Optimisation of O&M Efficiency at Qatar Power using the PI System

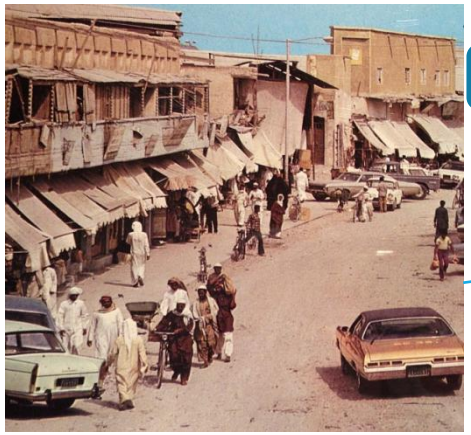
Presented by Parasram Borkar

Sr Engineer- Commercial & Performance

Enlighten the life in Middle East

- Imagine Life without Power and Water

Enrich the life in Qatar



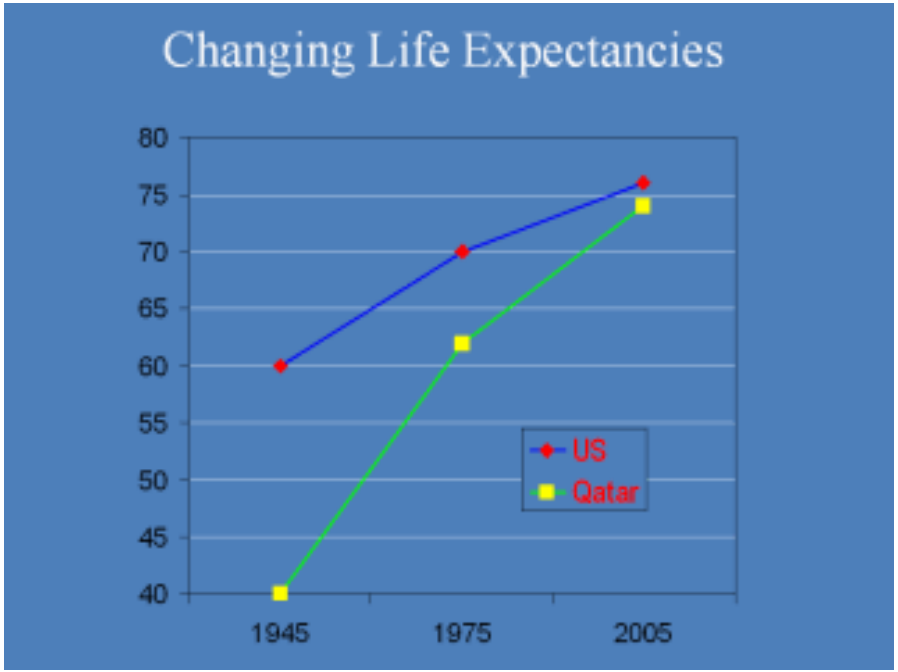
THEN

Transformation

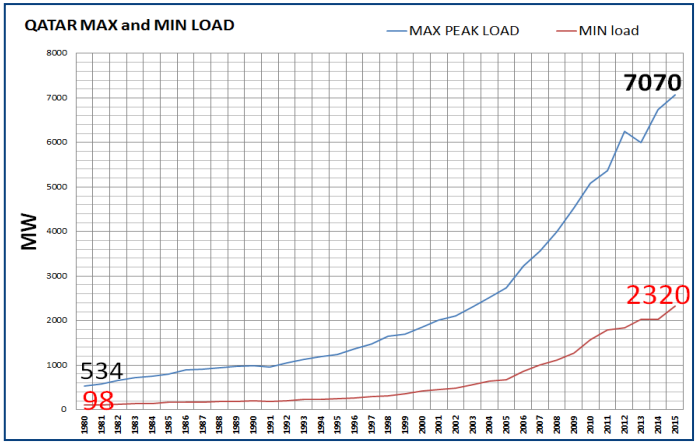
NOW

Energy, Power & Water plays the vital role in Qatar's Development and Transformation

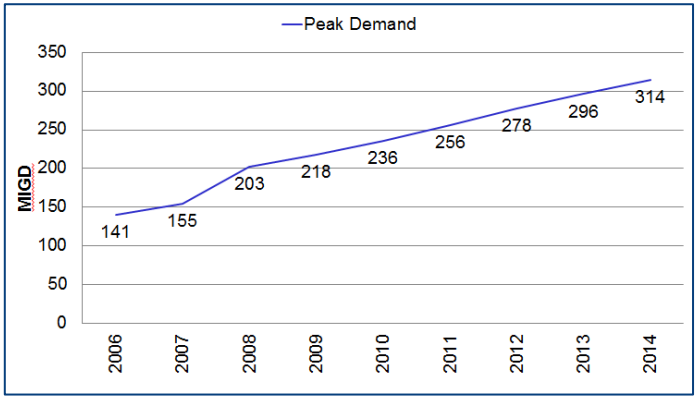
Changing Life Expectancies in Qatar



Power and Water plays a vital role



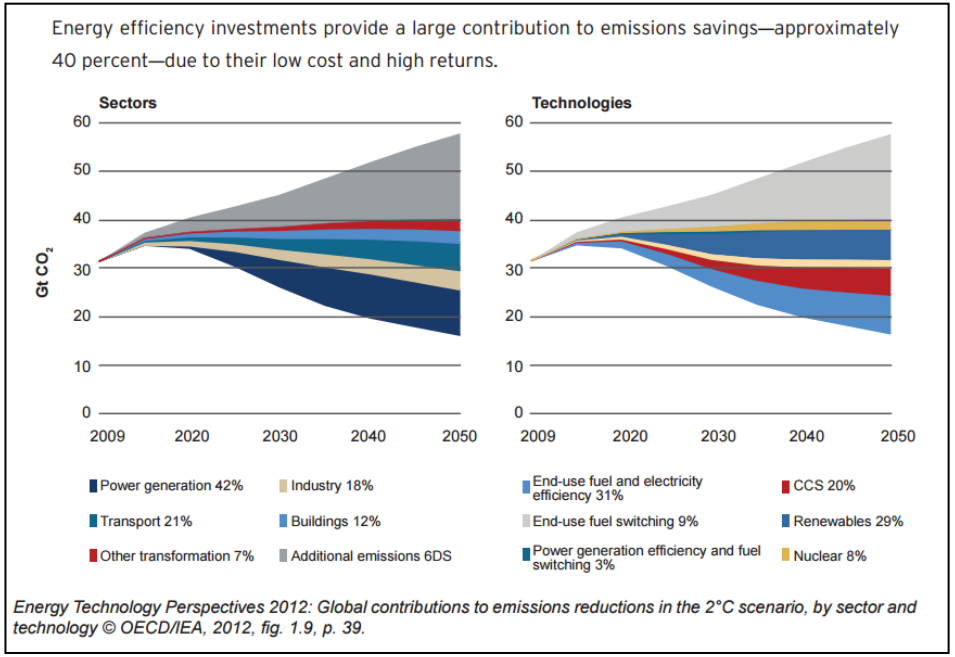
Power Demand



Water Demand

Changing Scenarios in Qatar

- Exponential growth and demand in power and water sector
- Rising demand for energy resource conservation due to climate change and green gas reduction
- Government initiated various energy and efficiency measures



Energy Technology Perspectives 2012: Global contributions to emissions reductions in the 2°C scenario, by sector and technology © OECD/IEA, 2012, fig. 1.9, p. 39.

- Optimisation of O&M Efficiency at Qatar Power
- PI System plays important role in improving O&M performance

Agenda

- About Qatar Power Company
- Business Environment and Challenge
- Case Study to improve O&M efficiency
- PI System Capabilities to solve Qatar Power's Business Challenges
- Results Obtained and Business Impact
- Future Plan and next step
- Summary and Conclusion

Qatar Power Company

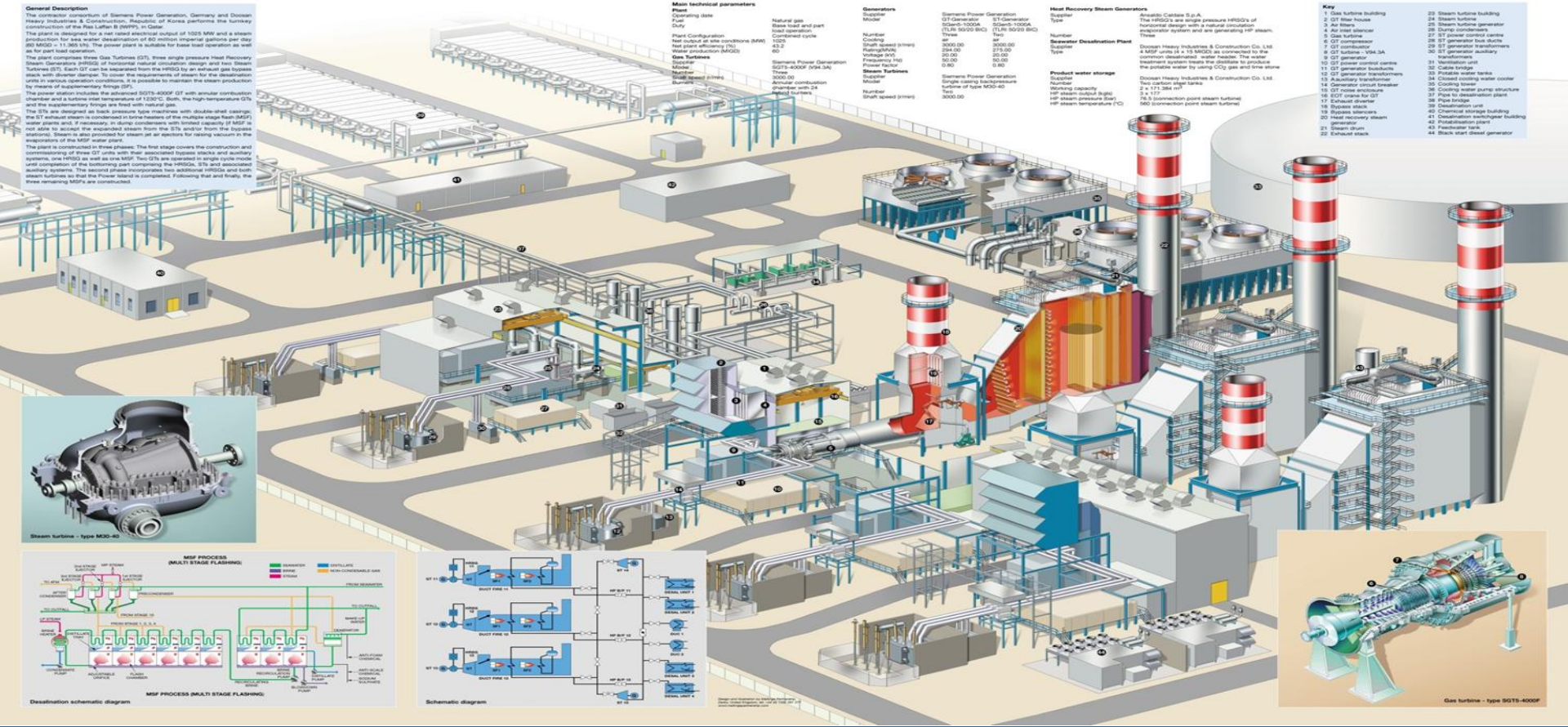
Ras Laffan-B Independent Water and Power Plant (IWPP)
Plant Capacity: Power 1025 MW and Water 60 MIGD
Company: Q Power Q.S.C, P O Box 22664, Doha, State of Qatar

Qatar Power Company

- Long term PWPA with Kahramaa (regulator of Qatar)
- IWPP project company, responsible for facility O&M for 25 years under BOOT agreement
- It is consortium of Engie (GDF Suez),Chubu Electric and Qatar Electricity and Water Company
- Commissioned full facility of 1025MW Power and 60MIGD Desalination Water in year 2008.
- State of art technology in power and water production
- Implemented PI System in year 2012

Ras Laffan B - Independent Water & Power Plant (IWPP)

Combined Cycle Power and Desalination Plant



Plant Configuration

Commercial Operation Start : Jun 2008

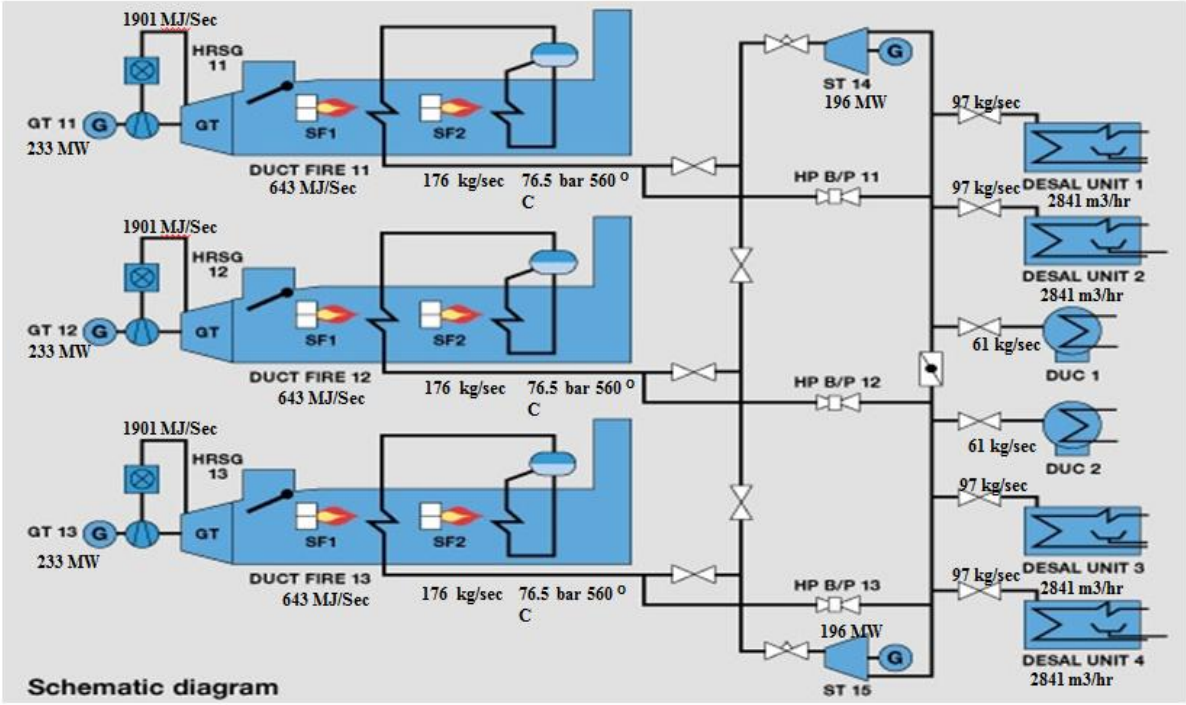
Capacity
- 1025 MW Net
- 60 MIGD (272700 m³/day)

Plant Design
- 3 GT 237.35 MW
- 2 ST 221 MW
- 4 MSF 15.13 MIGD

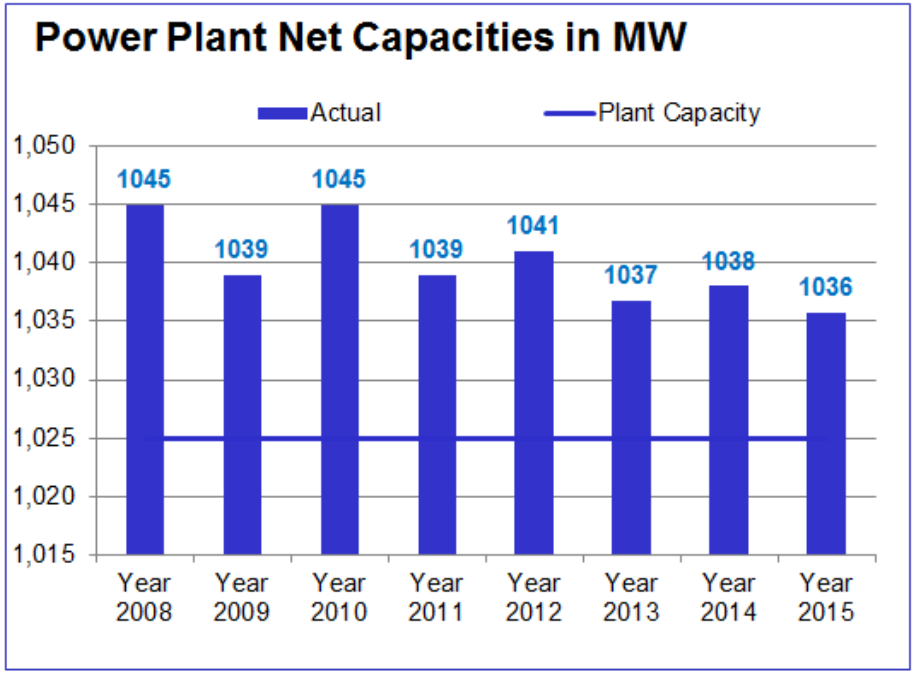
Plant Technology
- GT : 94.3A-Siemens
- ST : M30-40-M2A-Siemens
- MSF : Doosan

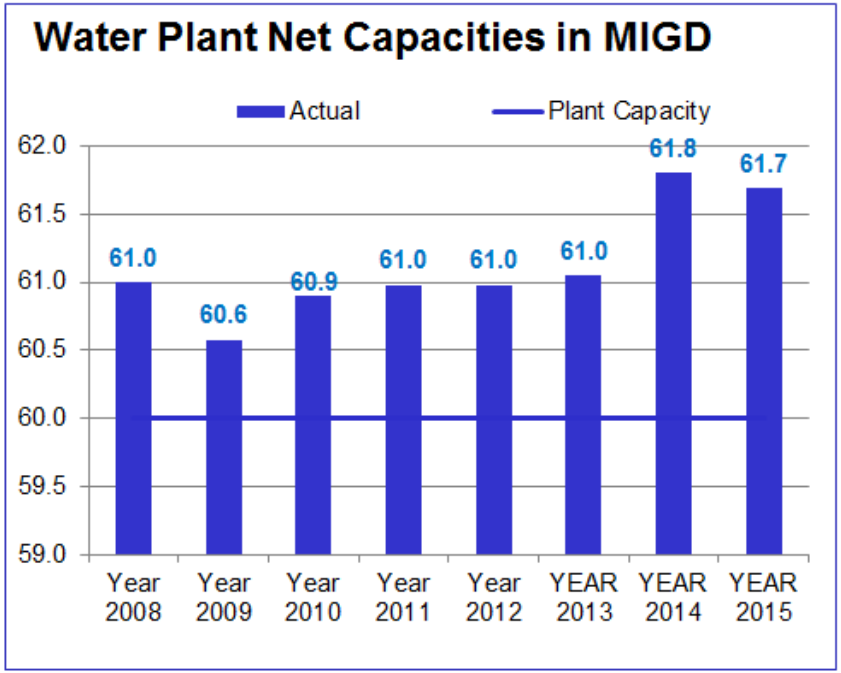
Plant Net Efficiency

At Ref Conditions
- Facility : 40.29 %
- GT : 37.45 %
- MSF PR : 8.26

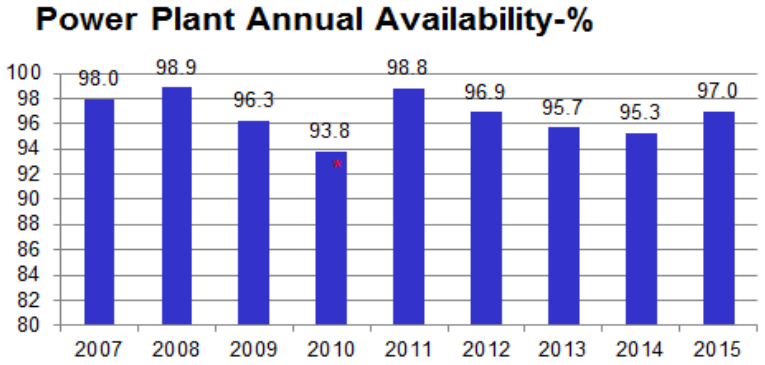


KPI - Plant Dependable Capacity Tests



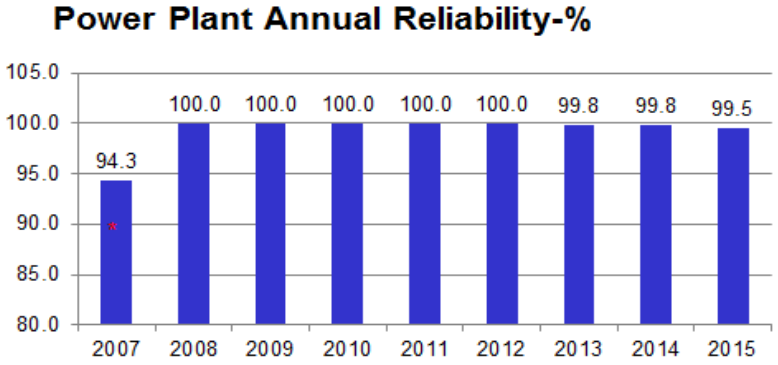


KPI - Power Plant Availability and Reliability



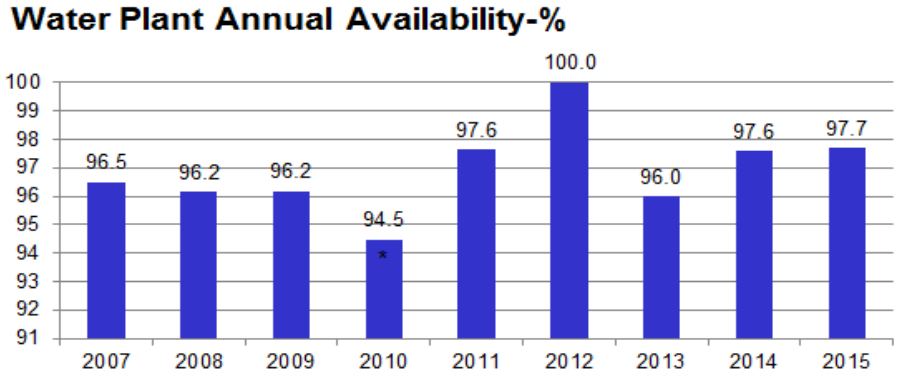
2015 figs are till YTD- July-15

* Year 2010, Two Gas Turbine Power Plant Planned Outage for HGPI/Major overhaul



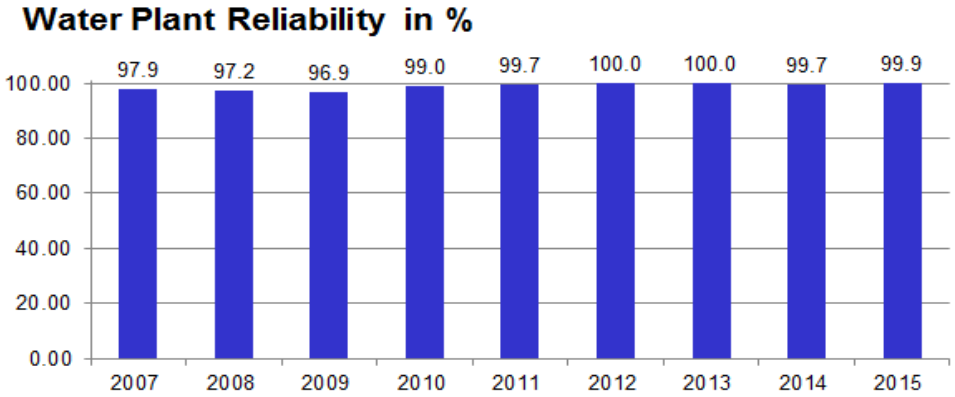
* Year 2007, plant commissioning period

KPI - Water Plant Availability and Reliability



2015 figs are till YTD- July-15

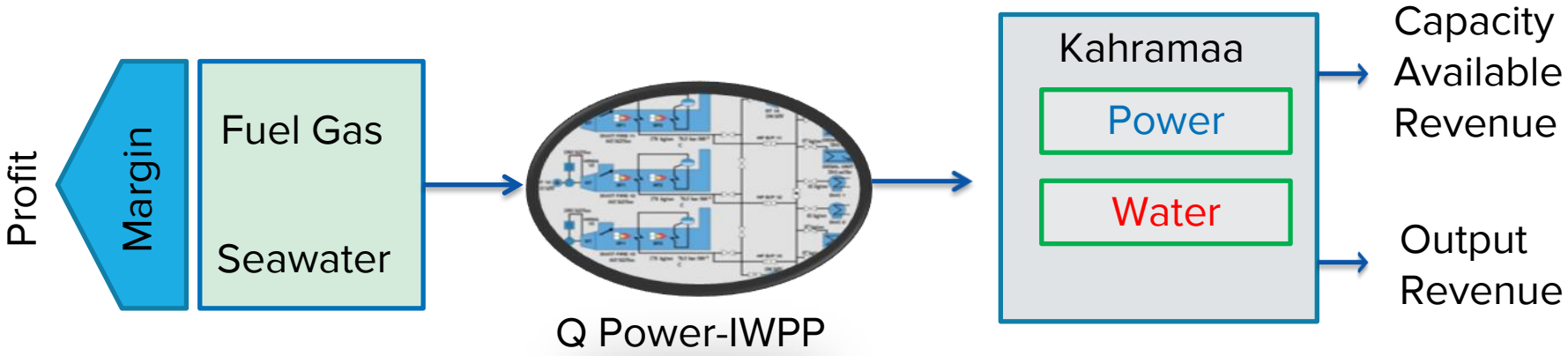
* Year 2010 &13 , Two Desalination Water Plants Planned Outage for tube replacement hence not comparable for benchmarking



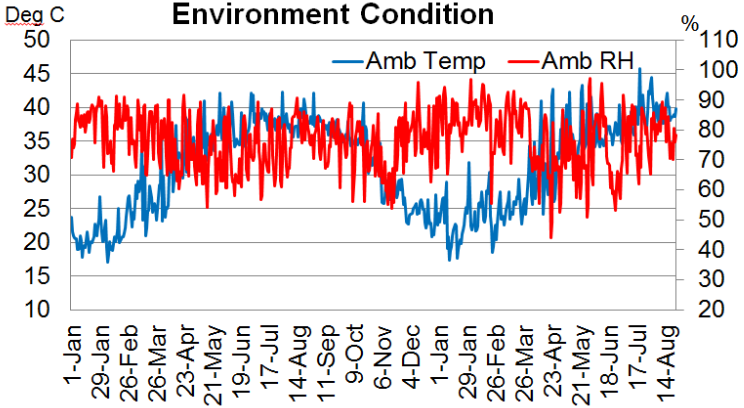
Awards and Recognition

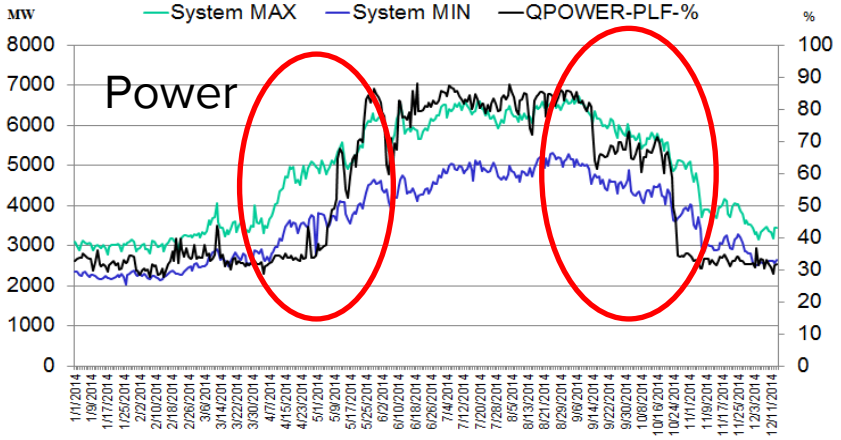
Business Environment

- Company income through PWPA
- Fuel gas and seawater used for power and water generation is not directly pass-through under PWPA
- Efficient O&M is vital for higher profit and to avoid penalties.

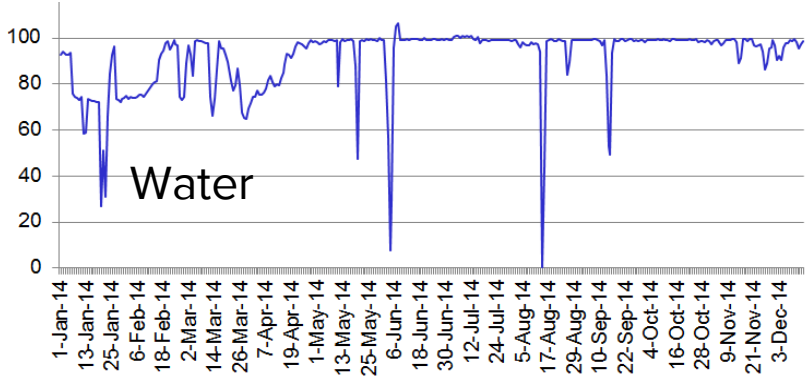


Business Environment





- Adverse & Harsh Climate Conditions- RH – 90% Temp-45 ^{O}C
- Annual system demand variation (summer-winter) - 230%
- Daily system peak and low power demand- 45%
- QPower Water Demand-100%
- QPower Power demand in Winter-30%
- QPower Power demand in Summer-98%



Business Challenges

- Meet Health and Safety Target
- Meet Power and Water Demand
- Maintain higher Plant Capacity available all the time
- Efficient O&M at all operating scenarios
- Deterioration in Plant Efficiency factor over the period
- Deterioration in fuel and seawater margins
- Availability of real time plant information
- Availability of historical plant data and archival
- Real time analysis and Management information system

Business Challenge & PI System

- Implemented PI System and tools to find solutions to Business Challenges

- Application implemented in real-time

HSE: Monitoring Heat Stress Index

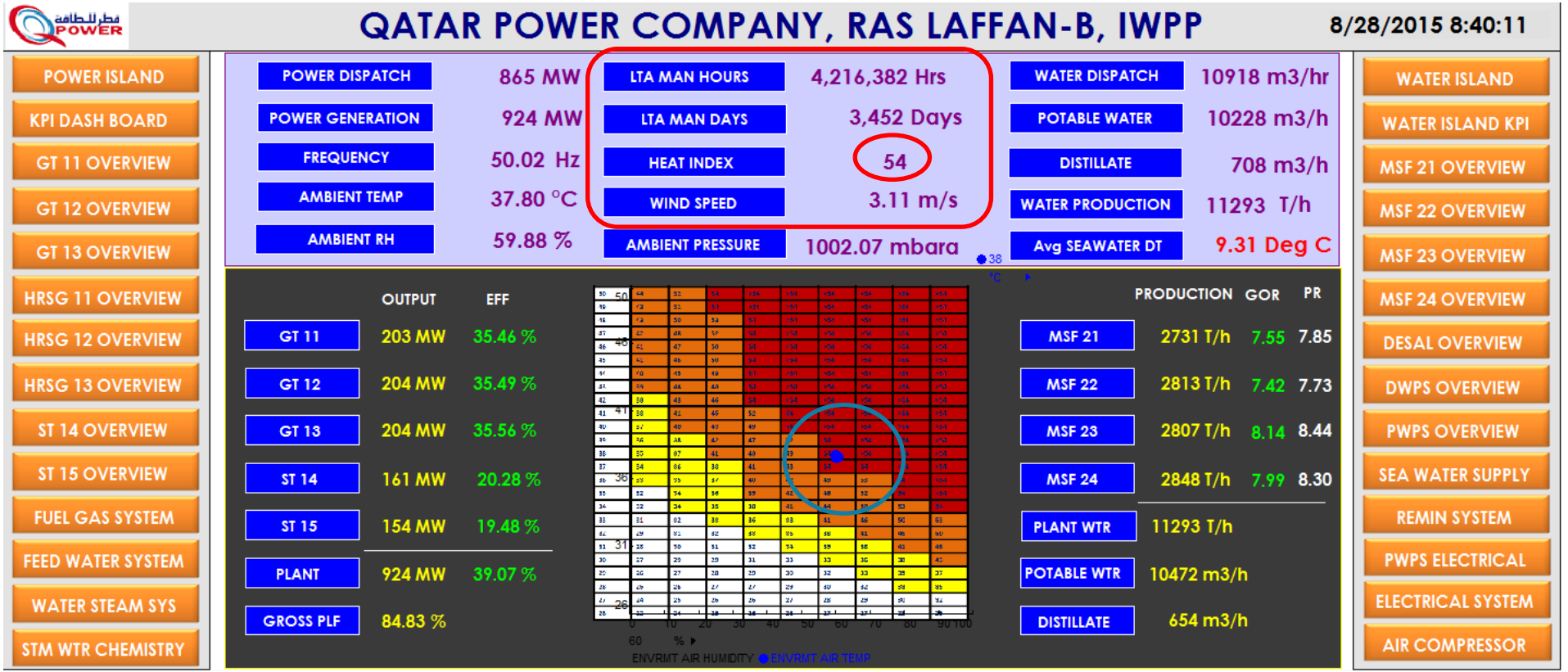
Past

- Difficult to monitor Heat Index.
- Conventional manual monitoring.
- Difficult decision making
- Missing Controls
- No people awareness

Present

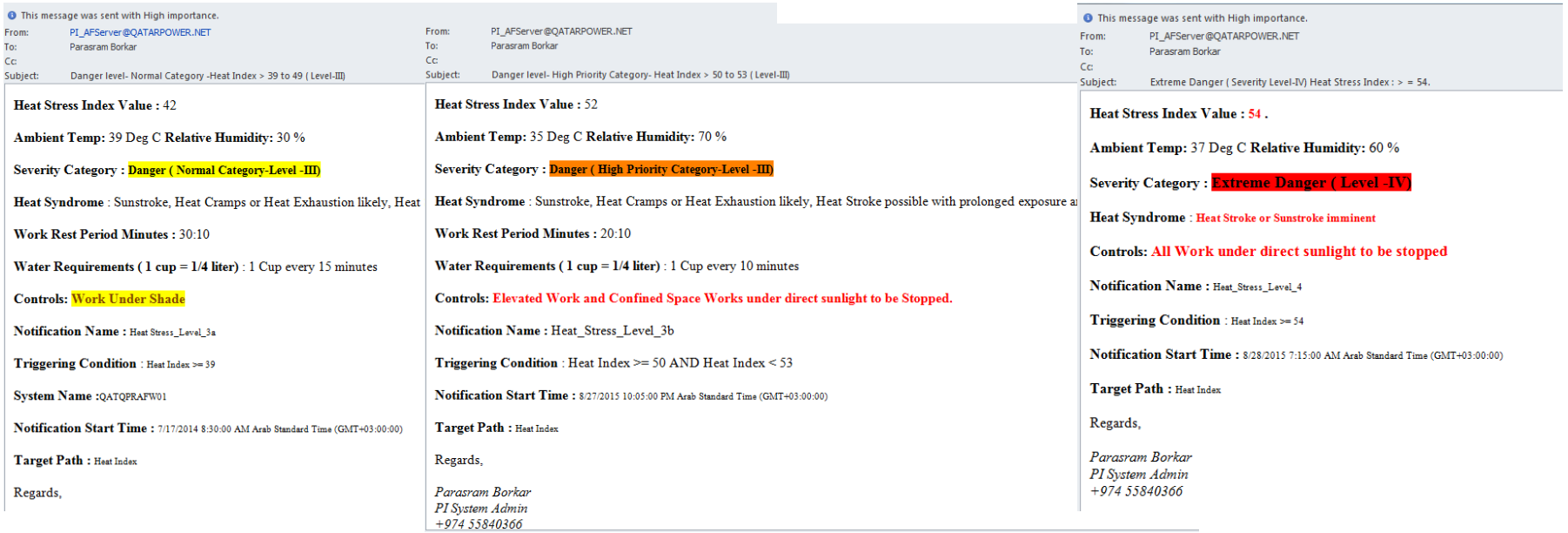
- Online Monitoring of Heat Index through PI System
- Real time messaging and notifications
- Easy decision making
- System controlled measures
- People awareness
- Dash Board and displays

HSE: Monitoring Heat Index - PI ProcessBook



HSE: Monitoring Heat Index - Notifications

Category



This message was sent with High importance.

From: PI_AFServer@QATARPOWER.NET
To: Parasram Borkar
Cc:
Subject: Danger level- Normal Category -Heat Index > 39 to 49 (Level-III)

Heat Stress Index Value : 42

Ambient Temp: 39 Deg C **Relative Humidity:** 30 %

Severity Category : Danger (Normal Category-Level -III)

Heat Syndrome : Sunstroke, Heat Cramps or Heat Exhaustion likely, Heat

Work Rest Period Minutes : 30:10

Water Requirements (1 cup = 1/4 liter) : 1 Cup every 15 minutes

Controls: Work Under Shade

Notification Name : Heat Stress_Level_3a

Triggering Condition : Heat Index >= 39

System Name :QATQPRAFW01

Notification Start Time : 7/17/2014 8:30:00 AM Arab Standard Time (GMT+03:00:00)

Target Path : Heat Index

Regards,

From: PI_AFServer@QATARPOWER.NET
To: Parasram Borkar
Cc:
Subject: Danger level- High Priority Category- Heat Index > 50 to 53 (Level-III)

Heat Stress Index Value : 52

Ambient Temp: 35 Deg C **Relative Humidity:** 70 %

Severity Category : Danger (High Priority Category-Level -III)

Heat Syndrome : Sunstroke, Heat Cramps or Heat Exhaustion likely, Heat Stroke possible with prolonged exposure a

Work Rest Period Minutes : 20:10

Water Requirements (1 cup = 1/4 liter) : 1 Cup every 10 minutes

Controls: Elevated Work and Confined Space Works under direct sunlight to be Stopped.

Notification Name : Heat_Stress_Level_3b

Triggering Condition : Heat Index >= 50 AND Heat Index < 53

Notification Start Time : 8/27/2015 10:05:00 PM Arab Standard Time (GMT+03:00:00)

Target Path : Heat Index

Regards,

Parasram Borkar
PI System Admin
+974 55840366

This message was sent with High importance.

From: PI_AFServer@QATARPOWER.NET
To: Parasram Borkar
Cc:
Subject: Extreme Danger (Severity Level-IV) Heat Stress Index : > = 54.

Heat Stress Index Value : 54 .

Ambient Temp: 37 Deg C **Relative Humidity:** 60 %

Severity Category : Extreme Danger (Level -IV)

Heat Syndrome : Heat Stroke or Sunstroke imminent

Controls: All Work under direct sunlight to be stopped

Notification Name : Heat_Stress_Level_4

Triggering Condition : Heat Index >= 54

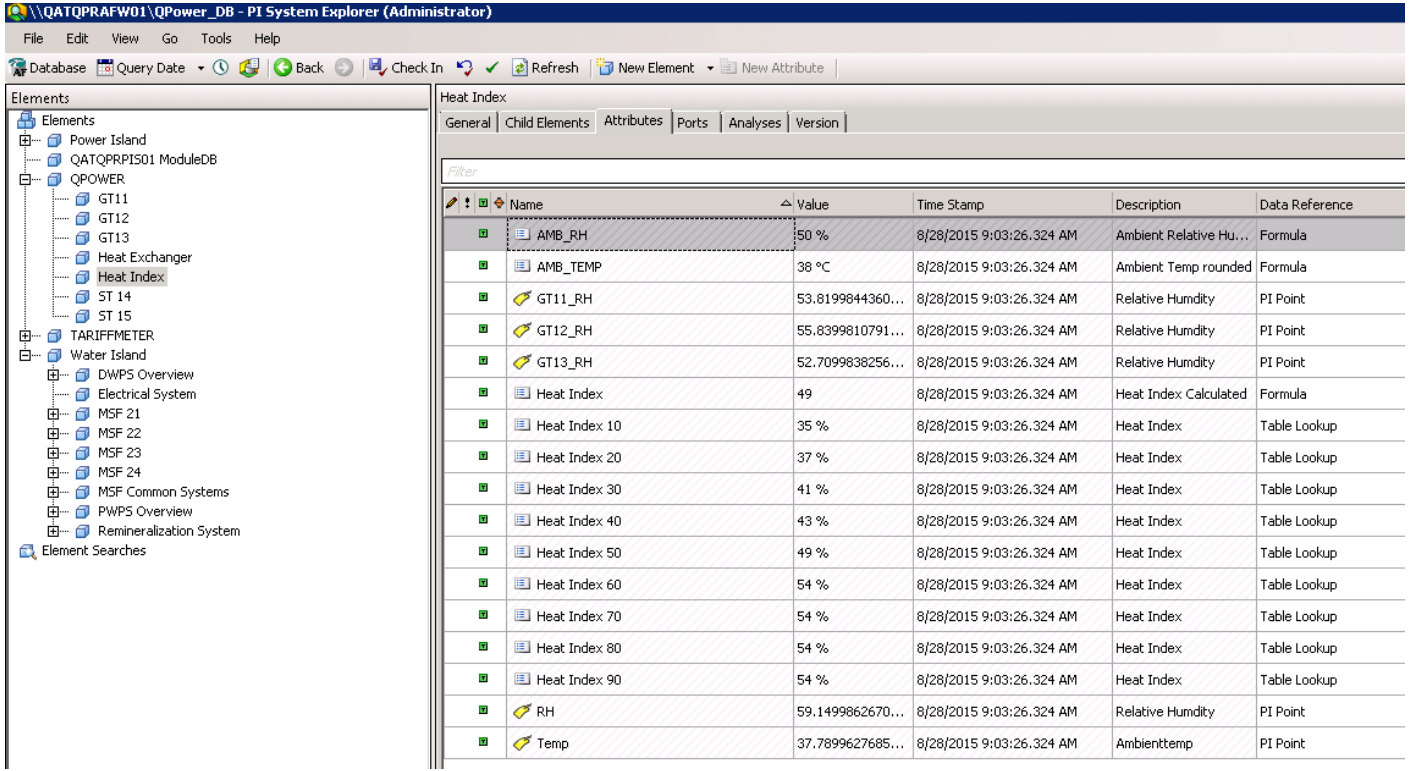
Notification Start Time : 8/28/2015 7:15:00 AM Arab Standard Time (GMT+03:00:00)

Target Path : Heat Index

Regards,

Parasram Borkar
PI System Admin
+974 55840366

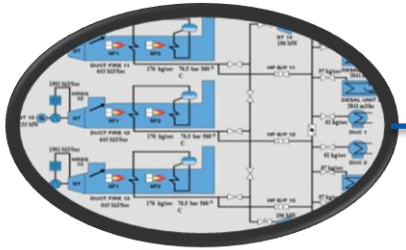
HSE: Monitoring Heat Index – Asset Framework



HSE Performance Achievements

- No heat stress related incidents.
- Achieved 4.2 million man-hours in 3,452 days without LTA

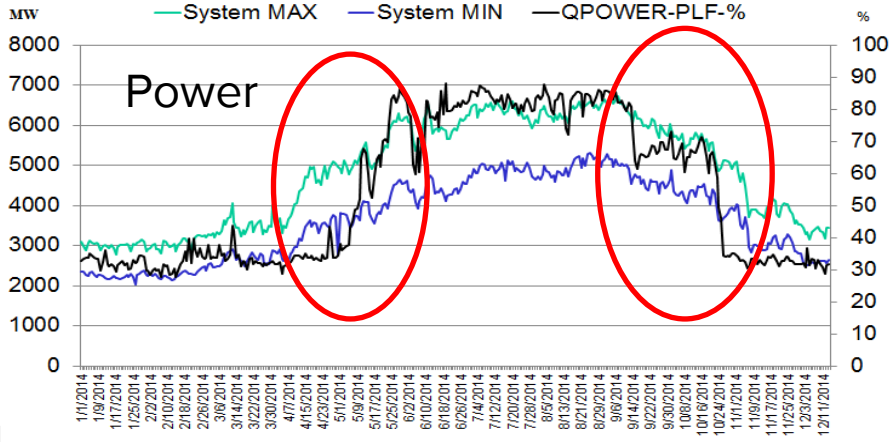
Plant O&M Optimisation

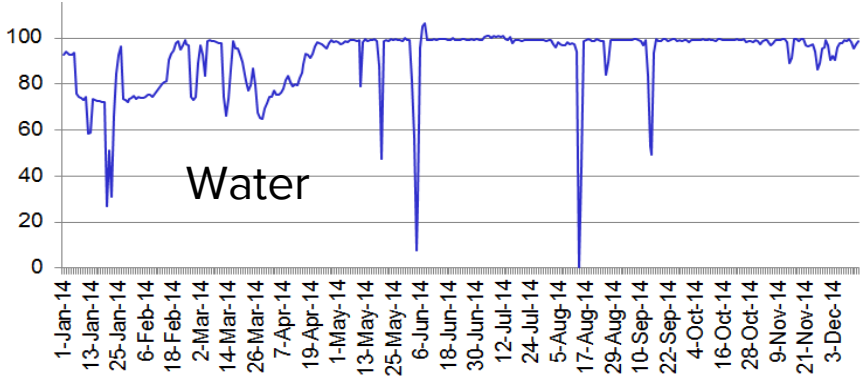


Q Power

Power Grid Demand

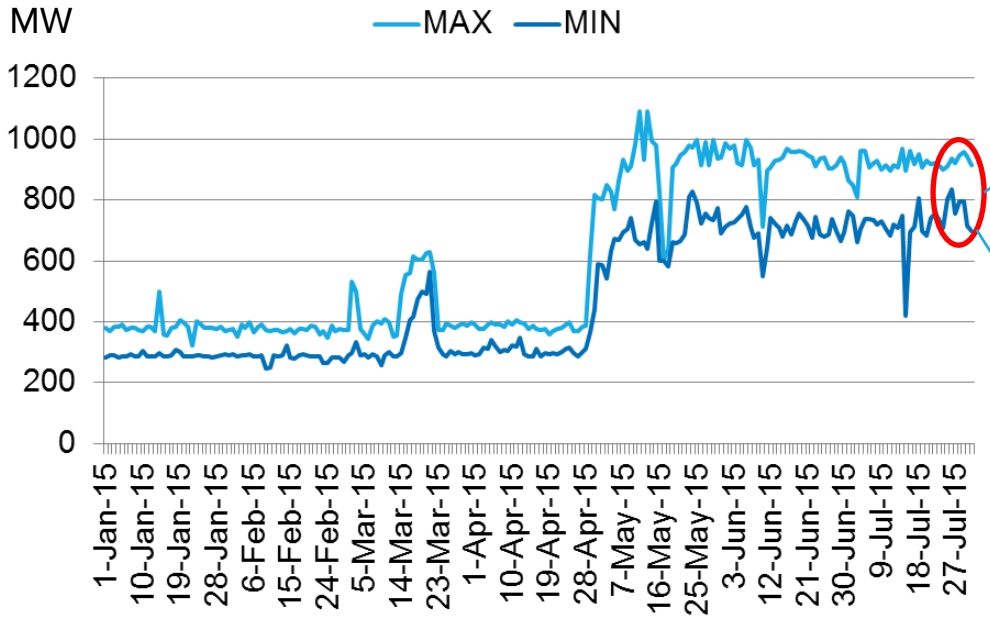
Water Grid Demand

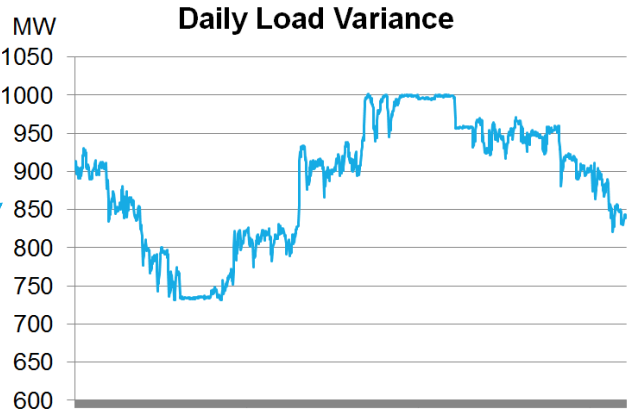


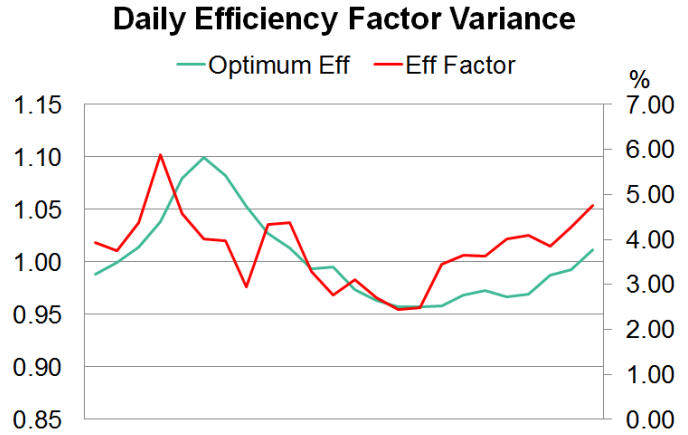


- Difficult to optimise Plant Configuration
- Inherent Energy Losses
- Plant efficiency deterioration
- Plant life and maintenance issues
- Lower fuel and seawater margins
- Real time data archival and analysis

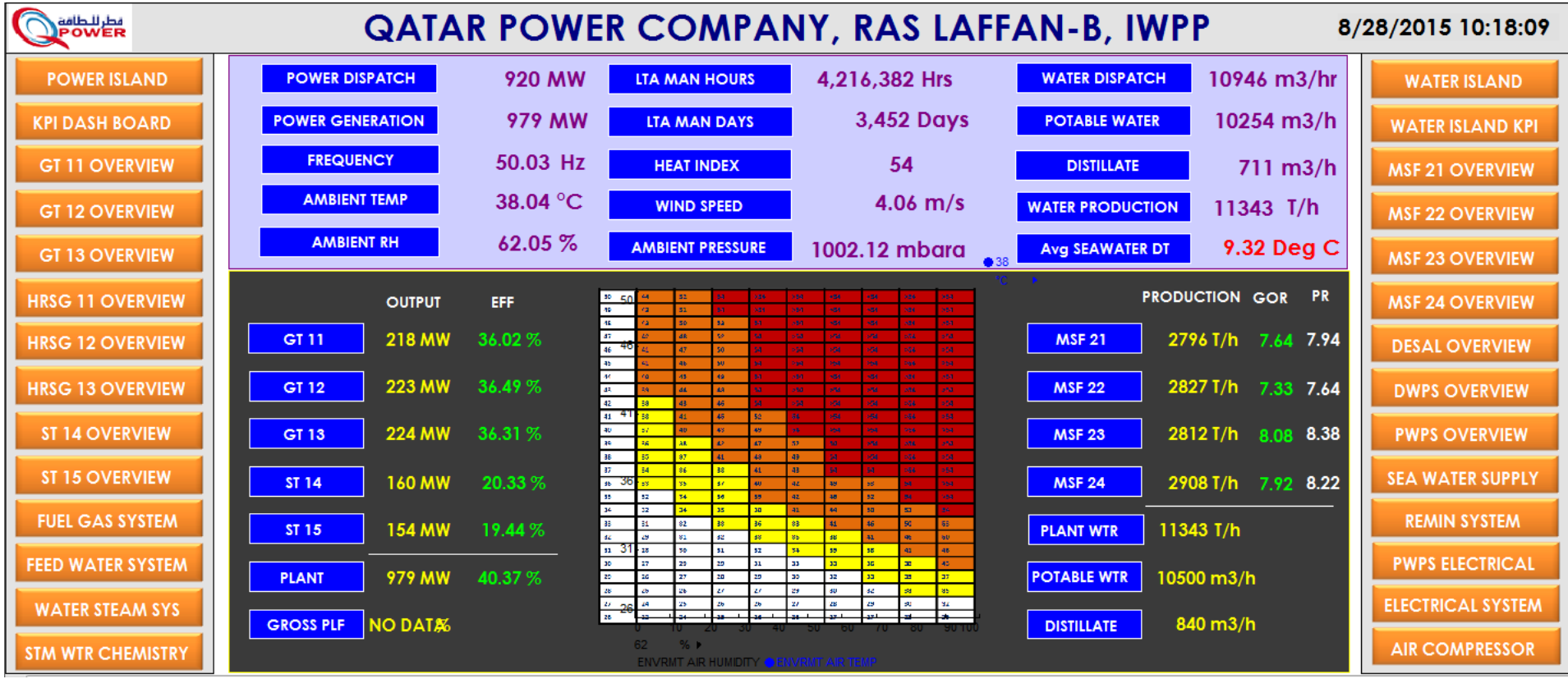
Plant O&M Optimisation



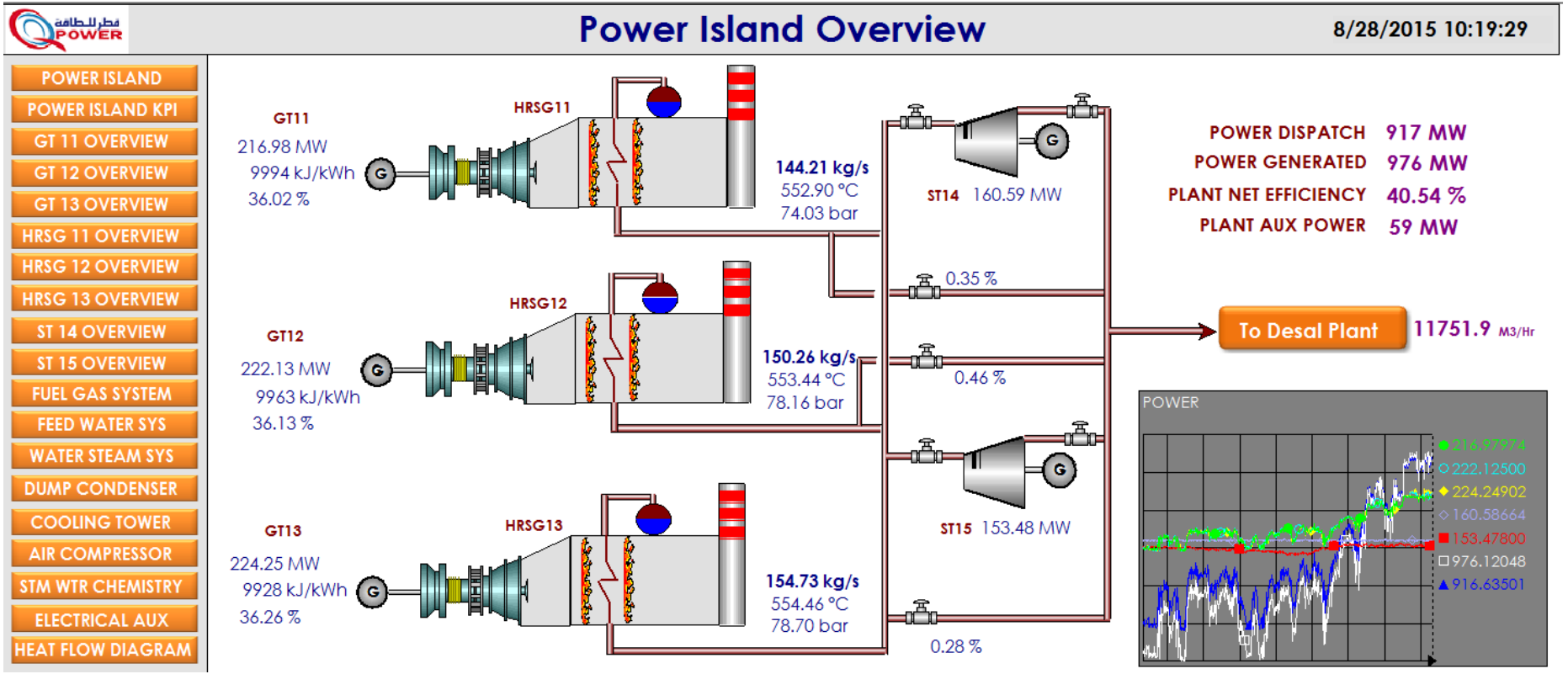




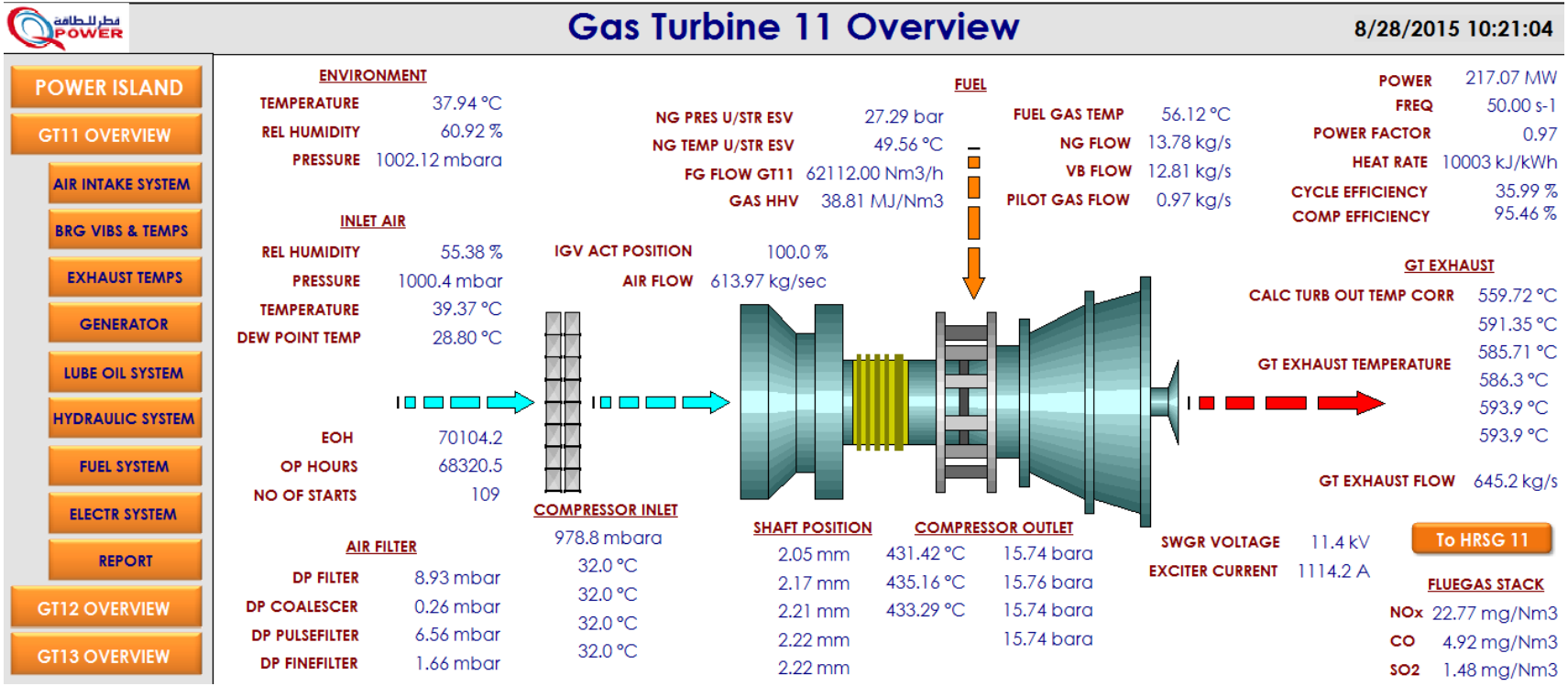
Plant O&M Optimisation - Dash Boards



Plant O&M Optimisation - PI ProcessBook



Plant O&M Optimisation - Equipment monitoring



Plant O&M Optimisation - PI ProcessBook Report

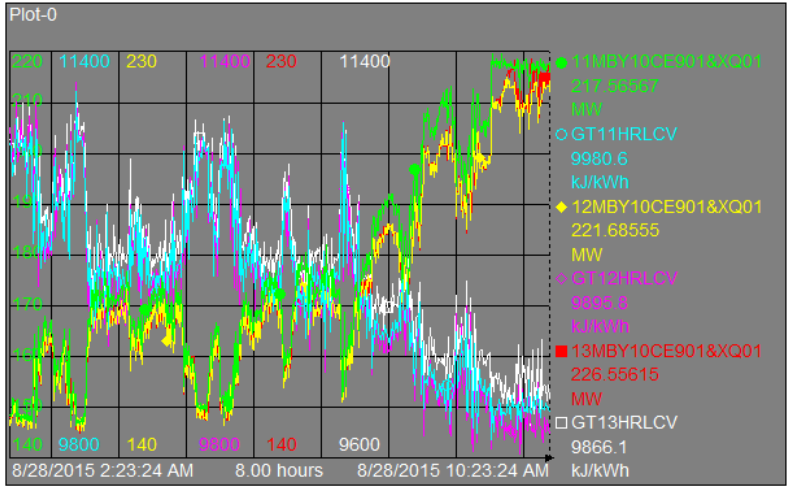
Gas Turbine Report

8/28/2015 10:23:24

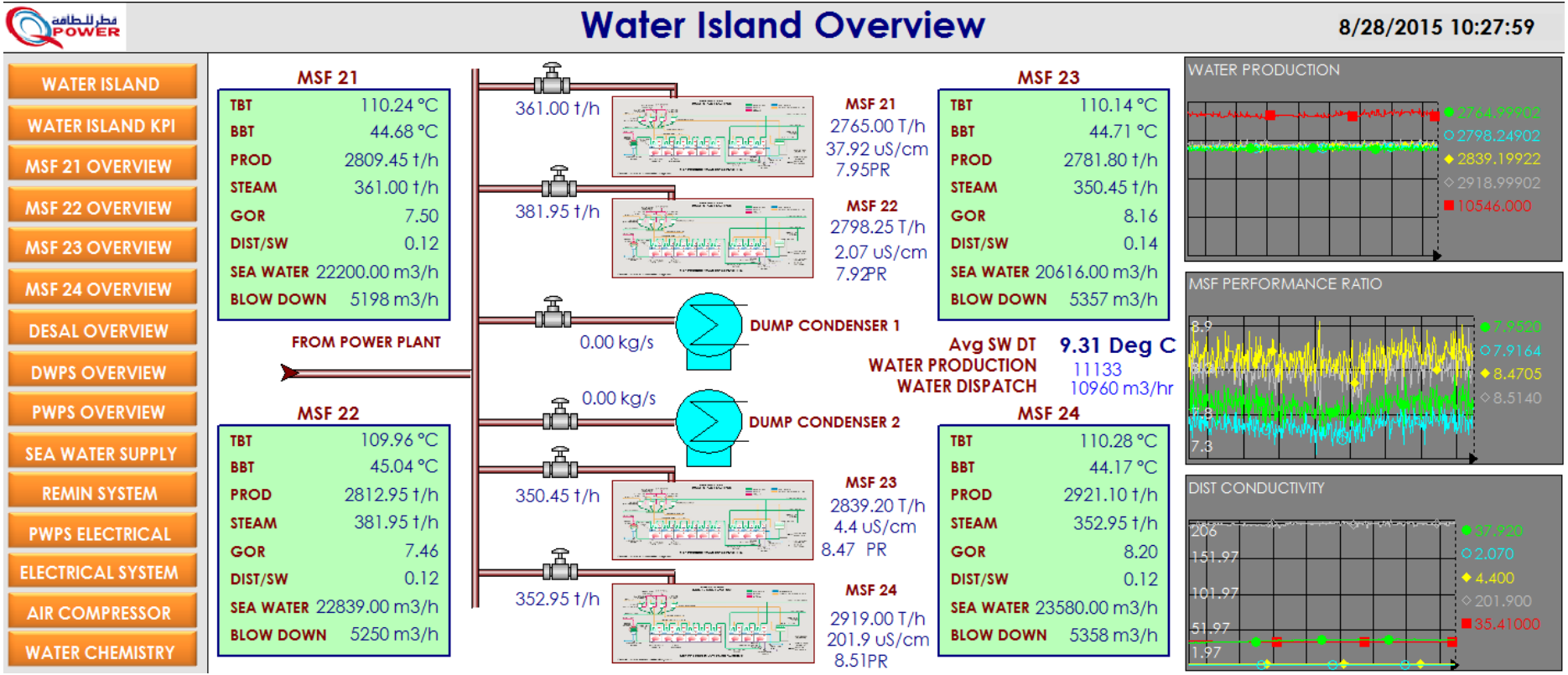
- POWER ISLAND
- POWER ISLAND KPI
- GT 11 OVERVIEW
- GT 12 OVERVIEW
- GT 13 OVERVIEW
- FUEL GAS SYSTEM
- FEED WATER SYSTEM
- WATER STEAM SYS
- DUMP CONDENSER
- COOLING TOWER
- AIR COMPRESSOR
- STM WTR CHEMISTRY
- ELECTRICAL AUX
- HEAT FLOW DIAGRAM

Parameter	Units	GT11	GT12	GT13
Ambient Temperature	°C	39.37	37.56	37.30
Ambient Pressure	mbar	1000.44	1000.30	1000.16
Ambient Humidity	%	56.54	63.94	59.72
Fuel LHV	MJ/Nm3	38.81	38.81	38.81
Power Output	MW	217.57	221.69	226.56
Heatrate LHV	kJ/kWh	9981	9896	9866
Thermal Efficiency	%	36.07	36.38	36.49
Evap Cooler Effectiveness	%	88.3	85.6	77.0
Evap Cooler ON / OFF		ON	ON	ON
Fuel Flow	kg/s	13.78	14.00	14.23
Air Flow	kg/s	614.0	617.5	610.7
Exhaust Flow	kg/s	645.2	645.2	640.2
Exhaust Temperature	°C	591.6	594.2	597.9

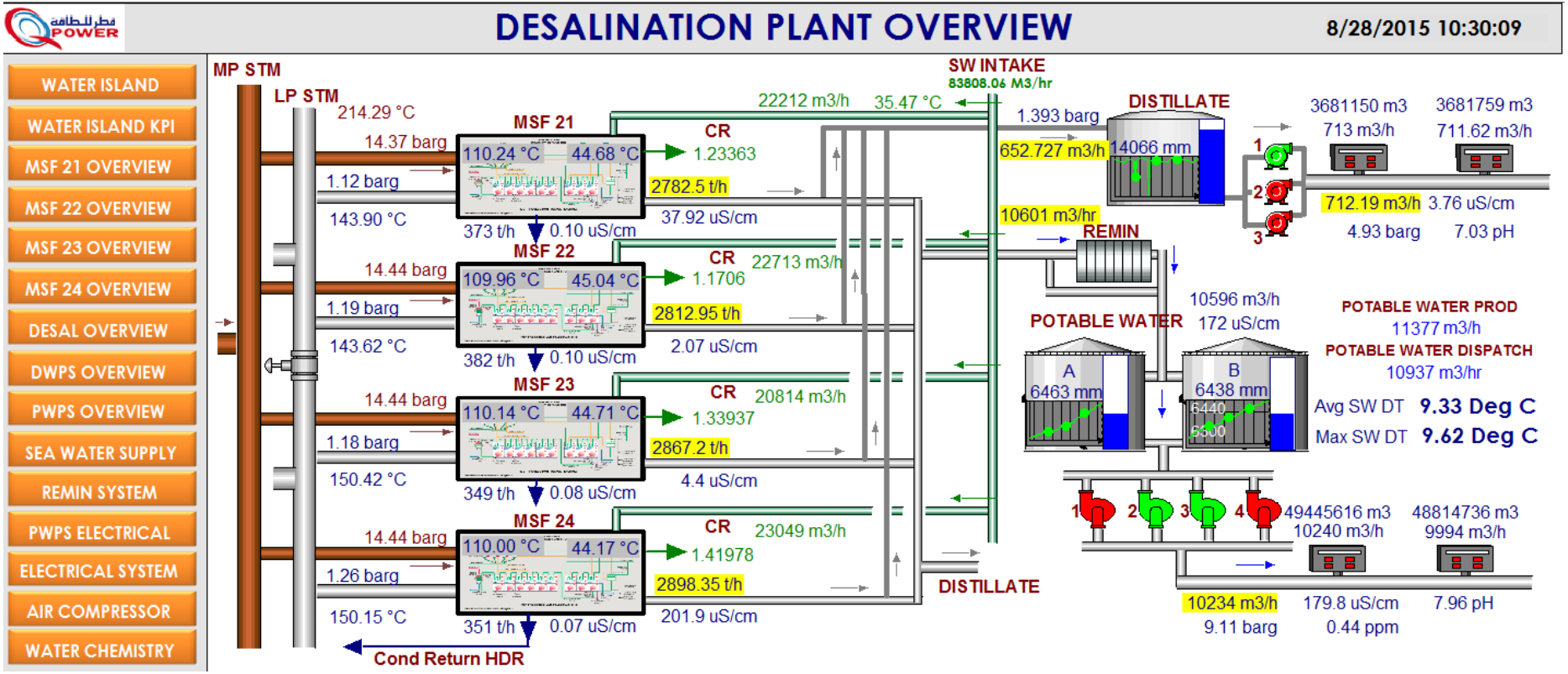
Parameter	Units	GT11	GT12	GT13
Flue Gas Stack NOx	mg/Nm³	22.40	25.77	31.12
Flue Gas Stack CO	mg/Nm³	4.59	4.74	2.44
Flue Gas Stack SO2	mg/Nm³	1.72	3.00	1.00



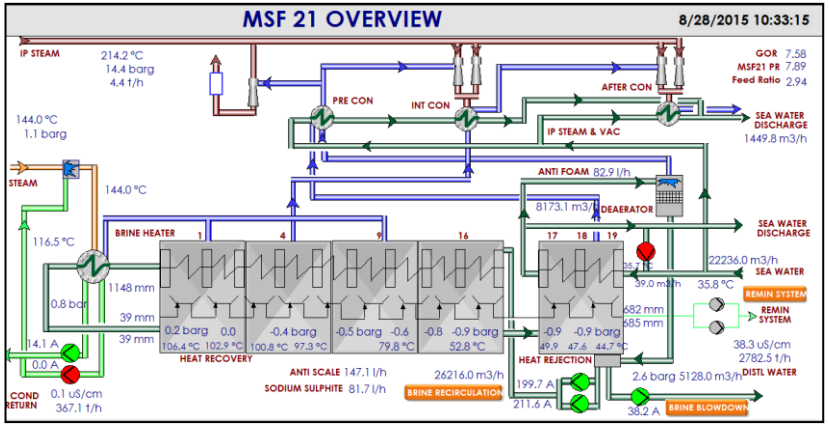
Plant O&M Optimisation - PI ProcessBook

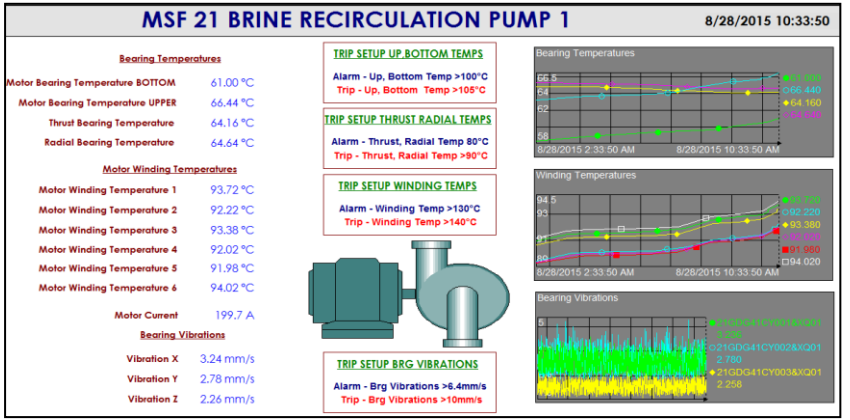


Plant O&M Optimisation - Water Plant Monitoring



Plant O&M Optimisation – Real-time Reports





MSF WATER CHEMISTRY

8/28/2015 10:35:50

COMMON SYSTEMS	
HYD CARB SW DISCHARGE COMMON HEADER	9.96 ppm
HYD CARB SW SUPPLY COMMON HEADER	0.09 ppm
CL SEA WATER HEADER	0.00 ppm
PRODUCT WATER ALKALINITY	60.93 ppm
CL2 PRODUCT WATER	Bad
CLO2 LOW PRESSURE LINE	0.13 PPM
POTABLE WATER CLO2	0.44 ppm
RESIDUAL CLORINE LOW PRESSURE LINE	0.39 PPM
RESIDUAL CLORINE HIGH PRESSURE LINE	0.12 PPM
DISTILLATE WATER PH	7.16 pH
PRODUCT WATER PH	7.88 pH
POTABLE WATER PH	7.96 pH
NEUTRAL WATER PH	7.40 pH
SW COMMON HEADER DISCHARGE CONDUCTIVITY	83.15 µS/cm
SW HEADER ANLAYSIS CONDUCTIVITY	55.44 µS/cm
DISTILLATE WATER CONDUCTIVITY	3.76 uS/cm
PRODUCT WATER CONDUCTIVITY	173.78 uS/cm
POTABLE WATER CONDUCTIVITY	180.20 uS/cm

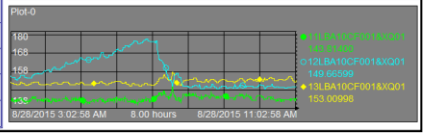
	MSF #21	MSF #22	MSF #23	MSF #24
DISSOLVED OXYGEN	133.40 ppb	327.40 ppb	5.20 ppb	16.20 ppb
CWRP SUCTION PH	8.07 pH	8.40 pH	7.60 pH	6.83 pH
CWRP DISCHARGE PH	7.54 pH	8.28 pH	6.61 pH	8.09 pH
BRINE RECIRC CONDUCTIVITY	68.64 µS/cm	65.36 µS/cm	74.60 µS/cm	78.74 µS/cm
DISTILLATE CONDUCTIVITY	38.28 uS/cm	2.07 uS/cm	4.40 uS/cm	201.45 uS/cm
CONDENSATE CONDUCTIVITY	0.10 uS/cm	0.10 uS/cm	0.08 uS/cm	0.07 uS/cm
DISTILATE PRODUCTION	2769.20 T/h	2802.45 T/h	2858.45 T/h	2860.90 T/h
PERFORMANCE RATIO	7.98 PR	7.78 PR	8.43 PR	8.32 PR
GROSS OUTPUT RATIO	7.68	7.47	8.13	8.01
FEED RATIO	2.91	2.91	2.95	2.84
ANTISCALE CONSUMPTION RATIO	35.40 Kg/MIG	34.11 Kg/MIG	35.35 Kg/MIG	33.04 Kg/MIG
CWRP FLOW	39.0 m3/h	24.0 m3/h	-4.5 m3/h	16.5 m3/h
SEAWATER INTAKE	22890.0 m3/h	23025.0 m3/h	20505.0 m3/h	23472.0 m3/h
DISTILLATE/ SEAWATER RATIO	0.12	0.12	0.14	0.12

HRSG Report

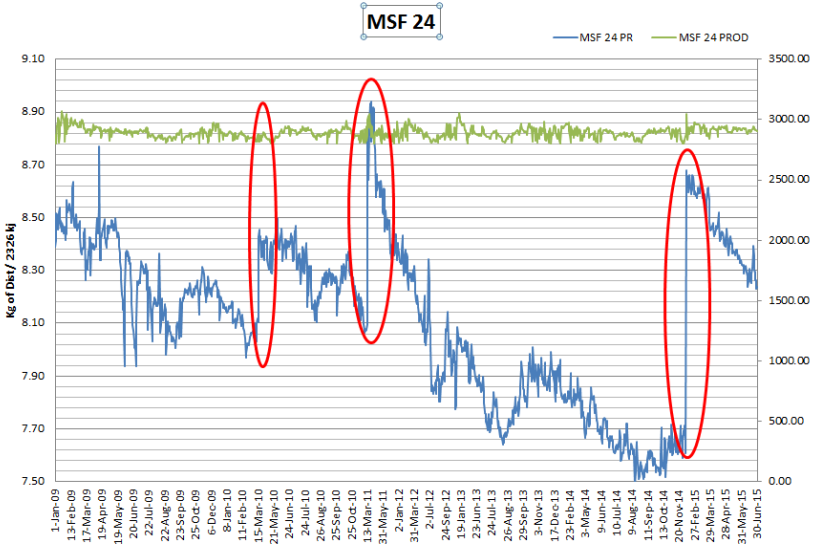
8/28/2015 11:02:58

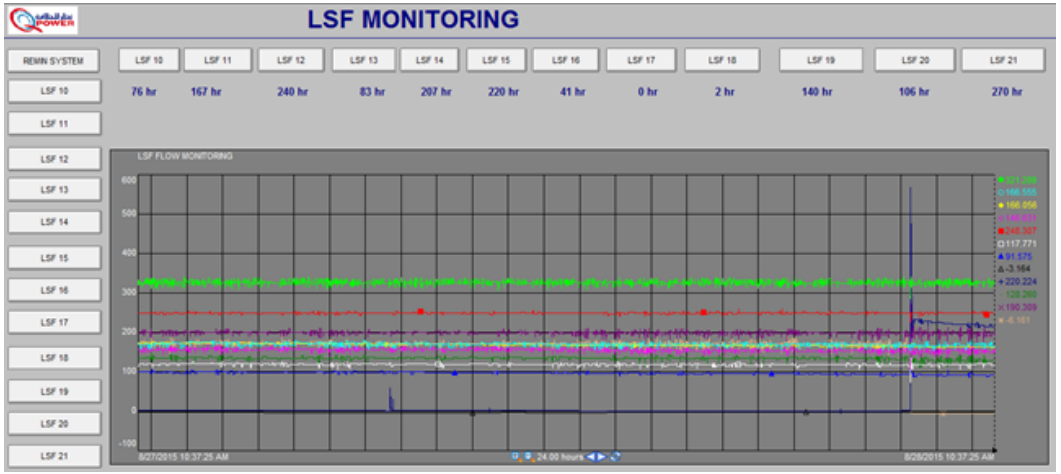
Parameter	Units	HRSG 11	HRSG 12	HRSG 13
Feedwater Flow	kg/s	143.35	140.21	144.74
HP Steam Flow	kg/s	143.81	149.67	153.01
HP Steam Temperature	°C	552.00	552.96	553.62
HP Steam Pressure	bar	74.60	74.60	74.60
Duct Burner1 Fuel Flow	Nm3/h	7635.60	7673.47	7585.61
Duct Burner 2 Fuel Flow	Nm3/h	6671.68	6612.95	6950.66
Duct Burner1 Inlet Temp	°C	NO DATA	NO DATA	NO DATA
Duct Burner1 Outlet Temp	°C	NO DATA	NO DATA	NO DATA
Duct Burner2 Inlet Temp	°C	NO DATA	NO DATA	NO DATA
Duct Burner2 Outlet Temp	°C	NO DATA	NO DATA	NO DATA
Drum Pressure	bar	81.86	81.20	80.80
GT Exhaust Flow	kg/s	645.25	644.87	627.68
HRSG Efficiency	%			

Parameter	Units	HRSG 11	HRSG 12	HRSG 13
Drum Water CA	æS/cm	1.77	1.67	1.72
Drum Water pH	pH	9.17	9.24	9.20
Saturated Steam CA	æS/cm	0.06	0.06	0.06
Main Steam CA	æS/cm	0.06	0.06	0.06
Stack Temperature	°C	166.83	165.69	162.42
Flue Gas Stack NOx	mg/Nm³	22.52	25.60	31.60
Flue Gas Stack CO	mg/Nm³	4.99	4.78	2.79
Flue Gas Stack SO2	mg/Nm³	1.32	1.32	1.12



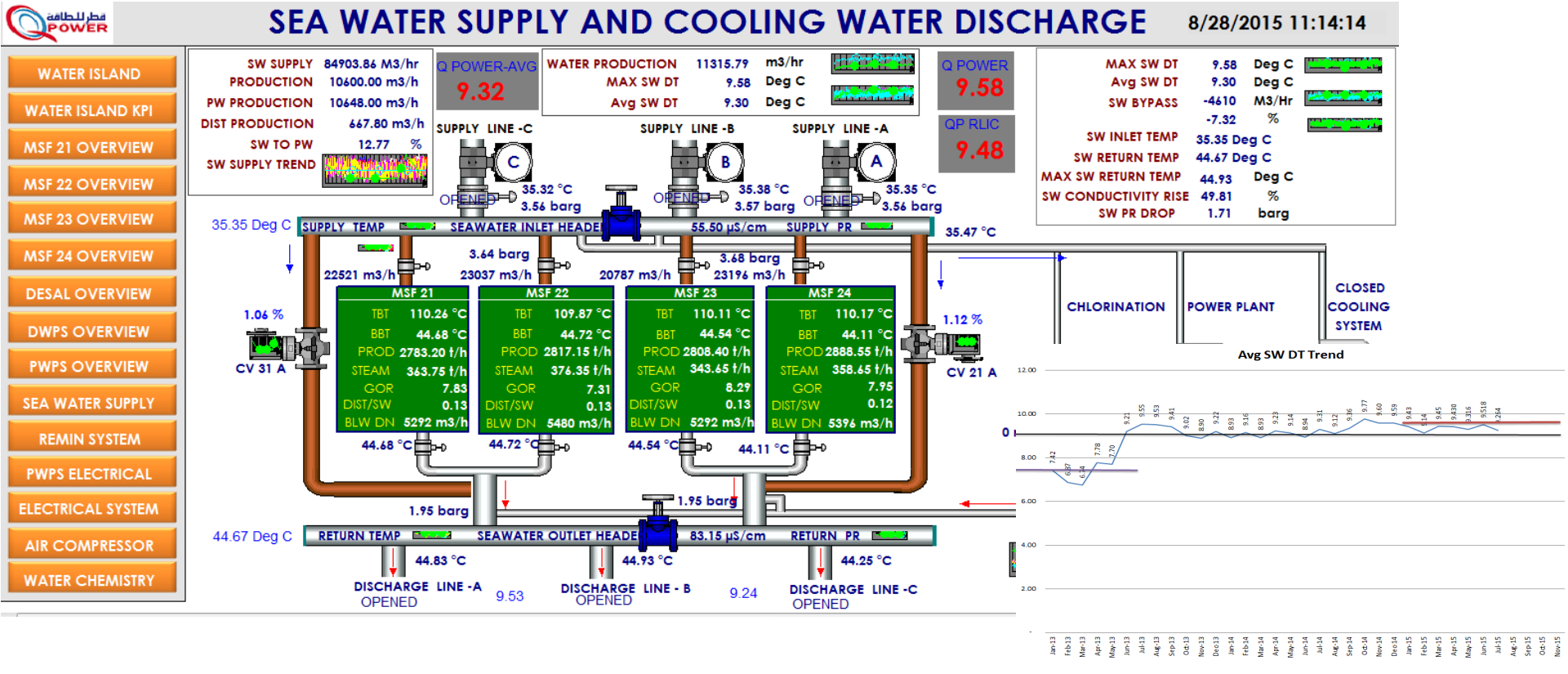
Plant O&M Optimisation - Performance/Conditioned based Maintenance



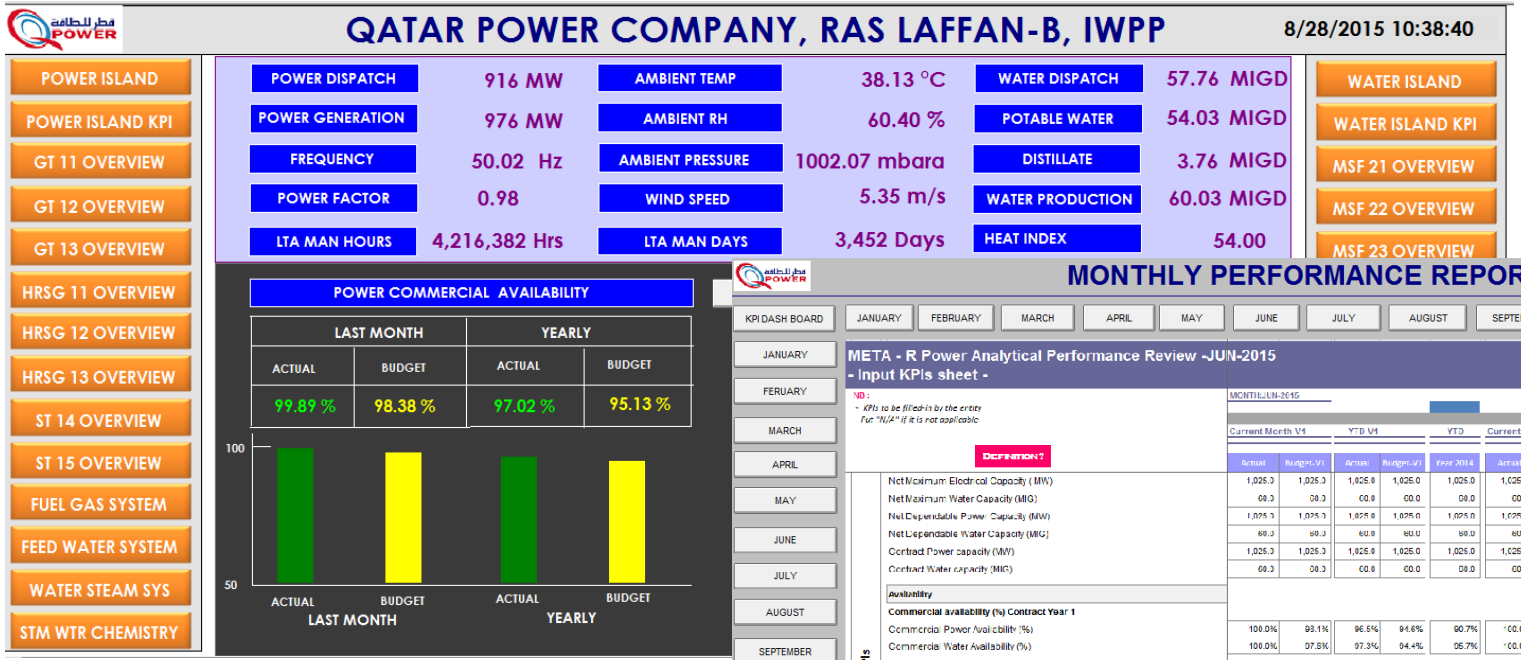


Online Monitoring of equipment performance used for performance & condition based maintenance of distillers, lime stone filters and major pumps, GT suction filters etc.

Seawater Margin Improvement



Plant O&M Optimisation - Monthly KPI Reporting



Plant O&M Optimisation – Real-time KPI Monitoring

Power Plant KPI

Key Performance Indicator	Unit	Design	Current Value	Average	Minimum	Maximum	Std Dev
GROSS POWER GENERATION	MW	1090	974.13	892.13	722.42	987.70	80.26
POWER EXPORT	MW	1025	914.62	832.53	663.07	927.93	80.08
PLANT EFFICIENCY	%	40.29	40.57	38.56	34.22	41.43	1.87
PLANT EFFICIENCY FACTOR		1	1.09	1.09	1.09	1.18	0.05
PLANT LOAD FACTOR	%	100	89.23	89.23	89.18	90.26	0.29
GT 11 LOAD	MW	233	216.89	192.37	135.02	221.70	26.29
GT 11 EFFICIENCY	%	36.76	35.79	34.96	31.35	36.68	1.29
GT 12 LOAD	MW	233	220.29	193.34	134.60	226.61	27.19
GT 12 EFFICIENCY	%	36.76	36.24	35.06	31.24	36.93	1.38
GT 13 LOAD	MW	233	223.00	193.79	134.99	229.50	27.66
GT 13 EFFICIENCY	%	36.76	36.36	35.08	31.25	37.02	1.40
ST 14 LOAD	MW	220	159.69	160.21	158.23	162.22	0.41
ST 15 LOAD	MW	220	152.27	152.43	137.56	157.40	1.82
HRSG 11 STEAM TEMP	Deg C	566.6	549.66	555.29	547.20	563.58	4.05
HRSG 11 STEAM FLOW	Kg/Sec	176.9	143.40	143.32	139.26	146.59	1.02
HRSG 11 STEAM PRESSURE	Bar	88.7	73.81	74.49	72.92	75.71	0.49
HRSG 11 FLUEGAS EXIT TEMP	Deg C	146.7	160.56	156.26	148.28	160.83	4.00

Water Plant KPI

Key Performance Indicator	Unit	Design	Current Value	Average	Minimum	Maximum	Std Dev
TOTAL WATER PRODUCTION	M3/Hr	11462.5	11207.56	11161.73	11146.38	11207.56	21.76
TOTAL WATER EXPORT	M3/Hr	11362.5	10940.63	11117.83	10823.01	11308.68	105.42
PW DISPATCH	M3/Hr		97.10	97.07	96.82	97.24	0.09
DISTILLATE DISPATCH	M3/Hr		717.83	786.67	611.45	938.86	118.27
WATER PLANT LOAD FACTOR	%	100	10940.63	10956.70	10940.63	10967.21	8.74
MSF21 DIST PROD	M3/Hr	2840.9	2787.05	2778.87	2661.05	2911.30	24.74
MSF21 STEAM CONSUMPTION	TPH	336.9	362.55	363.10	347.20	373.80	3.68
MSF21 SW INTAKE	Ton/Hr	22500	22797.00	22665.37	21360.00	24102.00	328.13
MSF21 DISTILLATE COND	uS	<25	38.31	35.09	28.65	40.29	2.77
MSF21 BRINE HEATER PR	Bar		0.78	0.78	0.77	0.78	0.00
MSF21 GOR	Kg Dist/ Kg Steam	8.43	7.61	7.63	7.53	7.69	0.06
MSF21 COVERSION FACTOR	%		0.13	0.12	0.12	0.13	0.00
MSF21 TBT	Deg C	110	110.26	110.26	109.95	110.44	0.09
MSF21 BBT	Deg C	43.8	44.68	45.01	44.43	45.83	0.29
MSF21 ANTIFOAM	L/Hr	0.027	82.98	81.71	77.44	121.54	1.36
MSF21 ANTISCALANT	L/Hr		146.91	141.18	133.95	171.54	2.03
MSF22 DIST PROD	M3/Hr	2840.9	2801.75	2801.86	2714.60	2911.65	21.77
MSF22 STEAM CONSUMPTION	TPH	336.9	376.75	377.46	362.00	386.10	2.93

Process displays, AF Asset Model and reports are build in-house within short time.

Plant O&M Optimisation - Performance Reports

STATION STATUS REPORT

PRODUCTION		GENERATION	DISPATCH	POWER SYSTEM CONDITION			WEATHER CONDITION		
LOAD	MW	949.58	890.05	FREQUENCY	HZ	50.04	TEMPERATURE	Deg C	38.09
POTABLE WATER	M3/HR	10314	10232	POWER FACTOR		0.98	RELATIVE HUMIDITY	%	61.32
POTABLE WATER	MIGD	54.45	54.02						
DISTILLATE WATER	M3/HR	756	715	220 KV BUS VOLTAGE	kV	226	WIND SPEED	m/sec	5.03
DISTILLATE WATER	MIGD	4.0	3.8						
PRODUCT WATER	M3/HR	11070	10947	AUXILLIARY POWER	MW	60	RAIN FALL	kg/m2	42.00
PRODUCT WATER	MIGD	58.4	57.8						

POWER PLANT STATUS REPORT

PARAMETER	UNIT	GT 11	GT 12	GT 13	ST 14	ST 15	TOTAL		
ACTIVE LOAD	MW	212.64	212.91	212.91	160.78	156.0	955.21		
REACTIVE LOAD	MVAR	40.28	39.22	38.64	19.17	34.82	172.12	DC-14 kg/sec	0.00
FREQUENCY	HZ	50.02	50.03	50.03	50.04	50.03	50.04	DC-15 kg/sec	0.00
POWER FACTOR		0.97	0.97	0.98	0.97	0.95	0.98		
IGV POSITION	%	95.70	95.7	79.08					
OTC TEMP	Deg C	559.33	553.6	564.26					
EOH	HR	70105.2	72493	62676	33584	34405			
NO OF STARTS	nos	109	135	107	58	70			
OPERATING HOURS	HR	68322	69973	60481	33584	34405			
FUEL GAS FLOW	NM3/HR	60968	60680	60584			227100		
EFFICIENCY	%	32.35	32.55	32.60			39.01		

WATER PLANT STATUS REPORT

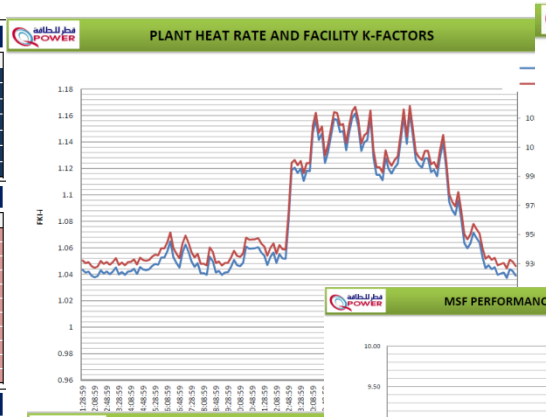
PARAMETER	UNIT	DESIGN	MSF 21	MSF 22	MSF 23	MSF 24	TOTAL		
DISTILLATE PROD.	M3/HR	2865.94	2762.90	2821.70	2812.25	2838.50	11235.35	SW I/L- A	35.42
DISTILLATE PROD.	MIGD	15.13	14.59	14.90	14.85	14.99	59.31	SW I/L- B	35.51
DISTILLATE COND.	M3/HR	<25	38.37	2.01	4.40	203.34	62.03	SW I/L- C	35.38
STEAM CONS.	T/H	336.89	363.40	378.85	345.05	356.45	1443.75	SW O/L- A	44.83
TOP BRINE TEMP	Deg C	110.00	110.26	109.85	110.12	109.96	110.05	SW O/L- B	44.93
SW I/L TEMP	Deg C	35.00	35.84	35.48	35.32	34.66	35.32	SW O/L- C	44.28
SW SUPPLY	M3/HR	22500.00	22299.00	23559.00	20718.00	22983.00	84038.38	Avg SWDT-Deg C	9.25
% DIST CONVERSION	%	12.737	12.390	11.977	13.574	12.350	13.37	OP SW DT	9.30
GOR	RATIO	8.507	7.603	7.448	8.150	7.963	7.78	SW TEMP CV-21	1.12
PR	kg dist/2326 kJ	8.26	7.94	7.61	8.22	8.03	7.95	SW TEMP CV-31	1.06
Corrected PR	kg dist/2326 kJ	8.26	8.06	7.73	8.24	7.98	8.00		

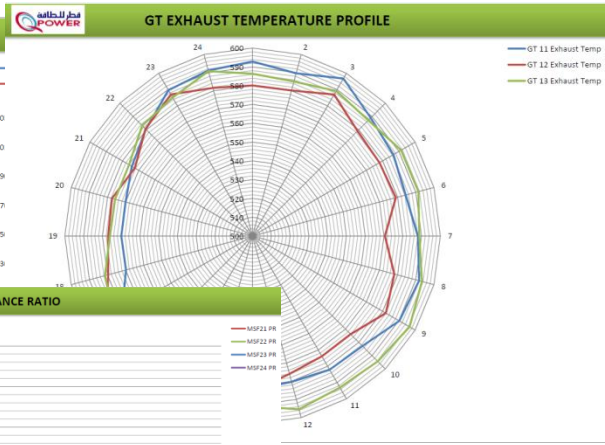
POWER PLANT CONDITION MONITORING

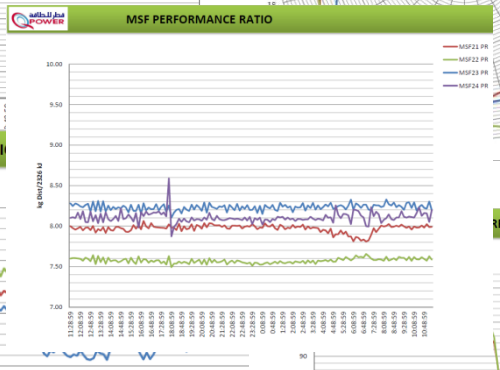
PARAMETER	UNIT	GT 11	GT 12	GT 13	
SUCTION FILTER DP	mbar	8.84	9.73	8.22	
COALESER FILTER DP	mbar	0.22	0.36	0.16	
PULSE FILTER DP	mbar	6.57	7.68	6.30	
FINE FILTER DP	mbar	1.68	1.28	1.39	
AMB TEMP	Deg C	40.19	37.93	37.66	
AMB RH	%	54.65	63.33	58.77	
Wet Bulb Temp-Calc	Deg C	31.28	30.99	29.87	
EVAP COOLER EFF	%	89.27	79.97	72.92	
AMB PRESSURE	mbar	999.56	999.62	999.30	
COMP I/L TEMP	Deg C	32.24	32.38	31.98	
COMP O/L TEMP	Deg C	433.73	432.68	350.68	
COMP O/L PR.	bar	15.61	15.57	15.26	
COMB CHAMBER DP	mbar	455.52	480.48	433.08	
GT EXHAUST TEMP	Deg C	586.19	583.59	591.74	
GT STACK TEMP	Deg C	586.19	583.59	591.74	

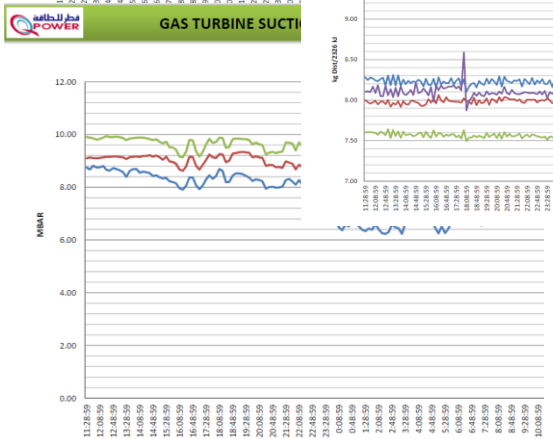
TANK LEVELS		
POTABLE WATER-A	MM	6480.38
POTABLE WATER-B	MM	6467.17
DISTILLATE WATER	MM	14052.22
DM WATER	MM	12.53

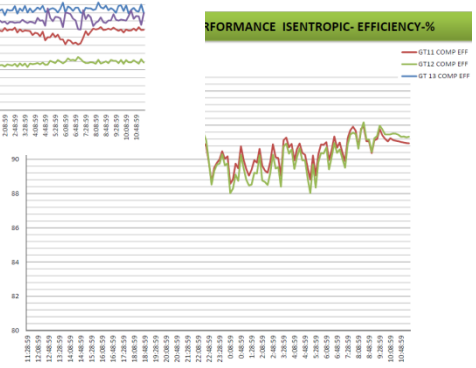
ENVIRONMENT	GT 11	GT 12	GT 13
NOX : mg/Nm3	23.05	24.87	33.17
SO2: mg/NM3	1.52	1.68	0.80
CO :mg/NM3	4.95	4.47	2.43











Plant O&M Optimisation - Performance Reports

- Daily, Weekly and Monthly Performance reports
- Daily O&M meeting discussion on performance issues with real time data reporting
  - Plant Efficiency
  - Plant Loading
  - GT/MSF/HRSG Efficiency
  - GT Evaporative cooler efficiency
  - HRSG Main Steam Temp
  - HRSG Flue Gas Exit Temp
  - GT Comb Chamber Monitoring
  - Seawater Consumption
  - Chemical Consumption
  - MSF Distillate Conductivity
  - GT Suction Filter perf. Monitoring
  - Step Change and abnormality reporting

QATAR POWER COMPANY RAS LAFFAN "B" "IWPP"

DAILY GENERATION AND PERFORMANCE REPORT — DATE 23-Aug-15

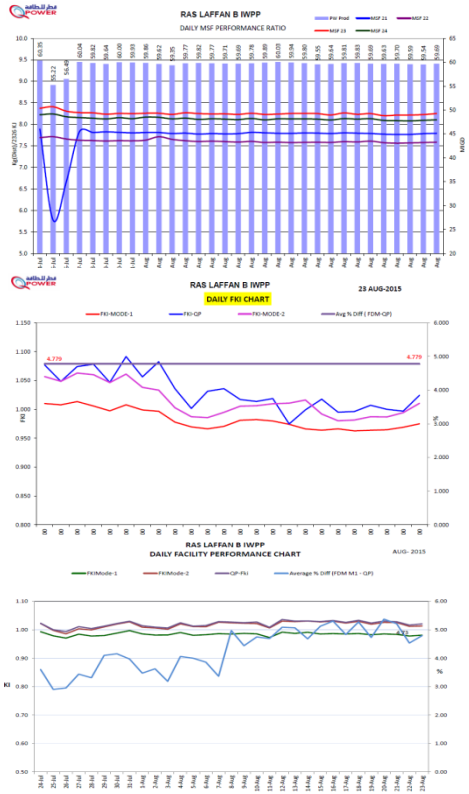
GENERATION PLAN(MWH) :	DAILY :	22990	MONTHLY :	506140	
POTABLE WATER (MIG) :	DAILY:	60	MONTHLY :	1380	

	FACILITY PERFORMANCE:		DAILY	Aug-15	YEAR 2015	REMARK
1	POWER					
		GROSS GENERATION (MWh)	22516	504233	3630177	
		NET GENERATION (MWh)	21143	472840	3320869	
		POWER IMPORT(MWh)	0	0	29142	
		COMMERCIAL AVAILABILITY(%)	100.00	100.00	97.33	
		OPERATIONAL AVAILABILITY (%)	100.00	100.00	97.36	
		FORCED OUTAGE RATE (%)	0.00	0.00	0.29	
		PLANT LOAD FACTOR (%)-Gross	91.53	89.12	62.79	
		MAX Net HOURLY LOAD (MWh)	967	971	1093	
		MIN Net HOURLY LOAD (MWh)	790	699		
		AUX POWER (MWh)	1373	31393	309308	
	WATER					
		MSF DISTILLATE WATER PRODUCTION (MIG)	59.69	1373.72	13653.82	
		NET POTABLE WATER PRODUCTION (MIG)	55.57	1266.84	12611.36	
		DISTILLATE WATER TO DIST TANK	3.49	91.23	854.58	
		PERFORMANCE RATIO (KG$_{DIST}$/2326 KJ)	7.93	7.94	8.08	
		COMMERCIAL AVAILABILITY (%)	100.00	100.00	97.93	
		OPERATIONAL AVAILABILITY (%)	100.00	100.00	97.94	
		FORCED OUTAGE RATE (%)	0.00	0.00	0.03	
		MAX HOURLY PRODUCTION (M3/HR)	11341	11392	11683	
		MIN HOURLY PRODUCTION (M3/HR)	11018	10707		
	GAS CONSUMPTION (MMBTU)					
		GT GAS FIRING	153591	3512074	26205670	
		SUPPLEMENTARY GAS FIRING	47328	1037747	12331238	
		TOTAL GAS FIRING	202919	4549821	38536908	
	SEA WATER CONSUMPTION (KM3)		2008	46038	418037	
	POTABLE WATER					
		POTABLE WATER DISPATCH (MIG)	54.73	1264.40	12573.79	
		DISTILLATE WATER DISPATCH (MIG)	3.47	91.53	852.37	
		TOTAL PRODUCT WATER DISPATCH (MIG)	58.20	1355.93	13426.16	

	UNIT WISE PERFORMANCE					
	POWER	GT 11	GT 12	GT 13	ST 14	ST 15
	GROSS GENERATION (MWh)	4907	4932	4950	3816	3911
	EOH (Up to date)	69998	72385	62568	33477	34297
	NO OF STARTS (Nos)	109	135	107	58	70
	AVAILABILITY (%)	100.00	100.00	100.00	100.00	100.00
	PLANT LOAD FACTOR (%)	87.75	88.20	88.51	71.95	73.75
	MAX HOURLY LOAD (MWh)	220	224	229	181	180
	MIN HOURLY LOAD (MWh)	178	178	178	150	158
	WATER		DS 21	DS 22	DS 23	DS 24
	GROSS WATER PRODUCTION (MIG)		14.68	14.83	14.95	15.24
	PERFORMANCE RATIO (KG$_{DIST}$/2326 KJ)		7.79	7.59	8.25	8.11
	AVAILABILITY (%)		100.00	100.00	100.00	100.00

	AVERAGE AMBIENT CONDITIONS		DEVIATION w.r.t. PLAN	DAY	MONTH
	AMBIENT TEMPERATURE(Deg C)	35.992			
	AMBIENT PRESSURE(bar)	1.000			
	AMBIENT RH(%)	65.503	POWER	-473.5	506140.0
	SEA WATER I/L TEMP(Deg C)	35.714	WATER	-5.3	1380.0
	FREQUENCY(Hz)	50.030			
	POWER FACTOR	0.983			
	FUEL LHV(kJ/Kg)	46796			

	POTABLE WATER STOCK	TANK A	TANK B	TOTAL STOCK
	(14 MIG is Dead Stock) 6.28 M	14.49 MIG	6.31 M	14.74 MIG	29.23 MIG
	Distillate Water Stock	14.09 M	5.15 MIG	(P W + Dist) =	34.38 MIG



Application of PI System Tools and Capabilities

ProcessBook

- Real-time data analysis
- Dashboards
- Process Displays
- Equipment performance
- Trending
- Real-time deviation

PI DataLink

- Real -ime data analysis
- Online performance monitoring
- Reports
- Equipment performance
- Trending
- Excel add ins

PI Coresight

- Real-time data analysis
- Dash Boards
- Equipment performance
- Trending
- Real-time decision making

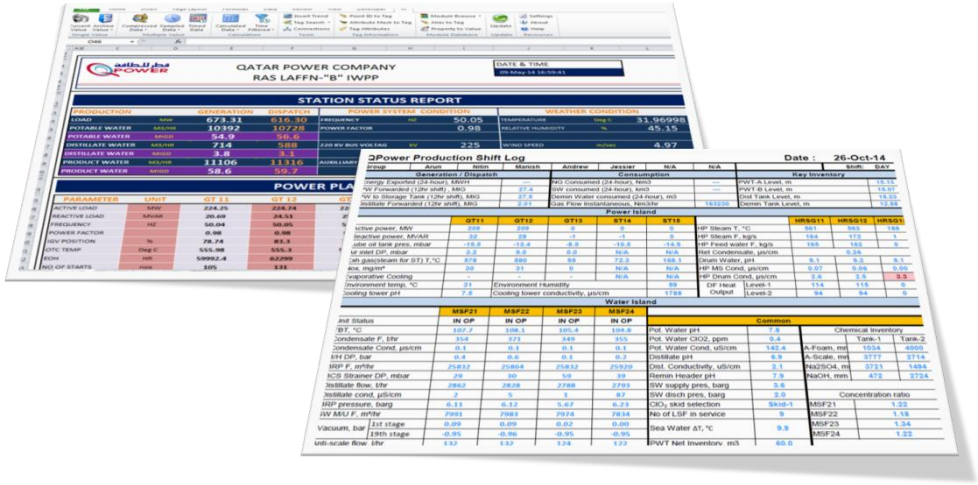
PI Analytics AF Server

- Analytical
- Performance Calculation
- Heat stress Index
- Creating asset model analytics and notification

Notifications

- Real-time messaging
- Notification on heat stress
- Alerting high deviations
- Equipment tripping's
- Start/stop notification

Application of PI ProcessBooks and PI DataLink



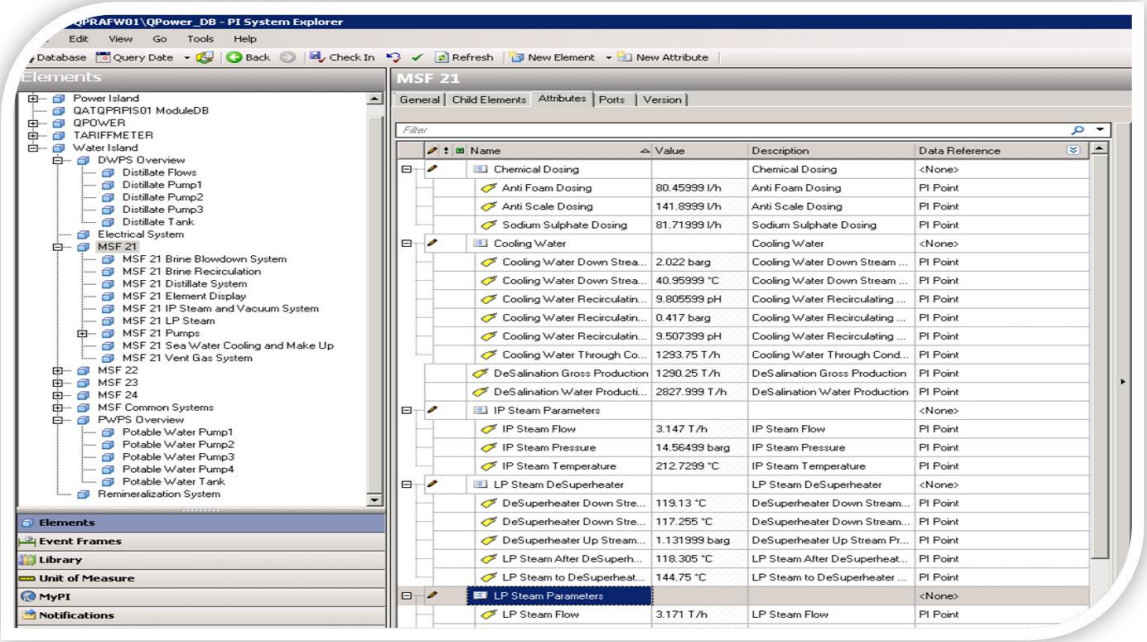
- 24/7 access to plant data from Engineers desktop
- Applications can be build in house without in depth expertise in IT

Application of PI Coresight

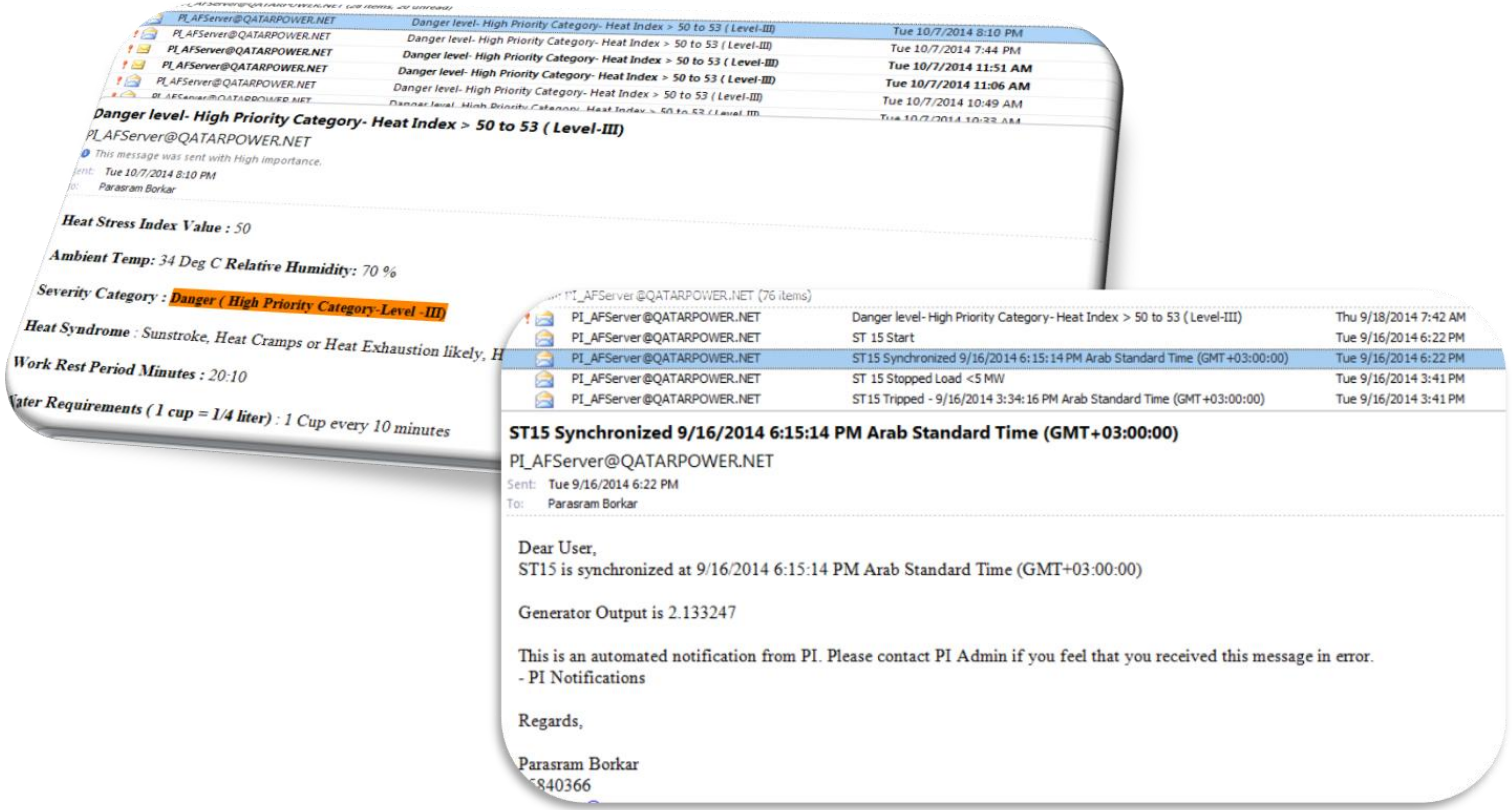
Mainly designed for Senior Management

Application of PI Server and Analytics

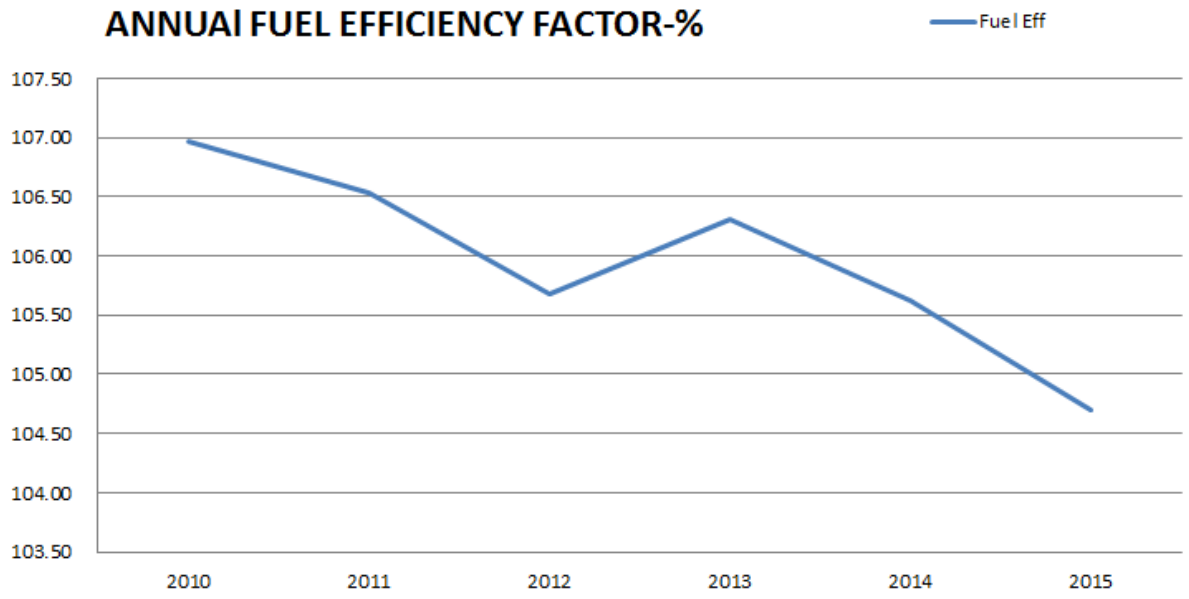
- Asset Model developed based on function and equipment
- Created templates for equipment performance analysis
- Used for HSE heat stress index calculation and notifications



Application of Notifications

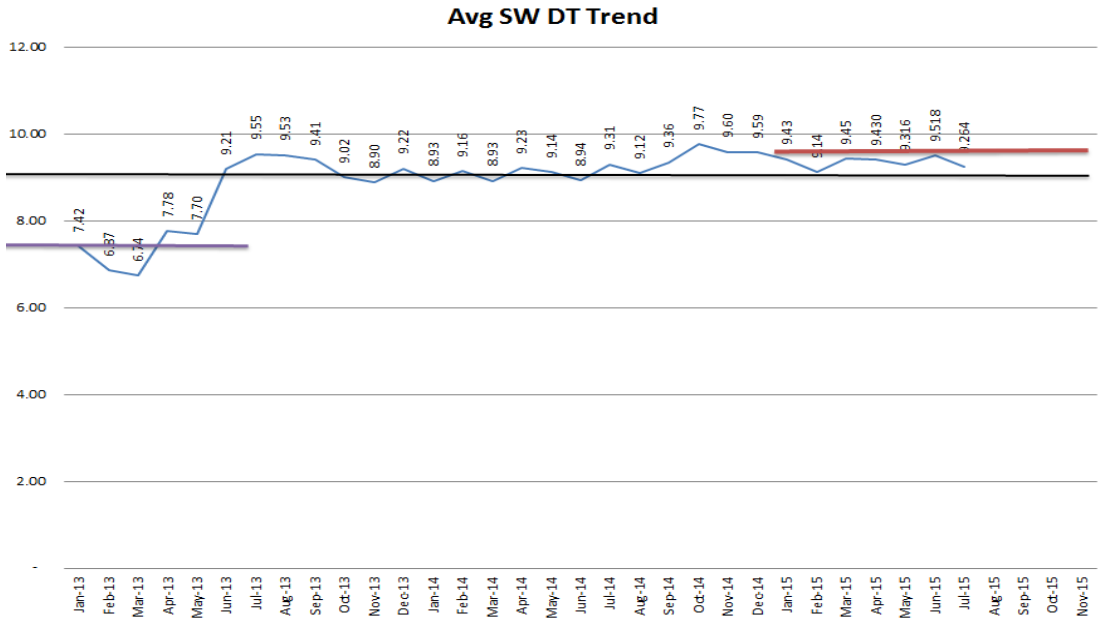


Result Obtained - Fuel Gas Margin Improvement



- Continuous monitoring of O&M efficiency, the savings through fuel margin have improved.

Result Obtained - Seawater Margin Improvement



- Continuous monitoring of seawater usage leads to savings of more than 1 million USD in first year

Results Obtained and Business Impact

- HSE Performance Improved
- Availability and Reliability Improved
- Fuel efficiency Factor Improved- Fuel margin improved
- Seawater usage reduced- Seawater margin improved
- ROI of PI System implementation is achieved

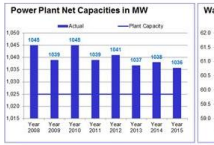
At QPower, the PI System has been utilised in an effective way to improve the plant efficiency, troubleshooting, reducing seawater consumption and condition monitoring. This improved O&M capability and continue to maintain the plant in a healthy condition for higher reliability.
QPower utilised PI System for HSE performance improvement which is unique step towards protection of human resource occupational health hazards.

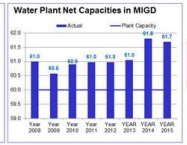
Future Plan

- Event Frames
- PI Coresight with future data
- Building displays with PI ProcessBook and PI Coresight
- Continue to improve availability, reliability and plant efficiency through utilization of PI System tools
- Create value to the stake holders

Summary

QPower: Emerged as a most trusted reliable and efficient source of power and water for the State of Qatar.
Contributed to Qatar's national growth to fulfill Vision 2030.
The PI System creates value to QPower's business through real-time KPI monitoring for financial benefits.





BUSINESS CHALLENGES

A. Availability of operational data across the company

B. Improve the fuel and seawater margin

C. Improve O&M efficiency

D. Improve reliability, availability

E. Improve HSE performance

SOLUTION

A. Implemented PI system infrastructure and historian with the powerful analytical tools

B. Devised real time performance management system

C. Integration of Offline FDM with PI DataLink

RESULTS AND BENEFITS

- Real-time data availability. Implementation of dash-boards includes operational efficiency and KPIs for quick decision making
- Fuel Efficiency Factor improved by 0.98% resulting into fuel margin of 1.4 million USD/year (0.2%)
- Seawater margin improved by 1.3 million USD for year 2013 &14.
- Positive NPV with ROI – 8 months

Contact Information

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Qatar Power Company

Questions

Please wait for the **microphone** before asking your questions

State your
name & company

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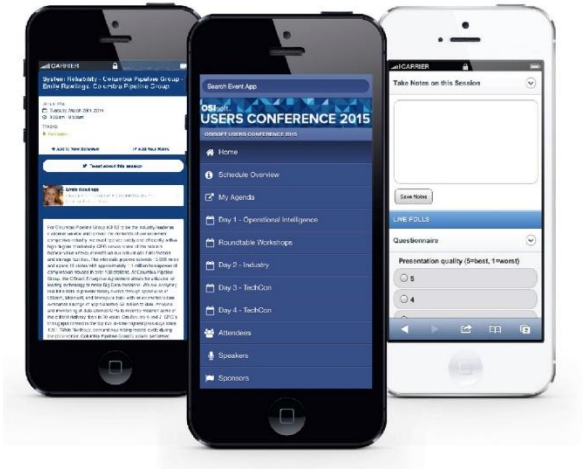

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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado