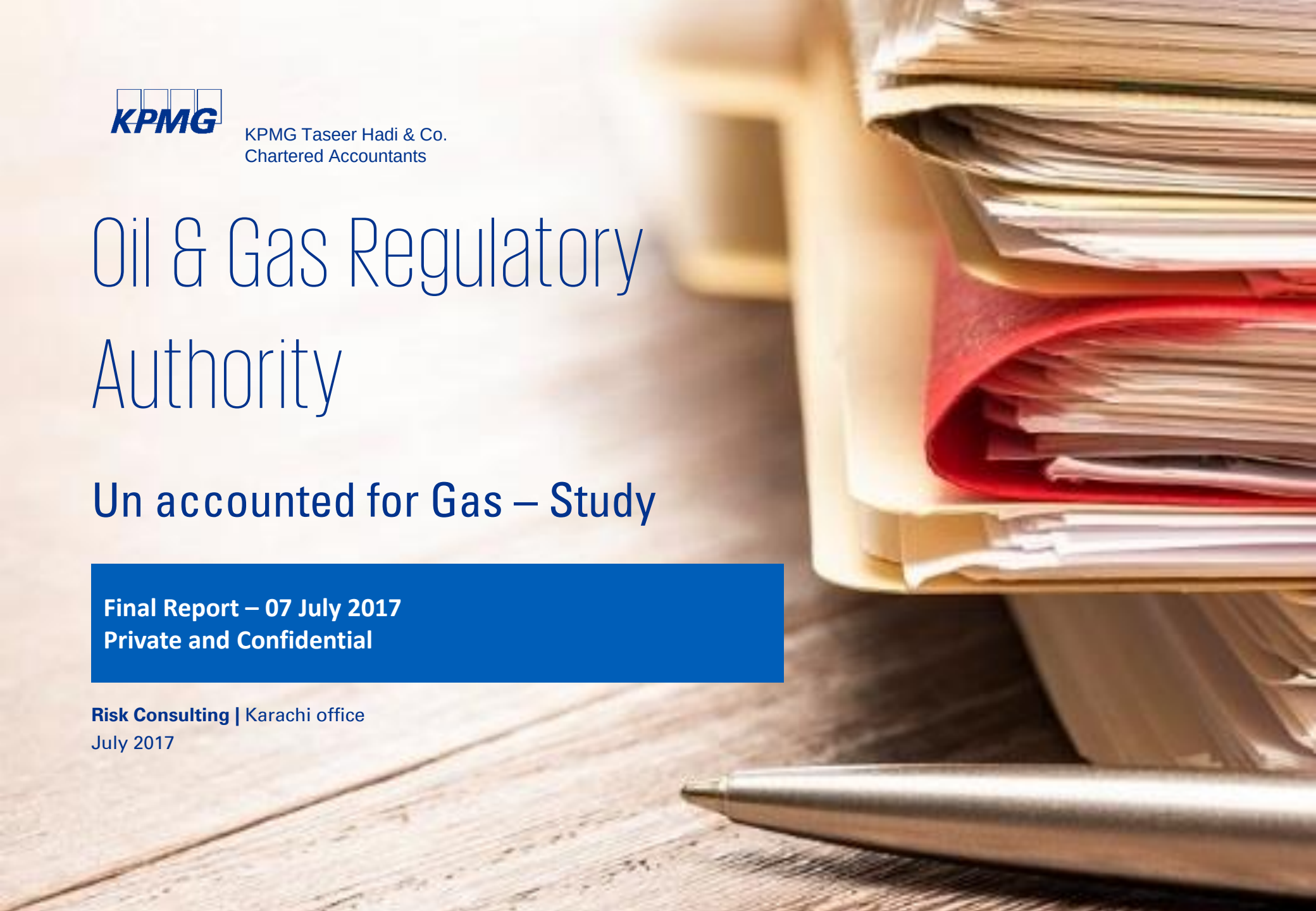

KPMG Taseer Hadi & Co.
Chartered Accountants

Oil & Gas Regulatory Authority

Un accounted for Gas – Study

Final Report – 07 July 2017
Private and Confidential

Risk Consulting | Karachi office
July 2017

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Our ref: KAS-SNH-690

Mr. Shahzad Iqbal,
Executive Director (Gas),
Oil and Gas Regulatory Authority,
Plot No 54-B, Fazl-e-Haq Road,
Blue Area, Islamabad,
Pakistan.

7 July 2017

Dear Sir,

Final – Unaccounted for Gas (UFG) study.

With reference to the tasks specified in our scope of work as per contract Ref. OGRA – 9(379)/201 dated 21 April 2016 (the Contract) to provide advisory services on determining UFG levels, we are pleased to enclose four (4) copies of the final version UFG Study.

Based on our contract, we compiled our 1st and 2nd draft report which was shared with Oil and Gas Regulatory Authority (OGRA, the Authority) and accordingly the Authority shared the draft report with the Sui Southern Gas Company Limited (SSGC) and Sui Northern Gas Pipeline Limited (SNGPL) to ensure factual accuracy of information contained in the draft report followed by public awareness sessions and feedbacks at large on the study. After discussions and analysis of the comments received we have made appropriate changes to our study and have finalized the document which is being submitted to you as final report.

It has been our privilege to have this opportunity to work with you and your team, and we would like to express our gratitude for the co-operation and courtesy extended to us by you, OGRA and teams of SSGC and SNGPL during the course of the engagement.

Yours sincerely,

_____

Rana Nadeem Akhtar

Partner

Encl.

Final UFG Study

Structure of Report

The report comprises of the following 3 sections:

Report Sections	Scope Elements
Section 1 – Background and Situational Assessment This section provides a brief context of the UFG issue. We have endeavored to evaluate the existing UFG related practices of Sui Companies and OGRA in the light of international better practices, as applicable in demographics and dynamics of Pakistan. We have assessed the UFG contributing factors[1] to form basis of our recommendations and proposed way forward as discussed in section 2 and 3 of the report respectively.	• Identify the bulk consumers in both gas companies with their respective volumes, inline with the international practices. • International best practices adopted for treatment of theft by non registered consumers. • Preparation of methodology for treatment of theft volume in the UFG computation as well as what actions would be required by the companies to qualify for such volumes. • Suggest appropriate way forward for quantification and treatment of Law & Order affected areas and define prerequisites to qualify for law and order volumes. • Suggest whether there is a justification to consider allowance in UFG for volume against minimum billing claimed by the gas companies. • Devise a mechanism to stream line the Btu equivalence issue in case of third party access and treatment of third party gas volume for calculation of UFG.
Section 2 – Our Recommendations This section of the report highlights our recommendations in relation to UFG control, calculation methodology and the UFG Allowance. Further, we have endeavored to highlight the impact that our recommendations will have on Sui Companies.	• Suggest methodology for calculating UFG in the light of present practice, definition as per rules and international practices applicable. • Develop rationalized overall benchmark for UFG, in natural gas sector/ development of a formula to calculate UFG on yearly basis. • Establish a formula to calculate the impact of volumetric shift in sales mix for calculation of UFG. • Elaborate international best practices as well as appropriate discounts for local operating conditions, with specific reference to countries with similar operating environment along with details of company's network / consumers in respective countries.
Section 3 – Way forward We have proposed a roadmap with specimen Key Monitoring Indicators (KMIs) to monitor the progress against UFG reduction plans and achievement of those KMIs has been linked with the UFG Allowance.	• Develop framework for incremental improvement in all areas/ components of UFG control. • A methodology / mechanism is to be devised for capping the volumes to be allowed (if any).

1 UFG Contributing factors refers to theft, measurement errors, pipelines leakages, effect of change in sales mix, minimum billing, gas losses law and order affected areas and other factors.

Abbreviations and Acronyms

AFS	Available for Sale
AGA	American Gas Association
Authority	Oil & Gas Regulatory Authority
BCF	Billion Cubic Feet
BTU	British Thermal Unit
CMS	Consumer Meter Station
CNG	Compressed Natural Gas
CP	Cathodic Protection
CPS	Cathodic Protection Stations
ECC	Economic Coordination Committee
ERGEG	European Regulators' Group for Electricity and Gas
EOI	Expression of Interest
ERR	Estimated Revenue Requirement
EVC	Electronic Volume Corrector
FIR	First Investigation Report
FRR	Final Revenue Requirement
GCV	Gross Calorific Value
GoP	Government of Pakistan
GPA	Gas Processing Association
GPRS	General Packet Radio Service
JMC	Joint Meter Check
KM	Kilo Meter
KMI	Key Monitoring Indicators
MMBTU	Million British Thermal Unit
MMCF	Million Cubic Feet
MP&NR	Ministry of Petroleum and Natural Resources
NGTR	Natural Gas Tariff Rules
NTSB	National Transportation Safety Board
OGRA	Oil and Gas Regulatory Authority
PDA	Price Determining Authority
PE	Polyethene/ane/yne
PGW	Philadelphia Gas Works
PRS	Pressure Reducing Station
PUC	Pennsylvania Utility Commission
PUG	Passing Unregistered Gas
RERR	Revised Estimated Revenue Requirement
RLNG	Re-gasified Liquefied Natural Gas
SMS	Sales Meter Station
SNGPL	Sui Northern Gas Pipeline Limited
SSGC	Sui Southern Gas Company Limited
Sui Companies	SSGC and SNGP
TBS	Town Border Station
TOR	Terms of Reference
YoY	Year-on-Year
3PLE	Triple Polyethylene

Content

KPMG

Executive Summary

Executive Summary - Working Towards a Better Solution

Background, History and Impact

- Gas losses or Unaccounted for Gas (UFG) has been a long standing challenge for both the Sui Companies and the Oil and Gas Regulatory Authority (OGRA, the Authority).
- The twofold mandate of Authority demands it to protect the public interest by respecting their rights and secondly requires it to enable a controlled and regulated environment for the utilities. OGRA has to make sure that good consumers are not penalized for menace created by illegal consumers and that adequate UFG control mechanism is implemented and appropriate UFG allowance is provided in the gas tariff.
- On the contrary, SSGC and SNGPL are coping up with several technical/operating challenges and susceptibilities viz. unfavorable operating conditions, expanding outreach coupled with vulnerable supply management, demographical challenges in terms of law and order discontents, low pace technical advancement – vis-à-vis network expansion – in terms of measuring capacities, theft identification and controlling leakages etc.
- Also, the Government with its socio-economic agenda intends to provide utilities to every individual in Pakistan. In this relation, Sui Companies are instructed time to time by the local and federal governments to expand their outreach where gas supply and its maintenance is not even commercially viable.
- All of these challenges are contributing factors to UFG. Further, weak and delayed legal recourse system has also exacerbated UFG situation. Over the past decade the actual UFG has swelled drastically. Gas losses are provided following in Fig. ES -1.

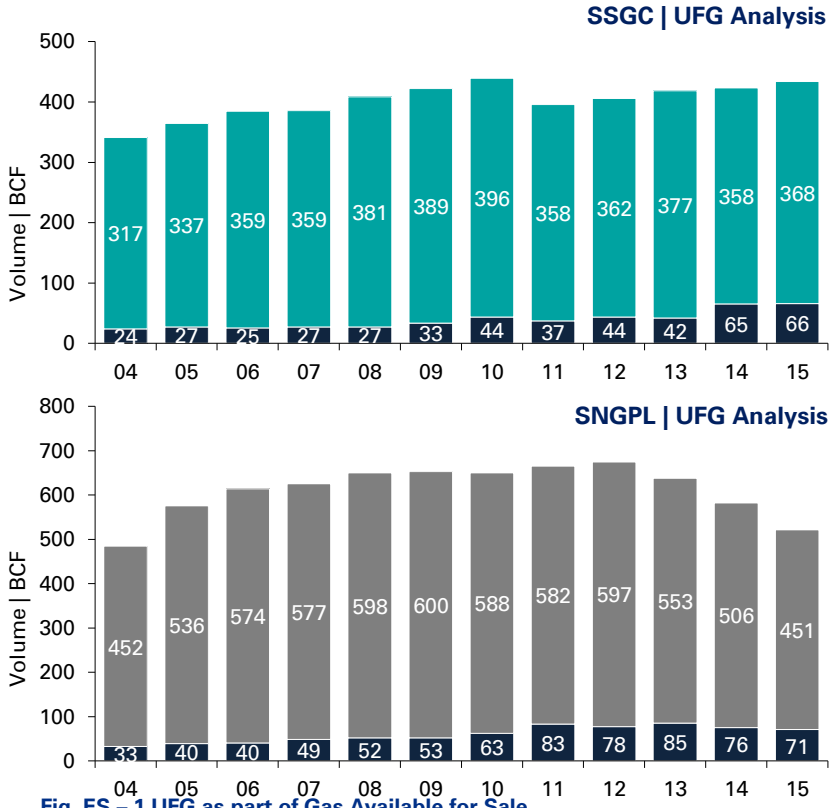
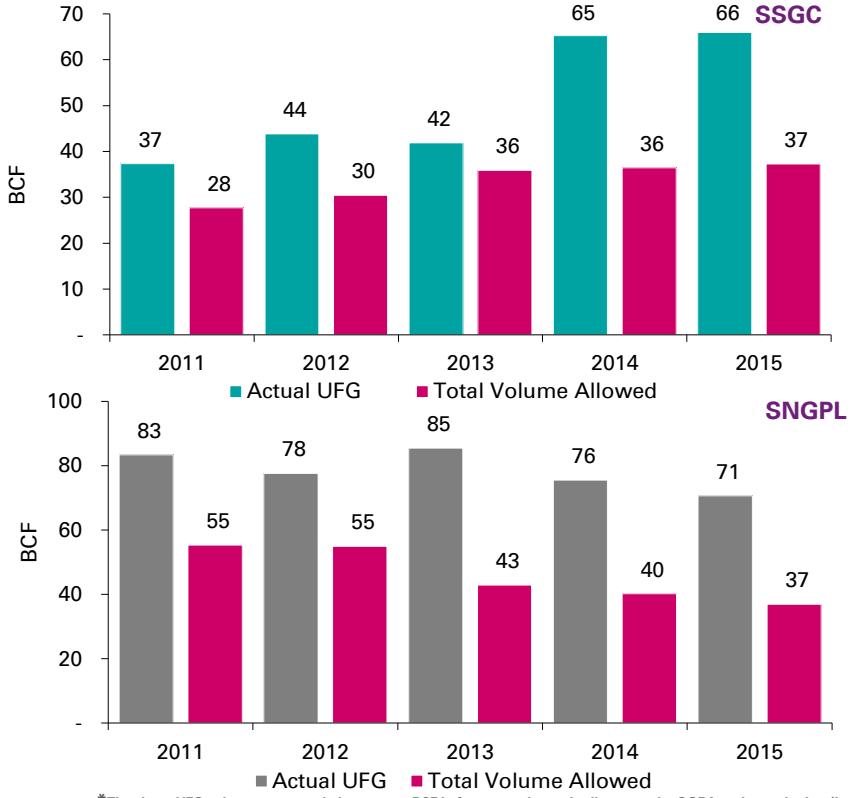


Fig. ES – 1 UFG as part of Gas Available for Sale.

*The above UFG volumes are rounded to nearest BCF before any volumetric allowances by OGRA as deemed sales. (i.e., Theft by non-consumer and law & order)

Executive Summary - Working Towards a Better Solution

- OGRA being cognizant of the increasing gas losses, associated financial & operational risk and impact on equity for both the Sui Companies, initially devised a three year incentive based schedule from year 2003-04 to reduce the UFG to 6.00%. UFG allowed by OGRA against Actual UFG is provided below:



*The above UFG volumes are rounded to nearest BCF before any volumetric allowances by OGRA as deemed sales. (i.e., Theft by non-consumer and law & order)

- To further comprehend this issue, UFG calculation formula applied by OGRA to calculate UFG needs to be understood.

UFG Calculation

- In line with the international better practices, UFG is calculated as the difference between the metered gas volume injected into the transmission and distribution network – Point of Dispatch (POD) – and the metered gas delivered to the end consumers at Consumer Meter Station (CMS) during a financial year.
- This is expressed as a percentage of the metered quantity of gas entering the network / Available for Sale (AFS). The formula used to calculate UFG is:

$$\mathbf{UFG\ \%} = \frac{\mathbf{(A - C) - B}}{\mathbf{A - C}}$$

Where,

A = gas received by the company (gas purchased) during a financial year;

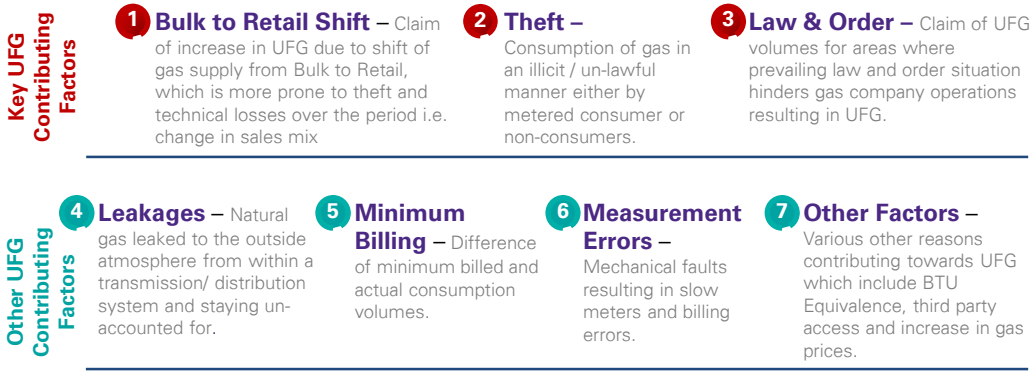
B = volume of natural gas metered as having been delivered by the licensee to its consumers (gas sold); and

C = metered natural gas used for self consumption.

- As discussed previously, gas losses are because of operational & technical challenges faced by the Sui Companies. These challenges are termed as the contributing factors to UFG. Fig ES-2 briefly describes these factors.

Executive Summary - Working Towards a Better Solution

Fig. ES-2 UFG Contributing Factors



- A study conducted by US Department of Energy concluded that: **"You can not manage what you do not measure. If you do not measure it, you can not improve it".**

- Internationally, measurement based mechanisms are used to regulate and control UFG as it is primarily associated with data and meter errors. The gas distribution companies globally have a measured and managed approach to gauge UFG with robust gas distribution networks where gas being transported is fully measured end to end.

- The existing measurement mechanisms at Sui Companies are not adequate enough to provide UFG details appropriately at contributing factors level. Sui companies are unable to determine the actual difference between the volume received and dispatched for a particular network segment.

- Accordingly, with the existing setup it is not possible to identify actual gas losses associated with each contributing factor in UFG.

- Sui Companies currently exhibit break up of UFG into contributing factors based on assumptions and estimates. We have endeavored to provide a formula to calculate UFG on yearly basis, including technical and local conditions component, as per our scope of work under the contract of the engagement and UFG definition given in NGTR, 2002 and applicable law.

- In line with our scope of services, we have devised a methodology for capping the UFG allowances, considering growth in natural gas sector, a balance between consumers & the Sui Companies and to maintain reasonable pressure on the Sui Companies to put due efforts to control these gas losses. This methodology includes introduction of framework with a model for incremental improvement in all areas/components of UFG control for the Sui Companies.

Executive Summary - Working Towards a Better Solution

Proposed Way-Forward

Model for incremental improvement for UFG control

- Interventions at strategic and operational levels of the Sui Companies are required for the resolution of UFG issue. Failure to control gas losses stems from the absence of a mindset that owns this problem and puts a cohesive and coordinated strategy to address the same.
- In this regard, UFG Control framework with an objective of *"Enhanced UFG Control"* is proposed.
- This framework requires improvement in the following four areas of the Sui Companies:
  - Network Measurement and Visibility;
  - Network Rehabilitation;
  - Theft Control; and
  - Research & Development.
- To better ensure implementation of the UFG control framework, the implementation is translated into a UFG Benchmark formula used for calculating UFG Allowance which is explained under the below caption.

UFG Benchmark and Control Formula

- We have proposed a two component formula for calculating UFG Allowance viz. Technical Component and Local Conditions Component.
- KPIs and KMIs have been devised in consultation with the leadership of Sui Companies and the Authority to achieve improvement in the identified four areas of UFG Control framework:
  - Network Measurement and Visibility;
  - Network Rehabilitation;
  - Theft Control; and
  - Research & Development
- All KPIs, together with their respective KMIs, are provided with scores aggregating to a total of 100%. The incentive factor enables additional relief of 2.6% for contributing factors representing local conditions, subject to the achievement of KMIs.
- Going forward, OGRA is suggested to monitor performance of Sui companies and achievement of KPIs vis-à-vis agreed KMIs periodically, at least annually especially before approval of Final Revenue Requirement (FRR).
- UFG control framework aims to bring year on year improvement in UFG levels. Albeit specific funds and resources will be required to achieve these KPIs and augment controls over UFG but the benefits expected to be derived in the form of reduced overall UFG levels will be exemplar.

Executive Summary - Working Towards a Better Solution

$$UFG = Volume \times (Rate1 + Rate2 \times \beta)$$

UFG Allowance = **GAS Volume Available for Sale** x (**Technical Component** + **Local Challenging Conditions Component** x **Performance Factor**)

Total UFG Allowance in volume for a financial year

Volume of Gas Available for Sale in a year.

Benchmark rate based on international practices for technical losses usually inherent to a gas supply network.

Finding comparable countries remained a challenge, however, based on nearest matches maximum allowance provided by regulators is 5% and we suggest the same to be applied by the Authority taking a moderate approach.

The study recognizes that Sui Companies have to operate under challenging conditions as compared to the world at large. Accordingly, Local Challenges allowance factor is suggested to cover impact of expanding network and making it more prone to theft, leakages, supply to law and order affected areas and data/meter errors. Accordingly we have evaluated impact of law and order effected areas and theft.

Allowance for these challenging conditions is suggested to be 2.6 % based on the past 5 years average allowance for local operating conditions.

β (Beta) denotes the cumulative efficiency score as determined by OGRA of Key Monitoring Indicators (KMIs) based on a mutually-agreed UFG control program for a financial year.

The allowance for the challenging conditions is made subject to ensuring adequate UFG control efforts are made by the Sui Companies.

Executive Summary - Working Towards a Better Solution

- For prior years, the Authority may issue directives to close the provisional FRRs as evaluating Sui Companies' performance against the proposed KMIs for those periods may not be practicable. FRR for FY 2017 may also be evaluated based on prevailing criteria due to the above mentioned reason.
- Further, to compute and evaluate ERRs in prospective years the Rate 2 may be taken at 50% and the same may be actualized in line with the achievement of proposed KMIs to evaluate respective FRRs on submission.
- UFG allowance under all circumstances shall not exceed the actual reported UFG.
- As mentioned our recommendations and advice shall not be construed as legal opinion and in any circumstances and shall not contradict or come in conflict with any court order or authority of competent jurisdiction.
- This Executive Summary shall not, in any respect, be considered as substitute of the report and shall be read in conjunction with our detailed report.

KPMG

Preamble

Preamble

Introduction

- Oil and Gas Regulatory Authority (the Authority, OGRA), with an intention to carry out an independent study for determining UFG Benchmarks/ targets for natural gas sector in Pakistan invited proposals vide advertisements dated 26 November 2015 titled "Selection of consultant firms for determining UFG Level".
- KPMG Taseer Hadi & Co. (KPMG, we, us, our) submitted the proposal through letter reference KAS-SNH-395, dated 30 December 2015 (our Proposal). After the due selection process, the Authority appointed KPMG as consultant for carrying out the Study for determining UFG level on the Terms of Reference (TORs) agreed under the Contract for Service dated 21 April 2016 reference: OGRA – 9(379)/2015 (the Contract).
- The key objectives of the proposed UFG study are to assist OGRA in regulating the UFG related matters for the gas utility companies i.e. Sui Southern Gas Company limited (SSGC) and Sui Northern Gas Pipelines Limited (SNGPL).

Scope of Services

Our scope of the work as per the Contract comprises of the following tasks:

To assist Oil and Gas Regulatory Authority for determining and fixing the UFG benchmark(s) for the gas utility companies i.e.. SNGPL and SSGCL for next five years and thereafter development of a formula to calculate UFG on yearly basis keeping in view all the relevant factors as well as international best practices. Based on the "Request for Expression of Interest" for selection of consultant firms for determining UFG level, the scope of the project covers the following:

Task 1: Rationalized Overall UFG benchmark

- Develop rationalized overall benchmark for UFG, in natural gas sector /development of a formula to calculate UFG on yearly basis, including fixed and variable parameters, as per relevant clauses of OGRA Ordinance and UFG definition given in NGTR and applicable law.

Task 2- International best practices

- The benchmark study must elaborate international best practices as well as appropriate discounts for local operating conditions, with specific reference to countries with similar operating environment along with details of company's network / consumers in respective countries. References on UFG Benchmarks prepared by other renowned regulators should be included along with their methodology adopted to calculate UFG disallowance, if any.

Preamble

Task 3: Factors Contributing UFG

Brief of some of the issues which are the contributing factors raised by the gas companies in the specific socio economic conditions and the required tasks identified by OGRA are as follows:

A. Shift of bulk sales to retail sales

- Identify the bulk consumers in both gas companies with their respective volumes, inline with the international practices.
- To establish a formula to calculate the impact of shift in sales mix i.e. from bulk to retail sales for calculation of UFG, inline with the international practices also indicate reference countries.

B. Theft

- International best practices adopted for treatment of theft by non registered consumers along with proper referencing vis-à-vis countries specific conditions.
- Preparation of methodology for treatment of theft volume in the UFG computation as well as what actions would be required by the companies to qualify for such volumes.

C. Law and order affected areas

- Suggest appropriate way forward for quantification and treatment of such volumes as part of UFG in line with the best international practices with specific references along with legal provisions vis-à-vis local conditions.
- Define pre- requisites to qualify for law and order volumes.

D. Minimum billing

- Whether there is a justification to consider allowance in UFG for volume against minimum billing claimed by the gas companies, giving references, if any keeping in view applicable legal provisions.

E. Formula for UFG calculation

- To suggest methodology of calculating UFG in the light of present practice, definition as per rules and international practices applicable.

F. BTU equivalence issue in case of third party access

- To devise a mechanism to streamline the above anomaly in line with the best international practices vis-à-vis local conditions.

G. Treatment of third party gas volume for calculation of UFG

- To suggest treatment of such gas volumes as per standard norm / best international practices.

Preamble

Task 4- Capping Volumes of allowable

- A methodology / mechanism is to be devised for capping the volumes to be allowed (if any) as mentioned in Task 3 (A), (B), (C), (D) above, with a view to create a balance between consumers and the licensees and to maintain reasonable pressure on the licensees to put due efforts to control these losses.

Task 5- Anticipated development in natural gas sector

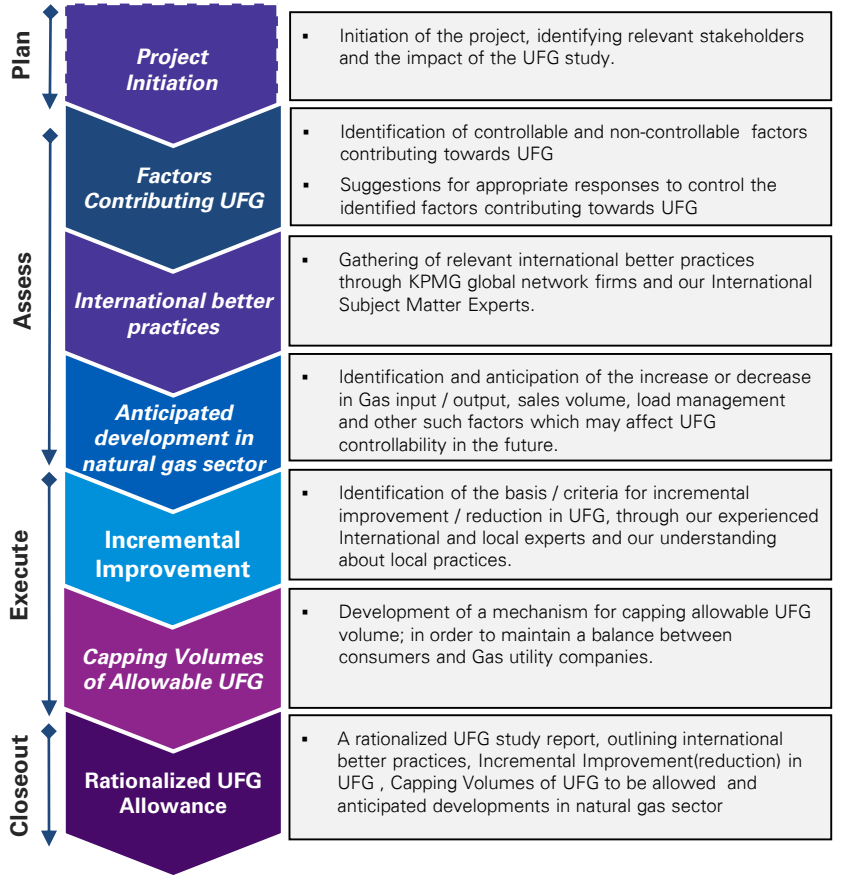
- The benchmark must also cater for anticipated development in natural gas sector, which may include increase in gas input due to indigenous gas discoveries, import of natural gas through interstate pipelines /LNG, increase / decrease in gas sales volumes, load management, and other such factors as per international best practices.

Task 6- Incremental Improvement

- Develop framework for incremental improvement in all areas/components of UFG control.

Our Approach

Our project approach as explained in our proposal is as follows:



Preamble

Work Done

In order to carry out our scope of work and in line with our work approach, we have performed the following steps:

- Performed walkthroughs for the relevant activities relating to UFG determination and quantification;
- Conducted meetings with the relevant key personnel at the Sui Companies to obtain understanding of the claims, major impediments and challenges faced by the companies in monitoring and controlling UFG (**details provided in Annexure D – Key Persons Interviewed**);
- Reviewed relevant information and documentation prepared and submitted by Sui Companies as supporting evidences and basis of our understanding of the business and operational model of the Sui Companies along with the regulatory and policy documents (**details provided in Annexure E – Key information/documents reviewed**);
- We regularly discussed and shared the progress and issues related to the engagement with focal persons and project committee at OGRA. The Authority was also updated using structured presentations at regular intervals.
- We also attended OGRA hearing in Karachi on SSGC petitions to augment our understanding on the subject and gather views of industry representatives.
- Subject matter experts were deployed and assessment was performed to determine the underlying causes of UFG and difficulties faced in their quantification and net impact on UFG disallowances.
- Reviewed reduction plans developed by Sui Companies and assessed the anticipated increase/decrease in Gas volumes, sales volume, load management and other such factors which may affect UFG controllability in the future.
- Reviewed the financial position of the Sui Companies to understand the impact of UFG disallowance at various levels.
- Visited company installations from TBS/DRS to CMS, meter plants and measurement teams for practical experience of the on field gas supply mechanisms.
- Accessed through our global network support, UFG management practices and related regulatory approaches to manage and control UFG levels in various international jurisdictions.
- Accompanied the SSGC theft control teams to observe procedure followed to detect theft by non-consumers.
- Developed a rationalized UFG calculation formula and proposed a structured UFG management & control strategy for the Sui Companies.

Standard Terms and Conditions and Terms of Contract

- This engagement is governed by the Contract and terms contained in it and our Standard Terms and Conditions as outlined in our Proposal.
- In case there is an overlap between any provision of the Contract and our Standard Terms and Conditions, provision of the Contract shall prevail.

Preamble

Duration of engagement

- This engagement was carried out from 22 April 2016 to 15 August 2016 and the data and information relevant for this study has been gathered during that period. We have not sought to update the data or information after that date.
- The data used for the analysis generally pertain to the period beginning 1 July 2010 and ending 30 Jun 2015, except as specified otherwise.

Use & Circulation of report

- This document has been prepared specifically to determine the UFG allowance for the gas utility companies to help the Authority regulate the UFG issue. Accordingly, this report should not be used for any other purpose.
- This document is confidential and for the internal use of its intended users. Therefore, circulation of this document should be restricted and should not to be distributed to any person other than those mentioned above. This report should not be referred to or quoted, in whole or in part, without our prior written consent except as specifically provided in terms and conditions of the Contract.

Notice to the Reader

- Reader to the report should take into account the limitations and notices mentioned at the end of the report.
- Also, the terminologies used in the report have specific meaning and accordingly are defined under the heading 'Specific terminologies used' at the end of the report.

KPMG

Section I –

Background and Situational Assessment

KPMG

Background

Background

Introduction

- In Pakistan, OGRA is the prime regulatory authority vested with the responsibility to regulate Natural Gas Sector in Pakistan. OGRA regulates the two natural gas transmission and distribution companies, SSGC in the south and SNGPL in the north.
- Key regulatory activities performed by OGRA are managing licensing for transmission and distribution of natural gas, advising the Federal Government on fixing the gas prices for consumers and regulating related matters.
- Gas is a public utility and accordingly its price is regulated based on the principle of cost reimbursement. Utility companies submit their tariff petitions to OGRA stating Revenue Requirements (Revenue required to meet the Costs to provide gas to the consumers) and claim for Rate Base (return on assets employed) as guaranteed in the licensing agreement with OGRA.
- On gas pricing OGRA is guided by Natural Gas Tariff Rules, 2002 (NGTR) issued under the OGRA Ordinance, 2002. Based on NGTR and tariff petitions submitted by utility companies, OGRA evaluates and decides the petitions by allowing the costs to supply gas and the guaranteed return. As a result upward or downward revisions are recorded to gas sale prices and are communicated to Federal Government for notification.
- One of the critical elements of price revision petitions is the allowance for UFG. It represents the value of normal portion out of the total UFG accepted by the authority to be included in the gas price.
- The term UFG is used in various forms by gas utility companies across the world in rate proceedings, filings, reviews, and related documents.
- Internationally, UFG generally refers to gas in a transmission and / or distribution system which the utility company cannot account for as usage or through appropriate adjustments. Adjustments are usually made for factors as variations in temperature, pressure, meter-reading cycles, or heat content; calculable losses from construction, purging, line breaks, etc., where specific data is available to allow reasonable calculation or estimate; or other similar factors.

Historical Perspective of UFG Allowance

- General underlying factors causing UFG have been pipeline leakages, measurement problems and theft. All these need focused management and control but these may, to a limited extent, be taken as un-controllable also.
- Un-controllability or inherent susceptibility of gas supply network to leakages and theft form the basis for UFG values to be allowed as a normal loss and included to the gas price. If disallowed, the loss will be borne by the utility company.

Background

- UFG allowance beyond normal and un-controllable values will result in unjustified price increase to be borne by consumers and authority needs to remain cognizant of such a situation. On the other hand if the gas companies are not allowed normal un-controllable UFG values these would fail to meet revenue requirements and may fail to survive in the long run. However, identifying and controlling UFG that is beyond normal and un-controllable values remains the responsibility of gas companies.
- In Pakistan, prior to establishment of OGRA in 2002, Price Determining Authority (PDA) as a practice fully allowed the claimed UFG values to be included in the gas price. At that time UFG levels were determined by gas companies around 7-8% of the total gas available for sale.
- In the year 2002, OGRA in its first determination of gas price accepted the then UFG level which was also around 8%. However, gas companies were required by OGRA to reduce UFG level to 6%, or less, in the next three years. This target was again revised in 2005 and OGRA required the gas companies to further reduce UFG level to 4% by 2012.
- UFG has been increasing from around 7% in FY 2002, 8% in FY 2008, 10% in FY 2011 and up to 15% in FY 2015 owing to various reasons and has now become a critical survival factor for the gas companies.
- In FY 2010, Sui Companies requested the Authority to relax the then allowable UFG level associating the increasing UFG levels to network expansion. OGRA appointed consultants to review and advice the allowable UFG levels for the Sui Companies. The study from the consultants could not be concluded and the Authority decided to continue with allowable UFG rate at 4.5%.
- Considering 4.5% allowable UFG as unjust, gas companies approached respective High Courts for a stay on the above stance of the Authority.
- The High Courts granted stay orders and directed the Authority to apply a provisional UFG rate of 7% to the price revisions petitions filed by the gas companies. However, for SNGPL the stay order was withdrawn for FY 2013 and onward petitions which were decided by the Authority using UFG allowance rate of 4.5%. For SSGC the stay order of Sind High Court has also lapsed during the year putting SSGC also to SNGPL's position.
- Beside approaching courts of law gas companies also approached the Government and presented their plea for providing policy guidelines as per the mandate of Federal Government under section 21 of OGRA Ordinance 2002. As a result, the Economic Coordination Committee of the Cabinet (ECC) provided policy guidelines against case reference No. ECC-154/25/2014 dated 20-11-2014 of Ministry of Petroleum and Natural Resources (MP&NR, the Ministry) (Refer Annexure K- ECC decision*)* advising OGRA to *provisionally allow* under following heads representing

Background

UFG volumes as deemed gas sales for the purposes of revenue requirements:

a. Volume pilfered by non-consumers, detected and determined by the companies in accordance with OGRA Procedure as provided in rule 30 of Natural Gas Licensing Rules 2002;

b. Volumes consumed in law & order affected areas; and

c. Impact of change in Sales mix on UFG, using the base year 2003-04.

- ECC also required that UFG Study, as required under clause 21.1 of Licensing Conditions applicable to the gas companies, should be completed as soon as possible. As per the ECC guidelines above, the authority was expected to provisionally allow UFG volumes till the said UFG Study is completed.

- Following the ECC guidelines OGRA partially allowed for a. and b. above but did not consider the impact of c. while deciding the price revision petitions for the years 2013, 2014 and 2015. This partial allowance was in addition to the 7% UFG allowance as per the stay order of the High Court for SSGC and 4.5% for SNGPL. The following table illustrates the volume of activity and related UFG allowance by OGRA in the past 5 years:

A snap-shot of scale of activity and developments of Sui Companies is provided on the following page.

SSGC – UFG Profile *BCF*

	2012	2013	2014	2015	2016
Gas Available For Sale	406	418	423	434	468
Total UFG Volume Actual	44	42	65	66	71
Total UFG %age	10.8%	10.0%	15.4%	15.2%	15.2%
UFG Allowance @ 4.5%*	18.3	18.8	19.0	19.5	21.1
UFG Allowance for:					
- Theft by non-consumers					
- Law & order affected	2.0	6.6	6.8	6.9	6.9
Total Volume Allowed	20.3	25.4	25.8	26.4	28.0
Effective Allowance %age	4.9%	6.1%	6.1%	6.1%	6.0%

**The above UFG volumes are rounded to nearest BCF.
*Amended vide FRR 2016 - Sindh High Court Judgment dated 25 Nov 2016.

Source: SSGC FRR [FY 2012 – FY 2016]

SNGPL – UFG Profile *BCF*

	2012	2013	2014	2015	2016
Gas Available For Sale	675	638	582	522	506
Total UFG Volume Actual	78	85	76	71	60
Total UFG %age	11.6%	13.3%	13.1%	13.6%	11.8%
UFG Allowance @ 4.5%*	30.4	28.7	26.2	23.5	22.8
UFG Allowance for:					
- Theft by non-consumers					
- Law & order affected	8.7	14.2	14.0	13.5	13.3
Total Volume Allowed	39.1	42.9	40.2	37.0	36.1
Effective Allowance %age	5.8%	6.7%	6.9%	7.1%	7.1%

**The above UFG volumes are rounded to nearest BCF.
*Amended vide FRR 2013 – Para 8.6 Prior Period Adjustment

Source: SNGPL FRR [FY 2012 – FY 2016]

Snapshot of SSGC and SNGPL

SSGC	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gas Connections												
Domestic	1,713,153	1,766,839	1,837,495	1,920,098	2,045,957	2,127,593	2,219,138	2,338,853	2,460,494	2,546,619	2,618,806	2,683,024
Commercial	18,152	19,055	19,938	20,971	22,558	23,606	24,156	24,998	24,494	24,119	23,740	23,408
Industrial	2,638	2,795	2,978	3,184	3,561	3,801	3,863	4,042	4,129	4,119	4,156	4,153
Total Connections	1,733,943	1,788,689	1,860,411	1,944,253	2,072,076	2,155,000	2,247,157	2,367,893	2,489,117	2,574,857	2,646,702	2,710,585
Network Size (KMs)												
Transmission Network	2,980	2,943	3,062	3,290	3,309	3,320	3,320	3,337	3,401	3,490	3,551	3,551
Distribution Network	24,339	25,752	27,542	29,830	31,930	34,282	36,785	39,253	40,905	42,360	43,090	43,890
Total Network Size	27,319	28,695	30,604	33,120	35,239	37,602	40,105	42,590	44,306	45,850	46,641	47,441
Gas Available for Sale (MMCF)	341,033	364,689	384,356	385,846	408,484	422,387	439,341	395,779	405,737	418,396	422,735	433,798
Gas Sales (MMCF)	318,068	337,638	353,869	351,994	377,372	384,522	388,828	360,012	364,409	373,645	353,904	362,510

SNGPL	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gas Connections												
Domestic	2,263,875	2,437,541	2,641,273	2,869,208	3,101,303	3,358,439	3,611,187	3,836,091	4,151,518	4,394,281	4,670,962	4,908,461
Commercial	38,842	41,358	43,919	45,925	49,176	52,242	54,631	55,877	55,906	56,212	53,957	47,913
Industrial	2,881	3,271	3,773	4,425	5,443	5,953	6,375	6,606	6,628	6,561	6,455	4,649
Total Connections	2,305,598	2,482,170	2,688,965	2,919,558	3,155,922	3,416,634	3,672,193	3,898,574	4,214,052	4,457,054	4,731,374	4,961,023
Network Size (KMs)												
Transmission Network	5,763	6,121	6,195	6,625	7,016	7,347	7,585	7,613	7,654	7,654	7,733	7,796
Distribution Network	38,258	42,192	46,964	52,394	59,951	67,449	75,653	81,828	87,796	93,646	95,855	97,300
Total Network Size	44,021	48,313	53,159	59,019	66,967	74,796	83,238	89,441	95,450	101,300	103,588	105,096
Gas Available for Sale (MMCF)	484,678	575,913	613,968	625,199	650,052	652,987	650,291	665,235	674,868	638,076	581,961	521,533
Gas Sales (MMCF)	451,959	536,382	573,387	576,628	598,361	585,316	587,163	581,901	597,283	552,621	506,423	450,843

KPMG

UFG Definition, Calculation and Methodology

UFG Definition

Unaccounted for Gas

- UFG in a fiscal year is the difference between gas available for sale and actual sales.
- According to NGTR, rule 2(m) "UFG means, *in respect of a financial year, the difference between the total volume of metered gas received by a licensee during that financial year and the volume of natural gas metered as having been delivered by the licensee to its consumers excluding therefrom metered natural gas used for self-consumption by the licensee for the purposes of its regulated activity; and such other quantity as may be allowed by the Authority for use by the licensee in the operation and maintenance of its regulated activity."*
- General underlying factors causing UFG have been pipeline leakages, measurement problems and theft. All these need focused management and control but these may, to a limited extent, be taken as un-controllable.
- UFG is technically linked to nature and size of the gas supply network and the quality of gas itself. Aging pipes are prone to leakages if not maintained, weak or faulty measurement equipment hamper accounting for the supplied gas and supply to densely populated or remote areas in domestic sector are susceptible to theft.

UFG defined in International jurisdictions

- We referred to the American Gas Association that defined UFG as:

  "the difference between the total gas available from all sources, and the total gas accounted for as sales, net of interchange, and company use. This difference includes leakage or other actual losses, discrepancies due to meter inaccuracies, variations of temperature and/or pressure, and other variants, particularly due to measurements being made at different times. In cycle billings, an amount of gas supply used but not billed as of the end of a period."
- Further, the Pennsylvanian Public Utility Commission has recommended the following UFG calculation methodology;

$$\text{UFG } \% = \frac{\text{Gas recieved} - \text{Gas delivered} - \text{Adjustments}}{\text{Gas received}}$$

- In addition to above, in Germany the UFG is calculated as the difference between the measured gas supplied in the grid and the gas billed to consumers, thus leaving the grid paid.
- In accordance with the Reconciliation Code of the New Zealand Gas Industry of 1 July 2000, UFG means the Long-term difference between the metered quantities of gas entering a transport system at a Receipt Point and the metered quantities of gas leaving the transport system at a Delivery Point, expressed as a percentage of the metered quantities of gas entering the transport system at the Receipt point.

UFG calculation

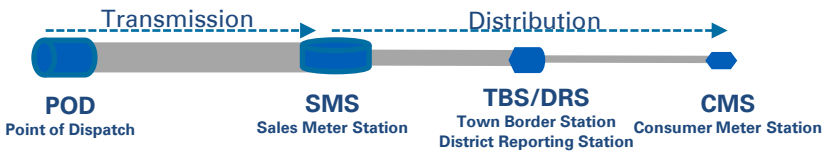
- Based on the above definition and our understanding of nomenclatures used at Sui Companies, UFG is the

UFG Calculation

difference between the metered gas volume injected into the transmission and distribution network – Point of Dispatch (POD) – and the metered gas delivered to the end consumers – Consumer Meter Station (CMS) – during a financial year.

Mathematically;

UFG = Gas received at POD – Gas delivered to CMS, adjusted for self consumptions and other adjustments allowed by the Authority.



- UFG is expressed as a percentage of the metered quantity of gas entering the network/ Available for Sale (AFS) and the formula used to calculate is:

$$\textbf{UFG \%} = \frac{\textbf{Gas Available for Sale – Gas sold}}{\textbf{Gas Available for Sale}}$$

Where;

Gas available for sale is the total gas purchased during the year less the metered natural gas used for self consumption by the licensee for the purpose of its regulated activity and such other quantity as may be allowed by the Authority for use by the Sui Companies in the operation and maintenance of its regulated activity. i.e..

$$\textbf{Gas}_{\textbf{available for sale}} = \textbf{Gas Purchased – Internal Consumption}$$

Gas sold is the metered quantity of gas delivered to the customer and gas volumes allowed by the Authority to be treated as deemed sales. Currently, OGRA allows volumes against law & order affected area, pilfered volumes and gas shrinkage.

SNGPL has contested the UFG calculation methodology based on the arguments that the existing formula for UFG calculation is not in accordance with the UFG definition stated in NGTR, 2002.

- We were provided with ***Annexure F*** – *Revision of Method for Calculating UFG* vide letter reference SGMD:113, dated 15 June 2016 where SNGPL has suggested the following formula (the proposed formula) for UFG calculation.

$$\textbf{UFG \%} = \frac{\textbf{(A – B) – C}}{\textbf{A}}$$

- Where, A is the gas received by the company (gas purchased) during a financial year and B is the volume of natural gas metered as having been delivered by the licensee to its consumers (gas sold), and C is the metered natural gas used for self consumption.
- The difference between current formula and the proposed formula is of denominator. SNGPL has proposed to use Gas Purchased as denominator for calculating UFG

UFG Methodology

Percentage instead of using 'Gas available for Sale'.

- Using the existing UFG calculation methodology, the percentage of UFG at SNGPL for the Year 2014-15 is 10.97% and by using the formula suggested by SNGPL, UFG for the said year will be 10.88%.
- This reflects a decrease of 0.09% in the UFG percentage as a result of the change in the UFG calculation formula.

Accounting Treatment for UFG

- Organizations involved in manufacturing and / or distribution activities suffer various types of losses during the production and or distribution processes. Some of these losses are inherent to the product / processes and are unavoidable, other types of losses might otherwise be avoided through various measures. As per the generally accepted accounting and costing principles these can be categorized into the following:
  - normal loss; and
  - abnormal loss.
- The inherent loss expected or anticipated prior to production in the processing operations is defined as a normal process loss. It is thus termed as a standard loss and accepted as unavoidable. Weight losses, shrinkage, evaporation, rusting etc. are the examples of normal loss. Normal loss is absorbed in the cost and thus increases the cost of production of the useable or saleable units of product manufactured or distributed.

Example working based on SNGPL FRR 2014-15

UFG through existing formula used by OGRA

$$UFG = \frac{\text{Gas available for sale} - \text{Gas Sold}}{\text{Gas available for sale}} \times 100$$

$$UFG = \frac{521{,}533 - 464{,}304}{521{,}533} \times 100$$

$$UFG = 10.97\%$$

UFG through SNGPL's recommended formula

$$UFG = \frac{(\text{Gas purchases} - \text{Gas sold}) - \text{Adjustments}}{\text{Gas purchases}} \times 100$$

$$UFG = \frac{(525{,}891 - 464{,}304) - 4{,}358}{525{,}891}$$

$$UFG = 10.88\%$$

*The above workings are based on Gas Sales reported in FRR after volumetric allowances as deemed sales.

UFG Methodology

- Abnormal process losses are caused by unexpected or abnormal conditions such as accidents, machine breakdowns, use of substandard material etc. as per generally accepted accounting principles abnormal loss is the loss which occurs over and above normal loss. Therefore, abnormal loss is also called an avoidable loss.
- These losses are segregated from process costs and investigated to prevent their occurrence in future. Abnormal loss is not absorbed in the cost of product manufactured or distributed.
- With regards to Sui Companies transmission activity is relatively loss free and almost all the UFG related losses relate to distribution activity.
- As stated earlier, underlying factors causing UFG related losses have been pipeline leakages, measurement problems and theft. All these need focused management and control but these may, to a limited extent, be taken as un-controllable also. Un-controllability or inherent susceptibility of gas supply network to leakages and theft form the base for UFG values to be allowed as a normal loss and included to the gas price.
- However, to what extent such losses are normal is the key to determining the benchmark UFG level. This can only be achieved if the entire supply throughout the distribution network is well measured enabling the gas companies to pin point losses geographically, further, quantify these losses into various contributing factors.
- As per applicable accounting principles, the gas companies should only be granted allowance for UFG contributing factors that are unavoidable as these form a part of the normal business activities and cannot be eliminated. The remainder should be disallowed and borne by gas company as a consequence of failure or inability to control the factors rendering gas to be un-accounted for.

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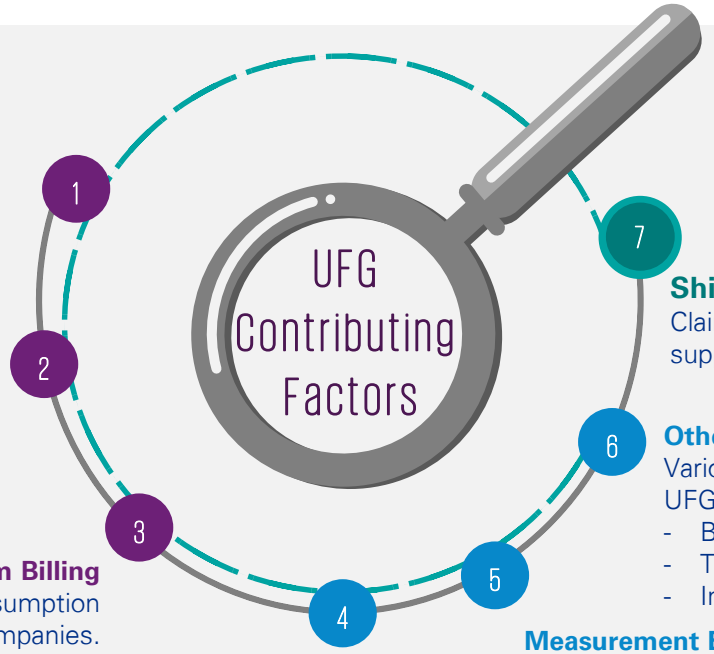
UFG Contributing Factors

UFG Contributing Factors

For the purpose of our study and in line with our scope of work we have endeavored to evaluate and analyze UFG contributing factors relating to Sui Companies in the context of current situation. We have attempted to understand and present the link between contributing factors and their impact on UFG levels. Following are the major contributing factors of gas lost and UFG.
We have presented the components which are globally accepted as UFG contributing factors along with their significance in UFG levels.



Theft
Theft of natural gas means use / consumption of gas in an unauthorized / un-lawful manner for which the user / consumer has neither been billed nor he has paid for such consumption.

Law & Order Affected Areas
Claim of UFG volumes for areas in which prevailing law and order situation hinders gas company operations resulting in UFG.

Minimum Billing
Difference of minimum billed and actual consumption volumes included in UFG claimed by the companies.

Leakages
Natural gas leaked to the outside atmosphere from within a transmission/ distribution system and staying un-accounted for.

Measurement Errors
Mechanical faults resulting in slow meters and billing errors, billing cycle

Others
Various other reasons contributing towards UFG which include, but are not limited to:
- BTU Equivalence
- Third party access
- Increase in gas prices

Shift of Bulk Sales to Retail
Claim of increase in UFG due to shift of gas supply from Bulk to Retail ratio over the period.

In the following pages, we have discussed these contributing factors and their impact on Sui Companies.

Contributing Factor 1 - Theft (Cont.)

Gas Theft

- Theft of natural gas is any unlawful / unauthorized use or consumption for which the consumer / user has neither been billed nor such consumption is paid for.
- In Pakistan, Natural gas theft has been a problem for Sui companies and is perceived to be forming a major portion of annual gas losses / UFG. Gas theft can be classified into two broad categories as follows:
  a. Gas theft by Registered Consumers; and
  b. Gas theft by Non-Consumers

- **Theft by registered consumers** is the unauthorized use of gas by consumers having registered connections of the Sui Companies. Theft by consumers generally occur due to meter tempering or by meter by-pass. While tempering with meters, leakages above and under ground may also occur.
- In such cases, the consumer is identified. Accordingly, theft volumes are estimated and charged to the consumer based on past consumption patterns.

- **Gas theft by non-consumers** is pilferage of gas by parties not registered on the company's network. In such cases mostly underground pipes are tempered with, to draw connections for pilferage of gas. Identification and quantification of theft is difficult and prone to estimation errors.

These individuals / organizations do not exist on Sui Companies billing records and are therefore difficult to identify and approach.

Theft – Causes and Concerns of Sui Companies

Continuous growth of distribution network

- Distribution of gas in retail sector to densely populated or remotely located areas is prone to theft. Underground gas infrastructure and the fact that gas is the cheapest domestic fuel make it more vulnerable to theft.
- Gas supply to domestic consumers by laying pipelines had remained on government's socio-economic agenda forcing the gas companies to supply gas in retail sector where theft is more likely and difficult to detect. Continuous expansion resulted in shift of consumer mix towards retail and theft also increased adding to UFG volumes.

Situation in gas producing areas

- People living in gas producing areas, especially in Balochistan have held the premise that they own the gas extracted from their land and are not supposed to pay for it. Accordingly, residents do not prefer metering and get illegal connections wherever possible and do not pay when billed.

Contributing Factor 1 - Theft (Cont.)

Countrywide moratorium

- Countrywide moratorium on new gas connections was enforced since FY 2011 because of decreasing availability of natural gas. Sui Companies had the concern that in certain areas people are willing to obtain legal connections and when refused they attempt to use illegal means to consume gas perceived as the cheapest available fuel.

Non availability of any law in the past

- Due to the absence of any anti gas theft legislation before FY 2011, controlling gas theft was difficult. Sui Companies were not able to take legal actions against gas pilferers which encouraged gas pilferers and multiplied incidents of gas theft. However, increasing UFG levels show that this concern even addressed has not made any positive impact.

OGRA Procedure for Dealing with Theft of Gas Cases

- OGRA formulated procedures in 2005 for dealing with gas theft cases, Refer Annexure H for details.
- This document provides guidelines for Sui Companies to deal with theft cases including:
  - Instances/ acts that amount to theft;
  - Various sources of information used to locate gas theft and its documentation;
  - Basis of suspicion of theft;
  - Course of action to be followed on theft detection;
  - Assessment of value of gas stolen; and
  - Procedure for recovery of gas
- Concerns have been raised by Sui Companies regarding certain clauses defined in the document. Sui Companies, accordingly filed an application in July 2013 for the review of the procedure for dealing with theft of gas cases requesting the Authority to allow them claiming recoveries of theft for the actual period of the crime and to amend the maximum time period fixed for booking recovery of theft cases which is maximum one year.
- The premise of the request was based on the fact that many a times recovery claims stay pending in courts of law for longer periods and there are no special courts for gas theft.
- OGRA decided the review request in July 2014 against the Sui companies request to extend the time period beyond one year. Refer Annexure I for details.
- Sui Companies still claim that the refusal of the Authority to allow them from claiming recoveries of theft for the actual period of the crime contributes a significant proportion to the annual UFG losses suffered/ faced by them. Industrial consumers are regularly monitored and modern technologies like EVCs are installed at majority of industrial CMSs.

Detection of Theft

- **For detection of theft by consumers** Sui Companies usually react to information received through internal/external sources which include phone calls or surveillance and monitoring by company officials.
- Another proactive method applied is based on a monthly data analysis of consumer consumption pattern using a

Contributing Factor 1 - Theft (Cont.)

software tool that provides list of consumers where consumption has varied beyond a certain percentage (e.g. 5%) of normal average consumption. The list is then reviewed for any seasonal variation and effect of pressure profiling activities in certain areas. Based on this analysis, the suspected consumers are visited for further evidence collection.

- As a result of visits the following possibilities occur:
  - Meter is identified to be malfunctioning or tempered;
  - Leakage is identified;
  - Extra connection bypassing the meter is noted;
  - Nothing evidenced to confirm the suspicion, means a false alarm.
- Accordingly, meters are then sent to meter workshop for diagnosis and impact analysis.
- In case of leakage, respective departments are notified for rectification.
- Similarly, in cases where meter is found tempered with or an indication of meter by-pass is found, the consumer is served with a notice and accordingly procedures specified by OGRA are followed to estimate and charge the theft volume to consumers.
- **In cases of theft by non-consumers** information received through internal/external sources which include phone calls or observations by surveillance and monitoring teams indicate towards possibility of theft. In such cases, raids by specialized teams supported by law enforcement agencies are conducted. On detection, illegal connections are removed and attempts are made to quantify the theft volume. Refer Annexure I for details.

Estimation of Theft volume

- In cases relating to theft by registered consumers, estimation of theft volume is based on historical consumption pattern of the consumers. As per OGRA procedures only volume equal to gas consumed in previous one year can be charged to the consumer and billed as claim. However, in case of theft by direct by-pass the period shall not exceed three (3) years subject to provision of concrete physical/ documentary evidence .
- For non-consumer theft, procedures that are generally applied include the following:
  - Check meters are installed at the location for a pre-defined period to measure gas consumption of the area and based on its readings, consumption of the area is estimated.
  - The impact of seasonal variation in the consumption pattern is also incorporated into the estimation.
  - Calculation of gas theft volume where theft setups have been removed, is based on estimating the gas flow from the hole made for the illegal connection and the pressure in the line. Beyond that estimation is also dependent on judgment of the gas company staff for the period of pilferage, area and no of houses / facilities to which gas was supplied etc.

Contributing Factor 1 - Theft (Cont.)

- Defined approaches as supported by OGRA procedures may appear appropriate in theory. In practice whether these are sufficiently and efficiently applied to enable Sui Companies to detect most of the gas theft cases, remains a question to be answered. The following tables highlight the detection of theft by gas companies:

Table TT – 1 Theft by Consumers - detected

	SSGC *		SNGPL	
	No. of Cases	Volume (MMCF)	No. of Cases	Volume (MMCF)
2011	332	133	14,919	4,042
2012	581	177	21,188	8,312
2013	713	142	26,602	7,196
2014	905	270	29,520	10,712
2015	1,502	439	39,173	3,028

Source: SSGC & SNGPL Reported Information

* The information provided by SSGC represents Surveillance & Monitoring (S&M) department only i.e.. (Industrial and Commercial consumers)

Table TT – 2 Theft by Non-Consumer Claimed

	SSGC	SNGPL
	Volume Claimed *MMCF*	
2011	-	6,607
2012	2,059	11,172
2013	6,387	10,136
2014	8,772	7,406
2015	10,420	8,735

Source: SSGC & SNGPL Reported Information

Treatment by OGRA for theft cases

- Sui Companies contend that when theft is detected and its volume is estimated, the volume becomes accounted for and thus shall not become part of UFG.
- In case where theft by registered consumers is detected, OGRA procedures are followed for calculating the volume pilfered and claims are billed to consumers. Any photographic or other evidence is documented for future reference.
- However, if recoveries are not made within one year of billing the claim, cumulative volume related to such cases is added back to UFG volume.
- In case of theft by non-consumers, claim-files are prepared under OGRA procedures. Notices are sent to parties identified and FIRs are lodged for recovery of claims.
- A considerable number of such consumers approach various courts of law and file for stay orders. Consequently, recovery process becomes time-consuming and surpass the one year time for recovery as set by OGRA.
- Sui Companies argue that for the reason narrated above, companies' efforts against theft control are not acknowledged. And therefore, contest that theft should not be linked with recoveries.

Contributing Factor 1 - Theft (Cont.)

- ECC considering socio-economic conditions and complexity of the UFG issue, has given policy guidelines to OGRA under section No. 21 of OGRA Ordinance, 2002 in the case No. ECC-154/25/2014 dated 20 November 2014 of Ministry of P&NR. ECC has advised OGRA to provisionally allow Sui Companies claims against Gas Volume pilfered by non-consumers. ECC further reminded OGRA to have the UFG study completed as soon as possible.
- OGRA while giving Determination of Final Revenue Requirement of Sui Companies for the years 2013, 2014 & 2015 has allowed 80% of actual established volume against non consumers. The gas volumes claimed and their respective allowance by OGRA in the respective years is provided below:

Table TT – 3 Analysis of Theft Volumes allowed and disallowed

	SSGC			SNGPL		
	Claimed	Allowed	Difference	Claimed	Allowed	Difference
						Volumes in MMCF
2011	-	-	-	6,607	6,607	-
2012	2,059	1,218	841	11,172	5,586	5,586
2013	6,387	5,110	1,277	10,136	8,109	2,027
2014	8,772	5,110	3,662	7,406	5,925	1,481
2015	10,420	5,110	5,310	8,735	5,925	2,810

Source: SSGC & SNGPL Reported Information

- However, the rationale behind theft volume allowable of the claimed volumes and mechanism to verify these claims is not clear.
- Also, the judgment and subjectivity involved in estimation of pilfered volume in each case raises concerns on the accuracy of such claims.
- Sui Companies argue that due to weak legal recourse available, political influence exercised as a culture and possibility of collusion by company staff. Therefore, it becomes extremely difficult to recover amounts against pilfered volumes from non-consumers in the ordinary course of business and thus, OGRA should exclude these claims from UFG calculations.
- However, if this is done on a continuous basis it becomes a window for shifting the burden caused due to theft by non-consumers to good consumers. It may be construed as relieving Sui Companies from their responsibility of controlling the UFG.

Contributing Factor 1 - Theft (Cont.)

Table TT 4 – SNGPL Consumer Wise Analysis of Theft volume and Recoveries

	No. of Cases		Volumes Booked (MMCF)			Volumes Recovered (MMCF)					
	Ind. & Com.	Dom. & Sp. Dom	Ind. & Com.	Dom. & Sp. Dom.	Total	Ind. & Com.	Dom. & Sp. Dom	Total	Total %age Recovered	Consumers	Cases / Consumers
2011	8,071	6,848	3,578	464	4,042	2,919	304	3,223	80%	3,898,574	0.38%
2012	7,316	13,872	7,641	671	8,312	6,335	327	6,662	80%	4,214,052	0.50%
2013	8,521	18,081	6,367	829	7,196	5,108	415	5,523	77%	4,457,055	0.60%
2014	6,601	22,919	9,065	1,647	10,712	3,161	914	4,075	38%	4,731,374	0.62%
2015	5,506	33,667	1,597	1,431	3,028	999	1,080	2,079	69%	4,961,023	0.79%

Source: SNGPL Reported Information

- The table provides the volumes booked and recoveries made in respect of all different consumer categories of SNGPL for the past five (5) years.
- In the last five years there is a decline of 9% in the total number of cases detected for industrial/commercial, however, this category accounts for the major portion of volumes booked i.e. around 85% of total booked volumes during the period beginning FY 2011 – FY 2014.
- Additionally, in FY 2015 industrial and commercial theft volumes decreased by 82% while increase in efforts toward domestic and special domestic category resulted in an increase of 47% in the number of cases detected. However, the volume booked in the respective category decreased.
- Further, the number of cases identified, compared to the total consumer base has remained less than 1% in the last five (5) years. This may highlight deficiency in theft detection, monitoring and control. Whereas, theft as a whole contributes a significant portion of annual UFG of the Sui Companies.

Contributing Factor 2 - Law and Order Affected Areas

UFG in Law & Order Affected Areas

- The premise for the captioned factor is the hindrance in gas supply operations and recovery of gas bills in the areas where law and order situation is abnormal. It may be due to a military operation against terrorism, political unrest or any tribal resentment to pay bills claiming ownership of gas being produced from those areas
- Gas companies have claimed for certain areas that due to adverse law and order situation, employees cannot go and perform controlling activities and therefore, UFG volumes are very high in those areas.
- In FY 2011, SNGPL was allowed for volume adjustment against their claim for gas supplied through 13 SMSs in Nowshera and Gurguri districts of KPK. This allowance is continuing to date where claims based on gas supplied to these areas are accepted by OGRA.
- SSGC has also made claims on the above grounds for Sariab region in Quetta, same were allowed by OGRA since 2012. Volumes for the claims are calculated through meter readings of gas supplied through Sales Meter Stations (SMS) and any billed volume is deducted therefrom.

  Unbilled Volume = A – B

  Where; **A** is gas supplied from SMS and **B** is gas billed to the customers in the affected area
- ECC of the Cabinet advised OGRA to provisionally allow Sui Companies for such claims till the UFG study is completed.
- However, OGRA permitted 75% of the claimed volume as deemed sales for UFG computation purposes and advised Sui Companies to claim the balance form Federal Government. Later, Federal Government advised back to OGRA to follow ECC guidelines and fully allow such claims as there is no mechanism with them to allow such subsidy. Claimed volumes and allowances under this factor for the last 5 years are provided below:

Table LO – 1 Analysis of Theft Volumes allowed and disallowed

	SSGC		SNGPL	
	Claimed	Allowed	Claimed	Allowed (MMCF)
2011	-	-	2,136	2,136
2012	1,286	813	3,377	2,136
2013	1,950	1,463	8,124	6,093
2014	2,279	1,709	10,803	8,102
2015	2,355	1,766	10,048	7,536

Source: SSGC & SNGPL Reported Information

- We understand and acknowledge the issue of "law and order affected areas" faced by Sui Companies and its impact on the existing UFG levels. The same was acknowledged by the Chief Minister of KPK vide its letter to the Authority dated 19 December 2013 ***(Refer Annexure R – KPK Letter)***. However, Government of KPK vide letter No. CPO / E&P / TOG / OGRA / 16-17 to OGRA has informed that Law and order situation is improving since 2013 in KPK, foreign nationals are residing in camps in Karak and Kohat and Foreign investors are also showing interest. Sui Companies, on the contrary still claim that law and order is linked with recoveries; and not with the actual law and order situation of the areas itself, residents of gas producing areas consider themselves as owners of the natural gas and refuse to pay for gas consumption.

Contributing Factor 3 - Minimum Billing

Minimum billing

- The Authority has notified minimum consumption charges for the natural gas consumers, vide Consumer Price Notification under section 8 of OGRA Ordinance, 2002 and Rule18(3) of NGTR 2002. A minimum consumption of 40M^3 per month per domestic consumer is set by the Authority i.e. consumers having gas consumption of less than 40M^3 will be subject minimum charges which may be notified from time to time.
- The current applicable minimum consumption charges for domestic customers is based on 40M^3 vide OGRA's notification dated 1 September 2015 are:

	Amounts in PKR per month
Domestic Sector	
Stand alone Meters.	148.50
Mosques, Churches, Temples, Madrasas and other religious places.	148.50
Government and semi- Government offices, Hospitals, Clinic, Maternity Universities, Colleges, Schools and private Educational Institutions, Orphanages and other charitable Institutions along- with Hostels and Residential colonies to whom gas is supplied through bulk meters including captive power.	810.00

Refer Annexure L - Gas Price Notification

Impact of Minimum billing on UFG

- Minimum billed domestic customer is assumed to have consumed a volume of 40M^3, though consumption recorded is as per its metered reading. This may be less than 40M^3 due to actual consumption being less by the consumer or due to any measurement error of the meter.
- In cases where consumer actually consumes more than 40M^3 and the installed meter measures it below 40M^3 as a result of meter being Sticky/ PUG, any difference between the volume billed (40M^3) and actual volume metered (meter reading) is not absorbed in the volume of gas sold and becomes the part of UFG.
- Therefore, customers may become subject to minimum billing due to either of the following reasons:
  - The consumer has in actual consumed less than the notified minimum consumption(40M^3); or
  - The metering errors (slow, PUG, sticky, etc.) have resulted in less volumes being metered than the consumer's actual consumption which may be higher or less than the notified minimum consumption (40M^3)

The minimum consumption of 40M^3 per month is substantiated through various studies carried out by Sui Companies, the Authority and University of Engineering and Technology Lahore concludes that the average gas consumption for 4 hours a day by a common domestic consumer is 40M^3. *For details refer* ***Annexure M – Minimum Consumption***

Contributing Factor 3 - Minimum Billing (Cont.)

Table MB – 1 Customers Subject to Minimum Billing

	SSGC	SNGPL
		Number of Customers
2013	692,966	1,070,079
2014	718,941	1,200,886
2015	761,104	1,651,585

Source: SSGC & SNGPL Reported Information

- No segregation was made available as to what extent these minimum billed consumers represent the actual less than 40M^3 consumption and between consumers who were billed at minimum owing to measurement errors.
- As in cases of malfunctioned meters the difference between meter reading and minimum volume may not reflect the actual gas supplied and hence that may remain un-accounted for. Quantifying such volumes at company level is only possible where malfunctioned meters are fully identified which is not the case.

Claim of Minimum billing

- Sui Companies claim that minimum billing due to metering errors is an uncontrollable factor and such volume should be included in the gas sold considering it as a deemed sales for UFG calculation purposes. Following table shows claims over the past 5 years:

Table MB – 2 Minimum Billing Claims

	SSGC	SNGPL
		MMCF
2011	-	6,883
2012	3,987	7,541
2013	4,705	7,663
2014	5,365	8,238
2015	5,916	9,327

Source: SSGC & SNGPL Reported Information

- Further, in its determination of FRR of SSGC for FY 2011 the Authority promulgated that *"the amount claimed by Sui Companies against minimum billing includes even those cases where meters are not registered for gas supply"*.

Contributing Factor 4 - Leakages

Pipeline leakages

- Internationally, leakage is defined as "the action of unmeasured gas passing from within a transmission/ distribution system to the outside atmosphere"
- The volume of gas lost as a result of pipeline leakage is generally correlated with the size of leaks and the pressure of gas passing through the pipeline. (i.e.., larger the size of the leak or higher the pressure, greater the volume of gas lost.)

Causes of Pipeline leakage

- The factors instigating the increase in pipeline leakages at Sui Companies, generally include:
  1. Size and age of network
  2. Corrosion
  3. Third party damage

1. Size and age of network

- Size and age of network is a prominent factor contributing towards the increase in pipeline leakages for Sui Companies, as aged pipelines are considerably more susceptible to leakages. This is due to their extended exposure to adverse environmental conditions, earth movement, heavy rains and flood, temperature, high winds, excavation by the operator, fire or explosion external to the pipeline, accidents and rupture of previously damaged pipe and terrorist attack etc.

- Following tables illustrate the increase in the proportion of aged pipelines in the distribution network of Sui Companies, *(Based on the Information received from Sui Companies)*

Table L – 1a Distribution Network Ageing

	SSGC			
KMs	Below 10 Years	10 to 20 Years	20 Years & above	Total
2011	16,303	13,383	8,918	38,604
2012	17,231	12,927	9,973	40,132
2013	18,126	11,830	11,601	41,557
2014	18,729	11,083	13,277	43,088
2015	18,103	10,378	15,406	43,887

Source: SSGC Reported Information

Table L – 1b Distribution Network Ageing

	SNGPL			
KMs	Below 10 Years	10 to 20 Years	20 Years & above	Total
2011	49,003	32,825	-	81,828
2012	53,703	34,093	-	87,796
2013	57,832	35,814	-	93,646
2014	57,571	19,909	18,375	95,855
2015	55,015	20,503	21,782	97,300

Source: SNGPL Reported Information

- This clearly demonstrates insufficient network rehabilitation by Sui Companies which has consequently increased the pipelines aged 20 years & above.
- During the course of our discussion with the management of Sui Companies it was argued that they were compelled to expand their network size and consumer base, on the premise of Government's socio-economic agenda.

Contributing Factor 4 - Leakages (Cont.)

- This has made, difficult for Sui Companies to control pipeline leakages through adequate network rehabilitation with the existing capacity limitations. However, as the maintenance and network rehabilitation is the responsibility of Sui Companies, network rehabilitation carried out by SSGC and SNGPL for their distribution network of 43,890 Km and 97,300 Km, respectively, is as follows:

Table L – 2 Rehabilitation of Mains & Services

	SSGC	SNGPL
		KMs
2011	483	99
2012	176	102
2013	219	115
2014	196	128
2015	170	231

Source: SSGC & SNGPL Reported Information

- The table above indicates the extent of rehabilitation carried out by Sui Companies which is not sufficient. For e.g. in FY 2015, SSGC and SNGPL network rehabilitation was of only 0.22% and 0.24% of their total distribution networks, respectively.

2. Corrosion

- Corrosion is a natural process, which results in pipeline deterioration, caused due to the exposure of metal to environment. Distribution network of Sui Companies is substantially covered with steel pipes which are naturally exposed to corrosion.

- The following is composition of Sui Companies' distribution network in terms of Steel and PE:

Table L – 3 Composition of Distribution Network

	SSGC	SNGPL
2015		*KMs*
Steel	37,118	69,945
P.E	6,772	27,355
Total	43,890	97,300

Source: SSGC & SNGPL Reported Information

- The extent of corrosion depends upon the following factors:
  I. Pipeline Wall Thickness;
  II. Pipeline Coating;
  III. Pipeline Ageing;
  IV. Material Grade; and
  V. Depth of Cover.

I. Pipeline Wall thickness

- Corrosion occurs independent of wall thickness, but thinner the pipeline wall, the sooner the pipeline deteriorates.
- Whereas, thicker pipelines takes longer before causing an incident. Therefore, Sui Companies need to consider the thickness of its pipeline as per the applicable standards to protect their network from being corroded.

Contributing Factor 4 - Leakages (Cont.)

- For SNGPL pipeline wall thickness of its distribution network ranges from 0.113 to 0.312 inches. Whereas SSGC's distribution network (steel) in terms of its wall thickness is as follows:

Table L – 4 SSGC - Wall Thickness (Steel)

Inches	0.113	0.133	0.154	0.188	0.188	0.219	0.25	Above 0.25	Total
KMs	4421	3,208	1913	794	478	603	278	228	**11,923**

Source: SSGC Reported Information

II. Pipeline Coating

- Pipeline coating is an alternative tool for protection of pipelines, it can be metallic or nonmetallic, with either of these, the objective is to isolate the underlying pipelines from the corrosive environment.
- Majority of the Sui Companies' distribution network is coated with Coal Tar, Asphalt and 3PLE, tape coating and others.

III. Pipeline Ageing

- Aged pipelines are more susceptible to corrosion due to their additional exposure to adverse environmental conditions over the time.

IV. Material Grade

- The material grade of pipeline has an inherent corrosive behavior that can range from high to low corrosion resistance, however, it is more dependent upon the environment it is exposed.
- It is noted that 97% of SSGC's network consists of Grade B material.
- Whereas, SNGPL distribution network is of API-5l standard and grade-B material for steel pipes, for PE pipelines the company uses 'ASTM D-2513' Standard and 'Medium Density Pipe' up to 4" diameter and 'High Density Pipe' is used for 6" diameter.

IV. Depth of Cover

- The depth of pipeline cover is considered as an important line of defense for pipeline against external interference.
- For SNGPL, the pipeline cover of its distribution network ranges from 3.5 to 5 feet. Where as for SSGC, the distribution network in terms of its pipeline cover is as follows:

Table L – 5 SSGC Pipeline Cover

Detail	3.5 feet	4 feet	4.5 feet	5 feet	> 5 feet	Total
KMs	6,000	3,000	2,500	1,500	2,550	**15,550**

Source: SSGC Reported Information

Corrosion control

- As an initiative to reduce pipeline corrosion, Sui Companies have taken the following initiatives:
  a. Established Cathodic Protection (CP) stations across the distribution network.
  b. Introduced PE pipelines in the distribution network to reduce its exposure to corrosion.

Contributing Factor 4 - Leakages (Cont.)

a. Cathodic Protection

- Cathodic protection (CP) is an effective tool used to control pipeline corrosion through CP stations across the network, by passing electric current through it. This protects the pipeline from corrosion and other environmental affects.
- At present, SSGC claims that 93% and 45% of its supply mains and distribution mains are protected through CP stations respectively.
- Where as, in case of SNGPL 92% and 66% of its supply mains and distribution mains are protected through CP stations respectively.
- However, the CP activities of Sui Companies are subject to interruptions due to frequent power outage on buried steels.

Effect of Power Outage on Buried Steel pipes

- Cathodic protection is carried out using electric current, however the repeated power outage has adversely affected the CP process, as during the power outage interval, CP level of the network drops, making it exposed to corrosion and leakages.

b. Use of PE Pipeline

- During FY 2015, the total distribution network of SSGC and SNGPL consists of 15% and 28% of PE pipeline respectively. Although this shows an increasing trend towards PE pipeline, efforts are still required to reduce the network exposure to corrosion.

Table L – 6 Composition of Distribution Network

	SSGC		SNGPL	
2015	**KMs**	**Percentage**	**KMs**	**Percentage**
Steel	37,118	85%	69,945	72%
P.E	6,772	15%	27,355	28%
Total	43,890	100%	97,300	100%

Source: SSGC & SNGPL Reported Information

- It is argued that PE pipes are safer and economical than pipes made of steel. However, as per National Transportation Safety Board (NTSB) report, the number of plastic pipeline accidents investigated that cracked in a brittle-like manner, resulting from premature failure is considerably high.

3. Third Party damage

- Third party contractors working nearby natural gas network often cause damages to the Sui Companies pipeline network, resulting in gas losses.
- This can range from damage to the external pipeline coating causing accelerated pipeline leakages, to the extent of pipeline ruptures.

Table L – 7 Number of Third Party Damages

	SSGC	SNGPL
		Number of instances
2012	1,892	877
2013	3,013	100
2014	3,153	13
2015	3,076	19
2016	2,697	3,342

Source: SSGC & SNGPL Reported Information

Contributing Factor 4 - Leakages (Cont.)

- Table L–7 provides the number of third party damages to the network of Sui Companies. Although, Sui Companies have established procedures for inspection of third party damages to the network, necessary efforts are required to control the same.

The Impact of Leakages

- Based on the factors discussed earlier, leakages can be divided into the following two categories:
  1. Overhead Leakages
  2. Underground Leakages

Overhead Leakages

- Overhead leakages are mainly contributed by the domestic consumers, as the above ground pipelines are commonly exposed to the external environment.
- International better practices suggest that leakage volume can be determined through leakage factor taking into account the elements causing leakages.
- Based on a study carried out by SNGPL, average leakage rate of a single leak in a domestic connection is 0.95cft/hr. and an estimated loss due to aboveground leakages is estimated to be around 15-20% of the total gas loss.
- An average domestic connection comprises of at least 9 joints (potential leakage points). This creates a possibility of 1.8 leaks per domestic connection. (9 x 20%)

Underground Leakages

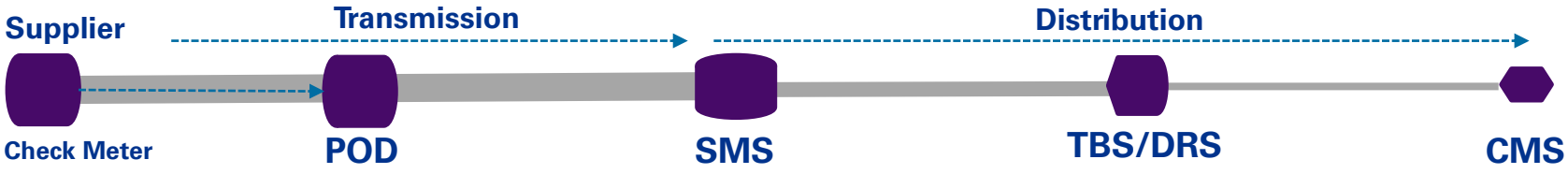
- Underground pipelines form a substantial portion of the total distribution network. Ageing of underground pipeline is an important factor affecting the network being prone to leakages owing to the factors discussed earlier.
- Normally, gas leakage is at a fairly constant rate and will increase gradually with time if not identified and repaired. Gas lost due to underground leakages is deceptive and at times can be very difficult to detect.
- Based on the results of surveys carried out by Sui Companies, the average leakage rate per kilometer for underground pipelines of SSGC and SNGPL is 4.9 and 2.2 leaks/Km, respectively. *Refer Annexure N - Leaks per KM.* The difference among the leakage rates of both Sui Companies, is due to the size of network coverage during the surveys conducted. SSGC's leakage rate is based on a survey of only 16,150 KMs out of 43,890 KMs of total distribution network. Whereas, in case of SNGPL the leakage rate of 2.2 leaks/ Km is based on the survey of 80,370 KMs out of 97,300 KMs of its total distribution network.
- However, considering international better practices, we noted that in Germany the average number of leaks per KM is 0.215. Whereas, in Massachusetts (USA) the average leaks/KM is 0.36 Leaks/KM.

Contributing Factor 5 - Measurement Errors

Overview

- A study conducted by US Department of Energy concluded that: "*You can't manage what you don't measure. If you don't measure it, you can't improve it*". Any weakness in measurement mechanisms is bound to aggravate the UFG problem.
- Measurement mechanism for natural gas is dependent on sufficient and accurate measurement infrastructure. If all key points of dispatch from source of natural gas to consumer are not metered, reconciling flow of gas across the network to identify and monitor losses in supply will not be possible. Accordingly, gas company will neither be able to relate and quantify losses to specific factors causing the losses to happen nor will be in a position to take focused control measures. This is apparently the case for continuously increasing UFG in distribution networks of both the utility companies. Table ME - 1 on next page highlights the existing measurement capacity of both the gas companies. We understand unless this is improved UFG cannot be controlled.
- In terms of accuracy, measurement of natural gas has a scientific relation to its temperature and pressure at any given point of time. Additionally, compressibility and quality (heating capacity) is also important to be measured accurately. Refer Annexure O – Measurement Errors for details.
- We understand that these parameters are, therefore, required to be measured and incorporated into the metering calculations to reflect correct natural gas supply and consumption.
- Table ME – 1 shows that transmission network is fully metered and there is negligible UFG in transmission, however, the distribution network is not fully metered.
- Internationally gas supply networks are precisely metered to allow visibility of gas supply across the network including the fluctuations and unusual consumer behavior at geographical or consumer class level.
- Unless gas companies have sufficient and accurate measurement of gas supply across the network UFG cannot be controlled.
- Currently, in the absence of measurement segments at municipalities/metropolis and sub-town level, gas supply at a single SMSs may not reconcile due to interconnected/looped network.

Contributing Factor 5 - Measurement Errors (Cont.)



POD
Measures the gas inflow into the transmission network with metering devices.

SMS
Measures the gas flow with metering devices and reduce the natural Gas Pressure.

TBS/DRS
Reduces the Gas pressure and allows company to track natural gas as it flows along the pipeline.

CMS
Allows the companies to account for natural gas delivered to their customers

Table ME - 1	SNGPL	SSGC	SNGPL	SSGC	SNGPL	SSGC	SNGPL	SSGC
Total	38	29	383	123	4,058	2,442	4,961,023	2,280,999
Metered	38	29	383	123	472	625	3,611,119*	1,519,895*
Percentage	100%	100%	100%	100%	12%	26%	73%	67%

*Net of minimum billed meters assumed to be sticky/PUG for the purposes of this analysis.

Source: SNGPL & SSGC Reported Information

Contributing Factor 5 - Measurement Errors (Cont.)

Network Segmentation

- Network segmentation bifurcates gas supply networks on pressure and demographic basis to end consumers. As per the current state, Sui Companies gas supply network have a weak network segmentation at distribution level which are as follows:
  - Table ME – 2 shows that around 45% of SNGPL's network is currently looped with the highest percentage in Islamabad / Rawalpindi, Lahore, and Gujranwala. As multiple TBSs/DRSs are still unmetered and not segmented, the extent of measurement error can not be determined along with other contributing factors of UFG. Non segmentation therefore, creates a barrier for reconciliation of UFG losses.
  - Table ME – 3 shows that SSGC's network is currently looped with the highest percentage in South Region i.e.. 45%. Further, all three sub regions need to be isolated on priority basis to minimize and trace UFG level in South Region.
  - As per our understanding, government initiatives for gas supply and lack of strategic planning by Sui Companies have caused gas network to change into a spaghetti network.

Table ME - 2 SNGPL

Region	No. of TBSs/DRSs (As of 29 Jul 16)			Percentage of Network Looped
	Isolated	Looped	Total	Percentage
Abbottabad	48	20	68	29%
Bahawalpur	221	22	243	9%
Faisalabad	387	360	747	48%
Gujranwala	26	372	398	93%
Gujrat	180	24	204	12%
Islamabad/Rawalpindi	94	376	470	80%
Lahore	129	341	470	73%
Multan	393	169	562	30%
Peshawar	251	104	355	29%
Sahiwal	125	1	126	1%
Sargodha	189	32	221	14%
Sheikhupura	169	25	194	13%
	2,212	**1,846**	**4,058**	**45%**

Source: SNGPL Reported Information

Table ME – 3 SSGC

Region	No. of TBSs/DRSs (As of 29 Jul 16)			Percentage of Network Looped
	Isolated	Looped	Total	Percentage
Central	74	58	132	44%
Eastern	67	32	99	32%
Western	54	72	126	57%
Total South	195	162	357	45%
Hyderabad	852	21	873	2%
Nawabshah	505	4	509	1%
Sukkur	169	7	176	4%
Larkana	445	10	455	2%
Quetta	53	19	72	26%
Total North	2,024	61	2,085	3%
	2,219	**223**	**2,442**	**9%**

Source: SSGC Reported Information

Contributing Factor 5 - Measurement Errors (Cont.)

Metering Errors at Sui Companies

- Measurement errors at Sui Companies can be classified into two categories:
  1. Use of obsolete/incorrect equipment; and
  2. Use of defective measuring equipment

- Both of the above factors result in unmetered gas passing through the system causing unbilled quantity being used by the consumers. Consequently, there is an increment in UFG level of Sui Companies.

- **Use of obsolete equipment** may result in meters becoming slow or PUG. Standard technical specifications for equipment and material issued by the Authority in 2009 are applicable and all measurement equipment are required to be procured and installed in accordance with these specifications.

  However, there are other factors that impair meters and equipment which include accidental damage, intentional tampering of the meter and/or regulators installed at the customer premises or varying characteristics of the gas beyond the defined parameters in the installed meter resulting in unmetered gas passing through the system (PUG meters).

- **Defective meters** can be broadly categorized into the following:

  – Passing Unregistered Gas (PUG) Meters are meters defected in such a way that gas passing through meter without being measured resulting in lower volumes of natural gas being billed to the customer than actually consumed.

  – Slow Meters are meters that become slow when meter dial is un-calibrated or is damaged, due to which meter dial moves at an increased or decreased RPM and becomes unable to provide an accurate meter reading resulting in an increase in the UFG levels.

Table ME – 4 Defective Meters

	SSGC			SNGPL		
Year	Slow/ Fast	PUG	Total	Slow/ Fast	PUG	Total
2011	19,156	44,723	63,879	7,698	2,344	10,042
2012	2,988	112,342	115,330	13,778	3,388	17,166
2013	2,130	100,887	103,017	13,987	4,111	18,098
2014	1,980	115,946	117,926	16,172	3,765	19,937
2015	2,467	94,574	97,041	23,141	3,367	26,508

Source: SSGC & SNGPL Reported Information

Contributing Factor 5 - Measurement Errors (Cont.)

- The table ME – 4 presents breakup of the total number of slow and PUG meters (meters 'Passing Unregistered Gas') of the SSGC and SNGPL respectively.
- In addition to above it also needs to be considered that the figures reflect the faulty meters that were identified and replaced in the said period; defective meters not identified have not been reflected in the statistics presented above and may also be a major cause of the rising UFG levels being faced by the companies.
- This can also be linked to the fact that around 1.3 million and 0.7 million consumers are billed at minimum by SNGPL and SSGC respectively. As discussed in the respective section, major reason behind minimum billing is defective meters.

Meters Ageing

Table ME – 5 and 6 shows the meter installed on Sui Companies network

Table ME – 5 SSGC - Meter Ageing

	SSGC				
Age (Years)	**Industrial**	**Commercial**	**Domestic**	**Total**	**Percentage**
Less than 1	319	2,312	189,542	192,173	6.9%
1 to 2	1,200	4,953	566,971	573,124	20.7%
2 to 3	725	1,645	214,987	217,357	7.9%
3 to 7	1,591	8,115	800,205	809,911	29.3%
7 to 10	329	6,035	966,278	972,642	35.2%
Total	**4,164**	**23,060**	**2,737,983**	**2,765,207**	**100%**

Source: SSGC Reported Information

As per international better practices, meters installed by utility companies for measurement of gas volume, has a defined policy for meter replacement that have gone beyond their useful life to avoid inaccurate meter readings. We were given to understand that there is no such documented policy available at SSGC. However, following table shows the meter replacement policy for SNGPL that we can apply to analyze SSGC situation also.

S. No.	Meter Type	Replacement Period (SNGPL)
1	Industrial	1 year
2	Commercial and Special Domestic	7 years
3	Domestic	16 years

- 26% of the total meters that pertains commercial sector have been in operation for 7-10 years which is in excess of the defined exemplary replacement period .
- Out of a total of 4,164 industrial meters installed, only 8% (319 meters) are less than a year old. The remaining 92% exceed the optimal replacement time period. This fact must be considered that industrial sector consume large volume of natural gas and without proper metering it can have a significant impact on UFG volumes.

Contributing Factor 5 - Measurement Errors (Cont.)

- The meter ageing analysis (Table ME -6a and 6b) of SNGPL shows the application of meter replacement policy by the company.

Table ME – 6a Meter Ageing

	SNGPL				
	Industrial			Commercial	
Age Years	Meters	Percentage	Age Years	Meters	Percentage
Upto 1	3,638	85.5%	Upto 7	46,214	96.9%
1 – 2	550	12.9%	7 – 10	957	2.0%
2 – 4	62	1.5%	10 – 15	483	1.0%
4 and above	3	0.1%	15 and above	27	0.1%
	4253	**100%**		**47,681**	**100%**

Source: SNGPL Reported Information

Table ME – 6b Meter Ageing

	SNGPL				
	Special Domestic			Domestic	
Age Years	Meters	Percentage	Age Years	Meters	Percentage
Upto 7	12,054	89.1%	Upto 16	4,886,483	95.4%
7 – 10	621	4.6%	16 – 20	160,170	3.1%
10 – 15	515	3.8%	20 – 25	55,211	1.1%
15 and above	340	2.5%	2 above	19,503	0.4%
Total	**13,530**	**100%**	Total	**5,121,367**	**100%**

Source: SNGPL Reported Information

- Approximately 14.5% (615) of the industrial meters need to be replaced as their useful life has lapsed. If these are kept in operation any longer, the contribution to the UFG as a result of measurement errors may increase.

- Whereas, 74,714 domestic meters are over 20 years old and therefore need to be replaced with new meters to prevent any unbilled gas from being consumed by the customer, further contributing to a rise in UFG levels.

Contributing Factor 6 - Other Contributing Factors

BTU Equivalence and 3rd Party Access

- As stated in "the Low BTU pricing policy, 2012", the Low BTU gas contains large volume of undesirable contents of natural gases like carbon dioxide, nitrogen and hydrogen sulfide with low contents of methane.
- At present, SNGPL imports Re-gasified liquid Natural Gas(RLNG) to meet the natural gas demand of the existing consumers, where SSGC transports RLNG received in Karachi to SNGPL through its own network.
- As per third party access rules, the transporter of gas i.e.. Sui Companies are required to be paid for transportation charges for the contracted capacities in terms of volumes at the entry point and shall account for this gas in terms of equivalent energy value at exit point irrespective of the volumes. With existing transmission lines, probability of commingling of gas is higher and consequently affects the Gas Calorific Value (GCV) of the transmitted gas becomes low.
- In the absence of a dedicated transportation line for RLNG, currently SSGC swaps the gas from its indigenous sources to SNGPL and distributes RLNG into its own consumers. The swapped gas is of lower GCV and to compensate it in terms of energy, SSGC delivers extra volume to SNGPL. This difference of gas volume received at entry point and gas volume provided to SNGPL contributes to UFG level for SSGC.
- SSGC claims that the issue is temporary and a dedicated line for transportation of RLNG is under construction. OGRA has allowed a provisional adjustment for this excess volume to be accounted for as deemed sales for UFG calculation purposes. The same excess received by SNGPL is treated as part of internal consumption.

Increase in Gas Price

- Increase in the cost of gas purchased from exploration companies is also considered as another factor contributing towards UFG level.
- Increase in cost of gas for Sui Companies results in an increase in the gas tariffs. Incremental gas tariffs with inadequate monitoring of gas networks encourage theft, meter tempering and other means to avoid gas expenses.

Shift in Sales Mix

- As per the License[1] of Sui Companies § 1.2.2, "***Bulk or wholesale consumer means a consumer who purchases natural gas for resale".*** *Internationally there is no benchmark definition available with respect to bulk sales or retail sales separately.* Sui Companies refer consumers with large volumetric purchases in heavy industrial sector viz. power, fertilizer, cement and steel as bulk sales; reason being special needs of their supply. It is a presumed reflective of theft, leakages and measurement errors as a result of expansion of retail sales.
- Sui Companies consider gas resellers as special domestic customers. For the purpose of this report and simplification for our discussions we have considered bulk sale as sales made to large size industries of the country.

Contributing Factor 7 - Impact of Bulk to Retail Shift

- To better forecast UFG levels and revenue / budgetary requirements, Sui Companies bifurcate their supply/sales mix into bulk sales (i.e.. power, fertilizer, cement & steel) and retail sales (i.e.. Industrial, Commercial, CNG, Domestic and Special Domestic). Sui companies refer to this sale ratio between Sales Mix.
- With the constant growth of companies and various interventions to address evolving needs of the country, the demand for gas supply has changed. Consequently, sales mix has also changed. Sales mix of bulk and retail for SSGC and SNGPL from FY 2004 to FY 2016 is provided in Table BR 1.

Table BR - 1 Bulk to Retail Sale Mix

	SSGC			SNGPL		
	Bulk G_{AFS}	Retail G_{AFS}	Bulk %age	Bulk G_{AFS}	Retail G_{AFS}	Bulk %age
Year						*Volumes in BCF*
2004	178	163	*52%*	219	266	*45%*
2005	180	184	*49%*	259	317	*45%*
2006	188	196	*49%*	244	369	*40%*
2007	175	211	*45%*	199	426	*32%*
2008	178	231	*44%*	190	460	*29%*
2009	181	241	*43%*	157	496	*24%*
2010	173	266	*39%*	148	502	*23%*
2011	119	277	*30%*	162	503	*24%*
2012	108	298	*27%*	158	517	*23%*
2013	104	314	*25%*	135	503	*21%*
2014	102	321	*24%*	128	454	*22%*
2015	110	324	*25%*	117	405	*22%*
2016	148	320	*32%*	126	381	*25%*

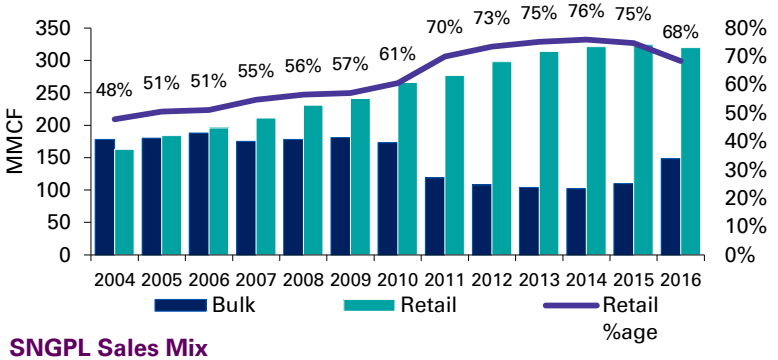
Source: SSGC and SNGPL Information Set [2016]

1 The License dated 3 Sep 2003 issued to SSGC and SNGPL by the Authority.

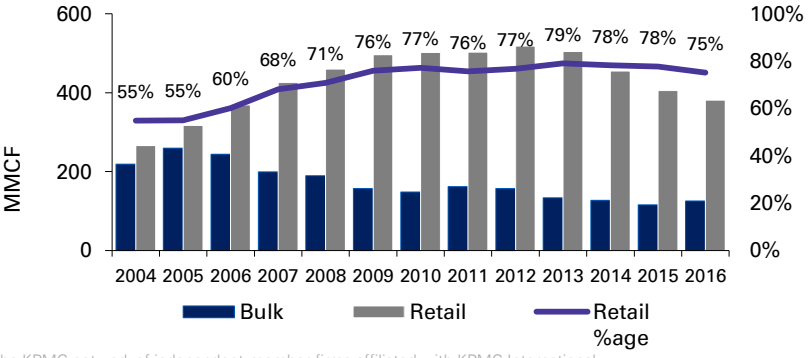
Sales Mix Analysis

- Sales mix or Gas Available For Sale (G_{AFS}) to Bulk was SSGC: 52% / SNGPL: 45% in FY 2004 which gradually decreased and has plunged to SSGC: 32% / SNGPL: 25% in FY 2016. This shift is mainly because of the Socio-Economic agenda being pursued by Government of Pakistan (GoP) to provide gas to the masses across the country.

SSGC Sales Mix



SNGPL Sales Mix



Contributing Factor 7 - Bulk to Retail Shift (Cont.)

- Sui Companies usually receive directives from GoP / Governmental bodies/ Public Representatives to lay networks in new towns, villages (including remote locations) for new gas connections. We were informed that Sui Companies have consistently documented their dissent for these new connections in remote locations where they claim that it is difficult to maintain and safeguard a mostly domestic network.
- Further, continuous reduction of gas input from indigenous gas sources is another constraint for SNGPL. Consequently, SNGPL has performed load curtailment of industrial customers within the Retail sector to meet the demands of existing as well as new domestic consumers.
- Also, Sui Companies are required to comply with the Gas Allocation Policy issued by the Authority in 2005 and its subsequent amendments. This policy sets the priority of gas allocation to various customer classes. The allocation has also contributed to the shift in bulk and retail sales. With these interventions for domestic supplies, the gas distribution network has grown considerably. Refer Table BR – 2 for growth analysis.
- Gas supply to bulk customers is mainly through dedicated lines designed to operate at high pressures and hence contribute minimum leakages and pilferages. Further, measurement errors of the meters in bulk sales are predominantly in the accuracy range of ±1%.

Table BR – 2 Expansion in Retail

	SSGC		SNGPL	
	Distribution Network	Domestic Consumers	Distribution Network	Domestic Consumers
Year	*KMs*	*Million*	*KMs*	*Million*
2004	24,339	1.71	38,258	2.26
2005	25,752	1.77	42,192	2.44
2006	27,542	1.84	46,964	2.64
2007	29,830	1.92	52,394	2.87
2008	31,930	2.05	59,951	3.10
2009	34,282	2.13	67,449	3.36
2010	36,785	2.22	75,653	3.61
2011	39,253	2.34	81,828	3.84
2012	40,905	2.46	87,796	4.15
2013	42,360	2.55	93,646	4.39
2014	43,090	2.62	95,855	4.67
2015	43,890	2.68	97,300	4.91
CAGR	**5.51%**	**4.16%**	**8.86%**	**7.32%**

Source: SSGC and SNGPL Information Set [2016]

- Monitoring & maintenance of bulk metering is controllable because of a manageable clientele. Refer Annexure Q.1 & Q.2 for list of bulk clientele with volumes for past 5 years.

Impact of Changes in Sales Mix on UFG Levels

- Bulk Sales with controllable clientele and close monitoring has insignificant gas losses. Therefore, UFG level in bulk sales is around 0.5% of Gas $_{AFS}$.

Contributing Factor 7 - Bulk to Retail Shift (Cont.)

- Whereas, UFG level in retail vis-à-vis bulk sales is considerably high due to various reasons such as gas theft, gas leakages, measurement errors and spaghetti networks etc. These contributing factors are relatively controllable in bulk sales.
- The new domestic connections provided in pursuance of the "Gas Allocation Policy" and governmental reforms have increased the network length in the last decade as shown in Table BR-2. The expanded networks in retail sector are susceptible to gas pilferages, leakages and measurement errors.
- This growth in distribution networks requires improved monitoring and measurement mechanism. Apparently, efforts made by Sui Companies to improve maintenance, control and monitoring mechanism for this exponential growth was not sufficient; which has exacerbated the UFG level in the recent years. Sui Companies claim that the management and monitoring of these complex networks is cumbersome and expensive.
- The tariff mechanism of Sui Companies is designed in a way that that cost of maintenance and upgrading the network is passed on to the consumers by including it in the gas prices. However, increasing tariffs was also not conducive for Sui Companies being against socio-economic objectives of the government.
- Further, regular upgrades require extensive work which is not only expensive but needs coordination and approvals of various government departments and bodies. Therefore, Sui companies contend that the companies are handicapped due to coordination and approval issues.
- As discussed in Background section of the report, OGRA initially stipulated a benchmark rate in FY 2004 to control UFG level having considerations to the then UFG level of Sui Companies. Sui Companies are of the view that the dynamics of the business are now changed resulting in adverse operating conditions and undesirable shift in Sales Mix. With a plea that the shift in sales mix over the years was beyond their control mainly because of government interventions, Sui Companies on various occasions requested government representative committee viz. Economic Coordination Committee to comprehend the issue.
- As mentioned ECC advised OGRA to provisionally allow volumes as deemed gas sales volumes against impact of change in sales mix on UFG, using the base year 2004.
- Subsequently the Authority in FRR of Sui Companies of FY 2013, FY 2014 & FY 2015 partially allowed volumes against gas volume pilfered by non-consumers and gas losses in law affected areas. The Authority however, did not allow volumes claimed against impact of change in sales mix and was made subject to the recommendations of the UFG study.

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Impact Analysis of UFG

Effect of UFG Disallowance

Effect of UFG Disallowance on tariffs

- For the purpose of Annual Revenue Requirement calculation, UFG disallowance[1] is subtracted from the "Cost of gas sold" which affects the "increase / decrease requested in average prescribed price". Sui Companies are required to account for the UFG disallowance. Refer Table RR 1 for details.
- In recent years reported UFG has shown an increasing trend. However, due to stay order from the honorable High Court the Authority has allowed UFG to the extent mentioned in the stay order and provisional adjustment for theft by non-consumer and for claim relating to law and order affected areas.

Table RR 1- Revenue Requirement	
Particulars	***PKR. / MMBTU***
Cost of gas sold	XXX
UFG disallowance	**(XXX)**
Transmission & distribution and Elements[2]	XXX
Cost of service / prescribed price	XXX
Current average prescribed price	XXX
Inc. / (Dec) req. in avg. prescribed price	XXX
Revenue Requirement	**XXX**

(Refer Annexure G - Revenue Requirement)

Sensitivity to Financial Position of Sui Companies

- The effect of UFG disallowances on the financial outlook of Sui Companies is provided on the following pages where we have endeavored to analyze the impact of varying UFG disallowance rates on the net equity of the Companies.
- It is evident that an immediate financial improvement action is required to provide the companies a breathing space and time to consolidate and augment their measurement capacities as well as help them in implementing controls over continuously increasing UFG.
- In the past five years Sui Companies have faced a constant reduction in its annual reported profits, as a result the company's' net equity has also deteriorated to a significant extent. In the event that this trend continues the companies could face situation where validity of going concern assumption may be questioned for the preparation of financial statements.
- To demonstrate this impact the current effective UFG allowance of 8.5% and 7% is assumed to prevail in the future for SSGC and SNGPL respectively. This effective rate includes the existing UFG benchmark rate and the other allowances currently being granted to the Sui Companies as deemed sales adjustment.

1 – UFG disallowance is the excess of total UFG over UFG Allowed by the Authority.
2 – Operational Elements are Shortfall of previous year plus depreciation, return on net average operating fixed assets and Subsidy for LPG Air-Mix Project less other incomes.

Effect of UFG Disallowance

- The proposed roadmap, which spreads over a period of five years, addresses the measures that companies need to take to improve their existing predicament.
- To enable the companies to implement these measures it is necessary to provide Sui Companies with time period in which they work on improving the UFG control measures without facing further losses/ going bankrupt. For this purpose a favorable rate, at which the Companies' deteriorated equity can be recovered, needs to be allowed to the companies temporarily and this has been presented in the analysis as follows.
- For our recommendation regarding the allowance to be granted please refer the chapter 'Our Recommendations'.

Key Assumptions to the Analysis

- The following assumptions have been used in the preparation of the financial projections:
  - Non-current assets are assumed to grow at 6.28%/ 6.35% annually for SSGC and SNGPL respectively in line with the growths observed in the past five year.
  - Non-current assets are assumed to grow at 4.93%/ 6.22% annually SSGC and SNGPL respectively in line with the growths observed in the past five year.
  - Estimated WACOG growth is expected to be:

2016	2017	2018	2019	2020
				Million PKR/MMCF
320.2	268.3	282.01	295.7	310.4

  - The values for Gas $_{AFS}$ is based on the Sui Companies provided projections.
  - Working Capital is the difference of projected current assets and current liabilities, which balances the projected statements.
  - UFG levels of SSGC and SNGPL are assumed to remain constant at 15%, 13% p.a. during the period beginning 2016 and ending 2020 i.e.. optimism that UFG will not be let to grow further.
  - Equity and reserves remains constant throughout the period of the forecast as shareholders and investors may not choose to put their money at stake in current situation.

Sensitivity Analysis - SSGC

SSGC - Financial Position	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
										Amounts in PKR Billion
Non-current Assets	60.79	67.52	71.07	73.46	77.54	82.41	87.58	93.08	98.92	105.12
Non-current Liabilities	(34.83)	(39.86)	(45.50)	(42.34)	(42.21)	(44.29)	(46.48)	(48.77)	(51.17)	(53.69)
Working Capital - Net	2.07	0.71	0.79	(8.05)	(17.44)	(22.03)	(25.04)	(28.09)	(31.24)	(34.52)
Net Assets	**28.03**	**28.37**	**26.37**	**23.06**	**17.89**	**16.08**	**16.06**	**16.22**	**16.50**	**16.91**
Equity and Reserves	11.57	13.77	13.80	13.84	13.96	14.05	14.05	14.05	14.05	14.05
Surplus on Rev. of Fixed Assets	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25	10.25
Accumulated Profit / (Loss)	6.21	4.34	2.32	(1.13)	(6.32)	(8.22)	(8.24)	(8.08)	(7.80)	(7.39)
Net Equity	**28.03**	**28.37**	**26.37**	**22.96**	**17.89**	**16.08**	**16.06**	**16.22**	**16.50**	**16.91**
Equity with UFG Allow. 15% - 4.5%						(0.17)	0.63	0.53	0.50	0.57
15% - 5%						0.58	1.27	1.21	1.22	1.33
15% - 6%						2.08	2.57	2.57	2.66	2.86
15% - 7%						3.58	3.87	3.93	4.10	4.38
15% - 8.5%	**17.78**	**18.11**	**16.12**	**12.71**	**7.64**	**5.83**	**5.81**	**5.97**	**6.25**	**6.66**
15% - 9%						6.58	6.46	6.65	6.97	7.42
15% - 10%						8.08	7.76	8.01	8.41	8.94
15% - 4.5%						15.74	13.61	14.27	15.09	15.96
15% - 5%						14.99	12.96	13.59	14.37	15.20
15% - 6%						13.49	11.67	12.23	12.93	13.68
15% - 7%						11.99	10.37	10.87	11.49	12.16
UFG Disallowance - Current / 8.5%	2.47	3.88	1.92	9.94	10.28	**9.75**	**8.43**	**8.84**	**9.34**	**9.88**
15% - 9%						9.00	7.78	8.16	8.62	9.12
15% - 10%						7.50	6.48	6.80	7.18	7.60
Gas Available for Sale (Bcf)	396.16	405.74	418.20	422.70	433.80	468.24	483.15	481.99	485.86	489.77
Gas Sales (Bcf)	358.81	361.91	376.37	357.46	367.86	398.00	410.68	409.69	412.98	416.30
UFG Volume Total (Bcf)	37.35	43.83	41.83	65.24	65.94	70.24	72.47	72.30	72.88	73.47
UFG Total %	9.43%	10.80%	10.00%	15.43%	15.20%	15.00%	15.00%	15.00%	15.00%	15.00%

Sensitivity Analysis - SNGPL

SNGPL - Financial Position	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
										Amounts in PKR Billion
Non-current Assets	91.3	95.1	100.9	106.8	116.8	124	132	140	149	159
Non-current Liabilities	(69.6)	(74.4)	(69.3)	(74.0)	(88.6)	(94.1)	(99.9)	(106.1)	(112.7)	(119.7)
Working Capital - Net	(3.0)	0.5	(21.6)	(26.8)	(24.6)	(26.5)	(26.0)	(24.5)	(21.2)	(16.5)
Net Assets	**18.7**	**21.2**	**10.0**	**6.1**	**3.6**	**3.6**	**6.1**	**9.8**	**15.4**	**22.6**
Equity and Reserves	10.1	10.4	10.9	10.9	10.9	11.0	11.0	11.0	11.0	11.0
Surplus on Rev. of Fixed Assets										
Accumulated Profit / (Loss)	8.6	10.9	(0.9)	(4.9)	(7.4)	(7.4)	(4.9)	(1.2)	4.4	11.6
Net Equity	**18.7**	**21.2**	**10.0**	**6.1**	**3.6**	**3.6**	**6.1**	**9.8**	**15.4**	**22.6**
Equity with UFG Allow. 13% - 4.5%						(0.4)	2.8	6.6	12.6	20.1
13% - 5%						0.4	3.4	7.2	13.1	20.6
13% - 6%						2.0	4.8	8.5	14.2	21.6
13% - 7%	**19**	**21**	**10.0**	**6.1**	**3.6**	3.6	6.1	9.8	15.4	22.6
13% - 8%						5.2	7.4	11.1	16.5	23.6
13% - 9%						6.8	8.8	12.4	17.6	24.7
13% - 10%						8.5	10.1	13.7	18.8	25.7
13% - 4.5%						13.7	11.3	10.9	9.6	8.6
13% - 5%						12.9	10.7	10.3	9.0	8.1
13% - 6%						11.3	9.3	9.0	7.9	7.1
UFG Disallowance - Current / 7%	7.18	6.52	13.6	12.3	11.6	**9.7**	**8.0**	**7.7**	**6.8**	**6.1**
13% - 8%						8.1	6.7	6.4	5.6	5.1
13% - 9%						6.5	5.3	5.1	4.5	4.1
13% - 10%						4.8	4.0	3.8	3.4	3.1
Gas Available for Sale (Bcf)	665.24	674.87	638.08	581.96	521.53	504.25	496.91	454.92	382.11	327.62
Gas Sales (Bcf)	581.9	597.28	552.62	506.42	450.84	438.70	432.31	395.78	332.44	285.03
UFG Volume Total (Bcf)	83.34	77.59	85.46	75.54	70.69	65.55	64.60	59.14	49.67	42.59
UFG Total %	12.53%	11.50%	13.39%	12.98%	13.55%	13.00%	13.00%	13.00%	13.00%	13.00%

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Conclusion to the Situational Assessment

Conclusion to the situational assessment

Conclusion to the situational assessment

Theft

- Albeit various reasons may be associated with theft of natural gas in Pakistan but the key drivers which we identified as significant impediments are:
  - continuous growth of the gas distribution network,
  - insufficient and delayed legislative support for recovery of detected cases,
  - inadequate monitoring and maintenance efforts of Sui Companies; and
  - Expectation of free supply in gas producing areas.
- The responsibility to detect, monitor and prevent theft is of Sui Companies and disconnection of gas pilferers is the right of Sui Companies. The number of cases detected by both utilities as a percentage of their total customer base in 2015 is less than 1%, this demonstrates that efforts need to be improved as theft contributes a major portion of overall UFG
- Existing procedures provided by OGRA may be appropriate to provide basic guidance in handling and recording of gas volumes relating to theft cases detected. Increased efforts are still required by Sui Companies to curb gas theft and overall UFG losses which requires time and dedicated resources.
- The process of allowing claims of theft by non-consumers is prone to errors as volumes are based on judgments and hypotheses. There is no validation mechanism at OGRA for independent verification of such claims.
- Theft by consumers or non-consumers once detected can be accounted for and may not be considered as UFG.
- A detected theft case when recorded is a claim to be recovered from the consumer or non-consumer, with or without a legal recourse using gas company's efforts and resources. If not recovered or is no more recoverable it becomes an issue of debtors management. Either the claim is reversed by writing it off or is provided for till it is recovered or confirmed to be non-recoverable.
- The volume pilfered not detected is what remains in overall UFG volume and is perceived to form a significant portion of it. The more the volume of pilfered gas is detected the less is the UFG.
- For UFG allowance purpose the key information is how much out of the total theft volume is beyond the control of Sui Companies. For this purpose, first all measures need to be in place to quantify theft volumes and then certain volumes need to be claimed out of it as undetectable / controllable. From the analysis it is clear that in the existing situation such information is not available. Therefore, we suggest that under UFG control program, efforts should be made by Sui Companies to build capacity to track and measure theft by non-consumer.

Conclusion to the situational assessment

- However, owing to factors listed above and other complexities in retail supply of gas, arguments for non-controllability of theft by Sui Companies carries weight and needs to be addressed

Law and Order Affected Areas

- The premise that due to law and order issues gas companies cannot carry out their billing and recovery activities in certain areas and hence the volume of gas supplied to such areas should be allowed, carries critical implications at national level.
- If gas companies cannot operate in such areas then there should be an evidence that other utilities and state machinery was also unable to carry out their operations in those areas. ECC acceptance to the issue is provisional. However, NEPRA while determining Revenue requirement for power sector considers recovery challenges in such areas and provide allowance on account for law and order situations.
- Nevertheless, only the Federal Government can declare an area as "law & order affected" where Sui companies can claim any relief on losses. However, there is a remote a chance that Federal Government may declare such areas as law & order affected accepting no writ of the Government. The claims of SSGC and SNGPL against gas losses in the law and order affected areas have grown by approximately 80% and 200% over the last five years and need to be curbed to restrict the growing levels of total reported UFG of the Sui Companies.

Minimum Billing

- Customers may be subject to minimum billing due to following reasons:
  - The consumer has in actual consumed less than the notified minimum consumption ($40M^3$); or
  - The metering errors (slow, PUG, sticky, etc.) have resulted in less volumes being metered than the consumer's actual consumption which may be higher or less than the notified minimum consumption($40M^3$)
- No segregation was made available as to what extent these minimum billed consumers represent the actual less than $40M^3$ consumption and how many of the consumers were billed at minimum owing to measurement errors.
- As in cases of malfunctioned meters the difference between meter reading and minimum volume may not reflect the actual gas supplied and hence that may remain un-accounted. Quantifying such volumes at company level is only possible where malfunctioned meters are fully identified which is not the case.

Leakages

- Leakage (overhead and underground) as a result of the size and age of network, corrosion and third party damage is also a major contributor to overall UFG levels of Sui Companies.
- As discussed earlier the leak rate as per the studies conducted by Sui Companies are 4.9 and 2.2 leaks/ km for SSGC and SNGPL.

Conclusion to the situational assessment

- As at the financial year ended 2015, 35% and 22% of SSGC and SNGPL's distribution network respectively was over 20 years of age. In contrast, during the corresponding year rehabilitation activities were carried out on just 0.21% and 0.24% of the distribution networks of the companies, respectively.
- Similarly, CP over the distribution network currently extends to 45% and 66% of SSGC and SNGPL's network (steel); this is a major reason for corrosion of the steel pipes resulting in leakages.
- The above statistics reflect weaknesses of Sui Companies to implement proper controls for the reduction of gas losses due to leakages. We understand that there is substantial room for improvement and the average leakage rate could be reduced to an acceptable level and in line with international practices.

Measurement

- UFG has always been closely associated with data and meter errors. Improved metering capacity at Sui Companies is a concern to curb overall UFG losses.
- Deficiencies exist in current measurement capacity at both Sui Companies as district/town/sub-town metered with EVCs installed for SSGC and SNGPL are only around 24% and 12% respectively. This needs to be brought to 100% metering in the near future in line with better practices, increasing visibility of the network and ensuring that gas passing through every point in the system is accurately measured, reconciled and accounted for.
- Furthermore, the network of both Sui Companies is not segmented properly, hence, gas is supplied to areas through looped stations, which acts as a hindrance in reconciling UFG losses for specific areas.
- In order to effectively monitor and measure gas supply, network must also be segmented to identify area wise gas sale and consumption.
- Internationally measurement based mechanism are used to regulate and control UFG.

Changes in Sales Mix

- We have discussed in detail the claims of the Sui Companies relating to the impact of the change in sales mix on UFG and the reasoning behind those claims in the chapter 'UFG contributing factors'.
- As per Provision of Rule No. 20 of NGRA Licensing Rules, 2002 – Obligation of licensees, Sui Companies with the consent of the Authority, are allowed not to provide transmission or distribution service or make sales of natural gas in the areas where it is not commercially / financially viable unless GoP provides special financial arrangements to Sui Companies.
- In addition Terms and Condition 13.1 and underlying sub conditions of the Licenses of Sui Companies provides a corridor to provide services to persons/consumers who are technically and economically viable.
- Since 2003 Sui Companies have grown their networks exponentially, majorly on the basis of government elevation programs, without considering or confronting on grounds of the financial viability of the expansions.

Conclusion to the situational assessment

- On the other hand, we understand that it is the responsibility of Sui Companies to develop capabilities to cater expansion and the growing clientele. Contesting expansions without accepting incongruous measures adopted by Sui Companies over the period is not balanced.
- In the past decade the reported UFG of SSGC and SNGPL has increased by 75% and 63% respectively. However this increase is not proportionate to the shift in sales mix over the corresponding period.
- Also, we understand that the definition of bulk as prescribed and the definition interpreted or commonly used by Sui Companies and the Authority together is different. The Sui Companies may align their practices to the definition of 'Bulk' according to the license agreement.
- Albeit the assertions of the of Sui Companies in this regard are correct to some extent but the solution lies in strengthening of the infrastructure and implementation of improved UFG control measures to reduce gas losses as a result of measurement errors, theft and leakages.

Overall Conclusion

- Sui Companies do not have appropriate control over constantly growing UFG levels resulting from the various contributing factors as discussed in our situational assessment.
- This may result in significant risk to financial & operational losses and erosion of equity for both the companies. If the existing trend continues the companies could face a situation where financial statements may be prepared without a valid going concern assumption.
- Based on the assessment of the existing operating environments of Sui Companies and impact analyses of UFG disallowance performed on the information received, we understand that there are areas of the companies' operational and strategic plans that require immediate improvement for the resolution of UFG issue.
- Currently Sui Companies' strategy for UFG management is reactive rather than preventive. Sui Companies have not implemented sufficient measures/ controls that can help companies deal with the UFG issue in a sustainable manner, rather temporary relief is sought in the form of allowances to reduce annual losses. We understand that failure to control gas losses stems from the absence of a mindset that owns this problem and that puts a cohesive and coordinated short to long term strategy in place to address the root causes of UFG.
- We recommend that Sui Companies should focus their efforts on developing a long term UFG management and control program divided into numerous medium to short term objectives aimed at reducing the UFG levels to an acceptable level in the long run in line with the international better practices. We have proposed objectives in section III of the report.

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Section II

Our Recommendations

Our Recommendations

Based on our assessment of the existing practices and infrastructure of the Sui Companies in relation to UFG, we recommend the following UFG control measures:

100% Metering

UFG has always been closely associated with data and meter errors. Increased visibility of the network leading to metering at all possible levels should be ensured so that the gas passing through every point in the system is accurately measured, reconciled and accounted for. This will reduce deficiencies in the existing measurement mechanism and lead to reduced gas losses and future gas sustainability. Internationally, this is the most used UFG monitoring better practice.

Network Segmentation

In order to effectively monitor and measure gas supply, the gas network must be segmented, making it easier to identify and pin point susceptible area and if required, cut gas supply of identified areas with precision where gas is being pilfered. Lack of proper segmentation of the gas supply network will act as a barrier in reconciling UFG and their respective factors to the overall gas losses.

Cylinder Model

Bottled (cylinder) LPG is the perfect option for homes that do not have access to a piped network *"OnGas-Newzealand"*. This is an easy solution to provide gas to areas where metering and segmentation is not possible.

Cylinder model is easy to operate as only a flick of a switch or the press of a button, gas will be at the doorstep of the consumers. LPG Cylinders can be refilled from dedicated stations or delivered to the end consumer.

The cylinders can also be equipped with auto-change regulators having a visual indicator to show the consumers when a cylinder is empty and needs to be replenished. A bottle (cylinder) contains 45kg of gas when full, which equals 2250 mega joules or 625 kilowatts of energy, *"OnGas-Newzealand"*. A feasibility study can be conducted for implementing such model locally initially on pilot basis, then for difficult areas where pipeline based supply is difficult to manage and is expensive.
Cost differential of the two models can be analyzed and subsidized as appropriate.

Key Monitoring Indicators

To effectively streamline the UFG reduction plan and assist the Sui Companies and the Authority to monitor and control the UFG reduction, a set of quantifiable KMIs must be implemented and achieved annually over a period of five (5) years, aligned to the overall UFG reduction strategy. This will allow the utilities to compare their performance in terms of meeting their strategic and operational goals. Further, UFG allowance will be directly linked to the achievement of these KMIs. The same is discussed in detail in Section III of the report.

Our Recommendations (Cont.)

Regional UFG Management

The responsibility of UFG control should be assigned to regional UFG teams. The regional teams shall be assigned annual UFG reduction targets for their specific regions and their performance evaluated accordingly. This regional accountability will drive management to peak performance that can be incentivized according to achievement of region specific annual UFG reduction targets.

Two-Yearly Meter Inspections

The Sui Companies to conduct meter inspections of all the connection over the network every two years. The inspection will include an inspection of the meter and associated equipment for evidence of theft and tempering etc. This approach will help utilities assess the state of their network metering, deter the consumers from tempering them, additionally all slow/sticky meters will also be rectified.

Technological Advancement

Technological advancements within the system at all possible avenues will bring in an efficient mechanism to control UFG losses, measures can be sought in all avenues including but not limited to:

- Increased installation of meters with EVCs.
- Remote meter reading thorough GPRS based systems.
- Establish separate data cells for analysis of the EVC data.
- Roll out of Smart Meters which will have a positive impact on reducing gas theft.
- This will also lead to removal of existing temper, give tempering alerts and provide detailed and accurate consumption data.

Cost of Service Study

Determine actual cost of transporting gas to the end consumer based on individual cost drivers for each consumer class, spread geographically across the network.

This will lead to revision of tariffs and further identification of new consumer classes. This will enable differential pricing based on cost of service for specific customer segments and geographies.

Detect, Monitor and Control

It is the responsibility of Sui Companies to detect, monitor and prevent theft, however, the Sui Companies have a reactive approach rather a proactive one to control it. Improved arrangements to detect and prevent theft, designed to deter consumers from committing an offence are expected to have a positive impact on reduction of theft and overall UFG losses.

- Disconnection of gas pilferers shall be the right of Sui Companies.
- A validation mechanism/ special audit is recommended for an independent verification of gas volumes claimed and to protect consumers from any unjust claims made by the Sui Companies.

Our Recommendations (Cont.)

Ring Fencing

Particular monitoring of areas susceptible to gas pilferage will involve isolating the susceptible and affected area. The boundary of the area shall be defined and the gas passing through the region shall be measured through the installation of a bulk/ check meters

Use of bulk meters

Bulk meters are specialized meters with the capacity to operate at a pressure level higher than the normal operating pressure of the domestic meters enabling them to accurately measure the gas passing through the distribution main.

These bulk meters may be installed in the law and order affected areas at the last operational point of the region and gas passing into the area shall be measured in order to ensure that volume is quantified. This shall ensure verification of the gas claimed as deemed sales under the head 'Law and Order Affected Areas' in the UFG computation by the Sui Companies.

Leakage Management Plan

A leakage management plan will be implemented focused on replacing deteriorating parts of the underground pipelines, leading to increased rehabilitation of the network and increased follow up on all customer leak complaints through establishment of a dedicated customer hotline to report the same.

Recommendation on UFG calculation and treatment

- Based on our analysis of the existing UFG calculation methodology along with reservation made by Sui Companies and considering the international better practices for calculating UFG. We recommend that the Authority may allow the following formula for the UFG calculation purpose.

$$\textbf{UFG \%} = \frac{(\textbf{Gas Received} - \textbf{Gas Delivered}) - \textbf{Adjustments}}{\textbf{Gas Received}}$$

Where,

Gas Received, is the natural gas volume metered as received by the licensee during a financial year;

Gas Delivered, is the volume of natural gas metered as having been delivered by the licensee to its consumers; and

Adjustments, is the natural gas used for self consumption by the licensee for the purpose of its regulated activity and such other quantity as may be allowed by the Authority for use by the licensee in the operation and maintenance of its regulated activity.

Our Recommendations (Cont.)

Recommendations relating to UFG Allowance

- As per the European Regulators' Group for Electricity and Gas (ERGEG) the determination of network losses can be done only if the network has been metered adequately. Robust measurement of network losses is possible in networks with continuous metering systems installed and operating at full capacity.
- Nevertheless, approaches for measurement adopted by regulators internationally for UFG quantification are possible when the gas network is fully metered and is isolated, i.e.. the number of gas receipt points or delivery points are metered and finite. Within the large pipeline system, an isolated system simplifies the quantification of gas within the network segments at any particular time.
- However, we identified that currently Sui Companies do not have measurement mechanism installed at full capacity on their networks. Consequently, actual UFG level for a particular network segment cannot be quantified precisely (i.e. from SMS to TBS/DRS, TBS/DRS to CMS or assigned to any underlying factor like leakage, theft or measurement error).
- We believe that Sui companies with their existing measurement mechanism are unable to measure the actual difference between the volume received and dispatched for a particular network segment. Accordingly, with the existing setup it is not possible to identify actual gas losses associated with each contributing factor in UFG.
- Albeit, Sui companies present their UFG volumes in terms of contributing factors but the basis of these presentations are hypothetical assumptions rather than actual measurements.
- To enable robust UFG benchmarking based on the UFG contributing factors, the existing measurement capacity needs to be augmented to the extent which enables the measurement of the UFG volumes for a particular network segment.
- Consequently, benchmarking of UFG based on its contributing factors is not appropriate and a one go rehabilitation attempt to augment the financial outlook of Sui Companies is challenging.

Model for incremental improvement for UFG control

- Interventions at strategic and operational levels of the Sui Companies are required for the resolution of UFG issue. Failure to control gas losses stems from the absence of a mindset that owns this problem and puts a cohesive and coordinated strategy to address the same.
- In this regard, UFG Control framework with an objective of *"Enhanced UFG Control"* is proposed.
- This framework requires improvement in the following four areas of the Sui Companies:
  - Network Measurement and Visibility;
  - Network Rehabilitation;

Our Recommendations (Cont.)

  - Theft Control; and
  - Research & Development.
- To better ensure implementation of the UFG control framework, the implementation is translated into a UFG Benchmark formula used for calculating UFG Allowance which is explained under the below caption.

UFG Benchmark and Control Formula

- We propose a two component formula for calculating UFG Allowance viz. Technical Component and Local Operating Conditions Component.

$$UFG_{Allowance} = Gas_{AFS} \times (Rate_1 + Rate_2 \times \beta)$$

- $UFG_{Allowance}$ is the total UFG Allowance, Gas_{AFS} is the Gas Available for Sale in any year and β denotes the cumulative score of Key Monitoring Indicators (KMIs) based on achievement of mutually-agreed Key Performance Indicators (KPIs) in a financial year.

Technical Component based on international benchmarks

- $Rate_1$ is the benchmark rate based on international practices for technical losses usually inherent to the supply network.

1 The approved UFG reduction plan is an annual plan submitted by the Sui Companies to the Authority encompassing activities and targets to make necessary efforts to reduce UFG.

- Based on our study of the UFG Allowances as applicable in various international regulatory jurisdictions we have identified country wise UFG allowances and demographical indicators shown in the Table R -1.
- We recommend that fixed component of UFG allowance for Sui Companies may be used by the Authority in line with internationally accepted UFG benchmarks considering the dynamics and demographics as applicable in Pakistan.
- UFG allowances are commonly set in correlation with the gas consumptions and network lengths. For instance in Australia UFG allowance rates varies w.r.t. consumption patterns and network size. For AGNL Queensland UFG allowance is 0.5% whereas for Multinet it is 4.03%. However, in New Zealand a UFG Rate of 2.45% is defined as a blanket rate.
- Keeping in view the gas consumption of around 41.2 BM^3 and a network size of 141,190 Kms in Pakistan along with the demographical challenges that the country is facing, we suggest that a fixed component of UFG benchmark rate should be fixed in correlation with the comparable countries/utilities for the next five years. The fixed rate also includes allowance for transmission losses which is calculated upto 0.5% as per ECC Decision.
- The table R-2 provides the total population of the reference countries that we have used for the purpose of our analysis. Finding comparable countries remained a challenge, however, based on the nearest matches maximum allowance provided by regulators is 5% and we suggest the same to be applied by the Authority taking a moderate approach.

Our Recommendations (Cont.)

Table R – 1 - International UFG Allowances

Countries	Population	Urban Population%	Area (Km^2)	Density (P/Km^2)	Network (Km)	Consumption BM^3	UFG Benchmark
USA	324,118,787	82.7%	9,155,898	35	2,225,032	759.4	1.41% - 5%**
Canada	36,286,378	81.9%	9,071,595	4	100,000	104.4	2.65%
Germany	80,682,351	77.2%	348,520	232	34,327	77.5	2.16%
United Kingdom	65,111,143	81.7%	241,959	269	39,778	70.2	1.00%
Turkey	79,622,062	71.9%	769,295	104	15,641	48.5	4.20%
Russia	143,439,832	73.2%	16,299,981	9	259,913	409.2	5.00%
Australia	24,309,330	89.2%	7,596,666	3	580,000	38.8	0.5% - 4.03%*
Ukraine	44,624,373	69.5%	579,537	77	45,597	33.8	2.60%
Bangladesh	162,910,864	34.9%	130,172	1252	20,804	22.9	5.00%
New Zealand	4,565,185	87.8%	263,884	17	15,000	5.4	2.45%
Croatia	4,225,001	59.5%	55,960	76	3,020	2.8	3.30%
Pakistan	192,826,502	38.9%	770,998	250	141,190	41.2	-

Source: *Central Intelligence Agency (CIA),The world fact book and KPMG Data Bank.*
The information presented above is based on facts and figures publicly available and recent statistics of the countries.
The dates of these statistics varies and are between 2013 - 2015.
** 0.5% is the UFG Benchmark for AGNL Queensland and 4.03% is for Multinet.*
*** 1.41% is the UFG Benchmark for Atlanta and 5% is for Texas.*

Our Recommendations (Cont.)

Table R – 2 - Total population						
Country	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
						in Million
Australia	22.16	22.54	22.91	23.27	23.62	23.97
Bangladesh	151.62	153.41	155.26	157.16	159.08	161.00
Canada	34.13	34.50	34.87	35.23	35.59	35.94
Germany	80.44	80.42	80.48	80.57	80.65	80.69
New Zealand	4.37	4.40	4.44	4.47	4.50	4.53
Turkey	72.31	73.52	74.85	76.22	77.52	78.67
USA	309.88	312.4	314.80	317.14	319.45	321.77
UK	62.72	63.16	63.57	63.96	64.33	64.72
Ukraine	45.65	45.48	45.32	45.17	45.00	44.82
Croatia	4.32	4.31	4.29,544	4.28	4.26	4.25
Pakistan	**170**	**174**	**177**	**181**	**185**	**189**

Source: The world metering Report [August 2016]

- Further, to embark a journey reducing UFG to an acceptable and desirable level, Sui companies need adequate UFG allowance to make necessary efforts to reduce UFG while sustaining their financial outlook.
- The study recognizes that Sui Companies have to operate under local challenging conditions as compared to the world at large. Accordingly, additional allowance factor is currently proposed to cover impact of gas losses because of contributing factors like Law and Order situation, shift in sales mix and theft by non-consumers.

Local operating Conditions Component

- **Rate$_2$** is the allowance for local challenging conditions as compared to the world at large. This factor is suggested to cover impact of gas losses due to expanding gas supply network in retail including law & order affected areas and making it more prone to theft, leakages, data/meter errors, and non-recovery of gas bills from law and order affected areas.
- Allowance for these challenging conditions is suggested to be 2.6%, calculated on the average claimed volumes of law and order situations and theft by non-consumers.
- As mentioned, the objective of R2 is to provide an acceptable term relief to Sui Companies to enable them consolidate their efforts and work in line with their UFG Reduction plan, approved and agreed with the Authority. Therefore, to ensure, appropriate and serious efforts are directed towards reducing UFG over the agreed term of five (5) years, the local challenging conditions component is linked to the achievement of certain KMIs. Refer Section III for KMIs details.

Our Recommendations (Cont.)

Table R -3 UFG Relief Working – Allowance for local Operating Conditions

SNGPL	2012	2013	2014	2015	2016	Average (5 Years)	% of GAS (5 Years Average)	Total Relief
Claimed Volumes in respect of Law & Order affected Areas	3,377	8,124	10,803	10,048	11,526	8,776	*1.5%*	*3.0%*
Claimed Volumes in respect of Theft by Non-Consumers	11,172	10,136	7,406	8,735	5,895	8,669	*1.5%*	
Gas Available for Sale	674,868	638,074	581,961	521,533	506,444	584,576		

SSGC	2012	2013	2014	2015	2016	Average (5 Years)	% of GAS (5 Years Average)	Total Relief
Claimed Volumes in respect of Law & Order affected Areas	1,286	1,950	2,279	2,355	2,467	2,067	*0.6%*	*2.2%*
Claimed Volumes in respect of Theft by Non-Consumers	2,059	6,387	8,774	10,420	6,690	6,866	*1.6%*	
Gas Available for Sale	405,737	418,396	422,735	433,798	468,299	429,793		

R2

Average 2.6% approx.

Our Recommendations (Cont.)

Performance Factor

- **β (Beta)** denotes the cumulative efficiency score as determined by OGRA of Key Monitoring Indicators (KMIs) based on a mutually-agreed UFG control program for a financial year. *(refer KMIs in Section III- Way forward)*
- The allowance for the challenging conditions is made subject to ensuring adequate UFG control efforts are made by the Sui Companies.
- KPIs and KMIs have been devised in consultation with the leadership of Sui Companies and the Authority to achieve improvement in the identified four areas of UFG Control framework:
  - Network Measurement and Visibility;
  - Network Rehabilitation;
  - Theft Control; and
  - Research & Development
- All KPIs, together with their respective KMIs, are provided with scores aggregating to a total of 100%. The performance factor enables additional relief of 2.6 % for contributing factor representing local conditions, subject to the achievement of KMIs.
- Going forward, OGRA is suggested to monitor performance of Sui companies and achievement of KPIs vis-à-vis agreed KMIs periodically, at least annually especially before approval of Final Revenue Requirement (FRR). UFG control framework aims to bring year on year improvement in UFG levels.
- Albeit specific funds and resources will be required to achieve these KPIs and augment controls over UFG but the benefits expected to be derived in the form of reduced overall UFG levels will be exemplar.
- The performance of Sui Companies against agreed KMIs shall be validated through an annual review/ assessment by the Authority itself or through an independent expert.
- Our recommendations will be applicable for the next five (5) years as required under our scope of work in the contract, subsequent to which the Authority is advised to review the mechanism and revise the UFG Allowance, if deemed appropriate. However, during the interim revision period, the recommended UFG model may remain valid.
- For prior years, the Authority may issue directives to close the provisional FRRs as evaluating Sui Companies' performance against the proposed KMIs for those periods may not be practicable. FRR for FY 2017 may also be evaluated based on prevailing criteria due to the above mentioned reason.
- Further, to compute and evaluate ERRs in prospective years the Rate 2 may be taken at 50% and the same may be actualized in line with the achievement of proposed KMIs to evaluate respective FRRs on submission.
- UFG allowance under all circumstances shall not exceed the actual reported UFG.

Our Recommendations (Cont.)

A common form calculation to demonstrate the proposed UFG Allowance is as follows:

UFG ALLOWANCE ANALYSIS						
Based on 1000 MMCF	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Gas Available for Sale (mmcf)	1,000	1,025	1,051	1,077	1,104	1,131
UFG (mmcf)	152	155	150	144	139	137
UFG Percentage	15.20%	15.10%	14.30%	13.40%	12.60%	12.10%
UFG Allowance						
Rate1 @ 5%	50	51	53	54	55	57
Rate2 @ 2.6 %	26	27	27	28	29	29
Beta Factor @ 80%	0.8	0.8	0.8	0.8	0.8	0.8
UFG Volume Allowance	71	73	74	76	78	80
Effective Allowance %	7.08%	7.08%	7.08%	7.08%	7.08%	7.08%
UFG Disallowed	81	82	76	68	61	57
% age	8.1%	8.0%	7.2%	6.3%	5.5%	5.0%
Beta Factor @ 60%	0.6	0.6	0.6	0.6	0.6	0.6
UFG Volume Allowance	66	67	69	71	72	74
Effective Allowance %	6.56%	6.56%	6.56%	6.56%	6.56%	6.56%
UFG Disallowed	86	88	81	74	67	63
% age	8.64%	8.54%	7.74%	6.84%	6.04%	5.54%
Beta Factor @ 40%	0.4	0.4	0.4	0.4	0.4	0.4
UFG Volume Allowance	60	62	63	65	67	68
Effective Allowance %	6.04%	6.04%	6.04%	6.04%	6.04%	6.04%
UFG Disallowed	92	93	87	79	72	69
% age	9.16%	9.06%	8.26%	7.36%	6.56%	6.06%

Section III –

Way Forward

Way forward

UFG Management and Control Strategy

- The previous sections of the report discuss the historical trends, contributing factors and impact that rising levels of UFG have on the Sui Companies. To address the latter issue, a structured UFG management and control strategy has been formulated after thoughtful consultation by both the utilities.
- To streamline UFG reduction plan and assist the Sui companies and the Authority in monitoring the UFG reduction progress we have devised a set of KMIs. These KMIs are a set of quantifiable outcomes / results that Sui Companies will use to compare their performance in terms of meeting their strategic and operational goals and if required, take corrective measures thereof.
- Furthermore, the annual UFG allowances as per our recommendations is directly linked to the achievement of these KMIs. The accomplishment of the annual targets monitored by the KMIs will make Sui Companies eligible for the annual UFG allowance in lieu of local challenging conditions to operate.

Proposed Long term plan: *Consolidate and Reduce UFG level to 5.0% by FY 2021.*

Increased Network Visibility	Network Rehabilitation	Theft Control	Research & Development
Reduce Data & Metering Errors	**Reduce Leakages and Gas Losses**	**Detect, Monitor & Control**	**Improve and enhance capacity**
• Increase network visibility via installation of stringent measurement facilities and enhanced meter witnessing throughout the network.	• Ensure periodic and extensive maintenance of the company network to reduce gas lost as a result of leakages and network deterioration.	• Curb gas losses as a result of pilferage of gas by registered and non-consumers through stringent monitoring and vigilance activities.	• Build capacity of the organization by investing in resources to ensure long term and sustainable improvements in the company operations.

Key Monitoring Indicators achievement will be spread over a period of 5 (five) years according to the agreed UFG Reduction strategy

For each category, action points are proposed and these are discussed in the following pages.

Way forward - Metering

Reduce Data & Metering Errors

Increase visibility of the network by ensuring gas passing through the company's network is accurately measured and accounted for via the installation of stringent measurement facilities throughout the network

Strategy	Corrective Actions	Key Monitoring Indicators (Annual)	Target
Increased Network Visibility	Identification of UFG prone areas	Identification of at least 10 areas per region	FY 2021
	Segmentation of UFG Prone Areas & Installation of Check Meters for reconciliation	Develop and report segments and install check meters on identified UFG prone areas	FY 2021
	Reconciliation of Check meters vs CMS Readings on monthly Basis of such Segregated Segmented Areas	Reconciliation of Segmented Areas on monthly basis and identify UFG contributing factors in individual segments	FY 2021
	Design gas pipeline network for new areas in a way that the system segregation is possible and check meter can be installed for reconciliation for better system visibility.	Design all segmented and segregated pipeline network for new areas and schemes making segregation and installation of check meters possible	FY 2021
	Inspection and rectification of all industrial and commercial consumer meters/ CMS's across the (along with reconciliation, seals verification & and by pass checking).	Inspection and rectification of all industrial consumer meters/ CMS's across the network once every month (along with reconciliation, seals verification & and by pass checking).	On-going
		Inspection and rectification of all commercial consumer meters/CMS's over the network once every three (3) months or Quarterly - (As above)	On-going
	Identify and replace defected (slow/ PUG/ sticky) meters and bring it to an acceptable level of < 5% of total connections.	Number of defective Industrial meters replaced as a percentage of total defective Industrial meters reported/notified per annum	On-going
		Number of defective Commercial meters replaced as a percentage of total defective Commercial meters reported/notified per annum	On-going
		Number of defective Domestic meters replaced as a percentage of total defective Domestic meters reported/notified per annum	On-going
	Incorporate in the existing system relevant features or acquire a system with built in features of analyzing the system data and identifying malfunctioning meters on the basis of anomalies identified.	Industrial meters replaced as a percentage of total Industrial meters qualifying scheduled replacement criteria	On-going
		Commercial meters replaced as a percentage of total Commercial meters qualifying scheduled replacement criteria	On-going
		Domestic meters replaced as a percentage of total Domestic meters qualifying scheduled replacement criteria	On-going
	The company shall carry out an exercise by testing a batch of minimum billed replaced meters to ascertain the actual minimum billing cases vs defective meters	Carry out quarterly exercise by testing a batch of minimum billed replaced meters vs defective meters and shall subsequently make all efforts to reduce the percentage in minimum billed consumers w.r.t. present of 25% SSGCL, SNGPL 32%	On-going

Way forward - Rehabilitation

Reduce Leakages and gas losses

Ensure periodic and extensive maintenance of the company network to reduce gas lost as a result of leakages and network deterioration.

Strategy	Corrective Actions	Key Monitoring Indicators (Annual)	Target
Network Rehabilitation	Replace overage underground distribution network, increase annual rehabilitation of ageing pipelines to control leakages and corrosion.	Length of the underground distribution network replaced (KMs) as a % of total company's annual network replacement target	On-going
	Acquire tools with improved features for underground leakage detection and reduce the underground leak per Km to less than 1 leak/ Km.	Reduce present level of leak rate from 2.2 & 4.9 underground leaks/km in case of SNGPL & SSGC gradually to less than 1 leak/km in 5 years	FY 2021
	Carry out surveys for leak identification and extensive leak rectification of the overhead leakages and reduce it to less than 1 leak/ connection.	Inspect & Survey twenty (20) % total Domestic connections annually and rectification of detected aboveground leak connections	FY 2021
	Establish additional Cathodic Protection Stations to ensure 100% Cathodic protection over the network to control corrosion. Ensure availability of alternative source power supply at all CP stations.	No. of CP stations installed/refurbished as a %age of CP stations selected for installation/renovation	On-going

Way forward - Theft Control

Detect, Monitor & Control

Curb gas losses as a result of gas pilferage by registered and non-consumers through stringent monitoring and vigilance activities.

Strategy	Corrective Actions	Key Monitoring Indicators (Annual)	Target
Theft Control	Enhance/ develop system capabilities to enable automated analysis of billing data and identification/ of gas pilferers on the basis of anomalies identified. During the transition period establish a Special Cells/ units to manually analyze CC&B data to detect abnormal consumer behavior for identification of gas theft.	No. of disconnections in respect of theft as a % of total consumer base of the period.	FY 2019
	Re-Inspect all meters disconnected to prevent gas pilferage through reconnections by the disconnected consumers.	Re-inspection of 100% disconnected industrial consumers annually.	On-going
		Re-inspection of 50% disconnected commercial consumers annually.	On-going
		Re-inspection of 20% disconnected domestic consumers annually.	On-going
	Increase the Turnaround Time (TAT) of the resolution of gas theft complaint applications received during the year. Improve/ Increase the channels for theft complaints available to the general public such as online complaint registration system etc.	No. of gas theft/Leakages complaints resolved as a % of actual complaints lodged in the same year.	On-going

Way forward - Research & Development

Increase and Enhance Capacity

Build capacity of the organization by investing in resources to ensure long term and sustainable improvements in the company operations.

Strategy	Corrective Actions	Key Monitoring Indicators (Annual)	Target
Research & Development	Conduct mandatory technical training programs for employees of all levels. Ensure the attendance of employees in seminars/ workshops pertaining to the gas industry, both national and international.	Number of training hours per employee per year.	N/A
	Establish dedicated research and development cells with the aim to identify/ develop tools for increased efficiency cost reduction.	Innovation / New projects to improve cost effective construction, maintenance, emergency repairs & efficiency	FY 2019
	Identify high UFG regions and progress are	Identification of higher UFG regions & progress on UFG reduction through a Reward/Penalty scheme for Regional Management and relevant staff.	FY 2019
	Organize knowledge sharing sessions	Number of knowledge sharing meetings/ joint sessions attended/ organized during the period.	FY 2019
Upgrade Meter Workshop	Improvement in meter testing workshop carried out as per the required international standards.	Improvement in meter testing workshop carried out as per the required international standards. Certification / affiliation with a relevant international forum who shall verify the facility on regular intervals	N/A
Compliance with the performance and service standards	Compliance of performance and service standards.	All performance and Service Standard to be complied which are already in place and communicated to gas companies. It will require the companies to promptly respond to gas emergencies, leakages, meter replacement and low pressure complaints, proper backfilling, adherence to contractual pressure, timely removal of service lines etc. Audit of which may be initiated as and when advised by OGRA.	On-going

Way forward Key Monitoring Indicators (KMIs) - Weightage

Key Monitoring Indicators			Beta (ß)
S.No.	**Strategy**	**Key Monitoring Indicators (KMIs)**	**Weightage %**
1	**Increased Network Visibility**	Identification of UFG prone areas (at least 10 areas per region)	*3.0%*
2		Segmentation of UFG Prone Areas & Installation of Check Meters for reconciliation	*3.0%*
3		Reconciliation of Check meters Vs CMS Readings on monthly Basis of such Segregated / Segmented Areas and identification of the cause of UFG which may include pilferage, line leakages, measurement errors and corrective measures taken thereafter indicating reduction in UFG due to the exercise carried out	*5.0%*
4		For new areas, design of gas pipeline network may be made in such a way that the system segregation is possible and check meter can be installed for reconciliation for better system visibility. Similar exercise, as indicated at 3 above, to be carried out on such systems.	*3.0%*
5		Inspection and rectification of all industrial consumer meters/ CMS's across the network once every month *(along with reconciliation, seals verification & and by pass checking).*	*2.0%*
6		Inspection and rectification of all commercial consumer meters/CMS's over the network once every three (3) months or Quarterly - (As above)	*2.0%*
7		Number of defective Industrial meters replaced as a percentage of total defective Industrial meters reported/notified per annum	*2.0%*
8		Number of defective Commercial meters replaced as a percentage of total defective Commercial meters reported/notified per annum	*2.0%*
9		Number of defective Domestic meters replaced as a percentage of total defective Domestic meters reported/notified per annum	*4.0%*
10		Industrial meters replaced as a percentage of total Industrial meters qualifying scheduled replacement criteria	*2.0%*
11		Commercial meters replaced as a percentage of total Commercial meters qualifying scheduled replacement criteria	*3.0%*

Way forward Key Monitoring Indicators (KMIs) - Weightage

Key Monitoring Indicators			Beta (ß)
S.No.	**Strategy**	**Key Monitoring Indicators (KMIs)**	**Weightage %**
12	**Increased Network Visibility (Cont.)**	Domestic meters replaced as a percentage of total Domestic meters qualifying scheduled replacement criteria	*4.0%*
13		The company shall carry out an exercise by testing a batch of minimum billed replaced meters to ascertain the actual minimum billing cases vs defective meters and shall subsequently make all efforts to reduce the percentage in minimum billed consumers w.r.t. present of 25% SSGCL, SNGPL 32%	*5.0%*
14	**Network Rehabilitation**	Length of the underground distribution network replaced (KMs) as a % of total company's annual network replacement target	*6.0%*
15		Reduce present level of leak rate from 2.2 & 4.9 underground leaks/km in case of SNGPL & SSGC gradually to less than 1 leak/km in 5 years	*7.0%*
16		Inspection & Survey twenty (20) % total Domestic connections annually and rectification of detected aboveground leak connections	*3.0%*
17		Number of CP stations installed/refurbished as a %age of CP stations selected for installation/renovation	*3.0%*
18	**Theft Control - Registered**	No. of disconnections in respect of theft as a % of total consumer base of the period along with the pilfered volume detected and recovery achieved	*3.0%*
19		Re-inspection of 100% disconnected industrial consumers quarterly. Service line to be removed in accordance with Performance and Service Standard	*2.0%*
20		Re-inspection of 50% disconnected commercial consumers by annually. Service line to be removed in all cases	*2.0%*
21		Re-inspection of 20% disconnected domestic consumers annually. Service line to be removed in all cases	*2.0%*
22		Improvement in detection of No. of theft cases w.r.t. present of <1% of consumer base along with pilfered volume detected and recovery initiated/achieved	*4.0%*

Way forward Key Monitoring Indicators (KMIs) - Weightage

Key Monitoring Indicators			Beta (ß)
S.No.	**Strategy**	**Key Monitoring Indicators (KMIs)**	**Weightage %**
23	**Theft Control – Non-registered**	Number of FIR's registered against the number of cases detected	*5.0%*
24		Number of criminal suits filed	*3.0%*
25		Number of recovery suits filed	*3.0%*
26	**Research & Development**	Number of training hours per employee per year	*1.0%*
27		Innovation / New projects to improve cost effective construction, maintenance, emergency repairs & efficiency	*2.0%*
28		Identification of higher UFG regions & progress on UFG reduction through a Reward/Penalty scheme for Regional Management and relevant staff	*2.0%*
29		Number of knowledge sharing meetings/ joint sessions attended/ organized during the period.	*1.0%*
30	**Up gradation of metering workshop**	Improvement in meter testing workshop carried out as per the required international standards. Certification / affiliation with a relevant international forum who shall verify the facility on regular intervals	*5.0%*
31	**Compliance with the "performance and Service Standard"**	All performance and Service Standard to be complied which are already in place and communicated to gas companies. It will require the companies to promptly respond to gas emergencies, leakages, meter replacement and low pressure complaints, proper backfilling, adherence to contractual pressure, timely removal of service lines etc. Audit of which may be initiated as and when advised by OGRA.	*6.0%*
		Total %	***100%***

KPMG

Annexure

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