

Asphalt (tonne)

MONTH	1998	1999	2000	2001	2002	2003	Average	tonne SRF*
Jan	10688	10505	10704	7678	8508	8812	9483	9485
Feb	8204	8882	8786	8716	7480	7546	8269	8272
Mar	8440	10350	8449	10473	8451	7901	9011	9013
Apr	8926	10941	10286	9955	7822	7823	9292	9295
May	9397	10837	8556	11721	9114	9524	9858	9861
Jun	9572	10798	8550	10983	9081	9557	9757	9760
Jul	9644	11361	10980	11948	7679		10322	10326
Aug	10702	11195	9340	11883	9405		10505	10508
Sep	9609	10542	10508	14481	6970		10422	10425
Oct	10546	10112	9243	9410	7304		9323	9326
Nov	10868	9473	8393	9073	7361		9034	9036
Dec	10382	9840	9331	9390	8751		9539	9542
TOT	116978	124836	113126	125711	97926	51163	114814	114850

Fuel gas (tonne)

Month	1998	1999	2000	2001	2002	2003	Average	tonne SRF*
Jan	1128	2097	1330	3247	2200	2730	2122	2504
Feb	1874	2487	1719	1774	2159	2402	2069	2441
Mar	1693	2203	2440	898	2390	2656	2047	2415
Apr	1520	1248	1370	1052	2497	2428	1686	1989
May	941	1331	1494	516	2169	2669	1520	1793
Jun	1278	810	2837	1776	2655	1514	1812	2138
Jul	1374	1608	1050	1593	2823		1690	1994
Aug	1500	1545	2031	551	2379		1601	1889
Sep	1667	1926	991	1283	1546		1483	1749
Oct	1780	1503	2300	990	1264		1567	1849
Nov	2397	1167	2880	1427	2245		2023	2387
Dec	2034	1209	2505	2056	2300		2021	2384
TOT	19186	19134	22947	17163	26627	14399	21640	25533

Fuel oil (tonne)

MONTH	1998	1999	2000	2001	2002	2003	Average	tonne SRF*
Jan	944	649	964	488	437	53	589	594
Feb	939	584	383	282	789	244	537	541
Mar	1699	651	192	745	124	311	620	625
Apr	1749	1326	90	75	451	593	714	720
May	1301	889	2215	101	670	23	867	873
Jun	927	1655	115	662	487	587	739	745
Jul	2016	526	145	292	2174		1031	1039
Aug	1030	844	816	183	841		743	749
Sep	1454	648	589	327	2633		1130	1139
Oct	768	798	119	83	3093		972	980
Nov	472	871	374	194	501		482	486
Dec	723	740	82	398	172		423	426
TOT	14022	10181	6084	3830	12372	1811	8847	8917

Total fuel consumption (tonne SRF)	149300
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*SRF means Standard Refinery Fuel, a reference fuel whose lower heating value is 9673 kcal/kg

Electricity purchase (MWh)

MONTH	1998	1999	2000	2001	2002	2003	Average
Jan		3,527	3772.6	4021	3941	2949	3642
Feb		3,034	3677.4	3190.3	3121.6	3126	3230
Mar		3,143	3123.9	3301.5	3416.4	3344	3266
Apr		1,704	3123.9	3489	2729	3290	2867
May		1,181	3095.5	3507.9	2298	3578	2732
Jun		2,870	2450.9	3310	2930	2640	2840
Jul		3,257	2109.3	2605	2000		2493
Aug		3,344	2685.3	2841.7	2582		2863
Sep		3,034	2642	2710	2431		2704
Oct		2,849	2676	2165.6	3075		2692
Nov		2,976	3648	2573.4	2771		2992
Dec		3,410	3172	3425.7	2757		3191
TOT		34327.4	36176.8	37141.1	34052	18927	35512

Medium Pressure Steam production (tonne)

MONTH	2000	2001	2002	2003	Average
Jan	133991	143267	129865	144302	137856
Feb	130919	125131	117381	130534	125991
Mar	133053	136762	122845	136767	132356
Apr	131540	130446	123427	134709	130031
May	143051	147408	135579	142821	142215
Jun	136953	145628	135014	131949	137386
Jul	139478	130072	132415		133988
Aug	141794	135711	134991		137499
Sep	137817	148091	121510		135806
Oct	140648	115620	125854		127374
Nov	124829	114033	119719		119527
Dec	134128	130903	118592		127874
TOT	1628199	1603071	1517192	821082	1587903

High Pressure Steam production (tonne)

MONTH	2000	2001	2002	2003	Average
Jan	163649	146303	138826	148775	149388
Feb	137555	133815	130909	135657	134484
Mar	143166	148490	137636	140241	142383
Apr	148821	137123	133464	136573	138995
May	155463	150509	147717	155338	152257
Jun	148797	169722	151743	144001	153566
Jul	152352	169732	157561		159882
Aug	155149	153940	155738		154942
Sep	150559	148091	140994		146548
Oct	147916	127687	142604		139402
Nov	149534	129482	136311		138442
Dec	152181	144448	147210		147946
TOT	1805142	1759342	1720713	860585	1758236

Fuel consumption rate, tonne SRF/100 tonne HPS	8.20	measured
Total fuel consumption 1, tonne SRF	144175	determined from steam output and specific fuel consumption
Total fuel consumption 2, tonne SRF	149300	measured
Difference "1 - 2", tonne SRF	-5124	-3.43%

Fuel consumption rate, tonne SRF/100 tonne HPS	8.49	calculated by dividing total fuel consumption measured by total steam output
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High Pressure Steam from refinery (tonne)

MONTH	2000	2001	2002	2003	Average
Jan	48680	59586	55994	52840	54275
Feb	56905	52030	47147	48781	51216
Mar	62248	53311	57305	53899	56691
Apr	57521	56221	54761	51986	55122
May	60109	56317	54653	49914	55248
Jun	59433	38156	51235	45225	48512
Jul	59263	26386	47532		44394
Aug	56006	52166	47594		51922
Sep	54206	59249	47184		53546
Oct	55932	42697	45954		48194
Nov	38990	49701	48037		45576
Dec	45937	54001	31462		43800
TOT	655230	599821	588858	302645	608497

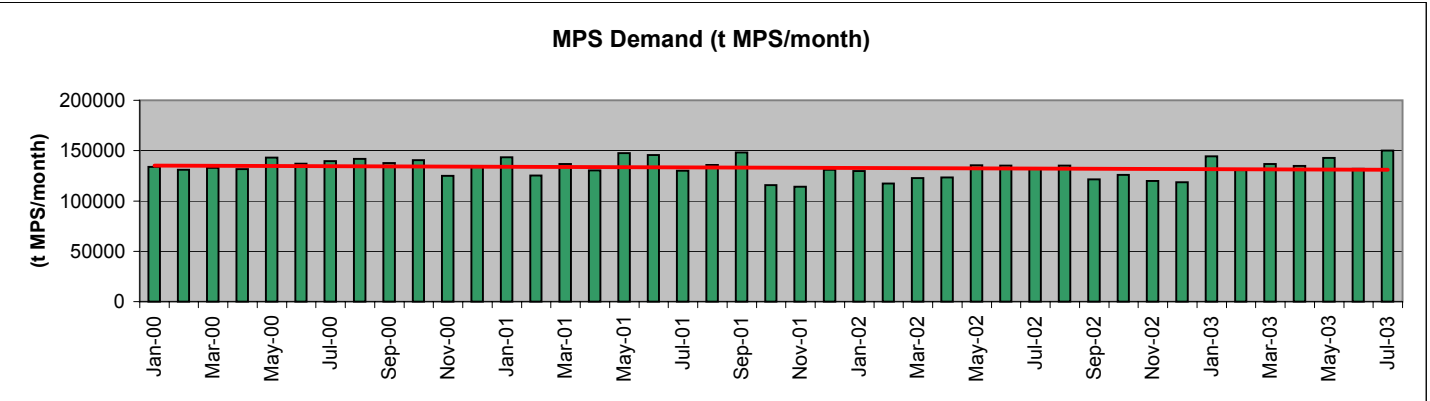
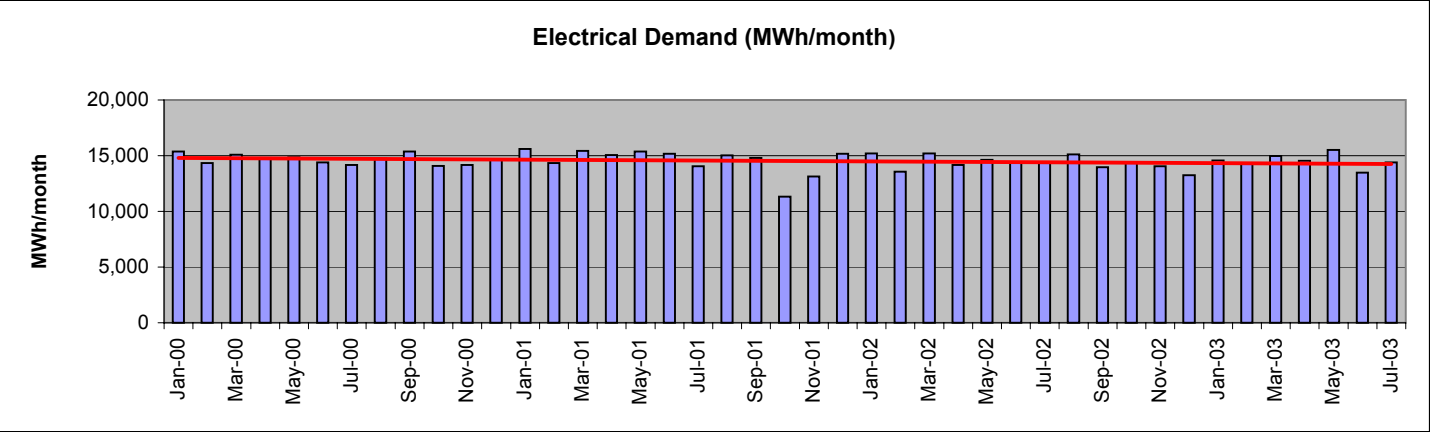
Using average consumption data for each fuel, this sheet determines relative consumption of each fuel

Month	Asphalt tonne/month	Fuel gas tonne/month	Fuel oil tonne/month
Jan	9483	2122	589
Feb	8269	2069	537
Mar	9011	2047	620
Apr	9292	1686	714
May	9858	1520	867
Jun	9757	1812	739
Jul	10322	1690	1031
Aug	10505	1601	743
Sep	10422	1483	1130
Oct	9323	1567	972
Nov	9034	2023	482
Dec	9539	2021	423
Annual total	114814	21640	8847
LHV (kJ/kg)	9676	11413	9750
Energy content, GJ LHV	1110942	246979	86257
Standard Refinery Fuel, tonne	114850	25533	8917
Relative fuel consumption	0.769	0.171	0.060
This relative consumption of the three fuel types is used to characterize baseline fuel consumption profile.			

Total
149300
1.000

FUEL CONSUMPTION GROWTH RATE (FCGR)

In the figures below we see that historic electricity and steam demand of the refinery has been constant during the past three years. Shell does not plan to add other production units during the project lifetime and thus we assume fuel consumption growth rate to be zero.



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Ex-ante assumptions based on thermodynamic analysis of baseline and project configurations

Item	Value	Units
Boiler steam production fraction	8.2 t SRF/100 t HPS	
HPS production in boilers (baseline)	218 t /h	
Electricity generation (baseline)	18.9 MW	
Refinery electricity demand	21 MW	
HPS production in boilers (project)	119 t /h	
Electricity generation (project)	33 MW	

Baseline Scenario

HPS production in boilers (t/year)	Fuel consumption in boilers (t SRF/year)	Electricity import from power grid (MW)
1909680	156594	2.1

Boiler fuel consumption is made up of asphalt, fuel gas and fuel oil in fixed proportions, both for baseline and project scenarios. See subsequent sheets for calculation of baseline (BE) and project emissions (PE).

Project Scenario

HPS production in boilers (t/year)	Fuel consumption in boilers t SRF/year	Electricity export through power grid (MW)
1042440	85480	12.0

Project Scenario also involves natural gas consumption in gas turbine. For details, see sheet "Natural gas - PE"

up of asphalt,
ortions, both for
see subsequent
(BE) and project

natural gas
details, see

Item		Value	Units	Data sources
FCGR	Fuel consumption growth rate	0.00%	per year	See "fuel cons growth rate" sheet
CV_{SRF}	Lower heating value	9673	kcal/kg	SRF = Standard refinery fuel. Value provided by Shell
CV_a	Lower heating value	9676	kcal/kg	Value provided by Shell. Equiv. To 40.51 MJ/kg. IPCC value 40.19 MJ/kg.
EF_a	CO ₂ emissions factor (combustion)	0.08066	Ton CO ₂ /GJ	Argentina First National Comm to UNFCCC, revised 1997
MEF_a	CH ₄ emissions factor (combustion)	0.000003	ton CH ₄ /GJ	IPCC 1996 Table 1.16, Residual fuel oil boilers
GWP (CH₄)	Global Warming Potential (CH ₄)	21		Kyoto Protocol
NEF_a	N ₂ O emissions factor (combustion)	0.0000003	ton N ₂ O/GJ	IPCC 1996 Table 1.16, Residual fuel oil boilers
GWP (N₂O)	Global Warming Potential (N ₂ O)	310		Kyoto Protocol

Year	Year	Asphalt consumption t SRF/year MFC _a	Asphalt consumption GJ/year FC _a	CO ₂ emissions (combustion) t /year E _a	CH ₄ emissions (combustion) t /year E _{met comb a}	N ₂ O emissions (combustion) t /year E _{N2O comb a}	CO ₂ equiv emissions t /year E _{TOTAL a}
1	2003	120461	4878525	393502	14.6	1.5	394263
2	2004	120461	4878525	393502	14.6	1.5	394263
3	2005	120461	4878525	393502	14.6	1.5	394263
4	2006	120461	4878525	393502	14.6	1.5	394263
5	2007	120461	4878525	393502	14.6	1.5	394263
6	2008	120461	4878525	393502	14.6	1.5	394263
7	2009	120461	4878525	393502	14.6	1.5	394263
8	2010	120461	4878525	393502	14.6	1.5	394263
9	2011	120461	4878525	393502	14.6	1.5	394263
10	2012	120461	4878525	393502	14.6	1.5	394263
11	2013	120461	4878525	393502	14.6	1.5	394263
12	2014	120461	4878525	393502	14.6	1.5	394263
13	2015	120461	4878525	393502	14.6	1.5	394263
14	2016	120461	4878525	393502	14.6	1.5	394263
15	2017	120461	4878525	393502	14.6	1.5	394263
16	2018	120461	4878525	393502	14.6	1.5	394263
17	2019	120461	4878525	393502	14.6	1.5	394263
18	2020	120461	4878525	393502	14.6	1.5	394263
19	2021	120461	4878525	393502	14.6	1.5	394263
20	2022	120461	4878525	393502	14.6	1.5	394263
21	2023	120461	4878525	393502	14.6	1.5	394263

Baseline emissions of GHG from fuel gas consumption

Item		Value Units	Data sources
FCGR	Fuel consumption growth rate	0.00% per year	See "fuel cons growth rate" sheet
CV_{SRF}	Lower heating value	9673 kcal/kg	SRF = Standard refinery fuel. Value provided by Shell
CV_{fg}	Lower heating value	11413 kcal/kg	For fuel gas. Value provided by Shell.
EF_{fg}	CO ₂ emissions factor (combustion)	0.0561 t CO ₂ /GJ	Calculated from carbon content and calorific value of fuel gas samples
MEF_{fg}	CH ₄ emissions factor (combustion)	0.0000014 t CH ₄ /GJ	IPCC 1996 table 1.16, Natural gas boilers
GWP (CH₄)	Global Warming Potential (CH ₄)	21	Kyoto Protocol
NEF_{fg}	N ₂ O emissions factor (combustion)	0.0000023 t N ₂ O/GJ	IPCC 1996. Table 1.8
GWP (N₂O)	Global Warming Potential (N ₂ O)	310	Kyoto Protocol

Year	Year	Fuel gas consumption t SRF/year MFC _{fg}	Fuel gas consumption GJ/year FC _{fg}	CO ₂ emissions (combustion) t /year BE _{fg}	CH ₄ emissions (combustion) t /year BE _{met fg}	N ₂ O emissions (combustion) t /year BE _{N₂O fg}	CO ₂ equiv emissions t /year BE _{TOTAL fg}
1	2004	26780	1084569	60844	2	2	61649
2	2005	26780	1084569	60844	2	2	61649
3	2006	26780	1084569	60844	2	2	61649
4	2007	26780	1084569	60844	2	2	61649
5	2008	26780	1084569	60844	2	2	61649
6	2009	26780	1084569	60844	2	2	61649
7	2010	26780	1084569	60844	2	2	61649
8	2011	26780	1084569	60844	2	2	61649
9	2012	26780	1084569	60844	2	2	61649
10	2013	26780	1084569	60844	2	2	61649
11	2014	26780	1084569	60844	2	2	61649
12	2015	26780	1084569	60844	2	2	61649
13	2016	26780	1084569	60844	2	2	61649
14	2017	26780	1084569	60844	2	2	61649
15	2018	26780	1084569	60844	2	2	61649
16	2019	26780	1084569	60844	2	2	61649
17	2020	26780	1084569	60844	2	2	61649
18	2021	26780	1084569	60844	2	2	61649
19	2022	26780	1084569	60844	2	2	61649
20	2023	26780	1084569	60844	2	2	61649
21	2024	26780	1084569	60844	2	2	61649

References

- 1 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (1996).
- 2 According to Article 5, section 3 of the Kyoto Protocol, GWP value is as agreed on at COP3.

Item		Value	Units	Data sources
FCGR	Fuel consumption growth rate	0.00%	per year	See "fuel cons growth rate" sheet.
CV_{SRF}	Lower heating value	9673	kcal/kg	SRF = Standard refinery fuel. Value provided by Shell
CV_{fo}	Lower heating value	9750	kcal/kg	For fuel oil. Value provided by Shell.
EF_{fo}	CO ₂ emissions factor (combustion)	0.077926	t CO ₂ /GJ	Argentina First National Comm to UNFCCC, revised 1997, page 133.
MEF_{fo}	CH ₄ emissions factor (combustion)	0.000003	t CH ₄ /GJ	IPCC 1996 Table 1.16, residual fuel oil boilers
GWP (CH₄)	Global Warming Potential (CH ₄)	21		Kyoto Protocol
NEF_{fo}	N ₂ O emissions factor (combustion)	0.0000003	t N ₂ O/GJ	IPCC 1996. Table 1.16, residual fuel oil boilers
GWP (N₂O)	Global Warming Potential (N ₂ O)	310		Kyoto Protocol

Year	Year	Fuel oil consumption t SRF/year MFC _{fo}	Fuel oil consumption GJ/year FC _{fo}	CO ₂ emissions (combustion) t /year BE _{fo}	CH ₄ emissions (combustion) t /year BE _{met comb fo}	N ₂ O emissions (combustion) t /year BE _{N2O comb fo}	Total CO ₂ emissions t /year BE _{TOTAL fo}
1	2004	9353	378784	29517	1.136	0.114	29576
2	2005	9353	378784	29517	1.136	0.114	29576
3	2006	9353	378784	29517	1.136	0.114	29576
4	2007	9353	378784	29517	1.136	0.114	29576
5	2008	9353	378784	29517	1.136	0.114	29576
6	2009	9353	378784	29517	1.136	0.114	29576
7	2010	9353	378784	29517	1.136	0.114	29576
8	2011	9353	378784	29517	1.136	0.114	29576
9	2012	9353	378784	29517	1.136	0.114	29576
10	2013	9353	378784	29517	1.136	0.114	29576
11	2014	9353	378784	29517	1.136	0.114	29576
12	2015	9353	378784	29517	1.136	0.114	29576
13	2016	9353	378784	29517	1.136	0.114	29576
14	2017	9353	378784	29517	1.136	0.114	29576
15	2018	9353	378784	29517	1.136	0.114	29576
16	2019	9353	378784	29517	1.136	0.114	29576
17	2020	9353	378784	29517	1.136	0.114	29576
18	2021	9353	378784	29517	1.136	0.114	29576
19	2022	9353	378784	29517	1.136	0.114	29576
20	2023	9353	378784	29517	1.136	0.114	29576
21	2024	9353	378784	29517	1.136	0.114	29576

References

- 1 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Volume 3 (1996).
- 2 According to Article 5, section 3 of the Kyoto Protocol, GWP value is as agreed on at COP3.

Baseline emissions of CO₂ from electricity supply to plant, that is offset by output from cogeneration system

Item	Value	Units	Data sources
Electric power export (project)	12.0	MW	Ex-ante estimation
Electric power import (baseline)	2.1		
Transmission and distribution losses	0.14		

Year	Year	Electricity purchase from grid (baseline) MWh/year, BEP	Net electricity sold through the grid (project) MWh/ year, NPES	CO ₂ emissions factor for electricity from public supply kg CO ₂ e/MWh EF _{elec gen}	Total CO ₂ emissions electricity t /year
1	2004	18396	105120	365	46176
2	2005	18396	105120	365	46176
3	2006	18396	105120	365	46176
4	2007	18396	105120	365	46176
5	2008	18396	105120	365	46176
6	2009	18396	105120	365	46176
7	2010	18396	105120	365	46176
8	2011	18396	105120	365	46176
9	2012	18396	105120	365	46176
10	2013	18396	105120	365	46176
11	2014	18396	105120	365	46176
12	2015	18396	105120	365	46176
13	2016	18396	105120	365	46176
14	2017	18396	105120	365	46176
15	2018	18396	105120	365	46176
16	2019	18396	105120	365	46176
17	2020	18396	105120	365	46176
18	2021	18396	105120	365	46176
19	2022	18396	105120	365	46176
20	2023	18396	105120	365	46176
21	2024	18396	105120	365	46176



Project emissions of GHG from natural gas consumption

Item			Value	Units	Data sources
FCGR	Fuel consumption growth rate		0.00%	per year	See "fuel cons growth rate" sheet
CV _{SRF}	Lower heating value		9673	kcal/kg	SRF = Standard refinery fuel. Value provided by Shell
CV _{ng}	Lower heating value		11413	kcal/kg	For natural gas. Value provided by Shell.
EF _{ng}	CO ₂ emissions factor (combustion)		0.0561	T CO ₂ /GJ	carbon content and
MEF _{ng}	CH ₄ emissions factor (combustion)		0.0000014	t CH ₄ /GJ	IPCC 1996 table 1.16, Natural gas boilers
GWP (CH ₄)	Global Warming Potential (CH ₄)		21		Kyoto Protocol
	CH ₄ emissions factor (natural gas production)		0.07	kg/GJ	Ref. 1, Table 1-64 page 1.131. 39590 to 96000 kg/PJ of gas produced. An average value of 70000 kg/PJ is considered here.
	CH ₄ emissions factor (gas pipeline leakage)		0.23	kg/GJ	Ref. 1, Table 1-64 page 1.131. 116610 to 340000 kg/PJ of gas consumed. An average value of 230000 kg/PJ is considered here.
MLR _{ng}	CH ₄ emissions factor (natural gas production and pipeline leakage)		0.3	kg/GJ	Sum of above two emissions factors.
NEF _{ng}	N ₂ O emissions factor (combustion)		0.0000023	t N ₂ O/GJ	IPCC 1996. Table 1.8
GWP (N ₂ O)	Global Warming Potential (N ₂ O)		310		Kyoto Protocol
FC _{ng} max	Gas turbine natural gas consumption (max)		6.66	t/h	Value of 6.6 provided by Shell. For rated capacity =
	hours per year		8760		25 MW
CF _{GT}	Gas turbine capacity factor		1		Fuel consumption is
MPS _{GT}	Medium pressure steam production rate		7	t MPS / t SRF	76000 Mcal/h =
	Heat rate of gas turbine		3040	kcal / kWh	6.66 t/h Nat. Gas
Elec _{GT}	Electricity production rate		3.18	MWh / t SRF	

For ex-ante estimations natural gas consumption in the project is considered to be equal to the maximum consumption rate of the gas turbine

Year	Year	Natural gas consumption t SRF/year MFC _{ng}	Natural gas consumption GJ/year FC _{ng}	CO ₂ emissions (combustion) t/year BE _{fg}	CH ₄ emissions (combustion) t/year BE _{met fg}	N ₂ O emissions (combustion) t/year BE _{N2O fg}	CO ₂ equiv emissions t/year BE _{TOTAL fg}	MPS production t MPS/year (from MPS _{GT})	Power generation MWh/year (from Elec _{GT})	Average power generation MW (from Elec _{GT})	Power generation MWh/year (from heat rate)	Average power generation MW (from heat rate)
1	2004	68836	2787792	156395	4	6	158465	481853	218899	25.0	219030	25.0
2	2005	68836	2787792	156395	4	6	158465					
3	2006	68836	2787792	156395	4	6	158465					
4	2007	68836	2787792	156395	4	6	158465					
5	2008	68836	2787792	156395	4	6	158465					
6	2009	68836	2787792	156395	4	6	158465					
7	2010	68836	2787792	156395	4	6	158465					
8	2011	68836	2787792	156395	4	6	158465					
9	2012	68836	2787792	156395	4	6	158465					
10	2013	68836	2787792	156395	4	6	158465					
11	2014	68836	2787792	156395	4	6	158465					
12	2015	68836	2787792	156395	4	6	158465					
13	2016	68836	2787792	156395	4	6	158465					
14	2017	68836	2787792	156395	4	6	158465					
15	2018	68836	2787792	156395	4	6	158465					
16	2019	68836	2787792	156395	4	6	158465					
17	2020	68836	2787792	156395	4	6	158465					
18	2021	68836	2787792	156395	4	6	158465					
19	2022	68836	2787792	156395	4	6	158465					
20	2023	68836	2787792	156395	4	6	158465					
21	2024	68836	2787792	156395	4	6	158465					

References

- 1 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (1996).
- 2 According to Article 5, section 3 of the Kyoto Protocol, GWP value is as agreed on at COP3.

Item		Value Units	Data sources
FCGR	Fuel consumption growth rate	0.00% per year	See "fuel cons growth rate" sheet
CV_{SRF}	Lower heating value	9673 kcal/kg	SRF = Standard refinery fuel. Value provided by Shell
CV_a	Lower heating value	9676 kcal/kg	Value provided by Shell. Equiv. To 40.51 MJ/kg. IPCC value 40.19 MJ/kg.
EF_a	CO ₂ emissions factor (combustion)	0.08066 Ton CO ₂ /GJ	Argentina First National Comm to UNFCCC, revised 1997
MEF_a	CH ₄ emissions factor (combustion)	0.000003 ton CH ₄ /GJ	IPCC 1996 Table 1.16, Residual fuel oil boilers
GWP (CH₄)	Global Warming Potential (CH ₄)	21	Kyoto Protocol
NEF_a	N ₂ O emissions factor (combustion)	0.0000003 ton N ₂ O/GJ	IPCC 1996 Table 1.16, Residual fuel oil boilers
GWP (N₂O)	Global Warming Potential (N ₂ O)	310	Kyoto Protocol

Year	Year	Asphalt consumption t SRF/year MFC _a	Asphalt consumption GJ/year Fca	CO ₂ emissions (combustion) t /year E _a	CH ₄ emissions (combustion) t /year E _{met comb a}	N ₂ O emissions (combustion) t /year E _{N2O comb a}	CO ₂ equiv emissions t /year E _{TOTAL a}
1	2003	65756	2663048	214801	8.0	0.8	215217
2	2004	65756	2663048	214801	8.0	0.8	215217
3	2005	65756	2663048	214801	8.0	0.8	215217
4	2006	65756	2663048	214801	8.0	0.8	215217
5	2007	65756	2663048	214801	8.0	0.8	215217
6	2008	65756	2663048	214801	8.0	0.8	215217
7	2009	65756	2663048	214801	8.0	0.8	215217
8	2010	65756	2663048	214801	8.0	0.8	215217
9	2011	65756	2663048	214801	8.0	0.8	215217
10	2012	65756	2663048	214801	8.0	0.8	215217
11	2013	65756	2663048	214801	8.0	0.8	215217
12	2014	65756	2663048	214801	8.0	0.8	215217
13	2015	65756	2663048	214801	8.0	0.8	215217
14	2016	65756	2663048	214801	8.0	0.8	215217
15	2017	65756	2663048	214801	8.0	0.8	215217
16	2018	65756	2663048	214801	8.0	0.8	215217
17	2019	65756	2663048	214801	8.0	0.8	215217
18	2020	65756	2663048	214801	8.0	0.8	215217
19	2021	65756	2663048	214801	8.0	0.8	215217
20	2022	65756	2663048	214801	8.0	0.8	215217
21	2023	65756	2663048	214801	8.0	0.8	215217

Project emissions of GHG from fuel gas consumption

Item			Value	Units	Data sources
FCGR	Fuel consumption growth rate		0.00%	per year	See "fuel cons growth rate" sheet
CV_{SRF}	Lower heating value		9673	kcal/kg	SRF = Standard refinery fuel. Value provided by Shell
CV_{fg}	Lower heating value		11413	kcal/kg	For fuel gas. Value provided by Shell.
EF_{fg}	CO ₂ emissions factor (combustion)		0.0561	T CO ₂ /GJ	Calculated from carbon content and calorific value of fuel gas samples
MEF_{fg}	CH ₄ emissions factor (combustion)		0.0000014	t CH ₄ /GJ	IPCC 1996 table 1.16, Natural gas boilers
GWP (CH₄)	Global Warming Potential (CH ₄)		21		Kyoto Protocol
NEF_{fg}	N ₂ O emissions factor (combustion)		0.0000023	t N ₂ O/GJ	IPCC 1996. Table 1.8
GWP (N₂O)	Global Warming Potential (N ₂ O)		310		Kyoto Protocol

Year	Year	Fuel gas consumption t SRF/year MFC _{fg}	Fuel gas consumption GJ/year FC _{fg}	CO ₂ emissions (combustion) t /year BE _{fg}	CH ₄ emissions (combustion) t /year BE _{met fg}	N ₂ O emissions (combustion) t /year BE _{N2O fg}	CO ₂ equiv emissions t /year BE _{TOTAL fg}
1	2004	14619	592035	33213	0.8	1.4	33653
2	2005	14619	592035	33213	0.8	1.4	33653
3	2006	14619	592035	33213	0.8	1.4	33653
4	2007	14619	592035	33213	0.8	1.4	33653
5	2008	14619	592035	33213	0.8	1.4	33653
6	2009	14619	592035	33213	0.8	1.4	33653
7	2010	14619	592035	33213	0.8	1.4	33653
8	2011	14619	592035	33213	0.8	1.4	33653
9	2012	14619	592035	33213	0.8	1.4	33653
10	2013	14619	592035	33213	0.8	1.4	33653
11	2014	14619	592035	33213	0.8	1.4	33653
12	2015	14619	592035	33213	0.8	1.4	33653
13	2016	14619	592035	33213	0.8	1.4	33653
14	2017	14619	592035	33213	0.8	1.4	33653
15	2018	14619	592035	33213	0.8	1.4	33653
16	2019	14619	592035	33213	0.8	1.4	33653
17	2020	14619	592035	33213	0.8	1.4	33653
18	2021	14619	592035	33213	0.8	1.4	33653
19	2022	14619	592035	33213	0.8	1.4	33653
20	2023	14619	592035	33213	0.8	1.4	33653
21	2024	14619	592035	33213	0.8	1.4	33653

References

- 1 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual (1996).
- 2 According to Article 5, section 3 of the Kyoto Protocol, GWP value is as agreed on at COP3.

Item		Value	Units	Data sources
FCGR	Fuel consumption growth rate	0.00%	per year	See "fuel cons growth rate" sheet.
CV_{SRF}	Lower heating value	9673	kcal/kg	SRF = Standard refinery fuel. Value provided by Shell
CV_{fo}	Lower heating value	9750	kcal/kg	For fuel oil. Value provided by Shell.
EF_{fo}	CO ₂ emissions factor (combustion)	0.077926	t CO ₂ /GJ	Argentina First National Comm to UNFCCC, revised 1997, page 133.
MEF_{fo}	CH ₄ emissions factor (combustion)	0.000003	t CH ₄ /GJ	IPCC 1996 Table 1.16, residual fuel oil boilers
GWP (CH₄)	Global Warming Potential (CH ₄)	21		Kyoto Protocol
NEF_{fo}	N ₂ O emissions factor (combustion)	0.0000003	t N ₂ O/GJ	IPCC 1996. Table 1.16, residual fuel oil boilers
GWP (N₂O)	Global Warming Potential (N ₂ O)	310		Kyoto Protocol

Year	Year	Fuel oil consumption t SRF/year MFC _{fo}	Fuel oil consumption GJ/year FC _{fo}	CO ₂ emissions (combustion) t /year BE _{fo}	CH ₄ emissions (combustion) t /year BE _{met comb fo}	N ₂ O emissions (combustion) t /year BE _{N2O comb fo}	Total CO ₂ emissions t /year BE _{TOTAL fo}
1	2004	5106	206767	16113	0.620	0.062	16145
2	2005	5106	206767	16113	0.620	0.062	16145
3	2006	5106	206767	16113	0.620	0.062	16145
4	2007	5106	206767	16113	0.620	0.062	16145
5	2008	5106	206767	16113	0.620	0.062	16145
6	2009	5106	206767	16113	0.620	0.062	16145
7	2010	5106	206767	16113	0.620	0.062	16145
8	2011	5106	206767	16113	0.620	0.062	16145
9	2012	5106	206767	16113	0.620	0.062	16145
10	2013	5106	206767	16113	0.620	0.062	16145
11	2014	5106	206767	16113	0.620	0.062	16145
12	2015	5106	206767	16113	0.620	0.062	16145
13	2016	5106	206767	16113	0.620	0.062	16145
14	2017	5106	206767	16113	0.620	0.062	16145
15	2018	5106	206767	16113	0.620	0.062	16145
16	2019	5106	206767	16113	0.620	0.062	16145
17	2020	5106	206767	16113	0.620	0.062	16145
18	2021	5106	206767	16113	0.620	0.062	16145
19	2022	5106	206767	16113	0.620	0.062	16145
20	2023	5106	206767	16113	0.620	0.062	16145
21	2024	5106	206767	16113	0.620	0.062	16145

References

- 1 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual Volume 3 (1996).
- 2 According to Article 5, section 3 of the Kyoto Protocol, GWP value is as agreed on at COP3.

Emission reduction (ex-ante estimation)

		Baseline emissions, t CO ₂ equiv/year BE _{TOTAL}					Project emissions t CO ₂ equiv/year E _{TOTAL}					Emissions reductions t CO ₂ equiv/year ER
Year	Year	Asphalt	Fuel gas	Fuel oil	Electricity purchase and sale	Total	Asphalt	Fuel gas	Fuel oil	Natural gas	Total	
1	2004	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
2	2005	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
3	2006	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
4	2007	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
5	2008	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
6	2009	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
7	2010	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
8	2011	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
9	2012	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
10	2013	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
11	2014	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
12	2015	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
13	2016	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
14	2017	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
15	2018	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
16	2019	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
17	2020	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
18	2021	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
19	2022	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
20	2023	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
21	2024	394263	61649	29576	46176	531665	215217	33653	16145	158465	423479	108186
Total		8279520	1294639	621100	969704	11164964	4519555	706707	339041	3327761	8893063	2271901

20% reduction