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— Wang Chuanfu, Chairman and President of BYD

SkyRail: BYD's silver bullet for urban congestion



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BYD has greatly expanded its commercial footprint since 1995, when it hit the tech scene as a battery producer for cell phones. Today, the Chinese company has emerged as a leader in new energy vehicles and photovoltaic energy storage technology as part of its Four Green Dreams strategy, covering solar power plants, battery storage power plants, electric cars, and rail transit.

By Xu Shenglan, Xue Hua



Given today's ubiquitous traffic congestion, BYD believes the solution lies in "3D" traffic networks that combine underground, ground, and air transport. This belief led to the genesis of its straddle monorail project, SkyRail.

With five years of development propelling the project forward, BYD Chairman and President Wang Chuanfu feels

that SkyRail can forge the silver bullet that will stop urban congestion in its tracks and make transportation truly smart.

Building cities on rails

Wang cites a past gridlock experience as his inspiration for SkyRail. On business in Beijing six years ago, a sudden rainstorm brought the entire city to a standstill – as a

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result, it took him four or five hours to get from Xizhimen to the airport. “That [traffic jam] left a particularly deep impression on me,” says Wang. The next week, he visited Tokyo and, despite more cars and fewer roads relative to Beijing, the traffic ran smoothly. On investigation, he observed that, “Tokyo is a city of railways, with 85 to 90 percent of the population opting for public transportation on weekdays.” In contrast, says Wang, “Cities on rails is the future [for China] because the popularization of cars and urbanization have overwhelmed urban roads.” The stats support his view: From 2012 to 2016, automobile production and sales in China rose from 19.3 million to 28 million vehicles per year, while the nation’s rapid urbanization will mean that 60 percent of the nation’s population – some 850 million people – will be living in cities by 2020 if current estimates pan out.

According to Wang, SkyRail will mainly meet the needs of second- and third-tier cities, “The number of cars in these cities is increasing by 15 percent per year, but the number of roads is growing at just 1 percent,” he says. “As people’s standard of living improves, buying a car has become a must-have and so congestion is inevitable. The solution is public transportation.”

Investing 5 billion yuan to unlock a 1-trillion yuan door

BYD formally entered the trillion-yuan rail transit industry with a 5 billion yuan (US\$790.3 million) investment in SkyRail tech R&D in 2012. Moreover, the company fully owns the IPR for the SkyRail monorail system.

The most obvious advantage of SkyRail is that it’s relatively cheap, so small- and medium-sized cities can benefit in a way that extremely expensive subway construction doesn’t allow. According to Wang, “Building a 1-kilometer length of subway costs 1 billion yuan, compared with 200 million yuan for the same length of SkyRail, just one-fifth of the cost, and the construction time is up to 75 percent faster.” He mentions that there are 273 prefecture-level cities like Shantou in China. “It’s not feasible to build metro systems in medium-sized cities such as these,” he says. “But, multiplying 273 by 40 billion yuan gives you a market size of over 1-trillion yuan.” As a straddle monorail, SkyRail covers a small area, has a good ability to climb and a small turning circle, and can hit speeds of up to 80 km/h.

Wang is crystal clear about SkyRail’s market positioning. He believes that subways and high-speed railways are high-capacity traffic systems, whereas SkyRail is a medium-capacity system that’s a seamless fit for medium-sized cities and the



suburbs of large cities. “SkyRail can be integrated with existing public transport systems to create three-dimensional transport networks consisting of underground, surface and air transportation,” says Wang. “In the transit systems of first- and second-tier cities, SkyRail can be widely used for feeder lines and new lines, and as main trunk lines in third- and fourth-tier cities, as well as for sightseeing lines for tourist attractions.”

SkyRail blooms at Yinchuan Flower Expo

On September 1, 2017, the first SkyRail line went into commercial operation at the Flower Expo in Yinchuan, marking the city’s first ever rail transit system and giving SkyRail users the best view of the sea of flowers on show. Around 40,000 people were estimated to have used the system on launch day, rising to more than 60,000 more each day on September 2 and 3 – the peak first weekend of the expo. As a tourist carrier, SkyRail’s speed in this scenario was limited to a sedate and barely audible 25 km/h.

“The project got underway on April 18 and by August 31, the railway was officially up and running,” explains Wang, describing just how fast the project got off the ground. In just over four months, work on constructing

the infrastructure, erecting steel columns, installing track girders, installing mechanical and electrical communications equipment, and constructing the battery storage power station was completed. Neither the rapid turnaround nor the heavy initial use affected quality, however. “Because the number of people visiting the garden exceeded our expectations, we launched a plan to run a backup SkyRail,” says Wang. “All seven of the SkyRail trains ran at full capacity with zero safety faults or passenger complaints, and on-time rates exceeded 99 percent. It went almost perfectly.”

Each SkyRail car is equipped with high-speed wireless broadband services, so passengers can easily share photos and videos. Based on real-time passenger flow monitoring technology, announcements about congested areas are played on platforms and in cabins in real-time, so passengers can plan their routes.

Since the launch of SkyRail, BYD has signed contracts with over a dozen cities, including Shantou, Shenzhen, Bengbu, and Guilin, as well as Yinchuan. On August 22, 2017, the company also signed a contract with Iloilo City in the Philippines to build a SkyRail of over 20 kilometers in 2019, an indication that SkyRail will be rolled out in more overseas regions in the future.

The fast track to autonomy



In the event of a mains failure, SkyRail can automatically switch to an onboard battery and drive safely to the next station in driverless mode.



In the future, SkyRail will adopt a high-tech driverless system, with BYD tech providing the highest level of automation out of the four possible for rail systems. Unattended train operation (UTO) delivers full automation, enabling the shortest safe train headway, automated diagnosis, automated sleep and wake-up capabilities, real-time passenger flow monitoring, facial recognition, and full automation during power failures. “In the event of a mains failure, SkyRail can automatically switch to an onboard battery and drive safely to the next station in driverless mode,” says Wang.

Each morning, SkyRail trains can automatically wake up and enter the network after carrying out tests on traction, braking, doors, lighting, batteries, and air conditioning. They’re then able to operate automatically and, after completing their set schedules, automatically return home and sleep. Before and during operation, SkyRail trains carry out self-diagnostics comprising more than 300 tests on their entire system. The system also works perfectly well in extreme temperatures, able to adapt to lows of -40 °C and withstand highs of up to 80 °C.

As well as BYD’s control and positioning technology, SkyRail uses Huawei’s eLTE communications technology in the shape of its 4.5G rail wireless network, which acts as a channel for the fast and

efficient transmission of information. The Huawei solution has three important advantages: First, thanks to 4.5G’s high reliability, low latency, and A+B dual-network configuration, eLTE provides a more reliable communication network for SkyRail’s driverless systems to ensure low-latency service handover and service continuity when the trains are moving, which increases SkyRail’s reliability.

Second, eLTE’s advanced anti-interference technology can handle interference by virtue of end-to-end encryption and authentication algorithms, making car-ground communication more secure and stable.

Third, eLTE’s advantages in coverage capabilities, multi-user access capabilities, and QoS guarantees mean multiple services like railway signaling, passenger information systems, and closed-circuit television can be carried over a single network, enabling simple and smart car-to-ground communication over the network. According to Wang, “Huawei’s 4.5G wireless network for railways meets SkyRail’s requirements for reliability, efficiency, and intelligence.”

Already off to a great start, BYD hopes to play a greater role in narrowing the physical distance between people by expanding its operations on a global scale and building a strong collaborative ecosystem. [www](#)