Supporting Documents for Part B

Form IPPC Part B - Application for a permit (Marsa Power Station)

Supporting Documents

EU Affairs Section
January 2007

Issue	Original	January 2007
Revision	1	
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General Note:

Queries listed in the application form are presented in blue and underlined. Hence accompanying documents follow the same application form query reference numbers.

B1.1 Installation table for new permit application

Activities in the "stationary technical unit"	Schedule 1 refs	Operator
"Combustion installations with a rated thermal input exceeding 50 MW"	1.1	Applicant

Directly associated activities	Schedule 1 refs	Operator
NIL		

B1.2 Why is the application being made?

It is an existing installation and you are applying in accordance with the timetable in the IPPC Regulations

B1.3 Site maps and reports

General Site Report, Ref. B1.3.1

1.0 General Description

1.1 Introduction

Marsa Power Station (formerly known as *Marsa B Power/Water station*) is situated at the inner end of the Grand Harbour as shown in the site plan at the end of this report.

The power station is situated in a built up area that grew larger after the construction of the power station. Since the site was previously built up no significant impact on land wildlife was produced. The seawater treatment used to inhibit growths inside the seawater culverts has a low residual value and has minor effect on marine life outside the station precincts. (Please refer to ***Attachment 10***.)

Air pollution, especially sulphur dioxide emissions in the vicinity of the power station has been reduced by the adoption of heavy fuel oil (HFO) low in sulphur and ash content[1] and on the introduction some years ago of electrostatic precipitator (ESP) equipment; hence acid rain is minimized or avoided and the settlement of dust on surrounding buildings has been drastically

[1] Malta Environment & Planning Authority (MEPA) January 2006. *State of the Environment Report 2005, Sub-report 2: Air*, page 22.

reduced. Since the reduction of sulphur dioxide emissions there have been fewer complaints by the public in the immediate vicinity.

While the noise from the plant at the power station is always present in the vicinity of the site, this noise is not of an intensity that will disrupt normal activity.

Land use is optimized at Marsa Power Station, which had to be built and expanded within a limited area which is a fraction of the area which would have been taken up had the plant been installed on virgin land. No agricultural land or land with intrinsic natural beauty was used and no area of Malta was degraded by the building of the power station.

1.2 Station generation plant

The plant in the station is listed in **Table B1.3.1** below:

Table B1.3.1: Plant Listing of Marsa Power Station[2]

Plant Ref.	Plant Type	Fuel	Com. year	Age of Plant	Thermal Rating	Nominal Rating	Actual Rating	Efficiency	Remarks
				Years	MWth	MWe	MWe	%	
1	Steam Boiler	HFO	1964	42	NA	NA	NA		Decommissioned
2	Steam Boiler	HFO	1964	42	NA	NA	NA		Decommissioned
3	Steam Boiler	HFO	1969	37	220	30	25		3 & 4 share a common stack
4	Steam Boiler	HFO	1969	37		30	25		
5	Steam Boiler	HFO	1982	24	240	35	25		5 & 6 share a common stack
6	Steam Boiler	HFO	1982	24		35	35		ESP installed
7	Steam Boiler	HFO	1984	22	250	70	70		ESP installed
8	Steam Boiler	HFO	1987	19	250	70	60		ESP installed
1	Steam T/A		1965	41		12	-		
2	Steam T/A		1966	40		12	10		
3	Steam T/A		1970	36		30	30		
4	Steam T/A		1970	36		30	30		
5	Steam T/A		1982	24 (54)		30	30		
6	Steam T/A		1983	23 (54)		30	30		
7	Steam T/A		1984	22 (54)		30	30		
8	Steam T/A		1987	19 (47)		60	60		
9	Gas turbine	Gas Oil	1990	16	121	37	W[3] 36.5 / S[4] 30	32	Open cycle type

1.3 Fuel oil usage & facilities

The fuels used are heavy fuel oil for the steam boilers and gasoil for the gas turbine. HFO is delivered by tanker at Flagstone Wharf and stored in 6 tanks with a total capacity of 34,000 m^3. The fuel is burned in the boilers and the flue emissions produced are exhausted from 4 stacks.

[2] Information based on the "***Electricity Generation Plan 2006 – 2015***", Enemalta Corporation, refer to ***Attachment 1.***

[3] Winter

[4] Summer

Gasoil for the gas turbine is delivered by barge to one gasoil storage tank which has a capacity of 1,200 m^3. It is then burned in the gas turbine to provide motive power for the electricity generator. The exhaust gas is emitted from its own chimney.

1.4 Steam plant & cooling system

The steam from the boilers is used to power the steam turbines and is then exhausted to condensers, which are cooled by seawater that is drawn from Bridge Wharf and discharged at Church Wharf. The seawater is treated with a biocide or other treatment to discourage the deposition of marine organisms in the passages of the condenser tubes since these adversely affect performance and efficiency. (Please refer to ***Attachment 10***.)

A seawater evaporator takes in seawater and discharges concentrated brine into the sea. Anti-scaling chemicals used in the evaporators are formulated not to harm the environment. Chemicals from the regeneration of the demineraliser plant are neutralised before discharge.

1.5 Plant emissions

1.5.1 Sulphur dioxide & unburnt carbon:

Using fuels with lower ash and sulphur content than used previously minimize the production of wastes from boiler operations, especially sulphur dioxide. A fuel/water emulsion in boilers 3 to 6 was successful in reducing the amount of unburned carbon in the ash.

1.5.2 Carbon dioxide:

Carbon dioxide emissions from the boilers & gas turbine are monitored by calculation from fuel usage. The methods used are those advocated by the ***Intergovernmental Panel for Climate Change (IPPC)***, and in accordance with ***EU Directive 2003/87/EC*** which amends ***EU Directive 96/61/EC***. A greenhouse gas emissions report for 2005 was submitted to MEPA in April 2006.

1.5.3 Dust:

Electrostatic precipitators remove dust (or fly ash) emissions from boilers 6, 7 and 8 and this dust has to be disposed of. At present this is being removed by a contractor and used as an additive for low-grade mass concrete.

1.5.4 Other solid wastes:

Other solid wastes include sludge from the periodic cleaning of fuel oil tanks, ash from the periodic cleaning of boilers, and sludge from sedimentation pits.

There are also other solid industrial wastes such as lagging, sheet metal, scrap metal etc.

Office and packaging waste and other industrial scrap is sent to the landfill for disposal.

1.5.5 Liquid wastes:

Water from the washing of boilers, electrostatic precipitators and other plant is discharged either,

a. through settling chambers where solid matter is allowed to settle and the water is discharged into the sea, or,
b. through the use of collection tanks where the solid matter is again allowed to settle whilst the water is collected and transferred to Delimara for further processing.

The dried solid matter from the fireside cleaning of boilers is collected and taken by a contractor for use as an additive in low-grade mass concrete. The other dried sludge generated from the waterside cleaning, which contains some heavy metals, is at present stored temporarily in containers at the Marsa site. It is expected that when *WasteServ* completes the hazardous waste landfill, this solid matter could be disposed of there.

Surface runoff water is discharged into the sea after passing through oil interceptors.

All waste oils are mixed with the fuel oil and burned in the boilers.

Oil sludge is at present being stored pending a solution to the disposal methodology. Again, it is expected that when *WasteServ* completes the hazardous waste landfill, this sludge could be disposed of there.

2.0 Operation Philosophy at Marsa Power Station

2.1 General scheme

The generation capacity of Marsa Power Station plant has been presented in **Table B.1.3.1**. It is to be noted that the steam boilers No. 3 to 7 feed a common steam header that then feeds turbo-alternators Nos. 3 to 7. **Table B.1.3.2** presents how this capacity is *combined together* with the generation capacity of Delimara Power Station, given that their *combined output follows a common operation philosophy* in the manner as explained in the same table. **Charts B.1.3.3 (a), (b), (c) and (d)** show graphically how typical load variations take place and how the combined Marsa and Delimara plants operate on these various days of the year.

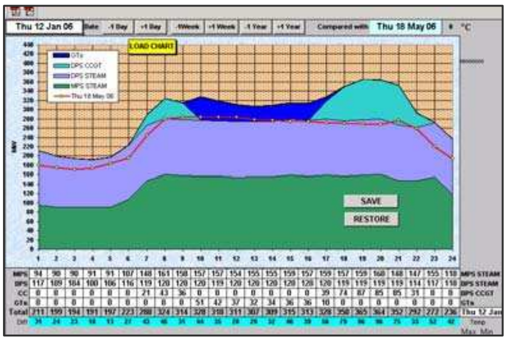
The overall combined installed total is therefore 571 MW, and as can be seen from **Table B.1.3.2** these consist of 350MW of base load plant, 110MW as two shifting plant, and 111MW peak lopping or emergency plant. The latter is required since the system is an isolated one therefore backup is a priority and a basic requirement.

Table B.1.3.2: Combined generation plants operating modes

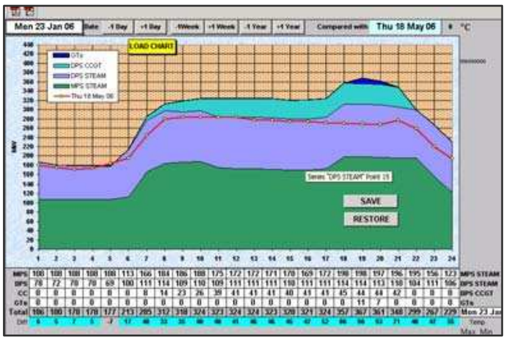
Plant	Base Load Plant	Two-Shifting Plant	Peak lopping (Emergency) Plant	Total
	MW	*MW*	*MW*	*MW*
MPS: Conventional Steam Units				
T/alternator 1	**10**			
T/alternator 2	**10**			
T/alternator 3	**30**			
T/alternator 4	**30**			
T/alternator 5	**30**			
T/alternator 6	**30**			
T/alternator 7	**30**			
T/alternator 8	**60**			

Plant	**Base Load Plant**	**Two-Shifting Plant**	**Peak lopping (Emergency) Plant**	**Total**
	MW	***MW***	***MW***	***MW***
S/Total:				***230***
MPS: Gas Units				
GT 9			**37**	
S/Total:				***37***
DPS: Conventional Steam Units				
Unit 1	60			
Unit 2	60			
S/Total:				*120*
DPS: Gas Units				
CCGT 3A (+HRSG)		37		
CCGT 3B (+HRSG)		37		
Steam Turbine		36		
S/Total:				*110*
GT1			37	
GT2			37	
S/Total:				*74*
Overall Total:	**350MW**	**110MW**	**111MW**	**571MW**

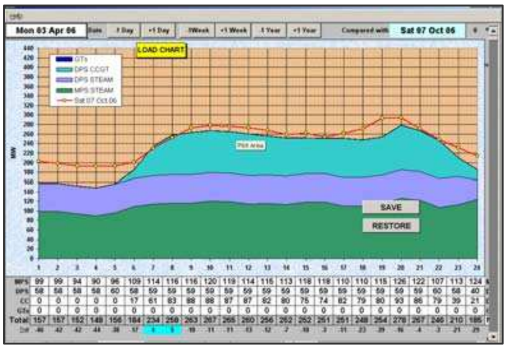
Charts B.1.3.3: Typical Load variations and loading on MPS & DPS plants



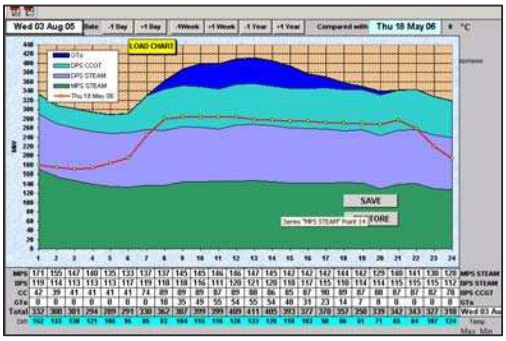
(a) 12th January 2006



(b) 23rd January 2006



(c) 3rd April 2006



(d) 3rd August 2006

As can be noted from ***Table B.1.3.2*** 66% of the base load plant is located at the Marsa Power Station. Most of these units are old and past their 25 year economic lifetime. It can be considered that the newest steam turbine dates from 1971. 3 of these units which were originally commissioned in 1952, were brought over second hand from Palermo, Italy, whilst a fourth which was originally installed in 1959, was brought over from Little Barford, UK. This makes the youngest steam turbine 35 years of age. The frequency of faults in this power station is on the increase and it is only due to the quality and dedication of the operation and maintenance staff that the machines are still in operation. To restrict the number of faults, the philosophy of operation of these units although cyclic due to the load curve, is never two shifting. This includes the base load steam plants at Delimara, which are also being cycled, again due to the load curve. However, because they are the most efficient steam plant they are the last to cycle.

The CCGT plant at Delimara is operated in a two shifting mode. Start up and shut down are performed every day. Although this plant was designed for this type of operation, it too is showing signs of stress.

The rest of the plant, i.e. the OCGTs, is used for peak lopping especially during the winter season when the peak duration is short or during emergencies, when a loss of one of the units is experienced. The OCGT generators at Delimara can also be used as synchronous compensators to generate reactive power and improve the power factor for the main generating plant at that station.

2.2 Efficiency Consideration

The anticipated load demand is calculated on historical data and anticipated weather conditions. The best mix of plant to meet this demand is decided upon and mainly depends on availability and efficiency of plant. Since each unit has its own efficiency curve, the operations personnel work out the most economical loading procedure on each unit every hour and each unit is thus loaded accordingly. Hence the most economical combination is acquired. This will be explained in the proposed ***Boiler & Turbine Plant Operations Procedures*** (please refer to ***Report Ref. B2.3: Proposed Installation Activities & Techniques to Reduce Waste & Emissions***), which will form part of the proposed Environment Management System.

2.3 Efficiency Improvement

The units at Marsa are, as stated above, approaching the end of their lifetime, consequently the company policy is to concentrate efforts to maintain their present efficiency and not let it drop any further. Typical efforts include:

Plant Item	Maintenance activity description	Frequency	Typical Results
Condenser maintenance	Efforts are continuously made to keep condensers as clean as possible. In the last few years, these efforts proved to be very effective in fact an average improvement of 1% during the summer months was registered, equivalent to 0.5% over a one-year period.	Pre Summer Period	Overall improvement in efficiency of 0.5% over the period 04/05. Aim to keep this figure constant and stable.
Insulation maintenance	After maintenance insulation is repaired	Immediate	NA
Furnace maintenance	During overhaul clean furnace	Annually	NA
Superheater tubes maintenance	Operation of Sootblowers During overhaul clean superheater	Every 8 hr Shift	NA

		Annually	
Steam leakages control & repair	Steam leakages are attended to, when they occur, load permitting shut down/isolation of plant	Immediate when possible	NA
Fuel burners maintenance	Burner tips are replaced when worn out. During overhaul burner throat are checked and repaired.	Average 6 monthly. Overhauls annually.	NA

Other activities to improve overall plant efficiencies are also carried out on a regular basis and these are detailed more in the proposed ***Boiler & Turbine I&M Procedures***.

2.4 Emission Improvements

The improvements possible on the Marsa units was to switch to 1% sulphur HFO and utilise the existing flue gas precipitators. The latter were rehabilitated and are now in operation. By using these ESPs Enemalta is managing to capture 400 tonnes of dust annually when compared to an estimated total emission from the *same* boilers of 427 tonnes and an overall estimated total flue emission of 830 tonnes from *all* boilers.

Moreover, 2 of the boilers had their control system changed from manual to automatic control similar to boilers 7 and 8. This completely eliminated as much as possible operator intervention, thus the boilers are at present being operated automatically, keeping the preset parameters for best efficiency.

Furthermore, the Marsa plant is now programmed to be limited to 20,000 hours of operation as from 1st January 2008 till 31st December 2015, following which it will be shut down according to the LCP Directive[5]. Nevertheless, a tender for the automated measuring system is currently being adjudicated[6]. Please refer to ***Attachment 2: Supply and Installation of Automated Measuring Systems and Data Acquisition Recording System***. Technically this will be the adoption of BAT for emissions monitoring and measurement. From acceptance of tender it is estimated that it will take 38 to 52 weeks till final commissioning and handing over of equipment. Hence it is projected that the equipment will be in use by the 1st or 2nd quarter of 2008.

2.5 Fuel

Until the early 1990s both heavy fuel oil and coal were burned to generate electricity. However, coal was stopped in the mid nineties because of the amount of ash it generates which was creating environmental and disposal problems. In 2004 all HFO burned was changed from one of 3% sulphur to 1% sulphur despite higher fuel costs, and hence unit cost. This was done to reduce the SO_X levels.

Finally fuel oil additives are currently being used on some of the boilers to improve on combustion efficiency of the boilers. These include Magnesium Oxide (MgO) slurry emulsifier and Combustion catalyst (*Fuelsolv PEP990*). Please refer to ***Attachment 3: PEP99 Emulsion***

[5] EU Directive 2001/80/EC: Limitation of emissions of certain pollutants into the air from large combustion plants [*LCP Directive*]

[6] ***Advert No. GN/DPS/T/3/2006***: Supply and Installation of Automated Measuring Systems and Data Acquisition Recording System, Publication date 22/09/06; Closing date 05/12/06.

Technology Preliminary Report for details on initial trail runs on the use of such additives, demonstrating quantitatively their effectiveness.

2.6 Future Plans

It is envisaged that by 2015 all units at Marsa will be decommissioned (refer to ***Attachment 13*** related with ***Report B2.11***). Hence there is little scope for investment in BAT since little if any cost-benefits can be made. Therefore, the installation and operation of new, more efficient plant, which replaces these old units, makes more economical sense. (Please refer to ***Attachment 1: Electricity Generation Plan 2006 – 2015***.) This will reduce primary fuel consumption, which in turn will reduce Carbon and Sulphur airborne emissions. Such reduction will protect the environment and will be in line with the European Union strategy to improve health conditions. Reduction of NO_X emissions will have to be carried out through plant specific technologies, similar to today's situation.

2.7 Limitation

The main limitation of the present electrical system is its isolation. It is not interconnected with the European continent, thus a high spare capacity is required. At present the capacity of the units installed for this purpose is 111MW equivalent to 19% of all the nominal capacity, this excluding a 60MW unit out for maintenance at any time of the year. If this is included then the percentage rises to 30%. Another reason for having such a high percentage of spare capacity is related to the size of the installed larger capacity machines, which are rated at 60MW. In a small isolated system with an average peak load of 300MW (max of 410MW), a 60MW machine represents 20% of the whole load. This is already too high because in a case of loss of on of these units, the transient on the system is too high to handle and it may easily destabilize the whole system. On the other hand, the higher the nominal capacity of a unit, the higher its efficiency, thus a compromise was found.

This disadvantage of having to limit the size of machines to 60MW and running machines in cyclic mode has great influence on the BAT available with respect to emission abatement. Present emission abatement technology is concentrating on big machines running on base load. The effectiveness and experience of these abatement systems on smaller machines running on cyclic or two shifting is very limited.

For these reasons the options open for a small isolated system is very limited. This restricts the type and size of machines and the fuel used, with the consequence that energy generation in a small isolated system is much more expensive than on the mainland where connection with an infinite grid is possible. A study was performed for the cable interconnection by ***Electricté de France*** (EdF), and another one by ***Eni Snamprogetti*** (SNAM) for a gas pipeline. Please refer to ***Attachments 4: EdF Report (Cable Interconnection)*** and ***Attachment 5: SNAM Report (Gas Pipeline)***. The ***Malta Resource Authority*** is currently in the process of starting a study about a cable interconnection and Malta has been mentioned in EU documents for priority projects of interconnection.

Site Plans, Ref B1.3.2

The following site plans and drawings are included at the end of the supporting documents:

1. Map of Malta showing sites Of Enemalta Power Stations at Marsa & Delimara, *Drawing No. B132-1*
2. Marsa Power Station: Schematic of steam plant & material inputs and discharge levels, *Drawing No. EMC/XZ/178*
3. Marsa Power Station Site Plan, *Drawing No. EMC/XZ/161*
4. Marsa Power Station Block Plan, *Drawing No. CDS/MPS/22-09*

B2.1 Provide details of your proposed management techniques

Proposed Management Techniques, Ref. B2.1

1.0 General observations

Power plant generation emissions and waste management has been assessed in terms of the various parts that contribute to or are a potential source of waste or emissions. A qualitative and quantitative assessment has been done of the various raw and auxiliary materials used for power generation, and of the various parts of the plant and its supporting services. Given such information it was then possible to identify and list all possible pollutants or wastes in order to:

- Adopt an ***integrated approach*** by taking into account the whole environmental performance of the plant, covering as far as possible all the sources of pollution, plant efficiencies, and safety practices, e.g. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents.
- Adopt the ***Best Available Techniques*** **(*BAT*)** for emissions reduction and control in order to manitain ***emission limit values (ELVs)*** below those targets defined in the appropriate relevant directives
- Establish and maintain ***monitoring performance and operational procedures*** including any associated equipment
- Carry out regular ***data analysis*** to ensure satisfactory performance of the plant and other asociated resources and ensuring that the monitoring procedures are effective
- Maintain appropriate ***records*** as necessary for reporting purposes
- Carry out ***regular reviews*** of all techniques and procedures in order to maintain and/or develop further the quality performance of the plant.

In the context of the above the following management activities are performed on a routine basis to run the power plant as efficiently as possible:

1. *Raw materials & other consumables management*
    a. Planning, procurement and delivery procedures
    b. Storage and issuing procedures
    c. Monitoring of consumption and performance
    d. Storage and disposal of waste generated from raw materials & consumables
    e. Training of staff as necessary.

2. *Generation Plant management*
    a. Planning of plant operation to optimise performance and minimise emissions
    b. Regular monitoring of power plant performance, including gaseous, liquid and solid emissions
    c. Upkeep and maintenance of power plant equipment and machinery, including maintenance of effective procurement and storage of spare parts and replacement machinery
    d. Plant development and/or modification work
    e. Effective plant and site housekeeping
    f. Training of staff as necessary.

2.0 Environment Managment System

In order to ensure that good management practices are reinforced within the organization an *internal* ***Environmental Management System*** is being proposed to be set up and implemented. The proposed structure of such EMS is presented in ***Attachment 6: Basic Elements of Proposed Environment Management System***. It is anticipated that the organisation and implementation of the EMS will take around 30 months, hence assuming commencement of project beginning early 2007 it will be running by mid- to late-2009. Further details on such an internal EMS is given in the subsequent sections with due emphasis on the implementation of related procedures.

B2.2 Identify the raw and auxiliary materials, other substances and water that you propose to use

Proposed Raw & Auxiliary Materials, Ref. B2.2

The following materials are the main fuels and chemicals used in power plant generation, as shown in ***Table B2.2.1.*** Related data sheets are included in ***Attachment 7: Material Safety Data Sheets of Materials Used at Marsa Power Station***.

Table B2.2.1: Main Materials used at Marsa Power Plant

No.	Material	Details	Qty[7]	Units	Remarks
1	Heavy Fuel Oil (HFO)	With maximum sulphur content of 1% & low ash	374,445	tonnes	
2	Gas Oil	With maximum sulphur content of 0.2%	442	tonnes	
3	Fuel oil additives	Magnesium Oxide (MgO) slurry emulsifier (*FireMag / PentoMag 2000*)	100	tonnes	
4		Combustion catalyst (*Fuelsolv PEP990*)	40	tonnes	
5	Sea water treatment chemical	Chemical to generate Chlorine Dioxide in situ (*Biocaf 1320*)	90	tonnes	
6	Boiler water intake treatment chemical	Tri Sodium Phosphate	750	kilograms	
7		Oxygen scavenger (*Cortrol OS5009*)	10	tonnes	
8	Evaporators chemical treatments	Anti-scaling chemical (*Belgard EV2050*)	9	tonnes	
9		Sulfamic Acid	500	kilograms	
10	Demineralisation plant regeneration chemicals	Sulphuric Acid 98%	30	tonnes	
11		Caustic soda flakes	20	tonnes	
12	Sodium Bicarbonate	Acid neutralizer in acid spills	1	tonne	In emergency

[7] Annual Average consumption values for year 2005/6

B2.3 Describe the proposed installation activities and the proposed techniques and measures to prevent and reduce waste arisings and emissions of substances and heat

Proposed Installation Activities & Techniques to Reduce Waste & Emissions, Ref. B2.3

The installation activities or sources that contribute towards or may influence waste, emissions generation and potential hazards are listed in ***Table B2.3.1.*** The list also indicates their actual or potential pathways by which they may contaminate the environment, especially if no measures are taken or are insufficient.

Table B2.3.2 is an extension to ***Table B2.3.1*** and lists various techniques and measures used to prevent or reduce waste or emissions in the context of an Internal ***Environment Management system***.

Table B2.3.1: Listing of Sources, Pollutants & Potential Hazards at Marsa Power Station

No.	Activity	Pollutant	Pathways
	Fuel System Operations		
1	Solid, liquid or sludge waste from fuel oil spillage & deposits in fuel oil tanks and associated cleaning operations	Fuel sediments & suspended organic compounds Fuel oil & water emulsions	Water
	Boiler Water Preparation & Treatment		
2	Discharge of brine & chemical treatment deposits in evaporators	Water treatment chemical deposits	Water
3	Liquid waste generated from makeup water demineralisation	Chemical regeneration effluents	Water
	Boiler Operation & Cleaning		
4	Dust and gaseous emissions generated from combustion of fuels for boiler/s and gas turbine plant	Particulate matter (fly ash) Oxides of sulphur, nitrogen, carbon Organic compounds Compounds of trace metals in fuel	Air
5	Solid, sludge and liquid waste generated from *fireside* boiler/s maintenance & cleaning operations	Bottom ash & boiler slag Unburnt fuel deposits Suspended matter scale deposits	Water Land
6	Liquid waste generated from *waterside* boiler/s cleaning & blowdown	Cleaning chemical treatment effluents	Water
7	Sludge waste generated from fuel oil filtration	Oil filtration waste products	Water Land
	Cooling Systems Operations		
8	Liquid waste or contaminants generated from sea water cooling systems	Seawater treatment chemical deposits	Water
	Plant Maintenance		
9	Liquid waste from changeover of lubricating oils used in stationary and mobile plant	Spent organic, mineral or synthetic oils	Water
10	Liquid waste from changeover of transformer /switchgear oils	Spent organic, mineral or synthetic oils	Water
11	Solid and liquid waste and gaseous emissions generated from general plant maintenance and repair work	Various scrap metal items & fittings Fabric, mineral and plastic materials Spent detergents & containers	Land
	Site Storm Water Collection		
12	Liquid waste from site surface runoff water at oil interceptors	Oil effluents	Water

No.	Activity	Pollutant	Pathways
	Administrative Operations		
13	General solid waste generated from administrative work and use of electrical/non-electrical equipment	General office waste Scrap office electrical/non-electrical equipment and/or parts	Land
	Environmental Hazards		
14	Hazards resulting from noise in proximity to plant operation	Steam Plant & associated auxiliary equipment Gas turbine plant& associated auxiliary equipment	Air
15	Hazards resulting from vibration in proximity to certain plant items operations	Steam Plant & associated auxiliary equipment Gas turbine plant & associated auxiliary equipment	Land
16	Hazards arising from handling of hazardous substances & waste	Toxic, oxidizing, corrosive, carcinogenic or ozone-depleting substances (e.g. SF6) which may affect the aquatic or non-aquatic environment	Air Water Land
17	Hazards from potential major accidents arising from failure of fuel storage facilities or plant equipment	Major oil spills & leakages Fuel and lube oil tank fires Other plant fires	Air Water Land

Table B2.3.2: BAT and Procedures for Marsa Power Station

No.	Item Description	Related EU Directive/s or Other Documents	Waste & Emission Control Techniques	EMS Methodology	Remarks
	Fuel System Operations				
1	Solid, liquid or sludge waste from fuel oil spillage & deposits in fuel oil tanks and associated cleaning operations		• Fuel management operations good practice and energy efficient measures which regulate those activates associated with higher risk levels of emissions • Carrying out regular I&M[8] on plant • Selection, use, and I&M of instrumentation • Safe disposal of sludge & liquid waste • Staff training on operational and maintenance practices in respect of emissions control Containment of sludge or waste oil	• Documented ***Fuel Oil Operations Procedures*** on best practice and emissions measurements & control arising from filling, tank-to-tank transfer, tank-to-burner transfer, pre-treatment, emptying, cleaning, sludge removal, sampling, gauging, draining & leakage testing activities • Documented ***Fuel Oil I&M Procedures*** for oil storage, transfer and pre-treatment facilities • Documented ***Power Station Fuel Data Management System*** • Documented ***Waste Management Procedures*** to minimise, recycle, and safe disposal of waste • *Liquid or sludge disposal measurement requirements* incorporated in ***Waste Management Procedures***	*To be developed* *To be developed* *To be developed* *To be developed*
	Boiler Water Preparation & Treatment				
2	Discharge of brine	IPPC BREF	• Regular I&M of water	• *Makeup water treatment*	

[8] Inspection and Maintenance

No.	Item Description	Related EU Directive/s or Other Documents	Waste & Emission Control Techniques	EMS Methodology	Remarks
	& chemical treatment deposits in evaporators	document[9] [*LCP*] IPPC BREF document[10] [*Monitoring*]	treatment dosing system • Safe disposal of waste	incorporated in ***Boiler & Turbine Operations Procedures*** • Documented ***Waste Management Procedures*** • *Waste water testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	*To be developed*
3	Liquid waste generated from makeup water demineralisation	IPPC BREF document [*LCP*] IPPC BREF document [*Monitoring*]	• Regular I&M of water treatment dosing system • Safe disposal of waste	• *Makeup water treatment* incorporated in ***Boiler & Turbine Operations Procedures*** on boiler and fuel preparation to optimise performance and energy efficiencies • Documented ***Waste Management Procedures*** • *Waste water testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
	Boiler Operation[11] & Cleaning				
4	Dust and gaseous emissions generated from combustion of fuels for boiler/s and gas turbine plant.	2001/80/EC 2001/81/EC[12] 1999/32/EC[13] IPPC BREF document [*LCP*] IPPC BREF document [*Monitoring*]	• Boiler operations good practice to optimise energy efficiency • Use of low ash & sulphur (less than 1%) HFO • Appropriate fuel filtration methods • Use of fuel additives to improve combustion efficiency • Optimizing combustion controls • Use of low excess air • Use of ESP[14]s for dust • Regular maintenance and repair work on fuel	• Documented ***Manual Emissions Measurement Procedures*** using portable equipment • Documented ***CEM[15] Procedures*** on the use of online equipment in compliance with EN 14181[16] standard • Carbon Dioxide (CO_2) emissions reporting as per Documented ***Power Station Fuel Data Management System*** • Documented ***Boiler & Turbine Operation Procedures***	*In place* *To be developed* *To be developed*

[9] European Commission: Integrated Pollution Prevention & Control Reference Document on the Best Available Techniques for Large combustion Plants, July 2006
[10] European Commission: Integrated Pollution Prevention & Control Reference Document on the General Principles of Monitoring
[11] Since the Marsa power plant will be utilised within a limited number of hours, *other* emissions control techniques that are recommended as BAT to control LCP Directive emissions (dust, Sulphur Dioxide & Nitrogen Oxides) have not been considered here.
[12] EU Directive 2001/81/EC: National emissions ceilings for certain atmospheric pollutants
[13] EU Directive 1999/32/EC: Reduction in the sulphur content of certain liquid fuels
[14] Electrostatic Precipitators
[15] Continuous Emissions Measurement
[16] EN 14181: Stationary source emissions - Quality Assurance of Automated Measuring Systems

No.	Item Description	Related EU Directive/s or Other Documents	Waste & Emission Control Techniques	EMS Methodology	Remarks
			system and boiler furnace • Recycling of ash material • Safe disposal of ash & other solid waste • Staff training on boiler operations, energy efficiency, plant maintenance and emissions control	• Documented ***Boiler & Turbine I&M Procedures*** on boilers and firing systems • Documented ***Waste Management Procedures*** • *Waste ash measurement requirements* incorporated in ***Waste Management Procedures***	*To be developed*
5	Solid, sludge and liquid waste generated from *fireside* boiler/s maintenance & cleaning operations	IPPC BREF document [*LCP*]	• Use & maintenance of waste water treatment plant. • Separation and filtration of solid waste from liquid effluent • Safe disposal of solid waste	• Documented ***Waste Management Procedures*** • *Waste water testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
6	Liquid waste generated from *waterside* boiler/s cleaning & blowdown	IPPC BREF document [*LCP*] 75/442/EEC[17]	• Use & maintenance of waste water treatment plant. • Separation and filtration of solid waste from liquid effluent • Safe disposal of solid waste	• Documented ***Waste Management Procedures*** • *Waste water testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
7	Sludge waste generated from fuel oil filtration	IPPC BREF document [*LCP*]	• Safe disposal of solid waste	• Documented ***Waste Management Procedures*** • *Waste oil testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
	Cooling Systems Operations				
8	Liquid waste or effluents generated from sea water cooling systems	2000/60/EC[18] IPPC BREF document[19] [*Industrial Cooling Systems*] 75/442/EEC	• Controlled use of sea water intake, and I&M of pre-filtration /screening facilities • Regular I&M of cooling water plant to improve plant energy efficiency • Choice of appropriate water treatment additives • Controlled use of cooling water additives by appropriate settings and practices, and I&M of dosing systems • Staff training on cooling	• Documented ***Auxiliary Plant Operation Procedures*** to optimise performance and energy efficiencies • Documented ***Auxiliary Plant I&M Procedures*** • Documented ***Waste Management Procedures*** • *Waste cooling water testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	*To be developed* *To be developed* *To be developed*

[17] EU Directive 75/442/EEC & related Amendments: Waste Framework Directive
[18] EU Directive 2000/60/EC: Establishing a framework for Community action in the field of water policy [*Water Framework Directive*]
[19] European Commission: Integrated Pollution Prevention & Control Reference Document on the Best Available Techniques to Industrial Cooling Systems, December 2001

No.	Item Description	Related EU Directive/s or Other Documents	Waste & Emission Control Techniques	EMS Methodology	Remarks
			systems		
	Plant & Site Maintenance				
9	Liquid waste from changeover of lubricating oils used in stationary and mobile plant	75/442/EEC 75/439/EEC[20] 2000/76/EC[21]	• Re-cycling of waste oils together with new fuel oils in boiler combustion • Staff training on plant maintenance practice	• *Recycling of waste oils requirements & monitoring activities* incorporated in ***Fuel Oil Operations Procedures*** • Documented ***Auxiliary Plant I&M Procedures*** • Documented ***Waste Management Procedures*** • *Waste oils testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
10	Liquid waste from changeover of transformer /switchgear oils	75/442/EEC 75/439/EEC 2000/76/EC	• Re-cycling of waste oils together with new fuel oils in boiler combustion • Staff training on plant maintenance practice	• *Recycling of waste oils requirements & monitoring activities* incorporated in ***Fuel Oil Operations Procedures*** • Documented ***Auxiliary Plant I&M Procedures*** • Documented ***Waste Management Procedures*** • *Waste oils testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
11	Solid and liquid waste and gaseous emissions generated from general plant maintenance and repair work	75/442/EEC 91/689/EEC[22] 87/217/EEC[23] IPPC BREF document [*LCP*]	• Segregation of solid waste in appropriate containers • Controlled use of maintenance activities which generate polluting gases • Safe disposal of solid wastes	• Documented ***Waste Management Procedures*** • *General waste testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
	Site Storm Water Collection				
12	Liquid waste from site surface runoff water at oil interceptors	75/442/EEC IPPC BREF document [*LCP*]	• Separation of oils by oil interceptor • Recycling of oils	• Documented ***Waste Management Procedures*** • *Runoff waste testing and / or measurement requirements* incorporated in ***Waste Management Procedures***	
	Administrative Operations				
13	General solid waste generated	75/442/EEC	• Procuring materials & equipment which are	• Documented ***Waste Management Procedures***	

[20] EU Directive 75/439/EEC & related Amendments: Disposal of waste oils [***Waste Oils Directive***]
[21] EU Directive 75/439/EEC & related Directives: On the incineration of waste
[22] EU Directive 91/689/EEC & related Amendments: Disposal of hazardous waste [***Hazardous Waste Directive***]
[23] EU Directive 91/689/EEC & related Amendments: The prevention and reduction of pollution by asbestos [***Asbestos Directive***]

No.	Item Description	Related EU Directive/s or Other Documents	Waste & Emission Control Techniques	EMS Methodology	Remarks
	from administrative work and use of electrical/non-electrical equipment	2002/95/EC[24] 2002/96/EC[25]	energy efficient and / or eco-friendly or biodegradable • Minimizing consumption of materials & promoting energy efficiency practices • Recycling of materials • Segregation of solid waste & scrap equipment in appropriate containers • Safe disposal of solid waste & scrap equipment • Training of staff	• *Administrative waste measurement requirements* incorporated in ***Waste Management Procedures***	
	Environmental Hazards				
14	Hazards resulting from noise in proximity to plant operation	2002/49/EC[26] IPPC BREF document [*LCP*]	• Use and application of noise abatement practices and materials • Use of vibration isolators • Regular I&M of rotating plant & sound insulation materials or partitions • Regular I&M of sound muffling or silencing equipment • Training of staff	• Documented ***Boiler & Turbine Operation Procedures*** • Documented ***Boiler & Turbine I&M Procedures*** Documented ***Auxiliary Plant Operation Procedures*** • Documented ***Auxiliary Plant I&M Procedures*** • *Noise monitoring and / or measurement requirements* incorporated in ***Boiler & Turbine I&M Procedures***, and in ***Auxiliary Plant I&M Procedures***	
15	Hazards resulting from vibration in proximity to certain plant items operations	2002/44/EC[27] IPPC BREF document [*LCP*]	• Use and application of vibration abatement practices and materials • Regular I&M of rotating plant & other vibration generation sources • Regular I&M of rotating plant & machinery • Training of staff	• Documented ***Boiler & Turbine Operation Procedures*** • Documented ***Boiler & Turbine I&M Procedures*** • Documented ***Auxiliary Plant Operation Procedures*** • Documented ***Auxiliary Plant I&M Procedures*** • *Vibration monitoring and / or measurement requirements* incorporated	

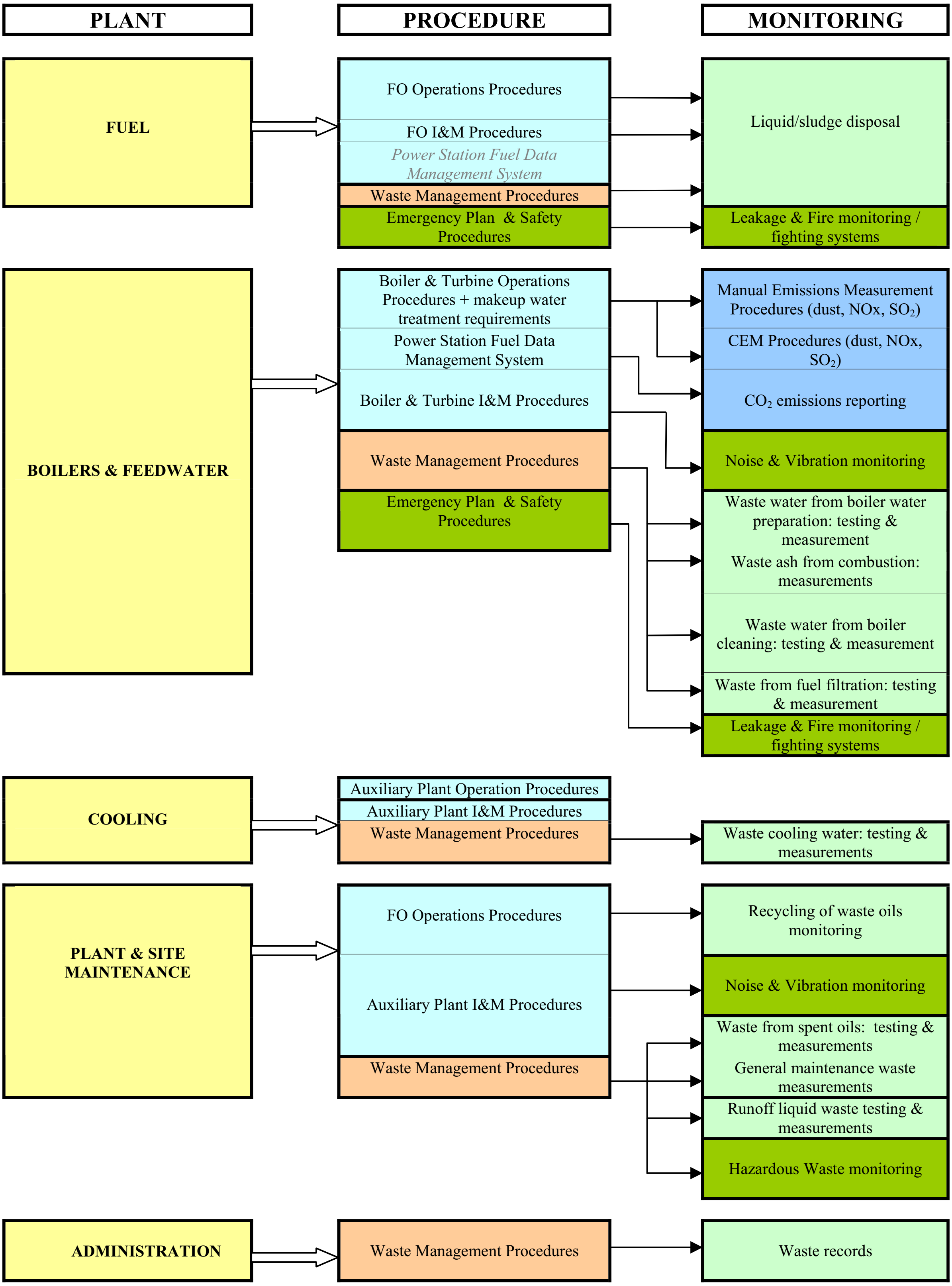
[24] EU Directive 2002/95/EC: Restriction in the use of certain hazardous substances in electrical and electronic equipment [**RoHS Directive**]
[25] EU Directive 2002/96/EC: Waste electrical and electronic equipment [***WEEE Directive***]
[26] EU Directive 2002/49/EC: The assessment and management of environmental noise - Declaration by the Commission in the Conciliation Committee on the Directive relating to the assessment and management of environmental noise
[27] EU Directive 2002/44/EC: Minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration) (sixteenth individual Directive within the meaning of Article 16(1) of Directive *89/391/EEC*) - Joint Statement by the European Parliament and the Council

No.	Item Description	Related EU Directive/s or Other Documents	Waste & Emission Control Techniques	EMS Methodology	Remarks
				in ***Boiler & Turbine I&M Procedures***, and in ***Auxiliary Plant I&M Procedures***	
16	Hazards arising from handling of hazardous substances & waste	91/689/EEC[28] 87/217/EEC[29] IPPC BREF document [*LCP*]	• Replacement with non-hazardous material • Seclusion and containment of hazardous material for safe use or waste disposal as per national requirements • Training of staff	• Documented ***Waste Management Procedures*** • *Hazardous waste inspection requirements* incorporated in ***Waste Management Operation Procedures***	
17	Hazards from potential major accidents arising from failure of fuel storage facilities or plant equipment	96/82/EEC[30] IPPC BREF document [*LCP*]	• Provision of fire or hazardous substance detection equipment • Provision of fire fighting equipment facilities & consumables including access to site • Provision of emissions containment facilities • Training of staff	• Documented ***Fuel Oil Operations Procedures*** • Documented ***Fuel Oil I&M Procedures*** • Documented ***Emergency Plan*** [31] ***& Safety Procedures***	*In Place*

Chart B2.3.3 presents the overall Procedures and Monitoring activities as listed in ***Table B2.3.2*** in the context of the internal ***Environment Management System***. ***Attachment 8: EMS Procedures*** includes the proposed Procedures and Monitoring Methodologies developed to date.

[28] EU Directive 91/689/EEC & related Amendments: Disposal of hazardous waste [***Hazardous Waste Directive***]
[29] EU Directive 87/217/EEC & related Amendments: The prevention and reduction of pollution by asbestos [***Asbestos Directive***]
[30] EU Directive 96/82/EEC & related Amendments: The control of major-accident hazards involving dangerous substances [***The Seveso II Directive***]
[31] Emergency Plan: Fire – Injury – Oil Spill, Enemalta, Marsa Power Station.

Chart B2.3.3 Plant Procedures & Monitoring Activities forming part of the EMS



B2.4 Characterise and quantify each waste stream from the installation and describe the proposed measures for waste management, storage and handling

Waste Streams & Proposed Measures for Waste Management, Ref. B2.4

The emission and waste components[32] that are measured or calculated using emission factors and other methods are given in ***Table B2.4.1***.

Table B2.4.1: Emission components & measures for waste management, storage & handling

No.	Emission components	Amounts[33]	Units	Method	Activity	Waste Management Measures[34]
	Air Stream					
1	Methane, CH_4	13,000	kg/year	Calculated	Fuel combustion	Item no. 4
2	Carbon monoxide, CO	221,000	kg/year	Calculated	Fuel combustion	Item no. 4
3	Carbon dioxide, CO_2	1,159,927,000	kg/year	Calculated	Fuel combustion	Item no. 4
4	Nitrous oxide, N_2O	4,000	kg/year	Calculated	Fuel combustion	Item no. 4
5	Oxides of nitrogen, NO_x	3,060,000	kg/year	Calculated	Fuel combustion	Item no. 4
6	Sulphur dioxide, SO_2	7,489,000	kg/year	Calculated	Fuel combustion	Item no. 4
7	Heavy Metals:				Fuel combustion	Item no. 4
a	*Arsenic*	NM[35]				
b	*Cadmium*	NM				
c	*Chromium*	NM				
d	*Nickel*	NM				
e	*Lead*	NM				
8	PCDD + PCDF (Dioxins & Furans)	NM			Fuel combustion	Item no. 4
9	Polycyclic Aromatic Hydrocarbons	NM			Fuel combustion	Item no. 4
10	Chlorine & inorganic compounds	NM			Fuel combustion	Item no. 4
11	Fluorine & inorganic compounds	NM			Fuel combustion	Item no. 4
12	Dust (PM10)	830,000	kg/year	Estimated	Fuel combustion	Item no. 4
	Water Stream					
13	Total - Nitrogen	5,300,000	kg/year	Measured	Boiler operations	Item nos. 2 to 12
14	Total - Phosphorus	NR[36]	kg/year	Measured	Boiler operations	Item nos. 2 to 12
15	Heavy Metals:				Boiler operations	Item nos. 2 to 12
a	*Cadmium*	NR	kg/year	Measured		
b	*Chromium*	NR	kg/year	Measured		
c	*Copper*	209	kg/year	Measured		
d	*Mercury*	NR	kg/year	Measured		
e	*Nickel*	NR	kg/year	Measured		
f	*Lead*	NR	kg/year	Measured		
g	*Zinc*	NR	kg/year	Measured		

[32] Based as applicable on details given in*: Guidance Document for EPER implementation. European Commission Directorate-General for Environment, November 2000*
[33] Based on data give to MEPA with respect to EPER forms & other communications
[34] As listed and explained in **Table2.3.2**.
[35] Not Monitored
[36] No traces

No.	Emission components	Amounts[33]	Units	Method	Activity	Waste Management Measures[34]
16	Benzene, Toluene, ethyl benzene, xylene	NR	kg/year	Measured	Boiler operations	Item nos. 2 to 12
17	Polyaromatic hydrocarbons	NM			Boiler operations	Item nos. 2 to 12
18	Total Organic Carbon (TOC)	NM			Boiler operations	Item nos. 2 to 12
19	Chloride	NM			Boiler operations	Item nos. 2 to 12
20	Fluoride	NR	kg/year	Measured	Boiler operations	Item nos. 2 to 12
	Land Waste Stream					
21	Fly ash (collected from ESPs)	400	tonnes/ year	Estimate	Boiler plant operation, cleaning & maintenance	Item nos. 4 & 6
22	Other maintenance solid wastes	240	tonnes/ year	Estimate	Plant maintenance	Item 10
23	Administrative operations waste				Administration work	Item 12

B2.4.1 Identify if there may be discharge of any List I or List II substances and if any are identified, explain how the requirements of the Groundwater Regulations (LN203 of 2002) have been addressed

Groundwater Discharge, Ref. B2.4.1

Discharge into groundwater: There are no discharges which effect groundwater.

B2.5 Could the installation involve the release of any Schedule A or Schedule B substance into the sewers and if any are identified, explain how the requirements of LN139 of 2002 have been addressed

Sewer Discharge, Ref. B2.5

Discharge into sewers: There is no discharge into sewers except for drains from the personnel toilets.

B2.5.1 Could the installation involve the release of any substances directly into relevant territorial waters or coastal waters?

Sea Discharge, Ref. B2.5.1

Discharge into the sea: Further to details presented in earlier sections the following effluents are discharged into the sea:

- ***Cooling water*** after passing through condensers and heat exchangers. The temperature is raised typically by 4 degrees between intake and outfall. The seawater is treated using methods approved by environmental authorities (e.g. the EPA) and the residual chemicals are below the approved minimum. A period contract tender is also regularly issued and awarded for services to keep culverts, condensers and heat exchangers free from micro and macro fouling. Please refer to ***Attachment 9: Tender for Biocide Dosing Services against Micro & Macro Fouling.***

- ***Brine*** discharged from the seawater evaporator. Certified[37] scale control chemicals are used which are formulated to be environmentally acceptable.
- ***Boiler blowdown,*** which is technically pure water, except for some highly diluted levels of contaminants as referred in the attachment below.
- ***Surface runoff water***, discharged through oil interceptors to remove any contamination by oil.
- Samples of water discharges are analyzed by a certified laboratory in accordance with MEPA requirements.

Please refer to ***Attachment 10: Marine Discharges to Comply with EU Directive 78/464*** for more details about discharge to sea and "***Analytical Reports***" for discharge water samples taken on 19th May 2006.

B2.6 Describe how each waste stream is proposed to be recovered or disposed of and, if you propose any disposal, explain why recovery is technically and economically impossible and describe the measures planned to avoid or reduce any impact on the environment.

Proposed Recovery or Disposal of Waste Streams, Ref. B2.6

Please refer to *Waste Management Procedures*.

B2.7.1 Provide a breakdown of the proposed energy consumption and generation by source and end-use

Proposed Energy Consumption & Generation, Ref. B2.7.1

Energy is generated from heavy fuel oil from the units listed in ***Table B1.3.1: Plant Listing of Marsa Power Station***, except for minor contribution by the gas turbine, which uses gas oil.

The following figures are for ***Budget Year 2005/2006*** and are typical:

Item	Quantity	Units
Units generated by steam units	**1,194,558**	MWh
Units used in station	**74,859**	MWh
Heavy fuel oil consumed	**374,445**	tonnes
Units generated by gas turbine	**1,694**	MWh
Gas oil consumed	**701**	tonnes

[37] Belgard EV2050 is certified to ANSI/NSF [*NSF International, the Public Health & Safety Company*] Standard 60 for use in seawater distillation plants producing potable water. Please refer to ***Attachment** 7*.

B2.7.2 Describe proposed basic measures for improvement of energy efficiency.

Proposed Energy Efficiency Measures, Ref. B2.7.2

The power station plant is designed for generation at optimized efficiency at all stages and the management and staff give priority to efficiency improvements in the steam and gas turbine cycle, avoidance of energy losses, retention and reuse of condensate drains, heat insulation, plant controls, economy in the use of standby plant, energy efficient lighting, etc. Further details are presented in the appropriate Procedures listed in earlier ***Report B2.3***, viz.

- *Table B2.3.2: BAT and Procedures for Marsa Power Station*
- *Chart B2.3.3 Plant Procedures & Monitoring Activities.*

B2.8 Describe the documented system proposed to be used to identify, assess and minimize the environmental risks and hazards of accidents and their consequences.

Proposed Documented System for Environmental Risks & Hazards of Accidents, Ref. B2.8

Enemalta has a ***Fire and Safety section*** which is engaged in providing for safe plant and procedure, including the certification of plant including pressure vessels, cranes etc. and procedures such as hot work, gas free enclosures, confined space working, scaffolding, and emergency measures for oils spills or fires. The ***Health and Safety section*** is engaged in safety of personnel and work practices.

According to ***Legal Notices 37(2003)***[38] and ***6(2005)***[39] the Marsa Power Station is not a ***COMAH***[40] site since the gas oil storage capacity falls below the threshold level for a lower tier site. Nevertheless, an ***Emergency Plan & Safety Procedures*** is in place as detailed in *Table B2.3.2: BAT and Procedures for Marsa Power Station.* Please refer to ***Attachment 11: Marsa Power Station Emergency Plan & Safety Procedures.***

B2.9 Describe main source of noise and vibration (including infrequent sources); the nearest noise sensitive locations and relevant environmental noise measurement surveys which have been undertaken, and the proposed techniques and measures for control.

Environmental Noise & Vibration, Ref. B2.9

1.0 Noise

While the power station plant is intrinsically noisy the specifications for the plant require compliance with noise standards in accordance with good industry practice. Silencers are installed on noisy plant such as safety valve and steam vent tailpipes, while sound barriers are used on the gas turbine.

[38] Control of Major Accident Hazard Regulations, 2003
[39] Control of Major Accident Hazards (Amendment) Regulations, 2005
[40] Control Of Major Accident Hazards

Personnel workstations for operating staff are enclosures with noise reduction measures, which are assessed by the H&S department. Ear protectors are provided for personnel working in high noise areas.

Periodic hearing tests by qualified external personnel are carried out on personnel working at the power station.

Moreover environmental noise tests at the site boundary have been carried out to assess noise level hazards in adjacent areas to the station. Such noise emission level results are presented in ***Attachment 12: Noise Emission Level at MPS Plant Boundaries***.

2.0 Vibration

As far as vibration the main sources are related to rotating plant such as turbines, pumps, fans, compressors and motors. Whenever such items may pose such hazard vibration absorption and damping features and equipment are normally installed to isolate the item from its supporting structure according to equipment manufacturer recommendations. However, since abnormal vibration patterns are also intrinsically indicative of potential plant problems, continuous vibration-monitoring equipment is installed on the turbo-alternator sets since these constitute the major risk to power plant failure. Hence, technically major plant is continuously monitored visually and/or physically for the least amount of vibration and safe operation.

B2.10 Describe the proposed measures for monitoring emissions including any environmental monitoring and the frequency, methodology and evaluation procedures proposed.

Proposed Environmental Monitoring Methodology & Procedures, Ref. B2.10

Details about monitoring of emissions is given in the respective procedures indicated in the following:

- *Table B2.3.2: BAT and Procedures for Marsa Power Station*
- *Chart B2.3.3 Plant Procedures & Monitoring Activities.*

B2.11 Describe the proposed measures upon definitive cessation of activities, to avoid any pollution risk and return the site of the installation to a satisfactory state (including relevant measures for the design and construction of the installation).

Proposed Installation Decommissioning & Reinstatement of Site, Ref. B2.11

It is being projected that the plant will be used within the total annual hour limit allowed in the LCP Directive, that is, up to 20.000 hours from 1st January 2008 to 31st December 2015. Hence the site will eventually be decommissioned and for this scope a draft report is presented in ***Attachment 13: Draft Report on the Decommissioning of Marsa Station***.

Details about the site prior to the installation of the various plants are also included with the attachment. These include:

- A report[41] by General Sir Charles Bonham Carter, Governor of Malta (1936-1940), dated 27th October 1936, recommending the construction of a new power station (the "A" station) at Church Wharf, Marsa, which was then the site of the ***Admiralty Coal Stores***. The station was installed underground to offer "*a high degree of protection from hostile attack*". At the time of writing of the report "*a level space has already been formed by removing the rock to a distance of about 200 feet inland*". The report also recommends that this level space in front of the rock will be utilised for offices, workshops, coal yard, etc., and subsequently the "B" station was installed at a later date. The underground "A" station was stopped from operating any further in 1994.
- A site map of the Marsa creek area within the Grand Harbour prior to the installation of the "A" and the "B" stations.
- A set of photos showing the site just at the beginning the works for the "A" station and the foundations for the "B" station in front of the "A" underground station.

B2.12 Where you are not the only operator of the installation, describe the proposed techniques and measures (including those to be undertaken jointly by yourself and other operators) for ensuring satisfactory operation of the whole installation.

Proposed Techniques & Measures for Joint Installation Operation, Ref. B2.12

Not applicable.

B3 Please provide written information about the emissions which will result from the techniques described in response to the question in section B2.

You should:

- Provide any other information about the installation which you think is relevant to that issue

B3.1 Describe the nature, quantities and sources of foreseeable emissions into each environmental medium

Foreseeable Emissions into Environmental Media, Ref. B3.1

The Marsa Power Station will be operated within the limit of 20,000 hours till 2015[42]. Therefore the emissions to the air are expected to be at the current levels, in so far as dust, sulphur dioxide and nitrogen dioxides are concerned. ***Attachment 14: Projected Emissions for Enemalta Power Plants*** gives more details about the foreseeable emissions according to the Enemalta Generation Plan as referenced in ***Attachment 1***.

Emissions in the sea will be below the threshold for such emissions.

[41] Reference No. AMD/9486, Public Records Office, UK. We would like to thank Mr Max Farrugia, S Principal in charge of Delimara Library, for his research and provision of this document, the site plan and the photographs.

[42] Please refer to ***General Site Report, Ref. B1.3.1, Emission Improvements***, page 7.

B4 Please provide written information about the impact your emissions may have on the environment.

You should:

- Address all of the issues set out in the section
- Justify your proposals
- Provide any other information about the installation which you think is relevant to that issue.

B 4.1 Provide an assessment of the potential significant environmental effects (including transboundary effects) of foreseeable emissions.

Transboundary Effects, Ref. B4.1

Given our island conditions with approximately 100km south from Sicily, the nearest island forming part of the Italian territories, as well as the small amount of fuel used (<500,000 tonnes/year), it is believed that the presence of the power station at Marsa has no significant transboundary effects on other Member States. Moreover the prevalence of the northwesterly winds makes it even more remote that flue gas emissions form the Marsa Station will reach the nearest Italian cities. On the other hand transboundary air pollution from other countries are considered as an "*issue of concern given the Islands' geographical situation and typical weather patterns with high solar irradiation and low wind speeds*".[43]

B4.2 Provide an assessment of whether the installation is likely to have a significant effect on another site in Malta and if it is, provide an assessment of the implications of the installation for that site

Effects on Other Sites, Ref. B4.2

The presence of the power station at Marsa takes up a significant part of the coastline inside the harbour and restricts mooring, water sports, swimming, etc in the immediate area. Fuel tankers need to berth at Flagstone Wharf and this may restrict the use of the berth for other purposes (such as the setting up of a yacht marina at the Menqa area). However adjacent areas are utilised as a ship repair yard, cargo unloading, etc.

B5.1 Has the development of the installation (or any subsequent change or extension of the development) required an environmental statement under LN 204/2001 on the assessment of certain public and private projects on the environment?

No.

B 6.1 In which area is the installation located?

[43] Malta Environment & Planning Authority (MEPA) January 2006. *State of the Environment Report 2005, Sub-report 2: Air*, page 23.

If premises are on a boundary please give names of all relevant authorities.

Local Council

Marsa Council

B6.2 Are there any other sites which may be affected by emissions from the installation?

Yes

Apart from Marsa, the following neighbouring towns or villages are also affected to varying extent, as can be observed in the "*State of the Environment Report 2005, Sub-report 2: Air*" published by MEPA:

- Fgura
- Floriana
- Hamrun
- Kordin
- Qormi
- Paola
- Pieta

B6.3 Could the installation involve the release of any substance into a harbour managed by a port authority?

Yes. Please name the port authority.

Malta Maritime Authority

B7.1 Are you applying to operate any 'specified waste management activities'?

No. [*Activities are interpreted in the context of Schedule 1, part 5 "Waste Management" industrial activities of* ***Legal Notice No. 234 of 2002***]

B7.2 Which of the following applies to the specified waste management activities identified in B7.1?

You have planning permission.
You have a certificate of lawful existing use or development.
Planning permission is not required – please say why.
If you have submitted an application for planning permission which has not yet been determined, please provide a copy of the application.

Not Applicable (N/A)

B7.3 Has the operator or any relevant person been convicted of any 'relevant offence'?

N/A

B7.4 Who will provide the technically competent management of the specified waste management activities?

N/A

B7.6 Are any of these 'Responsible people' already providing the technically competent management at other IPPC installations or at sites licensed under the Environment Protection Act 2001?

N/A

B7.7 If known how does the operator intend to make financial provision for the specified waste management activities?

Renewable Bonds
Bonds
Bank Guarantee
Parent company guarantee
Escrow account
Trust fund
Insurance captive
Lump sum
Others

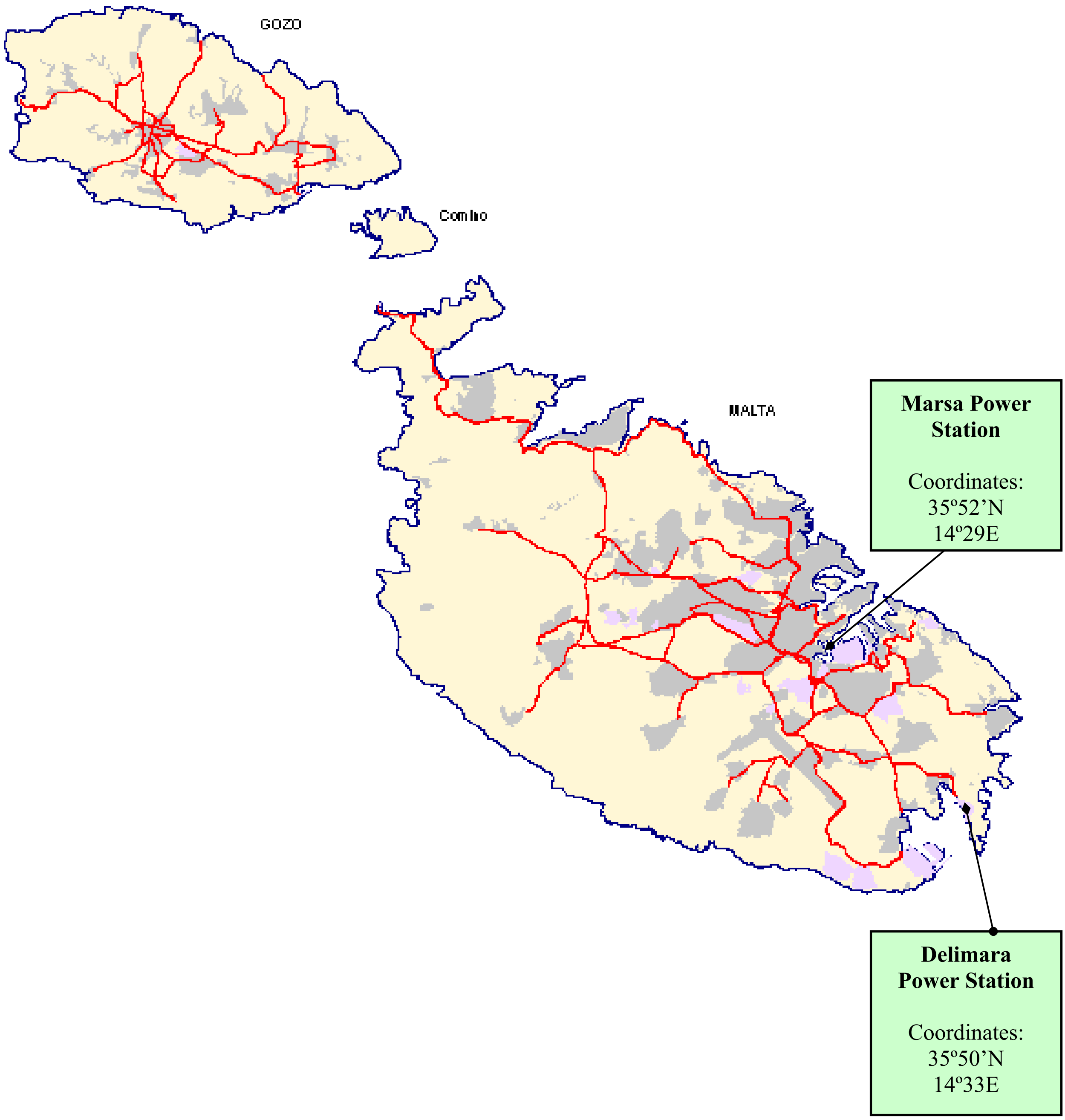
N/A

B7.8 Please provide a plan of the estimated expenditure for each phase of the specified waste management activities.

The plan should include the likely cost of

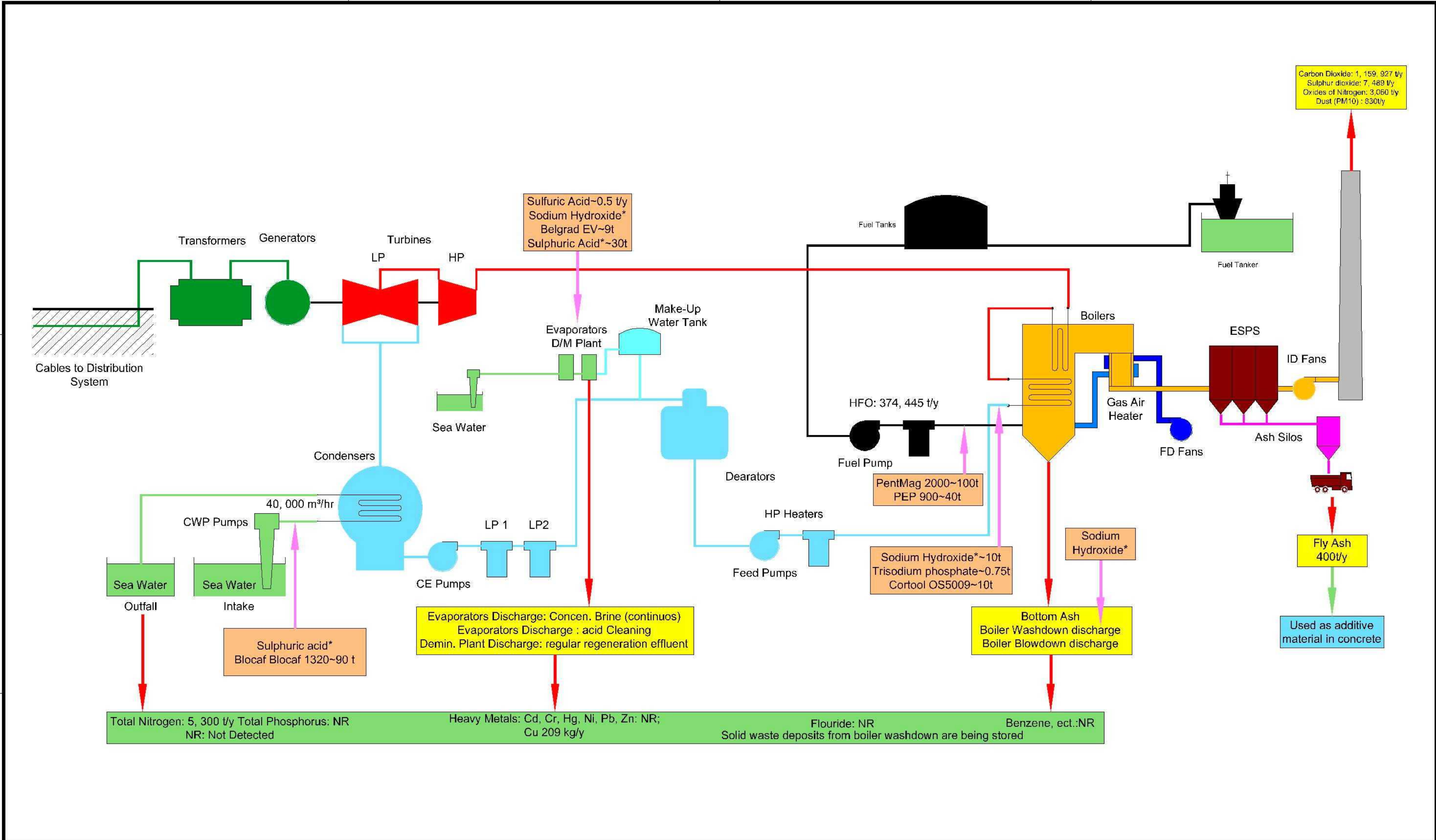
- Monitoring
- Restoration - *landfill only*
- Aftercare - *landfill only*
- Clearing the installation (including drainage systems) of all wastes – *non-landfill*
- Remedial action in the event of the failure of pollution control systems

N/A



Map of Malta showing sites of Enemalta Power Stations at Marsa & Delimara

Drawing No. B132-1



enemalta

MARSA POWER STATION
CHURCH WHARF MARSA MALTA
TEL. 22 36 01, 22 19 07, 22 04 62
TELEGRAMS: ELPEGA MALTA
TELEX No.: 1735 ENECOR MW, 1942–ENERGY MW

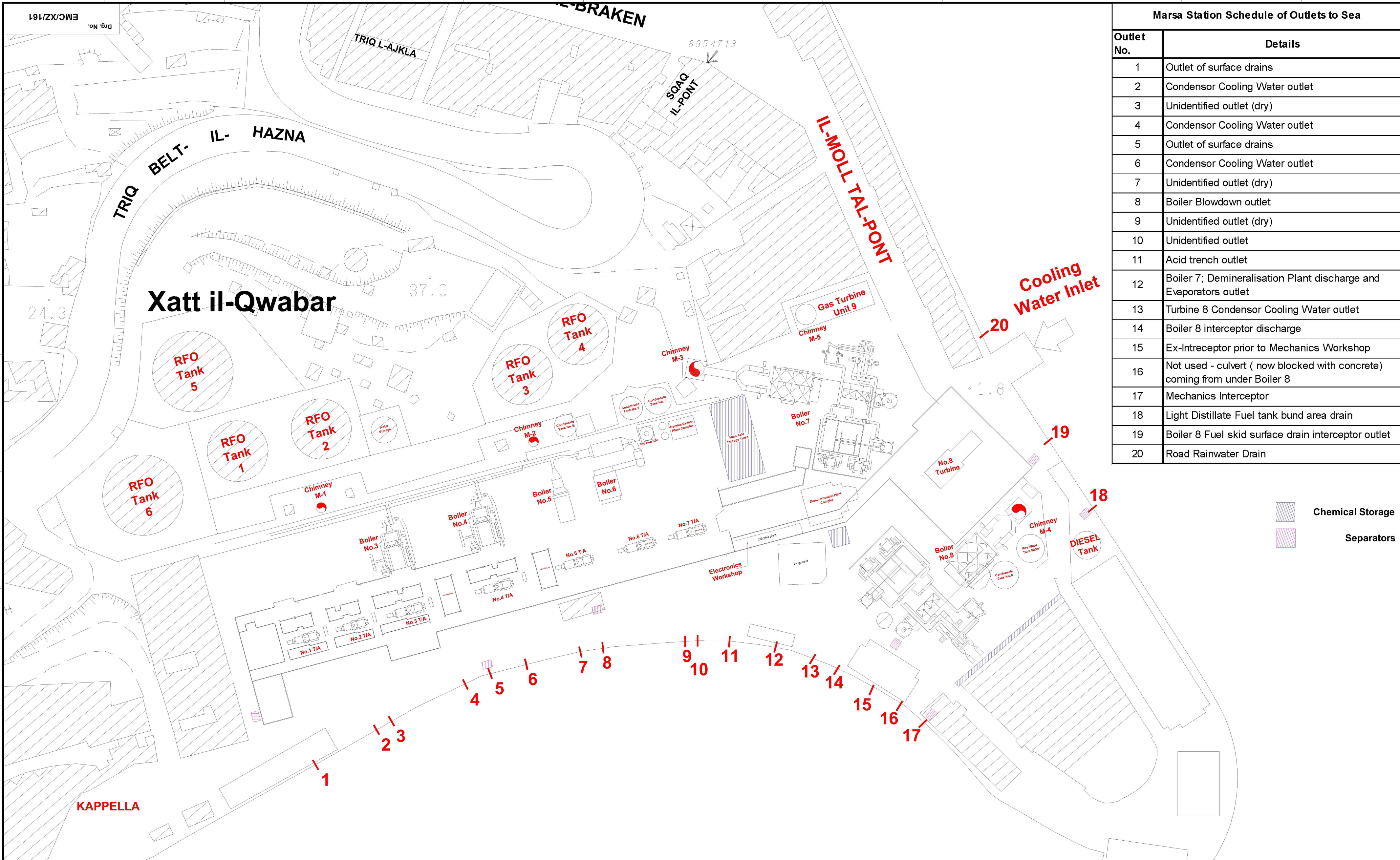
FAX: 243055, 232592
DELIMARA POWER STATION
DELIMARA MALTA. ZTN 09
TEL. 65 02 92/5
FAX: 653519, 657449

REFER ERRORS TO DRAWING OFFICE | DO NOT SCALE DRAWING

MPS Schematic of Steam Plant and Materials Input and Discharge Levels

SCALE		ALL DIMENSIONS IN mm	
DRAWN BY	M. Borg	ISSUE	1
CHECKED BY	C. Busuttil	DATE	18-12-06
APPROVED BY		DRG. No.	EMC/XZ/178
REVISED			

Mechanical Engineering Design Section (tel: 22980 816)



Marsa Station Schedule of Outlets to Sea

Outlet No.	Details
1	Outlet of surface drains
2	Condensor Cooling Water outlet
3	Unidentified outlet (dry)
4	Condensor Cooling Water outlet
5	Outlet of surface drains
6	Condensor Cooling Water outlet
7	Unidentified outlet (dry)
8	Boiler Blowdown outlet
9	Unidentified outlet (dry)
10	Unidentified outlet
11	Acid trench outlet
12	Boiler 7; Demineralisation Plant discharge and Evaporators outlet
13	Turbine 8 Condensor Cooling Water outlet
14	Boiler 8 interceptor discharge
15	Ex-Intreceptor prior to Mechanics Workshop
16	Not used - culvert (now blocked with concrete) coming from under Boiler 8
17	Mechanics Interceptor
18	Light Distillate Fuel tank bund area drain
19	Boiler 8 Fuel skid surface drain interceptor outlet
20	Road Rainwater Drain

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MARSA POWER STATION
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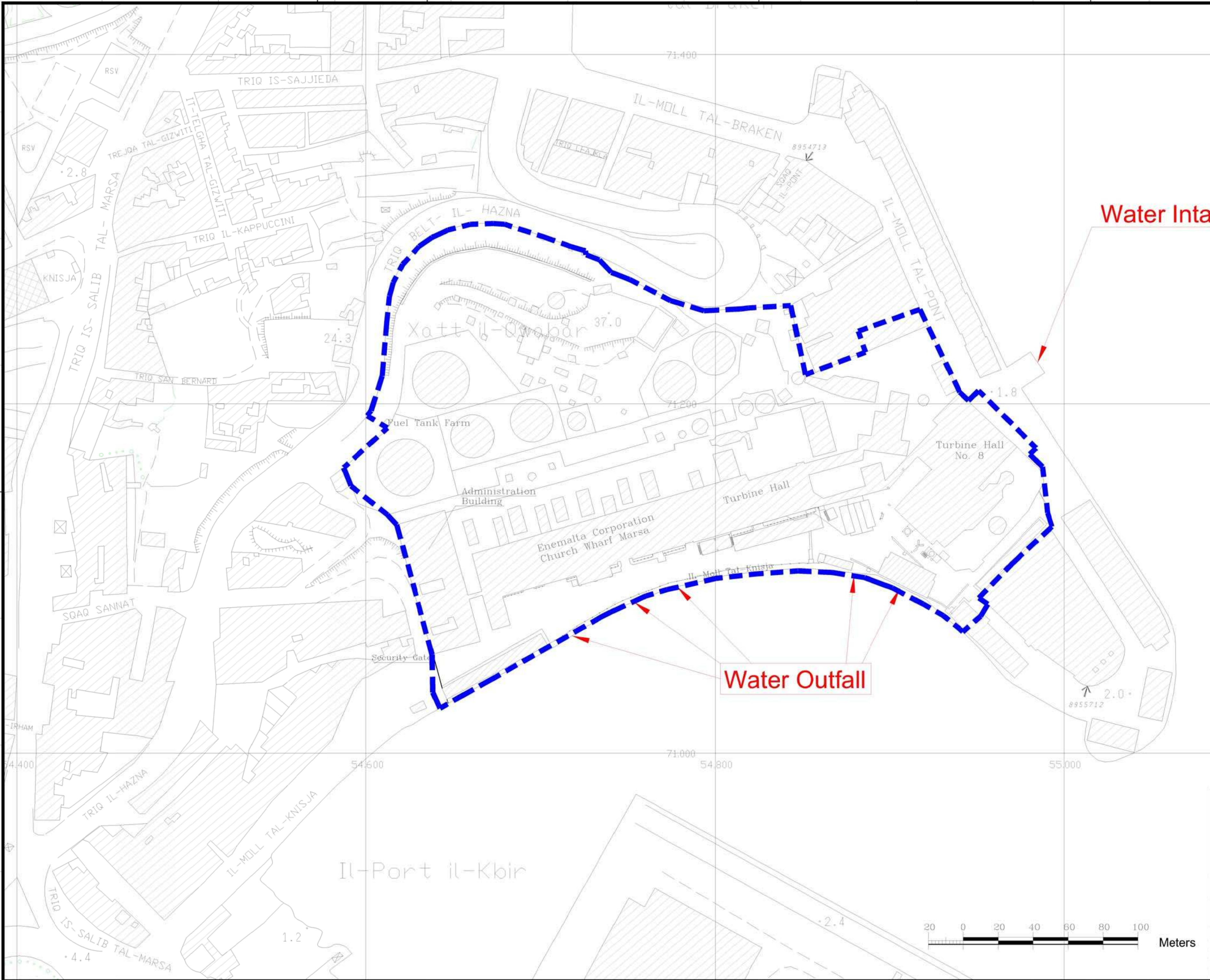
ALL DIMENSIONS IN MM

Marsa Power Station Site Plan

REV	DATE	BY	ALTERATION	CHK'D	APP'D

SCALE	N.T.S.	DO NOT SCALE DRAWING	
DRAWN BY	M. Borg	ISSUE	1 / 2
CHECKED BY	C. Busuttil	DATE	04/04/06 / 03/01/06
APPROVED BY		DRG. No.	EMC/XZ/161
REVISION			



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CENTRAL ADMINISTRATION BUILDING
DELIMARA POWER STATION
M'XLOKK
CIVIL SECTION
TEL. Nos. 22980842
FAX No. 22980847

PROJECT: Marsa Power Station

TITLE: Block Plan

SCALE	N.T.S.	DO NOT SCALE DRAWING	
DRAWN BY	M.Vella	ISSUE	
CHECKED BY	P.Baldacchino	DATE	January 2007
APPROVED BY	M.Sciduna A&CE	DRG. No.	CDS/MPS/22-09
Comp. File No. Acad 2000		REVISED	0

Attachment 1

Electricity Generation Plan 2006 – 2015

Enemalta Corporation

Electricity Generation Plan
2006 – 2015

Ministeru għall-
Investiment,Industrija u Teknoloġija ta' l-Informazzjoni

Table of Contents

Executive Summary

Background

This document provides information on the present status of Enemalta`s generating plant and its plans for electricity generation up to to 2015. The generation plan reflects Enemalta's commitment to contribute to the quality of Malta's environment and ensure full compliance with Malta's environmental obligations. Despite the liberalisation of the energy sector in 2004, Enemalta expects to remain the only major organisation responsible for the generation and distribution of electricity in Malta. This document explains how we plan to fulfil the obligations that come with that responsibility.

Presently Enemalta has a nominal generation capacity of 571MW (Marsa Power Station (MPS) = 267MW, Delimara Power Station (DPS) = 304MW), which is reduced due to a number of factors. The nominal available generating capacity during the summer months is 495MW.

The existing plant has aged considerably. Over the years a number of turbines have been refurbished. However the average age of the steam turbines at Marsa Power Station is 45 years and the age of the boilers range from 19 to 37 years. At Delimara, the two steam units are 14 years old: more than half their design economic lifetime, whilst the combined cycle plant (CCGT) is 8 years old with only half of its design economic lifetime ahead. There are also three open cycle gas turbines, one at Marsa (16 years old) and two at Delimara (11 years old), however these are expensive to operate and are reserved for peak load or emergency duty.

The average operating efficiency of the operational steam plant at Marsa is 27% compared with an average efficiency of the steam plant at Delimara of 32% and of the CCGT plant of 40%.

The calculated present natural growth rate in peak demand (MW) is about 3% per annum over the present peak load with the peaks occurring both during the summer and winter months. This increase in peak demand is associated with an increase in electrical energy consumption (MWhrs) of just over 2% of present demand.

There are also a number of new developments, which are planned within this period and which will add both to the total expected peak demand and the total electricity consumption. On this basis, with the existing generating plant, Enemalta will only just meet the expected demand in 2010 and will be left with no reserve capacity.

It should also be noted that based on the expected growth in demand (MW) the reserve capacity available after the summer of 2007 will be less than 60MW, which means that in case of loss due to a fault in one of the large units (MPS boilers 7 & 8, DPS units 1& 2 or DPS CCGT plant) during the summer months will result in a shortfall in generation capacity resulting in power outages possibly in large areas on the islands.

Constraints

In order to fulfil our environmental obligations, all the generating plant must generate emissions below the limits set in the Large Combustion Plant Directive (LCPD). Furthermore, from 2010 Malta will have to meet the National emissions limits under the National Emissions Ceiling Directive (NEC) and for 2006 it will have to meet the emissions limits for green house gases (GHG) under the National Allocation Plan (NAP). In addition to the above, additional restrictions may be introduced under provisions of the Gothenburg Protocol. These emissions limits are very tight and are expected to become even tighter in the future (National Emissions Ceiling Directive anticipated for 2020). To comply with these emissions limits, any new generating plant must have low airborn emissions either directly through design of equipment or fuels or using emissions-abatement techniques to manage the content of gases from the combustion process.

The installed steam plant at both Marsa and Delimara do not comply with the LCPD, although given the age difference of the plant at the two stations different regulations and limits apply.

Unless emissions from the steam plant at Marsa Power Station are reduced to below the established limits by 1st January 2008, the plant will only be allowed to operate for 20,000 hours from this date and is expected to be shut down by April 2010 at the present rate of operation. The modifications required to achieve the required reduction in emissions are both expensive and time-consuming and given the age and low efficiency of the plant are not economically viable. In the case of the Delimara steam plant, Malta obtained a 'transition period' from the provisions of the LCPD which expired on the 1st of January 2006.

This transition period was however, applicable specifically to particulate emissions . The steam plant at Delimara is not compliant with the LCPD with respect to emissions of NO_x and SO_2. In order to achieve compliance with the SO_2 emission limit values, fuel oil with less sulphur content must be used, whilst reduction of NO_x emissions from these boilers will require extensive modifications to the boilers. To ensure the effectiveness of these modifications, stack emission studies are required and Enemalta has recently issued a call for tenders for consultants to carry out these studies.

The reduction of particulates will require the installation of either electro-static precipitators or filters. Given the limitations on availability of plant for extensive outage, this project is not expected to be completed for both boilers, before three years from now.

The cost to meet the LCPD dust and NO_x limits vary from an estimated capital cost of Lm 5,000,000 for precipitators and primary NO_x abatement techniques. If secondary NO_x abatement is required, this is estimated to cost an additional Lm 2,500,000 with an annual running cost of Lm 1,200,000. This estimate depends upon the technology adopted and the amount of electricity generated. In the case of secondary NO_x abatement, there are a number of technical solutions, which would need to be analysed in detail. Such solutions might require additional capital expenditure

The main technical constraints on the selection of new generating plant are the need for operational flexibility, and reasonably high efficiency when operated at part load. The plant will be required to have the capability to operate in load following mode, i.e. subjected to a variable load depending on the actual daily load demand, cycling and two-shifting modes, i.e. with daily startup and shutdown, apart from base load operation, i.e. at continuous full output. This is due to the fact that the night time load can be as low as 160-170MW compared with a day time load of around 260MW and an evening peak of around 280-290MW. This large load variation can be accommodated either by operating sufficient plant capacity for the daytime load and reducing the output at night or by starting and stopping the plant daily.

The cycling from full load to 50% or less load (overnight) can have serious detrimental effects on the lifetime of the plant, particularly if these load changes are accompanied by changes in operating temperature of the plant. During the period that the plant is operating at significantly reduced load the efficiency of the generation process is drastically reduced. Similarly two-shift operation can result in both increased maintenance costs and a reduction of the lifetime of the plant. Therefore it is essential that the plant acquired should be designed to be capable of cycling and two shift operation, so that the damaging effects both in terms of increased maintenance, reduced lifetime and reduced efficiency can be partially mitigated using superior materials and design.

We have also considered the continued use of fuel oil and of the use of alternative fuels such as coal and natural gas.

It should also be noted that discussions were held with both the Malta Resources Authority (MRA) and the Malta Environment and Planning Authority (MEPA) and due consideration is being given to the direction that has been received from the latter as regards compliance with emission levels of the various possible generation plant.

Technical options

There are several technical options available. These options include:

- Diesel engines, which are available in three main types, namely high-speed, medium-speed and low-speed units. The high-speed diesel engines are normally rated up to 5MW and are not a practical solution for use in Enemalta's power stations. Medium-speed units are commonly used on smaller ships and low-speed units are used on larger commercial vessels.

- Gas turbines, whether heavy-duty or aero-derivative are available in both open- and combined-cycle variants.

- Conventional steam units, which presently form the bulk of the electric power generating plant in Malta.

- Re-powering of existing steam plant by means of steam produced from heat-recovery boilers and gas turbines, to form a CCGT plant.

- Electric Cable interconnection, which although not generation in itself, represents the replacement of local generation with generation overseas. In order to maintain security of supply this option needs to be backed up by alternative sources of supply.

This Generation plan summarises the investigations carried out by Enemalta Corporation into the optimum generation plant which can meet the requirements of the present and expected environmental legislation at the lowest generation cost. Consideration has also been given to an electric cable interconnection with the European Networks, which would enable some local generation capacity to be replaced with imported electricity supplies. Comparisons of the impact on emissions and cost of the main options were also considered.

Conclusion

This report identifies the use of Combined Cycle Gas Turbines (CCGT) as the only generating plant able to comply with the present expected emissions limits in 2020.

It also highlights the need for 200 MW of local generation to be replaced either by new generating plant or by a cable interconnection.

In order to minimise the local cost of electricity these CCGT plants should be fired with gas which implies that a local supply of gas, either through a pipeline or a terminal will also be required.

It should be noted that these conclusions do not in any way prejudice the country's commitment to the liberalisation of the energy market. The supply of the generation plant required to meet the country's needs as well as its European and international obligations can be financed both internally by the Government as well as externally by third parties. If the latter vehicle is used, there are various forms of partnerships and or management relationships that can be utilised. However this aspect is outside the remit of this report, and care has been taken in the report not to prejudice either option.

Finally the use of alternative energy sources has not been extensively discussed in this document simply because it is not envisaged that these can provide any significant substitute for the use of fossil fuels at the level of energy required. The only exception to this, as is mentioned in the report, is the installation of a submarine cable linking Malta to the European electricity grid, which would enable Malta to buy energy from green sources in Europe. Enemalta also re-states its commitment to buy onto its grid all the green energy that can be produced locally by third parties.

1.0 Introduction and Background information

This report provides information on the present status of Enemalta's generating plant and generation plans for the ten year period 2006 to 2015. The generation plan reflects Enemalta's commitment to comply with Malta's environmental obligations. Throughout this period it is envisaged that Enemalta will, despite the liberalisation of the electricity generation market in 2004, remain the only major organisation responsible for the generation and distribution of electricity in Malta.

The nominal installed capacity is 571MW (Marsa Power Station - MPS = 267MW, Delimara Power Station - DPS = 304MW), however this is reduced due to several factors:

- Derating of plant during summer as a result of high ambient temperatures. This affects negatively the capacity of the electrical equipment, particularly the generators (and cables) due to the degradation of electrical insulation if operated at high temperature, and the lower capacity of the cooling systems.
- The steam plant is also affected by the reduced capacity of the condensers resulting in less heat absorption and consequently higher steam condensing temperatures (and pressures) resulting in lower efficiency and unit derating.
- The gas turbines are highly affected by a reduction in nominal output of approximately 20% at 40ºC with respect to their rated output.
- The capacity of the electrical distribution system is also derated significantly due to high summer temperatures and consequent reduction of heat absorbing capacity by the environment.

Steam turbines 1 and 2 at Marsa (rated 10MW each) have been included in the nominal total capacity of 571MW, however due to limitations in steam availability they are in reality only available as backups for failure of steam turbines 3 and 4. Therefore the real total nominal installed capacity is 551MW.

Due to the age of the plant (even the ´new´ Delimara steam plant is already past half its design lifetime), faults resulting in plant derating or outages are inevitable. Due to the changing load demand profile, with peak loads occurring both in summer and winter, the periods available for plant outage have been reduced to April-June and September-November.

This results in a reduction of the number of required overhauls with the consequent risk of increased unplanned outages. It has been the policy in recent years to avoid planned maintenance during the peak months (summer and winter), however the average capacity loss due to faults (unplanned) is in the order of 70MW. It should be appreciated that the outage duration of a boiler to repair a major tube leak is around 10 days.

As a result of the above-mentioned factors the nominal capacity in summer is reduced to 495 MW since:

- Marsa Power Station (MPS): The nominal capacity of 267MW is reduced to 225MW, since 20MW from T/A's 1 & 2 not available, and the MPS Gas Turbine capacity is derated from 37MW to 30MW as a result of high ambient temperatures, and steam plant derated from 210MW to typically 195MW, also as a result of high sea water and air temperatures;

- Delimara Power Station (DPS): The nominal capacity of 304MW is reduced to 270MW since the combined cycle plant capacity is derated to 90 MW and the open cycle gas turbines are each derated to 30MW from 37MW.

An outage of a 60MW unit (boiler or turbine), i.e. one of the largest units currently in service, will reduce summer capacity to 435MW.

The following two tables show the installed generating plant at Marsa and Delimara Power Stations.

Table 1.1
Installed generating plant at MPS

Unit	Commissioning date[1]	Age of plant (years)[1]	Nominal Rating (MW)	Actual Rating (MW)	Efficiency[2] %	Remarks
Steam T/A 1	1965	41	10	-	-	Not in Service
Steam T/A 2	1966	40	10	8		Boilers and turbines on common steam header
Steam T/A 3	1970	36	30	30		
Steam T/A 4	1970	36	30	30	25	
Steam T/A 5	1982 (1952)	24 (54)	30	30		
Steam T/A 6	1983 (1952)	23 (54)	30	30		
Steam T/A 7	1984 (1952)	22 (54)	30	30		
Steam T/A 8	1987 (1959)	19 (47)	60	60	29	
Gas T/A 1	1990	16	37.5	W 36.5 S 30	32 (at base load)	Typical efficiency at part loads <19%
Boiler 1	1964	42	20	-	Given above with steam turbine units	Retired
Boiler 2	1964	42	20	-		Retired
Boiler 3	1969	37	35	25		In Service
Boiler 4	1969	37	35	25		In Service
Boiler 5	1982	24	35	25		In Service
Boiler 6	1982	24	35	35		In Service
Boiler 7	1984	22	70	70		In Service
Boiler 8	1987	19	70	60		In Service

[1] Figure in brackets represents original commissioning abroad for reconditioned plant.
[2] Efficiency given is total unit efficiency (from combustion of fuel and includes auxiliary consumption).

Table 1.2
Installed generating plant at DPS

Unit	Commissioning date	Age (years)	Nominal capacity (MW)	Actual capacity (MW)	Efficiency %	Remarks
Steam Unit No 1	1992	14	60	60	32	
Steam Unit No 2	1992	14	60	60	32	
Gas turbine No1	1995	11	37.5	W 36 S 30		Part load efficiency 20%
Gas Turbine No 2	1995	11	37.5	W 36 S 30		Part load efficiency 20%
Combined Cycle Plant	1998	8	110	W 110 S 90	46 (at base load)	Efficiency of 39% at typical operation

The actual average increase in peak load over the last five years is approximately 12MW per annum. This represents a natural load increase and is considered as a low growth rate. Unless there are significant changes in electricity consumption or other factors such as an extremely hot summer, the expected summer peak loads over the next five years are shown below in table 1.3. A comparison with a medium growth scenario is also given.

Table 1.3
Expected Peak Loads (natural growth only)

	Low Growth rate (3% of present peak) (12MW/annum)		Medium Growth rate (4% of present peak) (16MW/annum)	
	Expected Summer Peak Load (MW)	Reserve Capacity[1] (Present plant) (MW)	Expected Summer Peak Load (MW)	Reserve Capacity[1] (Present Plant) (MW)
2005 (actual)	411	84	411	84
2006	423	72	427	68
2007	435	60	443	52 [2]
2008	447	48 [2]	459	34 [2]
2009	459	36 [2]	475	18 [2]
2010	471	24 [2]	491	2 [2]
2011	483	12 [2]	507	
2012	495	0	523	
2013	507		539	
2014	519		555	
2015	531		571	

[1] Reserve capacity figures given assume no change in generation output capacity.
[2] Reserve capacity figures lower than the rating of the largest generating unit.

Given the effect of the following planned developments, the anticipated load demand can be expected to increase and is as shown below in table 1.4.

These developments are the opening and operation of Mater Dei Hospital with an expected 10 MW net increase over St Lukes Hospital, between 2007-2008; MIDI (Manoel Island and Tigné), 14MW between 2006-2012; Pender Place, 8 MW between 2009-2012; and Smart City (Ricasoli), 30MW between 2009-2015.

Table 1.4
Expected Peak Loads (incl. planned developments)

	Low Growth rate (3% of present peak load) (12MW/annum) + planned developments		**Medium Growth rate (4% of present peak load) (16MW/annum) + planned developments**	
	Expected Summer Peak Load (MW)	**Reserve Capacity[1] (Present plant) (MW)**	**Expected Summer Peak Load (MW)**	**Reserve Capacity[1] (Present plant) (MW)**
2005 (actual)	411	84	411	84
2006	423	72	427	68
2007	442	53 [2]	450	45 [2]
2008	462	33 [2]	474	21 [2]
2009	488	7 [2]	504	
2010	511		531	
2011	532		556	
2012	551		579	
2013	568		600	
2014	585		621	
2015	602		642	

[1] Reserve capacity figures assume no change in generation output capacity.
[2] Reserve capacity figures lower than the rating of the largest generating unit.

From the above two tables, it can be seen that as from 2009, the outage of any plant during the summer peak months will imply power outages in a number of areas of the islands, which might last more than 48 hours at one time until the necessary repairs are carried out on the generating plant.

Action therefore needs to be taken either to reduce the peak demand or to acquire additional generating capacity before this date.

In order to ensure a reasonable level of security of supply, it is necessary to have an adequate level of reserve capacity. There are two main methods of determining the appropriate level of reserve capacity:

- Statistical methods based on a calculated probability of exceeding a specified duration where loss of supply is a result of inadequate generation capacity and may affect part or all of the consumer base.

- Fixed reserve capacity margins over peak demand, calculated as a percentage of peak demand. This calculation is based on historical plant availability records. A variant of this method is to calculate the reserve capacity as being equal to the capacity of the two largest units in the system, based on the reasonable assumption that planned outages should not reduce the reserve capacity to below the capacity of the largest unit, which could be subject to an unplanned outage – known as the N-2 criteria, (in our case 120MW). This method of determining the reserve capacity is usually used in the case of small systems such as Enemalta's.

The average capacity loss throughout the year due to planned maintenance and faults is of around 114MW. However over the past years and for the foreseeable future it has been the policy of Enemalta to avoid planned outages during the peak load months, namely summer and winter. This has consequently allowed Enemalta to operate with reduced levels of reserve capacity during these periods, whilst maintaining a satisfactory level of supply reliability (security), albeit at the cost of reduced operational flexibility and reduced maintenance durations. However this situation is not sustainable as shown above, since as the demand increases, the available reserve capacity will fall to below the rating of the largest unit by summer 2008. Therefore assuming no plant retirement, an additional 120MW of generating plant is required by 2010, simply to be able to meet the load demand safely and reliably, ideally with 60MW becoming available before summer 2008.

Table 1.5 shows the anticipated increase in electricity consumption over the period 2005 to 2020. This is based on an annual natural increase of approximately 2% of the present consumption (linear), with an expected decrease in this rate of increase brought about by the increased utilisation of energy efficient appliances and buildings and programmes for energy conservation. Several major developments, which are expected to come into operation during this period, will however increase the electricity consumption in a step fashion.

However MEPA are finalising a policy, which will require large developments to invest in renewable sources of energy (concentrated solar energy for heating and cooling, and possibly building-integrated Photo Voltaic Cells (PV)), together with use of energy efficient building design. MEPA are also planning to introduce a requirement whereby large developments are required to invest in efficient combined heat and power (CHP) installations. Both of these policies will tend to reduce the load that Enemalta is required to supply. These policies are however still being considered and therefore will not influence the development of the New Hospital (Mater Dei) or the Manoel Island – Tigne projects.

Table 1.5
Anticipated Electrical Energy Consumption

Year	Generation MWhrs	Remarks
2005	2263145	Annual increase 48000MWhrs
2006	2311145	Annual increase 48000 MWhrs
2007	2389145	Annual increase + 30000MWhrs MIDI
2008	2507145	Annual increase + 70000MWhrs MIDI + New Hospital
2009	2625145	Annual increase + 70000MWhrs MIDI + New Hospital
2010	2693145	Annual increase + 20000MWhrs Pender Place
2011	2781145	Annual Increase + 40000MWhrs Pender Place + Ricasoli
2012	2859145	Annual Increase + 30000MWhrs Ricasoli
2013	2937145	Annual Increase + 30000MWhrs Ricasoli
2014	3015145	Annual Increase + 30000MWhrs Ricasoli
2015	3093145	Annual Increase + 30000MWhrs Ricasoli
2016	3133145	Annual increase 40000 MWhrs
2017	3173145	Annual increase 40000 MWhrs
2018	3213145	Annual increase 40000 MWhrs
2019	3253145	Annual increase 40000 MWhrs
2020	3293145	Annual increase 40000 MWhrs

It should also be noted that the above growth scenario implies use of the open cycle gas turbines (OCGT) to meet the peak load. The peak load period during the summer has over the past years been extended to the hours between 8am and 6pm due mainly to changing behaviour patterns (people staying at home or at work, both presumed to be air conditioned) in the afternoon to avoid the sun. The operation of the OCGT's will have a significant adverse effect on the unit cost of generation due to the relative inefficiency of this plant and high fuel costs.

The above scenario presupposes that all the installed plant is available throughout the peak load demand periods, which considering the age and condition of the plant at Marsa is dubious.