

CHAPTER 1: INTRODUCTION

1.1 General introduction – Introduction to the report describing its basic purpose, etc.

1.2 Approach – Basic methodology, approach, team make-up, project sponsors etc.

1.3 Report structure – Chapter Structure Description of content, approach etc.

CHAPTER 2: OVERVIEW OF GAS NETWORKS AND UFG

2.1 Gas networks – This section will provide a simple introduction to gas transmission and distribution networks, to define terms, and provide an overview of gas network logistic

2.2 Introduction to UFG – This section will explore UFG at a high level, where it comes from etc. This section will also provide a definition of UFG in terms of its key components which will be used throughout the report.

2.3 Environmental aspects of UFG – This section shall explore the environmental implications of UFG.

2.4 Concluding discussion

CHAPTER 3: UFG DUE TO LEAKAGE

3.1 Understanding and quantifying the problem – This section will seek to understand the nature of the UFG problem in relation to leakage. For example.

- Why do leaks occur?
- Where do leaks occur and why?
- What are the different sources of gas leaks throughout the gas network? For example, gas leaks on transmission systems, distribution systems, customers premise etc.
- Quantifying the volume of a leak and leaks. What is an acceptable level of leakage? If any?

3.2 Fixing the problem and reducing UFG

- How do gas network operators discover gas leaks? For example, leakage surveys, customer notifications etc.
- What does new technology have to offer in terms of identifying leakage? – For example, use of drones, satellite imagery.
- What solutions do network operators deploy?
- What future solutions could network operators deploy in the future?

3.3 Concluding discussion

CHAPTER 4: UFG DUE TO THEFT

1.1 Understanding and quantifying the problem – This section will explore UFG and theft. For example.

- How does gas theft occur? Where does theft occur? For example, this would include meter tampering, illegal connections, etc.
- How do gas network operators quantify theft?
- How do network operators manage theft? For example, do they introduce legal proceedings? Are there any social / welfare implications etc.
- What are the social implications of rising energy costs, and gas theft?

1.2 Fixing the problem and reducing UFG

- What actions do gas network operators take to discover gas theft? For example, regular visits to customer sites, mathematical analysis of gas flows, customer notifications etc.
- What does new technology have to offer in terms of reducing theft? – For example, use of drones, satellite imagery, development of network segments etc.
- What solutions do network operators deploy?

1.3 Concluding discussion

CHAPTER 5: UFG DUE TO MEASUREMENT ERRORS

5.1 General introduction to gas metering

5.1.1 *Gas measurement at Entry Points*

5.1.2 *Gas measurement at Exit Points*

5.1.3 *Weighted average CV measurement*

5.1.4 *Temperature, pressure, and altitude correction*

5.2 Understanding and quantifying the problem – This section will explore UFG in relation to gas measurement. For example.

- What measurement problems occur at Entry Points with fiscal gas meters fail? For example, orifice plate degradation, ultrasonic meter failures etc.
- What measurement problems occur at the customers premise?
- Quantifying the impact of measurement errors.

5.3 Fixing the problem and reducing UFG

- What actions do gas network operators take to identify and reduce measurement errors? For example, regular visits to customer sites, mathematical analysis of gas flows, customer notifications etc.
- What does new technology have to offer in terms of reducing measurement errors? – For software algorithms that highlight unusual readings.
- What solutions do network operators deploy?
- What future solutions could network operators deploy in the future?

CHAPTER 6: UFG AND OWN USE GAS

6.1 General introduction to own use gas

6.1.1 *Own use gas in gas compression*

6.1.2 *Own use gas in gas pre-heating*

6.2 Understanding and quantifying the problem – This section will explore UFG in relation to own use for example.

- Poor estimates of own use gas in compression and pre-heating.
- Inefficient equipment.

6.3 Fixing the problem and reducing UFG

6.4 Concluding discussion

CHAPTER 7 - THE FINANCIAL AND ENVIRONMENTAL COST OF UFG

7.1 The financial impact of UFG – This section will explore using a range of examples what the financial cost of UFG is to various stakeholders in the gas chain but ultimately to the end consumer.

7.2 The environmental impact of UFG –NRAs (National Regulatory Agencies) are showing an increased interest in UFG and its environmental impact, this section shall seek to quantify the environmental cost of UFG.

7.3 Concluding discussion

CHAPTER 8 – GAS NETWORK REGULATION AND UFG

7.1 An introduction to gas network regulation

7.2 A review of regulatory models and UFG

7.2 Concluding discussion

CHAPTER 9 – BENCHMARKING REVIEW OF UFG DATA AND ASSOCIATED REGULATORY MECHANISMS

9.1 Introduction – This section shall seek to gather a cross section of international UFG data from gas network, owners, operators, and regulators from around the world.

9.2 Choice key benchmarks

- Name of gas network
- Size of gas network in terms of km of pipelines, numbers of customers, annual gas demand.
- Regulatory regime in place
- UFG by % throughput, volume for both transmission and distribution.

9.3 Presentation of data

9.4 Concluding discussion

CHAPTER 10 – CONCLUSION

This section shall draw the key information from the previous chapters together to have both a meaningful discussion and develop some conclusions on UFG and the future.