

Shell Exploration & Production



Klimakur 2020

Shell's metodikk/verktøy for økt energieffektivitet

20-08-2009

Odd Bjarne Morch
Energy Strategy Leader



Innhold

- Shell EP's EE/GHG metodikk / verktøy og implementering i Upstream International Europe (UIE)
- Energy Efficiency Surveillance Tool (EEST)

Back-up slides for “pre-read”



3-2-1

3 HARD TRUTHS



DEMAND



SUPPLY

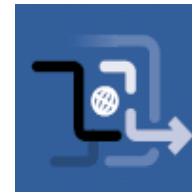


CO₂

2 SCENARIOS



SCRAMBLE



BLUEPRINTS

1 PREFERRED APPROACH



BLUEPRINTS

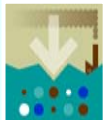


6 - REDUCTION PATHWAYS



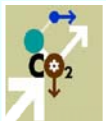
Efficiency

- 1 Increasing the efficiency of our operations, seeking to be first quartile



CCS

- 2 Establishing a substantial capability in CO2 Capture and Storage (CCS).



Technology

- 3 Continuing to research and develop technologies that increase efficiency and reduce emissions in hydrocarbon production.

Low CO₂
Energy

- 4 Aggressively developing low-CO2 sources of energy, including natural gas and low CO2 fuel options.



Customers

- 5 Helping manage energy demand by growing the market for products and services that help customers use less energy and emit less CO2.



Advocacy

- 6 Working with governments and advocating the need for more effective CO2 regulation.



ROLE OF EFFICIENCY IN CO₂ ABATEMENT

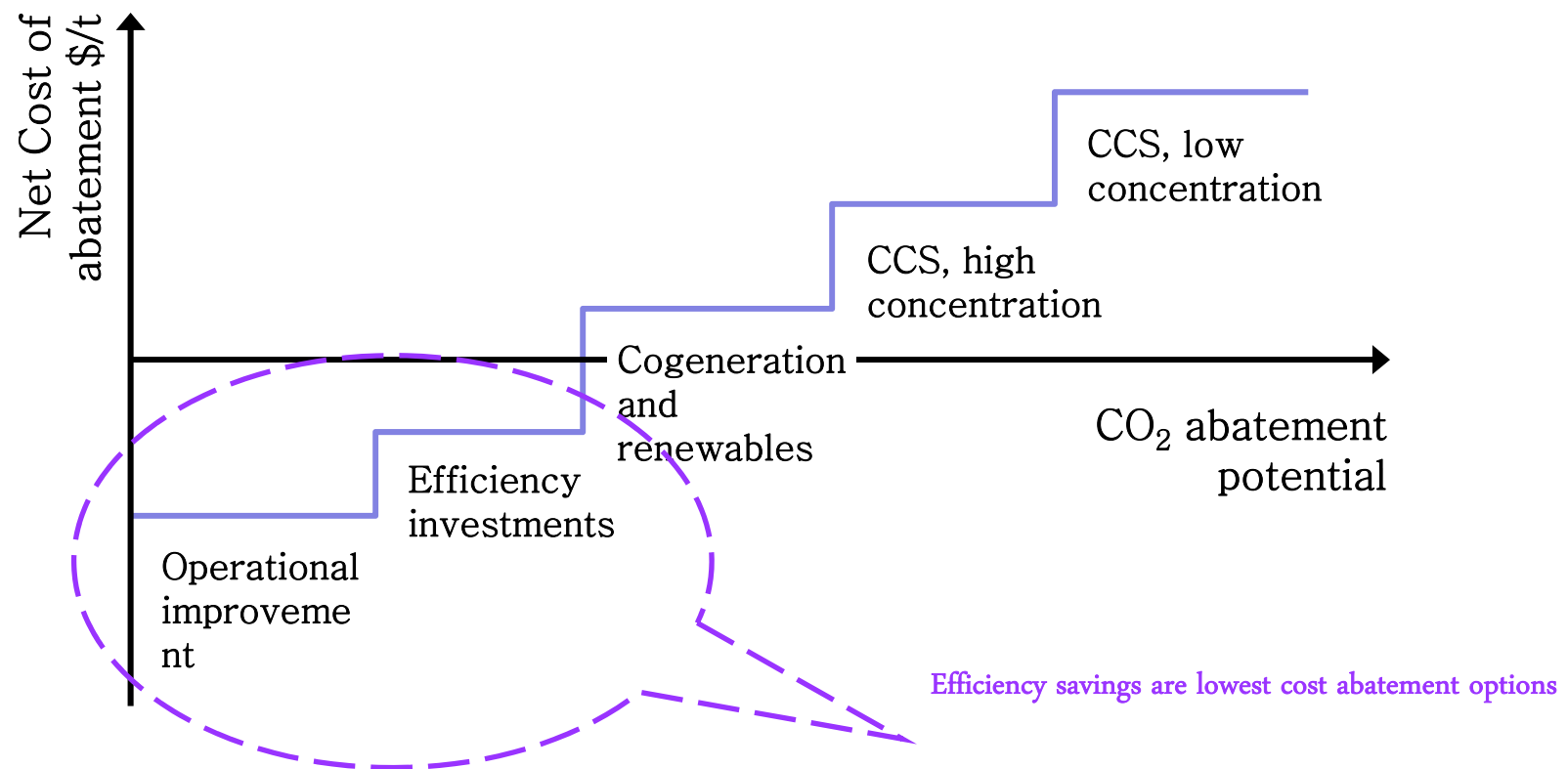
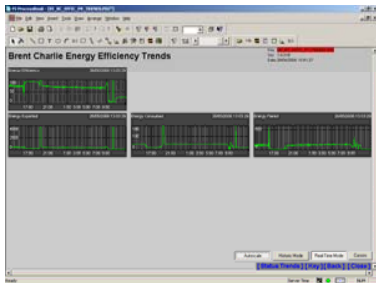


Table of Contents

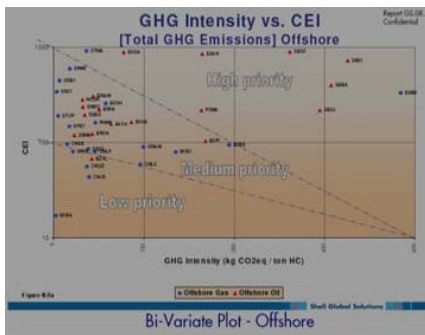
GHG and Energy Management Plan

- 1. Introduction
- 2. Purpose
- 3. Scope
- 4. Key Definitions
- 5. Key Objectives and Key Results
- 6. Key Performance Indicators
- 7. Key Risks and Mitigation Measures
- 8. Key Stakeholders
- 9. Key Messages
- 10. Key Findings
- 11. Key Recommendations
- 12. Key Action Items
- 13. Key Deliverables
- 14. Key Milestones
- 15. Key Dates
- 16. Key Contacts
- 17. Key References
- 18. Key Appendices
- 19. Key Glossary
- 20. Key Index

- Structured CO2 Reduction Plans for our Major Facilities:
 - Development of Greenhouse Gas and Energy Management Plans
 - ✓ The Strategy and Plan towards Top Quartile Performance – Asset C
 - ✓ 20 plans delivered in 2008, location specific



- Real-time Performance Data & Operational Decisions:
 - “Energy Efficiency Surveillance Tool” (EEST) roll out – Office/Field – Currently at 12 UK and 2 NO facilities
 - ✓ Enabling improved & more efficient operational decisions



- CO2 Baseline Benchmarking for all our facilities to drive TQ Performance:
 - Location performance against TQ Benchmark
 - Gap Analysis to drive identification of Improvement Proj
 - Ormen Lange and Draugen are TQ performing operation

- Managing ‘CO2 performance’ is the way we do things around here:
 - Implementation and Embedding into everyday Processes & Operational Decisions



Objectives - Energy Efficiency Surveillance Tool

Improve Energy Efficiency in existing Operations

- Low Efficiency: **Root Cause** for unnecessary CO₂ Emissions
- **Where** to look?
- **What** to do?

Energy Efficiency Surveillance Tool: **Goal**

- Create **awareness** about Energy Efficiency in Operations;
- Provide **clear overview** of Energy Consumption;
- Provide **basic guidance** for identification of Improvement Opportunities.
- Provide (indicative) **Key Performance Indicators**.
- Visualisation of **energy consumption** and **energy efficiency** at an **installation real time** level

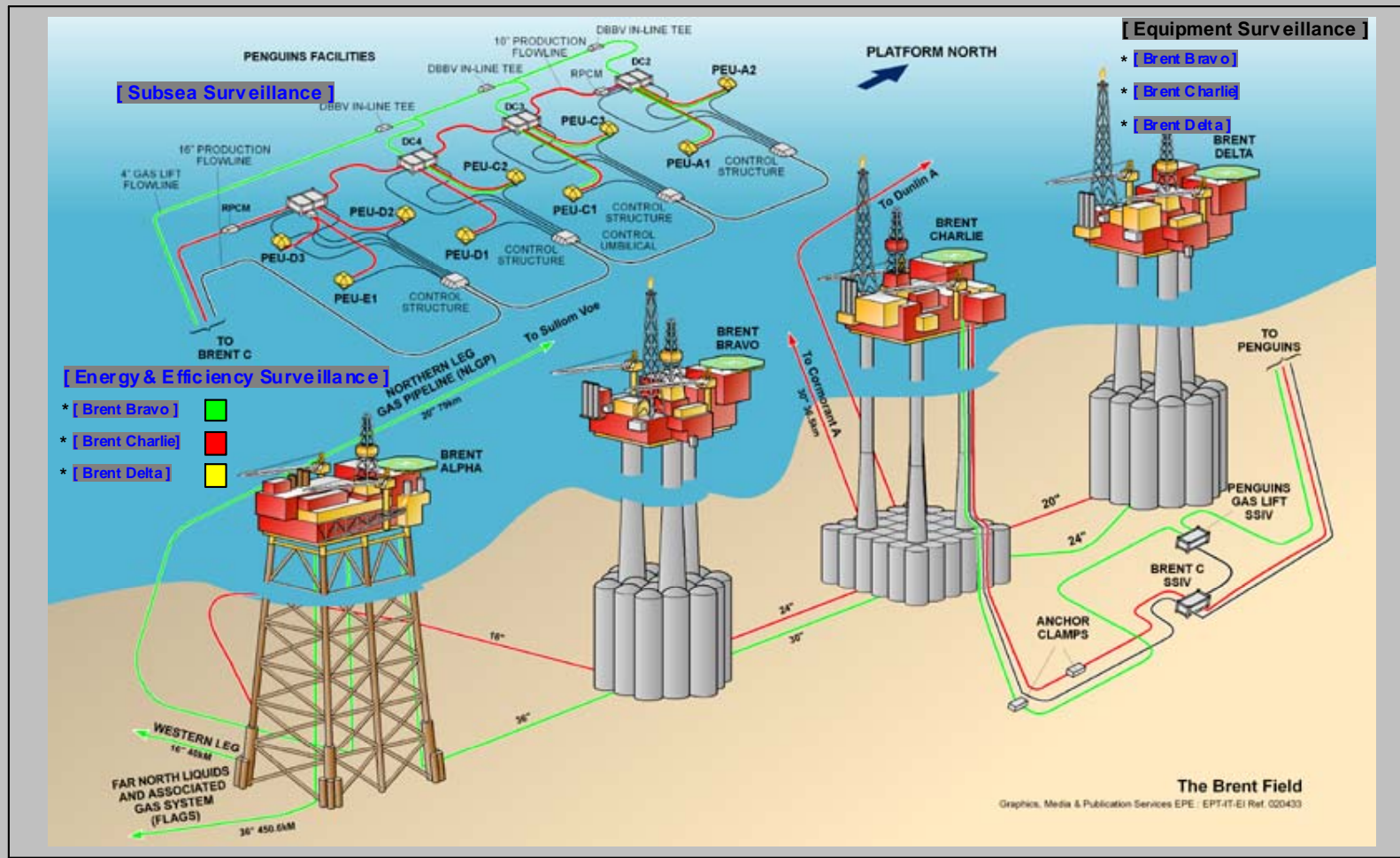


Asset HOME Page

Asset Home Page

File: [AP_BF_OVERVIEW.pdf](#)
Ver: 1.0.080
Date: 27/02/2009 12:27:15

Brent Field:



[Analysis Period]

Start Time:
End Time:
Data Reference Time:
Real-Time

Options:

- Navigation
- Topsides
- Subsea
- Surveillance Tools

[Key] [Back] [Close]



Asset Overview Page

Energy & Efficiency Surveillance Tool

File: **EE_BRENT_OVERVIEW.PDI**
 Ver: 1.1
 Date: 30/10/2008

Brent Overview:

	Energy Summaries (%)			CO2 Emissions (T)		Energy Cost (\$)		SSI	Notes
	Energy Efficiency	Energy Intensity	Energy Wasted	Daily Total	Year To Date	Daily Total	Year To Date	Alarm ONOC	* Energy Intensity = $\frac{\text{Energy Consumed}}{\text{Energy Exported}}$
[Brent Bravo]	86.03 90.00	16.42 10.50	2.09 1.50	629 750	165,702	97,382 137,200	27,166,764	■ ■	Platform : Batch Oil / gas export Gas lift Power Export
[Brent Charlie]	94.08 87.00	6.29 12.00	0.51 0.50	680 750	171,581	124,729 137,200	39,667,940	■ ■	Platform : Batch Oil / gas export Gas lift Power Export
[Brent Delta]	84.10 90.00	18.93 12.00	1.79 0.75	618 730	143,993	97,133 137,200	29,399,472	■ ■	Platform : Batch Oil / gas export Gas lift

[\[Analysis Period \]](#)

Start Time:
06/02/2009 08:37:37
 End Time:
06/02/2009 09:37:37
 Data Reference Time:
06/02/2009 09:37:37

Options:

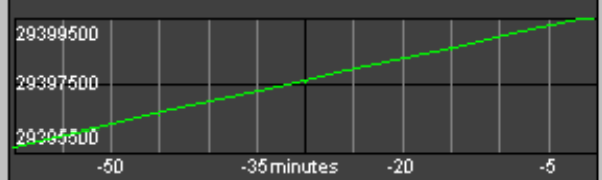
[\[Reset Totals \]](#)

Key: Energy Summaries (%) - Value is total to midnight (previous day). Costs = \$
 Emissions = Tonnes
 = Alarm Summary ■ = Fault ■ = Alert
 = Outside Normal Operating Conditions ■ = Normal ■ = Alarm

Selected Tag Summary

06/02/2009 09:37:37

Tag: EE_COSTUSD_CT Cumulative total energy cost (in \$)
 Range: 0. - 100000000. \$ Min/Max/Avg: (#,###,###) 29,395,638 / 29,399,472 / 29,397,607



[\[Cost Rates \]](#)

[\[Key \]](#) [\[Back \]](#) [\[Close \]](#)



Installation Overview Page

Status Summary Indicator (SSI)

Historical Mode Option

Section 1 (KPIs)

Section 2 (Emissions)

Section 3 (Costs)

Section 4 (ONCOs)

Section 5 (Graphs)

Energy & Efficiency Overview

Shearwater: [Intro](#) | [Quick Guide](#)

File: EE SW OVERVIEW.PDI
 Ver: 1.2
 Date: 22/12/2008

Energy Efficiency: (%) <i>(Indicative)</i>				Benchmark	Average	Estimated (Today)	Daily (Yesterday)	Cumulative (Year)
Energy Exported: 5414 MWh						96.91	96.88	
Energy Exported: 5414 MWh	Energy Consumed: 139.4 MWh	Energy Flared: 34.0 MWh	=	Energy Efficiency: 96.89	96.50			
	130.0 MWh	20.0 MWh		Energy Intensity: 3.23	2.50		3.22	
				Energy Wasted: 0.61	0.50		0.64	

Electricity (MW): Generated: 11.61 Major Users: 9.71 Minor Users: Other: 0.86
 Compression (MW): Generated: 14.19 Used: 13.45

CO2 Emissions: (Tonnes/d) <i>(Indicative)</i>					Total	Estimated (Today)	Daily (Yesterday)	Cumulative (Year)
Fuel Gas	LP Flare Gas	HP Flare Gas	Venting	=	712	712	714	325,821
459.6	128.0	124.5	N/A					
475.0	200.0	60.0						

Energy Cost: (£/d) <i>(Indicative)</i>				Total	Estimated (Today)	Daily (Yesterday)	Cumulative (Year)
Fuel Gas	Flare Gas	CO2 Emissions	=	81883	85000	81692	32,270,634
57127	13699	10681					
55000	15000	10500					

Operating Conditions:

Fuel Gas Import: ● Note: Gas is being imported

Selected Tag Summary 11/02/2009 12:30:21

Tag: EE_FUELEMIS Fuel Gas Emissions
 Range: 0. - 7000. TCo2/d Min/Max/Avg: (0.0)453.7 /463.1 /458.1

Analysis Period:
 Start Time: 10/02/2009 12:30:15
 End Time: 11/02/2009 12:30:15
 Data Reference Time: Real-Time

Options:
[Fuel Users](#)
[Major Electricity Users](#)
[Minor Electricity Users](#)
[Fuel User Trends](#)
[Maj. Elec. User Trends](#)
[Min. Elec. User Trends](#)
[Overview Trends](#)
[Analysis Display](#)

[User Displays](#)
[Manual Data Entry](#)
[Multi-Tag Trend](#)

[Historic Mode](#)
[Real-Time](#)

[Key](#) | [Back](#) | [Close](#)

Navigation Links



Next level...integrated

Nelson Daily Surveillance Overview

File: **DS_NE_Overview.PDI**
 Ver: 1.0
 Date: 01/06/2009

Overview:

Production:

	Value	Benchmark	Units
Oil Export Rate:	4146	4398	m ³ /d
Gas Export Rate:	268	260	km ³ /d
Water Production Rate:	25500	25498	m ³ /d
Total Lift Gas:	2962	3108	km ³ /d
Fuel Gas:	199	218	km ³ /d
LLP Flare:	6.685	5.000	km ³ /d
LP Flare:	0.511	2.000	km ³ /d
HP Flare:	2.005	2.000	km ³ /d
Compressor Total Gas:	2715	2834	km ³ /d
PU Oil Total RF:	1.03	1.00	
PW Injection:	1	8583	m ³ /d
Water Discharge:	25499	20000	m ³ /d

Production Events: ▲

[Wells:] & [Well Integrity:] [DP Monitoring:]

- Platform Wells (1-10) ■
- Platform Wells (11-20) ■
- Platform Wells (21-30) ■
- Southern Satellites ■
- Howe ■
- Water Injection ■

Well On Test: None

[Analysis Period]

Start Time:
02/06/2009 22:52:42
 End Time:
02/06/2009 22:53:42
 Data Reference Time:
02/06/2009 22:53:42

Historic Mode

Real-Time Mode

Options:

[Upload Spreadsheet]

[Application Log]

[Topside Systems:]

[Oil System]

- Prod. Separator: ■
- Test Separator: ■
- Exp. Oil Pump: P1031 STOPPED P1032 RUNNING
- Oil Booster Pump: P1010 RUNNING P1011 STOPPED P1012 RUNNING

[Produced Water System]

- PWRI: ■
- Prod. Wtr. Flash Drum: ■
- Reject Wtr. Pump A: RUNNING
- Reject Wtr. Pump B: RUNNING

[Gas System]

- 1st Stage Comp.: ■
- 2nd Stage Comp.: ■
- 3rd Stage Comp.: ■
- Comp. Speed: **7751** RPM

[Energy & Efficiency Surveillance]

- Efficiency: ■
- ONOC (Diesel Use): ■
- Efficiency: **93.38** **93.67** %
- CO2 Emissions: **605** **661** TCo2/d

[Utilities]

- [Chemical Injection]
- [Drainage]
- [Fire Water]
- [Flare] ■
- [Plant & Utility Air]
- [Sand Jetting]
- [Seawater] ■

Total Pwr. Generated: **6** mw
 Total Spinning Reserved: **12** mw
 Total Fuel Used: **6** MMscfd

Key:

- Not Running
- Fault
- Normal
- Alert
- Alarm
- Not Available
- In Development

[Key] [Back] [Close]





Can we further reduce the energy used for each boe produced?

Some areas to consider.....

- Process restarting procedures?
- Passing valves routines?
- Too much spinning reserve?
- Compressors running in recycle?
- Export Pumps or other 'big movers' may be oversized for current rates?





Thank you

Questions??

Back Up

- Flere skjermbilder for Energy Efficiency Surveillance Tool (EEST)
- EEST Quick User Guide
- Eksempler på bruk av verktøyet
- Shell CO2 Benchmarking



EPE EEST Overview Screen

PAN-EPE Summary

File: **EE_EPE_PAN_OVERVIEW.PD**
 Ver: 1.0.095
 Date: 12/08/2009 15:08:57

Overview:

[\[Analysis Period \]](#)

Start Time:

End Time:

Data Reference Time:

Real-Time

Options:

	Efficiency (%)	CO2 (Tonnes)		Yearly CO2 Totals (kTonnes)		Prev Day CO2 (T) shown as daily values	
	Actual	Prev Day	Benchmark	Current	Target		
[Gannet]	97,00	450	435	0,0	170	293 952	Persons Yearly CO2
[Shearwater]	95,23	888	750	0,0	290	29 319	TV on standby for yr
[Nelson]	95,36	2	719	0,0	223	66	TV on standby for yr
[Anasuria]	9,55	8	270	0,0	100	188 620	Kms driven by F1 car
[Curlew]	75,03	13	295	0,0	88	80	Boils of a full kettle
[Pierce]	90,18	398	400	1472101,6	165	13 095	TV on standby for yr
[Brent Bravo]	85,62	628	750	0,0	201	15 742 632	Kms driven by F1 car
[Brent Charlie]	93,53	791	750	0,0	205	19 755 750	Kms driven by F1 car
[Brent Delta]	88,23	616	730	0,0	205	403 510	Persons Yearly CO2
[Leman]	No Sample	0	450	0,0	192	0	Boils of a full kettle
[Sean]	96,40	190	45	0,0	72	4 752 438	Kms driven by F1 car
[Clipper]	97,46	446	500	0,0	118	104	Miles by 10000 large cars
[Draugen]	96,75	287	300	0,0	Pt Created	190 621	Persons Yearly CO2
[Ormen Lange]	99,54	113	80	0,0	Pt Created	1 057	Tumble dryer on for 1 yr

[\[Key \]](#) [\[Back \]](#) [\[Close \]](#)



Analysis Page

Energy & Efficiency Surveillance Analysis

File: EE SW_RESULTS.PDI

Ver: 1.1

Date: 30/10/2008

Shearwater:

Energy: (MW)

Energy Exported: 5403
 Energy Consumed: 138
 Energy Flared / Vented: 35

Efficiency: (%)

Energy Efficiency: 96.91
 Energy Intensity: 3.24
 Energy Wasted: 0.62

Emissions: (Tonnes CO2/day)

Total: 836
 Fuel Gas: 455.3
 LP Flare: 131.4
 HP Flare: 263.6

Flaring: (m3/d)

Stripping Gas: 4172
 LP Flare: 63803
 HP Flare: 132230

Generation: (MW)

	G8010	G8020	G8030	Total
Electrical Power Output:	5.71	0.00	5.70	11.52
Spinning Reserve:	2.77	0.00	2.76	5.52
Waste Heat Recovery:	3.67	0.00	3.48	7.32
Exhaust Heat:				104.8
Fuel Gas Power Used:	44	0	42	85.59

Compression:

	K2410	K2420	K2430	Total
Engine Power Output (MMW):	7.02	Calc Failed	6.81	13.92
Compressor Gas Power Used (MMW):	6.79	Calc Failed	6.25	13.45
Design Polytropic Efficiency (%):	75.29	No Data	76.02	
Actual Polytropic Efficiency (%):	62.66	No Data	70.64	
Recycle Valve Position (%):	-0.00	98.73	15.75	
Recycle Flow (Mn sm3/d):	0.00	No Data	1.12	

Power Users: (MW)

Export Compression: 13.92
 Condensate Export Pumps: 2.17
 Seawater Pumps: 1.80
 Cooling Medium Pumps: 1.22
 Heating Medium Pumps: 0.27
 Amine Pumps: 0.60
 Gas Compressors: 3.56
 Other Power Used: 0.86

Process KPI:

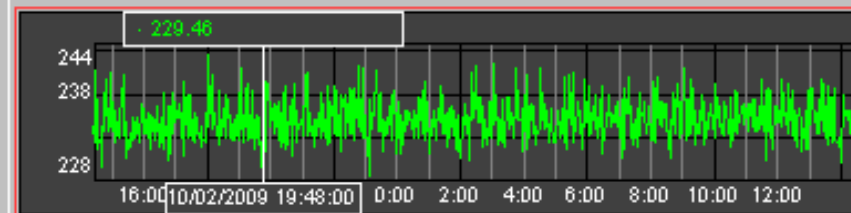
Gas Export: 8236 KSm³/D
 Condensate Export: 3422 Sm³/D
 Gas Import: 229 KSm³/D
 Fuel Gas Rate: 231000 Sm³/D

Tag Details:

[Clear]

Tag: Wepukpi4\SW_MTR1175
 Description: Current Imp Gas Stream 1 Std Vol Flow Rate
 Range: 0 - 44400 KSm³/D
 Comp: 0.5 KSm³/D (0.00113 %)

Data RefTime: 10/02/2009 19:48:00



Autoscale

Historic Mode

Real-Time

Current

[Multi-Tag Trend] [Back] [Close]



Screen Shots of examples of Screens

Energy & Efficiency - Fuel User Overview

File: **EE_FUELUSER_OVERVIEW.PH**
Ver: 1.1
Date: 30/10/2008

Nelson:

Power Generation:	G8000	G8001	G8002	G8003	G8004	Total
Electrical Power Output (MMW):	3.97	0.21	-0.02	4.31	3.94	12.42
Spinning Reserve (MMW):	1.84	0.00	0.20	1.81	1.72	5.57
Waste Heat Recovery (MMW):						
Exhaust Heat (MMW):						93.03
Fuel Gas Power Used (MMW):						
Thermal Efficiency (%):						

KPI:
Overall Energy Efficiency: 93.31 %
Energy Consumed: 130.6 MMW
Total Elec. Power Output: 12.4 MMW
Fuel Gas Rate: 8972 SM³/HR

[Analysis Period]

Start Time: 10/02/2009 14:18:16

End Time: 11/02/2009 14:18:16

Data Reference Time: Real-Time

Historic Mode

Real-Time

Options:

[Fuel Users]

[Major Electricity Users]

[Minor Electricity Users]

[Fuel User Trends]

[Maj. Elec. User Trends]

[Overview Trends]

[Analysis Display]

[User Display]

[Manual Data Entry]

[Multi-Tag Trend]

Export Compression: [Performance Monitor]

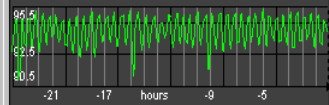
	K2011	K2021	K2031	Total
Engine Power Output (MMW):				22.85
Compressor Gas Power Used (MMW):	9.51	5.26	7.03	21.79
Design Polytropic Efficiency (%):	76.74	67.45	67.84	
Actual Polytropic Efficiency (%):	73.08	66.22	63.30	
Recycle Valve Position (%):	10.59	6.70	-0.01	
Recycle Flow (Mn sm ³ /d):	0.54	0.51	0.00	

Selected Tag Summary

11/02/2009 14:18:16

Tag: EE_ENGYEFF

Short-term rolling average energy efficiency in %
Range: 0. - 100. %
Min/Max/Avg: (0.00) 90.90 / 95.28 / 93.98



Energy & Efficiency - Major Electricity User Overview

File: **EE_MAJUSER_OVERVIEW.PH**
Ver: 1.1
Date: 30/10/2008

Nelson:

Process & Utilities:	Total
Power Used (MMW):	1.9

KPI:
Overall Energy Efficiency: 93.31 %
Energy Consumed: 130.6 MMW
Total Elec. Power Output: 12.4 MMW
Fuel Gas Rate: 9173 SM³/HR

[Analysis Period]

Start Time: 10/02/2009 14:19:31

End Time: 11/02/2009 14:19:31

Data Reference Time: Real-Time

Historic Mode

Real-Time

Options:

[Fuel Users]

[Major Electricity Users]

[Minor Electricity Users]

[Fuel User Trends]

[Maj. Elec. User Trends]

[Overview Trends]

[Analysis Display]

[User Display]

[Manual Data Entry]

[Multi-Tag Trend]

Prod. Water Injec. Booster Pumps: [Performance Monitor]

	PM4004	PM4005	Total
Power Used (MMW):	Calc Failed	0.8	0.8
Efficiency (%):			

Seawater Pumps:

	P4200	P4201	P4202	Total
Power Used (MMW):	1.0	0.0	0.9	1.8
Efficiency (%):				

Prod. Water Injec. HP Pumps: [Performance Monitor]

	PM3000	PM3001	Total
Power Used (MMW):	Calc Failed	4.2	4.3
Efficiency (%):			

Oil Export Pumps: [Performance Monitor]

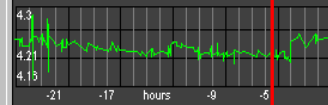
	P1030	P1031	P1032	Total
Power Used (MMW):	Calc Failed	3.3	Calc Failed	3.2
Efficiency (%):				

Selected Tag Summary

11/02/2009 14:19:51

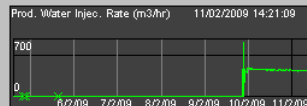
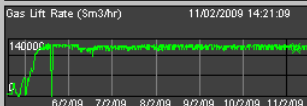
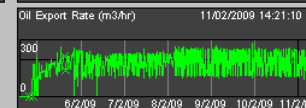
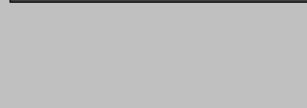
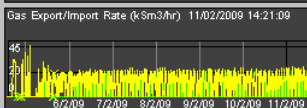
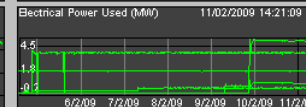
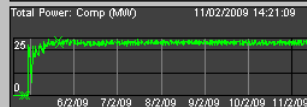
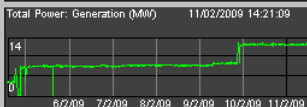
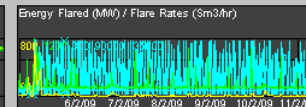
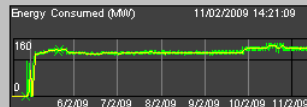
Tag: EE_PM3001_PWRUSED

Water Injection Pump B Power Used
Range: 0. - 5. MW
Min/Max/Avg: (0.0) 4.2 / 4.3 / 4.2



Overview Trends (Nelson)

File: **EE_OVERVIEW_TRENDS.PH**
Ver: 1.1
Date: 30/10/2008



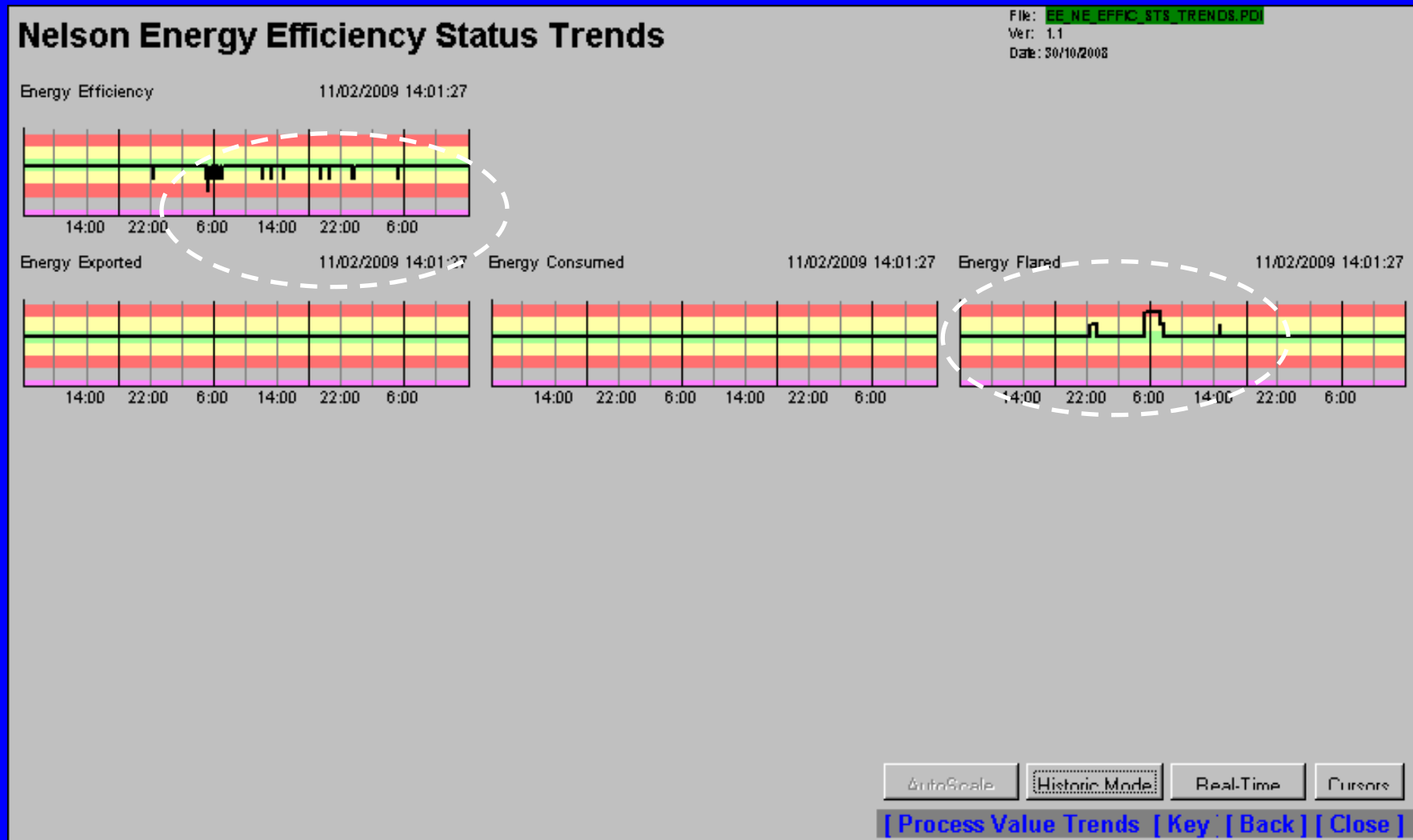
Autoscale Historic Mode Real-Time Cursors

[Last 7 Days] [Key] [Back] [Close]

Link to other "real time" performance monitoring tools (typ.)



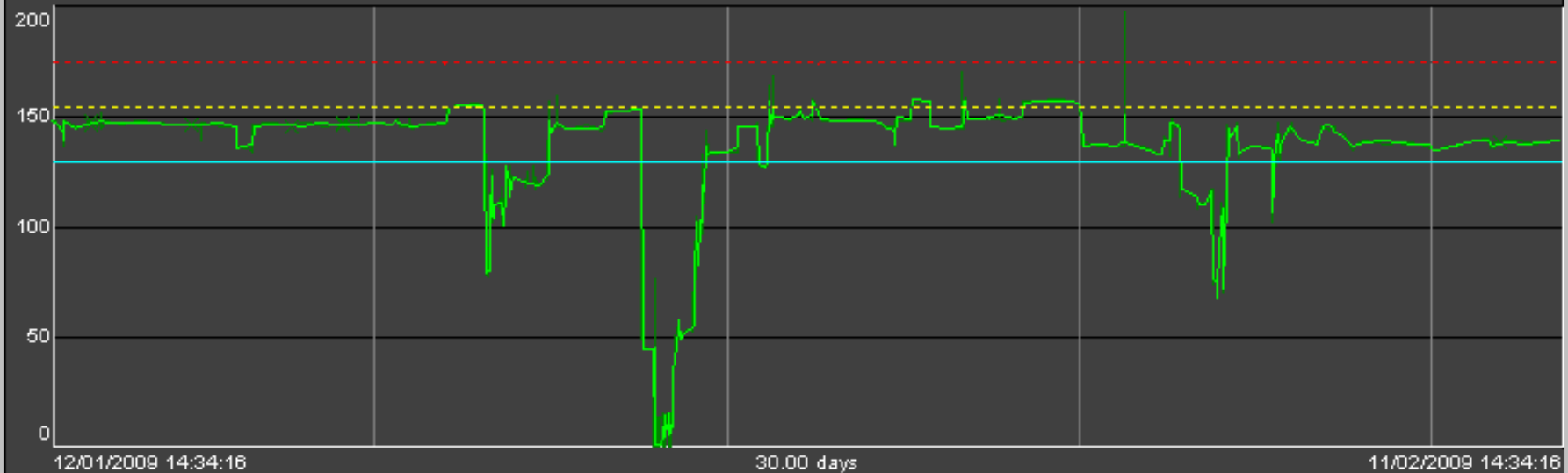
Status Summary indicator trend Page



Full Page Trend

Limit alarm on energy consumed

File: PA_ANALYSIS_TREND.PDI
Ver: 1.0.043
Date: 08/10/2008 14:38:27



Key:	Tag:	Description:	Data Summary:
P <input checked="" type="checkbox"/>	EEEnergyCons	Energy Consumed	Max: 197.62, Min: 0, Avg: 138.15 MW
F <input checked="" type="checkbox"/>	EEEnergyCons.Filt	Short-term rolling average energy consumed in MW	Max: 158.08, Min: 0.43, Avg: 138.14 MW
B <input checked="" type="checkbox"/>	EEEnergyCons.BM	Energy Consumed Benchmark	130 MW
S <input checked="" type="checkbox"/>	EEEnergyCons.Filt.S...	Limit alarm on energy consumed	LL: 0 L: 0 H: 155. HH: 175.
A <input type="checkbox"/>	EEEnergyCons.AVG	Rolling 3 days average - Click on the Settings button to change period	

[Key] [Back] [Close]



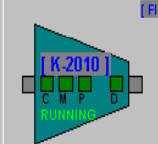
Screens for other real time Surveillance tools

Anasuria Compressor Performance Monitor

File: **CM_AN_OVERVIEW.PDI**
 Ver: 1.0.002
 Date: 19/12/2007 09:18:55

Key Performance Indicators:

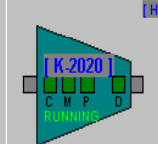
[Flash Gas Train]



Train Mechanical:
 Optimisation:
 Condition Monitoring:

Act Forward FlowCalc Failed M/s³/d
 Max Theoretical Calc: Failed M/s³/d

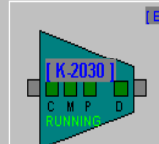
[HP Train]



Train Mechanical:
 Optimisation:
 Condition Monitoring:

Act Forward FlowCalc Failed M/s³/d
 Max Theoretical Flow: 0.08 M/s³/d

[Export Train]



Train Mechanical:
 Optimisation:
 Condition Monitoring:

Act Forward FlowCalc Failed M/s³/d
 Max Theoretical Flow: 0.01 M/s³/d

Analysis Period:
 Start Time: 11/02/2009 13:39:17
 End Time: 11/02/2009 14:39:17
 Data Reference Time: **Real-Time**

Options:

Event History:

Time	State	Description

Event Detail:

Compressor Monitoring Help

No event has been selected.
 Click on a row in the **Event History** to see possible corrective actions for that event.

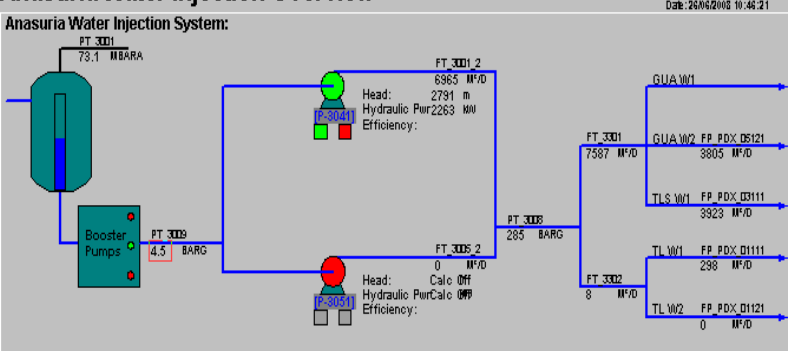
RTIME E: EPE PI Support T: 199 Last Mod:

[Key] [Back] [Close]

Anasuria Water Injection Overview

File: **PPI_AN_WI_OVERVIEW.PDI**
 Ver: 1.0.007
 Date: 26/06/2008 10:48:21

Anasuria Water Injection System:



Analysis Period:
 Start Time: 11/02/2009 13:41:17
 End Time: 11/02/2009 14:41:17
 Data Reference Time: **Real-Time**

Options:

Event History:

Time	State	Description

Event Detail:

RTIME Pump Performance Monitoring - Help

No event has been selected.
 Click on a row in the **Event History** to see possible corrective actions for that event.

[Key] [Back] [Close]



Energy Efficiency Surveillance Tool Quick Reference Guide

Asset Overview



Asset	Energy Summaries			CO2 Emissions		Energy Cost		SSI	Notes
	Energy Efficiency	Energy Intensity	Energy Wasted	Daily Total	Year To Date	Daily Total	Year To Date	Alarm OHOC	* Energy Intensity = Energy Consumed / Energy Exported
Nelson	91.05 95.0%	8.54 6.9	0.18 0.15	781 576	35,545	169,810 156,840	7,060,557	■ ■	Platform: Oil/gas export Gas lift + Produced water re-injection

- 1 - Navigation link to Nelson Home page.
- 2 - Yesterdays KPI totals
- 3 - Benchmark figures
- 4 - Alarm/Alert status summary indicator. Green = Normal Yellow = Alert Red = Alarm
- 5 - Out of normal operating condition status summary indicator. Green = Normal Yellow = Alert
- 6 - Brief platform description, added so like for like platform comparisons can be made.

Installation Overview



Energy Efficiency: (%) (Indicative) Energy Exported: 2345 MW Energy Consumed: 1328 MW Energy Flared: 6.2 MW Energy Efficiency: 94.99 Energy Intensity: 6.4 Energy Wasted: 0.36		Benchmark Average Estimated (Today): 93.95 Daily (Yesterday): 94.14 Cumulative (Year): 94.23
Electricity (MW): Generated: 13.31 Major Users: 11.07 Other users: 2.18 Compression (MM): Generated: 21.86 Used: 21.27		Daily (Yesterday): 94.27 Cumulative (Year): 94.27
CO2 Emissions: (Tonnes/d) (Indicative) Fuel Gas + LP Flare Gas + LLP Flare Gas + HP Flare Gas + Venting 843.8 + 5.2 + 3.3 + 4.2 + N/A = 856.5		Total Estimated (Today): 870 Daily (Yesterday): 867 Cumulative (Year): 86,682
Energy Cost: (\$M) (Indicative) Fuel Gas + Flare Gas + CO2 Emissions 54028 + 2399 + 9043 = 66470		Total Estimated (Today): 64000 Daily (Yesterday): 67760 Cumulative (Year): 6,741,094

- 1 - Main Efficiency KPI calculation using real time values.
- 2 - Alarm Status summary indicator (SSI), click on this to access the alarm status trends.
- 3 - Click on any data to create trend at bottom of page.

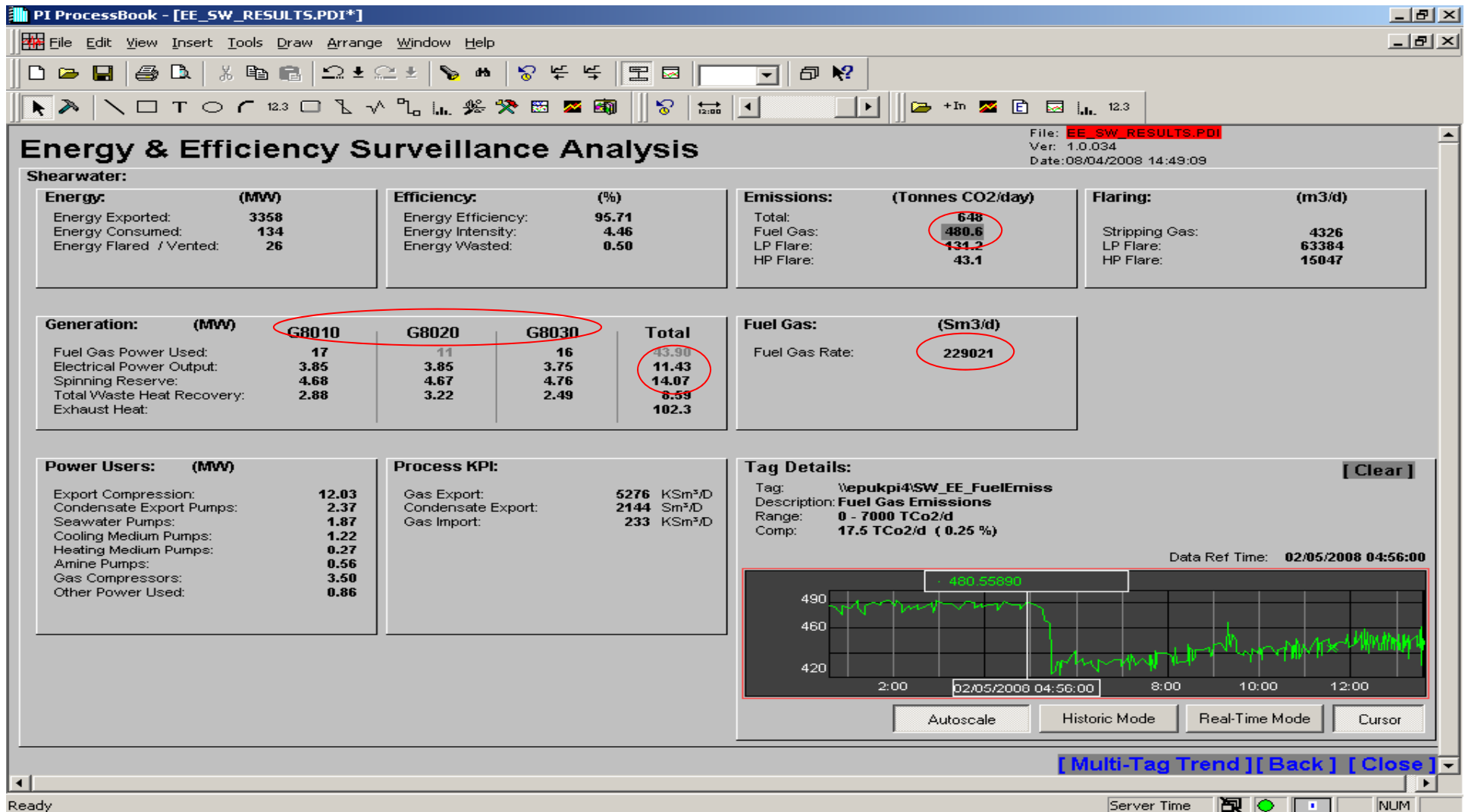


Using the Tool (Spinning Reserve)

Comparison between running with a large spinning reserve and not

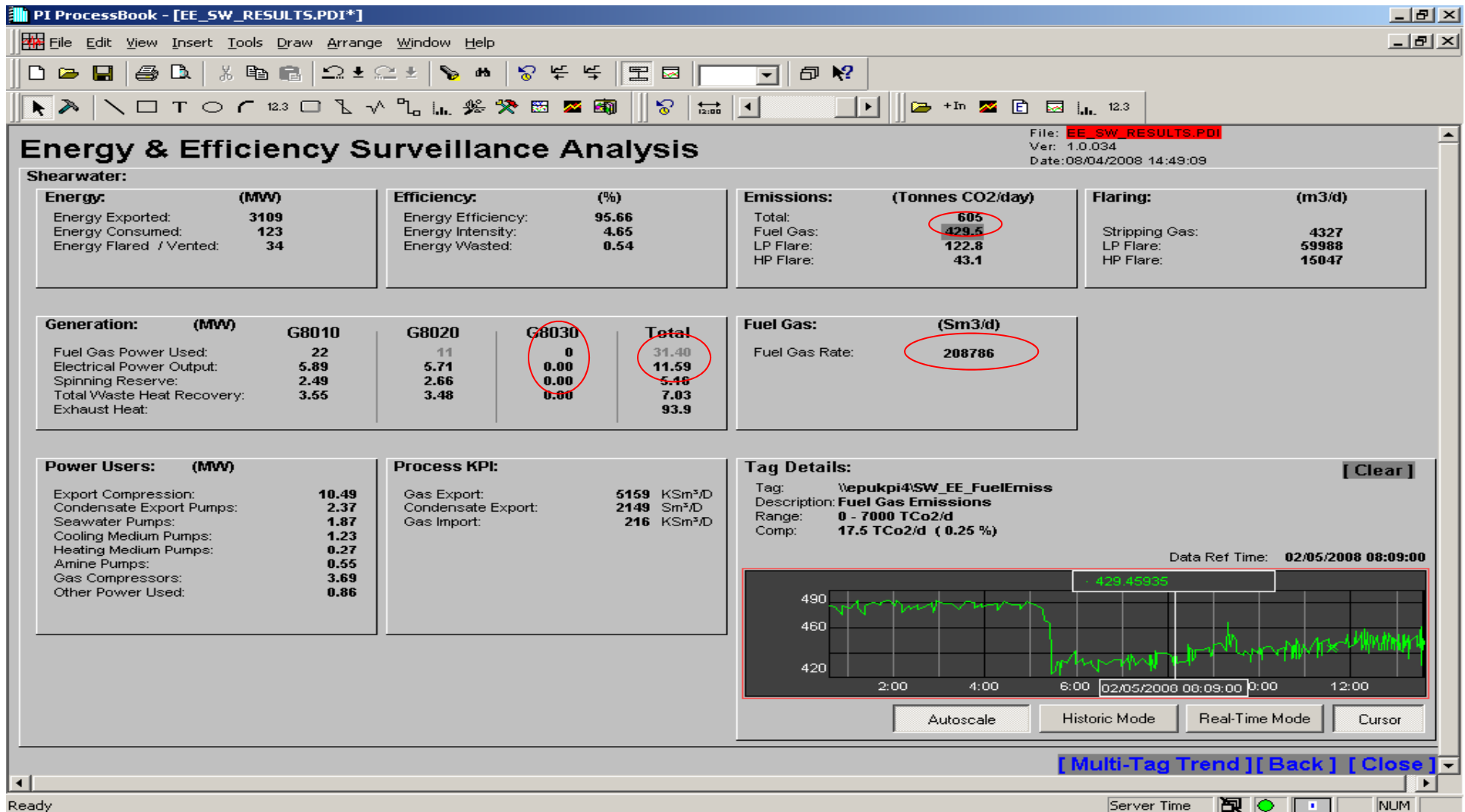
- *02 May 08 all three power turbines running at a specific installation, at approx 05:00 one turbine was shutdown dropping the spinning reserve from 14MW to 5 MW*
- *This in turn reduced the fuel gas Co2 emissions from approx 480 tCo2/day to 430 tCo2/day*
- *Also reduced fuel gas use rate from 229021 to 208786 Sm3/day*
- *See tool illustrations on the next slides....*





- Three power turbines running, electrical output of approx 3.8 MW each.
- Fuel gas rate 229021 sm³/day and Co₂ from fuel gas of 481 tonnes/day.
- Total spinning reserve 14 MW.





- Move cursor on trend across to point in time where the third generator has been shut down.
- Load on remaining two turbines 5.8 MW each, spinning reserve now 5.2 MW.
- Fuel gas rate reduced to 208768 sm3/day (20,253m3/day less) and Co2 from fuel gas reduced to 429.5 tonnes/day. (51 tonnes/day less)



Using the Tool (Passing valves)

- *The use of alarm/alert levels can inform the user of increased flaring and or fuel gas use*
- *The next slide shows the HP flare rate increase to above the alarm point*
- *Fault was traced to the fuel gas system*
- *Once this was repaired the normal background flare levels returned to below both alert and alarm points*

-See tool illustrations on the next slides....

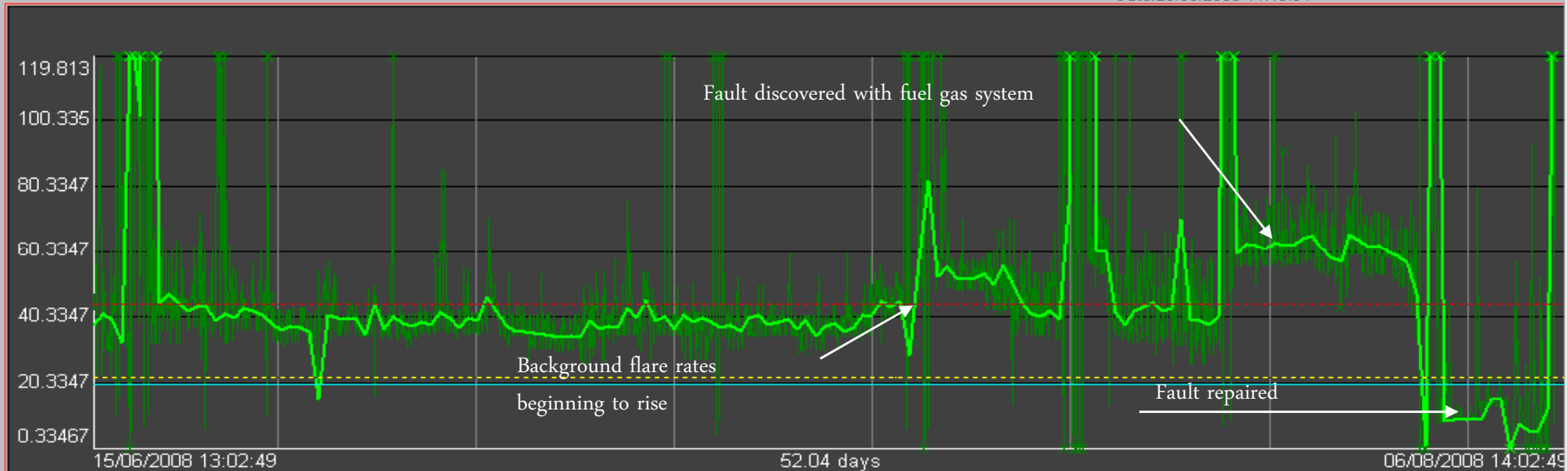


File Edit View Insert Tools Draw Arrange Window Help

12.3 12.3

Limit alarm on energy flared/vented

File: IPA_ANALYSIS_TREND.PDI
 Ver: 1.0.041
 Date: 29/08/2008 14:40:31



Key:	Tag:	Description:	Data Summary:
P <input checked="" type="checkbox"/>	EEEngyFlr	Total Flare Gas	Max: 2908.62, Min: 0.08, Avg: 51.86 MW
F <input checked="" type="checkbox"/>	EEEngyFlr.Filt	Short-term rolling average energy flared/vented in MW	Max: 499.76, Min: 0.09, Avg: 53.78 MW
B <input checked="" type="checkbox"/>	EEEngyFlr.BM	Total Flare Gas Benchmark	20 MW
S <input checked="" type="checkbox"/>	EEEngyFlr.Filt.ST...	Limit alarm on energy flared/vented	LL: 0 L: 0 H: 22. HH: 44.
A <input type="checkbox"/>	EEEngyFlr.AVG	Rolling 3 days average - Click on the Settings button to change period	

Redraw Hide Panel Settings Scaling AutoScale Historic Mode Real-Time Mode Cursors

[Key] [Back] [Close]



Background to Shell CO2 Benchmarking

- Shell Business Week 2006, Opening Address, Shell CEO Jeroen van der Veer

“To achieve 1st quartile status in energy efficiency and CO2 Emission in two-thirds of our facilities by 2015”.

- The Executive Committee of RDS requested businesses and Group CO2 to:
 - Understand our existing portfolio of emissions, future options and costs to mitigate
 - Assess the cost of CO2 mitigation for all new projects
 - Fully Comply with Existing Regulations and
 - Grow Organisational Competence
 - Provide a definition of 1st Quartile performance no later than July 2008.



The Shell CO2 Benchmarking Methodology

- The working principle of the benchmarking methodology is to compare the actual emissions with a Site Specific Standard Emission given for each facility. This is done by means of the Shell CO2 Efficiency Index:

$$\text{Shell CO2 Efficiency Index} = 100 \times (\text{Actual GHG Emissions} / \text{Site Specific Standard Emission})$$

- The approach used to determine the Site Specific Standard Emission equation combines elements of first principles (thermodynamics and fluid flow principles) to establish the relationships between key variables, and coefficients/constants that were derived empirically using operational data from Shell operated facilities.
- The justification for a Site Specific Standard Emission based system is the need to normalise the differences across different facilities and locations. The Site Specific Standard Emission predicts a value for CO2 emissions based on factors or conditions that are outside operational control – typical examples are reservoir pressure, water cut, contaminants.
- The facilities participating in the benchmarking are compared against each other on the basis of the Shell CO2 Efficiency Index and from the Index value the top quartile threshold is defined.



The Site Specific Standard Emission Building Blocks

What? (Site Specific Standard Emission Component)

Hydrocarbon export systems
(Compression & pumping)

Artificial lift systems
(Compression, ESPs, Beam Pumps)

Gas and Water re-injection
(Compression & pumping)

Gas conditioning systems

Thermal Enhanced Oil
Recovery

Baseload

Why? (Asset Differentiation addressed)

Field maturity
Fluid type
Distance to custody transfer

Field maturity
Reservoir characteristics

Secondary recovery
Produced gas disposal
Produced water disposal

Contaminated gas stripping

Steam Operations

Utilities & Miscellaneous load

How? (Parameter used to determine the Site Specific Standard Emission)

Production
Pressure
Water cut

Power consumption
Lift gas flow volume
Lift gas pressure

Gas volume injected
Water volume injected
Pressure

CO₂/H₂S removed

Oil Steam Ratio
Heat Recovery

Fixed value

