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# Control Loop Performance Monitoring AT Ras Gas, Qatar

Mayan Shah  
Applications Engineer

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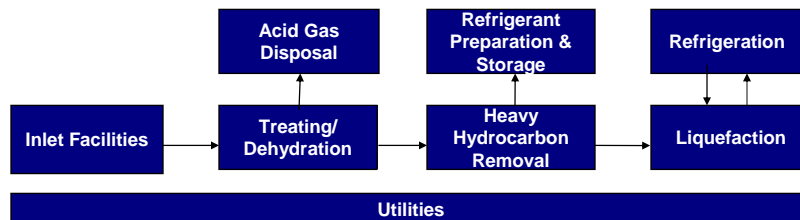
## The RasGas Environment

- ◆ High growth of operational complexity and capacity
- ◆ Increasing product portfolio volumes and diversity
  - ◆ LNG, Condensate, Flowing Gas, Helium, LPG's

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## Components of Onshore Facility



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## Common Plant Performance Issues –Control View

- ◆ Loops operating in manual or local
- ◆ Valve fully open or closed
- ◆ Different performance under different conditions -loop robustness
- ◆ Instability at any operating point
- ◆ Excessive valve maintenance / poor valve response
- ◆ Poor set point response
- ◆ Frequent operator interventions
- ◆ Poor load rejection
- ◆ Unexplained oscillations

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## Overview

### **Objectives**

#### A. Pre-requisite for APC Implementation

To keep regulatory loops responsive and optimised so that advanced controllers can do their job of optimisation against constraints.

#### B. Establish Benchmark AND KPIs TO:

- ◆ Define Baseline
- ◆ Identify Poor Performers
- ◆ Maintain Improvements

#### C. Help Optimize Regulatory Controls TO:

- ◆ Reduce Interactions / Disturbances
- ◆ Improve Robustness Over Controllable Range
- ◆ Maximize Benefits PRE-MPC Implementation at DCS LEVEL

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## KPI's for Control System Performance

- ◆ Control Loop Availability
  - % Time in Manual
  - % Time output at limit
  - % Time PV unavailable
  - % Time PV at limit
  - % noise in PV
  - Mode changes/shift
- ◆ Control Loop Performance
  - Integrated error –IAE, ISE, IE
  - Valve wear (travel and reversals)
  - Oscillation
    - % hysteresis & % stiction
    - % time in oscillation
    - % error vs operating point
  - Cross-correlation

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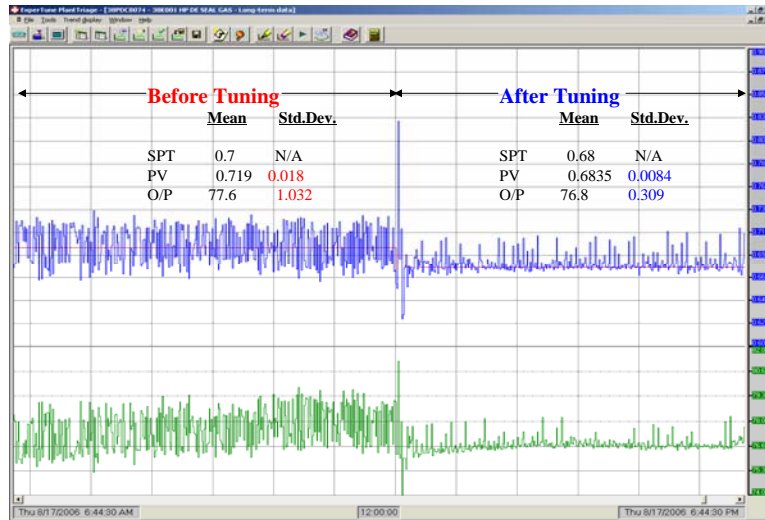


## Control Loops are Economic Assets ..

Train-3 Study shows that...

- ◆ 15% of control loops were oscillating.
- ◆ 33% had controller output at limit.
- ◆ 27% had excessive valve travel.
- ◆ 20% involved high variability.

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KPI Comparison before and after tuning



Key Performance	Before Tuning	After Tuning
Avg.% to Threshold	72.06	47.32
Variability – KPI	4.423	2.593
Variability - %T	147.4%	86.42%
Variability - %E	73.71%	43.21%
Avg.absolute Error – KPI	1.338	0.5325
Avg.absolute Error - %T	26.76%	10.65%
Avg.absolute Error - %E	13.38%	5.325%
Output Std.Deviation - KPI	0.8383	0.3103
Output Std.Deviation - %T	16.77%	6.206
Output Std.Deviation - %E	8.383%	3.103%
Valve Travel – KPI	34550	3448
Valve Travel - %T	138.2%	13.79%
Valve Travel - %E	69.1%	6.895%
Valve Reversal - KPI	25220	6726
Valve Reversal - %T	50.43%	13.45%
Valve Reversal - %E	25.22%	6.726%



## Improvements

### IDENTIFIED

- ◆ Normal Modes requirements
- ◆ Valve Travels and Reversals
- ◆ Variability



## LESSONS LEARNT

- ◆ **Project Execution**
  - ◆ Training
  - ◆ Project execution Team
  - ◆ Follow-up post-installation
- ◆ **Technical**
  - ◆ LNG experience
  - ◆ System Configuration issues



## Way forward

- ◆ Continuous Improvement of Control Loops prior to APC implementation
- ◆ Run and analyze reports regularly (Monthly)

### **Started developing Process Surveillance Monthly report to indicate**

- ◆ Top 10 Biggest Payback loops
- ◆ KPIs
- ◆ Roll-Out, Training and System Access
- ◆ Continuous Improvement Procedure



## Questions ??

## Thank you for your participation