MIRAE ASSET
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Company Report
September 13, 2017

Doosan Corp.

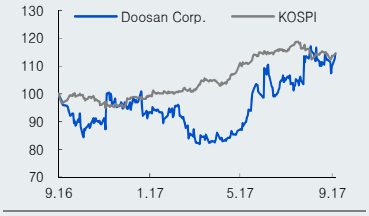
(000150 KS)

Fuel cells to drive growth momentum

(Maintain)	Buy
Target Price (12M, W)	▲ 170,000
Share Price (09/12/17, W)	130,500
Expected Return	30%

OP (17F, Wbn)	1,154
Consensus OP (17F, Wbn)	1,180
EPS Growth (17F, %)	-40.4
Market EPS Growth (17F, %)	45.4
P/E (17F, x)	29.6
Market P/E (17F, x)	9.7
KOSPI	2,365.47
Market Cap (Wbn)	2,637
Shares Outstanding (mn)	26
Free Float (%)	27.5
Foreign Ownership (%)	7.5
Beta (12M)	0.42
52-Week Low	93,400
52-Week High	133,500

(%)	1M	6M	12M
Absolute	-0.8	38.8	17.6
Relative	-2.7	23.1	-1.0



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Fuel cell business status

Doosan Corp. entered the fuel cell business in 2014 by acquiring the US company ClearEdge Power and merging with the Korean company Fuel Cell Power. We see strong growth prospects in the power generation application segment, where the company has secured a number of business opportunities.

In 1H17, the fuel cell division posted poor earnings, hurt by cost pressures related to the preparation of the new Iksan plant in 1Q17. However, we expect earnings to improve in 2H17, as a large portion of the order backlog (W715bn as of end-2Q17) is due for delivery by the end of the year. Meanwhile, now that the Iksan plant is complete, we expect the company to see meaningful orders in 2H17, including from Hanwha Energy (50MW), and view the 2017 order target of W1.3tr as highly achievable. Given that 40% of order backlogs are recognized as revenue within one year, we have little doubt fuel cell earnings will improve in 2018. Margins also look likely to recover on an increasing mix of long-term service agreements (LTSAs). We forecast Doosan Corp.'s fuel cell revenue to expand 61.6% YoY from W348.2bn in 2017 to W562.8bn in 2018.

Policy shift toward new/renewable energy to accelerate growth of fuel cells

As a new/renewable energy source, the domestic fuel cell market remains underdeveloped, estimated at 1,089GWh (2.9% of new/renewable energy sources) based on power generation and 171MW (1.2%) based on power capacity (as of 2015). Nevertheless, the domestic fuel cell market for power generation has been gaining increasing ground ever since the renewable portfolio standard (RPS) was adopted in 2012 as part of the government's effort to drive new/renewable energy deployment, and now accounts for more than half of the global market.

The government is currently considering raising the power generation mix of new/renewable energy to 20% by 2030 while also gradually increasing RPS targets from 2020 (to 28% by 2030). In our view, the government's energy policy stance could hasten the growth of the domestic fuel cell market.

Fuel cells have a number of advantages over other energy sources, such as lower up-front capital requirements and higher power efficiency. Furthermore, fuel cells take up little space and operate with low noise, making them well-suited for distributed generation. Thus, as technological advances in hydrogen extraction drive further improvements in fuel cell economics, we think the market could undergo exponential growth, fueling strong earnings growth for Doosan Corp.'s fuel cell business.

Reaffirm Buy and Raise TP to W170,000

We reaffirm our Buy call on Doosan Corp. and raise our target price to W170,000 (from W130,000), reflecting: 1) a change in our valuation base year for in-house businesses (from 2017 to 2018); and 2) an upward revision to the value of the company's stakes in subsidiaries.

We estimate operating profit from in-house businesses to expand over 18.9% YoY in 2018, bolstered by the fuel cell business. On top of continued earnings growth of in-house businesses, we also expect the company to deliver strong shareholder returns through dividend hikes and share cancellations. All in all, we believe Doosan Corp. offers an attractive opportunity at the current share price. It is also positive that debt levels are gradually declining on the back of ongoing efforts to repair the balance sheet, together with continued margin improvements across the group.

FY (Dec.)	12/13	12/14	12/15	12/16	12/17F	12/18F
Revenue (Wbn)	21,616	20,312	16,902	16,411	17,319	18,604
OP (Wbn)	1,135	998	71	917	1,154	1,262
OP margin (%)	5.3	4.9	0.4	5.6	6.7	6.8
NP (Wbn)	124	65	-391	197	113	249
EPS (W)	4,703	2,478	-14,671	7,384	4,402	9,736
ROE (%)	4.3	2.2	-14.3	7.9	4.8	10.3
P/E (x)	29.7	41.8	-	14.2	29.6	13.4
P/B (x)	1.1	0.9	0.8	1.0	1.3	1.2
Dividend yield (%)	2.5	3.9	5.1	4.9	3.9	3.9

Note: All figures are based on consolidated K-IFRS; NP refers to net profit attributable to controlling interests
Source: Company data, Mirae Asset Daewoo Research estimates

Overview of fuel cell business

Business status

Doosan Corp. entered the fuel cell business in 2014 by acquiring the US company ClearEdge Power and merging with the Korean company Fuel Cell Power.

*ClearEdge Power, currently known as Doosan Fuel Cell America, is a US company that supplies phosphoric acid fuel cells (PACFs) for buildings and regulatory applications.

*Fuel Cell Power was previously a producer of proton exchange membrane fuel cells (PEMFCs) used in households with an 80% domestic market share.

Table 1. Doosan Corp.'s fuel cell-related acquisitions

Company	M&A type	Price	Closing date	Notes
Fuel Cell Power	Small-scale merger	W45.8bn	September 30, 2014	- Fuel cell supplier for households established in 2001 - 80% of domestic household fuel cell market
ClearEdge Power	Acquisition of assets and liabilities	US$32.4mn (W33.4bnb)	July 18, 2014	- Fuel cell supplier for buildings established in 2003 - Secured PAFC technology with the acquisition of UTC Power in 2013 - Filed for Chapter 11 in May 2014

Source: Company data, Mirae Asset Daewoo Research

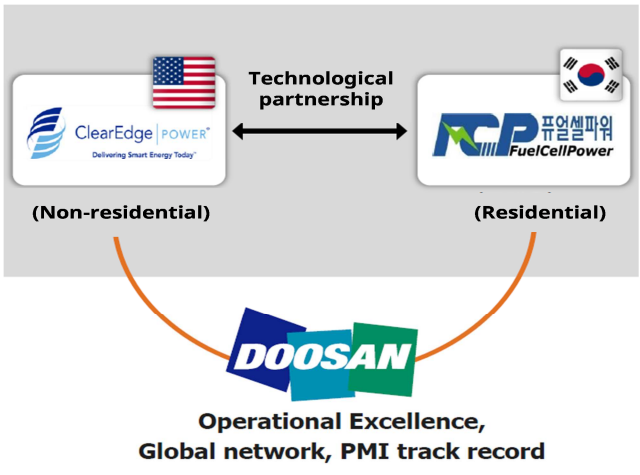
Production capacity

Annual capacity of W126MW: 63MW in Connecticut and 63MW in Iksan

In May 2017, Doosan Corp. completed the construction of its new fuel cell plant at the Iksan second general industrial complex in North Jeolla Province. The plant is capable of producing 144 units of 440KW PAFCs annually, which amounts to annual capacity of 63MW. The plant cost around W40bn and is the largest fuel cell facility (10,744m^2) in Korea.

The new plant has an automated system for producing fuel cell stacks, which play a critical role in fuel cells, and uses domestically-produced balance of plant (BOP) systems (previously manufactured in the US). Electrodes, key components that induce the reaction of hydrogen and oxygen, are also internally produced. (Previously, the company relied on foreign suppliers for electrodes.) Indeed, the company has achieved vertical integration of its fuel cell business, from technology development to component sourcing to fuel cell manufacturing. The in-house production and sourcing of core components should yield cost savings and improve product competitiveness.

Figure 1. Doosan Corp. entered the fuel cell business in 2014



Source: Company data, Mirae Asset Daewoo Research

Figure 2. New Iksan plant has annual capacity of 63MW

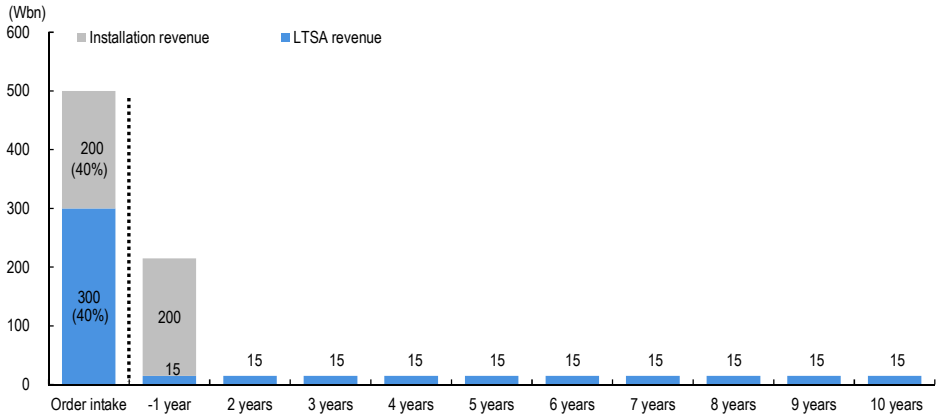
Source: Company data, Mirae Asset Daewoo Research

Fuel cell earnings outlook

Revenue recognition

Fuel cell orders consist of: 1) system installations (revenue recognized within six to 12 months); and 2) LTSAs (revenue recognized over a 10- to 20-year period), which respectively account for 40% and 60% of revenue.

Figure 3. Fuel cell order intake and revenue recognition



Note: LTSA based on 10-year period
Source: Mirae Asset Daewoo Research

1H17 review and 2H17 outlook

In 1H17, Doosan Corp.'s fuel cell division recorded revenue of W79.1bn and an operating loss of W6.2bn. The poor performance was largely due to cost pressures related to the preparation of the Iksan plant in 1Q17. However, we expect revenue to improve in 2H17, as a large portion of the order backlog (W715bn as of end-2Q17) is due for delivery by the end of the year.

We believe the 2017 order target of W1.3tr is highly achievable. Recently, Hanwha Energy established a special-purpose corporation (SPC) called Daehan Green Energy to build a 50MW hydrogen fuel cell power plant at the Daesan Industrial Complex in Seosan, South Chungcheong Province. (49% of the SPC is owned by Hanwha Energy, 35% by Korea East-West Power, 10% by Doosan Corp., and 6% by SK Securities.) The power plant will use hydrogen extracted from the crude refining process at Hanwha Total Petrochemical (Hanhwa Energy's second-tier subsidiary). The power plant project is expected to generate revenue of W500bn for Doosan Corp. in the form of fuel cell generator shipments and an LTSA.

In April 2016, Doosan E&C was named the preferred bidder for the 39.6MW Songdo fuel cell power plant project (W208.5bn bid). SK E&S also looks likely to place orders soon for its 39.6MW fuel cell power plant in Gangdong, which the power company needs in order to meet RPS targets from 2018 amid growing capacity.

Overall, we expect Doosan Corp.'s order intake to meaningfully grow, now that the Iksan plant is complete. Given that 40% of order backlogs are recognized as revenue within one year, we have little doubt fuel cell earnings will improve in 2018 and expect margins to also recover.

Table 2. Fuel cell earnings forecasts (Wbn)

	1Q15	2Q15	3Q15	4Q15	2015	1Q16	2Q16	3Q16	4Q16	2016	1Q17	2Q17	3Q17F	4Q17F	2017F	2018F
Revenue	19	13	27	110	168	18	65	15	89	187	13	66	65	108	348	563
OP	-6	-3	2	13	5	-6	-1	-6	3	-10	-9	3	2	12	24	50
OP margin	-31.6%	-27.0%	7.9%	11.6%	3.2%	-31.8%	-2.0%	-43.5%	3.8%	-5.3%	-71.0%	4.7%	3.1%	11.0%	6.9%	8.8%
New orders					588					444					1,015	1,200
Installation					212					160					366	480
LTSA					376					284					649	720
Order backlog					492					679					1,443	2,080

Note: Consolidated basis (domestic + US)
Source: Mirae Asset Daewoo Research

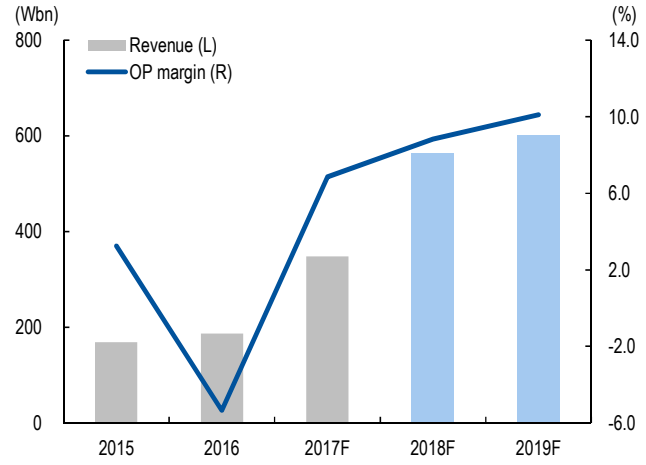
Table 3. Recent order wins

(Wbn)

Date	Details	Capacity (MW)	Value (estimate)
10/22/15	Signed contract to supply fuel cells for Busan fuel cell power plant	30.8	280
4/18/16	Doosan E&C named as preferred bidder of Songdo project	39.6	208 (total project value)
9/23/16	Along with KECC, selected as co-winner of the Bundang five-stage fuel cell power generation facility (5WM) contract by Korea South-East Power	5	30
11/3/16	Fuel cell power plant project for the Seonam Sewage Treatment Center in Magok, Seoul	20	125 (total project value)
7/6/17	Named as preferred bidder of Sangmu (Gwangju) fuel cell power plant project	27.5	170 (total project value)
8/28/17	Hanwha's hydrogen fuel cell power plant project	50	500

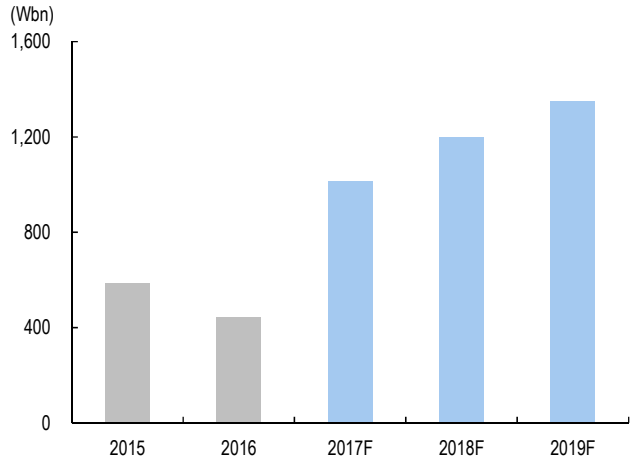
Source: Media reports, Mirae Asset Daewoo Research

Figure 4. Fuel cell revenue and OP margin



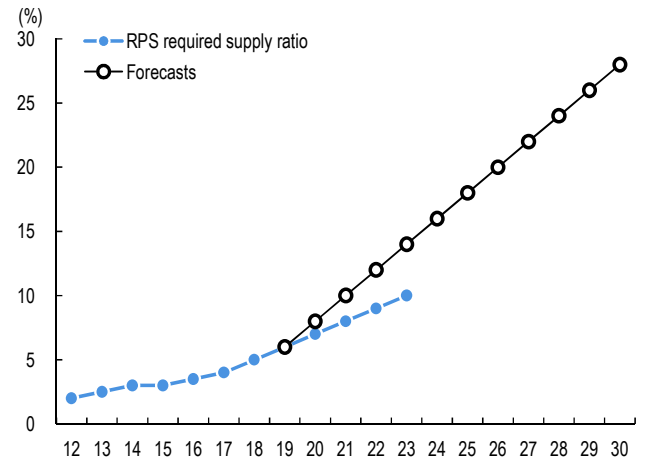
Source: Mirae Asset Daewoo Research

Figure 5. Fuel cell order intake



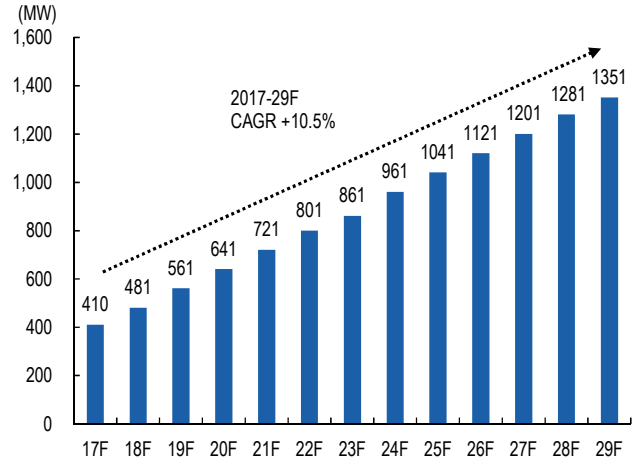
Source: Mirae Asset Daewoo Research

Figure 6. Current RPS targets and expected upward revisions



Source: Mirae Asset Daewoo Research

Figure 7. Fuel cell power generation capacity under 7th Basic Plan for Long-Term Electricity Supply and Demand



Source: Mirae Asset Daewoo Research

Fuel cell 101

Overview

Unlike conventional power generators, fuel cells do not rely on combustion to generate power, and instead convert chemical energy to electricity by combining hydrogen and oxygen in an electrochemical reaction (H_2 + ½ O_2 → H_2O + electricity and heat).

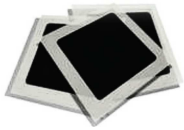
Fuel cell power plants generally use natural gas as a source of fuel. Heating liquefied natural gas (LNG) to a temperature above 600℃ separates hydrogen from the gas, which is then placed into a stack consisting of individual fuel cells. Here, the hydrogen is combined with oxygen, generating electricity and heat.

Fuel cells have an energy efficiency of over 30-60%, even after considering the energy or heat losses caused by the operation of equipment. When used in combined heat and power systems, energy efficiency energy efficiency can even exceed 80%.

The fuel cell value chain can be classified into several segments, including cells, stacks, reformers, BOPs and, fuel cell systems.

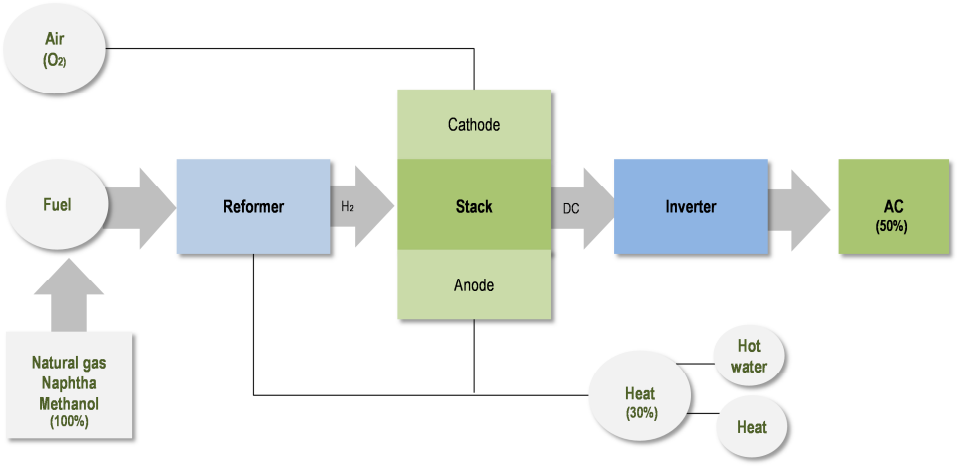
Figure 4. Fuel cell value chain

Component	Details
Reformer	Extracts hydrogen from hydrocarbons (natural gas, methane, oil, etc.) Compactness is critical to control sulfur (less than 10ppb) and carbon monoxide (less than 10ppm) and improve system efficiency
Stack	An arrangement of tens or hundreds of individual cells to achieve the desired power output Key technologies include individual cell manufacturing, stacking and sealing, and design/manufacturing of separator plates for hydrogen supply and heat recovery
Inverter	Converts the direct current generated from the fuel cell to alternating current
BOP	Pumps, blowers and sensors for fuel, air and heat recovery

Fuel cell system	Cell	Stack	Reformer	BOP
				

Source: Korea Energy Agency, Mirae Asset Daewoo Research

Figure 8. Fuel cell power generation system overview



Source: Korea Energy Agency, Mirae Asset Daewoo Research

Fuel cell types

Generally speaking, fuel cells can be categorized into: 1) PEMFCs; 2) PAFCs; 3) molten carbonate fuel cells (MCFCs); 4) solid oxide fuel cells (SOFCs); 5) alkaline fuel cells (AFCs); and 6) direct methanol fuel cells (DMFCs).

In addition, fuel cells are also classified into high- and low-temperature types. MCFCs and SOFCs are high-temperature fuel cells, operating at 650℃ or higher. Thanks to their high reactivity at high temperatures, they can use non-precious-metals (e.g., nickel, etc.) as catalysts. Furthermore, they boast high efficiency. However, they are characterized by longer start-up and shut-down times and vulnerable to thermal shocks. Accordingly, they are more suitable for long-running applications (i.e., adoption in power plants and large buildings).

Meanwhile, PAFCs, PEMFCs, and DMFCs operate at 200℃ or below. They require shorter start-up times and boast excellent resilience to load fluctuations. However, they require the use of high-priced platinum as a catalyst. These fuel cell types are generally used in power small/mid-sized factories, portable and backup generators, and residential cogeneration systems.

*** Comparison of PAFCs and MCFCs**

There is an inverse relationship between operating temperature and a stack's resistance to impurities. As such, the stack life of an MCFC is generally five years, while that of a PACF is 10 years. PAFCs boast higher cost competitiveness and are easier to install and maintain than MCFCs.

Table 5. Types of fuel cells

	High-temperature		Low-temperature			
	MCFC	SOFC	PAFC	AFC	PEMFC	DMFC
Operating temperature	550~700℃	600~1000℃	150~250℃	50~120℃	50~100℃	50~100℃
Major catalyst	Perovskite	Nickel	Platinum	Nickel	Platinum	Platinum
Electrolyte materials	Li/K alkali carbonate mixture	YSZ, GDC	H_3PO_4	KOH	Ion exchange membrane	Ion exchange membrane
Fuel	H_2, CO (natural and coal gas)	H_2, CO (natural and coal gas)	H_2, CO (,ethanol, coal gas)	H_2	H_2 (methanol, coal gas)	Methanol
Reformer	X	X	O	O	O	X
Efficiency (%LHV)	50~60	50~60	40~45	-	<40	-
Applications	Large power plants, small/mid-sized factories	Large power plants, small/mid-sized factories, portable applications	Small/mid-sized factories, biogas plants	Space launch vehicles	Transportation, household, portable applications	Portable applications
Advantages	High power generation efficiency, internal reforming, applicable to cogeneration power plants	High power generation efficiency, internal reforming, applicable to cogeneration power plants	High CO durability, applicable to cogeneration power plants	-	Low operating temperature, high power density	Low operating temperature, high power density

Source: Mirae Asset Daewoo Research

Table 6. Fuel cell applications

		Capacity	Fuel cell type				
			PAFC	MCFC	SOFC	PEMFC	DMFC
Fixed	Power generation	Double-digit kW – double-digit MW	●	●	●	○	○
	Residential/commercial buildings	Single-digit kW – double-digit kW	○	○	●	●	○
Transportation-use	Vehicles	Single-digit kW – triple digit kW	○	▲	●	●	○
	Vessels	Triple–digit kW – double-digit MW	○	●	●	○	○
Portable applications		Triple-digit W - single-digit kW	○	○	●	●	●
		Single-digit W – triple-digit W	○	○	○	●	●

Note: ● : applicable, ▲ : partially applicable, ○ : not applicable
Source: "New & Renewable Energy White Paper" (2016), Mirae Asset Daewoo Research

Domestic fuel cell market development

Article 2 of the Act on the Promotion of the Development, Use, and Diffusion of New and Renewable Energy defines new/renewable energy as follows:

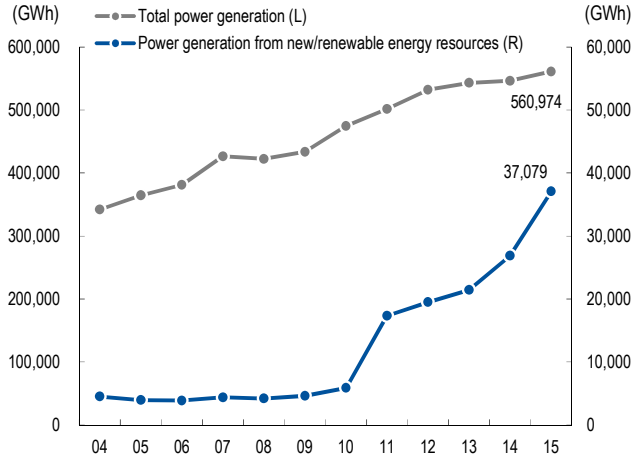
* New energy: Hydrogen energy; fuel cells; energy from liquefied or gasified coal and from gasified heavy residual oil

* Renewable energy: Solar energy; biomass energy; wind power; water power; marine energy; energy from waste; thermal energy.

As of 2015, the domestic fuel cell market is estimated at 1,089GWh (accounting for 2.9% of new and renewable energy) based on power generation and 171MW (1.2%) based on power capacity. While the market is still underdeveloped, it has been gaining increasing ground ever since the RPS was adopted in 2012 as part of the government's effort to drive new/renewable energy deployment, and now accounts for more than half of the global market. Cost efficiency has also improved sharply, with installation costs per MW falling from W6.4bn in 2011 to W4.6bn in 2015.

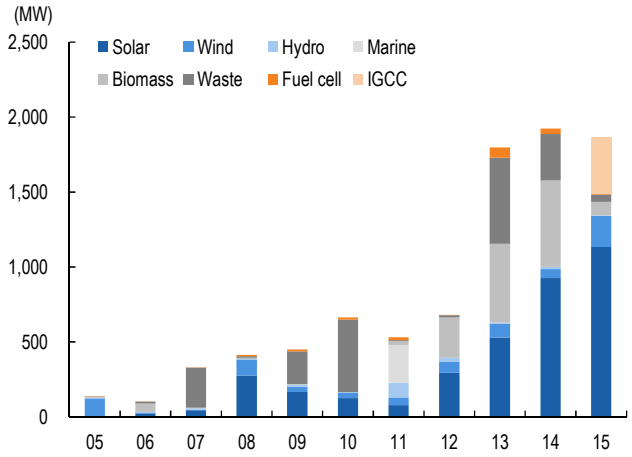
The government is currently considering raising the power generation mix of new/renewable energy to 20% by 2030. Once fuel cells undergo cost competitiveness improvement, they should serve as a strong growth driver of the new/renewable energy industry.

Figure 9. Gross power generation and new/renewable generation



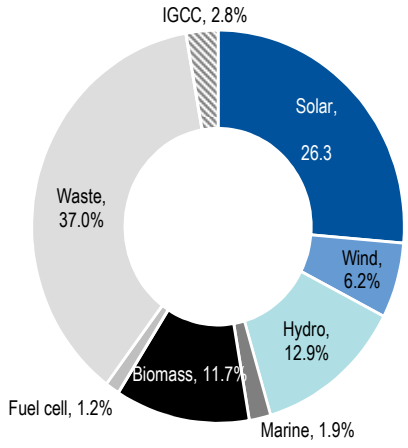
Source: KNREC, Mirae Asset Daewoo Research

Figure 10. New/renewable energy capacity trend during 2002-15



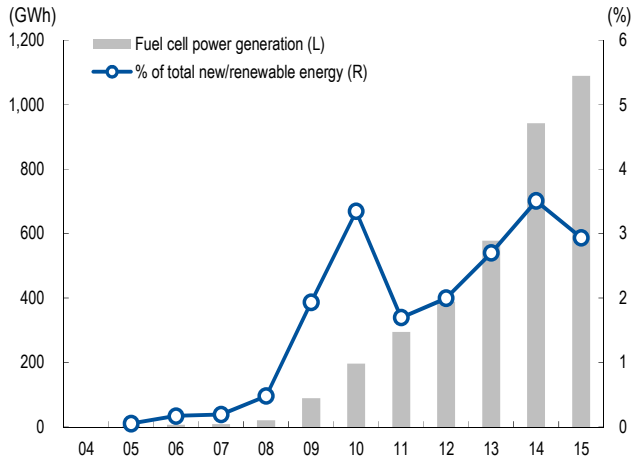
Source: KNREC, Mirae Asset Daewoo Research

Figure 11. New/renewable energy capacity breakdown (cumulative, as of 2015)



Source: KNREC, Mirae Asset Daewoo Research

Figure 12. Fuel cell power generation trend



Source: KNREC, Mirae Asset Daewoo Research

New/renewable energy policy direction

1) President Moon Jae-in's campaign promises

- During his campaign, President Moon Jae-in promised to discontinue the construction of nuclear power plants, scrap new nuclear plant construction plans, and prohibit lifespan extensions for existing plants (to eventually phase out nuclear power). After the election, he halted the construction of the Shin-Kori 5 and 6 reactors and shut down the Wolseong 1 reactor.
- He also promised to raise RPS targets and facilitate private sector investments in new and renewable energy.

2) Five-year road map

- The government plans to expand the power generation mix of renewable energy to 20% by 2030, and to strongly support industries related to new/renewable energy.
- The government also aims to gradually raise RPS targets starting in 2020 (to 28% by 2030).

3) MOTIE status check

- The Ministry of Trade, Industry and Energy (MOTIE) will shift its energy focus from supply/demand dynamics and economic efficiency to a balanced pursuit of public safety and environmental protection.
- In a bid to phase out nuclear energy, it will ban lifespan extensions for existing plants and cancel new power plant construction plans.
- The ministry will slash pollutant emissions by 50% by 2030 via the early shutdowns of seven aged coal power plants and improvement in environmental facilities.
- It will also ban the construction of a new coal power plant and strongly encourage changing coal power plants under construction to LNG power plants.
- To expand the power generation mix of renewable energy to 20% by 2030, the ministry will make efforts to enhance the public acceptance and economics of new/renewable energy.

4) 8th Basic Plan for Long-Term Electricity Supply and Demand

- Under the 8th Basic Plan for Long-Term Electricity Supply and Demand, the new/renewable energy capacity target will be raised to 62.6GW from 32.9GW.
- KEPCO plans to expand new/renewable power generation from 0.1GW in 2016 to 0.7GW in 2020, 5.2GW in 2025, and 13.5GW (5.0W from solar energy, 8.1GW from wind power, and 0.4GW from fuel cells) in 2030.

Table 7. Moon administration's energy policies

	Campaign promises	Five-year road map	MOTIE status
Key policies	**Abolition of nuclear power-driven energy policies** - Discontinuation of new nuclear power plant construction and the scrapping of new nuclear plant construction plans - Ban on extending the lifespans of existing plants **Increase in the power generation mix of new/renewable energy to 20% by 2030** **Upward revisions to RPS targets** - Temporary adoption of the feed-in tariff (FIT) scheme for new/renewable energy facilities - Expansion of new/renewable energy supply by boosting private sector investments - Promote corporate investments in renewable energy - KEPCO to launch large-scale new/renewable energy projects - Increase in public acceptance of renewable energy (e.g., PV applications in rural areas)	**Shift from nuclear energy and coal to new/renewable energy** - Increase in the power generation mix of new/renewable energy to 20% by 2030 - Gradual increase in RPS targets starting in 2020 (to 28% in 2030) - Active support for new energy industries	**Increase in the power generation mix of new/renewable energy to 20% by 2030** - Increase in the proportion of solar energy and wind power in the renewable energy mix; shift from businesses to local governments and residents - Improvement in public profile and economics of new and renewable energy **Current paradigm shift in energy policies to serve as an opportunity to nurture new energy industries** **Reduction of emissions by 50% by 2030 via the early shutdowns of seven aged coal power plants and other improvements,** **Ban on the construction of new coal power plants and support for switching coal power plants under construction to LNG power plants.**

Source: Media reports, Mirae Asset Daewoo Research

Growth potential of the fuel cell market

1. Upward revisions to RPS targets

The government implemented the RPS in 2012 to aid in the deployment of new/renewable energy. The RPS is a regulation that requires power plants with capacity of 500MW or over to maintain a certain ratio of renewable power generation.

The government designates power producers subject to the scheme and sets the required supply ratio every year. Any power producer that fails to meet the requirement is subject to penalties (equivalent to up to 150% of average renewable energy certificate (REC) prices). Penalties vary depending on the cause and frequency of non-compliance.

In 2017, six subsidiaries of KEPCO and 10 private power generation companies, including K Water and Korea District Heating Corp., are subject to the standard.

The government aims to gradually raise RPS targets starting in 2020 (to 28% in 2030). Such efforts should propel an increase in renewable energy investments and provide growth opportunities to the fuel cell market.

Table 8. Annual RPS required supply ratio timeline

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023-	-2030
Ratio (%)	2.0	2.5	3.0	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	28.0 (TBD)

Note: RPS supply = power generation (excluding power generation from new/renewable energy resources) × required supply ratio
Source: Mirae Asset Daewoo Research

Table 9. RPS required supply rate by company (GWh)

		2012	2013	2014	2015	2016	2017	2018F	2019F	2020F	2021F	2022F	2023F
Required supply ratio		**2.0**	**2.5**	**3.0**	**3.0**	**3.5**	**4.0**	**5.0**	**6.0**	**7.0**	**8.0**	**9.0**	**10.0**
Group I: Greater than 5,000MW	KHNP	2,010	2,463	2,524	2,662	2,883	2,916	3,645	4,374	5,103	5,832	6,561	7,290
	KOEN	834	1,267	1,597	1,949	2,713	3,138	3,922	4,706	5,491	6,275	7,060	7,844
	KOMIPO	738	1,055	1,510	1,550	1,778	1,986	2,482	2,978	3,475	3,971	4,467	4,964
	WP	761	1,141	1,519	1,500	1,876	2,242	2,802	3,363	3,923	4,483	5,044	5,604
	KOSPO	834	1,286	1,777	1,743	1,877	2,203	2,754	3,305	3,855	4,406	4,957	5,508
	EWP	734	1,157	1,465	1,501	1,898	2,277	2,846	3,416	3,985	4,554	5,123	5,693
Group II: Below 5,000MW	KDHC	104	164	220	207	238	259	324	388	453	518	583	647
	K-Water	2	8	15	21	25	28	36	43	50	57	64	71
	SK E&S	90	126	143	143	180	189	236	283	330	377	424	472
	GS EPS	81	132	195	198	140	170	213	255	298	341	383	426
	GS Power	51	91	111	69	71	87	109	131	153	175	197	218
	POSCO Energy	143	261	326	303	362	393	491	589	688	786	884	982
	MPC Yulchon	37	59	93	182	222	257	321	385	449	513	577	641
	Pyeongtaek Energy Service			83	132	92	72	90	108	126	144	162	180
	Daeryun				58	71	94	118	142	165	189	212	236
	S-Power				19	166	173	217	260	303	347	390	433
	Pocheon Power				139	195	192	240	288	337	385	433	481
	Dongducheon Dream Power					298	368	460	552	644	735	827	919
Total		**6,420**	**9,210**	**11,578**	**12,375**	**15,084**	**17,044**	**21,305**	**25,566**	**29,827**	**34,088**	**38,349**	**42,610**

Note: Calculated based on 2016 power generation
Source: Mirae Asset Daewoo Research

2. REC prices are on the rise

RECs are commodities that represent proof of electricity generation from eligible renewable energy resources. If power generation companies cannot meet their RPS targets via in-house power generation, they have to purchase RECs.

RECs are calculated by applying the designated weight of a renewable energy source to electricity generation (in MWh). For example, if a company generates 100MWh of electricity via solar PV systems, which have a weight of 1.5, it will receive 150 RECs. Fuel cells have a weight of 2.0.

Since the integration of the solar PV and non-solar PV REC markets in March 2016, REC spot prices have been steadily rising, as: 1) the entries of new players have been delayed due to the sharp fall in system marginal price (SMP); 2) trading of solar PV RECs has become easier; and 3) gradual increases in RPS targets are expected. We expect REC spot prices to stabilize at the current levels.

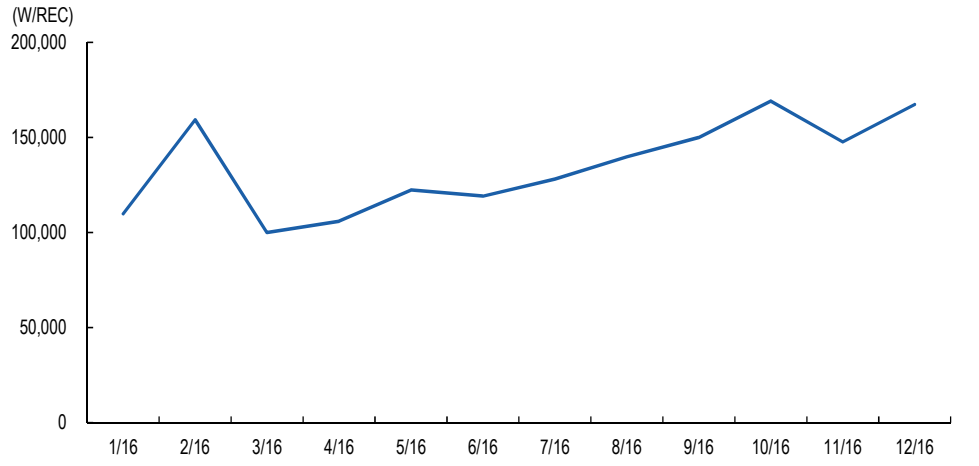
In addition, if the REC weighting for fuel cells is raised amid upward revisions to RPS targets, fuel cell demand will likely expand further.

Table 10. REC weights

Type	REC	Energy source and standards	
	Weight	Installation details	Detailed standards
Solar PV	1.2	Ground installation	Less than 100kw
	1		100-3,000kW
	0.7		More than 3,000kW
	1.5	Installation in existing facilities	3,000kW or less
	1		More than 3,000kW
	1.5	Installation on floating structures	
	1	In-house power generation	
	5	ESS facilities	2016, 2017
Non-solar PV	0.25	IGCC, gas by-products	
	0.5	Waste, landfill gas	
	1	Hydroelectric power, onshore wind power, biomass energy	
	1.5	Biomass, offshore wind power (within 5km), ocean thermal	
	2	**Fuel cells**	
	2	Offshore wind power (within 5km), ground thermal, marine current	Fixed-type
	1.0~2.5		Movable-type

Source: Mirae Asset Daewoo Research

Figure 13. REC price trend



Source: KPX, Mirae Asset Daewoo Research

3. Advantages of fuel cells

1) Efficiency

Fuel cells display similar power generation performance regardless of their capacity. In addition, fuel cell power generation systems are not affected by climate conditions and operate throughout the year with the exception of regular maintenance periods, leading to stable utilization of around 85-90%.

Furthermore, fuel cell power suppliers can meet their RPS targets while producing electricity and heat. And fuel cells have lower up-front capital requirements than other power generation sources.

Of note, fuel cells take up little space and can be produced in modules, making it easier to increase or reduce power generation capacity. As such, they are well-suited for distributed generation in urban areas.

2) Environmentally friendly

Currently, hydrogen is produced from fossil fuels, including natural gas and coal. Going forward, if hydrogen is secured from renewable energy sources, including wind power and solar PV, fuel cells can become a completely clean energy source without producing carbon dioxide, nitrogen oxide (NO_x), or sulfur oxide (SO_x).

3) Fuel cell economics

The power generation cost of fuel cells is W250/kWh (as of 2014), 1.7 to 2.7 times higher than that of other renewable energy sources, with LNG costs accounting for the lion's share. Backed by efforts to reduce LNG costs by developing large-scale natural gas and shale gas fields, LNG costs will likely stabilize at lower levels.

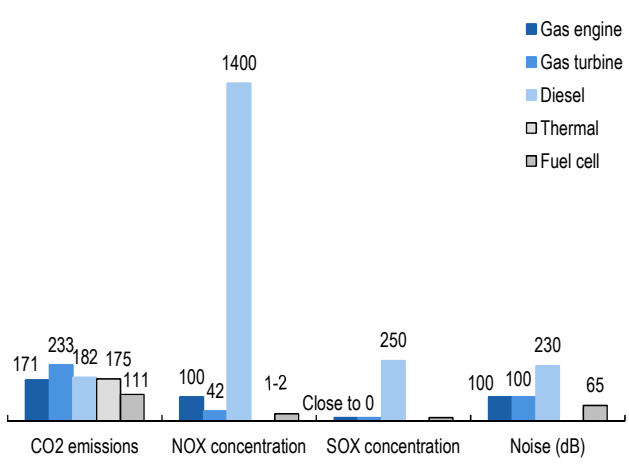
Thus, as technological advances in hydrogen extraction drive further improvements in fuel cell economics, we think the market could undergo exponential growth, fueling strong earnings growth for Doosan Corp.'s fuel cell business.

Table 11. Utilization and footprints of new/renewable energy resources

	Fuel cell	Solar	Wind
Utilization (%)/power generation	90%/7,884MWh	15%/1,314MWh	25%/2,190MWh
Footprint (㎡)	250	10,000	20,000

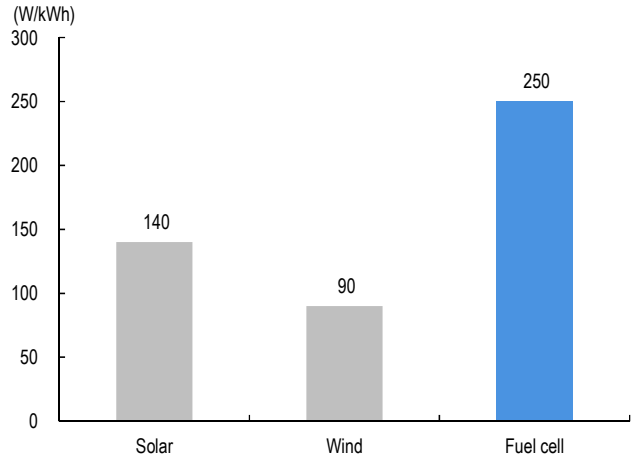
Source: Mirae Asset Daewoo Research

Figure 14. Air pollution by power generation category



Source: Mirae Asset Daewoo Research

Figure 15. Power generation costs by renewable energy source



Note: As of 2014, Source: Mirae Asset Daewoo Research

Valuation and earnings outlook

Reaffirm Buy and Raise TP to W170,000

We reaffirm our Buy call on Doosan Corp. and raise our target price to W170,000, reflecting: 1) a change in our valuation base year for in-house businesses (from 2017 to 2018); and 2) an upward revision to the value of the company's stakes in subsidiaries.

We estimate operating profit from in-house businesses to expand over 18.9% YoY in 2018, bolstered by the fuel cell business. On top of continued earnings growth of in-house businesses, we also expect to see strong shareholder returns via dividend hikes and share cancellations. We are also seeing a gradual decline in debt, on the back of ongoing efforts to repair the balance sheet, and continued margin improvements across the group. All in all, we believe Doosan Corp. offers an attractive opportunity at the current share price.

Table 12. Target price calculation (Wbn, W)

	2017F	2018F	Notes
1. Present value	**3,866**	**4,398**	
In-house businesses	3,316	3,848	
Electronics	1,784	1,751	20x 2017-18F after-tax OP
Industrial vehicles	793	837	15x 2017-18F after-tax OP
Mottrol	181	214	10x 2017-18F after-tax OP
Fuel cell	87	565	15x 2017-18F after-tax OP
ICT	471	481	15x 2017-18F after-tax OP
Brand royalties	413	413	g=3%, WACC=11%
Real estate	137	137	Fair value
2. Investment securities	**1,284**	**1,284**	
Listed subsidiaries	788	788	Market value
Unlisted subsidiaries	496	496	Relative value, book value
3. Total asset value (1+2)	**5,150**	**5,682**	
4. Net debt (-)	982	982	As of end-2Q17
Treasury stock market cap (+)	741	741	As of September 12, 2017
5. NAV (3+4)	**4,909**	**5,441**	
Market cap	3,059	3,059	Common/preferred shares as of September 12, 2017
Discount to NAV	37.7	43.8	
6. Number of shares ('000 shares)	25,604	25,604	Total issued shares (common + preferred)
7. NAV per share	191,718	212,495	
8. Theoretical target price	153,374	169,996	Applied 20% discount to NAV
Target price	**153,000**	**170,000**	
Current price	130,500	130,500	As of September 12, 2017
Upside potential	17.2	30.3	

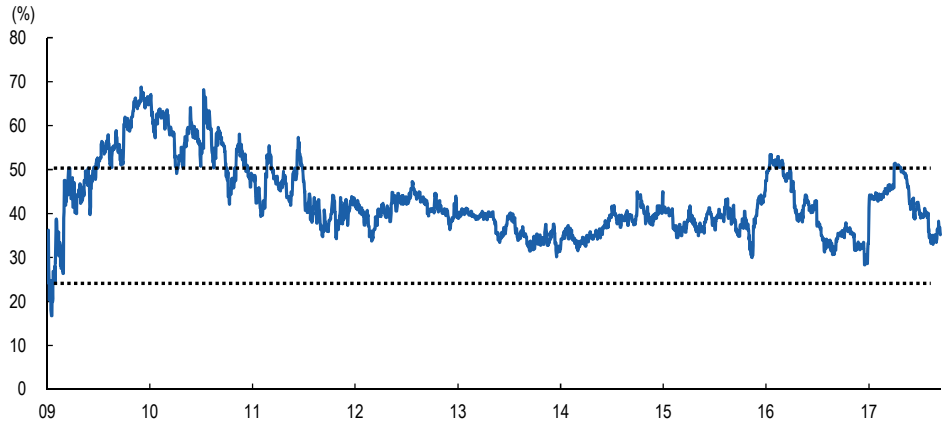
Source: Mirae Asset Daewoo Research

Table 13. Doosan Corp.'s investments (W, Wbn)

	Total shares outstanding ('000)	Stake	Book value	Current Share price	Value	Notes
Listed firms					**788**	Based on September 11th closing price
DHIC	43,946	41.4%	1,233	17,100	751	
Oricom	7,291	63.4%	23	4,960	36	
Unlisted firms					**496**	Based on book value
Doota Mall	6,000	100.0%	232		232	
Other			265		265	

Source: Mirae Asset Daewoo Research

Figure 16. Discount to NAV



Source: Mirae Asset Daewoo Research

Table 14. Quarterly earnings and forecasts (Wbn)

	2016					2017F					2018F	3Q17F growth	
	1Q	2Q	3Q	4Q	Annual	1Q	2Q	3QF	4QF	Annual		QoQ	YoY
Revenue	**3,709.0**	**4,251.4**	**3,647.8**	**4,802.5**	**16,410.7**	**4,086.3**	**4,588.4**	**4,039.2**	**4,605.5**	**17,319.4**	**18,604.1**	**-12.0**	**10.7**
In-house (parent)	492.2	585.0	513.8	618.1	2,209.1	554.9	667.4	630.8	676.9	2,530.0	2,990.0	-5.5	22.8
Electro-materials	194.4	195.7	203.2	206.3	799.6	216.6	224.6	227.9	226.7	895.8	920.4	1.5	12.1
Mottrol	67.3	69.0	62.2	85.4	283.9	92.0	101.3	73.2	91.3	357.7	414.7	-27.8	17.6
DIV	152.5	189.1	170.4	171.6	683.6	172.4	215.7	199.5	184.4	772.0	834.8	-7.5	17.1
I&C	60.2	65.8	63.3	65.6	254.9	60.8	59.8	65.6	67.0	253.2	257.2	9.6	3.6
Fuel cells	17.9	65.4	14.7	89.2	187.2	13.1	66.0	64.7	107.5	251.3	562.8	-2.0	340.1
Other	25.4	31.7	53.7	76.7	187.5	86.7	95.1	120.6	123.2	425.6	572.5	26.8	124.4
Dividends	39.4	134.0	0.0	1.7	175.1	85.8	5.6	0.0	0.0	91.4	97.3	-	-
DHIC/other	3,151.9	3,500.7	3,080.3	4,106.0	13,839.0	3,358.9	3,820.3	3,287.8	3,805.4	14,272.4	14,944.3	-13.9	6.7
Operating profit	**251.6**	**306.2**	**187.1**	**172.3**	**917.2**	**265.8**	**389.0**	**243.0**	**256.6**	**1,154.4**	**1,261.7**	**-37.5**	**29.9**
In-house (parent)	34.0	51.4	44.2	39.3	168.9	48.9	76.5	61.9	73.1	260.4	309.4	-19.1	40.0
Electro-materials	18.2	22.2	22.8	17.0	80.2	28.4	33.9	27.8	27.6	117.7	115.5	-17.9	22.1
Mottrol	2.4	3.2	3.3	2.4	11.3	5.2	9.3	4.5	4.9	23.8	28.3	-51.8	36.0
DIV	10.9	17.6	15.3	8.3	52.1	15.5	20.3	17.2	16.8	69.7	73.6	-15.4	12.3
I&C	8.2	9.7	9.2	10.4	37.5	9.1	9.9	10.4	12.1	41.4	42.3	4.9	12.9
Fuel cells	-5.7	-1.3	-6.4	1.2	-12.2	-9.3	3.1	2.0	11.8	7.6	49.7	-35.5	TTB
Other	-3.4	-27.5	-19.2	-35.0	-85.2	-14.2	-13.9	-5.7	-24.0	-57.9	-57.9	RR	RR
Dividends	39.4	134.0	0.0	1.7	175.1	85.8	5.6	0.0	0.0	91.4	97.3	-	-
DHIC/other	181.7	148.3	162.1	166.3	658.4	145.3	320.8	186.8	207.5	860.5	912.9	-41.8	15.2
OP margin	**6.8**	**7.2**	**5.1**	**3.6**	**5.6**	**6.5**	**8.5**	**6.0**	**5.6**	**6.7**	**6.8**	**-2.5**	**0.9**
In-house (parent)	6.9	8.8	8.6	6.4	7.6	8.8	11.5	9.8	10.8	10.3	10.3	-1.7	1.2
Electro-materials	9.4	11.3	11.2	8.2	10.0	13.1	15.1	12.2	12.2	13.1	12.5	-2.9	1.0
Mottrol	3.6	4.6	5.3	2.8	4.0	5.7	9.2	6.1	5.3	6.7	6.8	-3.0	0.8
DIV	7.1	9.3	9.0	4.8	7.6	9.0	9.4	8.6	9.1	9.0	8.8	-0.8	-0.4
I&C	13.6	14.7	14.5	15.9	14.7	15.0	16.6	15.8	18.0	16.4	16.4	-0.7	1.3
Fuel cells	-31.8	-2.0	-43.5	1.3	-6.5	-71.0	4.7	3.1	11.0	3.0	8.8	-1.6	46.6
Other	5.8	4.2	5.3	4.0	4.8	4.3	8.4	5.7	5.5	6.0	6.1	-2.7	0.4
Pretax profit	322.5	84.1	72.6	-479.4	-0.1	130.0	127.3	103.3	121.0	481.7	703.5	-18.9	42.2
Net profit	253.9	186.4	94.6	-484.5	50.4	51.3	23.1	41.6	48.7	164.8	282.4	79.9	-56.0
Controlling interests	**183.5**	**60.5**	**53.3**	**-100.7**	**196.6**	**8.2**	**21.4**	**38.5**	**45.0**	**113.0**	**249.3**	**79.9**	**-27.8**

Note: Based on consolidated IFRS; "other" reflects brand royalties, consulting fees, overhead allocation, and duty-free business (from 2Q16)
Source: Company data, Mirae Asset Daewoo Research estimates

Doosan Corp. (000150 KS/Buy/TP: W170,000)

Comprehensive Income Statement (Summarized)

(Wbn)	12/15	12/16	12/17F	12/18F
Revenue	**16,902**	**16,411**	**17,319**	**18,604**
Cost of Sales	**14,352**	**13,534**	**14,164**	**15,179**
Gross Profit	**2,550**	**2,877**	**3,155**	**3,425**
SG&A Expenses	**2,480**	**1,960**	**2,001**	**2,163**
Operating Profit (Adj)	**71**	**917**	**1,154**	**1,262**
Operating Profit	**71**	**917**	**1,154**	**1,262**
Non-Operating Profit	**-1,699**	**-917**	**-672**	**-558**
Net Financial Income	-637	-534	-502	-492
Net Gain from Inv in Associates	-78	-13	-11	-11
Pretax Profit	-1,628	0	482	704
Income Tax	184	191	316	421
Profit from Continuing Operations	-1,812	-192	165	282
Profit from Discontinued Operations	111	242	-1	0
Net Profit	-1,701	50	165	282
Controlling Interests	-391	197	113	249
Non-Controlling Interests	-1,310	-146	52	33
Total Comprehensive Profit	**-1,176**	**-219**	**163**	**282**
Controlling Interests	-75	-50	60	75
Non-Controlling Interests	-1,102	-169	102	207
EBITDA	759	1,558	1,759	1,801
FCF (Free Cash Flow)	-425	421	363	827
EBITDA Margin (%)	4.5	9.5	10.2	9.7
Operating Profit Margin (%)	0.4	5.6	6.7	6.8
Net Profit Margin (%)	-2.3	1.2	0.7	1.3

Statement of Financial Condition (Summarized)

(Wbn)	12/15	12/16	12/17F	12/18F
Current Assets	**12,324**	**10,769**	**11,040**	**12,029**
Cash and Cash Equivalents	2,333	2,016	3,329	4,024
AR & Other Receivables	3,297	2,775	2,661	2,762
Inventories	2,752	2,146	2,058	2,136
Other Current Assets	3,942	3,832	2,992	3,107
Non-Current Assets	**19,233**	**17,896**	**17,337**	**16,853**
Investments in Associates	74	90	87	90
Property, Plant and Equipment	8,796	8,077	7,758	7,417
Intangible Assets	7,025	6,954	6,791	6,593
Total Assets	**31,556**	**28,665**	**28,377**	**28,882**
Current Liabilities	**14,280**	**13,440**	**13,100**	**13,352**
AP & Other Payables	2,536	2,793	2,678	2,780
Short-Term Financial Liabilities	7,777	7,191	7,107	7,130
Other Current Liabilities	3,967	3,456	3,315	3,442
Non-Current Liabilities	**8,883**	**7,324**	**7,429**	**7,500**
Long-Term Financial Liabilities	6,840	5,370	5,555	5,555
Other Non-Current Liabilities	2,043	1,954	1,874	1,945
Total Liabilities	**23,163**	**20,764**	**20,529**	**20,852**
Controlling Interests	**2,577**	**2,392**	**2,344**	**2,493**
Capital Stock	135	135	135	135
Capital Surplus	839	828	855	855
Retained Earnings	1,357	1,411	1,337	1,486
Non-Controlling Interests	**5,817**	**5,509**	**5,504**	**5,537**
Stockholders' Equity	**8,394**	**7,901**	**7,848**	**8,030**

Cash Flows (Summarized)

(Wbn)	12/15	12/16	12/17F	12/18F
Cash Flows from Op Activities	-18	925	524	827
Net Profit	-1,701	50	165	282
Non-Cash Income and Expense	3,052	1,646	1,617	1,449
Depreciation	458	419	390	342
Amortization	231	222	214	197
Others	2,363	1,005	1,013	910
Chg in Working Capital	-617	3	-571	6
Chg in AR & Other Receivables	198	-158	-366	-88
Chg in Inventories	99	14	-37	-78
Chg in AP & Other Payables	-587	371	133	102
Income Tax Paid	**-166**	**-274**	**-200**	**-421**
Cash Flows from Inv Activities	-446	1,061	576	-51
Chg in PP&E	-388	-457	-125	0
Chg in Intangible Assets	-263	-275	-123	0
Chg in Financial Assets	-47	510	770	-51
Others	**252**	**1,283**	**54**	**0**
Cash Flows from Fin Activities	1,114	-2,254	213	-77
Chg in Financial Liabilities	1,123	-2,056	102	23
Chg in Equity	-107	-11	28	0
Dividends Paid	-227	-232	-271	-100
Others	**325**	**45**	**354**	**0**
Increase (Decrease) in Cash	642	-316	1,313	695
Beginning Balance	1,691	2,333	2,016	3,329
Ending Balance	**2,333**	**2,016**	**3,329**	**4,024**

Forecasts/Valuations (Summarized)

	12/15	12/16	12/17F	12/18F
P/E (x)	-	14.2	29.6	13.4
P/CF (x)	1.7	1.6	1.9	1.9
P/B (x)	0.8	1.0	1.3	1.2
EV/EBITDA (x)	25.7	11.5	10.2	9.6
EPS (W)	-14,671	7,384	4,402	9,736
CFPS (W)	50,660	63,720	69,562	67,604
BPS (W)	110,105	106,038	104,175	109,989
DPS (W)	4,550	5,100	5,100	5,100
Payout ratio (%)	-4.1	151.0	46.3	27.0
Dividend Yield (%)	5.1	4.9	3.9	3.9
Revenue Growth (%)	-16.8	-2.9	5.5	7.4
EBITDA Growth (%)	-54.4	105.3	12.9	2.4
Operating Profit Growth (%)	-92.9	1,191.5	25.8	9.4
EPS Growth (%)	-	-	-40.4	121.2
Accounts Receivable Turnover (x)	6.0	6.3	7.3	7.9
Inventory Turnover (x)	6.0	6.7	8.2	8.9
Accounts Payable Turnover (x)	5.2	5.1	5.2	5.6
ROA (%)	-5.4	0.2	0.6	1.0
ROE (%)	-14.3	7.9	4.8	10.3
ROIC (%)	0.4	6,566.2	2.3	3.1
Liability to Equity Ratio (%)	276.0	262.8	261.6	259.7
Current Ratio (%)	86.3	80.1	84.3	90.1
Net Debt to Equity Ratio (%)	136.8	124.4	118.9	107.9
Interest Coverage Ratio (x)	0.1	1.6	2.1	2.3

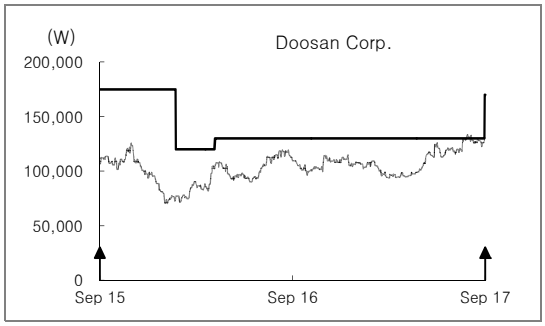
Source: Company data, Mirae Asset Daewoo Research estimates

APPENDIX 1

Important Disclosures & Disclaimers

2-Year Rating and Target Price History

Company (Code)	Date	Rating	Target Price
Doosan Corp. (000150)	09/12/2017	Buy	170,000
	04/19/2016	Buy	130,000
	02/05/2016	Buy	120,000



Stock Ratings		Industry Ratings	
Buy	: Relative performance of 20% or greater	Overweight	: Fundamentals are favorable or improving
Trading Buy	: Relative performance of 10% or greater, but with volatility	Neutral	: Fundamentals are steady without any material changes
Hold	: Relative performance of -10% and 10%	Underweight	: Fundamentals are unfavorable or worsening
Sell	: Relative performance of -10%		

Ratings and Target Price History (Share price (—), Target price (▬), Not covered (■), Buy (▲), Trading Buy (■), Hold (●), Sell (◆))

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* Although it is not part of the official ratings at Mirae Asset Daewoo Co., Ltd., we may call a trading opportunity in case there is a technical or short-term material development.
* The target price was determined by the research analyst through valuation methods discussed in this report, in part based on the analyst's estimate of future earnings.
* The achievement of the target price may be impeded by risks related to the subject securities and companies, as well as general market and economic conditions.

Equity Ratings Distribution & Investment Banking Services

	Buy	Trading Buy	Hold	Sell
Equity Ratings Distribution	69.67%	17.06%	13.27%	0.00%
Investment Banking Services	70.73%	17.07%	12.20%	0.00%

* Based on recommendations in the last 12-months (as of March 31, 2016)

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