Mineral Production, Shipments, and Trade."

(2) Information in this review was current as of September 20, 2012. Some information on project developments that occurred in 2012 has been included. (3) This and other reviews, including previous editions, are available on the Internet at www.nrcan.gc.ca/minerals-metals/business-market/canadian-minerals-yearbook/4070.

TARIFFS

Item No.	Description	Canada			United States	European Union	Japan
		MFN	GPT	USA	Canada	Conventional Rate (1)	WTO (2)
2611.00	Tungsten ores and concentrates	Free	Free	Free	Free	Free	Free
2841.80	Salt of oxometallic or peroxometallic acids: tungstates (wolframates)	Free	Free	Free	Free	5.5%	3.3%
2849.90.10	Carbides, whether or not chemically defined: other: tungsten carbide	Free	Free	Free	Free	4.1%	2.5%
7202.80	Ferro-alloys: ferro-tungsten and ferro-silico-tungsten	Free	Free	Free	Free	Free	2-2.5%
81.01	Tungsten (wolfram) and articles thereof, including waste and scrap						
8101.10	Powders	Free	Free	Free	Free	5%	Free
8101.94	Other: unwrought tungsten, including bars and rods obtained simply by sintering	Free	Free	Free	Free	5%	Free
8101.96	Other: wire	Free	Free	Free	Free	6%	Free
8101.97	Other: waste and scrap	Free	Free	Free	Free	Free	Free
8101.99	Other: other	Free	Free	Free	Free	6-7%	Free

Sources: Canadian Customs Tariff, effective January 2011, Canada Border Services Agency; Harmonized Tariff Schedule of the United States, 2011; Official Journal of the European Union (Tariff Information), October 29, 2011, edition; Customs Tariff Schedules of Japan, 2011.

GPT General Preferential Tariff; MFN Most favoured nation; WTO World Trade Organization.

(1) The customs duties applicable to imported goods originating in countries that are Contracting Parties to the General Agreement on Tariffs and Trade or with which the European Community has concluded agreements containing the most-favoured-nation tariff clause shall be the conventional duties shown in column 3 of the Schedule of Duties. (2) WTO rate is shown; lower tariff rates may apply circumstantially.

TABLE 1. CANADA, TUNGSTEN PRODUCTION AND TRADE, 2009-11

		2009		2010		2011 (p)	
		(kilograms)	(\$000)	(kilograms)	(\$000)	(kilograms)	(\$000)
SHIPMENTS (1)							
Northwest Territories		2 505 680	48 378	363 830	7 370	2 367 580	62 478
EXPORTS							
2611.00	Tungsten ores and concentrates						
	China	2 362 749	26 609	878 888	8 762	2 023 124	41 223
	Netherlands	21 455	290	228 591	2 484	1 877 243	23 995
	Japan	—	—	—	—	236 002	4 981
	United States	1 495 074	20 596	21 651	401	170 788	3 570
	Austria	—	—	21 454	290	59 874	660
	Australia	—	—	—	—	666	8
	Peru	—	—	—	—	49	1
	United Kingdom	—	—	—	—	16	...
	Germany	9 231	323	—	—	—	—
	Total	3 888 509	47 818	1 150 584	11 937	4 367 762	74 438
8101.10	Tungsten (wolfram) powders						
	Germany	1 482	74	60 417	2 428	609 393	27 056

	United States	21 446	1 018	66 436	2 416	184 950	8 864
	Australia	1 982	137	12 674	611	17 787	1 209
	China	—	—	625	28	2 153	113
	New Zealand	—	—	—	—	1 593	84
	Japan	1 500	80	700	37	400	30
	South Africa	1 580	90	360	19	538	30
	Sweden	2 202	117	300	15	92	6
	South Korea	60	3	300	16	95	5
	Philippines	—	—	—	—	80	5
	Czech Republic	100	6	—	—	—	—
	India	30	2	—	—	—	—
	Turkey	7	...	—	—	—	—
	Brazil	—	—	50	3	—	—
	Israel	—	—	5	...	—	—
	Total	30 389	1 527	141 867	5 573	817 081	37 402
8101.94	Other: unwrought tungsten, including bars and rods obtained simply by sintering						
	Germany	—	—	19 571	563	2 048	65
	United States	—	—	1 434	40	587	17
	China	2	...	—	—	—	—
	Cuba	—	—	60	5	—	—
	United Arab Emirates	—	—	146	9	—	—
	Total	2	...	21 211	617	2 635	82
8101.96	Other: wire						
	India	6	3	—	—	—	—
8101.99	Tungsten (wolfram) and articles thereof, n.e.s.						
	United States	60	15	13	12	244	94
	Colombia	72	14	67	12	53	14
	Sierra Leone	—	—	—	—	17	4
	Venezuela	—	—	—	—	11	3
	Mexico	—	—	..	...	9	2
	Ecuador	—	—	—	—	2	...
	Russia	—	—	—	—	1	...
	Australia	324	56	20	5	—	—
	India	46	3	—	—	—	—
	Ireland	—	—	22	3	—	—
	Sudan	—	—	100	11	—	—
	United Kingdom	—	—	13	3	—	—
	Total	502	88	235	46	337	117
Total exports		3 919 408	49 436	1 313 897	18 173	5 187 815	112 039
IMPORTS							
2611.00	Tungsten ores and concentrates						
	Austria	—	—	—	—	3	...
	Germany	37	1	16	...	—	—
	United States	384	6	410	6	—	—
	China	—	—	9 072	430	—	—
	Total	421	7	9 498	436	3	...
2841.80	Tungstates (wolframates)						
	China	16 714	59	48	...	7 274	26
	Australia	8 579	30	11 574	41	6 899	24
	Germany	4 610	16	2 468	9	5 298	19
	United States	27 981	99	21 721	77	5 226	19
	Belgium	—	—	—	—	156	1
	India	6 317	22	119	...	14	...
	Japan	229	1	1 172	4	134	...
	Switzerland	30	...	—	—	—	—
	Russia	—	—	144	1	—	—
	Total	64 460	227	37 246	132	25 001	89

2849.90.00.10	Tungsten carbide						
	Germany	33 452	940	23 496	1 238	955 371	29 062
	China	75 668	3 174	335 046	10 306	335 311	16 471
	United States	70 776	3 204	124 114	5 338	126 720	6 427
	Russia	–	–	–	–	100 000	3 383
	United Kingdom	673	29	1 210	54	41 456	1 621
	Vietnam	–	–	–	–	6 343	452
	France	420	36	920	70	1 497	124
	South Korea	278	39	403	26	1 248	66
	Uzbekistan	–	–	–	–	126	9
	Canada	1 000	89	5	...	74	5
	Mexico	–	–	–	–	44	5
	Luxembourg	146	15	–	–	46	3
	Austria	239	8	79	4	30	2
	India	67	6	–	–	–	–
	Japan	340	14	–	–	–	–
	Spain	15	2	–	–	–	–
	South Africa	–	–	19	1	–	–
	Total	183 074	7 556	485 292	17 037	1 568 266	57 630
7202.80	Ferro-tungsten and ferro-silico-tungsten						
	China	10 082	269	2 577	62	876	23
	Germany	95	2	75	2	–	–
	United States	986	27	149	4	–	–
	Vietnam	–	–	3 000	69	–	–
	Total	11 163	298	5 801	137	876	23
8101.10.00.10	Tungsten powders, not alloyed						
	United States	48 460	2 208	86 465	3 573	130 314	7 680
	China	10 800	372	49 800	1 712	79 710	4 680
	Israel	1 040	54	732	34	3 791	276
	Germany	62	3	692	36	603	45
	Japan	–	–	–	–	2	...
	Belgium	81	4	693	33	–	–
	South Africa	12	...	–	–	–	–
	Switzerland	1	...	–	–	–	–
	United Kingdom	..	...	–	–	–	–
	South Korea	–	–	7	...	–	–
	Total	60 456	2 641	138 389	5 388	214 420	12 681
8101.10.00.20	Tungsten powders, alloyed						
	Germany	54 516	3 219	43 224	2 319	86 500	5 778
	United States	29 185	1 263	25 073	1 315	23 965	1 816
	China	2 801	121	5 958	252	11 325	557
	Switzerland	–	–	–	–	70	6
	Italy	–	–	–	–	46	1
	France	6	1	17	1	–	–
	Israel	200	12	50	3	–	–
	United Kingdom	5	...	–	–	–	–
	Japan	–	–	4	...	–	–
	South Korea	–	–	9 150	378	–	–
	Total	86 713	4 616	83 476	4 268	121 906	8 158
8101.94.00.10	Unwrought tungsten, sintered bars and rods, not alloyed						
	United States	2 267	203	6 510	503	5 514	510
	China	2 464	189	3 527	239	5 908	451
	United Kingdom	140	11	271	21	252	18
	Germany	25	2	269	17	230	17
	Austria	–	–	–	–	19	4
	Italy	–	–	–	–	5	...
	Israel	–	–	1 200	64	–	–

	South Korea	–	–	82	6	–	–
	Total	4 896	405	11 859	850	11 928	1 000
8101.94.00.91	Unwrought tungsten, not alloyed						
	United States	664	29	4 130	159	19 499	1 221
	Israel	40	2	250	14	5 600	483
	China	200	7	354	21	1 223	76
	Austria	–	–	38	2	270	14
	Luxembourg	–	–	–	–	59	3
	Total	904	38	4 772	196	26 651	1 797
8101.94.00.92	Unwrought tungsten, alloyed						
	China	100	4	2 773	181	7 169	440
	United States	4 569	271	7 144	427	6 946	431
	Austria	–	–	45	4	130	11
	Germany	151	10	459	31	38	5
	Taiwan	–	–	–	–	2	...
	Israel	50	3	208	11	–	–
	New Zealand	921	52	–	–	–	–
	Canada	–	–	34	2	–	–
	United Kingdom	–	–	157	14	–	–
	Total	5 791	340	10 820	670	14 285	887
8101.96.00.10	Tungsten wire, not alloyed						
	United States	2 648	159	2 144	140	1 848	121
	China	..	...	23	1	42	3
	Japan	–	–	6	...	2	...
	Taiwan	32	2	10	1	–	–
	Canada	–	–	..	...	–	–
	Germany	–	–	6	...	–	–
	Total	2 680	161	2 189	142	1 892	124
8101.96.00.21	Tungsten wire, alloyed, not coated or covered						
	China	3 177	130	2 082	87	5 030	267
	United States	484	30	343	22	75	5
	Japan	81	5	1 016	60	34	2
	South Korea	62	4	–	–	–	–
	Germany	–	–	30	3	–	–
	Italy	–	–	63	2	–	–
	Total	3 804	169	3 534	174	5 139	274
8101.96.00.22	Tungsten wire, alloyed, coated and covered						
	France	1 229	67	205	11	579	31
	United States	855	47	1 017	55	450	21
	Japan	479	26	408	22	289	16
	China	301	11	19	1	983	14
	Taiwan	275	10	158	7	287	12
	Germany	217	12	5	...	108	6
	Sweden	55	3	–	–	2	...
	Belgium	462	9	–	–	–	–
	Italy	2	...	–	–	–	–
	United Kingdom	33	2	–	–	–	–
	South Korea	–	–	..	...	–	–
	Total	3 908	187	1 812	96	2 698	100
8101.97	Unwrought tungsten, waste and scrap						
	United States	8 743	379	23 502	969	27 365	1 177
	Israel	–	–	210	11	–	–
	Total	8 743	379	23 712	980	27 365	1 177
8101.99.10	Tungsten (wolfram) and articles, thereof, n.e.s.						
	United States	20 162	1 116	25 430	1 723	20 405	1 399
	Germany	87	6	265	19	661	42
	Belgium	–	–	–	–	571	38

	China	1 360	76	1 026	47	336	24
	Luxembourg	–	–	181	12	114	11
	Sri Lanka	–	–	–	–	2 399	10
	South Korea	–	–	–	–	100	7
	Japan	2	...	94	7	95	5
	Philippines	7	...	15	...	..	...
	Hong Kong	1	...	–	–	–	–
	United Kingdom	6	...	–	–	–	–
	Austria	–	–	9	1	–	–
	Israel	–	–	2 450	135	–	–
	Total	21 625	1 198	29 470	1 944	24 681	1 536
8101.99.90	Tungsten, other						
	United States	14 418	1 584	22 054	2 193	28 117	3 299
	China	2 171	124	2 153	202	1 228	130
	Israel	64	5	20	2	873	67
	Germany	198	23	372	10	329	56
	Switzerland	852	8	132	16	175	22
	United Kingdom	57	9	–	–	156	14
	Austria	–	–	5	1	11	4
	Japan	28	...	11	...	18	3
	Italy	5	1	–	–	15	2
	France	20	3	75	2	6	1
	Taiwan	100	2	–	–	8	...
	Canada	–	–	–	–	2	...
	Philippines	–	–	–	–	..	...
	South Korea	6	2	..	...	–	–
	Netherlands	3	...	–	–	–	–
	Total	17 922	1 761	24 822	2 426	30 938	3 598
Total imports		476 560	19 983	872 692	34 876	2 076 049	89 074

Source: Natural Resources Canada; Statistics Canada.

– Nil; .. Not available; ... Amount too small to be expressed; n.e.s. Not elsewhere specified; (p) Preliminary.

Note: Numbers may not add to totals due to rounding. Harmonized System (HS) code descriptions in this table may have been abbreviated. For detailed HS code descriptions related to this commodity, please refer to the corresponding tariffs table.

TABLE 2. CANADA, TUNGSTEN, ADVANCED DEVELOPMENT PROJECTS

Project Name/ Commodity	Province/ Territory	Operator	Type	Development Stage	Planned Production Capacity (t/y)
Burnt Hill tungsten-molybdenum-tin	New Brunswick	Cadillac Ventures Inc.(51%)	Open -pit	Feasibility study	..
MacTung tungsten	Yukon	North American Tungsten Corporation Ltd	Open-pit	In development	7 500
Northern Dancer	Yukon	Largo Resources Ltd.	Open-pit	Pre-feasibility/scoping	8 300
Sissons tungsten-molybdenum	New Brunswick	Northcliff Resources Ltd.	Open-pit	Feasibility study	3 500
Mt. Pleasant tungsten-molybdenum-tin	New Brunswick	Adex Mining Inc.	Underground	Pre-feasibility/scoping	..

Sources: Intierra Resource Intelligence; company reports.

.. Not available.

**TABLE 3. WORLD TUNGSTEN MINE PRODUCTION, (1)
2009-11**

Country	2009	2010	2011
	(tonnes)		
China	51 000	59 000	61 800
Russia	2 300	2 800	3 500
Bolivia	1 023	1 204	1 100
Austria	887	1 000	1 100
Canada	1 964	420	1 976
Portugal	..	..	820
Other	3 826	4 376	2 804
Total world	61 000	68 800	73 100

Sources: U.S. Geological Survey, 2012 *Minerals Yearbook*; company reports.

.. Not available.

(1) Tungsten content of world concentrate production.