



Best Practice Sharing Award

**ชื่อโครงการ : Improving F-1751 efficiency by
online chemical cleaning**

**บริษัท : PTT Global Chemical Public Company
Limited
Branch 6: Refinery**


คณะทำงาน

1.Nattapong Po.

2.Piyachai B.

3.Wasan K.




1. Key Word (Taxonomy)


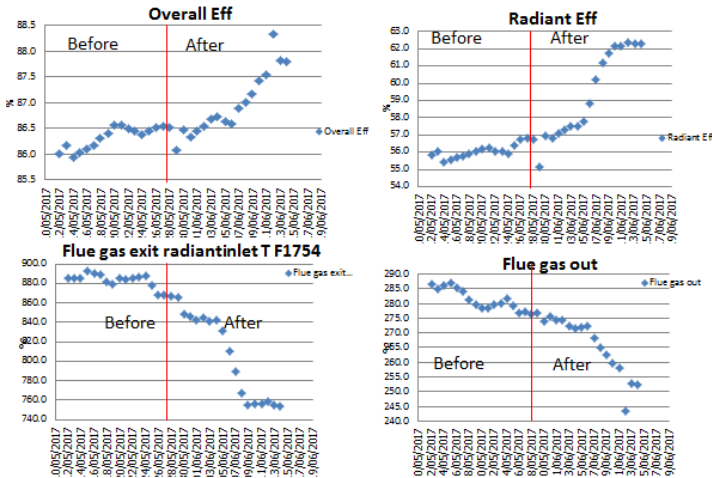
Project Type	<p>Please select the 6 Key word from the attached file below.</p>  <p>Key word.xls</p>
Business Line	
Operational Function	
Operational Unit	
Equipment Type	
Product Group	

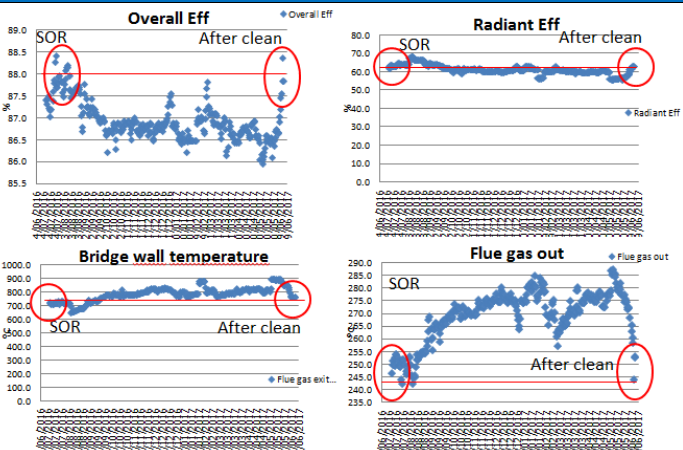
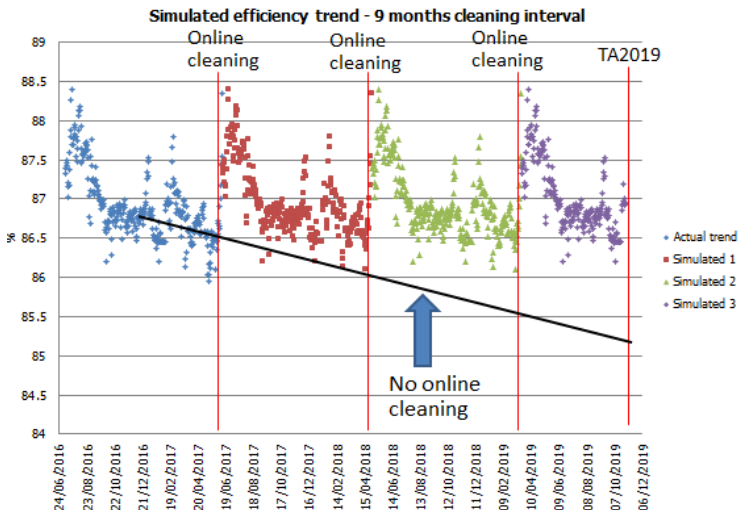
2. Project Details

No.	Title	Details
1	Project Name*	(English*) Improving F-1751 efficiency by online chemical cleaning
2	Objective*	To apply online chemical cleaning technique in order to improve F-1751 efficiency
3	Executive Summary*	After nine months of fuel oil introduction, the fuel efficiency of F-1751 had declined to the point where fuel oil firing might be no longer economical. To allows fuel oil firing throughtout turnaround cycle, online chemical cleaning was successfully performed in June 2017 under the supervision of plant technical and plant operation divisions.
3.1	Executive Details	<p>Simulated trend of F-1751 efficiency throughtout turnaround cycle.</p> <p>Every time online cleaning is performed, F-1751 is likely to return to SOR conditions.</p>
4	Procedures*	<p>Why online chemical cleaning is required and how it is performed?</p> <p>It is a recommended practice for oil-fired furnaces to regularly perform online chemical cleaning every 9-18 months (as per UOP). There are many advantages of online chemical cleaning, see examples as follows.</p> <ol style="list-style-type: none"> 1. Fuel efficiency improvement 2. Prevent bridgwall temperature to exceed its limit 3. Reduced firebox pressure as convection and air preheating section can be efficiently cleaned. 4. Etc.

No.	Title	Details
		<p style="text-align: center;">Overall Eff</p> <p style="text-align: center;">Figure 1 Overall efficiency decline after 9 months of fuel oil firing (F-1751)</p> <p>F-1751 as one of oil-fired furnaces in PTTGC6 is no exception. Figure 1 shows the rapid decline in overall efficiency of F-1751 since fuel oil introduction on 5th August 2017. The characteristics of F-1751 during fuel oil firing period can be summarized as follows</p> <ol style="list-style-type: none"> 1. Better fuel efficiency once switching from 100% RFG to dual-firing then rapidly fell. 2. Rapid decline (first 100 days) . 3. Gradual decline (after 100 days) 4. Poorer efficiency in the long run <p>Eventually, the fuel efficiency had declined to the point where fuel oil firing might be no longer economical in May 2017. The mutual decision was made by plant technical and plant operation divisions to temporarily stopped fuel oil firing on 12th May 2017 for online chemical cleaning. After a month of clarification and preparation, the cleaning program started on 29th May 2017. The cleaning procedure can be described as follows</p> <ol style="list-style-type: none"> 1. Magnesium nitrate-based chemical is injected at flame centers via observation window during the first 7 days to soften soot deposits on radiant tubes.

No.	Title	Details
		<div>  </div> <p>Figure 2 Chemical injection via observation windows</p> <p>2. Steam blowing (MPS) of radiant section (5 days)</p> <div>  </div> <p>Figure 3 Radiant section cleaning by MPS blowing</p> <p>3. Steam blowing (MPS) of convection section (2 days)</p> <div>  </div> <p>Figure 4 Convection section cleaning by MPS blowing</p> <p>4. Steam blowing (MPS) of air preheater (1 day)</p>

No.	Title	Details
		 <p>Figure 5 Air preheating section cleaning by MPS blowing</p> <p>During the execution phase, the work was performed by Technochem (contractor) under a supervision of plant operation division to ensure safe operation. Field operator as an activity coordinator was a key part of the success.</p>  <p>Figure 6 Collaboration between field operator and contractor</p> <p>Benefit evaluation</p> <p>After online chemical cleaning program (29th May -12th June 2017), the overall efficiency of F-1751 was significantly improved as demonstrated in Figure 7.</p>  <p>Figure 7 Efficiency improvement after online chemical cleaning</p>

No.	Title	Details
		 <p>Figure 8 F-1751 efficiency, SOR vs. after online chemical cleaning</p> <p>In summary, the online chemical cleaning successfully brang F-1751 to Start of Run (SOR) conditions (see Figure 8). Considering 9 months online chemical cleaning interval, the efficiency trend of F-1751 will be more or less like what shown in Figure 9.</p>  <p>Figure 9 Simulated trend of F-1751 efficiency throughout 2016-2019 cycle</p> <p>From the view point of operating cost, the cost of online chemical cleaning contribute only 1% of total operating cost (see Figure 10). For this reason, the cost of chemical cleaning can be neglected in economic justification considering the fact that online chemical cleaning would allow fuel oil firing of F-1751 until October 2019. The fuel margin will be as high as 2.76 million \$ if fuel oil is constantly used throughout turnaround cycle.</p>

No.	Title	Details																				
		<div><div><div>OPEX structure (dual firing)</div><div><div>Fuel cost</div><div>IPS cost</div><div>Chemical cleaning cost</div></div><div><div>4%</div><div>1%</div><div>95%</div></div></div><div>Figure 10 OPEX structure, F-1751</div><div>Optimization of online chemical cleaning interval</div><div><p>The total operating cost of F-1751 was evaluated to find the most optimal interval of online chemical cleaning. From Table 1, it can be concluded that the most optimal interval for online chemical cleaning considering references from other sites is 12 months.</p><table><tr><td>Cleaning frequency</td><td>months</td><td>6</td><td>9</td><td>12</td></tr><tr><td>Online chemical cleaning</td><td>time</td><td>5</td><td>3</td><td>2</td></tr><tr><td>No. of days with 100% fuel gas</td><td>Day</td><td>75</td><td>45</td><td>30</td></tr><tr><td>Total operating cost</td><td>M\$/cycle</td><td>14.07</td><td>13.94</td><td>13.92</td></tr></table><div>Table 1 Optimization of online chemical cleaning interval</div><p>The major factor contributing the operating cost of F-1751 is the frequency of on chemical cleaning. More frequent cleaning requires more days with 100% RFG (15 days/cleaning).</p><div>What’s next</div><p>Next online chemical cleaning will be in July 2018 (12 months interval). If F-1751 efficiency is successfully recovered, cleaning interval will be extended to 14 months (or more). The cleaning quality and fuel efficiency to be furthered analyzed to determine the most optimum interval.</p><div>Miscellaneous</div><p>In comparison with past operation, the effects of fuel oil firing to fuel efficiency seems to be worse than ever. This is due to the fact that all oil-fired furnaces were put on dual-firing mode. This operational mode is not recommended by UOP as it results in severe afterburning thus more soot deposition. Ideally, 100% fuel oil firing is preferred if fuel oil is economical.</p></div></div>	Cleaning frequency	months	6	9	12	Online chemical cleaning	time	5	3	2	No. of days with 100% fuel gas	Day	75	45	30	Total operating cost	M\$/cycle	14.07	13.94	13.92
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No.	Title	Details																						
5.1	Operation Duration*	start date: 29 th May 2017 end date : 12 th June 2017																						
5.2	Project Duration	N/A																						
6	Application*	Online chemical cleaning can be applied to furnaces which experience severe efficiency decline.																						
7	Investment (Mil.Baht)*	27,000 \$/time																						
8	Benefit*	Margin from fuel oil firing = 2.76 M\$/cycle (2016-2019)																						
9	Benefit Value(Mil.Baht/year)*	Margin from fuel oil firing = 2.76 M\$/cycle (2016-2019)																						
10	Benefit Value Calculation	Fuel oil firing margin																						
		<table><tr><td></td><td colspan="2">Mode</td><td colspan="2">Fuel margin, M\$/cycle</td></tr><tr><td></td><td>Fuel gas</td><td>Dual firing</td><td colspan="2"></td></tr><tr><td>Total operating cost, M\$/cycle</td><td>16.71</td><td>13.94</td><td colspan="2">2.76</td></tr></table>						Mode		Fuel margin, M\$/cycle			Fuel gas	Dual firing			Total operating cost, M\$/cycle	16.71	13.94	2.76				
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			Fuel gas	Dual firing																				
		Total operating cost, M\$/cycle	16.71	13.94	2.76																			
		- 04/08/2017 (first day of fuel oil firing) – 31/10/2019 (TA2019)																						
		- Major benefit is from fuel oil firing margin																						
		Cost assumptions																						
		- RFO cost = 195.8 \$/ton																						
		- RFG cost = 335 \$/tSRF																						
Calculation of interval optimization																								
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11	Apply From	F-1101 online chemical cleaning																						
12	Company	PTTGC6																						
13	Team member*	1.Nattapong Po. 2.Piyachai B. 3.Wasan K.																						
14	Contact Person*	Name : Nattapong Pongboot Phone: 1464																						

No.	Title	Details
		Email: Nattapong.Pongboot@pttgcgroup.com
15	Year Contest	2017
16	Project Type*	Operational Improvement
17	Business Line*	Refinery
18	OEMS Element	Operations
19	Operational Function*	Energy Management /Unit Performance Monitor
20	Operational Unit*	Hydrocracking
21	Equipment Type*	Furnace
22	Product Group	Naphtha/Jet fuel/Diesel
23	Community of Practice	PTT Group
24	People Tag Account	Nattapong Po <R-P1-TE/1464>; Piyachai B <R-P1-OP/1229> (Piyachai.B@pttgcgroup.com); Wasan K <R-P1-OP/1443>
25	People Tag Name	N/A
	OpEx Committee	รายชื่อคณะกรรมการของบริษัทนั้นๆ (Optional)
	OpEx Team	รายชื่อคณะทำงานของบริษัทนั้นๆ ที่ดำเนินการ Upload เอกสาร (Optional)

No.	Title	Details
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1. Support Information

1. F-1751 online chemical cleaning optimization



F-1751 online
cleaning frequency of