

Refire (2570 HK)

New subsidies, lowering costs may make fuel cell competitive in 2027

Initiate with BUY. Shanghai REFIRE Group Limited (“Refire”) is a leading player in the hydrogen industry, starting with fuel cell system manufacturing and later expanding into key components and hydrogen production system making. It has been in the top two fuel cell makers in China since 2021, with better know-how in key components, greater cost control capabilities and earlier overseas exposure than its peers.

- New subsidies as positive catalyst in the short term.** We expect a new round of fuel cell subsidy scheme to be announced in 1H26, with more demonstration city clusters and total subsidy budgets more than doubled than last round in 2021-25. We estimate new subsidy scheme to support hydrogen-powered vehicle sales volume of 96,000-120,000 units in 2026-30, 4x higher than last round in 2021-25. Hydrogen production and infrastructure building may also benefit, as the new scheme is expected to cover more downstream applications, not only fuel cell vehicles.
- Fuel cell could be a good supplement in HDT, with possible inflection point in 2027.** We estimate the total cost of ownership (TCO) of a fuel cell heavy-duty truck (HDT) without any subsidies to be close to that of a diesel HDT in 2027. That means the payback period could be less than two years with our estimated purchase subsidies and expressway toll exemption in 2027, which could make fuel cell HDT attractive to Chinese truck buyers. In the short term, hydrogen refuelling price is key to making fuel cell HDTs economical to diesel HDTs, as we analyze costs for hydrogen production, transportation and station operation. In the long term, we see huge room for cost reduction for the key components of a fuel cell system amid technological advancement and greater economies of scale. We project fuel cell system’s costs to fall to RMB520/kW in the steady state, vs. about RMB1,500/kW now, or a payback period of 1.5 years vs. a diesel HDT. Therefore, we believe fuel cell could be a good supplement in the HDT market, taking up a meaningful market share, especially in the long-haul transportation segment, based on our TCO analysis assuming established infrastructure.
- Earnings/Valuation.** We project Refire’s revenue to rise 1%/14%/123% YoY to RMB655mn/749mn/1,670mn in FY25-27E, based on our anticipation of new subsidies, Refire’s competitive edge and cost reduction roadmap. We expect Refire’s net losses to narrow during FY25-27E and turn profitable at operating level in FY28E. We initiate with a BUY rating and target price of HK\$80.00, based on 4x our FY27E P/S. We believe such valuation is justified given Refire’s fast revenue growth potential and its peer SinoHytec (688339 CH/2402 HK, NR)’s H share trading at 4.2x FY27E P/S now.

Earnings Summary

(YE 31 Dec)	FY23A	FY24A	FY25E	FY26E	FY27E
Revenue (RMB mn)	895	649	655	749	1,670
YoY growth (%)	48.1	(27.5)	1.0	14.4	122.8
Gross margin (%)	20.1	17.2	12.0	18.2	22.4
Operating profit (RMB mn)	(455.9)	(660.2)	(374.2)	(301.8)	(113.2)
Net profit (RMB mn)	(529.5)	(737.3)	(540.3)	(428.8)	(242.3)
P/S (x)	4.5	6.2	6.2	5.4	2.4
Net gearing (%)	(35.0)	(33.2)	(60.4)	(77.4)	(45.4)

Source: Company data, Bloomberg, CMBIGM estimates

BUY (Initiate)

Target Price HK\$80.00
Up/Downside 63.3%
Current Price HK\$49.00

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Stock Data

Mkt Cap (HK\$ mn)	4,568.4
Avg 3 mths t/o (HK\$ mn)	85.0
52w High/Low (HK\$)	283.00/46.08
Total Issued Shares (mn)	93.2

Source: FactSet

Shareholding Structure

Mr. Lin Qi	19.7%
Others	80.3%

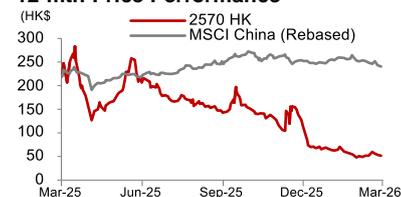
Source: HKEx

Share Performance

	Absolute	Relative
1-mth	-5.1%	0.7%
3-mth	-56.7%	-53.9%
6-mth	-65.0%	-63.7%

Source: FactSet

12-mth Price Performance



Source: FactSet

Focus Charts

Figure 1: TCO analysis for 49-ton fuel cell HDTs (2025-27) and HDTs with other powertrains

	Fuel cell HDT			Diesel HDT	Natural gas HDT	Battery electric HDT
	2025	2026E	2027E			
Vehicle price ('000 RMB)	546	889	568	376	438	546
Vehicle cost ('000 RMB)	827	765	718	300	350	470
Fuel cell system	360	328	300	-	-	-
Hydrogen storage system	155	132	118	-	-	-
Battery	32	30	30	-	-	190
Powertrains excl. battery (engine, motor etc.)	80	75	70	100	150	80
Vehicle body	200	200	200	200	200	200
Gross margin assumption	10%	10%	13%	13%	13%	13%
Government subsidies ('000 RMB)	(378)	-	(300)	-	-	-
Purchase tax and other expenses ('000 RMB)	5	39	37	32	36	5
Fuel costs ('000 RMB)	3,540	3,046	2,566	2,945	1,964	1,428
Fuel consumption per 100km (kg, kWh)	8.5	8.0	7.7	33	33	150
Fuel price (RMB/kg, RMB/kWh)	35	32	28	7.5	5.0	0.8
Annual mileage assumption ('000 km)	170	170	170	170	170	170
Lifespan (year)	7	7	7	7	7	7
Maintenance costs ('000 RMB)	518	518	518	539	469	434
Expressway tolls ('000 RMB)	1,275	1,275	1,275	1,785	1,785	1,785
Annual tolls assumption ('000 RMB)	255	255	255	255	255	255
Lifespan (year)	7	7	7	7	7	7
Number of years with tolls waived	2	2	2	-	-	-
Total cost of ownership ('000 RMB)	5,879	5,728	4,926	5,646	4,656	4,193

Source: CMBIGM estimates

Figure 2: TCO analysis for 49-ton HDTs with our assumptions of fuel cell costs in steady state

	Fuel cell HDT	Diesel HDT	Natural gas HDT	Battery electric HDT
Driving range (km)	920	1,300	1,300	250
Vehicle price ('000 RMB)	640	376	438	575
Vehicle cost ('000 RMB)	513	300	350	470
Fuel cell system	169	-	-	-
Hydrogen storage system	56	-	-	-
Battery	18	-	-	190
Powertrains excl. battery (engine, motor etc.)	70	100	150	70
Vehicle body	200	200	200	200
Gross margin assumption	13%	13%	13%	13%
Purchase tax and other expense ('000 RMB)	50	32	36	46
Fuel costs ('000 RMB)	1,702	2,945	1,964	1,428
Fuel consumption per 100km (kg, L, kWh)	6.5	33	33	150
Fuel price (RMB/kg, RMB/kWh)	22.0	7.5	5.0	0.8
Annual mileage assumption ('000 km)	170	170	170	170
Lifespan (year)	7	7	7	7
Maintenance costs ('000 RMB)	518	539	469	434
Expressway tolls ('000 RMB)	1,785	1,785	1,785	1,785
Annual tolls assumption ('000 RMB)	255	255	255	255
Lifespan (year)	7	7	7	7
Total cost of ownership ('000 RMB)	4,645	5,646	4,656	4,222

Source: CMBIGM estimates

Figure 3: Cost breakdown for fuel cell system

RMB/kW	Now	Our assumption for steady state
Stack cost	1,000	300
MEA	600	200
Proton exchange membrane	165	45
Catalyst layer	240	100
Gas diffusion layer	160	40
Others	35	15
Bipolar plate	223	50
Others	177	50
Balance of plant (BOP)	500	220
Fuel cell system cost	1,500	520

Source: Company data, CMBIGM estimates

Figure 4: Our forecasts for bipolar plate's potential cost cuts

	Now	Our assumption for steady state
Bipolar plate's basic information and assumptions:		
Stack power (kW)	90	90
Number of cells in the stack	255	89
Power of a cell (kW)	0.35	1.01
Voltage of a cell (V)	0.6	0.8
Electric current density (A/cm ²)	2.1	3.0
Area of reaction zone (cm ²)	280	420
Reaction zone as % of total area of a bipolar plate	49%	52%
Total area of a bipolar plate (cm ²)	570	808
Thickness of a bipolar plate (cm)	0.14	0.14
Raw-material density of a bipolar plate (g/cm ³)	2.25	2.25
The weight of a bipolar plate (g)	180	254
Production assumptions:		
Annual production capacity (units)	360,000	1,200,000
Production yield rate	90%	95%
Graphite price (RMB/metric ton)	58,000	53,000
Graphite costs for one bipolar plate (RMB)	10	13
Other material (resin, glue etc.) costs for one bipolar plate (RMB)	3	3
Material costs of a bipolar plate (RMB)	14	17
Equipment investments (mn RMB)	40	90
Assumption for depreciation years	5	5
Annual rental costs (mn RMB)	1.2	1.8
Depreciation & rental costs of a bipolar plate (RMB)	26	17
Number of workers needed	100	100
Annual salary per worker (RMB)	100,000	110,000
Labor costs of a bipolar plate (RMB)	28	9
Total annual manufacturing costs (mn RMB)	4	10
Manufacturing costs of a bipolar plate (RMB)	11	8
Total cost of one piece of bipolar plate (RMB)	79	51
Total cost of bipolar plate per 1kW (RMB)	223	50

Source: Company data, CMBIGM estimates

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Company Overview

A leading hydrogen player covering fuel cell systems, key components and hydrogen production

Founded in 2015, Refire started with manufacturing and sales of hydrogen fuel cell systems. Its 1st-generation product, the Caven Series, was launched in 2017 with the fuel cell stacks outsourced. In 2020, Refire launched a new-generation fuel cell system named Prisma with its proprietary fuel cell stacks. The 1st-generation stack named Polaris that Refire made in 2020 sourced two key components (membrane-electrode assemblies (MEAs) and bipolar plates) from foreign suppliers. In 2021, Refire started to produce its proprietary MEAs in Shanghai, which were equipped in its 2nd-generation stack named Electra. The 3rd-generation stack named Sirius, which started mass production in 2023, uses both self-made MEAs and bipolar plates, as Refire has been producing its own bipolar plates in Jiaxing, Zhejiang, since 2023. The in-house research and production of key components, along with the joint development with Chinese raw-material suppliers, have cut average cost of sales for its fuel cell system from RMB3,070/kW in 2021 to RMB1,894/kW in 2023, derived from its financial data disclosed in the IPO prospectus. We estimate such costs to be about RMB1,500/kW in 2025E. The production of its proprietary MEAs and bipolar plates are mainly under its subsidiaries Shanghai Unilia and Zhejiang Unilia, respectively.

Figure 5: Refire's major fuel cell system products with different proprietary stacks

Stack series	P Series	E Series	S Series
Illustrations			
Models	Prisma 6, Prisma 8, Prisma 11	Prisma 12+	Prisma 8, Prisma 12+, Prisma 18, Prisma 22
Self-made key components	Fuel cell stacks	Fuel cell stacks, MEAs	Fuel cell stacks, MEAs, bipolar plates
Fuel cell stacks equipped	Polaris series	Electra series	Sirius series
Rated power	63kW-110kW	120kW-130kW	80kW-220kW
Power density under rated power	400W/kg-541W/kg	556W/kg-702W/kg	487W/kg-815W/kg
Commencement of production	2020	2021	2023

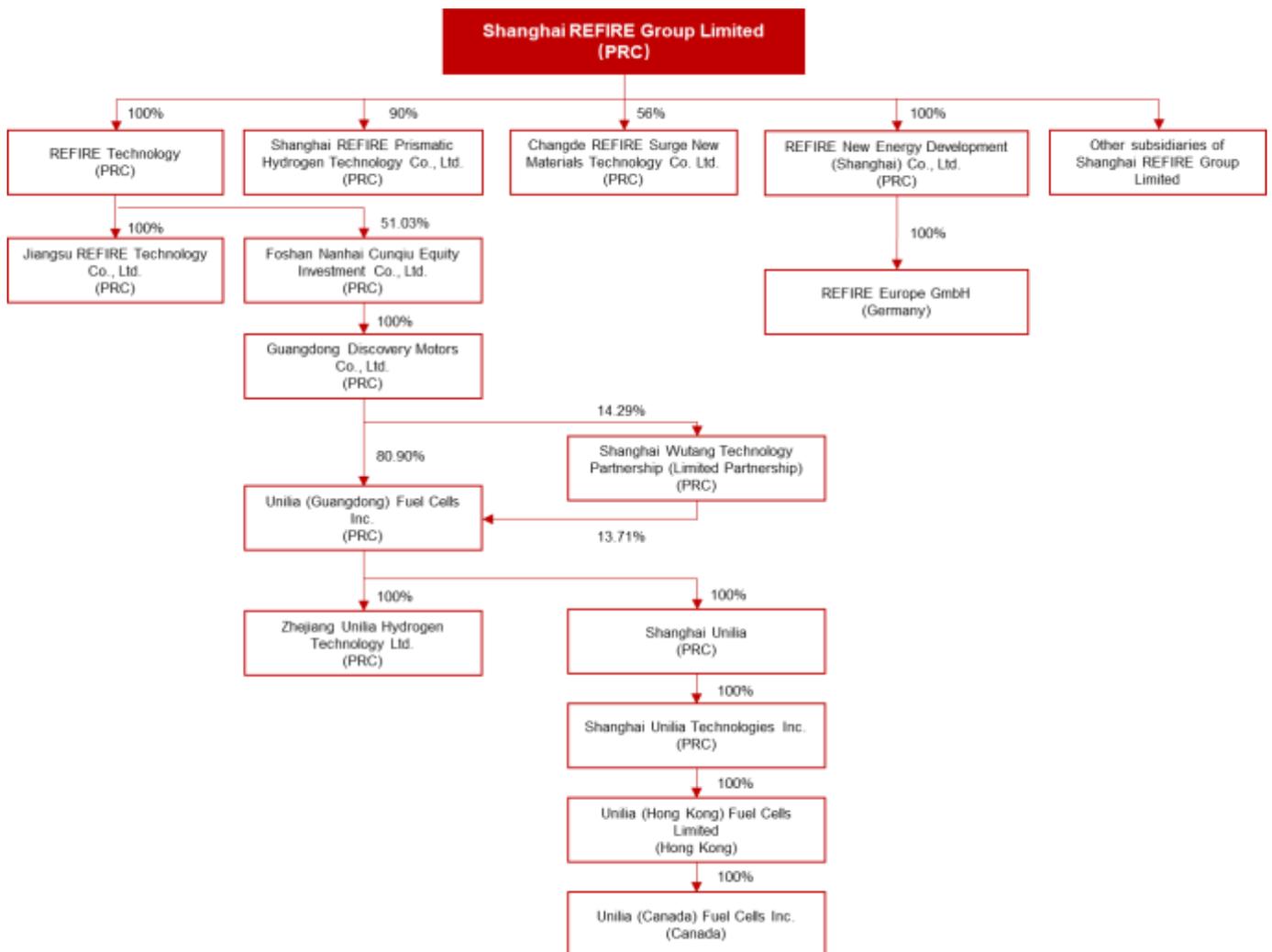
Source: Company data, CMBIGM

In 2023, Refire further extended its business into hydrogen production. The company develops hydrogen production systems with both Alkaline (ALK) water electrolysis and proton-exchange membrane (PEM) water electrolysis methods, mainly through its subsidiaries Changde REFIRE Surge New Materials Technology and Shanghai REFIRE Prismatic Hydrogen Technology. Management has determined to focus on PEM hydrogen production given its better compatibility with renewable energy electricity and less competitive landscape.

In Jan 2024, Refire acquired 70% equity interest of Jiaqing (Shanghai) Industrial, turning it from an associate to a wholly-owned subsidiary. Jiaqing mainly operates hydrogenation stations.

Refire also partners with industry peers, including Shanghai Zhengtai Hydrogen Energy (a subsidiary of CHINT Group), Xiongchuan Hydrogen Technology and FAW, to develop key components for fuel cell system, hydrogen-powered commercial vehicles, fuel cell products for different applications and etc., mainly through associates.

Figure 6: Company structure



Source: Company data, CMBIGM

Refire has been downsizing number of employees since 2024 amid improving operational efficiency and industry headwinds with diminishing subsidies. The company had 395 employees as of 30 Jun 2025, down from 414 as of 31 Dec 2024 and 531 as of 20 Feb 2024. R&D personnel accounted for 27.6% of total employees and production personnel took up 18.0% as of 24 Aug 2024.

The company's founder, Mr. Qi Lin, who is also the chairman of the Board and CEO of the company, has about 20 years of experience in the fuel cell industry. He worked as an engineer in Shanghai Shenli Technology Co., Ltd. and SAIC Motor (600104 CH, NR) prior to founding Refire. He held about a 13.23% equity interest of the company directly as of 31 Jan 2026 and is the general partner and executive partner of Refire's employee incentive platforms which combined held about a 6.46% equity interest of the company as of 31 Jan 2026. Dr. Zhe Hu, who serves as COO and president, has over 15 years of experience in automotive fuel cell systems with 5.5 years at SAIC Motor. The average age of the five executive directors is about 42, ranging from 40-44. The senior management team has an average age of 45, ranging from 37-70.

Well positioned with leading technologies, established capacity, cost control capabilities and overseas expansion

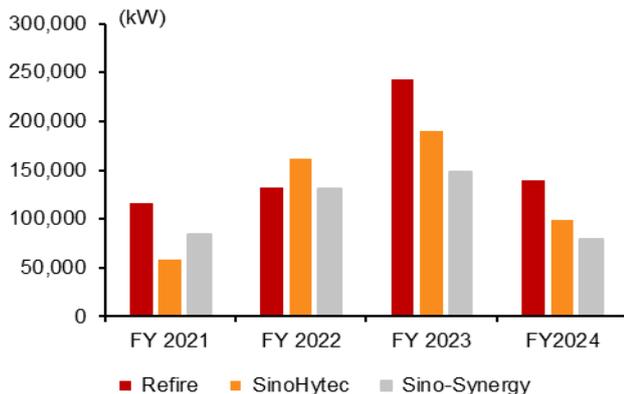
Refire is a leading fuel cell system maker in China, along with peers including SinoHytec (688339 CH/2402 HK, NR), Sino-Synergy (9663 HK, NR), State Fuel Cell Technology, Shanghai Hydrogen Propulsion and FTXT. Refire has secured the top 2 fuel cell system

makers in China in terms of power output since 2021. We estimate Refire's market share in China's fuel cell systems to be 18-27% during 2021-24.

As State Fuel Cell Technology, Shanghai Hydrogen Propulsion and FTXT are unlisted and thus have limited operational and financial data, we compare Refire with SinoHytec and Sino-Synergy to better understand their positioning in the industry.

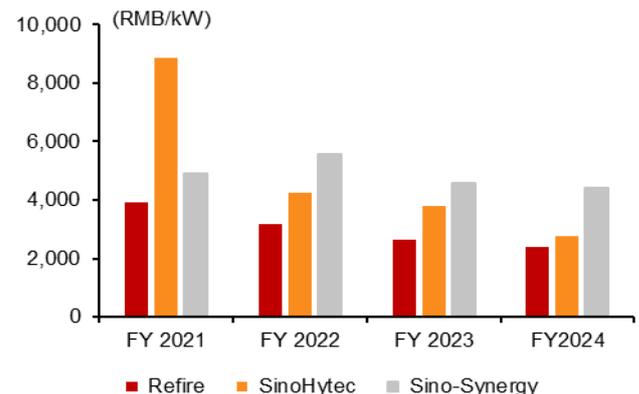
Refire had the highest YoY sales growth among the three leading Chinese players in FY23, both in terms of power output (+83% YoY) and revenue (+48% YoY). It was also the most resilient when facing the industry headwinds in FY24-25. Both fuel cell system sales power output and total revenue at Refire fell the least in FY24 among the three players, based on the data from annual reports and our estimates.

Figure 7: Fuel cell system sales power output



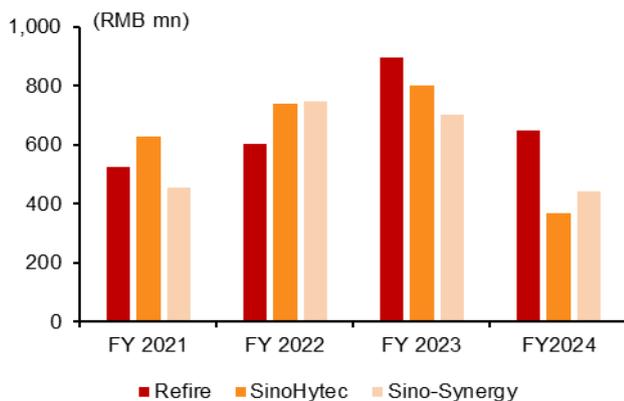
Source: Company data, CMBIGM estimates

Figure 8: Fuel cell system ASP comparison



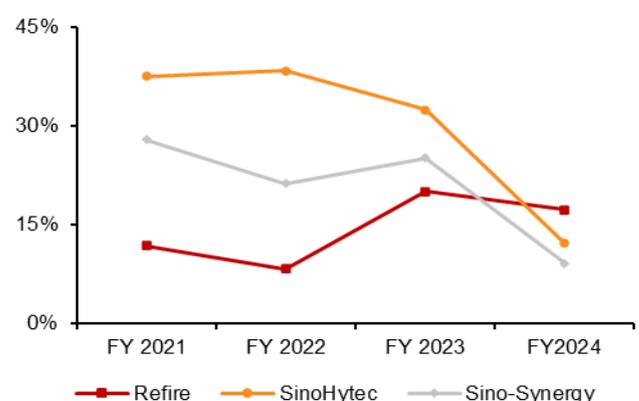
Source: Company data, CMBIGM estimate

Figure 9: Total revenue comparison



Source: Company data, CMBIGM

Figure 10: Companywide gross margin comparison



Source: Company data, CMBIGM

Refire had the lowest average selling price (ASP) per kW for fuel cell systems in the past years among the three players, and one of the reasons is due to its highest market share in HDT's fuel cell systems. About 86.3% of Refire's fuel cell systems were used in HDTs in 2023, much higher than 58.3% at Sino-Synergy and 52.7% at SinoHytec. Despite its lower ASP, Refire's gross margin was the highest (12%) among the three in FY24. In fact, Refire's gross margin has also become the most resilient during industry headwinds: It narrowed the least YoY in FY24 among the three leading players. That largely reflects Refire's superb cost control capabilities.

We are of the view that technological capabilities are the foundation for Refire's cost control capabilities. Refire started with the fuel cell system manufacturing and expanded to the stack, as well as key components of the stack, including MEA and bipolar plates, as noted above. Sino-Synergy started with the stack manufacturing and expanded into the fuel cell system. Sino-Synergy produces its proprietary graphite bipolar plates but purchases MEAs from suppliers. Similar to Sino-Synergy, SinoHytec also procures MEAs from suppliers. In 2015, SinoHytec acquired 25.6% equity interest of Sino Fuel Cell which provides graphite bipolar plates to SinoHytec.

Refire's technological advantage is not limited to higher portion of proprietary core components than peers, but also longer lifespan and fuel efficiency. That also explains why Refire has the highest market share of fuel cell systems used in HDTs, as the mileage requirement is crucial to HDTs.

Refire has also established ample capacity in a preparation of potential industry inflection point. It has an annual production capacity of about 5,000 units for both fuel cell systems and stacks, 0.4mn units for bipolar plates and 1.2mn units for MEAs. We expect such capacity to be sufficient by FY27.

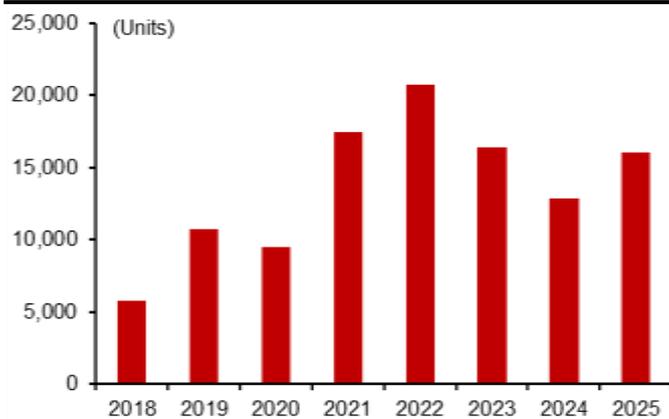
Refire has been exploring overseas markets in the past few years. Refire's overseas revenue more than doubled YoY to RMB58mn in FY24, accounting for about 9% of its total revenue. SinoHytec generated about RMB9mn revenue in the overseas markets in FY24, or less than 3% of its total revenue. There has not been any meaningful overseas income for Sino-Synergy, based on its FY24 annual report disclosure.

New Subsidies around the Corner

Unlike other countries, commercial vehicles dominate the application of fuel cell systems in China now, as China's fuel cell subsidy scheme in 2021-2025 was focused on vehicles, especially on commercial vehicles. Commercial vehicles utilized about 95% of the hydrogen fuel cell systems in 2023 in China, in terms of kW, according to Frost & Sullivan, while the ratio was only 28% for the globe in 2023. Globally, passenger vehicles and stationary power utilized another 28% and 30% of the hydrogen fuel cell systems in 2023.

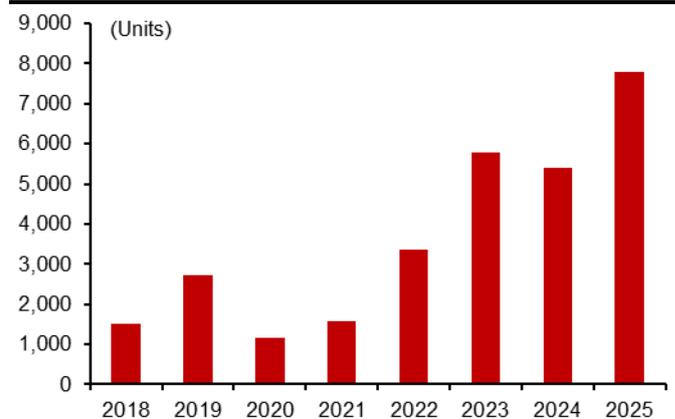
China's fuel cell vehicle sales volume started to surge (more than doubled YoY) in 2022 when subsidy details were confirmed and five demonstration city clusters were approved. Sales volume CAGR during 2023-25 fell to 16%, according to China Association of Automobile Manufacturers (CAAM), as the subsidy scheme was nearing the end. China sold about 7,800 units of fuel cell vehicles in 2025, or almost half of global total.

Figure 11: Global fuel-cell vehicle sales volume



Source: SNE Research, CMBIGM

Figure 12: China's fuel-cell vehicle sales volume



Source: CAAM, CMBIGM

New subsidy scheme may support 4x sales volume than last round

A new round of subsidy scheme is likely to be announced in 1H26, which may take less time to be implemented than last round, based on our channel checks. More importantly, the number of demonstration city clusters is likely to be increased from 5 during 2021-25 to 8-10 during 2026-30. **Total subsidy budgets** from both central and local governments are likely to be more than doubled from RMB17bn during 2021-25 to **RMB32-40bn** during 2026-30. In addition, the downstream applications to be subsidized this time will be broader than last time, not limited to vehicles only. That could benefit green hydrogen production and hydrogen infrastructure building, in our view.

Assuming 60% of subsidies being used on vehicles with an average subsidy of RMB200,000 per vehicle, the upcoming new subsidy scheme could support hydrogen-powered vehicle sales volume of about 96,000-120,000 units during 2026-30, vs. about 25,000 units during 2021-2025. Therefore, we expect fuel cell vehicle sales volume to be 20,000-30,000 units in both 2027 and 2028. We also project Refire's market share to be around 18-20% in 2027-28, taking both Refire's leading technologies, established capacity and rising competition into account.

Meanwhile, we also expect new subsidies to favor fuel cell systems with higher power output. Any fuel cell system with power output of 110kW or above was entitled to the same maximum subsidy in the previous scheme. We expect the threshold for the maximum subsidy in the new scheme to be 180kW or even higher.

Possible Inflection Point in 2027; TCO Analysis Shows Fuel Cell Could Be a Good Supplement in HDT Segment

Fuel cost as key to transitioning to market driven in the short term

We are of the view that hydrogen-powered vehicle sales in the past years were policy driven, as both purchase price and TCO of a fuel cell HDT are still higher than diesel or natural gas HDTs, as illustrated in Fig. 13.

Despite government subsidies and declining costs for fuel cell system in the past few years, we estimate that the purchase price for a 49-ton HDT was still about RMB170,000 higher than an equivalent diesel HDT in 2025. We assume the average assumption per HDT was RMB378,000, or half of the level in 2024, as 2025 was the last year of China's previous round of fuel cell vehicle subsidy scheme and some regions have used up the budgets. Unlike battery electric HDTs which have much lower fuel costs than diesel HDTs, hydrogen price was so high that it costs about RMB85,000 higher than refueling diesel every year, or about RMB595,000 higher during the entire lifespan, based on our estimates, assuming hydrogen price of RMB35/kg and a total mileage of 1.2mn kilometers in the lifespan.

Apart from vehicle-purchase subsidies, some local governments including Henan, Shaanxi, Liaoning, Jilin and Shandong started to waive expressway tolls for hydrogen-powered vehicles from 2024. Most waivers have been extended into 2027 but are limited to intra-province transportation. Therefore, we assume such policies could contribute a cost saving of about RMB510,000 in the lifespan of a fuel cell HDT, equivalent to a 2-year expressway toll exemption given the region limitation.

Figure 13: Our estimated TCO analysis for 49-ton HDTs with different powertrains in 2025

	Fuel cell HDT	Diesel HDT	Natural gas HDT	Battery electric HDT
Vehicle purchase price ('000 RMB)	546	376	438	546
Vehicle cost ('000 RMB)	827	300	350	470
Fuel cell system	360	-	-	-
Hydrogen storage system	155	-	-	-
Battery	32	-	-	190
Powertrains excl. battery (engine, motor etc.)	80	100	150	80
Vehicle body	200	200	200	200
Gross margin assumption	10%	13%	13%	13%
Government subsidies ('000 RMB)	(378)	-	-	-
Purchase tax and other expenses ('000 RMB)	5	32	36	5
Fuel costs ('000 RMB)	3,540	2,945	1,964	1,428
Fuel consumption per 100km (kg, kWh)	8.5	33	33	150
Fuel price (RMB/kg, RMB/kWh)	35.0	7.5	5.0	0.8
Annual mileage assumption ('000 km)	170	170	170	170
Lifespan (year)	7	7	7	7
Maintenance costs ('000 RMB)	518	539	469	434
Expressway tolls ('000 RMB)	1,275	1,785	1,785	1,785
Annual tolls assumption ('000 RMB)	255	255	255	255
Lifespan (year)	7	7	7	7
Number of years with tolls waived	2	0	0	0
Total cost of ownership ('000 RMB)	5,879	5,646	4,656	4,193

Source: CMBIGM estimates

We have analyzed the cost reduction roadmap for HDT's fuel cell systems by breaking down into different components based on the information we have collected, which we will elaborate in detail in the latter part of this report. We estimate that the cost (without subsidies) of a hydrogen-powered 49-ton HDT could drop by 7% YoY in 2026E and 6% YoY in 2027E, taking stake power increase into account, which would still be substantially higher than the purchase price of a diesel HDT. Therefore, the savings from operating costs, mainly fuel costs, tolls and maintenance costs, would be crucial to make fuel cell HDTs more economical than diesel HDTs.

We estimate that the TCO of a fuel cell HDT could be about RMB720,000, or 13% lower than that of a diesel HDT in 2027E, assuming a purchase subsidy of RMB300,000 and 2-year expressway toll exemption. In other words, the payback period would be less than two years. We estimate that the TCO of a fuel cell HDT without purchase subsidy and expressway toll exemption in 2027 could also be close to that of a diesel HDT, largely aided by lower fuel costs.

Figure 14: TCO analysis for 49-ton fuel cell HDTs (2025-27) and HDTs with other powertrains

	Fuel cell HDT			Diesel HDT	Natural gas HDT	Battery electric HDT
	2025	2026E	2027E			
Vehicle price ('000 RMB)	546	889	568	376	438	546
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Fuel cell system	360	328	300	-	-	-
Hydrogen storage system	155	132	118	-	-	-
Battery	32	30	30	-	-	190
Powertrains excl. battery (engine, motor etc.)	80	75	70	100	150	80
Vehicle body	200	200	200	200	200	200
Gross margin assumption	10%	10%	13%	13%	13%	13%
Government subsidies ('000 RMB)	(378)	-	(300)	-	-	-
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Fuel costs ('000 RMB)	3,540	3,046	2,566	2,945	1,964	1,428
Fuel consumption per 100km (kg, kWh)	8.5	8.0	7.7	33	33	150
Fuel price (RMB/kg, RMB/kWh)	35	32	28	7.5	5.0	0.8
Annual mileage assumption ('000 km)	170	170	170	170	170	170
Lifespan (year)	7	7	7	7	7	7
Maintenance costs ('000 RMB)	518	518	518	539	469	434
Expressway tolls ('000 RMB)	1,275	1,275	1,275	1,785	1,785	1,785
Annual tolls assumption ('000 RMB)	255	255	255	255	255	255
Lifespan (year)	7	7	7	7	7	7
Number of years with tolls waived	2	2	2	-	-	-
Total cost of ownership ('000 RMB)	5,879	5,728	4,926	5,646	4,656	4,193

Source: CMBIGM estimates

Fuel costs largely depend on fuel efficiency and fuel price. The current fuel consumption for a hydrogen-powered 49-ton HDT is about 8.0-9.0kg/100km. We project it to decline to 7.7kg/100km on average in 2026. The fuel efficiency is highly correlated with the fuel cell stack's efficiency to convert from hydrogen into electricity. Raising the voltage level could be an effective way to improve the conversion efficiency, all else being equal. We project hydrogen fuel efficiency to drop to 6.5 kg/100km in the long term.

To better understand the potential hydrogen price drop which is key to the fuel cell HDT’s fuel costs, we have analyzed the cost breakdown for hydrogen production, hydrogen transportation and hydrogen station operation.

Hydrogen production: grey hydrogen’s cost advantage could remain for a while

There are several methods to produce hydrogen: 1) directly from traditional sources such as coal or natural gas (grey hydrogen), 2) from traditional sources with carbon capture, utilization and storage (CCUS) technology (blue hydrogen), 3) from renewable energy sources, such as water decomposition by electrolysis (green hydrogen). The majority of hydrogen produced today is still through traditional methods, as the costs are about 50-60% lower than green hydrogen, based on our estimates.

Figure 15: Cost breakdown for hydrogen (H₂) produced through traditional methods

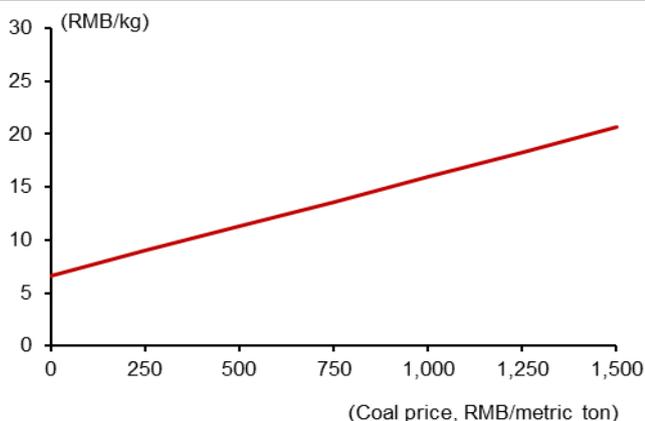
	From coal	From natural gas
Coal, natural gas needed to produce 1kg H ₂ (kg, m ³)	8.4	3.8
Price assumption for coal and natural gas (RMB/kg, RMB/m ³)	0.7	3.6
Raw material costs to produce 1kg H ₂ (RMB)	5.9	13.6
Other material (e.g. O ₂) costs to produce 1kg H ₂ (RMB)	2.8	0.2
Manufacturing, salary and other costs to produce 1kg H ₂ (RMB)	3.1	3.2
Total costs to produce 1kg H₂ (RMB)	11.8	17.0
Margin assumption	10%	10%
H₂ price (RMB/kg)	13.2	18.9

Source: Chemical Industry and Engineering Society of China (CIESC), CMBIGM estimates

As the technologies for hydrogen production through traditional sources are relatively mature, the key to the grey hydrogen price hinges on raw material prices. We estimate that the hydrogen price is about RMB13.2/kg when the coal price is about RMB700/metric ton. If the coal price drops by about 50% to RMB350/metric ton, the hydrogen price could drop by about 25% to RMB9.9/kg.

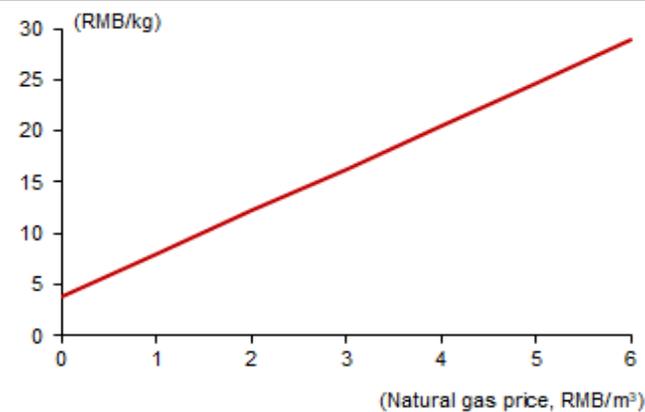
Hydrogen produced from natural gas is more sensitive to raw material prices than that from coal, although hydrogen price is higher when it is made from natural gas based on the current raw material prices. We estimate the hydrogen price to be RMB18.9/kg when the natural gas price is about RMB3.6/m³. Such price could drop by 40% to RMB11.3/kg, if the natural gas price is cut by half to RMB1.8/m³.

Figure 16: H₂ price sensitivity vs. coal price



Source: CIESC, CMBIGM estimates

Figure 17: H₂ price sensitivity vs. natural gas price



Source: CIESC, CMBIGM estimates

Our estimated hydrogen price above does not include the extra costs for CCUS. We estimate that blue hydrogen price could be about 20-40% higher than grey hydrogen price now. In other words, the hydrogen produced from coal could cost about RMB16-17/kg with the CCUS technology, which is still slightly lower than the green hydrogen price at the moment, despite declining investments for green hydrogen production.

There are also several methods to produce hydrogen through water electrolysis based on the diaphragm material of the electrolyser: 1) alkaline water electrolysis (ALK), 2) proton exchange membrane water electrolysis (PEM), 3) high temperature solid oxide electrolysis (SOEC) and 4) anion exchange membranes (AEM) water electrolysis. ALK and PEM are the primary methods for producing green hydrogen now, as SOEC and AEM are still in the early stage of commercialization.

In the past, ALK dominated the green hydrogen production, as the ALK technologies are more mature and have lower dependence on precious metals. For example, ALK accounted for approximately 74% of global electrolyser shipment volume and 97% of China's electrolyser shipment volume in 2023, according to Frost & Sullivan. That may start to change as the PEM equipment investment has been declining. PEM responds faster with a wider adjustment range, making it compatible with renewable energy electricity, which may make PEM more advantageous than ALK in the future green hydrogen production.

Figure 18: Cost breakdown for hydrogen produced through electrolysis of water

	ALK	PEM
H ₂ production efficiency (m ³ /hour)	1,500	800
Assumption for production hours every year	3,000	3,000
Assumed total H ₂ production every year (m ³)	4,500,000	2,400,000
Corresponding total H ₂ production every year (kg)	400,500	213,600
Electricity price assumption (RMB/kWh)	0.25	0.25
Electricity needed to produce 1m ³ H ₂ (kWh)	4.8	4.3
Investments for equipment and land use (RMB)	7,500,000	13,000,000
Assumption for depreciation years	10	10
Depreciation per 1kg H ₂ produced (RMB)	1.9	6.1
Electricity costs to produce 1kg H ₂ (RMB)	13.5	12.1
Maintenance costs per 1kg H ₂ produced (RMB)	1.5	2.8
Total costs to produce 1kg H₂ (RMB)	16.9	21.0
Margin assumption	10%	10%
H₂ price (RMB/kg)	18.7	23.3

Source: CIESC, China National Chemical Information Center (CNCIC), The Orange Group, CMBIGM estimates

Fig. 18 illustrates the cost breakdown for the hydrogen produced by ALK and PEM technologies, assuming total production hours of 3,000 in a year (8.2 hours per day on average), an investment of RMB3mn for land use and electricity price of RMB0.25/kWh (assuming green electricity). The hydrogen price based on the PEM technology is about 24% higher than that based on the ALK technology, as the investments for the PEM equipment is 2.2x higher than ALK based on our estimates. In fact, we estimate that equipment investment for PEM has dropped by about 60% in the past three years. As the total electricity cost for PEM is lower than ALK to produce the same amount of hydrogen, the production cost gap between ALK and PEM would be smaller when the initial investment continues to fall.

We have conducted a sensitivity analysis below to see the potential hydrogen price drop when the equipment investments reduce and/or production hours rise. Increasing utilization rate could be an effective way to lower hydrogen production costs for both ALK and PEM. Hydrogen prices could drop by about 5% and 11% based on current investments for ALK and PEM, respectively, if the production hours rise by 33% to 4,000 per year (11 hours per day on average). The table below shows that the price cuts for hydrogen produced through ALK water electrolysis could be limited. Production efficiency could be more important in lowering hydrogen price produced through ALK. On the other hand, price for hydrogen

produced through PEM water electrolysis could drop at a faster pace to RMB18.9/kg, if the equipment investment is cut by 50% and production hours rise to 4,000 hours per year.

Figure 19: Hydrogen price sensitivity analysis for initial investments and utilization

		ALK equipment investment (mn RMB)				PEM equipment investment (mn RMB)			
		1.5	2.5	3.5	4.5	2.5	5.0	7.5	10
Production hours per year	2,000	19.4	19.8	20.2	20.6	22.4	24.3	26.3	28.2
	3,000	17.9	18.2	18.4	18.7	19.4	20.7	22.0	23.3
	4,000	17.2	17.4	17.6	17.8	17.9	18.9	19.9	20.8
	5,000	16.7	16.9	17.1	17.2	17.0	17.8	18.6	19.4

Source: CIESC, CNCIC, The Orange Group, CMBIGM estimates

The sensitivity analysis in Fig. 19 assumes a fixed electricity cost of RMB0.25/kWh and fixed production efficiency (1,500m³/hour for ALK and 800m³/hour for PEM). Should these two parameters improve substantially, green hydrogen prices could also drop significantly. We believe green hydrogen production could be more widely adopted in the next few years with technology improvement and greater economies of scale to cut costs, as well as possible government subsidies.

Despite the current higher costs of hydrogen production through water electrolysis, there are still possible scenarios for green hydrogen production projects. While lithium-ion batteries are a more cost-effective way to store excess renewable energy, it is not easy to transport to other places when the source of renewable energy (such as solar and wind) is more than enough to satisfy the local electricity needs. In this case, using water electrolysis to produce hydrogen to store the excess renewable energy could be economical.

■ Hydrogen transportation: huge cost cut potential amid government support

Long-tube trailer and pipeline are the common ways to transport hydrogen. As the infrastructure for hydrogen refueling is still at an early stage, long-tube trailer is more commonly used now.

1) By long-tube trailer: flexible for short-distance transport, low initial investment

The cost calculation for hydrogen transport by long-tube trailer involves quite a few assumptions including transportation distance, hydrogen volume needed for a station, hydrogen tank's pressure and working hours for a long-tube trailer. As illustrated by Fig. 20, higher pressure containers could store more hydrogen and thus reduce the number of long-tube trailers and workers needed given the same amount of hydrogen to transport, although the initial investment for containers is higher. Fig. 20 shows our calculations for the hydrogen transportation costs based on the Type I (20Mpa) and Type III (50Mpa) hydrogen tanks, respectively, by assuming a transport distance of 100km, total transportation volume of 0.18mn kg per year (500kg per day), 20 working hours per day for a long-tube trailer and 8 working hours per day for a worker.

Accordingly, we calculate that the costs to transport hydrogen at a distance of 100km by long-tube trailer using the Type I hydrogen tank (20Mpa) would be about RMB6.7/kg. The costs would be about 51% lower, or RMB3.3/kg by using the Type III hydrogen tank (50Mpa), although the initial investment for the hydrogen tank is higher. Type I hydrogen tank is still widely used in the long-tube trailers in China. In our view, government's support in setting the industry standards, not only for the tanks in the long-tube trailers, but also for tanks in the hydrogen-powered HDTs and hydrogen stations, are fairly important to accelerate the industry development at this stage.

Figure 20: Cost breakdown for long-tube trailers to transport hydrogen

Hydrogen tank type	20 Mpa	50 Mpa
The density of H ₂ in the container (kg/m ³)	18	44
Assumption for storage capacity of trailer's container (m ³)	20	20
Assumed % of H ₂ that cannot be transferred from container to hydrogen station	20%	20%
Therefore, actual H ₂ transported per trip (kg)	282	705
We assume the station needs 500kg per day, therefore annual refueling volume as	182,500	182,500
Assumption for the distance between hydrogen station and production plant (km)	100	100
Investments for trailers (RMB)	582,858	532,899
Assumption for depreciation years	10	10
Workers needed to transport H ₂	6	2
Salary per worker (RMB/year)	100,000	100,000
Annual mileages for transportation (km)	129,524	51,810
Assumption for fuel consumption per 100km (L)	25	25
Diesel price (RMB/L)	7.5	7.5
Assumption for maintenance cost and tolls per 1km (RMB)	0.9	0.9
Insurance cost per year (RMB)	10,000	10,000
Electricity consumption to compress 1kg H ₂ (kWh)	1	1
Electricity price (RMB/kWh)	0.6	0.6
Depreciation per 1kg H ₂ transported (RMB)	0.3	0.3
Labor cost per 1kg H ₂ transported (RMB)	3.1	1.2
Fuel cost per 1kg H ₂ transported (RMB)	1.3	0.5
Maintenance cost per 1kg H ₂ transported (RMB)	0.6	0.3
Insurance cost per 1kg H ₂ transported (RMB)	0.1	0.1
Compression cost per 1kg H ₂ transported (RMB)	0.6	0.6
Total cost to transport 1kg H₂ (RMB)	6.0	3.0
Margin assumption	10%	10%
H₂ transport price per kg for a distance of 100km (RMB)	6.7	3.3

Source: CIESC, CMBIGM estimates

If the distance doubles to 200km, the costs to transport hydrogen by long-tube trailers would be about 58% higher at RMB10.6/kg, all else being equal, based on our estimates. That explains why the hydrogen prices differ quite a lot in different regions in China. We are of the view that increasing hydrogen density is key to lowering transportation costs. Yet, long-tube trailer may not be suitable for long-distance hydrogen transportation.

2) By pipelines: need central planning for a long-term optimal solution

Utilization rate is crucial to the hydrogen transportation costs by pipeline given its high initial investment. It means substantial and stable hydrogen demand is needed in the areas along the pipeline. Therefore, it may require government support to do central planning for both the pipes and hydrogen stations to improve the utilization rate of the hydrogen pipeline. The government may also need to lead or subsidize the early projects.

We estimate that the hydrogen transportation costs could be as low as RMB2.3/kg by hydrogen pipe, if the utilization rate is 80%, as illustrated in Fig. 21. It means about 83mn kg hydrogen would be transported every year for a pipe with a diameter of 0.5 meter and a flow velocity of 5 meter/second, or about 2% of total hydrogen produced in China in 2023. Should the utilization rate fall to 40%, the transportation costs would rise to RMB3.8/kg. As

the transportation price is sensitive to the utilization rate, large demand for hydrogen is needed to incentivize hydrogen pipeline building. The transportation price by pipeline is less sensitive to the distance, based on our calculations.

Figure 21: Cost breakdown for pipelines to transport hydrogen

	Pure H ₂ pipe	Natural gas pipe
Pipe diameter (m)	0.5	1.0
Assumption for velocity of flow (m/s)	5	8
Assumption for the proportion of H ₂	100%	5%
Annual capacity to transport H ₂ (m ³)	31,942,852	9,902,304
Assumption for the pressure of the pipe (Mpa)	4	4
The density of H ₂ in the pipe (kg/m ³)	4	4
Loss rate	8%	8%
Utilization rate	80%	80%
Actual H ₂ transported per year (kg)	82,814,074	25,672,414
Assumption for pipe investment per 1km (RMB/km)	6,000,000	1,750,000
Assumption for pipe length (km)	500	500
Total Investment for pipe (mn RMB)	3,000	44
Assumption for depreciation years	30	30
Assumption for total maintenance cost as % of total investment	15%	15%
Electricity consumption to compress 1kg H ₂ (kWh)	1	1
Electricity price (RMB/kWh)	0.6	0.6
Depreciation per 1kg H ₂ transported (RMB)	1.2	0.1
Maintenance cost per 1kg H ₂ transported (RMB)	0.2	0.0
Compression cost per 1kg H ₂ transported (RMB)	0.7	0.7
Purification cost per 1kg H ₂ transported (RMB)	-	0.3
Total cost to transport 1kg H₂ (RMB)	2.0	1.0
Margin assumption	10%	10%
H₂ transportation price (RMB/kg)	2.3	1.1

Source: CIESC, CMBIGM estimates

Another way to transport hydrogen by pipeline is to mix the hydrogen in the natural gas pipeline. That could make the hydrogen transportation costs even lower, if we assume the investment is proportional to hydrogen volume in the pipe. It can also utilize the existing nature gas pipelines to make the cost even lower. Again, it still needs the government support to lead these projects as a demonstration, as these assets are state-owned.

3) Other transportation methods: could be a positive surprise

While liquefying hydrogen by cooling it to cryogenic temperatures (below -252.8 °C) could increase its density, it requires a lot of energy and special containers that work at such low temperatures. We are of the view that it is unlikely to be a widely used option to transport hydrogen in the foreseeable future. Some companies have been exploring new methods to transport hydrogen at a low cost, such as using metal hydride to store and transport hydrogen in a solid form under moderate temperature and pressure. It does not require a lot of energy consumption to liquefy hydrogen but can store hydrogen at a high-density level. A lot of effort has been devoted to find suitable materials that are light and can hold more hydrogen.

■ Hydrogen station operation: economies of scale as the key

We estimate that it would cost about RMB7-10 per 1kg of hydrogen in order to support a hydrogen station operation with a daily hydrogen refueling of 500kg. About half of the costs are related to the operation, including electricity and maintenance costs. The remaining would be land and equipment depreciation, as well as workers' salaries. Apparently, increasing hydrogen refueling amount is the most effective way to lower the operation costs.

■ Hydrogen refueling price may drop to RMB20-25/kg in the medium to long term

In the short term, we believe most hydrogen would still be produced by coal or as a by-product of industrial production and transported through long-tube trailers. Therefore, we calculate that the hydrogen price could be around RMB25-40 per kg before subsidy, varying across regions. For example, hydrogen refueling price in some regions including Hebei Cangzhou and Chongqing, is as low as RMB25/kg before subsidy now. We estimate that the government subsidies for hydrogen refueling are about RMB5-10 per kg, which would result in a hydrogen refueling price of RMB20-30 per kg after subsidies in the short term.

In the medium term, we expect the Type III tanks to be widely used for long-tube trailers and a portion of hydrogen to be transported by pipe. Meanwhile, we expect green and blue hydrogen to contribute a certain portion of refueling source in the medium term as costs fall. That would result in a hydrogen refueling price of around RMB25-30/kg before subsidy in wider areas covered. If the government still subsidizes hydrogen refueling at that time, it would make hydrogen-powered HDTs very competitive to diesel HDTs in terms of TCO.

In the long term, we expect green hydrogen and pipe transportation to take a much larger market share, as the costs decline substantially. We also expect operating costs of hydrogen stations to decline with greater economies of scale. We estimate China's hydrogen refueling price to be about RMB22/kg without subsidies in the long term.

Figure 22: Our hydrogen refueling price projection in the short, medium and long term

	Short term	Medium term	Long term
Production method	Grey hydrogen	Mixture of grey, blue and green hydrogen	Green hydrogen
Main transportation method	By long-tube trailer with the Type I tank	By long-tube trailer with the Type III tank	By pipe
Estimated production cost for 1kg H ₂ (RMB)	13	15	15
Estimated transportation cost for 1kg H ₂ (RMB)	5-17	5	2
Estimated hydrogen station operating costs for 1kg H ₂ (RMB)	7-10	5-10	5
Government subsidies per 1kg H ₂ (RMB)	(5-10)	(5)	-
Estimated hydrogen refueling price (RMB/kg)	20-30	20-25	22

Source: CIESC, CMBIGM estimates

As previously calculated in Fig. 14, it could take less than two years for a hydrogen-powered 49-ton HDT to break even with a diesel HDT in terms of TCO in 2027E with three key assumptions: 1) hydrogen refueling price of RMB28/kg, 2) purchase subsidy of RMB300,000, 3) two-year expressway toll exemption or equivalent to a government subsidy of RMB510,000. Now the question is how economical a hydrogen-powered HDT could be without subsidies.

Fig. 23 illustrates our payback period analysis for a fuel cell 49-ton HDT without any subsidies when the vehicle price and hydrogen price drop. Our key assumptions for the 49-ton fuel cell HDTs include: 1) a fuel efficiency of RMB6.5kg/100km, 2) annual driving mileage of 170,000km, 3) no government subsidies.

Figure 23: Payback period analysis for a 49-ton fuel cell HDT vs. diesel and natural gas HDTs

	Payback years	vs. diesel HDT				vs. natural gas HDT			
		Hydrogen price (RMB/kg)				Hydrogen price (RMB/kg)			
		32	28	24	20	32	28	24	20
Vehicle price ('000 RMB)	1,000	8.9	5.5	3.9	3.1	NA	NA	67.7	10.7
	900	7.5	4.6	3.3	2.6	NA	NA	55.6	8.8
	800	6.0	3.7	2.7	2.1	NA	NA	43.6	6.9
	700	4.6	2.8	2.0	1.6	NA	NA	31.5	5.0
	600	3.2	2.0	1.4	1.1	NA	NA	19.5	3.1
	500	1.8	1.1	0.8	0.6	NA	NA	7.4	1.2

Source: CMBIGM estimates

As illustrated in Fig. 23, when the hydrogen refueling price drops to RMB24/kg or below, and the fuel cell HDT vehicle price declines to RMB700,000 or below, it only takes two years or less for a fuel cell HDT to break even with a diesel HDT in terms of TCO. As natural gas HDTs are more economical than diesel HDTs now given the current natural gas price, it is more difficult for fuel cell HDTs to be more economical than natural gas HDTs. Based on our estimates, it takes 3.1 years for a fuel cell HDT to break even with a natural gas truck in terms of TCO, only when the hydrogen refueling price falls to RMB20/kg and vehicle price drops to RMB600,000. However, natural gas price in China is quite volatile given its dependence on imports, which could make the payback analysis less reliable.

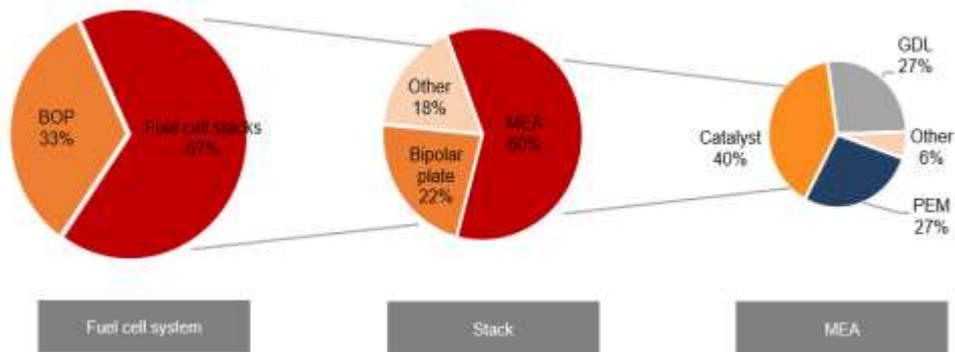
The next question then would be how much the cost of a hydrogen-powered HDT or a fuel cell system could drop, which we will try to answer in the next section.

Huge room for fuel cell system price cuts amid economies of scale and technological advancement

A fuel cell system consists of stack(s), air compressor, humidifier, hydrogen circulation system and other components, as illustrated in Fig. 24. We estimate that the current cost for a fuel cell system is about RMB1,500/kW and the stack accounts for about 2/3 of the cost, or RMB1,000/kW.

The stack consists of MEAs, bipolar plates and others. We estimate that MEAs account for about 60% of the stack's costs, or about RMB600/kW. Bipolar plates make up about 22% of the stack's cost, based on our estimates.

The MEA primarily consists of proton exchange membrane (PEM), catalyst layer and gas diffusion layer (GDL). We estimate that these components account for about 28%, 40% and 27% of the MEA costs. Platinum is the most commonly used precious metal in fuel cell catalysts, which makes the cost of the catalyst layer relatively high, especially as the majority of the catalysts are still imported. Note that the costs for all the components mentioned here include not only BOM costs, but also other costs like depreciation, manufacturing and labor costs.

Figure 24: Current cost breakdown for a fuel cell system


Source: CMBIGM estimates

We need to examine each component's cost breakdown in order to better estimate the possible cost cuts for the fuel cell system. We use bipolar plate as an example to showcase how technological advancement and economies of scale could possibly cut its costs significantly.

■ **We project 77% price drop for graphite bipolar plate in the long term, and even more for metal bipolar plate**

As shown in Fig. 25, our estimated current cost breakdown uses Refire's bipolar plates as a reference, based on our visit to its plant in Jiaxing in 2024. About 255 pieces of bipolar plates are needed for a stack with a power of 90kW. Therefore, the power for one single cell is about 0.35kW. Given the electric current density of 2.1A/cm² and the voltage of 0.6V for a single cell, we can calculate the area of the reaction zone for a bipolar plate is about 280cm².

As there is limited room to make the current graphite bipolar plate even thinner (which could cause safety and durability issues), increasing the reaction zone and the electric current density in the reaction zone should be the roadmap for bipolar plate's evolution. We believe that a density of 3.0A/cm² is possible in the foreseeable future (or steady state), as Refire's next-generation bipolar plate, which is likely to start mass production in 2026-27, targets 2.7A/cm². We also assume the reaction zone to increase by 50% and the voltage to be lifted from 0.6V to 0.8V in the steady state, both of which are feasible based on the data we have collected. Therefore, the power of one single bipolar plate would increase from 0.35kW to 1.01kW, while the BOM cost would only increase from RMB14 to RMB17. It means that it only needs 89 pieces of bipolar plates for a stack with a power of 90kW, from 255 pieces now. The BOM cost could drop by 59% per kW.

As raw materials only account for about 18% of total costs for a bipolar plate based on our estimates, the other costs could also drop substantially with greater economies of scale. If the annual production capacity increases 3.3x from 0.36mn to 1.2mn units (which could equip about 6,500 units of 180kW fuel cell system with a single cell's power of 1.01kW), we expect depreciation and rental costs to decline from RMB26 to RMB17 for one piece of bipolar plate, assuming the equipment investments to rise 2.3x and rental costs to increase by 50%. We also see possible automation for quite a few steps during the production process, based on our factory visit. In fact, Refire's bipolar plate plant cut the number of workers by half within one year in 2024. Therefore, we assume the same number of workers when the capacity increases to 1.2mn units per annum. Accordingly, we project labor costs of a piece of bipolar plate to cut by about 67% amid greater economies of scale. Manufacturing costs per unit would probably drop the least given the complex production process.

Figure 25: Our forecasts for bipolar plate's potential cost cuts

	Now	Our assumption for steady state
Bipolar plate's basic information and assumptions:		
Stack power (kW)	90	90
Number of cells in the stack	255	89
Power of a cell (kW)	0.35	1.01
Voltage of a cell (V)	0.6	0.8
Electric current density (A/cm ²)	2.1	3.0
Area of reaction zone (cm ²)	280	420
Reaction zone as % of total area of a bipolar plate	49%	52%
Total area of a bipolar plate (cm ²)	570	808
Thickness of a bipolar plate (cm)	0.14	0.14
Raw-material density of a bipolar plate (g/cm ³)	2.25	2.25
The weight of a bipolar plate (g)	180	254
Production assumptions:		
Annual production capacity (units)	360,000	1,200,000
Production yield rate	90%	95%
Graphite price (RMB/metric ton)	58,000	53,000
Graphite costs for one bipolar plate (RMB)	10	13
Other material (resin, glue etc.) costs for one bipolar plate (RMB)	3	3
Material costs of a bipolar plate (RMB)	14	17
Equipment investments (mn RMB)	40	90
Assumption for depreciation years	5	5
Annual rental costs (mn RMB)	1.2	1.8
Depreciation & rental costs of a bipolar plate (RMB)	26	17
Number of workers needed	100	100
Annual salary per worker (RMB)	100,000	110,000
Labor costs of a bipolar plate (RMB)	28	9
Total annual manufacturing costs (mn RMB)	4	10
Manufacturing costs of a bipolar plate (RMB)	11	8
Total cost of one piece of bipolar plate (RMB)	79	51
Total cost of bipolar plate per 1kW (RMB)	223	50

Source: Company data, CMBIGM estimates

In summary, we estimate that the total costs per kW for bipolar plate could drop by 77% from RMB223 now to RMB50 in the steady state.

We are of the view that the costs could be even lower if bipolar plate is replaced by metal plate, as the manufacturing process would be much simpler and the raw material costs would also be lower. The largest bottleneck for the metal bipolar plate is the durability of the coating. Toyota Motor (7203 JP, NR) and Hyundai Motor (005380 KS, NR) use metal bipolar plates, as the majority of their fuel cell systems are for passenger vehicles, which usually have shorter mileages in the lifespan than HDTs. However, we believe technology breakthrough to increase the metal coating's durability is possible but difficult to predict at the moment. We do not take an unpredictable technology breakthrough into account when we estimate possible cost reduction in the steady state.

■ Our estimated fuel cell system cost reduction roadmap

Similar to bipolar plates, we can do such exercises to estimate the potential cost reduction for other components including PEM, catalyst layer, gas diffusion layer etc. We project costs for all other components of the fuel cell system to decline 55-75% in the steady state, aided by technological advancement and greater economies of scale. We expect the cost of the catalyst layer to drop the least among all the major components given the price of platinum. On the other hand, we still project the catalyst layer cost to fall 58% in the steady state by material localization, platinum loading reduction and enhancing catalyst structure. Accordingly, we estimate that costs for the stack and system could fall to RMB300/kW and RMB520/kW, respectively, in the steady state.

Figure 26: Cost breakdown for fuel cell system

RMB/kW	Now	Our assumption for steady state
Stack cost	1,000	300
MEA	600	200
Proton exchange membrane	165	45
Catalyst layer	240	100
Gas diffusion layer	160	40
Others	35	15
Bipolar plate	223	50
Others	177	50
Balance of plant (BOP)	500	220
Fuel cell system cost	1,500	520

Source: Company data, CMBIGM estimates

With such assumptions, we can re-examine the TCO advantage of hydrogen-powered HDTs compared with other powertrains. We also change some of our key assumptions to fit the long-term scenario better:

- 1) Fuel cell system of 260kW, up from 200kW now in order to reduce battery capacity
- 2) Battery capacity of 50kWh, from 80kWh now, due to higher power and longer driving range
- 3) Fuel efficiency of 6.5kg/100km, down from about 8.5kg/100km now
- 4) Hydrogen storage of 60kg, from 32kg now, aided by higher tank pressure, which could boost hydrogen-powered HDT's driving range to 900+km
- 5) Hydrogen refueling price of RMB22/kg, from about RMB35/kg now
- 6) Gross margins of 13-20% for fuel cell system, hydrogen storage system and fuel cell HDT
- 7) No government subsidies or purchase-tax / expressway toll exemption

As illustrated in Fig. 27 below, we estimate the TCO during the entire lifespan for a hydrogen-powered HDT to be about RMB4.6mn in the steady state, lower than diesel HDT's RMB5.6mn and natural gas HDT's RMB4.7mn, but still higher than battery electric HDT's RMB4.2mn. In other words, the payback period would be 1.5 years and 6.6 years for a hydrogen-powered HDT to break even with a diesel HDT and a natural gas HDT, respectively, in terms of TCO. That would make hydrogen-powered HDTs at least very competitive to diesel HDTs, holding everything else equal. The TCO of a natural gas HDT is about RMB0.9mn lower than that of a diesel HDT given our assumptions for diesel price of RMB7.5/L and natural gas price of RMB5/kg. However, natural gas price in China is quite volatile given its dependence on imports. That could make the TCO of a natural gas HDT vary a lot. The payback period would change to 2.3 years for a hydrogen-powered HDT to break even with a natural gas HDT, if natural gas price rises to RMB6/kg, holding everything else constant.

Figure 27: TCO analysis for 49-ton HDTs with our assumptions of fuel cell costs in steady state

	Fuel cell HDT	Diesel HDT	Natural gas HDT	Battery electric HDT
Driving range (km)	920	1,300	1,300	250
Vehicle price ('000 RMB)	640	376	438	575
Vehicle cost ('000 RMB)	513	300	350	470
Fuel cell system	169	-	-	-
Hydrogen storage system	56	-	-	-
Battery	18	-	-	190
Powertrains excl. battery (engine, motor etc.)	70	100	150	70
Vehicle body	200	200	200	200
Gross margin assumption	13%	13%	13%	13%
Purchase tax and other expense ('000 RMB)	50	32	36	46
Fuel costs ('000 RMB)	1,702	2,945	1,964	1,428
Fuel consumption per 100km (kg, L, kWh)	6.5	33	33	150
Fuel price (RMB/kg, RMB/kWh)	22.0	7.5	5.0	0.8
Annual mileage assumption ('000 km)	170	170	170	170
Lifespan (year)	7	7	7	7
Maintenance costs ('000 RMB)	518	539	469	434
Expressway tolls ('000 RMB)	1,785	1,785	1,785	1,785
Annual tolls assumption ('000 RMB)	255	255	255	255
Lifespan (year)	7	7	7	7
Total cost of ownership ('000 RMB)	4,645	5,646	4,656	4,222

Source: CMBIGM estimates

Although the TCO of a battery electric HDT could be lower than a fuel cell HDT for a long time based on our estimates, electric HDTs face a few challenges including charging time and low driving range. That could limit electric HDT's adoption for only a few scenarios, such as short-distance transportation with fixed battery charging (or battery swap) infrastructure. We are of the view that solid state batteries could partially solve the problems that electric HDTs face now, which probably still take some time.

Although it is difficult to forecast the HDTs' market share by powertrain in the steady state, given the complexity of several factors mentioned above, we believe fuel cell could be a good supplement in the HDT market, based on our TCO analysis. More importantly, that could already mean huge market share gain potential for hydrogen-powered HDTs given that it only accounted for less than 1% of total HDT sales volume in China in 2025.

2027 could be an inflection point for fuel cell although government support is still needed; Infrastructure could be key to realizing fuel cell TCO advantage in the long term

Unlike passenger vehicles which consumers have wide preference spectrum in brand, design, driving experience and intelligent connectivity, TCO is the dominant factor for commercial vehicles. When the commercial vehicles with a new powertrain are more economical than others, its market share could increase exponentially.

Our calculations above show that the TCO of a hydrogen-powered HDT could be about 13% lower than that of a diesel HDT in 2027E with our estimated government subsidies. That could be a sign of the inflection point for fuel cell boom in the HDTs, if the refueling infrastructure could match the rising demand. Therefore, government support is still crucial, not only in providing subsidies, but also in infrastructure building and setting industry standards to minimize redundant investments. Fuel cell HDTs' driving range advantage over battery electric HDTs to take over the long-haul transportation segment could be wasted if the refueling infrastructure is missing.

While HDTs account for about 2/3 of fuel cell's downstream application in China now, new demand for fuel cell systems could also rise rapidly. For example, it could be used as a grid-independent generator to charge passenger NEVs to reduce the grid peak load. It can serve as an alternative fast charger given the high power of the fuel cell system. Fuel cell system makers also start to explore how to utilize hydrogen in ships now. We expect the new round of fuel cell subsidies to emphasize exploring new downstream applications for fuel cell. As the fuel cell market is still in its infancy now, any new demand could potentially contribute a significant portion of its growth.

Financial Analysis

We expect revenue growth to more than double YoY in FY27E

Refire's revenue mainly consists of fuel cell systems and related components, hydrogen production systems and its components, as well as engineering services provision. We project Refire's total revenue to rise 1% YoY to RMB655mn in FY25E, followed by 14% YoY growth to RMB749mn in FY26E and 123% YoY growth to about RMB1,670mn in FY27E, as we expect new subsidy scheme to be implemented by the end of 2026 and TCO of a fuel cell HDT to be closer to an equivalent diesel HDT which was elaborated in detail in the previous section.

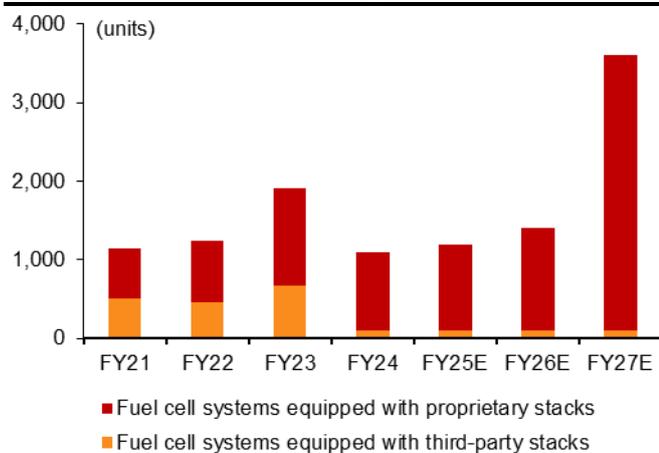
■ Fuel cell systems: sales volume to surge from FY27E with higher power, lower ASP

As Refire started its business with fuel cell system manufacturing, it is still making customized systems using third-party stacks required by clients. Outsourced stacks accounted for 35-44% of Refire's total fuel cell systems sold during FY21-23 but became minimal since FY24, according to management. We assume outsourced stacks to be 100 units every year during FY24-27E.

We project Refire's total fuel cell system sales volume to rise about 9% YoY to 1,200 units in FY25E, as the industrywide sales volume growth slowed down and Refire may have lost market share due to uneven regional development driven by subsidy budgets. We are conservative about FY26E given the time uncertainty of new subsidy scheme, expecting Refire's fuel cell system sales volume to rise 17% YoY to 1,400 units.

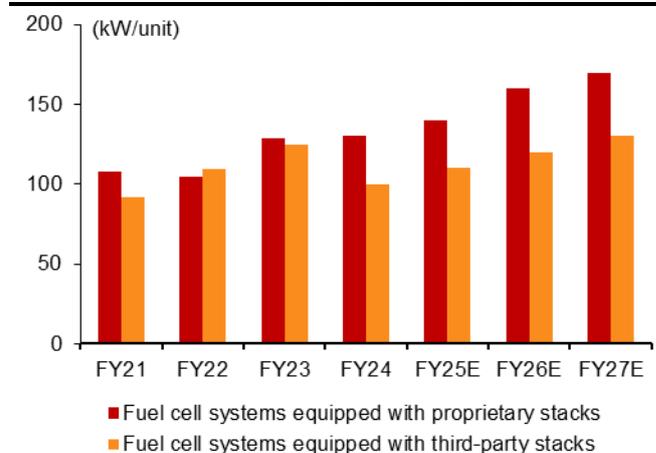
We expect the boom to start from 2027 with industrywide fuel cell system sales volume being at least 20,000 units. We project Refire to capture a market share of 18%, or 3,600 units in FY27E. We also expect Refire to gain market share in FY28E with its established capacity and competitive edge in the cost control and technologies.

Figure 28: Refire's fuel cell system sales volume



Source: Company data, CMBIGM estimates

Figure 29: Refire's average power per system



Source: Company data, CMBIGM estimates

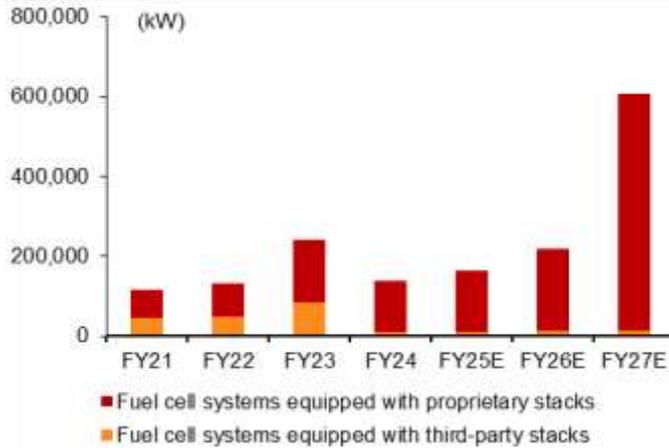
Meanwhile, we also expect the average power per system to rise during FY25-27E, as the unit cost falls and new subsidies likely favor higher power output. We estimate that the average power per fuel cell system to rise from 127kW in FY23 to 138kW/157kW/169kW in FY25-27E. A typical 49-ton hydrogen-powered HDT is now equipped with a 180kW fuel cell system. We expect the average power output of fuel cell HDTs to rise gradually in order to satisfy different working conditions and reduce the battery capacity. The fuel cell systems used in the stationery power, including grid-independent fast charging, also require high power.

On the other hand, we project ASP per kW to drop over the time amid the cost reduction from technological advancement and greater economies of scale. We project Refire's ASP per kW for fuel cell systems with its proprietary stacks to decline 17%/5%/16% YoY to RMB2,000/1,900/1,600 during FY25-27E. Our ASP forecasts are largely based on our cost reduction trajectory with a gross margin assumption of 23-28%. Refire plans to roll out next-

generation fuel system in 2027E, which could make a larger cost reduction possible in FY27E.

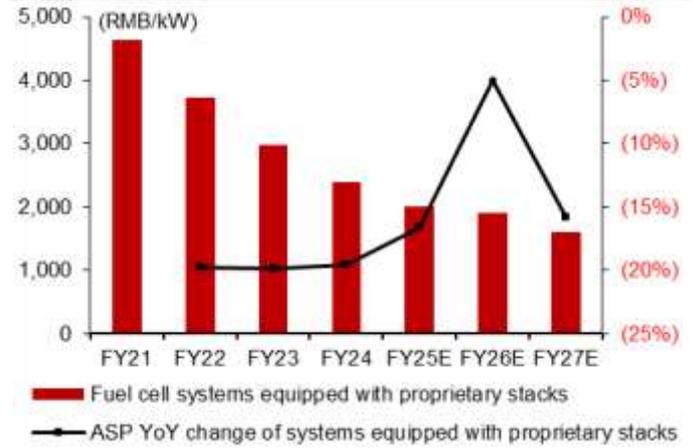
The ASP per kW for the systems equipped with third-party stacks was about 34-39% lower than the ASP per kW for the systems during FY21-23E, partially because some third-party stacks provided by the customers are not booked in the revenue. We still project ASP per kW for the systems with third-party stacks to be lower than that for systems with proprietary stacks during FY25-27E but the impact on Refire's revenue and profits is to be limited given its minimal contribution.

Figure 30: Refire's fuel cell sales power output



Source: Company data, CMBIGM estimates

Figure 31: Refire's fuel cell system ASP per kW

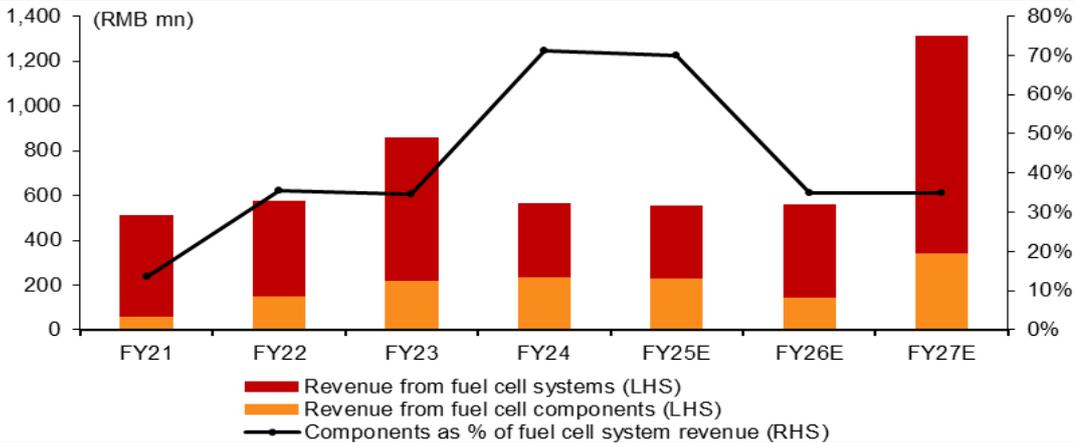


Source: Company data, CMBIGM estimates

Accordingly, we forecast Refire's revenue from fuel cell systems to fall 1% YoY to RMB327mn in FY25E, rise 27% YoY to RMB414mn in FY26E, and surge 134% YoY to RMB970mn in FY27E.

Revenue from fuel cell system related components amounted to 35-36% of the fuel cell system revenue during FY22-23 but the ratio jumped to 71% in FY24. We estimate such ratios to be about 70% in FY25E and 35% in FY26-27E when fuel cell system sales surge.

Figure 32: Refire's revenue from fuel cell systems and components



Source: Company data, CMBIGM estimates

Hydrogen production systems: faster growth amid low comparison

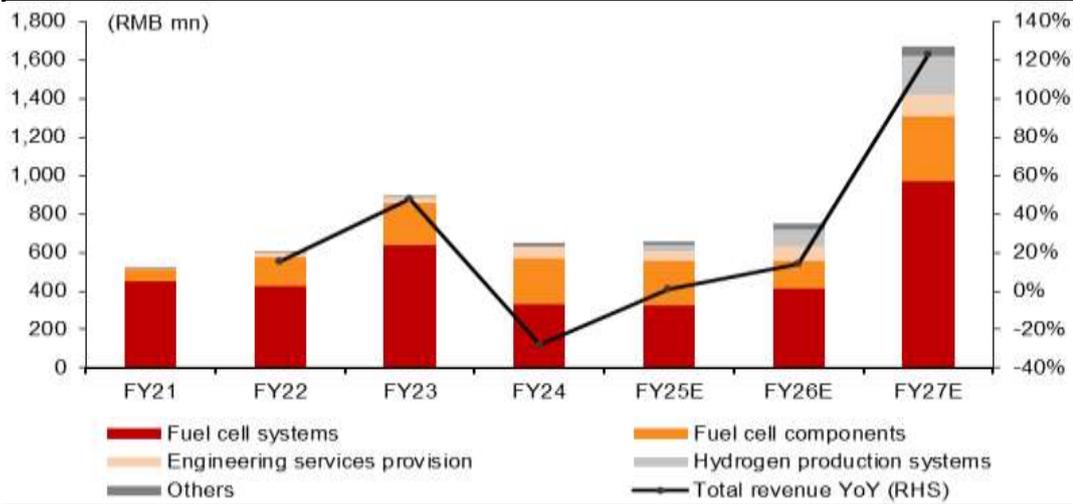
Refire has launched PEM water electrolysis hydrogen production systems and related components (including electrolysis cells and MEAs), as well as electrodes for ALK electrolysis since Aug 2023. As noted earlier, we estimate that the costs of green hydrogen production have been falling. That, along with possibly improving subsidies in 2026-30, could boost Refire's hydrogen production revenue. We project such revenue at Refire to surge 15x/3x/2.2x YoY to RMB30mn/90mn/200mn in FY25-27E amid low base. The company has been focusing on the PEM water electrolysis given its better compatibility with renewable energy electricity and greater cost cut potential, although ALK water

electrolysis still dominates green hydrogen production in China. We project hydrogen production to account for 5%/12%/12% of total revenue during FY25-27E.

Engineering services and others: 7-9% of revenue in FY25-27E based on our estimates

Engineering services and others contributed about RMB31mn/30mn/81mn during FY22-24, or about 3-12% of total revenue. We expect such income to continue contributing 10-13% of Refire’s total revenue during FY25-27E.

Figure 33: Refire’s revenue breakdown



Source: Company data, CMBIGM estimates

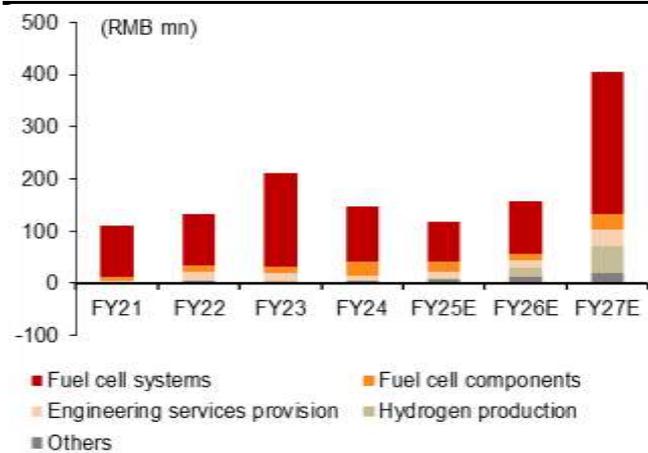
Gross margin to widen from FY26E; SG&A and R&D ratios to decline

Subsidies, new products to lift gross margin back to 20%+ in FY27E

The gross margin for Refire’s fuel cell systems rose from 21.6% in FY21 to 28.0% in FY23. We estimate such margin to remain at around 30% in FY24, although it was not disclosed. We project Refire’s gross margin for fuel cell systems to narrow to 23-24% in FY25-26E amid industry headwinds and rebound to 28-30% in FY27-28E driven by new subsidies and Refire’s new products. We also expect its gross margin for fuel cell system components to remain at 9-10% during FY25-27E. We project Refire’s gross margin for hydrogen production system and components to be 20-25% during FY26-27E, as revenue rises.

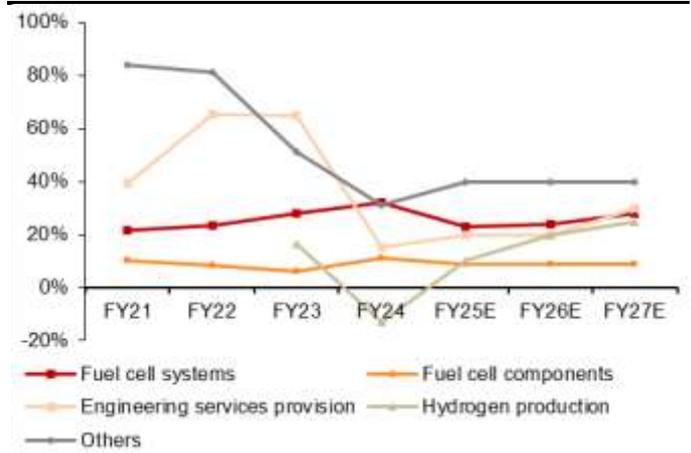
In a sum, we expect Refire’s overall gross margin to narrow to 12.0% in FY25E and rebound to 18.2% in FY26E and 22.4% in FY27E. We also expect inventory impairment to dent Refire’s gross margin less when revenue surges. In FY21-23, inventory impairment dragged Refire’s overall gross margin down by 13.6ppts, 3.5ppts and 5.3ppts, respectively.

Figure 34: Refire’s gross profit by segment



Source: Company data, CMBIGM estimates

Figure 35: Refire’s gross margin by segment

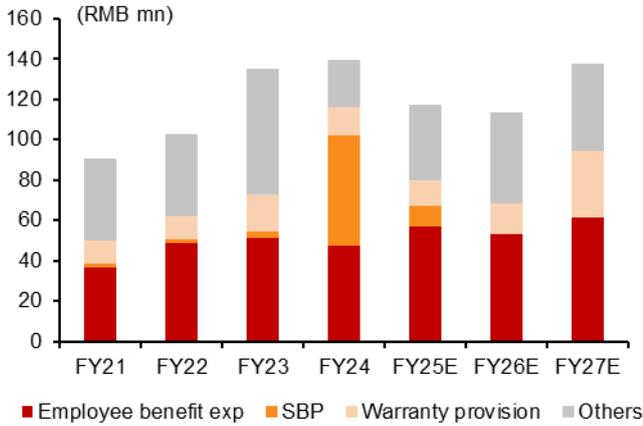


Source: Company data, CMBIGM estimates

SG&A, R&D ratios to decline amid higher revenue

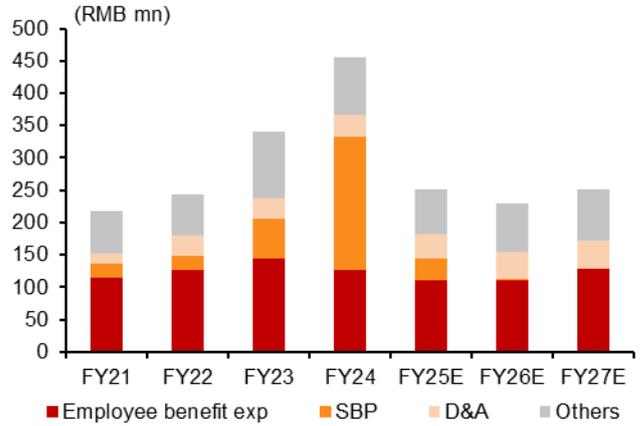
We expect the ratios (as % of revenue) of SG&A and R&D to drop significantly in FY26E, as the revenue surges and the share-based payment declines. Employee benefit expenses (excluding share-based payment), depreciation and amortization, and share-based payment (SBP) accounted for 42%, 14% and 12% of SG&A and R&D expenses combined in FY23, respectively.

Figure 36: Refire’s selling expense breakdown



Source: Company data, CMBIGM estimates

Figure 37: Refire’s G&A expense breakdown

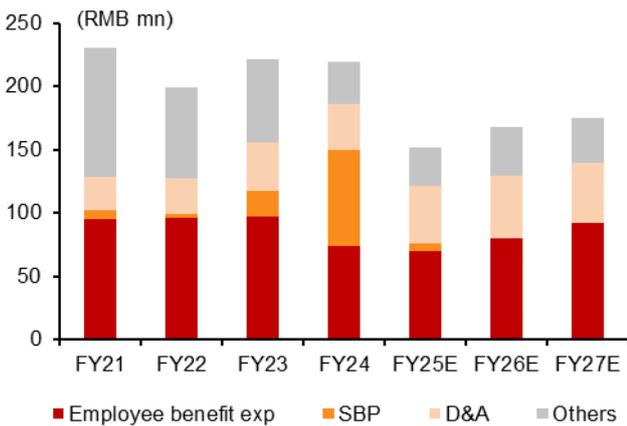


Source: Company data, CMBIGM estimates

We expect Refire’s total employee benefit expenses (excluding SBP) to decline 2% YoY in FY25E amid the company’s stringent cost control. We project total employee benefit expenses (excluding SBP) to rise 3% YoY in FY26E and 15% YoY in FY27E, at a slower pace than revenue YoY growth of 14% and 123% in FY26-27E, respectively, as operational efficiency improves when production ramps up. For example, its bipolar plate plant cut the number of workers by half in 2024.

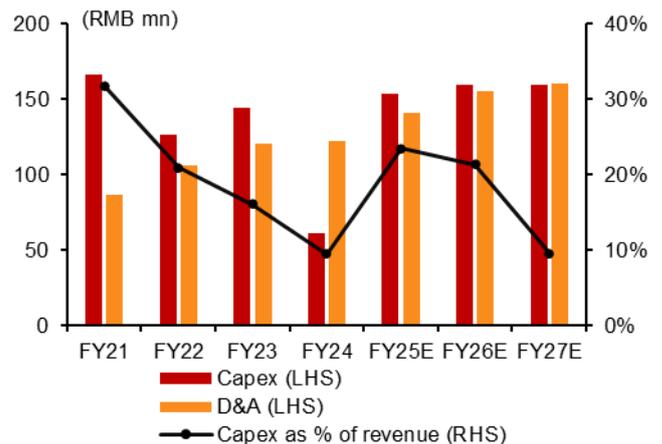
We project Refire’s capex to be around RMB150-160mn per annum during FY25-27E after a significant cut in FY24 (RMB62mn), as the company still needs to build and upgrade manufacturing base, as well as equipment investments. Meanwhile, we expect depreciation rate to slow down, as buildings may take up a larger portion of PP&E.

Figure 38: Refire’s R&D expense breakdown



Source: Company data, CMBIGM estimates

Figure 39: Refire’s capex and D&A



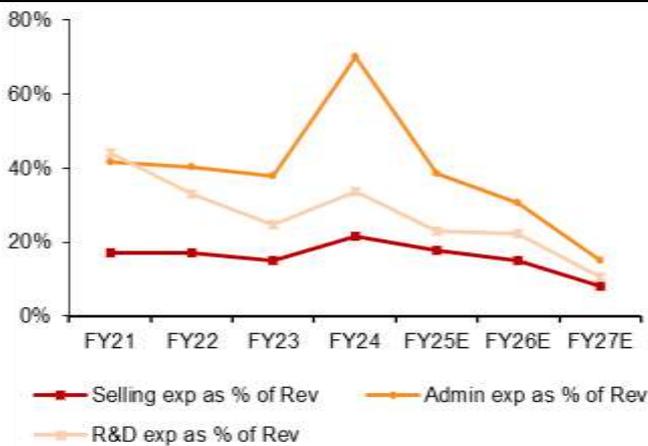
Source: Company data, CMBIGM estimates

There are three schemes related to Refire’s SBP: restricted share award scheme, share option scheme and incentive scheme over a subsidiary’s shares. The SBP from the former two schemes would end by FY25E while the expenses from the latter one is minimal. Therefore, we project SBP to be RMB52mn in FY25E and RMB1mn each year during FY26-27E, assuming no more share award scheme being granted in FY26-27E.

As illustrated in Fig. 40 and 41, we expect SG&A and R&D ratios to decline gradually during FY25-27E. The spikes in FY24E in Fig. 40 are mainly due to a larger impact from SBP. We project the combined ratio of SG&A and R&D expenses (including SBP) to fall to 68% in

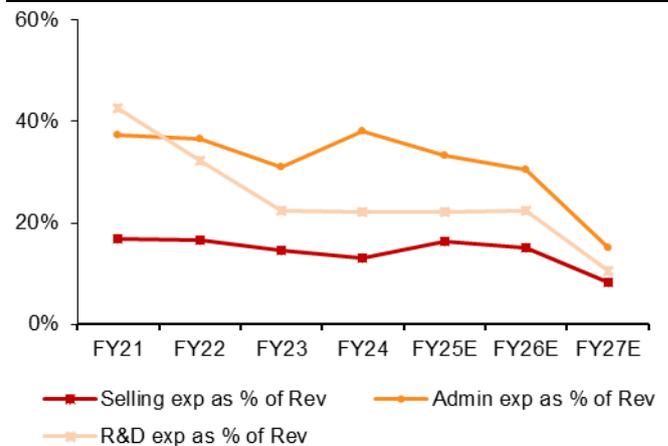
FY26E and 34% in FY27E, down from 78% in FY23. Note that all the R&D investments were expensed at Refire during FY21-24 and we expect such accounting treatment to continue in FY25-27E.

Figure 40: SG&A, R&D as % of revenue (incl. SBP)



Source: Company data, CMBIGM estimates

Figure 41: SG&A, R&D as % of revenue (excl. SBP)



Source: Company data, CMBIGM estimates

Non-operating income and costs: finance costs and impairment to drag profit

■ Equity income: no legacy issues for JV; losses at associates could be limited

Refire and Sino-Synergy formed a 49:51 joint venture (JV) named Guohong Refire in 2016 to produce fuel cell systems using the 9SSL stacks that Sino-Synergy provides under a license granted by Ballard Power Systems (BLDP CN, NR). It is no longer helpful to Refire's current businesses. There were fair value losses and impairment on financial guarantee obligations for Refire during FY21-22 related to this JV, as the local government funds made strategic investments in the JV which had the rights to exit, and Refire and Sino-Synergy provided financial guarantee for the JV's subsidiary's borrowing. All these issues have been cleared, as the JV has gradually ceased its business operation except selling existing inventories. There will be no additional impairment in the event where Guohong Refire is to be liquidated.

Although Refire has established quite a few associates with industry partners to explore different segments in the industry, such as customized stacks for aircraft, hydrogen production components, bipolar plates and autonomous driving fuel cell commercial vehicles, the share of losses of associates during FY22-24 were about RMB3-15mn. We project the share of losses to be around RMB5-10mn each year during FY25-27E, as Refire may exit any associate if it experiences significant losses without turnaround outlook. In our view, Refire has established comprehensive manufacturing capabilities in the key components of hydrogen industry. It may acquire equity interest of associates, if such associates could make Refire's business more comprehensive. For example, in Jan 2024, Refire acquired 70% equity interest of Jiaqing (Shanghai) Industrial which operates hydrogenation station, making it from an associate to a wholly-owned subsidiary. We also do not expect Refire to inject significant capital into the associates.

■ Finance costs: unlikely to lower debt level before FY27E

We project Refire's total debt level to be at RMB1.5-1.7bn during FY25-27E, vs. RMB1.3-1.6bn in FY23-24, as we expect the company to issue new shares to raise funds in order to keep a healthy debt ratio. We estimate the corresponding finance costs to be around RMB48-56mn in FY25-27E, vs. RMB48-58mn during FY22-24.

Interest income is booked under "other income" as part of operating profit. We project interest income to be around RMB12-15mn in FY25-27E, vs. RMB6-16mn in FY22-24. Refire's other income mainly comes from government grants and interest income.

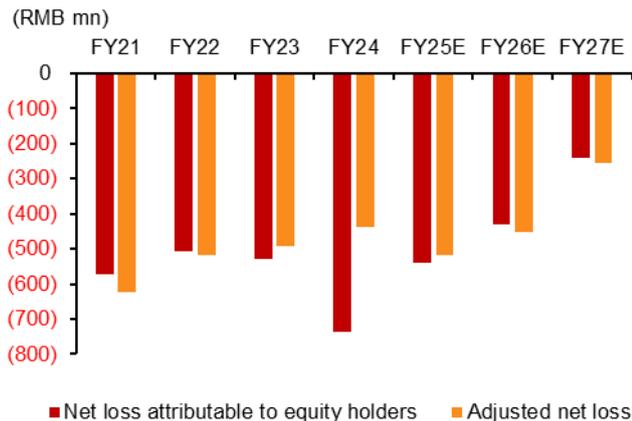
■ We expect impairment of trade receivables to be RMB80-100mn in FY25-27E amid continued pending subsidies

Refire's impairment losses mainly come from inventories and receivables. Impairment on inventories is booked as part of cost of goods sold at Refire. Impairment losses on trade receivables during FY22-24 were about RMB27-69mn, largely due to the pending government subsidies. We expect such impairment losses to be RMB80-100mn during FY25-27E, or 3.5-5% of total trade receivables and contract assets.

Net loss to narrow in FY25-27E; Possible operating profit in FY28E

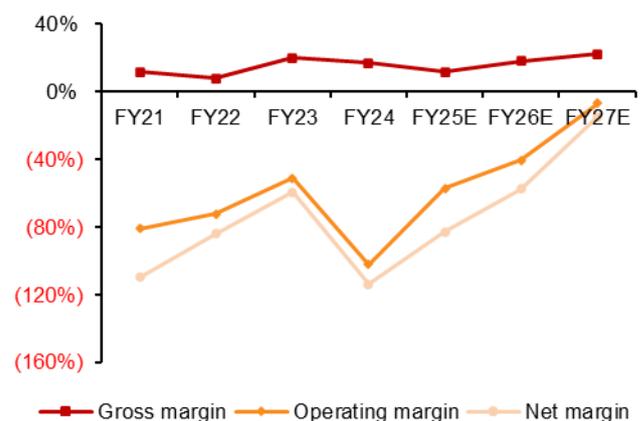
As elaborated in detail above, we therefore estimate net loss at Refire to narrow gradually to RMB540mn/429mn/242mn in FY25-27E. We also expect Refire to achieve a positive operating profit of RMB71mn in FY28E, as revenue continues to rise with higher gross margin and lower SG&A ratio.

Figure 42: Refire's net loss and adjusted net loss



Source: Company data, CMBIGM estimates

Figure 43: Refire's margin forecasts



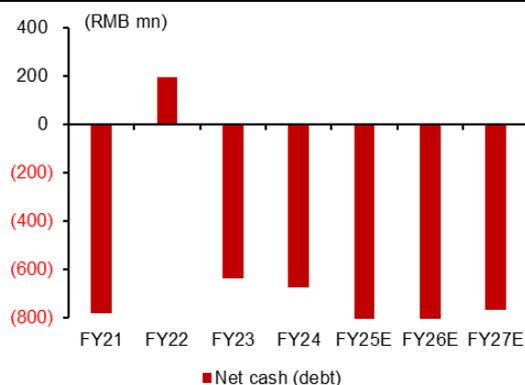
Source: Company data, CMBIGM estimates

Improving cash flow, equity financing to keep balance sheet healthy

Refire raised about RMB600mn from its Hong Kong IPO in Dec 2024, followed by two rounds of placement in Sep 2025 and Jan 2026 with a combined equity financing of about RMB300mn. We expect equity finance at Refire to continue in FY27E. Therefore, we estimate Refire's debt ratio (total liabilities / total assets) to be 61-64% in FY25-27E, vs. 46-59% in FY22-24.

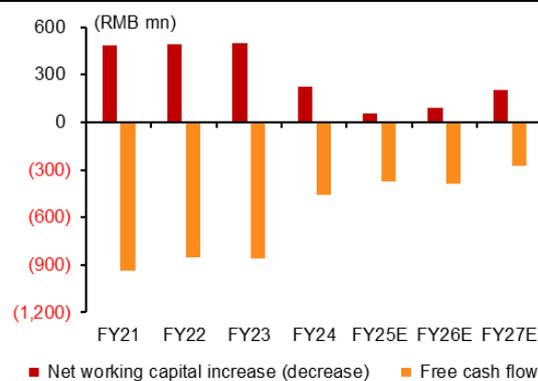
We project operating cash outflow to be RMB219mn/228mn/117mn in FY25-27E, respectively, despite narrowing net losses, as we believe Refire still needs to deploy working capital, especially with long receivable days for government subsidies. Therefore, we expect Refire to be in the net debt position during FY25-27E, but with net debt improving from FY27E. In fact, we project both operating cash flow and free cash flow at Refire to turn positive in FY28E with positive operating profit and better working capital condition.

Figure 44: Refire's net cash (debt) forecasts



Source: Company data, CMBIGM estimates

Figure 45: Refire's NWC and free cash flow forecasts



Source: Company data, CMBIGM estimates

Valuation and Key Risks

Initiate with BUY rating; TP of HK\$80.00 based on 4x FY27E P/S

We initiate our coverage of Refire with a BUY rating and target price of HK\$80.00, which is based 4x our FY27E P/S. We use P/S multiple to project Refire's valuation, given its net loss and negative free cash flow during FY25-27E on our estimates. We are of the view that such valuation multiple is justified given Refire's revenue CAGR of 60% during FY25-27E on our estimates. In fact, SinoHytec's H share is now trading at 4.2x FY27E P/S on consensus, while its FY26-27E revenue forecasts are both lower than Refire's, according to consensus. We believe Refire should gradually achieve a valuation premium compared with Sino-Synergy and SinoHytec with its better know-how in key components and cost control capabilities.

Figure 46: Peers' valuation

Company	Ticker	Mkt Cap (HK\$ mn)	Revenue (RMB mn)				P/S (x)			
			FY24A	FY25E	FY26E	FY27E	FY24A	FY25E	FY26E	FY27E
Refire	2570 HK	4,456	649	655	749	1,670	6.1x	6.4x	4.3x	2.4x
Sino-Synergy	9663 HK	2,646	442	NA	NA	NA	5.3x	NA	NA	NA
SinoHytec	2402 HK	5,797	367	420	703	1,221	14.0x	12.2x	7.3x	4.2x
Ballard Power Systems	BLDP CN	5,082	481	679	821	1,017	9.3x	6.6x	5.5x	4.4x

Source: Bloomberg, CMBIGM estimates

Note: Market data as of 3 Mar 2026. Refire's FY25-27E revenue is based on our forecast. Other companies' FY25-27E revenue is based on Bloomberg consensus.

Key risks to our rating and target price

- 1) Slower infrastructure building for hydrogen stations than we expect;
- 2) Slower pace of hydrogen price decline than we expect;
- 3) Slower cost reduction for fuel cell systems than we expect;
- 4) Slower technology advancement for the key components of fuel cell systems and/or hydrogen production systems than we expect;
- 5) Faster technology breakthrough in lithium-ion batteries to satisfy fast charging capabilities and ultra-high energy density than we expect;
- 6) Weaker hydrogen related government subsidies than we expect;
- 7) Lower diesel and/or natural gas prices than we expect that make TCO of diesel and/or natural gas HDTs lower than fuel cell HDTs;
- 8) Faster catch up from competitors and/or new competitors to drag Refire's revenue and margins down than we expect;
- 9) Higher operational and R&D expenses needed in order to remain competitive, which leads to greater losses occurred and later breakeven timeline than we expect.

Financial Summary

INCOME STATEMENT	2022A	2023A	2024A	2025E	2026E	2027E
YE 31 Dec (RMB mn)						
Revenue	605	895	649	655	749	1,670
Cost of goods sold	(555)	(716)	(537)	(577)	(613)	(1,296)
Gross profit	50	180	112	79	136	374
Operating expenses	(484)	(636)	(772)	(453)	(438)	(487)
Selling expense	(103)	(135)	(139)	(117)	(113)	(138)
Admin expense	(243)	(340)	(455)	(252)	(229)	(251)
R&D expense	(199)	(221)	(219)	(151)	(168)	(175)
Others	60	60	42	67	72	77
Operating profit	(435)	(456)	(660)	(374)	(302)	(113)
Other expense	(6)	(5)	(2)	(25)	(9)	(9)
Gain/loss on financial assets at FVTPL	1	(3)	25	0	5	6
Other gains/(losses)	(35)	(64)	(70)	(100)	(81)	(80)
Share of (losses)/profits of associates/JV	(21)	(4)	(15)	(10)	(5)	(5)
EBITDA	(390)	(411)	(600)	(368)	(236)	(41)
Depreciation	78	93	94	107	118	118
Depreciation of ROU assets	20	18	19	23	26	29
Other amortisation	8	10	10	11	12	14
EBIT	(496)	(532)	(722)	(509)	(392)	(201)
Net Interest income/(expense)	(49)	(48)	(58)	(59)	(59)	(54)
Pre-tax profit	(545)	(580)	(780)	(568)	(451)	(255)
Income tax	(1)	2	2	(1)	(0)	(0)
After tax profit	(546)	(578)	(778)	(569)	(451)	(255)
Minority interest	40	48	40	28	23	13
Net profit	(506)	(529)	(737)	(540)	(429)	(242)

BALANCE SHEET	2022A	2023A	2024A	2025E	2026E	2027E
YE 31 Dec (RMB mn)						
Current assets	3,172	2,785	3,561	2,849	2,649	3,260
Cash & equivalents	1,079	665	883	626	519	732
Restricted cash	60	1	0	10	20	20
Account receivables	1,266	1,583	2,049	1,580	1,610	1,793
Inventories	277	240	297	316	252	391
Prepayment	103	296	240	123	101	225
ST bank deposits	52	0	0	102	54	5
Financial assets at FVTPL	336	0	91	92	93	94
Non-current assets	969	1,252	1,132	1,253	1,241	1,311
PP&E	417	453	394	422	445	467
Right-of-use assets	88	69	91	88	87	83
Deferred income tax	11	13	15	15	15	15
Investment in JVs & assos	79	100	133	128	98	68
Intangibles	30	22	18	11	7	2
Financial assets at FVTPL	7	44	89	99	94	90
Other non-current assets	338	550	391	490	495	587
Total assets	4,141	4,037	4,692	4,102	3,890	4,572
Current liabilities	1,028	1,317	2,134	1,664	1,319	1,410
Short-term borrowings	269	470	1,054	962	652	308
Account payables	566	651	874	537	504	799
Tax payable	3	1	0	0	0	0
Other current liabilities	159	163	162	131	127	242
Lease liabilities	16	19	21	16	20	23
Contract liabilities	15	13	23	18	17	38
Non-current liabilities	874	969	619	873	1,163	1,393
Long-term borrowings	729	833	505	753	1,027	1,219
Obligations under finance leases	61	42	23	38	47	54
Deferred income	60	58	46	51	57	63
Other non-current liabilities	24	35	46	31	31	56
Total liabilities	1,902	2,286	2,753	2,536	2,482	2,803
Share capital	81	81	86	89	95	100
Other reserves	2,190	1,743	1,950	1,530	1,309	1,598
Total shareholders equity	2,272	1,824	2,036	1,618	1,403	1,697
Minority interest	(32)	(74)	(97)	(53)	5	72
Total equity and liabilities	4,141	4,037	4,692	4,102	3,890	4,572

CASH FLOW	2022A	2023A	2024A	2025E	2026E	2027E
YE 31 Dec (RMB mn)						
Operating						
Profit before taxation	(545)	(580)	(780)	(568)	(451)	(255)
Depreciation & amortization	106	121	122	141	155	160
Tax paid	(10)	(2)	(1)	(1)	(0)	(0)
Change in working capital	(491)	(498)	(227)	(55)	(91)	(204)
Others	212	241	492	264	159	181
Net cash from operations	(728)	(718)	(393)	(219)	(228)	(117)
Investing						
Capital expenditure	(127)	(144)	(62)	(154)	(160)	(160)
Acquisition of subsidiaries/ investments	(51)	(35)	(50)	(10)	0	0
Net proceeds from disposal of short-term investments	(336)	230	(103)	(15)	10	10
Others	(47)	66	5	(85)	90	90
Net cash from investing	(560)	117)	(210)	(264)	(60)	(60)
Financing						
Net borrowings	(70)	296	244	156	(36)	(152)
Proceeds from share issues	2,183	0	626	73	234	600
Others	(25)	(114)	(48)	(3)	(17)	(58)
Net cash from financing	2,088	181	822	225	181	390
Net change in cash						
Cash at the beginning of the year	276	1,079	665	883	626	519
Exchange difference	3	5	0	0	0	0
Cash at the end of the year	1,079	665	883	626	519	732
GROWTH	2022A	2023A	2024A	2025E	2026E	2027E
YE 31 Dec						
Revenue	15.4%	48.1%	(27.5%)	1.0%	14.4%	122.8%
Gross profit	(19.4%)	260.5%	(37.8%)	(29.5%)	73.0%	174.3%
PROFITABILITY	2022A	2023A	2024A	2025E	2026E	2027E
YE 31 Dec						
Gross profit margin	8.2%	20.1%	17.2%	12.0%	18.2%	22.4%
Operating margin	(71.9%)	(50.9%)	(101.8%)	(57.1%)	(40.3%)	(6.8%)
EBITDA margin	(64.5%)	(45.9%)	(92.4%)	(56.1%)	(31.6%)	(2.4%)
Return on equity (ROE)	(35.7%)	(25.9%)	(38.2%)	(29.6%)	(28.4%)	(15.6%)
GEARING/LIQUIDITY/ACTIVITIES	2022A	2023A	2024A	2025E	2026E	2027E
YE 31 Dec						
Net debt to equity (x)	0.1	(0.3)	(0.3)	(0.6)	(0.8)	(0.5)
Current ratio (x)	3.1	2.1	1.7	1.7	2.0	2.3
Receivable turnover days	917.7	822.8	1,316.3	1,100.0	980.0	490.0
Inventory turnover days	182.2	122.3	201.8	200.0	150.0	110.0
Payable turnover days	372.5	331.9	593.9	340.0	300.0	225.0
VALUATION	2022A	2023A	2024A	2025E	2026E	2027E
YE 31 Dec						
P/E	ns	ns	ns	ns	ns	ns
P/B	1.4	1.9	1.7	2.3	2.8	2.5
P/CFPS	ns	ns	ns	ns	ns	ns
Div yield (%)	0.0	0.0	0.0	0.0	0.0	0.0

Source: Company data, CMBIGM estimates. Note: The calculation of net cash includes financial assets.

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