Analysis of current state and prospects of steel production development

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Abstract. Data on world production of steel in the XXI century are provided. Analysis of current state and prospects of ferrous metallurgy development in the Russian Federation is carried out. Results of national steel production performance during 10 months of the year 2015 are given for different countries. Analysis of the main directions of metallurgical equipment import substitution aimed at technological independence in the industry is made. Russian ferrous metallurgy development predictions in its' main directions up to 2030 is provided.

1. Introduction

In accordance with modern concepts in present and foreseeable future steel production remains the main way of producing the most available construction material, which due to its physical, technical and operational properties is applicable in broad range of industries. However, if the first decade of the XXI century [1] was marked by significant growth in the world steel production (Tables 1, 2), contemporary state of iron and steel industry is marked by a decrease in production rate change.

Table 1. Steel production in the world.

Countries	Steel production, mln. t											
	2000	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
China	127.2	280.9	355.8	422.7	489.5	500.3	573.6	626.7	695.5	724.7	779.0	822.7
Japan	106.0	112.7	112.5	116.2	120.2	118.7	87.5	109.6	107.6	107.2	110.6	110.7
USA	102.0	99.7	93.9	98.5	98.1	91.4	58.2	80.5	86.2	88.7	87.0	88.2
India	26.9	32.6	40.9	44.0	53.1	55.1	62.8	68.3	72.2	77.3	81.2	87.3
Russia	59.1	65.6	66.1	70.8	72.4	65.5	60.0	67.0	68.1	70.4	69.4	71.5
South Korea	41.1	47.5	47.8	48.4	51.5	53.6	48.6	58.4	68.5	69.1	66.0	71.0
Germany	46.4	46.4	44.5	47.2	48.6	45.8	32.7	43.8	44.3	42.7	42.6	42.9
Brazil	27.9	32.9	31.6	30.9	33.8	33.7	26.5	32.9	35.2	35. 9	34.7	33.9
Ukraine	31.8	38.7	38.6	40.9	42.8	37.3	29.9	32.9	35.3	33.0	32.8	27.2
Italy	26.8	28.5	29.4	31.6	31.6	30.6	19.8	25.8	28.7	27.3	24.1	23.7
TOTAL	595.2	785.5	861.1	951.2	1041.6	1032	999.6	1145.9	1241.6	1276.3	1327.4	1379.1
World production	847.7	1046.3	1138.5	1250.0	1344.3	1326.5	1229.7	1413.6	1526.9	1552.9	1607.2	1644.2

Share of 10 countries, %	70.2	75.1	75.6	76.1	77.5	77.8	81.3	81.1	81.3	79.9	82.6	83.9

Table 2. The rate of change in steel production in 2013/2014.

Region, country	2013	2014	Rate of change, %
World production, mln.t	1607.2	1644.2	2.3
including Europe (with the CIS)	313.1	311.4	–0.5
where:			
EU (28 countries)	165.6	169.3	2.2
CIS countries	108.9	105.9	–2.8
among them Russia	68.8	71.5	3.9
North America	99.5	121.1	21.7
Latin America, Africa, Middle East	108.1	87.2	–19.3
Asia	1080.9	1118.9	3.5
including China	779.0	822.7	5.6
Pacific Islands	5.5	5.5	0

For instance, in 2000 world steel production was 848 million tons, in 2004 it has exceeded 1 billion tons and reached 1.046 billion tons, and in 2014, in spite of the global crisis has risen to 1644.2 million tons. Thus, in 14 years of the XXI century world steel production has grown almost twice. This is the highest level of world steel output in the history. At the same time, in January - October 2015 metallurgical enterprises of 66 countries providing production reports to World Steel Association, have melted 1345.9mln.t, which is 31.9mln.t. (2.3%) less in comparison with the same period of the previous year.

2. Research and results

According to the World Steel Association (WSA) data [2], world steel production in October 2015 was 133.6mln.t, 3.1% less than in the same month of the previous year. Average level of capacity utilization in industry has decreased to 68.3% compared with 69.3% in September and 71.7% in October 2014. This figure, however, is higher than in August (68.0%). Average daily steel yield amounted to 4.31mln.t in October, 1.4% less than in previous month.

Reduction in steel production is observed even in China, the major world metal producer, its' share in October was 49.5% of world production, decline in comparison with January - October 2014 amounts to 16.2mln.t or 2.3%, in other countries it is 18.8mln t. or 2.7%.

According to "Metal Supply and Sales" information and publishing network [3] steel yield in China amounted to 66.1mln.t. in October 2015, which is 3.1% less than in the same period of the previous year. According to China Iron and Steel Association (CISA) consumption at the same period decreased by 5.7%. In this regard, information coming from China is unpromising for metallurgists. GDP growth in China continues, but at the same time, there is a change in its structure. Share of industry and construction is reducing as a result of reduced investment in real estate and fixed capital assets, an increase is mainly in services and other intangible spheres. Until there is no other source of growth of Chinese industry instead of export to Western countries, this trend remains unchanged.

However, in 2015 there is growth in steel production in some countries compared to the same period of the previous year (Table 3).

Table 3. Steel production in countries with positive production dynamics.

Countries	Steel production (January-October), th. t		Increase in steel production	
	2014	2015	th. t	%
India	72668.00	75075.00	2407.00	3.21

South Africa	5490.30	6334.30	844.00	13.32
Poland	7178.71	7971.27	792.56	9.94
United Arab Emirates	1939.46	2493.54	554.07	22.22
Spain	12079.65	12612.04	532.39	4.22
Hungary	918.00	1434.00	516.00	35.98
Pakistan	1939.99	2351.00	411.01	17.48
Serbia	453.90	818.80	364.90	44.57
Oceania	4614.53	4835.37	220.83	4.57
Australia	3901.75	4118.38	216.63	5.26
Finland	3182.80	3355.00	172.20	5.13
Netherlands	5769.64	5926.61	156.97	2.65
Belarus	2054.83	2208.92	154.09	6.98
Belgium	6194.78	6310.99	116.21	1.84
Germany	36094.82	36208.24	113.42	0.31
Iran	13509.94	13610.90	100.96	0.74
Slovakia	3866.23	3965.00	98.77	2.49
Moldova	302.80	375.28	72.48	19.31
Peru	893.26	948.99	55.73	5.87
Ecuador	556.21	587.30	31.10	5.29
Czech Republic	4440.45	4466.73	26.28	0.59
Morocco	433.22	455.87	22.64	4.97
BosniaandHerzegovina	649.87	671.72	21.85	3.25
Cuba	211.27	222.42	11.15	5.01
Bulgaria	512.40	522.80	10.40	1.99
Venezuela	1194.78	1204.51	9.74	0.81
Guatemala	312.81	319.05	6.25	1.96
Colombia	1034.81	1039.74	4.94	0.48
New Zealand	712.78	716.99	4.21	0.59
Uruguay	72.69	75.83	3.15	4.15
Paraguay	36.52	37.67	1.14	3.03

It is significant that India, the only country in the world, proclaiming industrial development a priority of its national policy, this year can achieve higher GDP growth rates than China. In January-October of this year, Indian steel industry has achieved the world's highest rise compared to the last year's data [4]. While national steel producers are constantly complaining on sharp rise in imports, steel production in the country for ten months gained 3.2%, or more than 2.4mln. t. compared to previous year's level.

It is interesting, that the second and the third places in the world in absolute growth over the same period took South Africa and Poland. South African steel production in January-October of this year has risen by more than 840th.t. compared to the same period of the previous year, that is due to active policy of industrial development stimulation, large construction projects, and moderate protectionism. For Poland, the main reason for nearly 800th. t production expansion compared to the first ten months of the previous year was transition to independent steel production of Huta Czestochowa plant, owned by Ukrainian group “Industrial Union of Donbass”, after the last year stop of the Ukrainian “Alchevsk Iron and Steel Works”, which provided the Polish company with slabs. AISW currently operate, but do not deliver the same amount of semi-products to Eastern Europe [5]. In addition to this, Poland this year looks the most stable EU economy in terms of construction sector development.

Generally, the number of states that have increased production of steel in comparison with the previous years equals to the number of states that cut production (Table 4), however, decrease in absolute steel production values is apparent.

First of all, the US steel production has reduced significantly. In the end of ten months it has decreased by 9.7% or 6.5mln. t., compared to the same period of the previous year, in early November, according to the American Iron & Steel Institute (AISI), the decline has reached 13%. Experts

consider decline in American oil industry as a main reason for the collapse. This year investments in oil production decreased by more than 20% and, apparently, will continue to decline in future. This causes sharp drop in demand for pipes, drilling equipment, tanks and barges for oil transportation.

However, Japan, other industrial power, experiences difficulties as well, steel production in January-October has declined by 5.3% or almost 4.7mln. t. compared to the same period of the previous year. Industry in Japan and neighbouring South Korea, where steel production for the first ten months has decreased by 3.8% compared to the same period of the previous year, is suffering losses due to cut in orders for ships, drilling platforms and industrial equipment.

Table 4. Steel production in countries with negative production dynamics.

Countries	Steel production (January-October), th. t		Reduction in steel production	
	2014	2015	th. t	%
China	687632.10	675104.00	12528.10	1.86
USA	73747.98	67242.70	6505.28	9.67
Japan	92491.87	87815.23	4676.64	5.33
Ukraine	23438.50	19148.30	4290.20	22.41
South Korea	59847.42	57671.71	2175.71	3.77
Turkey	28520.04	26553.99	1966.05	7.40
Italy	20397.48	18593.19	1804.29	9.70
France	13646.98	12826.56	820.42	6.40
England	10271.77	9514.08	757.69	7.96
Taiwan	18976.97	18288.91	688.06	3.76
Egypt	5246.42	4735.02	511.41	10.80
Libya	635.70	255.89	379.81	148.43
Brazil	28605.80	28235.50	370.30	1.31
Saudi Arabia	5205.43	4866.99	338.44	6.95
Qatar	2535.00	2204.00	331.00	15.02
Argentina	4580.67	4251.53	329.15	7.74
Austria	6597.68	6386.78	210.90	3.30
Thailand	3420.34	3236.09	184.24	5.69
Mexico	16029.94	15873.14	156.80	0.99
Trinidad and Tobago	418.18	266.49	151.69	56.92
Canada	10666.29	10533.59	132.70	1.26
Kazakhstan	3102.30	2983.85	118.45	3.97
Russia	59412.80	59307.37	105.43	0.18
Uzbekistan	631.40	544.35	87.05	15.99
Sweden	3754.40	3673.74	80.66	2.20
Macedonia	187.99	110.02	77.97	70.87
Croatia	159.40	126.84	32.56	25.67
Luxembourg	1869.50	1841.08	28.41	1.54
Norway	494.39	478.72	15.67	3.27
Slovenia	531.86	519.98	11.89	2.29
Chile	905.02	900.05	4.97	0.55

Turkey has slightly reduced the last year schedule delay. 2.77 mln. t. of steel were produced in October, that is 2.0% higher than in the same period of 2014. This decrease is explained by decrease of scrap prices in the end of September and the first half of October, which reached their longstanding minimum and local mini-plants have expanded use of resource, as opposed to more expensive stock material.

Ukraine has reduced the rate of decline. According to the data for January-October it amounted to almost 4.3mln t. or 18.3% compared to the previous year. However, due to absence of active military operations in the Donbass and Alchevsk Iron and Steel Works return into operation in May, national steel production in August shows stable overrun of the last year's figures. However, recently situation

in Ukrainian steel industry deteriorates again. Production declines due to collapse of domestic market, negative market conditions, energy deficit.

Russian metallurgists have completed October with a slight arrear compared to the previous year figures. In October, steel production, according to the World Steel Association [2] has decreased by 2.4% compared to the same period of the previous year, and in ten months period – by 0.18%, or nearly 100th. t. Russian mill products market continues its fall, steel producers have to conduct restrictive policy, thus by the end of the year arrear increases.

Traditionally iron and steel production is one of strategic industries in Russian economy. It makes the foundation for many other industries development, including shipbuilding, aviation, transportation and heavy engineering, defense industry, railway transport, power engineering, construction, etc. Share of iron and steel production in GDP accounts for 1.4%, it comprises 8% of national industrial production and 6% of national exports [6]. As a consumer of products and services of natural monopolies iron and steel industry uses 5.3% of total domestic consumption of electricity, 5.8% of natural gas, its share in rail freight transportation is 15% [7].

According to expert estimations [8], the main task of Russian iron steel industry is meeting demand for steel products of required assortment and quality in volumes demanded on domestic and international markets. Further development of the enterprises will be based on accelerated innovation development, improving economic efficiency, environmental safety, resource and energy saving, product competitiveness ensuring import substitution.

Over the last 10 years about 1.3 billion rubles was invested in Russian iron and steel industry [9], the industry in general corresponds to the world technology level.

There are a number of external and intra-industry challenges and constraints that handicap the industry development in Russia.

External factors constraining development of iron and steel industry are as follows:

- low demand for metal products on domestic market due to insufficient development of machine building industries;
- significant share of metal-consuming machines and equipment imports. 70-75% of metallurgical equipment, and in general, more than 50% of machines, equipment and vehicles (ad valorem) are imported;
- Chinese and other Asian countries expansion on global steel market;
- increase of energy and railway transportation costs;
- insufficient protection of national market.

Among the intra-industry factors there are the following negative trends:

- increased specific consumption of raw materials, fuel and energy per 1 ton of steel in comparison with international peer-enterprises;
- high cost of transportation component in steel production costs, due to geographic location and high production concentration.

At present, despite minor dependence on imports of metallurgical industry as a whole, compared to the other industries (Figure 1), iron and steel production shows high dependence on import of metallurgical equipment (Figure 2).

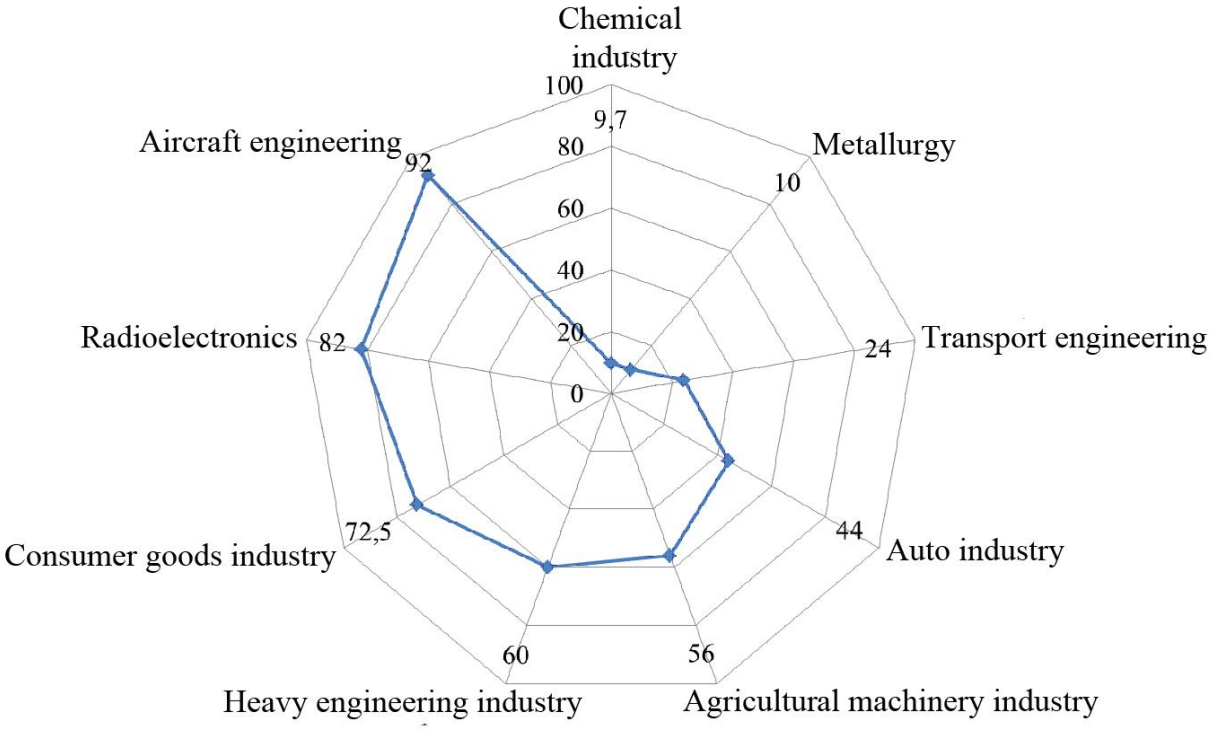
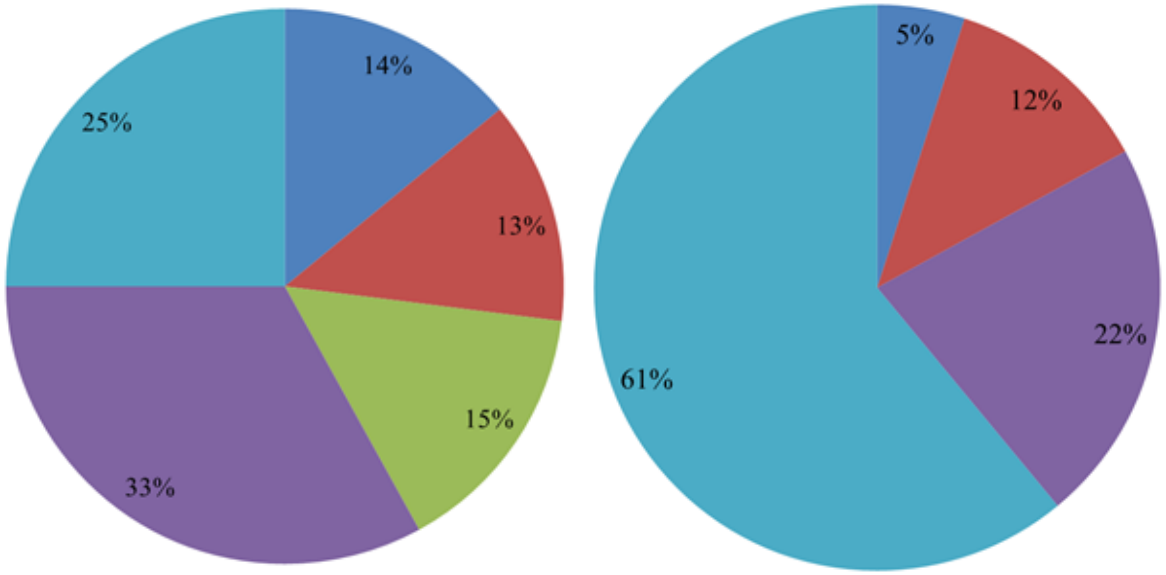


Figure 1. Import dependence of Russian industries.



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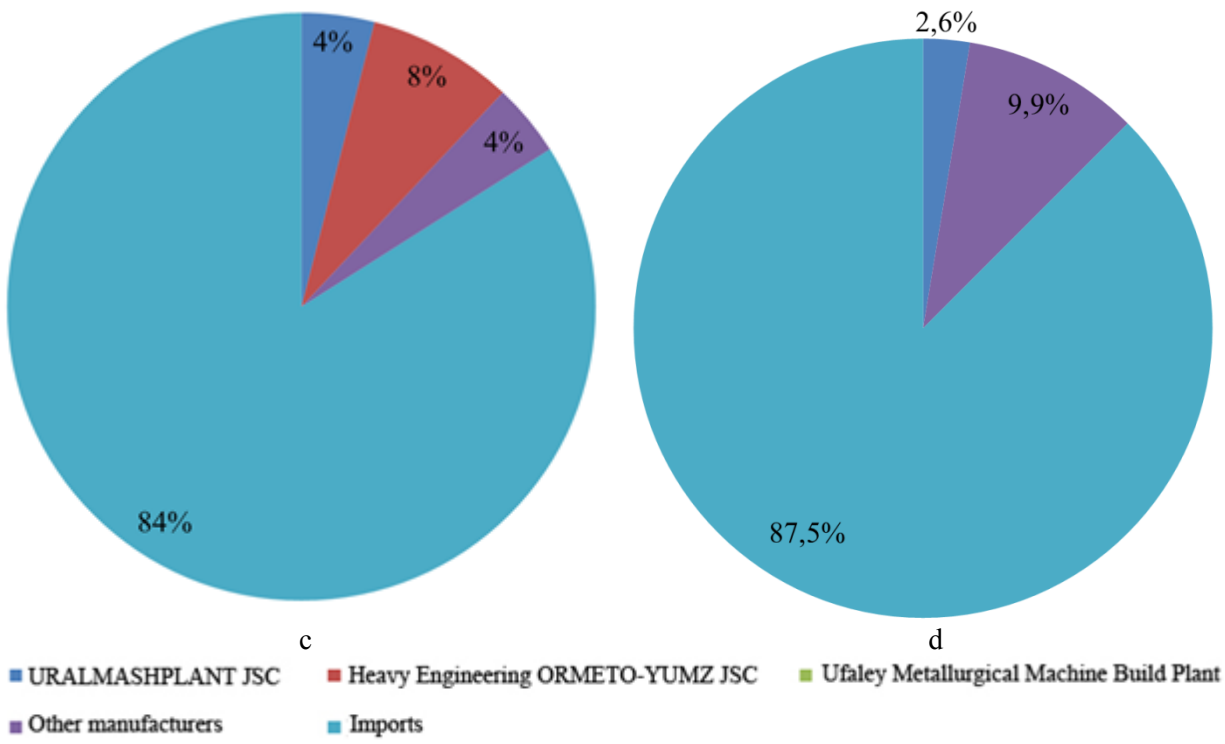

Figure 2. Metallurgical equipment producers share on domestic market (a – aglomeration and calcination equipment; b – blast furnace equipment; c – steel continuous casting equipment; d – rolling equipment).

In order to organize consistent work to ensure import substitution, particularly in metallurgical industry, an order of Ministry of Industry and Trade of Russia No. 654 dated March 31, 2015 "Approval of action plan of the Russian Federation on import substitution in heavy engineering" was issued, according to which plan of import substitution in iron and steel industry equipment was approved (Table 5).

Table 5. Plan of iron and steel industry equipment import substitution in the Russian Federation.

Technology	Project implementation period	Share of imports in consumption in 2014, %	Maximum planned share of imports in 2020, %
CCM (bloom-casters, billet casters) and accessories	2015-2017	70	55
CCMslab-casters	2015-2018	83	50
Rolling equipment	2015-2016	92	40
Pipe and tube mills	2015-2017	60	20
Isostatic equipment	2015-2017	50	20
CCMmoldtubes	2015-2017	95	20
Casting rollers	2015-2016	70	35
Oil film bearings	2015	40	0

Implementation of the plan will significantly increase the share of domestic producers of metallurgical equipment on domestic market.

3. Conclusions

In future, Russia remains a major exporter of steel products and continues to hold one of the world leading positions [10]. At the same time, absolute exports of finished steel may reduce due to a slight decrease in exports of blanks and semi-products supplied to the assets owned abroad. Exports of higher value added products will be determined by market conditions. Imports of steel products will be mainly determined by economic expediency.

Based on world metallurgical industry development prediction in the 2030 run until Russia retains leading positions on global market and will take the 5th place by steel production (after China, Japan, the USA and India), the 6th place by apparent metal consumption (after China, Japan, US, South Korea and India), and the 4th place by exports.

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