

Hyundai rotem: korean high-speed rail essay



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Railroads were once regarded as a reminder of a bygone era, before the advent of modern airplanes and widespread automobile ownership.

Today, however, rising energy prices and environmental concerns have encouraged a railroad comeback around the world. Railway transport consumes 20 percent less energy than passenger and cargo ships and 60 percent less than automobiles, while emitting 70 percent less and 90 percent less carbon dioxide respectively. Many countries are connecting cities with highspeed railways to promote balanced land development. According to the Union Internationale des Chemins de fer (UIC), an international rail transport industry body, 15, 000km of new highspeed railway lines¹ will be built worldwide between 2010 and 2015, for a market size of \$390 billion (\$65 billion on annual average).

High-speed rail was first introduced in Europe and Japan and has spread to fast growing emerging-market economies in recent years. In 2010, China had a high-speed railway network 92 | www. seriquarterly. com | Figure

1Expected Progression of World High-speed Rail Networks (km) 45000 40000 35000 30000 25000 20000 15000 10000 5000 0 1964 1967 1970 1973 1976 1979 1982 1985 1988 1991 1994 1997 2000 2003 2006 2009 2012 2015

2018 2021 2024 Source: Union International des Chemins de fer (2010), High speed world network evolution. covering 4, 000km with plans to add 9, 000km of tracks to the system by 2012. Brazil will build 510km of high-speed rail in preparation for the 2014 World Cup and 2016 Olympic Games.

Even the US, the quintessential auto-addicted nation, may warm to the idea of high-speed railways. A 1, 280km high-speed rail is being built in California

worth \$45 billion. highly developed economies like Canada where Bombardier, the world's largest train manufacturer, is headquartered. Hyundai Rotem operates within a small club dominated by four manufacturers who control 65 percent of the global rail transport market: Bombardier (22%), Alstom of France (19%) Siemens of Germany (15%), and GE of the US (9%).

2 Alstom, which concentrates on highspeed rail, ranks first in the market with the TGV, followed by Kawasaki Heavy Industries of Japan with the Shinkansen, and Siemens with ICE, both with a 12 percent share.

Manufacturers Hyundai Precision and Engineering, Daewoo Heavy Industries (now Doosan Infracore) and Hanjin Heavy Industries led Korea's rail transport industry until the 1997 currency crisis forced consolidation of their rail transport businesses into a new entity, Korea Rolling Stock Corporation (KOROS), in 1999. Hyundai RoTem pioneerS KoRea's Rail induSTRy Although Korea's successful high-speed railway service, Korea Train eXpress (KTX), has earned global recognition, even the millions of passengers who ride Korea's trains daily may not realize that Korea has become a source of railway technology to the world. At the forefront of Korea's burgeoning rail renaissance is Hyundai Rotem, which has sold rail cars to emerging market economies like Iran, and to 1 Defined as railways running at a speed of at least 250km per hour.

2 Bombardier (December 2009), Global Industries Conference 2009

Presentation. 3 Taurus Investment Securities (April 2010), Riding on the HSR.

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Figure 2 Hyundai Rotem's Rail Transport Sales (billion won) Domestic Sales

Overseas Sales 949. 1 819. 1 769. 4 772.

782. 1 410. 3 463. 8 436.

7 419. 8 272. 2 505. 9 145.

8 2005 Source: Hyundai Rotem 2006 2007 2008 2009 2010 KOROS was acquired by Hyundai Motor Group in 2002 and renamed Rotem, which became Hyundai Rotem in 2007. Hyundai Rotem's rail transport business grew rapidly in 2008 on the back of revitalization of private investment projects related to Seoul's rail transport business and expansion of light rail development among local governments. Total sales revenue of the rail transport industry 1 Hyundai Rotem's Overseas Advancement Order Rail car, Taiwan Railway Administration (56 units) Rail car, Manila, Philippines (72 units) Rail car, Delhi (India) Metro Rail Corporation (240 units) Rail car, Athens, Greece (126 units) Diesel rail car, North Carolina, US (32 units) Diesel rail car, North Carolina, US (32 units) Light rail transit, LINE, Canada (40 units) Passenger rail car, SCRRA, US (40 units) Rail car, Sao Paulo, Brazil (84 units) Rail car, DMRC Phase 3, India (156 units) Rail car, Sao Paulo, Brazil (84 units) Rail car, Tunisia (76 units) Rail car, Turkey (440 units) Rail car, Bangalore Metro, India (150 units) Rail car, Athens, Greece Electrical equipment and technology transfer, Shenzhen, China Diesel-electric locomotives, Bangladesh Rail car, Denver, US (50 units) Date Nov. 25, 1999 Dec. 16, 2000 May. 22, 2001 Sept.

5, 2002 Nov. 17, 2004 Jan. 28, 2005 Sept. 30, 2005 Apr.

13, 2006 Aug. 13, 2007 Oct. 19, 2007 Nov. 13, 2007 Dec. 24, 2007 Nov. 10, 2008 May 13, 2009 Sept.

16, 2009 Dec. 11, 2009 Jan. 11, 2010 June. 29, 2010 Source: Hyundai Rotem's quarterly report (Nov. 2010). 94 | www.

seriquarterly.com LEE Won-Hee rose to 1.7 trillion in 2010, up from 550 billion in 2005 when restructuring was nearing completion. Overseas sales topped domestic sales in 2010 significantly, reaching 950 billion compared to the 145 billion posted in 2005. The overseas marketing of Hyundai Rotem's predecessors focused on passenger and freight cars before 1990, and then shifted to rail transport and light rail vehicles, and then to high value-added rail and systems engineering like high-speed rail and magnetic levitation (maglev) trains.

In particular, Hyundai Rotem's Hong Kong Mass Transit Railway (MTR) cars used the UK's rail transport standard, gaining global recognition for quality and technology. Against this backdrop, Hyundai Rotem was able to win orders for not only rail cars but also entire subway systems from India, Turkey, and Greece. After advancing into Europe, the world's center for rail transport, Hyundai Rotem made inroads into the US in 2006, the first time a Korean rail company ever entered the US market. In 2007, it received orders to build rail cars for New Zealand and Tunisia, completing its entry into all the continents of the world.

In 2008, it received an order to build subway trains in Almaty Kazakhstan, thus entering the Commonwealth of Independent States. | Table Hyundai RoTem Builds KoRea's High-speed Rail (KTX) Korea drafted a high-speed rail <https://assignbuster.com/hyundai-rotem-korean-high-speed-rail-essay/>

plan in 1989 and broke ground in June 1992. In 2004, Korea opened its first high-speed rail service, the KTX, between Seoul and Busan, making Korea the fifth nation to launch high-speed rail service. According to the UIC 2011, Korea's high-speed railways transported 37.48 million people in 2009, ranking fourth after France, Germany and Japan. Korea has also maintained global standards in on time arrival and accident recovery.

From the initial stage of high-speed rail development, Korea has both imported advanced technologies and developed its own technologies to produce domestically made high-speed rail cars and engines. Locally, government research institutes like Korea Railroad Research Institute worked with Hyundai Rotem. development of Koreanstyle High-speed Rail Forty-six rail trains have been built in Korea to 2 High-speed Railways Around the World

| Country | Year | Model | Maximum Operation Speed |
|---------|------|------------|-------------------------|
| Japan | 1964 | Shinkansen | 300km/h |
| France | 1981 | TGV | 300km/h |
| Italy | 1981 | ETR | 300km/h |
| Germany | 1991 | ICE | 300km/h |
| Spain | 1992 | AVE | 300km/h |
| Belgium | 1997 | Thalys | 300km/h |
| UK | 2003 | Eurostar | 300km/h |
| Korea | 2004 | KTX | 300km/h |
| Taiwan | 2007 | THSR | 315km/h |
| China | 2007 | CRH | 350km/h |

Source: UIC (Dec. 2010), combined from high-speed lines in the world. April 2011 | SERI Quarterly | 95 Hyundai Rotem: Korean High-speed Rail | Table 3

Hyundai Rotem's KTX Development Content

- Signed supply contract and technology transfer agreement with Alstom in 1994: 46 trains (920 rolling stocks), max speed 300km/h
- Delivered in 2003
- Launched self-development in 1997: max speed 350km/h
- Applied technology to KTXII (KTX-Sancheon) in 2006
- Signed supply contract in 2006 and applied HSR-350X technology: 240 units
- Delivered in 2010: five years for KTXII delivery compared to 10 years for

delivery of KTX? Launched independent development in 2007: max speed 440km/h Target completion in 2012 Project KTX? HSR-350X KTXSancheon HEMU accommodate trains running at a maximum speed of 300km/h. The first 12 trains were manufactured and delivered by Alstom, and the remaining 34 were developed by Hyundai Rotem under a license contract with Alstom.

At the same time, the development of a Korean-style high-speed train was also promoted. For Korea to secure a stable high-speed rail business, components supply and demand had to be in place for maintenance and repair, as well as installment of rail lines for high-speeds. In 1996 the Korean government launched development of high-speed rail with domestic technology in cooperation with state-owned research institutions and universities. By 2002, HSR-350x, a prototype high-speed rail train, was designed; and work began on KTXII, a commercial rail train based on the HSR-350x.

Initially, the maximum speed of the HSR-350x was 100km/h but by December 2004, the top speed on the KTX-II Cheonan-Shintanjin section was 352.4km/h. In March 2010, the HSR350x-based KTX-II was officially named KTXSancheon. By then, development of Korea's next-generation high-speed train, HEMU-400x, was already well under way.

| Country | Opening Year | Max Speed (Km/h) | Number of Lines | Length (m) | Braking |
|------------------------------------|--------------|------------------|-----------------|------------|---------|
| Korean and Foreign High-Speed Rail | 2004 | 300 | 20 | 388 | 3, 250 |
| KTX-Sancheon | 2010 | 300 | 20 | 393 | 5, 520 |
| TGV-POS | 2006 | 320 | 10 | 200 | 3, 250 |
| ICE3 | 2000 | 300 | 8 | 200 | 3, 500 |
| Shinkansen 800 Series | 2004 | 260 | 6 | 155 | 4, 000 |

Distance (m) Interior Noise (dBA) Source: Woosong University (May 2007),
Current State of Korean and Foreign High-speed Rail. 96 | www.

seriquarterly. com LEE Won-Hee Korea's next-generation Highspeed Rail
Hemu-400x Development of HEMU-400x by Hyundai Rotem and state-owned
research institutions began in 2007 and is expected to last until 2013 with an
estimated total cost of about 97 billion. The HEMU-400x will be applied to
KTXIII, which is scheduled to begin in 2015. The target e d sp e e ds are 350k
m / h for reg u lar commercial operations and a maximum speed of 440km/h,
both faster than helicopters that fly at an average 200-300km/h. Therefore,
various advanced technologies are required.

Most importantly, motors need to have outstanding acceleration. Korea's
next-generation high-speed train will have acceleration of 0. 5 meters per
second squared (m/s²). KTX-Sancheon had a speed of 0.

45m/s². Another speed factor is the acceleration limit. KTX-Sancheon's
acceleration declines sharply when reaching 60km/h speed, but HEMU-400x
can maintain the same acceleration performance up to 150km/h. Unlike
current trains that operate based on " push-pull" operations, HEMU-400x is
being designed with multiple unit rail operations (using multiple power
motors) to secure proper acceleration.

In sharp contrast to KTX and KTX-Sancheon, which rely on eight
Development of HEMU400x by Hyundai Rotem and state-owned research
institutions began in 2007 and is expected to last until 2013 with an
estimated total cost of about 97 billion. HEMU-400x April 2011 | SERI
Quarterly | 97 Hyundai Rotem: Korean High-speed Rail | Table 5 Major
<https://assignbuster.com/hyundai-rotem-korean-high-speed-rail-essay/>

Resources of HEMU-400x 8 350 km/h 440 km/h 410 kW 9, 840 kW Length
Width Height Axle Load Track Gauge 23, 500 mm 3, 100 mm 3, 700 mm 13 t
1, 435 mm Rail cars in one train Maximum Speed Maximum Design Speed
Motor Output Rated Output , 100kW motors (total of 8, 800 kW motors),
HEMU-400x is being designed to use 24 410kW motors (total of 9, 840kW).
The weight of the train is also being reduced. The KTX-II has an axle load⁴
limit of 17 tons, but that of next-generation trains is 13 tons. Passenger
comfort and convenience also will be enhanced. For a smooth ride without
increases | Figure in vibration, active suspension⁵ will be installed for the
first time in Korea's rail history.

To enhance convenience, LCD monitors and information devices will be
embedded on the backs of seats so that passengers can be aware of their
location and destination. Smart sensors will automatically detect and control
the air purity level inside the train and passengers will have a cabin
attendant call button. Process of Next-Generation High-Speed Rail
Development Ministry of Land, Transport and Maritime Affairs Operating
Committee Professional Agency Assessment Committee Director of the High-
Speed Rail Technology Center (supervisory institution) R&D Project Council
Project Supervisory Committee Secretariat Integration of the Decentralized-
Power HEMU Rail System (I-0) Development of high-speed rail systems
engineering technology (KRRRI) Development of foundation technologies for
the EMU-type railway vehicle (Universities) Development of prototype train
technology (Hyundai-Rotem) Improvement of the highspeed track structure
performance and development of maintenance technologies (KRRRI)Source:
Next-generation High-speed Rail Technology Development Business Team,

Next-generation High-speed Technology Development Project. 4 Total weight felt by two wheels.

5 Active suspension is a system that controls the movement of the train by sensing when the train accelerates, decelerates, or steers. 98 | www.seriquarterly.com LEE Won-Hee success FacToRs FoR RoTem's High-speed Rail multi-collaboration High-speed rail development requires convergence of various technologies. A single company, moreover, is incapable of developing the necessary technologies alone.

Hyundai Rotem made bold steps and formed alliances, to secure the necessary technologies. In the development of Korea's first high-speed train, it introduced technologies from Alstom, thus quickly absorbing advanced technologies. Hyundai Rotem then embarked on developing domestic technologies by partnering early with Korea's stateowned research institutes and universities. It formed an organic network with Korea Railroad Research Institute and 38 other industry, academic and government institutions, with the basic technologies being developed by stateowned research institutes and universities. Total solutions provider The rail transport business is increasingly delivering "turnkey" solutions ranging from rail cars, control systems, construction, operations, and financing. This is because the business requires not only a technological competitive edge but the ability to hold down construction costs and keep projects on schedule.

Hyundai Rotem provides turnkey solutions for rail transportation, including vehicles and control systems. Jeong Kil-Young, executive vice president of Hyundai Rotem in charge of overseas business, stresses the importance of

total solution capability saying, “ An integrated system capability is a very important competitive edge especially April 2011 | SERI Quarterly | 99

Hyundai Rotem: Korean High-speed Rail in competing with Chinese companies that are rapidly catching up, winning overseas railway orders based on low prices. On the back of such capability, Hyundai Rotem in 2009 received orders worth \$150 million to build 28 rail cars as well as escalators, railway carriage bases and signal system for the first line of Almaty’s subway system in Kazakhstan. ceiving orders. ” “ Hyundai Rotem opened an assembly plant in Turkey and Philadelphia in the US, and established a manufacturing partner in India, which has contributed to raising our price competitiveness,” he added. government cooperation Railway investments are conducted by the central and regional governments because transportation is a public service and requires massive resources.

High-speed rail projects therefore require an active role on the part of the government. As a means to promote exports, countries have organizations exclusively devoted to highspeed rail and mobilize public-private partnerships. France and Japan established the stateowned organizations of SYSTRA and Japan Rail Technical Services (JARTS), respectively. They perform feasibility studies on high-speed rail business and provide technology advice, creating new projects and supporting overseas advancements of their country’s companies.

Korea in 2008 built an integrated support system to help rail businesses make inroads into overseas markets. Since the rail transport business needs massive investments, the government’s support for financing is also crucial. Amid Ukraine’s fiscal crisis in the wake of the global financial crisis, Hyundai

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Rotem raised funds with support from the Export-Import Bank of Korea and Korea Trade Insurance Corporation, eventual- competitiveness of Technology and price combined Hyundai Rotem has been able to compete against European and Japanese railway powers and its rapidly improving Chinese counterparts by securing competitiveness in both technology and price.

Executive Vice President Jeong says, “ Considering only technology, European and Japanese companies are ahead of Korea. And considering only price, China is a bit more competitive than Korea. But when technology and price are combined, Hyundai Rotem certainly has a more competitive edge.

Bolstering price competitiveness requires local production or localization through strategic alliances. Woo Dong-Ik, director of Hyundai Rotem’s overseas unit, explains, “ Localization is important not only for price competitiveness but also to win more orders. Customer countries are demanding localization for their job creation, and localization plays a big role in re- | Figure 4 Value Chain of High-speed Rail Feasibility Study F/S Basic Engineering Detailed Engineering Operation & Management O&M Pilot Survey Procurement EPC Construction Trial Run Note: “ F/S” stands for “ feasibility study;” “ EPC” stands for engineering, procurement, and construction; and “ O&M” stands for operations and management. 100 | www. seriquarterly.

com LEE Won-Hee y winning orders to build high-speed rail cars for Ukraine’s railway modernization. With railway business increasingly providing total solutions from manufacturing to operation, the role of state-owned companies is also becoming important. Korea Railway Corporation has world-class operational know-how and thus can provide support in many ways.

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Jeong noted, “ By leveraging the operational knowhow of Korea Railway Corporation, Hyundai Rotem is making efforts to win orders from Southeast Asian countries. ” Executive Vice President Jeong says, “ Considering only technology, European and Japanese companies are ahead of Korea. And considering only price, China is a bit more competitive than Korea.

But when technology and price are combined, Hyundai Rotem certainly has a more competitive edge. ” pRospecTs and implicaTions Selling only high-speed trains will not achieve profits in the short-term especially when competing with existing rail powers, and with fast improving Chinese rail companies. Once constructed, however, high-speed trains can create profits for at least 30 years through maintenance and repair work. A satisfied customer will tend to use the same rail system in the future for the sake of costs and maintenance and repair. Therefore, Hyundai Rotem, based on its performance, is expected to gain steady profits through maintenance and repair.

High-speed trains are guaranteed to possess the world’s best proven technology. So even if little short-term profit is made through high-speed rail itself, there is a bandwagon effect because high-speed trains serve as flagships in raising the awareness of general rail. On the back of the success of high-speed trains, Hyundai Rotem now boasts world-class rail transport that can match Bombardier and Alstom. It has also secured all core competitive advantages in the rail sector, including engineering and system integration. On the back of its experiences and capabilities, Hundai Rotem can expect to make more major advances as rail transport revives.

April 2011 | SERI Quarterly | 101 Hyundai Rotem: Korean High-speed Rail product portfolio. It also requires, as a capitalintensive industry, various advanced financing methods. Thus the infrastructure industry is led by advanced companies in western countries. Yet Korea too, has developed mature infrastructure competitiveness based on long-accumulated know-how, and persistent efforts to enhance construction and financial competitiveness. By combining the experience of private companies and the know-how of state-owned companies, Korea can drive exports to emerging market economies' infrastructure market.

Translation: RHEE Oak-Jung Selling only high-speed trains will not achieve profits in the short-term especially when competing with existing rail powers, and with fast improving Chinese rail companies. Once constructed, however, high-speed trains can create profits for at least 30 years through maintenance and repair work. Keywords High-speed rail, green transport, KTX-Sancheon, HEMU-400x, multi-collaborationThe success of Hyundai Rotem's high-speed rail business has various implications for Korea's infrastructure industry. The infrastructure industry involves convergence solutions that require an optimal combination through a broad 102 | www.seriquarterly.com SQ extends its special thanks to Mr.

Jeong Kil-Young, Executive Vice President of Hyundai Rotem, and Mr. Woo Dong-Ik, director of Hyundai Rotem's Overseas Unit, who explained the current situation facing Hyundai Rotem and the key factors behind its success. LEE Won-Hee is a research fellow at SERI. His research interests include technology and R; D strategy. He holds a PhD in Industrial Engineering from the University of Michigan. Contact: wonhee07.

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