Hydrogen power: China backs fuel cell technology

Producers are buying foreign tech but industry must build for future after subsidies

Henry Sanderson in Yunfu, Guangdong January 2, 2019

Stung by the impact of the financial crisis, the hilly city of Yunfu in China’s southern Guangdong province decided in 2009 it was time for a makeover. Known over hundreds of years for producing delicate stones for arts and crafts, the city had few modern industries apart from consumer appliances. So officials decided to lop the top off the surrounding hills and build a 13.4 sq km industrial park focused on fuel cells — a rival technology to internal combustion engines and electric batteries. Attracted by generous government subsidies, a whole suite of companies covering the supply chain have now set up in the park, which is producing hundreds of buses and small trucks using fuel cells that run on hydrogen gas. So successful has it been that local officials now plan to flatten two more hills to create a neighbouring vehicle manufacturing plant and a chemicals facility. “When we moved here it was all barren hills,” says Frank Ma, chairman of Guangdong Nation Synergy Hydrogen Power Technology, walking along a line of bright blue fuel cell buses. “Your first impression [of the area] is that this is not the kind of place to do this kind of manufacturing. [But] this is a special kind of industry in China.” The Yunfu park is the epitome of China’s powerful industrial policy — which is designed to use generous subsidies to develop and dominate emerging industries critical to the “Made in China 2025” shift to high-end manufacturing. Beijing has spent an estimated $58.8bn subsidising its electric car industry over the past decade, according to the US-based Center for Strategic and International Studies, creating the world’s largest market for electric cars as well as a dominant position in batteries — surpassing Japan and South Korea. Subsidies have also helped propel Chinese solar makers into the ranks of the world’s largest producers, overtaking competitors in the US and Europe.
Now Beijing hopes to do the same for fuel cells — which along with electric vehicles could help decarbonise the entire transportation fleet and reduce China’s vast reliance on imported oil. While fuel cells are unlikely to compete with batteries for small passenger cars because of the latter’s continued reduction in costs, they could play a role in larger vehicles such as trucks and buses, as well as in ships and trains. “If you look at what China did in solar, in wind and in battery electric vehicles the subsidy tap was opened and it brought a lot of capital and companies to these new markets, which resulted in China being the leader in all three of these segments,” says Randy MacEwen, chief executive of Canada’s Ballard Power, one of the world’s largest fuel cell manufacturers. “We expect to see something similar with the fuel cell industry.”

China’s rush into fuel cells could be an expensive gamble, however. The vehicles need to be able to compete without subsidies just as batteries are becoming ever cheaper, quicker to charge and able to hold more energy for the same amount of weight. Tesla chief executive Elon Musk has dismissed fuel cells and hydrogen as “mind-bogglingly stupid”. The power of China’s subsidy machine can be seen in the southern city of Shenzhen, which grew from a fishing village along the Sham Chun river that separates the mainland from Hong Kong into one of its most vibrant cities and home to some of its largest technology companies. Almost the entire taxi fleet uses electric cars made by hometown producer BYD, the world’s largest electric car manufacturer that is backed by Warren Buffett’s Berkshire Hathaway. The buses are also all electric. Almost half of all battery and plug-in hybrid vehicles sold this year will be sold in China. Thanks to government rules that restricted domestic car companies from buying batteries from foreign producers, Chinese battery maker CATL has become the world’s largest producer, overtaking
rivals LG Chem and Panasonic. Based in Ningde, in southeastern Fujian province, CATL this year signed deals to sell batteries to BMW and Daimler and announced plans to build a factory in Germany. Just as it was in batteries five years ago, China is a laggard in fuel cells, behind Japan and South Korea as well as the US and Europe. Toyota has consistently bet on the technology and launched its first fuel cell car, the Mirai, in late 2014. It sells for about £65,000. Hyundai’s Nexo fuel cell model goes on sale this year for a similar price.

To overcome that laggard status, Chinese companies last year began a concerted effort to acquire and integrate foreign technology. In May BYD announced it was working with the US Hybrid Corporation on a hydrogen-powered fuel cell bus to run in Honolulu airport. And in November Weichai Power, China’s largest state-owned diesel engine maker, spent $184m on a 20 per cent stake in Ballard. This month Weichai also paid £48m for a 20 per cent stake in UK-based fuel cell maker Ceres Power. Phil Caldwell, Ceres chief executive, says the size of the Chinese market was too big for his company to ignore. The company plans to transfer its technology to Weichai and jointly invest in a manufacturing facility in
eastern Shandong province. The fuel cells will initially run on buses using compressed natural gas before the hydrogen infrastructure is built, he says. “While we talk a lot about these technologies in Europe the Chinese government is actually pushing ahead,” Mr Caldwell says. “They can create the market and create the demand and drive these technologies down the cost curve.” Ballard says its joint venture with Weichai will aim to make at least 2,000 fuel cells a year for commercial vehicles by 2021 — the largest planned deployment to date. The company says the total cost for customers to buy and operate a fuel cell bus will be the same as for a battery-driven vehicle by 2020. “If you look at the costs we’re [currently] at a premium [compared] to battery electric vehicles,” says Mr MacEwen. “What hasn’t happened yet in the fuel cell market is the power of volume. China is a market that has proven that with subsidies they will drive production capacity and volume and see significant cost reductions.” Benny Oeyen, a former executive for General Motors in Shanghai, stands next to a fuel cell bus made by Feichi Bus in Yunfu and watches the water come out of the exhaust pipe. “I think this is the answer to the energy challenge of mankind,” says Mr Oeyen, now head of market development for platinum group metals at Anglo American. “It’s no longer pie-in-the-sky PowerPoint presentations.” All told, China will have spent about Rmb85bn ($12.4bn) on supporting fuel cell powered vehicles last year, in a mix of national and local subsidies. The technology received high-level support in October when Wan Gang, a former minister of science and technology who is considered the father of China’s push into electric cars, said “the next era belongs to fuel cell technology”. While Chinese subsidies for battery electric vehicles are expected to be phased out by 2020 they will continue for fuel cells to at least 2025, according to some in the industry.
The money has helped China reach its annual target of 5,000 fuel cell vehicles two years early — around the same number of vehicles as California. Industry participants say China could hit a target of 2m fuel cell vehicles by 2030, about 5 per cent of the total vehicle fleet. Under the current scheme, manufacturers of fuel cell vehicles are guaranteed to make a profit. They can receive as much as $30,000 from the central government per vehicle — provided it is driven at least 20,000km and meets minimum power requirements. They can also receive a local government subsidy that varies by region. “With the current subsidies the producer of the fuel cell bus is making money from day one,” says Mark Sun, head of
marketing in Asia for Anglo American Platinum, which is looking to boost demand for platinum through its use in fuel cells. The subsidies have prompted a host of Chinese companies to start producing fuel cell vehicles, including the country’s largest car manufacturer, SAIC Motor, and its largest electric bus maker, Yutong Bus. Yu Yi, head of fuel cell research at SAIC, says that when the company reaches a target of 10,000 fuel cell vehicles the “costs can be reduced substantially”. State-owned companies have also started to build hydrogen refuelling stations, with China Energy, the country’s largest power company, building one of the country’s biggest in the city of Rugao in eastern Jiangsu province. The price of hydrogen is also heavily subsidised, often making it cheaper than diesel.

Fuel cells have a number of advantages for China. They can help reduce the country’s reliance on imported energy as well as raw materials. While lithium-ion batteries require a host of metals such as cobalt, lithium and nickel, most fuel cells only require platinum, of which there is an abundant supply, as a catalyst, at a level of around 0.5 to 0.6 grammes per kilowatt. “In terms of resource adequacy, it’s a lot easier to see how you do it for fuel cells than for lithium-ion batteries,” says Paul Gait, an analyst at Bernstein. “If you go to the northern rim of the Bushveld [in South Africa] there’s enough platinum to electrify the entire auto fleet.” China may also have a solution for being self-sufficient in hydrogen. While most hydrogen is created from fossil fuels such as methane and used in the refining and chemical industries, another method is to produce it using electricity to split water, a process known as electrolysis. This process is not an efficient use of energy, but it makes sense when the cost of electricity is free. Beijing’s huge investment in renewable energy over the past decade has caused a lot of electricity to be
wasted, since intermittent wind and solar power cannot be properly integrated into the grid. China can use some of that wasted energy to generate hydrogen cheaply, says Nick Ni, general manager of Nantong Angstrom Renewable. It is estimated that around 150 gigawatts of renewable energy generating capacity is abandoned in China every year because it cannot be integrated into the grid. That could be used to power 18m passenger cars, says Ju Wang, deputy secretary-general of the International Hydrogen Fuel Cell Association. “China does not need to worry about hydrogen supply.” Despite this optimism, fuel cells will face fierce competition from batteries, given the amount of money that is going into that sector. The global battery market is expected to increase 10-fold by mid-century to $500bn, according to Bernstein Research, with costs expected to fall to parity with petrol engines by 2023. That is without any government subsidy. Carmakers from Tesla to Daimler have also launched electric trucks that will compete with fuel cells. “It gets more difficult for fuel cells — it’s not a matter of catch-up, it’s catching up with something that’s moving ahead of you all the time,” says Peter Harrop, chairman of consultancy IDTechEx. “China is backing all horses just in case.”

Sceptics also warn that China’s push into fuel cells could end up repeating its experience with electric cars, where government spending has created huge amounts of production without making sure there is real demand. There are more than 100 domestic electric vehicle makers in the Chinese market. “Can we identify electric car and fuel cell producers that will survive the inevitable consolidation? At some point there will be a war of attrition, and I’m not clear how they are going to go about that,” says Scott Kennedy, a senior adviser at CSIS. Mr Ma in Yunfu is hesitant when asked if he can survive without subsidies. “Subsidy dependence is hard to get rid of,” he says. Adding that if the whole experiment fails “the best fuel-cell vehicles are still scrap metal”. But he insists that once his company can produce more than 100,000 fuel cells stacks a year, up from the current 2,000, its buses should be competitive against battery-powered rivals. “I said to the Guangdong government, if you can purchase 100,000 vehicles I can give you a price 30 per cent lower than electric vehicles,” Mr Ma says. “Our target from the first day was to survive beyond government subsidy and support. Our goal is to keep costs down and completely commercialise. “The government has given a promise to the world that we have to reduce pollution,” he adds.