

## AUTOMOTIVE DEVELOPMENT IN FAST GROWING MARKETS

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### Evolution of Automotive Production in Emerging Markets

Since several years the automotive industry is shifting production plants form traditional locations to new markets emerging in countries like China, India, Russia, Brazil, Turkey, Iran and the Central European states. The market growth in these countries is driven by:

- High growth rates.
- Increased foreign direct investments.
- Huge investments in infrastructure.
- Huge middle class boosting consumption.
- Large potential of educated low cost workforce.

Table I compares the expected car production volume from 2004 until 2011 in the mature markets with that in the fast developing markets. In the latter the growth is 89% whereas in the mature markets it remains at a moderate 6%. Today already more than 25% of the European car production is located in Central and Eastern European countries.

Table I. Growth of automotive production in mature and fast developing markets [1].

Region	Production forecast in year								Growth
	2004	2005	2006	2007	2008	2009	2010	2011	
Europe (EU15)	16,201,570	15,970,460	16,098,720	16,279,760	16,077,170	16,114,100	16,217,570	16,533,580	2%
North America	15,784,811	15,664,064	15,960,504	16,651,008	16,977,830	17,078,043	17,039,572	16,839,697	7%
Japan & Korea	13,001,057	13,650,183	13,710,452	14,012,410	14,103,425	14,182,368	14,158,869	14,085,343	8%
<b>Mature markets</b>	<b>44,987,438</b>	<b>45,284,711</b>	<b>45,769,679</b>	<b>46,943,175</b>	<b>47,158,428</b>	<b>47,374,512</b>	<b>47,416,007</b>	<b>47,458,624</b>	<b>6%</b>
Brazil	1,999,851	2,164,683	2,252,979	2,344,815	2,429,900	2,490,711	2,581,496	2,648,744	32%
Russia	1,289,316	1,251,459	1,322,337	1,412,436	1,526,921	1,548,043	1,604,184	1,619,317	26%
India	1,217,941	1,343,836	1,458,272	1,785,518	1,956,734	2,134,146	2,263,772	2,387,855	96%
Iran	787,729	835,303	976,810	1,147,183	1,357,255	1,376,708	1,413,408	1,382,346	75%
Turkey	722,601	769,245	853,068	873,510	959,154	1,083,697	1,142,834	1,176,255	63%
China	3,637,240	4,277,301	5,000,961	6,008,927	6,848,372	7,287,845	7,767,592	8,371,626	130%
Central Europe	1,723,291	2,049,938	2,408,532	2,795,697	3,244,687	3,595,996	3,792,249	3,943,138	129%
<b>Developing markets</b>	<b>11,377,969</b>	<b>12,691,765</b>	<b>14,272,959</b>	<b>16,368,086</b>	<b>18,323,023</b>	<b>19,517,146</b>	<b>20,565,535</b>	<b>21,529,281</b>	<b>89%</b>

The original approach of Western and Japanese carmakers to produce CKD kits or older model generations in emerging markets is consequently being replaced by manufacturing up-to-date models that often have been specifically developed according to the local needs. Yet particular materials and parts still have to be imported from abroad. Political boundary conditions as well as cost and logistics issues however imply that the material to build these cars will be increasingly sourced locally in the future.

### Evolution of Sheet Steel Production in Emerging Markets

Due to the high level of sophistication of automotive steel products, local sourcing constitutes a major challenge to the steel industry in the emerging markets demanding specific investments. These involve upgrading of steel shops to produce clean and degassed steel, optimization of continuous casting, adaptation of the hot and cold rolling mills to achieve high flatness and good surface quality as well as the installation of suitable annealing facilities for cold rolled material. One of the most crucial investments will be that into hot dip galvanizing lines since carmakers are using this coating to a large extent (Table II).

Table II. Trends in zinc coating applications in Western European automotive industry.

	GA	GI	GE	GN	Remarks
<b>Audi</b>		=	=		Trials with GI coated material for exposed panels
<b>BMW</b>		↑	↓		Change to GI coated material for exposed panels
<b>DaimlerChrysler</b>			=		High share of thin organic coating on GE basis
<b>Fiat</b>		↑	↓		Trend to 100% GI coated material
<b>Ford</b>	=	↑	↓		Partial change from GE to GI for outer parts. GI coating thickness reduction to 100 g/m <sup>2</sup>
<b>Opel/GM</b>		↑	↑	↓	Change from GN to GE for exposed panels; use of GI for inner panels
<b>Porsche</b>		↑	↑		Increased share of GE for DP and TRIP steel
<b>PSA</b>		↑	=		Trend to 100% GI coated material
<b>Renault</b>		↑	=		Trend to 100% GI coated material
<b>Seat</b>	=	↑	=		Replacement of GE by GI coated material for several exposed panels
<b>Volvo</b>	=	↑	↓		Gradual changeover to GI coated material for exposed panels
<b>Volkswagen</b>	↓	↑	=		Trials with GI coated material for exposed panels; selected application of thin organic coating
<b>Western Europe</b>	↓	↑	↓	↓	<b>GI coated material is strongly gaining market share</b>

GA: Galvannealed, GI: Hot Dip Galvanized, GE: Electro-Galvanized, GN: Electro-Zinc-Nickel

Western and Japanese steel producers achieved a high level of sophistication and skill in automotive steelmaking over a period of more than two decades. On the contrary the learning curve in the developing markets will have to be much faster to achieve reliable production of sophisticated automotive steel sheet within only a few years. A practicable way to transfer knowledge and know-how is to set up joint ventures between local and experienced foreign companies. Some examples are given in the following.

#### Brazil

Vega do Sul is a joint venture of Arcelor and the local flat steelmaker CST in the Brazilian Santa Catarina state with a capacity to produce 880,000 tons per year of galvanized and cold-rolled products. Vega do Sul produces 0.4 to 2.0 mm cold-rolled steel, galvanized steel with pure zinc coating and galvanized steel with a zinc-iron (galvannealed) coating.

GalvaSud was set up early in 2001 as a joint venture between ThyssenKrupp and Companhia Siderúrgica Nacional (CSN) operating a 350,000 tpy hot dip galvanizing line, a 160,000 tpy steel

service center and a 8,000 tpy tailored blank welding line in Rio de Janeiro. In 2004 CSN has taken full ownership of GalvaSud.

Usiminas, being the major domestic steel supplier for the Brazilian automotive industry and being an important player in the international market has included microalloyed steels among its products since many years. Usiminas has recently concentrated its research effort in the development of those steels whose microstructures and mechanical properties may also be optimized by the consistent use of microalloying elements [2].

#### Russia

Severgal in Cherepovets being a joint venture between Severstal and Arcelor to make galvanized strip was started up in 2005. The plant's capacity is 400,000 tons per year of hot dip galvanized strip for the automotive industry. Besides, large steelmakers like Severstal and Magnitogorsk have their own development programs for automotive steel currently focusing on the production of IF steel grades [3, 4].

#### India

The four major Indian steelmakers being SAIL, Essar, Tata and Ispat have installed a galvanizing capacity of around 3 million tpy of which almost half is exported. Domestic consumption of this galvanized sheet, which was 1.4 million tons in 2002-03, is expected to rise to 1.9 million tons (assuming modest growth of 6 percent per annum) or even to 2.5 million tons (assuming a more ambitious growth rate of 9 percent) in 2008-09. Development work is also proceeding on hot and cold-rolled high strength steels [5, 6].

Arcelor has granted Tata Iron & Steel Co a technology license to produce hot dipped galvanized sheet for the automotive industry, which the Indian steelmaker is to produce on its continuous galvanizing line at Jamshedpur. The agreement covers pure zinc HDG and galvanized products. A technical cooperation between Arcelor, Nippon Steel and Tata Steel was initiated in 2002 aiming to provide effective steel solutions to the Indian automotive industry.

#### Iran

The Charmahal project is a 300,000 tpy hot dip galvanizing line joint venture between Mobarakeh Steel Complex and two Iranian automakers, Saipa and Iran Khodro. Charmahal is located in the Esfahan area near to the Mobarakeh steel plant. The galvanizing project should enable Mobarakeh to produce steel sheet capable of being used in exposed auto panels and other high-quality applications. At present Mobarakeh's steel products are used by Iranian automakers in all applications except exposed body panels.

#### China

Angang New Steel Co (ANSC) in Anshan operates a hot dip galvanizing line in the Chinese port of Dalian. The high-tech facility 'Tagal', co-owned by ThyssenKrupp Steel is a copy of the hot dip galvanizing line No. 8 in the Dortmund, Germany. Tagal is designed to produce around 400,000 tons per year of hot dip galvanized sheet meeting very high surface requirements.

Baosteel-NSC / Arcelor Automotive Steel Sheet Co., Ltd. (BNA) started test production at the end of 2004. The plant has an annual production capacity of 1.7 million tons of flat carbon steel, mainly for automotive applications. It is located next to Baosteel's upstream production facilities and comprises both cold rolling and galvanizing operations. Products include cold-rolled steel, galvanized steel and pure zinc galvanized steel. The two galvanizing lines will have a combined capacity of 800,000 tons per year. Besides, Baosteel has an extensive development program to develop hot-rolled and cold-rolled high strength steel grades [7].

Guangzhou Iron & Steel Company set up a joint venture with JFE to produce hot dip galvanized sheet. A 400,000 tpy continuous galvanizing line will be constructed in the south of the Guangdong Province in order to satisfy growing automotive, household appliance and building needs in the Huanan region.

### Central Europe

The existing steel industry in the central European countries has faced a change of ownership during the recent years and is well in progress of adapting to compete for high quality flat products. U.S. Steel Kosice already has an extensive range of automotive steel sheet grades. A new 350,000 tpy hot dip galvanizing line will be available in 2007 also allowing the production of multiphase steel in the future.

Mittal Steel has taken extensive engagement in the Central European steel industry. Ongoing investments in Poland and Romania aim at improving quality and enhancing capacity for automotive steel sheet.

### **Conclusions**

The automotive sector acts as a catalyst to build up a modern and performing steel industry in the fast growing markets. Both sectors typically involve industrial partners from the mature markets to gain knowledge and know-how at a high pace. This will lead to an increase of local content in the vehicles in the years to come and finally enable these economies to gain independence and to become fully competitive with the mature regions.

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