ONGC experiences with Methane Leak Detection and Measurement Studies

The Global Methane Initiative Partnership-Wide Meeting

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Krakow
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Agenda

- ONGC measurement study results
  - 2008 study (Collaborative)
  - 2009 study (Collaborative)
  - 2011 study (In-house)
- Opportunities for ONGC
- Potential Projects
- Future Plan
- Conclusions
ONGC’s measurement study results

- USEPA and ONGC conducted four onsite measurement studies to assess key methane emission sources and potential mitigation measures (May 2008, Nov 2009)
- ONGC conducted thru’ its inhouse team at 24 production facilities in 2011 (as of Oct 2011)
ONGC’s measurement study results

In 2008 under USEPA-ONGC collaboration

Heera Platform
Uran Plant
Kalol in Ahmedabad Asset
Geleki in Assam Asset
Summary Results of Measurement Study, May 2008

- Total 16.3 million m³/year methane emissions

**URAN PLANT**
- 8,522 thousand m³/year
- 52 percent

**GELEKI - ASSAM**
- 3,272 thousand m³/year
- 20 percent

**HEERA PLATFORM**
- 4,061 thousand m³/year
- 25 percent

**KALOL - AHMEDABAD**
- 426 thousand m³/year
- 3 percent

- In cases where measurements not possible due to physical access limitations, experts estimated emission rates based on previous measurement experience
Summary Results of Measurement Study, May 2008

- Top 12 recommended methane recovery projects
  - generate Rs. 311 Lakhs/year from gas value
  - reduce methane emissions by up to 10.8 million m³/year

- Projects also
  - increase production
  - recover natural gas liquids
  - potentially have carbon value
  - use field-proven and commercially available methods implemented by other worldwide operators
Overall Methane Emissions by Source

- Compressors, storage tanks, and acid gas removal vents contribute over 80 percent of the 16.3 million m³/year.
Heera Platform Site Study Results

- Platform vent stack contributes over 60 percent of the 4.1 million m³/year methane emissions

**CENTRIFUGAL COMPRESSORS**
1,269 thousand m³/year
31 percent

**FUGITIVES**
251 thousand m³/year
6 percent

**VENT**
2,541 thousand m³/year
63 percent
# Heera Platform Emissions and Revenue Opportunities

<table>
<thead>
<tr>
<th>Emissions Source</th>
<th>Mitigation Option</th>
<th>Recoverable Methane (Rs./year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platform vents</td>
<td>Route vented emissions to vapor recovery unit</td>
<td>81 Lakhs</td>
</tr>
<tr>
<td>Wet seal oil degassing</td>
<td>Route vented emissions to vapor recovery unit</td>
<td>41 Lakhs</td>
</tr>
<tr>
<td>Equipment leaks</td>
<td>Conduct periodic leak survey and repair</td>
<td>8 Lakhs</td>
</tr>
</tbody>
</table>

- Payback range based on gas value: 0.2 to 1.4 years
Uran Plant Site Study Results

- Centrifugal compressor seals, fugitives, and storage tanks contribute 39 percent of the 8.5 million m³/year methane emissions

- **Centrifugal Compressor**: 1,830 thousand m³/year (21%)
- **Fugitives**: 9 thousand m³/year (<1%)
- **Stabilized Crude Tanks**: 268 thousand m³/year (3%)
- **Un-Stabilized Crude Tanks**: 1,207 thousand m³/year (14%)
- **Acid Gas Removal**: 5,208 thousand m³/year (62%)
# Uran Plant Emissions and Revenue Opportunities

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<th>Emissions Source</th>
<th>Mitigation Option</th>
<th>Recoverable Methane (Rs./year)</th>
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</thead>
<tbody>
<tr>
<td>Centrifugal compressor wet seal degassing</td>
<td>Replace wet seals with dry seals</td>
<td>56 Lakhs</td>
</tr>
<tr>
<td>Un-stabilized crude tank</td>
<td>Route vented emissions to vapor recovery unit</td>
<td>220 Lakhs (as per actual data)</td>
</tr>
<tr>
<td>Stabilized crude tank</td>
<td>Route vented emissions to vapor recovery unit</td>
<td>9 Lakhs</td>
</tr>
</tbody>
</table>

- Payback range based on gas value: 0.2 to 4.0 years
Kalol – Ahmedabad Site Study Results

- Storage tank, well, and other vents contribute over 85 percent of the 0.4 million m³/year methane emissions

- **Tank Vents**: 176 thousand m³/year, 42 percent
- **Reciprocating Compressor Rod Packing**: 4 thousand m³/year, 1 percent
- **Fugitives**: 52 thousand m³/year, 12 percent
- **Well Venting**: 66 thousand m³/year, 15 percent
- **Vents**: 128 thousand m³/year, 30 percent
## Kalol – Ahmedabad Emissions and Revenue Opportunities

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<thead>
<tr>
<th>Emissions Source</th>
<th>Mitigation Option</th>
<th>Recoverable Methane (Rs./year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent stacks</td>
<td>Route vented emissions to vapor recovery unit</td>
<td>6 Lakhs</td>
</tr>
<tr>
<td>Storage tanks</td>
<td>Route vented emissions to vapor recovery unit</td>
<td>5 Lakhs</td>
</tr>
<tr>
<td>Well venting</td>
<td>Install beam gas compressors</td>
<td>3 Lakhs</td>
</tr>
<tr>
<td>Equipment leaks</td>
<td>Conduct periodic leak survey and repair</td>
<td>2 Lakhs</td>
</tr>
</tbody>
</table>

- Payback range based on gas value: 4.1 to 8.7 years
Geleki - Assam Site Study Results

- Reciprocating compressor rod packing contributes 89 percent of the 3.3 million m³/year methane emissions.

**Reciprocating Compressor Rod Packing**
2,915 thousand m³/year
89 percent

**Tank Vents**
227 thousand m³/year
7 percent

**Fugitive Emissions**
130 thousand m³/year
4 percent
# Geleki - Assam Emissions and Revenue Opportunities

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<tr>
<th>Emissions Source</th>
<th>Mitigation Option</th>
<th>Recoverable Methane (Rs./year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reciprocating compressor rod packing</td>
<td>Early replacement of rod packing</td>
<td>55 Lakhs</td>
</tr>
<tr>
<td>Oil storage tanks</td>
<td>Route vented emissions to vapor recovery unit</td>
<td>4 Lakhs</td>
</tr>
<tr>
<td>Equipment leaks</td>
<td>Conduct periodic leak survey and repair</td>
<td>3 Lakhs</td>
</tr>
</tbody>
</table>

- Payback range based on gas value: 0.8 to 10 years
Summary Results of Measurement Study, Nov 2009

Installation covered:

1. CPF Gandhar
2. Offshore SH Complex
3. Hazira Gas Processing Complex
Over 2.74 million cubic meters (million m\(^3\)) / year identified for reduction

1. Reciprocating compressor rod packing emissions: 1.78 million m\(^3\)/year
2. Emissions from centrifugal compressor seal oil degassing vents: 0.4 million m\(^3\)/year
3. Tank vent emissions (measured and estimated): 0.35 million m\(^3\)/year
4. Emissions from leaking components: 0.2 million m\(^3\)/year
Mumbai Offshore SH Complex

Over 8.74 million cubic meters (million m$^3$) / year has been identified for capture

1. Vent emissions at 3.89 million m$^3$/year (represents emissions from 10" LP Surge Tank and Strip Gas vent)
2. Leaking components emissions at 3.87 million m$^3$/year
3. Centrifugal compressor seal oil degassing vent emissions at 0.98 million m$^3$/year
Hazira gas processing complex

Over 2.23 million cubic meters (million m³) / year identified for reduction

1. Reciprocating compressor rod packing emissions: 0.04 million m³/year
2. Leaking components emissions: 1.04 million m³/year
3. Glycol reboiler vent emissions: 0.15 million m³/year
Measurement study by in-house ONGC team

Total 26 facilities covered: (Dec 2010-Oct 2011)

- **Ahmedabad Asset: Six Installations**
  - Kallol- GGS IV, GGS VII, GGS VIII
  - Nawagam- GGS III & GCP
  - Jalora - GGS I

- **Mumbai Offshore:**
  - BHS Complex
  - Neelam Complex

- **Uran Plant**

- **Tripura asset: 4 Facilities**

- **Assam Asset: 13 Facilities**
## Emissions and Revenue Opportunities - BHS platform

<table>
<thead>
<tr>
<th>Source</th>
<th>Quantity (MMSCM/Year)</th>
<th>Suggested Mitigation Option</th>
<th>Revenue (Rs./year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment leaks</td>
<td>0.86</td>
<td>Conduct periodic leak survey and repair</td>
<td>27.5 Lakhs</td>
</tr>
<tr>
<td>Platform vents</td>
<td>4.6</td>
<td>Feasible technical solution reqd- e.g. use of screw compressor etc</td>
<td>147 Lakhs</td>
</tr>
</tbody>
</table>

*Gas value at 3200/thousand m3; assuming 100% mitigation*
## Emissions and Revenue Opportunities-Neelam Platform

<table>
<thead>
<tr>
<th>Source</th>
<th>Quantity (MMSCM/Year)</th>
<th>Suggested Mitigation Option</th>
<th>Revenue (Rs./year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment leaks</td>
<td>0.0074</td>
<td>Conduct periodic leak survey and repair</td>
<td>0.24 Lakhs</td>
</tr>
<tr>
<td>Vents</td>
<td>1.8</td>
<td>Recommend detailed engineering study for thro’ screw compressor</td>
<td>57 lakhs</td>
</tr>
</tbody>
</table>

*Gas value at 3200/thousand m3; assuming 100% mitigation*
### Emissions and Revenue Opportunities - AMD Asset

<table>
<thead>
<tr>
<th>Source</th>
<th>Quantity (MMSCM/Year)</th>
<th>Suggested Mitigation Option</th>
<th>Revenue (Rs./year)</th>
</tr>
</thead>
</table>
| Storage tanks (GGS VII, GGS IV, GGS III, GGS I) | 0.8                   | - Very Low Tank emission except GGS VIII.  
- Individual tank vapor mitigation not viable |                    |
| GGS VIII                            | 0.55 (Conservative)   | Vented emissions - vapor recovery unit/ejector system                                      | 24 Lakhs           |
| Equipment leaks                     | 0.21                  | Periodic leak survey based repair                                                          | 9.2 Lakhs          |

Gas value at 4400/thousand m3; assuming 100% mitigation
## Emissions and Revenue Opportunities- URAN Plant

<table>
<thead>
<tr>
<th>Source</th>
<th>Quantity (MMSCM/Year)</th>
<th>Suggested Mitigation Option</th>
<th>Revenue (Rs./year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment leaks</td>
<td>0.15</td>
<td>Conduct periodic leak survey and repair</td>
<td>5 Lakhs</td>
</tr>
<tr>
<td>Tank Vapour</td>
<td>3.3 (Per the actual data)</td>
<td>Vapor recovery unit rehabilitated and working</td>
<td>10crores*</td>
</tr>
</tbody>
</table>

Gas value at 3200/thousand m3; assuming 100% mitigation
*VAP production 8T/day; @Rs 40000/T
Emission Recovery Potential

- 7 installations - 30 MMSCM/Yr
- 9 installations –  9 MMSCM/Yr

(Emission from other 17 installations not incorporated)

Work yet to be undertaken at-
- More than 100 GGS & GCP
Measurements Study Equipments

Gas Find IR Camera

Turbine meter

Vent bags
Opportunities – Directed Inspection & Maintenance (DI&M)

- Methane leaks are invisible and often go unnoticed
- Directed Inspection & Maintenance
  - Periodic, directed surveys and measurement
  - Prioritize leaks for repair
  - Fix significant leaks that are cost-effective to repair

CONDUCT baseline survey

SCREEN and MEASURE leaks

FIX on the spot leaks

ESTIMATE repair cost, select repairs

DEVELOP a plan for future DI&M

REPORT savings
Achievements through DI&M

- 3.2 MMSCM (2008-09)
- 4.7 MMSCM (2009-10)

In 2011 there was no opportunities under DI&M practices
Opportunities - Reciprocating Compressors

- Reciprocating compressor rod packing impediments to sealing:
  - Dirt or foreign matter
  - Worn rod
  - Insufficient/too much lubrication
  - Packing cup out of tolerance

- Determine economic replacement by:
  - Determining new packing leak rate and monitoring increases
  - Determining replacement cost
  - Replacing when leak reduction pays pack cost

Geleki - Assam: Replace Reciprocating Compressor Rod Packing

Net First-year Costs: 44 Lakhs
Payback: **0.8 years**
Methane Savsg: **2,843 thousand m³/year** average
Opportunities - Centrifugal Compressors

- Centrifugal compressor wet seals emit methane at:
  - Seal face (small emissions)
  - Seal oil degassing sump (large emissions)
- Dry seals reduce emissions and operating costs
  - Series of rings create high pressure gas barrier
  - Eliminates need for seal oil barrier

**Uran Plant: Replace Centrifugal Compressor Wet Seals with Dry Seals**

Net First-year Costs: 119 Lakhs
Payback: 0.9 years
Methane Savings: 1,742 thousand m³/year
Methane saving potential projects in ONGC thro the use of VRU

1. Kallol CTF Complex Process tanks, Ahmedabad Asset
2. GGS VIII- Ahmedabad Asset
3. Uran: Already implemented
Future Plan

- To map all the production installations across ONGC for methane emissions and form a comprehensive fugitive emission inventory of ONGC.

- To incorporate appropriate technical interventions to reduce these emissions.

- Yearly monitoring.

- A system of yearly reporting of methane reductions
Conclusions

- **Opportunities exist for ONGC**
  - Evaluate and implement cost-effective projects
  - Seek to improve project economics through carbon markets
  - Dedicated methane emission identification and measurement team—building capacity
  - Gain recognition for efforts via promotion internally and to external stakeholders
  - Share learning and best practices with other Gas STAR companies (presentations, articles)
Thank you

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