International Conference on
Refining Challenges & Way Forward

Hydrogen Unit debottlenecking
– An Innovative Approach

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Need for Innovation

- Unit Capacity 49,000 MTPA (148.5 MTPD)
- Plant Commissioned In August 2005.
- Hydrogen availability low because of reduced throughput, impacting HSD Production

Issues –
- Low Pre-reformer temperature, close to hydration limits
- This required lower firing in bottom section of reformer, which in turn caused higher skin temperature in upper sections of the reformer.
Bottlenecks

Unit was revamped in 2008 to include CRU off gas as part of the feed. This helped to some extent to increase pre-reformer temperature.

Problem aggravated with switch over reformer feed from naphtha to natural gas, since the reformer firing reduced. There was a sharp drop in Pre-reformer temperature.

There were 5 tube failures, causing expensive shut down’s. Unit was operated at reduced throughput & tube max skin temperature limited to 945 deg C.
Possible solutions

Licensor suggested to augment heat transfer area in reformer convection section. This was not found feasible, due to space limitations in the unit & needed a major revamp.

Other Licensers suggested duct firing or a convective reformer. These were capital intensive & also needed higher energy consumption.
BPCL Innovation

The innovation emerged from the following thought process.

- Can we use steam superheat space for process pre-heat? or
- Can we augment process pre-heat instead of steam superheating to such a high degree, which was really not needed.

A closer look at the process revealed that part of lower temperature steam from feed heat exchanger can be exported directly, which would augment process pre-heat.

The concept was agreed by Process Licensor, who supported for finalizing the process Design.
Prereformer Temperature Profile

NHGU Prereformer Temperature Profile

N H G U  P r e r e fo r m e r  T e m p e r a t u r e  P r o file

% Catalyst Bed

N a p h th a  f e e d  c a s e  R L N G  +  C R U  o ff g a s  f e e d  c a s e
Steam Network
Post Modification –
Pre-reformer Bed Temperatures

![Graph showing temperature changes before and after modification for Naphtha Case, RLNG Case, and After Modification.]
Results Achieved

- Pre-reformer minimum bed temperature increased by 15 deg C & tube skin temperature dropped by 10 deg C

- Fuel reduction – 4 MT/D

- CRU off gas – No longer essential in the feed, thus unit load can be increased independently during CRU shut down.

- Unit rated capacity achieved with 962 deg C max skin temperature & natural gas feed.
The idea won BPCL Chairman’s award at Ideas 2011 Platform. This is the highest in-house award to nurture Innovation & Talent in the organization.
Thank you