

**South Korea Refining Capacity - 1/1/2007 (In MBD) (1)**

Site	Company	Completion	CDU	VDU	Coking	HDC	R/FCC	Cat. Reform	Alky/Poly	BTX	Naph. HDT	Dist. HDT	GO Desulf	Resid Desulf.	Lubes	Asphalt
Daesan (1)	Hyundai		382	58	29	29	-	22	-	25	47	122	20	-	5.1	3.7
Inchon (2)	SK		258	18	-	-	-	31	-	7	32	48	-	-	-	-
Inchon Cond.	Ssangyong		36	-	-	-	-	-	-	-	-	-	-	-	-	-
Onsan (3)	Ssangyong		568	138	-	74	64	40	-	19	58	118	38	140	7.3	8.3
Onsan Cond. (4)	Samsung		80	-	-	-	-	16	-	11	-	-	-	-	-	-
Ulsan (5)	SK		832	85	-	42	54	68	14	21	92	216	-	122	4.2	3.0
Yeochon (6)	GS Caltex		636	11	-	-	88	67	10	41	70	178	-	-	2.6	5.3
<b>Total</b>			<b>2,792</b>	<b>310</b>	<b>29</b>	<b>145</b>	<b>206</b>	<b>244</b>	<b>24</b>	<b>124</b>	<b>299</b>	<b>682</b>	<b>58</b>	<b>262</b>	<b>19.2</b>	<b>20.3</b>

Notes: (1) Abu Dhabi is half shareholder in Hyundai Refining. Until 2006, there was reluctance to invest further in South Korean refining, but Abu Dhabi will likely fund expansion plans.

(2) SK at the end of 2006 began to ramp up utilization and by end-year was running at about 255 MBD. The South Korean refiner trumped Sinochem's bid to buy Inchon in 2005 and is still considering expansion plans to revamp this plant. In early 2007, a strategic alliance with Nippon Oil was signed, trading 1% shares with each, costing about \$100 million.

(3) Aramco has reversed its earlier thinking and is ready to make substantial investments in an expanded Ssangyong. Earlier unit upgrading focused in the Ssangyong plant's ability to handle higher-sulfur slates.

(4) Samsung added a mercury removal unit in 2006.

(5) SK continues to add substantial new capacity and also has a 1.4 MBD oxygenates unit and 4.6 MBD MTBE capacity. The company also added a 35 MBD petrochemical feedstock preparation (naphtha separation) unit.

(6) GS Caltex is the new name for LG Caltex and supermajor Chevron continues to hold a half-share in this venture. BTX capacity is that only of refinery; refinery also includes a 2.5 MBD oxygenates unit. GS' Honam

Petrochemicals BTX output is excluded. The company added a 70 MBD petrochemical feedstock preparation (naphtha separation) unit. Distillate HDTs have been retro-fitted for more severe desulfurization.

**South Korea Planned Refinery Expansion - 1/1/2010 (In MBD) (1)**

Site	Company	Completion	CDU	VDU	Coking	HDC	R/FCC	Cat. Reform	Alky/Poly	BTX	Naph. HDT	Dist. HDT	GO Desulf	Resid Desulf.	Lubes	Asphalt
Daesan (2)	Hyundai	4Q-2008	-	49	35	25	68	-	-	-	-	-	-	-	-	-
Inchon	SK	4Q-2009	-	-	-	-	40	-	-	-	-	-	-	-	-	-
Onsan	Ssangyong	2Q-2008	-	-	-	-	-	-	-	-	-	-	-	102	-	-
Onsan Cond.	Samsung	4Q-2007	20	-	-	-	-	-	-	-	-	-	-	-	-	-
Onsan Cond. (3)	Samsung	4Q-2008	-	-	-	-	-	16	-	7	-	-	-	-	-	-
Ulsan	SK	3Q-2007	-	-	-	-	-	-	-	-	-	-	-	78	-	-
Ulsan	SK	3Q-2008	-	-	-	-	-	30	-	-	-	-	-	-	-	-
Ulsan	SK	4Q-2008	-	-	-	-	60	-	-	-	-	-	-	-	-	-
Yeochon (4)	GS Caltex	2Q-2007	-	147	-	-	-	-	-	-	-	-	-	-	-	-
Yeochon (5)	GS Caltex	1Q-2008	-	-	-	54	-	-	-	-	45	-	-	-	17.0	-
Yeochon	GS Caltex	4Q-2008	-	-	-	-	-	-	-	9	-	-	-	-	-	-
<b>Total Expansions</b>			<b>20</b>	<b>196</b>	<b>35</b>	<b>79</b>	<b>168</b>	<b>46</b>	<b>-</b>	<b>16</b>	<b>45</b>	<b>-</b>	<b>-</b>	<b>180</b>	<b>17.0</b>	<b>-</b>

Notes: (1) SK planners by early 2007 had still not come to a final investment decision on the Inchon refinery. Extensive refinery investment, particularly in hydrotreating, desulfurization and further severe secondary capacity are likely, but details have yet to solidify.

(2) We believe the company is leaning towards this add-on configuration, though an alternative plan for a 38 MBD R/FCC and 50 MBD Resid Desulf. have been considered. If the first option is followed, further hydrotreating and desulfurization will also be added, though capacities have yet to be determined.

(3) Unit addition sizes are tentative and may change.

(4) Company has installed a 70 MBD naphtha separation unit, which has been mislabeled as condensate splitter. Expanded VDU will help feed naphtha unit.

(5) Plans shifted from R/FCC unit to HDC.

**South Korea Refining Capacity - 1/1/2010 (In MBD)**

Site	Company	Completion	CDU	VDU	Coking	HDC	R/FCC	Cat. Reform	Alky/Poly	BTX	Naph. HDT	Dist. HDT	GO Desulf	Resid Desulf.	Lubes	Asphalt
Daesan	Hyundai		382	107	64	54	68	22	-	25	47	122	20	-	5.1	3.7
Inchon	SK		258	18	-	-	40	31	-	7	32	48	-	-	-	-
Inchon Cond.	Ssangyong		36	-	-	-	-	-	-	-	-	-	-	-	-	-
Onsan	Ssangyong		568	138	-	74	64	40	-	19	58	118	38	242	7.3	8.3
Onsan Cond.	Samsung		100	-	-	-	-	32	-	18	-	-	-	-	-	-
Ulsan	SK		832	85	-	42	114	98	14	21	92	216	-	200	4.2	3.0
Yeochon	GS Caltex		636	158	-	54	88	67	10	50	115	178	-	-	19.6	5.3
<b>Total</b>			<b>2,812</b>	<b>506</b>	<b>64</b>	<b>224</b>	<b>374</b>	<b>290</b>	<b>24</b>	<b>140</b>	<b>344</b>	<b>682</b>	<b>58</b>	<b>442</b>	<b>36.2</b>	<b>20.3</b>

**South Korea Proposed Refinery Expansion by 1/1/2012 (In MBD)**

Site	Company	Completion	CDU	VDU	Coking	HDC	R/FCC	Cat. Reform	Alky/Poly	BTX	Naph. HDT	Dist. HDT	GO Desulf	Resid Desulf.	Lubes	Asphalt
Daesan	Hyundai	1Q-2011	-	-	-	-	83	-	-	-	-	-	-	-	-	-
Inchon (1)	SK	4Q-2010	-	-	-	55	-	-	-	-	-	-	-	-	-	-
Inchon Cond.	Ssangyong	3Q-2010	25	-	-	-	-	-	-	-	-	-	-	-	-	-
Sosan (2)	Ssangyong	1Q-2011	474	128	-	74	74	-	-	-	-	-	-	88	-	-
<b>Total Expansions</b>			<b>499</b>	<b>128</b>	<b>-</b>	<b>129</b>	<b>157</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>88</b>	<b>-</b>	<b>-</b>

Note: (1) Planning is tentative including unit size.

(2) Ssangyong will build a grassroots refinery with 30% Aramco shareholding. Severe secondary and base capacity now confirmed, but other units may well be added.

**South Korea Refining Capacity - 1/1/2005 (In MBD) (1)**

Site	Company	Completion	CDU	VDU	Coking	HDC	R/FCC	Cat. Reform	Alky/Poly	BTX	Naph. HDT	Dist. HDT	GO Desulf	Resid Desulf.	Lubes	Asphalt
Daesan (2)	Hyundai		335	46	18	22	-	22	-	25	47	74	-	-	5.1	3.7
Inchon (3)	Inchon Refining		258	18	-	-	-	31	-	2	32	48	-	-	-	-
Onsan (4)	Ssangyong		535	158	-	62	63	40	-	18	58	116	38	138	7.3	8.3
Onsan Cond.	Samsung		80	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulsan (5)	SK		807	94	-	42	54	68	14	39	92	186	-	108	4.2	3.0
Yeocheon (6)	GS Caltex		625	11	-	-	77	68	-	36	70	186	-	-	2.6	5.3
<b>Total</b>			<b>2,640</b>	<b>327</b>	<b>18</b>	<b>126</b>	<b>194</b>	<b>229</b>	<b>14</b>	<b>120</b>	<b>299</b>	<b>610</b>	<b>38</b>	<b>246</b>	<b>19.2</b>	<b>20.3</b>

Notes: (1) Distillation/lubes capacity at Busan has apparently been scrapped.

(2) Abu Dhabi is half shareholder in Hyundai Refining. The current Inchon Refining Co. was called Hanwha Refining Co. and was united with Hyundai Refining until spun off. Abu Dhabi has refused to increase its ownership stake.

(3) This refinery has been running at minimal capacity since 2000. China's Sinochem had been close to finalizing its purchase of this unit, but has been delayed, as government policy remains undecided.

(4) While minority partner Aramco is reluctant to fund substantial further capacity, the Ssangyong plant has increased its ability to handle higher-sulfur slates. While the Ssangyong refinery is minority owned by Aramco, it often acts as an Aramco affiliate.

(5) SK has added substantial intermediate unit capacity over recent years and also has a 1.4 MBD oxygenates unit and 4.6 MBD MTBE capacity. Mild hydrocracker is called 'Heavy Oil Upgrading Unit' and in recent years has had severity increased.

(6) Despite abandoning stakes in Japan and Bahrain, Caltex, now ChevronTexaco, remains a half shareholder in LG Caltex refining company. BTX capacity is that only of refinery; refinery also includes a 2.1 MBD oxygenates unit. LG's Honam Petrochemicals BTX output is excluded.

**South Korea Planned Refinery Expansion - 1/1/2008 (In MBD) (1)**

Site	Company	Completion	CDU	VDU	Coking	HDC	R/FCC	Cat. Reform	Alky/Poly	BTX	Naph. HDT	Dist. HDT	GO Desulf	Resid Desulf.	Lubes	Asphalt
Daesan	Hyundai	3Q-2005	-	-	-	-	-	-	-	-	-	25	20	-	-	-
Ulsan	SK	3Q-2005	-	-	-	-	-	-	-	-	-	30	-	14	-	-
Ulsan	SK	2Q-2006	-	-	-	-	-	30	-	-	-	-	-	-	-	-
Ulsan (2)	SK	4Q-2007	-	-	-	-	66	-	-	-	-	-	-	-	-	-
Yeocheon	GS Caltex	3Q-2005	-	-	-	-	-	-	10	-	-	-	-	-	-	-
Yeocheon	GS Caltex	4Q-2007	-	-	-	-	58	-	-	-	-	-	-	-	-	-
<b>Total Expansions</b>			<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>124</b>	<b>30</b>	<b>10</b>	<b>-</b>	<b>-</b>	<b>55</b>	<b>20</b>	<b>14</b>	<b>-</b>	<b>-</b>

Notes: (1) All refiners are considering further gas oil desulfurization units to meet new diesel specifications.

(2) RCC configuration and timing remain tentative as is case for GS Caltex. All refiners are studying RCC units and SK has yet to finalize plans for upgrade of recently purchased Inchon Refining Co.

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Daesan	Hyundai		335	46	18	22	-	22	-	25	47	99	20	-	5.1	3.7
Inchon	SK		258	18	-	-	-	31	-	2	32	73	20	-	-	-
Onsan	Ssangyong		535	158	-	62	63	40	-	18	58	116	38	138	7.3	8.3
Onsan	Samsung		80	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulsan	SK		807	94	-	42	120	98	14	39	92	216	-	122	4.2	3.0
Yeocheon	GS Caltex		625	11	-	-	135	68	10	36	70	186	-	-	2.6	5.3
<b>Total</b>			<b>2,640</b>	<b>327</b>	<b>18</b>	<b>126</b>	<b>318</b>	<b>259</b>	<b>24</b>	<b>120</b>	<b>299</b>	<b>690</b>	<b>78</b>	<b>260</b>	<b>19.2</b>	<b>20.3</b>

**South Korea Proposed Refinery Expansion by 1/1/2010 (In MBD)**

None now planned.