İSTANBUL TEKNİK ÜNİVERSİTESİ ★ ENERJİ ENSTİTÜSÜ

CONTRACT SET OPTIMIZATION MODEL (CUSTOM) FOR TURKISH NATURAL GAS MARKET

YÜKSEK LİSANS TEZİ

Alper ACARTÜRK
301091089

Enerji Planlaması ve Yönetimi Anabilim Dalı
Enerji Bilim ve Teknoloji Programı

Tez Danışmanı: Doç. Dr. Gülgün KAYAKUTLU

Teslim Tarihi: 5 Mayıs 2014

İTÜ, Enerji Enstitüsü'nün 301091089 numaralı Yüksek Lisans öğrencisi **Alper ACARTÜRK**, ilgili yönetmeliklerin belirlediği gerekli tüm şartları yerine getirdikten sonra hazırladığı "**CONTRACT SET OPTIMIZATION MODEL (CUSTOM) FOR TURKISH NATURAL GAS MARKET**" başlıklı tezini, aşağıda imzaları olan jüri önünde başarı ile sunmuştur.

Tez Danışmanı :	**Doç. Dr. Gülgün KAYAKUTLU** İstanbul Teknik Üniversitesi	**……...**
Jüri Üyeleri :	**Prof. Dr. Asiye Beril TUĞRUL** İstanbul Teknik Üniversitesi	**……...**
	Doç. Dr. Ömer İnanç TÜREYEN İstanbul Teknik Üniversitesi	**……...**

Teslim Tarihi : **5 Mayıs 2014**

Savunma Tarihi : **27 Mayıs 2014**

Bana olan ilgi ve desteğini hiçbir zaman esirgemeyen

Tez Danışmanım Doç. Dr. Gülgün KAYAKUTLU'ya

ve

her zaman olduğu gibi tez yazarken de bir an beni yalnız bırakmayan

dünyanın en güzel kadınına

teşekkür ederim.

PREFACE

I would like to thank to my managers and seniors who share their valuable knowledge and experience generously.

This thesis study is aimed to help to those who are willing to understand and improve the natural gas market with their valuable skills, but out of the sector. This study also could be seen as a guideline for junior professionals stepping into the natural gas trading business.

Studies on demand or price forecasting in Turkish natural gas market are yet not very useful to sector professionals since the liberal market is not complete and hence predictable. Without a mature spot market or a fairly competitive market structure, prior aim of studies should be to understand market realities. These studies are also should be capable of being a simulation tool to improve the market.

Arranging contracts is vital in the natural gas sector, as it is in every sector. Distinctively, in natural gas business it is necessary to deal with several concurrent contracts which strongly affect each other. Finding the correct route in this complicated business is a tough duty if one does not have a scientific approach.

Finally, I hope that employers value the professionals as well as they value their political relations, so the sector avoids a possible pseudo-development and really improves.

May 2014 Alper Acartürk

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ACQ	**:**	Annual contract quantity
bcm	**:**	Billion cubic meter
BOTAS	**:**	Petroleum Pipeline Corporation
BR	**:**	Board Resolution
CUSTOM	**:**	Contract SeT Optimization Model
CNG	**:**	Compressed natural gas
DCQ	**:**	Daily contract quantity
DGF	**:**	Balancing gas price
EBB	**:**	Electronic Bulletin Board
EMRA	**:**	Energy Market Regulatory Authority
EU	**:**	European Union
GCV	**:**	Gross calorific value
GRID	**:**	National transmission grid
GSPA	**:**	Gas Sales and Purchase Agreement
Kr	**:**	Kuruş
kWh	**:**	Kilo watt hours
LAW	**:**	Natural Gas Market Law No 4646
LCQ	**:**	Lunar contract quantity
LNG	**:**	Liquefied natural gas
MAQ	**:**	Minimum annual quantity
MSQ	**:**	Minimum summer quantity
NOP	**:**	Network Operating Principles
NBP	**:**	National balancing point
PDF	**:**	Probability density function
RMS	**:**	Pressure reduction and measurement station
SCT	**:**	Special consumption tax
STC	**:**	Standard Transmission Contract
Sm^3	**:**	Standard cubic meter
TAP	**:**	Trans Adriatic Pipeline
TANAP	**:**	Trans Anatolian Pipeline
TL	**:**	Turkish Lira
USD	**:**	United States Dollar
VAT	**:**	Value added tax

SYMBOLS

A	:	Annual contract amount
α	:	Multiplier
b	:	Daily nomination
B	:	Total nomination
c	:	Weight coefficient
δ	:	Daily amount difference
Δ	:	Total amount difference
e	:	Unit cost
E	:	Total cost
g	:	Tariff unit cost
I	:	Invoiced/lumpsum cost
j	:	Day number
J	:	Number of days of year
m	:	Customer address
n	:	Month number
N	:	Number of months of year
p	:	Delivery point
P	:	Price
q	:	Daily consumption
Q	:	Total consumption
ρ	:	Pressure
R	:	Currency
T	:	Tolerance
θ	:	Unit step function
u	:	Daily undelivered amount
U	:	Total undelivered amount
v	:	Validator
y	:	Contract address
z	:	Agreed daily quantity
Z	:	Agreed total quantity

CONTRACT SET OPTIMIZATION MODEL (CUSTOM) FOR TURKISH NATURAL GAS MARKET

SUMMARY

From the well to the end consumer, natural gas follows a long route owing to the valuable efforts of numerous professionals. Exploration, production, transmission and consumption of natural gas are well studied for ages and could be considered as mature professions those use proven techniques of several engineering disciplines.

On the other hand, trading of natural gas is a profession which could only be developed specifically for a certain country, especially if the market is just at the beginning of liberalization process. Under different geologic, political and economic conditions, none of the mathematical models structured for a specific market would fit perfectly for another one.

For Turkish natural gas market, the urgent need is that a mathematical model of the market to be structured, hence new improvements could be adopted and simulated during the legislation procedure. Many academic studies on energy planning which are focused on demand or price forecasting are only useful if there exists a mature, predictable market structure.

In this thesis study, Turkish natural gas market is overviewed to give the reader an insight about the market structure.

First interesting information about the Turkish gas market is, almost all of the natural gas agreements are signed by trading companies at the same time in a yearly basis, in order to access natural gas grid according to the regular schedule. It means that, by negotiations conducted between companies before the capacity reservation date, a company has information of many sales and purchase contracts ready to be signed. On the decision week, a professional has to decide on and purchase contracts to sign among the negotiated ones. Comparison of different contract sets are used to maximize the expected profit of the company for the upcoming year.

It is a fact that BOTAS has the vast majority of Turkish natural gas market and hence the BOTAS sales price practically acts as a reference price. On the other hand, since almost all of the demand is satisfied by imported natural gas, oil-indexed import agreement prices are also another reference for the market. Finally, as the third price structure, fixed price contract is included in the thesis study.

With the changes in the BOTAS tariff, reference oil product prices and exchange rate throughout the year, every price equation result in different prices for each month. Eight different estimations are offered in order to see the profitability of each contract set at the end of the year under different assumptions.

Gas volume definitions are stated in contracts in detail. The maximum amounts those could be withdrawn by buyer in a particular day and for the whole year are written explicitly in contracts. Moreover, minimum amounts those buyer has to take in summer time and during the whole year are also defined. These upper and lower boundaries allow buyer to fluctuate in a wide range without harming the contract conditions. A company has to consider the boundaries of sales and purchase contracts together to decide on the contracts to be signed among negotiated ones. Hence, four different extreme consumption case calculation methods are defined and applied to each contract.

For the purpose of maximizing the profit at the end of the year, Contract SeT Optimization Model (CUSTOM) is structured to generate a profitability matrix.

Comparisons of contracts are not enough to decide without including other costs and expenses arising from regulations and legislations. Every cost item is defined clearly by mathematical functions.

Combining the results, an overall profitability matrix is generated which summarizes the profit and loss situations for the decision maker.

CUSTOM intends to transform sector know-how into a mathematical functions set in order to let professionals who are out of the sector to study and improve the Turkish natural gas market.

For demonstration purpose, CUSTOM is applied to a fictional case study by using excel and the results of that study are presented in the last section of this thesis study.

CONTRACT SET OPTIMIZATION MODEL (CUSTOM) FOR TURKISH NATURAL GAS MARKET

ÖZET

Türkiye doğal gaz piyasası, Avrupa ve Amerika piyasalarını takiben, 2001'de yayınlanmış olan 4646 sayılı Doğal Gaz Piyasası Kanunu ile serbestleşme yoluna girmiştir.

Türkiye, doğal gaz kaynakları bakımından çok şanslı bir konumda bulunmamasına rağmen, doğal gaz kaynaklarının kümelendiği Orta Doğu ve Hazar bölgeleri ile başlıca tüketici konumunda bulunan Avrupa ülkeleri arasındaki konumu ile doğal gaz boru hatları geçiş güzergahı açısından Dünya doğal gaz piyasasında önemli bir ülke durumundadır.

Türkiye açısından doğal gazın sadece taşınan bir enerji kaynağından, ticareti yapılan, dolayısıyla kazanç elde edilen bir meta haline gelmesinin yolu, ülkedeki doğal gaz piyasasının gelişmesinden geçmektedir. Bu gelişim de bu konuda iş birliği yapacak uzmanların ortak çalışmalarıyla sağlanabilir.

Bu tez, Türkiye doğal gaz sektöründe çalışmakta olan bir sektör uzmanı tarafından, bu konuda çalışmak isteyen sektör dışı kişilere bir kaynak olması amacıyla yazılmıştır. Ayrıca, sektöre yeni katılan uzman adayları için de bir el kitabı olması hedeflenmiştir.

Doğal gaz piyasasında planlamalar yapılırken matematik, mühendislik, istatistik, hukuk gibi farklı disiplinlerin bir arada çalışması gerekmektedir. Bu gruplar arasında ortak bir dil oluşturulması kolay olmadığından, ortak bir dil geliştirebilmiş çalışma gruplarının, bu planlamalarda yardımcı olabilecek bir karar verme algoritması geliştirmelerine ihtiyaç vardır.

Doğal gaz ticareti, özellikle serbestleşme sürecinin henüz başındaki piyasalarda, ancak o piyasaya has kurallar ile yürütülebildiğinden, başka bir piyasa için kurgulanmış matematiksel modellerin adapte edilmesi mümkün olmamaktadır. Farklı

jeolojik, politik ve ekonomik koşullar altında, belli bir piyasa için oluşturulmuş hiçbir matematiksel model bir diğer piyasanın ihtiyaçlarını tam olarak gideremektedir.

Bu tez çalışması ile Contract SeT Optimization Model (CUSTOM) for Turkish Natural Gas Market (Türkiye Doğal Gaz Piyasası için Sözleşme Seti Optimizasyon Modeli) adı verilen model adım adım kurgulanmış, bu esnada maliyetler ve nasıl oluştukları tanıtılmıştır. Matematik fonksiyonları kullanılarak, gaz ticareti ile ilgili maliyet kalemleri sektöre aşina olmayanlarca da çalışmalarda kullanılabilecek şekilde modellenmiştir.

Türkiye doğal gaz ihtiyacının hemen hepsi ithal kaynaklardan sağlanmaktadır. Ayrıca, Türkiye'nin doğal gaz depolama kapasitesi de mevsimsel dalgalanmaları sönümleyebilecek kadar gelişmiş değildir. Bu iki kavramın bir araya gelmesiyle, doğal gaz ülkeye ithal edildiği birkaç gün içinde büyük oranda tüketilmek durumunda olan bir kaynak halini almıştır.

İthalatçı şirketler tarafından ithal edilen doğal gazın toptan satış şirketleri ve dağıtım şirketleri aracılığıyla son tüketiciye ulaşması esnasında her el değişikliğinde imzalanan sözleşmeler doğal gaz piyasasında işleyişin temelidir.

Doğal gaz piyasasında anlaşmalar yıllık olarak yapılmakta olup, BOTAS iletim hatlarını kullanabilmek için başvurulması gereken son tarih olan Eylül sonundan önce bir sonraki sene yürürlükte olacak tüm anlaşmalar aynı anda bağlanmaktadır. Bu sebepten tüm anlaşmalar birbirlerini etkilemekte olup, pek çok pazarlıklar sonucu gelinen anlaşma koşullarının hangilerinin bir sonraki sene karlı bir ticaret olacağı iyi hesaplanmak durumundadır.

Bu tez çalışmasında esas olarak özel sektördeki şirketlerin operasyonları incelenmiştir. Devlet şirketi olan BOTAS'ın piyasadaki hakim durumu, boru hatlarının mülkiyetini ve kontrolünü elinde bulundurması, doğal gaz piyasası gerçeklerinden bağımsız biçimde fiyat belirleyebilme serbestisi sebebiyle BOTAS satış operasyonlarının matematiksel olarak modellenmesi anlamsızdır. 2013 başından beri dünya doğal gaz piyasasındaki tüm değişikliklere, ayrıca yurt içinde döviz kurundaki tüm dalgalanmalara rağmen BOTAS, Hükümetin kararıyla gaz fiyatında herhangi bir düzenlemeye gitmemiştir. Önümüzdeki günlerde de bir fiyat ayarlaması yapılıp yapılmayacağı tamamen politik bir karardır.

Bu özellikleri ile BOTAS fiyatı tahmin edilemeyen bir yapıdadır. Ne var ki, doğal gaz ticaret şirketleri pazar paylarını artırmak için halihazırda BOTAS'tan alım yapan son tüketicilere muhtaçtır. Doğal gazın kalitesi veya teslim şartları tamamen BOTAS'ın işlettiği iletim hatları üzerinden gerçekleştirildiği için doğal gaz ticaret şirketlerinin tek enstrümanı fiyat rekabetidir. Bu, BOTAS-endeksli fiyat yapısının Türkiye doğal gaz piyasasında yaygınca kullanılması sonucuna yol açmıştır.

BOTAS-endeksli fiyatlandırma sisteminde, BOTAS tarifelerinden (abone, serbest tüketici ve organize sanayi bölgesi) oluşturulan bir sepet referans fiyatı olarak alınmakta, bu sepet üzerinden indirim teklif edilmektedir. Yıl içinde BOTAS'ın zam veya indirim yapması durumunda bu değişiklik sözleşme fiyatına aynı şekliyle yansımaktadır. Gazın taşınması ile ilgili maliyetler bu tip kontratlarda genellikle satıcı tarafından karşılanmaktadır.

Öte yandan ithalat sözleşmeleri petrol-endeksli olarak tanımlanmış olup, ithalatçı şirketler satışlarını bu fiyatın üzerine belirli bir kar koyarak yapma eğilimi gösterebilmektedirler. Böylece ithalatçı şirketler zarar etme riskinden kurtulmuş olmaktadırlar. Bu fiyat yapısı da, Türkiye doğal gaz piyasasında firmalar arasında yaygınca yer bulmuş durumdadır. Referans olarak belirlenmiş olan petrol ve petrol türevlerinin fiyatlarındaki dalgalanmalar, formül yapısına göre bazen birkaç ay gecikmeli olarak gaz fiyatına yansımaktadır. Bu tip kontratlarda gazın taşınması ile ilgili maliyetler de genellikle alıcıya yansıtılmaktadır.

Bunlarla birlikte, bir de basit karşılaştırma açısından sabit dolar fiyatlı bir fiyat yapısı öngörülmüştür.

Elbette pek çok farklı fiyat yapısı oluşturulabileceğinden tamamının bu tez çalışmasında değerlendirilmesi mümkün değildir. Bu çalışma kapsamında farklı karmaşıklık düzeyindeki bu üç fiyat yapısı yeterli görülmüştür. Gerçek bir operasyonda bu yapı esas alınarak sözleşme şartlarına uygun model kolaylıkla oluşturulabilir.

Fiyatların karlı bir operasyon sağlayıp sağlamayacağı, aynı zamanda bu operasyonların gerçekleştirilip gerçekleştirilemeyeceğine de bağlıdır.

İthalat anlaşmalarının belirli miktar şartları vardır. Bu şartlar çerçevesinde günlük belli bir miktara kadar gaz sağlanabilmekte olup bu miktarın üzerinde gaz arzı

sağlanamamaktadır. Ayrıca, günlük alınabilecek minimum miktarlar da bu anlaşmalarda belirtilmiştir.

Bununla birlikte yıllık alınabilecek maksimum miktar da belirlenmiştir. Bu miktar aşılamayacağı gibi, bu miktarın belirli bir yüzdesinin de satın alınması ilave olarak zorunlu kılınmıştır. Asgari yıllık miktar ve asgari yazlık miktar olarak adlandırılan bu miktarlar satın alınmadığı durumda alıcının ceza ödemesi söz konusu olmaktadır.

Bu şartlar, her yapılan sözleşmeye küçük değişikliklerle silsile halinde aktarılmaktadır. Dolayısıyla bir şirket, alış ve satış kontratlarını hazırlarken bu şartlara uymak zorundadır.

Bu çalışmada ele alınan kontratlar bir bütün olarak değerlendirilmektedir. Belirli bir yıllık dağılıma sahip gaz için fiyat formülü belirlendikten sonra kontrat parametreleri tamamlanmış olur ve diğer kontratlarla karşılaştırma bundan sonra başlar.

Herhangi bir kontratı kısmen ya da yılın belirli dönemlerinde devreye almak gibi bir uygulama olmadığından bu gibi faaliyetler SPOT satış olarak tanımlanmıştır ve bu tezin kapsamında incelenmemiştir. Zira SPOT satışlar kısa dönemli olup zaten fiyatları ve kar beklentisi kesin olarak bilinmektedir. CUSTOM kullanarak bir sonraki yılın planlamasını yapmış bir firma, portföyünün müsaitliğine göre yıl içinde herhangi bir zaman herhangi bir ticarete girerek bütçelediği karının üzerine kazanç ekleyebilir.

Bir firma, bir sonraki yıl için planlamasını yaparken alış ve satış kontratlarını miktar açısından çakıştırmakta zorlanmaktadır. Firmanın, alış kontratlarında tanımlanmış günlük maksimum miktarı hiç aşmadan satış kontratlarını bağlaması halinde kendisinden istenen gazı her gün tam olarak teslim etmesi garantilenmiş olur. Öte yandan, yıl içinde müşterilerin minimum miktarlarda alım yaptığı durumda, bu firma alış kontratlarındaki minimum şartları sağlayamama riski ile karşı karşıya kalacaktır.

Eğer firma, alış kontratlarındaki minimum miktarları satmayı garanti altına alacak şekilde satış kontratı bağlarsa da, müşterilerinin alabilecekleri miktarın tamamını almak istediği soğuk kış günlerinde bu talepleri karşılayamama ve onlara eksik yapacağı teslimattan dolayı tazminat ödeme riskiyle karşı karşıya kalabilir.

CUSTOM, bu iki durumu da maliyet olarak hesaplayıp sonuca dahil etmektedir ve böylece miktar açısından hiç cezasız satış stratejisini yakalayamasa da, cezalar ve tazminatlar ödendikten sonra toplam karın en yüksek olduğu sonucu bulmaktadır.

Tez çalışmasında, kontrat yapıları kadar kanunlar ve yönetmeliklerden doğan maliyetler de incelenmiştir. BOTAS boru hatları kullanıldığı için, Şebeke İşleyiş Düzenlemesi ve diğer yönetmelikler ile tarif edilen taşıma bedeli, kapasite bedeli, kapasite aşım bedeli, dengesizlik cezası gibi maliyetler matematiksel olarak tanımlanmıştır.

Bir diğer maliyet kalemi olan damga vergisi de bu çalışma kapsamında dikkate alınmıştır. Damga vergisi imzalanan her anlaşmada doğmakta olup, bir sonraki yıla otomatik olarak uzayan anlaşmalarda doğmamaktadır. Bu maliyet kalemi, bazen bir anlaşmanın yenilenmesi ya da ilgili miktar için başka bir anlaşmanın imzalanması kararı verilirken etkili olabilecek kadar büyüktür.

Miktar açısından birbirlerine denk gelen sözleşme setleri bu maliyetler de dahil edilerek kar zarar tablosu ortaya çıkarılmıştır.

Sözleşme setleri oluşturulması aşaması piyasadaki hemen her şirket için kullanılabilecek şekilde tasarlanmıştır. Alış kontratları, satış kontratları ayrı ayrı tanımlanmış olup, her birinin dengesizlik karakterleri tarif edilmiş durumdadır. Eğer ki şirket bir ithalat lisansına sahipse, alış kontratı sabit tutulup diğer kontratlardan karşılayan setler incelenecektir. Benzer şekilde şirket veya bağlı bulunduğu holding bir dağıtım şirketi veya kombine çevrim santraline sahipse, bu sefer satış kontratları sabit tutulup alış kontratlarından ihtiyaçlarını karşılayan set oluşturulacaktır.

Tez içinde örnek olması açısından tezin son bölümünde sunulan case study incelenmiş, alış kontratı sabit tutularak beş farklı müşteri seti alternatifi oluşturulmuştur. Birbirinden farklı miktar ve fiyat şartları bulunan toplamda 11 adet sözleşme arasından tespit edilen bu beş set, sekiz farklı geleceğe dönük fiyat beklentisi açısından incelenmiştir.

Her sözleşmenin minimum ve maksimum alım miktarları farklı olabileceğinden ve bu sınırlar dahilinde müşterilerin nasıl hareket edeceği yıl öncesinde kestirilemeyeceğinden, dört farklı ekstrem davranış yapısı öngörülerek her durum için bu setlerin ayrı fiyat beklentilerine göre kar / zarar durumu yeniden hesaplanmıştır.

Çalışmanın sonunda, sadece fiyatlara göre yapılan inceleme ile bir kar zarar tablosu çıkmıştır. Bu tablo, diğer tarif edilen maliyet kalemlerinden seçilen bazılarının

eklenmesiyle tekrar değerlendirilmiş olup, bazı varsayımlara göre karlı görülen alternatiflerin aslında zarar etme ihtimali olduğu açığa çıkmıştır.

Bu yaklaşım, hesaplamaların ne kadar kapsamlı ve detaylı yapılırsa gerçeğe o kadar yakın sonuç alınacağını ve sürprizlerle karşılaşma ihtimalinin azalacağını açıkça göstermektedir.

1. INTRODUCTION

This study aims to enlighten the reader about the facts and concerns about the natural gas sales and purchase agreements (GSPAs) which are operative in the Turkish natural gas market from the point of view of a contracts optimization specialist (Engineer) working for a privately owned natural gas trading company (The Company). By structuring a Contract SeT Optimization Model (CUSTOM), cost mechanisms in regulations and legislations which affect the profit of The Company will be modelled.

The terms of *natural gas* and *gas* are used for the natural gas carried through the national gas transmission grid (GRID) which is owned and operated by Petroleum Pipeline Corporation (BOTAS). Gas carried by other means such as Liquefied Natural Gas (LNG) or Compressed Natural Gas (CNG) will be investigated in further studies while constructing a complete Turkish natural gas market model, Enhanced CUSTOM (E-CUSTOM).

Since the natural gas production capacity of Turkey is far from satisfying the demand, almost all of the natural gas is imported. Every import contract has a certain annual amount that could be purchased, and minimum amounts for summer term and the whole year that have to be purchased. Quantitative limit clauses of the import contract inherently transferred to the downstream contracts, up to the end user.

Moreover, since the storage capacity of Turkey is also insufficient and is not capable to flatten the seasonal fluctuations, the imported gas is consumed in a very short time.

These facts force Engineer to match the sales contract amounts to the purchase contracts in order not to pay any penalty either to the supplier or to the consumer.

Daily contract quantity (DCQ) is the maximum amount that could be purchased per day, hence the total DCQ of the sales contracts should be planned such that the total DCQ of the purchase contracts would become enough.

On the other hand, in order not to jeopardize the minimum annual quantity (MAQ) and minimum summer quantity (MSQ) obligations of the purchase contracts, Engineer sets MAQ and MSQ of the sales contracts accordingly.

Contract amounts may not be dictated by a party unilaterally, but agreed between parties. CUSTOM runs at this stage.

By CUSTOM, contract sets, which got formed using contracts to be signed with customer and/or supplier candidates, are compared to each other to find the most profitable set under several assumptions.

CUSTOM should be considered as a core model. By defining a profit / loss equation, costs arising due to regulations and legislations, and contract clauses affecting the profit are described. CUSTOM is capable to work with numerous contracts and is a guideline for those who are willing to study specifically on Turkish natural gas market, but not a sector professional.

2. OVERVIEW ON THE NATURAL GAS MARKETS

2.1 Review of the Research

The study of natural gas markets took a considerably new direction after the liberalization of the natural gas markets during the early 1990s. As a result, several problems and research opportunities arose for those studying the natural gas supply chain, particularly the marketing operations (Kalashnikov, 2010).

Studies on natural gas market modelling are focused on a certain district and due to the market maturity and technical capabilities of the market; these studies ought to be specific to the area. For example, an empirical model GASTALE is described and used to analyze the European natural gas market and focus primarily on the role of the downstream trading companies and their interaction with oligopolistic gas producers (Boots et al., 2003). Or as another example; NATGAS is an integrated model of the European wholesale gas market providing long-run projections of supply, transport, storage and consumption patterns in the model region, aggregated in 5-year periods, distinguishing two seasons (Zwart and Mulder, 2006). Similar to NATGAS, CUSTOM has two seasons as winter and summer, but differently the duration projected is limited to one year.

Natural gas market is usually described as an oligopolistic market. For example, while analyzing the potential role of the LNG in the liberalization of gas market, an oligopoly model is developed (Dorigoni, 2010). World Gas Model, which is a large scale energy equilibrium system based on a complementarity equation, is used to analyze future gas cartels and their effects on gas markets in a number of regions across the world (Gabriel et al., 2012).

It seems like this market structure will last for more and is not likely to change. For instance, by using World Gas Model, it is concluded that Europe will expand its pipeline import capacities benefiting from its relative proximity to major gas suppliers (Egging et al., 2010).

Long-term supply contracts often have ambiguous effects on the competitive structure, investment and consumer welfare in the long term. In the new market context, these effects are likely to be worsened and thus even harder to assess (Hauteclocque and Glachant, 2009).

The only reason which prevents the above-mentioned major gas suppliers to aggress the consumers is the fact that their economies are heavily dependent on the income of natural gas and these suppliers are well aware of this situation.

Economic crisis of 2009 & 2010 plus steady decarbonization of the European Union (EU) energy policy decrease EU energy demand while gas supplies to the EU continue to increase as well as its multiplicity. Thus competitive niche for gas in Europe tightens, especially for Russian gas supplies with rather non-flexible contractual structures and pricing mechanisms such as long-term gas export contracts (LTGEC) with oil indexation. On top of this, Third EU Energy Package changes the whole architecture of the wholesale EU internal gas market. So risks and uncertainties for oil-indexed LTGEC within this tightening market niche for gas increase. To effectively address them, LTGEC need to become more flexible and adaptable. Gazprom has recently started such adaptation of its LTGEC (Konoplyanik, 2012).

Oil indexed contracts are still the one of the most important factor that determines the gas price in Turkish gas market and are considered seriously in CUSTOM.

Since the natural gas market is a regulated market, any study would be incomplete without considering the regulations and legislations.

In 1978 the US government moved to deregulate the American natural gas industry. The market changes that resulted from this initial step took time to ripple their way out to regional and subnational gas trading relationships. This ripple effect required subnational governments (state and provincial regulators) to rethink their gas regulatory policies (Wilson, 1997).

For the last 20 years, countless countries have been carrying out structural reforms in the natural gas industry, trying to achieve efficiency and economic rationality with the introduction of competition (De Mello Sant Ana, 2009).

Despite relatively good legislative framework, in practice, the reforms in Turkey are far from ideal as they are mainly in the form of ‘‘textbook reforms’’; and therefore a

significant amount of work still lies ahead of Turkey to set up a fully-fledged energy market (Erdogdu, 2007).

In terms of maturity, electricity market is much more developed than the natural gas market. So, the studies on the electricity market might be considered as the pioneers of the ones in natural gas market. It is concluded that, management and contract optimization are the key factors that determines the profitability of the companies.

In a study, a deregulated electricity market environment where a natural gas-fired power generation company can engage in different types of contracts to manage its natural gas supply as well as trade on the electricity market is considered. If the contracts are properly designed, they can protect the company from fluctuations in electricity price and demand, at some cost to the company's expected profit was the result of that study (Jirutitijaroen et al., 2013).

In the Turkish electricity and natural gas market, still plenty of research areas are remaining untouched. Even the electricity market liberalization is much ahead of the natural gas market, there are still limited studies about portfolio optimization in electricity markets and any study should be considered as frontier study. (Gokgoz and Atmaca, 2012).

Turkey is in a strategically advantageous position in terms of its natural gas market. It can import gas from a number of countries and diversify its sources. Turkey's motivation for restructuring its natural gas ownership and markets stems from its desire to fulfill EU accession prerequisites in the energy sector (Hacisalihoglu, 2008).

Turkey is currently heavily dependent on fossil fuels for energy consumption, with oil, natural gas, and coal being the predominant energy sources, accounting for a significant majority of the total energy consumption. Turkey has very limited domestic sources of oil and natural gas, thus it is almost entirely dependent on foreign sources (Balat, 2010).

Turkish natural gas demand is projected to increase dramatically in coming years (Akkurt et al., 2010). The studies on forecasting gas demand for future periods have a great importance because natural gas is an imported energy source. (Aras and Aras, 2004).

Turkey's natural gas demand in the year 2030 is calculated as 76.8 billion m^3 using the linear model and 83.8 billion m^3 based on the logistic model. Consequently, found to be in better agreement with the official Turkish petroleum pipeline corporation (BOTAS) forecast, 76.4 billion m^3, than results published in the literature (Melikoglu, 2013).

It is found that public firms compared to private firms, non- tender firms compared to tender firms, large firms compared to small firms and firms operating in more developed areas compared to firms operating in underdeveloped areas that utilize resources and manage costs more efficiently. However, not a certain conclusion has reached about the comparison of old firms versus the new firms (Erturk and Turut-Asik, 2011).

As a conclusion, this thesis study is designed to be a guide to those who want to understand natural gas contracts, regulations and legislations applicable, and the cost factors of participating in the Turkish market.

CUSTOM will be used as a core in the future studies to develop a complete Turkish natural gas market and business model.

2.2 A Brief Information on Turkish Natural Gas Market

Deloitte (2012) report quite well summarizes the improvement of Turkish natural gas market.

> The period between 2001 and 2004 can be classified as a very efficient initial period for the liberalization of natural gas market in Turkey, given such developments as the promulgation of Natural Gas Market Law No. 4646 in 2001; the establishment of Energy Market Regulatory Authority; the publication of several regulations by the Authority; the establishment of city natural gas distribution regions and very rapidly and efficiently executed privatization and licensing auctions; the opening of transmission network to third party access as of 2004; the account separation for BOTAS, as a monopoly actor, for its trading (import, export and wholesale), transmission and storage (LNG terminal) activities. As a matter of fact, Law No. 4646, which largely transposed the provisions relating to the market structure provided in the EU's First Gas Directive under the membership perspective, provides for much more liberal steps in some respects. In spite of the generally accepted view that it was not a realistic goal, the provision requiring that the market share of BOTAS as a monopoly be reduced to 20% by the end of 2009 and the adoption of "ownership separation" model for the transmission network operator (which was adopted as partially mandatory only

through the 3rd Gas Directive in the EU) being included in the NGML were conceived as very radical steps towards liberalization. On the other hand, Transmission Network Operation Principles (NOP) took effect as of September 1, 2004 and the transmission network was opened to third party access. As of 2004, many EU member states including Germany had not yet published the relevant regulations (NOP) and not completed the legal arrangements relating to third party access.

Following the initial period, which can be characterized as an efficient period for market liberalization, the period 2004 - 2007 was quite stable in terms of regulations and creation of a competitive environment; however, the process of operationalizing city distribution companies following the licensing auctions held by EMRA was run very efficiently, with city distribution companies starting operation in 52 distribution regions as of end-2007.

The period 2007 - 2011 was marked by very important developments in terms of both regulations and the market movements in the fields of import and wholesale, as well as gas transit via Turkey. While each of these developments are elaborated in the relevant sub-sections of our report, we can summarize these developments as follows:

- The monopoly position of BOTAS in wholesale sector has been eliminated as third parties other than BOTAS had access to the transmission network and started to ship gas via the network (July 2007).
- The first contract release auction was concluded, and four new importers entered the market with an annual total volume of 4 bcm (the period between end-2007 and first quarter of 2009).
- BOTAS started re-exporting to Greece (November 2007).
- Following the publication of Law No. 5784 dated 09 July 2008 on the Amendment of Electricity Market Law and Certain Laws, LNG imports were liberalized; provisions were introduced for Spot LNG import activity, which had not been provided for under Law No. 4646 earlier; and EGEGAZ started importing LNG through the LNG Terminal in Aliaga in May 2009.
- EMRA published the regulation regarding third party access to LNG Terminals in 2009; and approved and put into force the principles and procedures applicable to the use of BOTAS Marmara Ereglisi LNG Terminal and EGEGAZ Aliaga LNG Terminal by third parties.
- The regulation on the use of underground storage facilities was published in 2011.
- BOTAS did not extend the Gazprom Export Contract for the Western Line that had an annual volume of 6 bcm, which expired as of 2011 (excluding the special agreement reached in December2011).

The liberalisation timeline in Turkish natural gas market is shown in Figure 2.1 (PWC, 2014).

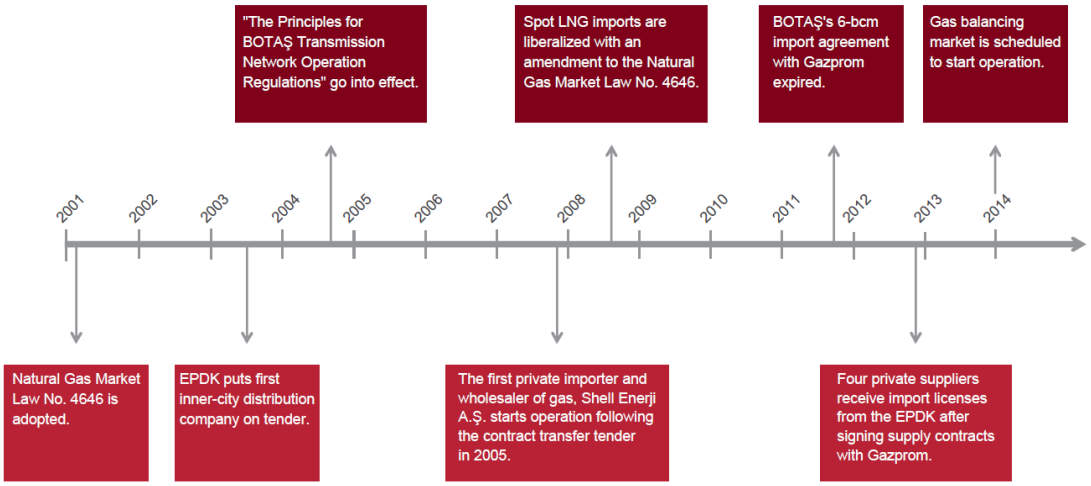


Figure 2.1: Liberalization timeline in Turkish natural gas market.

Up to date import license owners are summarized in the IEA (2013) report as follows:

> The gas market was liberalized in May 2001, with the Natural Gas Market Law N° 4646 which obliges state-owned BOTAS to reduce its market share in import, wholesale and distribution. However, BOTAS still remains a dominant gas market player. As for gas imports, BOTAS is obliged to gradually transfer its import contracts until its market share decreases to 20% of annual consumption. As such, 4 bcm of annual natural gas import from Russia was transferred to four private companies: Enerco Enerji (2.5 bcm), Bosphorus Gaz (0.75 bcm), Avrasya Gaz (0.5 bcm), Shell Enerji (0.25 bcm). In April 2012, the Administration conducted tender process for another 6 bcm of natural gas import from Russia via the border with Bulgaria. As a result of the tendering, four companies acquired right to import natural gas from Russia: Akfel (2.25 bcm), Bosphorus Gas (1.75 bcm), Kibar Enerji (1 bcm), and Batı Hattı (1 bcm).

Including the 1.2 bcm privileged amount of SOCAR Gas in the amount imported from Azerbaijan, total of importation agreements held by private companies are calculated to be 11,2 bcm total (SOCAR, 2014). Importation agreements of Turkey are summarized in the Table 2.1.

Table 2.1: Importation agreements of Turkey.

Agreement	Date of Operation	Duration	Amount	Ownership
Iran	Dec 2001	25 Years	10 bcm	State
Russia (Blue Stream)	Feb 2003	25 Years	16 bcm	State
Russia (West Line)	Mar 1998	23 Years	8 bcm	4 bcm State 4 bcm Private
Azerbaijan	Jul 2007	15 Years	6.6 bcm	5.4 bcm State 1.2 bcm Private
Russia (West Line)	Jan 2013	20 Years	6 bcm	Private
Turkmenistan	-	30 Years	16 bcm	State
Algeria (LNG)	Aug 1994	20 Years	4 bcm	State
Nigeria (LNG)	Nov 1999	22 Years	1.2 bcm	State
Total agreement amount operative in 2014			**51,8 bcm**	**40,6 State** **11,2 bcm Private**

2.3 Basic Concepts and CUSTOM

Natural gas trade in Turkish market is realized via contracts signed between natural gas trading companies and transmission contract which signed with BOTAS.

CUSTOM is elaborated for Engineer to decide which contracts to be signed before the gas year starts. Engineer is assumed to have negotiated with the potential suppliers and customers. Terms and conditions of the contracts of which the supplier offers or the customer is ready to accept are readily known before running the CUSTOM.

CUSTOM is an adoptable model to all market players. If The Company is a subsidiary of a holding which owns a distribution company or a natural gas power plant, then the sales side will be fixed and the CUSTOM will be used to decide on the purchase GSPAs. Similarly, if The Company is a subsidiary of a holding which

has production facilities, or entitled to have an import license, then the purchase side will be fixed and the CUSTOM will be used to decide on sales GSPAs.

Every trading company using BOTAS pipelines are named as “shipper” in the Transmission Network Operation Principles (NOP), which is a document prepared to set out specific rights and obligations of parties in the transportation of Natural Gas via the Transmission Network (GRID) within the framework of Natural Gas Market Law No. 4646 (LAW) and the regulations issued under the LAW.

By signing a Standard Transmission Contract (STC), shippers grant access to Electronic Bulletin Board (EBB) which is an internet platform owned and operated by BOTAS. Every real entrance points and main pressure reduction and measurement stations (RMS-A) are readily defined in EBB, but they are restricted to the shippers except the ones who have agreements to supply or receive gas through that real point. Also, according to the agreements signed between shippers, virtual transfer points are defined. These points are named as “Transfer Exit Point (Shipper A)” and “Transfer Entry Point (Shipper B)” for the case of Shipper A is seller and the Shipper B is buyer. Moreover, for every shipper, two more virtual points, National Balancing Point (NBP), are defined with the name of NBP Exit (Shipper A) and NBP Entry (Shipper A) to be used for spot agreements. All of the above described points are named delivery point in general.

In the CUSTOM, the case of any delivery point is shared by more than one shipper is considered as if the Company stands alone at that delivery point. Since BOTAS separately calculates all the amounts and costs for each shipper, this approach is not disturbing the projection result but significantly simplifies the CUSTOM.

By definition, in the Turkish natural gas market, each gas day starts at 08:00 and lasts for 24 hours. Shipper fills in its nominations to receive and supply for the upcoming days on a delivery point basis (nomination). Every shipper has to balance their nominations unless otherwise is instructed by BOTAS. In other words, nominated amounts from the supplier/production side should be equal to the ones at the customer/consumer side.

After the gas day finishes, all measurement results are gathered by BOTAS and accordingly the amounts are allocated to the shippers (allocation).

It is expected the shipper's nomination and allocation should match within a tolerance; otherwise the shipper gets fined with the Regulation Penalty. Moreover, total entered gas of the shipper is also expected to match the gas leaving within a tolerance; otherwise the shipper gets fined with the Unbalance Penalty.

Every penalty and cost, which would affect the customer set selection, caused by GRID operation will be investigated in detail while CUSTOM is structured in this thesis study. Other costs, which might be considered as a part of business startup costs such as license obtaining fee, will be left to the further studies to structure a complete market model.

3. CONTRACT SET OPTIMIZATION MODEL (CUSTOM)

3.1 Notations and Definitions

CUSTOM is aimed to be the core of a more general model for all market players. Reaching to this aim requires a systematic approach while structuring the symbols and abbreviations, numbering contracts and delivery points, and defining the costs.

Every GSPA is addressed by a number, but for a specific type of costumers such as "sales contract in which the delivery point is determined as virtual transfer point", some additional letters are defined to concatenate the numbers and so to structure the address.

Similarly, every delivery point is numbered as per to EMRA definition and is capable to represent the contracts.

Also, systematic followed while generating abbreviations are designed such that the related daily, monthly and annual quantities resemble each other.

This part is dedicated to give an insight on the notations and definitions, to ease the understanding of the equations and concepts.

3.1.1 GSPA addressing system

During this thesis study, number of the entrance points, which vary from 1 to 9 and subject to different transmission capacity fees, will be same as the ones used by EMRA.

All real exit points are numbered as 0.y, since the EMRA do not distinguish any of them and they are subject to same transmission capacity fee, but in CUSTOM they are distinguished by the contracts.

Finally, all virtual points will be numbered as 10, which are not subject to any transmission capacity fee. The addresses of the GSPA's to be used during this work are listed at the Table 3.1.

Table 3.1: GSPA addressing system.

Contract Type	**#**	**y**	**Y**	**Y**	**p**
Customer, Transfer Point	m_{ct}	ct1 ct2 ⋮ ctm_{ct}	c1 c2 ⋮ cm_{ct}	1 2 ⋮ m_{ct}	10
Customer, National Balancing Point	m_{cs}	cs1 cs2 ⋮ csm_{cs}	$c(m_{ct}+1)$ $c(m_{ct}+2)$ ⋮ $c(m_{ct}+m_{cs})$	$(m_{ct}+1)$ $(m_{ct}+2)$ ⋮ $(m_{ct}+m_{cs})$	10
Customer, Real Point	m_{cr}	cr1 cr2 ⋮ crm_{cr}	$c(m_{ct}+m_{cs}+1)$ $c(m_{ct}+m_{cs}+2)$ ⋮ $c(m_{ct}+m_{cs}+m_{cr})=cm_c$	$(m_{ct}+m_{cs}+1)$ $(m_{ct}+m_{cs}+1)$ ⋮ $(m_{ct}+m_{cs}+m_{cr})=m_c$	0.cr1 0.cr2 ⋮ $0.crm_{cr}$
Supplier, Transfer Point	m_{st}	st1 st2 ⋮ stm_{st}	s1 s2 ⋮ sm_{st}	(m_c+1) (m_c+2) ⋮ (m_c+m_{st})	10
Supplier, National Balancing Point	m_{ss}	ss1 ss2 ⋮ ssm_{ss}	$s(m_{st}+1)$ $s(m_{st}+2)$ ⋮ $s(m_{st}+m_{ss})$	$(m_c+m_{st}+1)$ $(m_c+m_{st}+2)$ ⋮ $(m_c+m_{st}+m_{ss})$	10
Supplier, Real Point	m_{sr}	sr1 sr1 ⋮ srm_{sr}	$s(m_{st}+m_{ss}+1)$ $s(m_{st}+m_{ss}+2)$ ⋮ $s(m_{st}+m_{ss}+m_{sr})=sm_s$	$(m_c+m_{st}+m_{ss}+1)$ $(m_c+m_{st}+m_{ss}+2)$ ⋮ $(m_c+m_{st}+m_{ss}+m_{sr})=(m_c+m_s)=m$	1 – 9

Three different structures are proposed for GSPA addresses.

- First addressing structure contains two letters and a number, which the first letter determines whether the contract is a sales contract or a purchase contract from the point of view of The Company, and the second letter stands for the type of the delivery point. (e.g. y=cr2)
- Second addressing structure contains only one letter and a number, forming a group of sales contracts and another group of purchase contracts. (e.g. y=s3)

- Finally, the contract will be addressed by only a number which is the assigned number of the contract while running the model. (e.g. y=12)

3.1.2 Day and month numbering system

In this study, the numbers listed in the Table 3.2 will be used for days and months whenever needed.

Table 3.2: Day and month numbering system.

Month	**n**	**# of days**	**J_n**	**J**
-	0	0	0	0
January	1	31	31	1-31
February	2	28	59	32-59
March	3	31	90	60-90
April	4	30	120	91-120
May	5	31	151	121-151
June	6	30	181	152-181
July	7	31	212	182-212
August	8	31	243	213-243
September	9	30	273	244-273
October	10	31	304	274-304
November	11	30	334	305-334
December	12=N	31	365=J	335-365

In the thesis study, any small letter j used in the equations represents a gas day, where the capital J represents the number of days in a year. If a subscript n is added to the capital J, it means not the number of days of month n, but means the corresponding number tabulated.

Similarly small letter n represents any month while capital N is equal to 12.

3.1.3 Notation methodology

In the thesis study, small letters are used for daily and/or unit values and capital letters are used for overall values. The subscripts are used to define a specific amount or cost, and brackets contain the day, month or delivery point variable. No bracket means annual lumpsum cost or amount of The Company.

j, J mean any day of year and number of days in a year respectively,

n, N mean any month of year and number of months in a year respectively,

p means any delivery point,

y means any contract,

v means validator, where $v=\{0,1\}$ and $\Sigma v=1$,

c means weight coefficient, where $c\in[0,1]$ and $\Sigma c=1$,

ε is a very small number,

z, Z mean daily and overall contract quantities respectively where the systematic is as follows:

- Z is the total contracts amount of The Company,
- $Z_{[y]}$ is the sum of daily contract quantities of contract y for one year,
- $Z_{[p]}$ is the annual reserved amount at point p,
- $Z_{[n]}$ is the total of contracts at month n,
- $Z_{[yn]}$ is the contract quantity of contract y at month n,
- $z_{[yj]}$ is the daily contract quantity of contract y at day j,
- $z_{rc[p]}$ is the daily reserved capacity amount at point p,

A means annual contract amount,

b, B mean daily and overall nominations respectively,

q, Q mean daily and overall consumptions respectively,

u, U mean daily and overall undelivered amounts respectively,

δ, Δ mean daily and overall amount differences respectively,

e, E mean unit cost and overall cost respectively,

P means price,

I means invoiced/lumpsum cost, and

R means USD/TL rate.

Every symbol will be defined when it first appears in the thesis study.

3.1.4 Frequently used equations

In the thesis study, unit step function, θ(x), will be used whenever needed where the definition of θ(x) is as follows:

$$\theta(x) = \begin{cases} 0, x < 0 \\ 1, x \geq 0 \end{cases} \quad \textbf{(3.1a)}$$

Hence, to check if a value (x_1) is greater or equal to a certain test value (x_2) or not, the equation will become;

$$\theta(x_1 - x_2) = \begin{cases} 0, x_1 < x_2 \\ 1, x_1 \geq x_2 \end{cases} \quad \textbf{(3.1b)}$$

However, if the function requires the check of the value (x_1) is greater than a certain test value (x_2), excluding the x_1=x_2 case, the equation will be modified as;

$$\theta_{ex}(x_1 - x_2) = 1 - \theta(x_2 - x_1) = \begin{cases} 0, x_1 \leq x_2 \\ 1, x_1 > x_2 \end{cases} \quad \textbf{(3.1c)}$$

One other function which is used frequently is max{x_1, x_2, …, x_t}, which results the greatest term in the array.

Similarly, min{x_1, x_2, …, x_t} function will be used to find the smallest term in the array.

3.2 Cost Constituents Caused by Legislations and Regulations

Turkish natural gas market is regulated by EMRA and each company is supposed to have a valid license that is granted by EMRA in order to be a player in the market. Having a license is a prerequisite to access the GRID which is owned and operated by BOTAS.

Costs will be clarified in the order of activation through the procedure, which the order may be summarized as follows:

- Obtaining a license
    - License Obtaining Fee
    - Annual License Fee (E_{ylf})
    - Participation Fee (E_{ptf})
- Signing agreements with customers and suppliers

    - Stamp Tax (E_{st})
- Application to use the GRID
    - Reserved Capacity Cost (E_{rc})
    - Idle Capacity Cost (E_{ic})
- Using the GRID
    - Over-Capacity Penalty (E_{oc})
    - Transmission Service Cost (E_{ts})
    - Grid Balancing Participation Costs
        - Regulation Penalty (E_{rg})
        - Unbalance Penalty (E_{ub})
    - Low Pressure Penalty (E_{lp})

3.2.1 License costs

License costs are defined in the Article 13 of License Regulation.

3.2.1.1 License obtaining fee

License Obtaining Fee is not included in CUSTOM since it is charged only once while obtaining the license and part of the foundation costs of the company. This cost will be investigated in the further studies to structure the complete business model.

3.2.1.2 Annual license fee

Annual license fee is paid due to the amount of gas that is handled in the previous year.

In the CUSTOM, total sold amount in the current year is considered while calculating the annual license fee to see the effect in the budget of the Company, even though the fee will be paid in the following year.

$$E_{ylf} = \sum_{y=1}^{m_s} \sum_{n=1}^{N} Q_{c[yn]} \times g_{ylf} = \sum_{y=1}^{m_s} Q_{c[y]} \times g_{ylf} \qquad \textbf{(3.2a)}$$

Calculation of annual license fee (E_{ylf}) starts by summing up the gas amount sold due to a sales contract y in the month n ($Q_{c[yn]}$) together to find the gas amount sold due to that sales contract in the year ($Q_{c[y]}$). Then the same is applied for all sales

contracts and results are summed up to find the amount of gas sold in the year. Finally, it is multiplied by the tariff (g_{ylf}) to find the cost.

Unit price for the annual license fee is determined and announced by EMRA every year. For 2014, g_{ylf} = 0.0005 Kr/kWh (EMRA BR 4771)

$$g_{ylf,2014} = 0.0005\left[\frac{Kr}{kWh}\right] \times 10.64\left[\frac{kWh}{Sm^3}\right] \times 0.01\left[\frac{TL}{Kr}\right] = 0.0000532\left[\frac{TL}{Sm^3}\right] \quad \textbf{(3.2b)}$$

Conversation factors should be considered before running CUSTOM, where all quantities are defined in the unit of Sm^3 and the costs are defined in the unit of TL unless otherwise stated.

3.2.1.3 Participation Fee

Participation fee is paid due to the gross sales income of the company for the previous year.

In the CUSTOM, gross sales income is considered while calculating the participation fee to see the effect in the budget of the Company, even though the fee will be paid in the following year.

$$E_{ptf} = \sum_{y=1}^{m_c} I_{c[y]} \times \alpha_{ptf} \quad \textbf{(3.3)}$$

Where, $I_{c[y]}$ represents the total invoices of the customer y in the gas year, and α_{ptf} is the ratio to calculate the participation fee. Percentage for the annual license fee is determined and announced by EMRA every year. For 2014, α_{ylf} = %0.05 (EMRA BR 4773)

3.2.2 Taxes

3.2.2.1 Stamp Tax Cost

When an agreement is signed, stamp tax arises proportional (α_{st}=0,00948 for 2014) to the total value of the agreement. Total value for the GSPAs is that the multiplication of the total amount, A, by the unit gas price, P_{gas}. If the P_{gas} is defined by a equation, and/or the currency of the P_{gas} is USD, then it is calculated by the applicable data at the day stamp tax is paid.

$$E_{st[y]} = \min\{E_{stcap}, v_{new[y]} \times P_{gas[y1]} \times A_{[y]} \times \alpha_{st}\} \quad \textbf{(3.4a)}$$

$$E_{st} = \sum_{y} E_{st[y]} \quad \textbf{(3.4b)}$$

By the Equation 3.4a, total cost of the contract is calculated by multiplication of projected unit gas cost of January, $P_{gas[y1]}$, and annual contract quantity ($A_{[y]}$) of contract y. Percentage for the stamp tax (α_{st}) is applied to find the cost. $v_{new[y]}$ is the validator to check if the contract is a new contract ($v_{new[y]}$=1) or not ($v_{new[y]}$=0). There is also a cap (E_{stcap}) for the amount of this tax (e.g. $E_{stcap,2013}$= 1,487,380.70 TL) is set by the state.

Equation 3.3b sums up the costs of all contracts to find the total stamp tax cost (Est) of the company in that year.

Considering the due date to apply BOTAS for capacity reservation for the following gas year is the end of September of the current year, agreements should be signed not later than September. It means that, in October the aforementioned agreement should be declared and the stamp tax be paid. For projections, projected price of January will be used instead of the one of October in the previous year, since both prices are projected and accepted to have a certain error margin.

If the agreement is prolonged automatically unless any party demands to terminate, then the stamp tax would not arise for the prolonged years. “Signing an agreement” is the key point of stamp tax cost.

3.2.2.2 Other Taxes

Any taxes such as Special Consumption Tax (SCT) and Value Added Tax (VAT) will be disregarded since the money gathered from the customers are paid to the state and do not affect the profit of the company.

Though, they should be considered in a whole business model by finance department in detail. For instance, for the imported gas, SCT is paid in every 15 days whereas the sales invoices are prepared monthly. So there may arise some extra cost regarding the cash flow balance.

3.2.3 Costs of GRID operation

To access the GRID and be a "shipper", a company is required to apply to BOTAS before the year starts and sign the Standard Transmission Contract (STS) which is limited to one year. BOTAS evaluates the applications and allocates capacities to the shippers.

3.2.3.1 Reserved capacity cost

For every delivery point p, capacity reservation should be carried out according to Article 2.1 of the NOP before the year starts. Reserved capacity for a point p is fixed for the whole year and is to be paid whether that capacity is used or not at any day j.

According to Article 2.9 of the NOP, in case reserved capacity is exceeded in any 8 days of the first quarter of the year (January 1st – March 31st), reserved capacity amount is increased to the peak value and charged for the whole year. To avoid it, either the possibility of that situation to occur should be investigated and the capacity should be reserved accordingly, or a safety margin should be applied for the first quarter of the year.

To understand the cost effect of Article 2.9 of the NOP; let's assume a customer who is consuming 1,000,000 Sm^3 gas per year. At the beginning of the year, let the Engineer concluded that 300 Sm^3/Day capacity reservation at the real delivery point p would be enough for the whole year. Unfortunately, at the end of the first quarter, Company is necessitated to increase the capacity reservation to 325 Sm^3/Day according to Article 2.9.

Using the BOTAS tariff applicable in 2014 for that customer, 0.717783 TL/Sm^3, estimated annual gas cost of the eligible customer would become 717,783.00 TL. Using the tariff applicable in 2014 for the capacity reservation at delivery point p, 0.006296 TL/Sm^3, additional 25 Sm^3/day amount would cause 57.41 TL for the whole year, which is 0.00008 of the gas cost. Since the cost effect of Article 2.9 of the NOP is negligible, that fact is disregarded and daily reserved capacity amount of point p is calculated as,

$$z_{rc[p]} = \max\{z_{[p1]}, z_{[p2]}, \cdots, z_{[pJ]}\} \quad \textbf{(3.5a)}$$

$$e_{rc[pj]} = z_{rc[p]} \times g_{rc[p]} \quad \textbf{(3.5b)}$$

$$E_{rc[pn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{rc[pj]} \quad \textbf{(3.5c)}$$

$$E_{rc[p]} = \sum_{n=1}^{N} E_{rc[pn]} = \sum_{j=1}^{J} e_{rc[pj]} \quad \textbf{(3.5d)}$$

$$E_{rc} = \sum_{p} E_{rc[p]} \quad \textbf{(3.5e)}$$

By Equation 3.5a, maximum contract amount becomes the daily reserved capacity at the delivery point p. Then, by Equation 3.5b, daily cost of reserved capacity is calculated and summing up for all days of any month n, monthly cost of reserved capacity is calculated by Equation 3.5c. Equation 3.5d sums up the annual reserved capacity cost of the point p and finally Equation 3.5e calculates the annual reserved capacity to be paid by the company for all delivery points. Unit capacity reservation price for point p, $g_{rc[p]}$ is determined and announced by EMRA every year. For 2014, daily capacity reservation fee is tabulated in Table 3.3. (EMRA BR 2970 & EMRA BR 4797).

Table 3.3: Capacity reservation fees.

Name of delivery point	Description	Capacity Cost (TL/Sm^3/Day)	P
Entrance 1	Malkoclar Measurement Station, West Line, Russia	0.000391	1
Entrance 2	Marmara Ereglisi LNG Terminal	0.000390	2
Entrance 3	Durusu Measurement Station, Blue Stream, Russia	0.000194	3
Entrance 4	Bazargan Measurement Station, Iran	0.000592	4
Entrance 5	Türkgozu Measurement Station, Azerbaijan	0.000422	5
Entrance 6	Egegaz LNG Terminal	0.000313	6
Entrance 7	TPAO Silivri Storage Facility	0.000212	7
Entrance 8	TPAO Akcakoca Handling Facility	0.000649	8
Entrance 9	TEMI Edirne Production Facility	0.000649	9
Exit	All real exit points	0.006292	0.y
Exit - Export	Kipi Measurement Station, Greece	0.056108	-
Virtual	Transfer Points or National Balancing Points	0	10

3.2.3.2 Idle capacity cost

If it's known that extra reserved capacity at a certain delivery point p will be needed for some particular months only, it is possible to reserve extra capacity for those months. The unit prices of the idle capacities are to be calculated by multiplying the unit capacity reservation prices by the coefficients tabulated in Table 3.4.

Table 3.4: Coefficients for idle capacity.

Period	$\alpha_{ic[n]}$	**N**
Summer	0.80	5-8
Winter	1.30	1-3, 11-12
Interlude	1.20	4, 9-10

$$e_{ic[pj]} = z_{ic[pj]} \times g_{rc[p]} \times \alpha_{ic[n]} \quad \textbf{(3.6a)}$$

$$E_{ic[pn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{ic[pj]} \quad \textbf{(3.6b)}$$

$$E_{ic[p]} = \sum_{n=1}^{N} E_{ic[pn]} \quad \textbf{(3.6c)}$$

$$E_{ic} = \sum_{p} E_{ic[p]} \quad \textbf{(3.6d)}$$

Where, $e_{ic[pj]}$ is the idle capacity reservation cost at the point p for the day j, and E_{ic} is the annual idle capacity cost. It is assumed that the reader got familiar with the equation systematic so far.

To compare two cases of capacity reservation strategies; where the Case-1 is that all the required capacity is reserved at the beginning of the year, and the Case-2 is that a lesser capacity is reserved at the beginning of the year and additional capacity is reserved for the months needed, the following inequality condition should be checked out.

$$E_{rc[p](Case-1)} > E_{rc[p](Case-2)} + E_{ic[p](Case-2)} \quad \textbf{(3.6e)}$$

3.2.3.3 Over-capacity penalty cost

For each day that the reserved capacity is exceeded, over-capacity penalty cost occurs. The unit prices of the over-capacity penalty cost are to be calculated by multiplying the unit capacity reservation prices by the coefficients tabulated in Table 3.5.

Table 3.5: Coefficients for Over-Capacity Penalty.

Period	$\alpha_{oc[n]}$	**N**
Summer	1.10	5-8
Winter	1.50	1-3, 11-12
Interlude	1.25	4, 9-10

$$e_{oc[pj]} = \max\left\{0, \left(q_{[pj]} - \left(z_{rc[p]} + z_{ic[pj]}\right)\right)\right\} \times g_{rc[p]} \times \alpha_{oc[n]} \quad \textbf{(3.7a)}$$

$$E_{oc[pn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{oc[pj]} \quad \textbf{(3.7b)}$$

$$E_{oc[p]} = \sum_{n=1}^{N} E_{oc[pn]} \quad \textbf{(3.7c)}$$

$$E_{oc} = \sum_{p} E_{oc[p]} \quad \textbf{(3.7d)}$$

The structure of Equation 3.7a secures that no over-capacity penalty is paid if the consumption amount stays within the reserved capacity amount.

3.2.3.4 Transmission service cost

Transmission service cost occurs for the amount that leaves the GRID. This cost is paid only for the real delivery points. Unit transmission service price, g_{ts}, is same for all exit points and is determined and announced by EMRA every year.

For 2014, g_{ts} = 0.019745 TL/Sm^3 (EMRA BR 4797)

$$e_{ts[pj]} = q_{[pj]} \times g_{ts} \quad \textbf{(3.8a)}$$

$$E_{ts[pn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{ts[pj]} \quad \textbf{(3.8b)}$$

$$E_{ts[p]} = \sum_{n=1}^{N} E_{ts[pn]} \quad \textbf{(3.8c)}$$

$$E_{ts} = \sum_{p} E_{ts[p]} = \sum_{y=cr1}^{crm_{cr}} E_{ts[0.y]} \quad \textbf{(3.8d)}$$

3.2.3.5 Grid balancing participation cost

Every day, nominations are submitted to BOTAS via EBB for the day j, not later than 11:00 in day (j-1). According to the nominations gathered all around Turkey, BOTAS plans the next day's operation.

It's aimed to operate the GRID properly in accordance to the planned operation program. In order to force shippers to submit precise nominations, Regulation Penalty and Unbalance Penalty are prescribed. GRID balancing participation cost consists of Regulation Penalty Cost and Unbalance Penalty Cost.

The demand predictability of the customer or supplier is the sole reason of the difference between allocation and nomination. If the customer or supplier's demand predictability characteristic is well known, then it is possible to calculate the grid balancing participation cost more precisely.

If the historical allocation & nomination information of the customer is available, it may be possible to generate a probability density function (PDF) of the allocation/nomination rate dispersion all year round.

Possibility distributions form a widely accepted method for representing a certain type of uncertain knowledge. As yet, most mechanisms for processing possibility distributions have been founded on intuitive argumentation only (Spott, 1999).

Although the calculation methodology is beyond the scope of this thesis study, some statements could be made.

In Figure 3.1, a schematic representation of PDF of Allocation/Nomination dispersion all year round of a real delivery point is shown. At a real point, it is possible for the deviation occurs in the both positive and negative ways.

Term of *positive* stands for the situation of which the allocation is higher than the nomination, in other words the situation of which the Allocation/Nomination ratio is larger than 1. For the term of *negative*, vice versa.

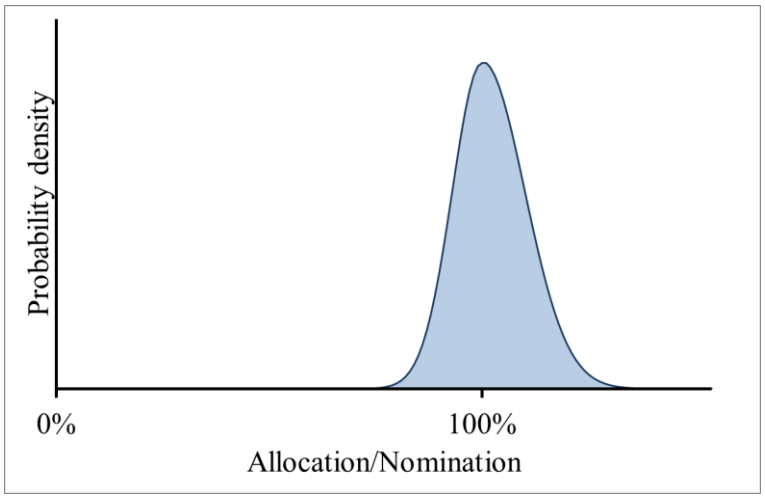


Figure 3.1: Schematic representation of PDF of allocation/nomination dispersion all year round of a real delivery point customer.

On the contrary, as shown in the Figure 3.2, for a transfer point, which is a virtual point that shippers trade with each other, it is valid only for the negative side.

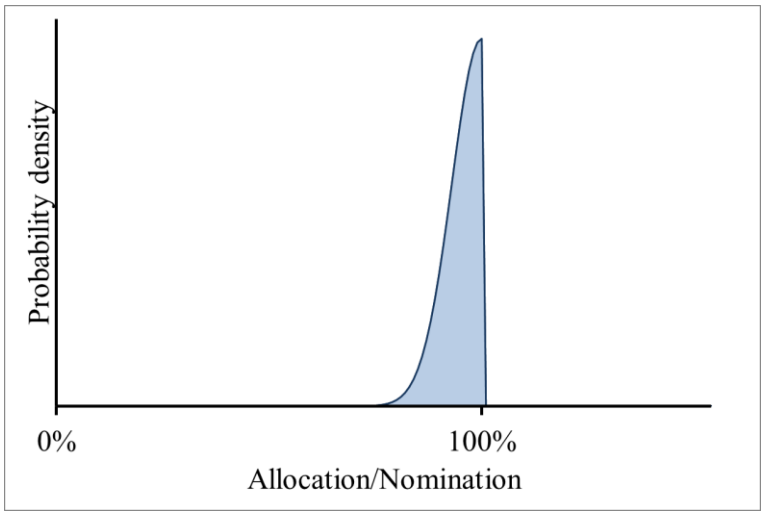


Figure 3.2: Schematic representation of PDF of allocation/nomination dispersion all year round of a transfer point customer.

If the supplier company is supplied through a real point itself, then it may have faced to both positive and negative dispersions. Let's assume a GSPA between this supplier company and another recipient company.

According to the NOP, if the intake of the supplier company is enough to satisfy the nomination of the recipient company, then the nomination of the recipient company is allocated to it. No more gas than asked amount is allocated, in other words.

In case the intake of the supplier company is not enough to satisfy the nomination of the recipient one, then the shortcoming amount is reflected to the recipient company, i.e. the allocation becomes less than the nomination for the recipient company.

Finally, as shown in Figure 3.3, at the national balancing point, allocation is exactly equal to the nomination.

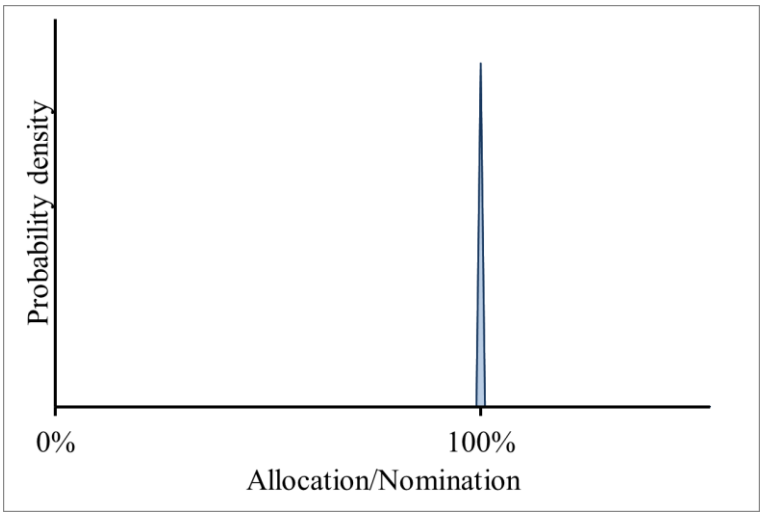


Figure 3.3: Schematic representation of PDF of allocation/nomination dispersion all year round of a national balancing point customer.

Regulation penalty cost

By the regulation penalty, it is aimed that all the shippers are forced to estimate the demand or intake precisely at any point p. Regulation penalty is calculated at the entry points of storage facilities (p= 7), LNG terminals (p= 2, 6), production facilities (p= 8, 9) and each exit point (p= 0.y).

Tolerance limits of the regulation cost is described at the Article 3.3.2.1 of the NOP.

The tolerance limits of the delivery points are calculated by using a piecewise linear Equation 3.9.

$$T_{rg[pj]} = \left| k_{rc[j]} + \left(h_{rc[j]} \times r_{rc[j]} \right) \right| \quad \textbf{(3.9)}$$

The components of (3.9) are tabulated in Table 3.6 for the entry points.

Table 3.6: Equation components of the regulation penalty for entry points.

$b_{[pj]}$	$k_{rc[j]}$	$h_{rc[j]}$	$r_{rg[j]}$
0 – 500,000	0	$b_{rc[pj]}$	+/- 0.15
500,001 – 1,000,000	+/- 75,000	$b_{rc[pj]}$ – 500,000	+/- 0.12
1,000,001 – 2,000,000	+/- 135,000	$b_{rc[pj]}$ – 1,000,000	+/- 0.10
2,000,001 – 4,000,000	+/- 235,000	$b_{rc[pj]}$ – 2,000,000	+/- 0.09
4,000,001 and above	+/- 415,000	$b_{rc[pj]}$ – 4,000,000	+/- 0.07

To visualize, consumption amount, q, should be in between the green lines shown in the Figure 3.4 for the entry points.

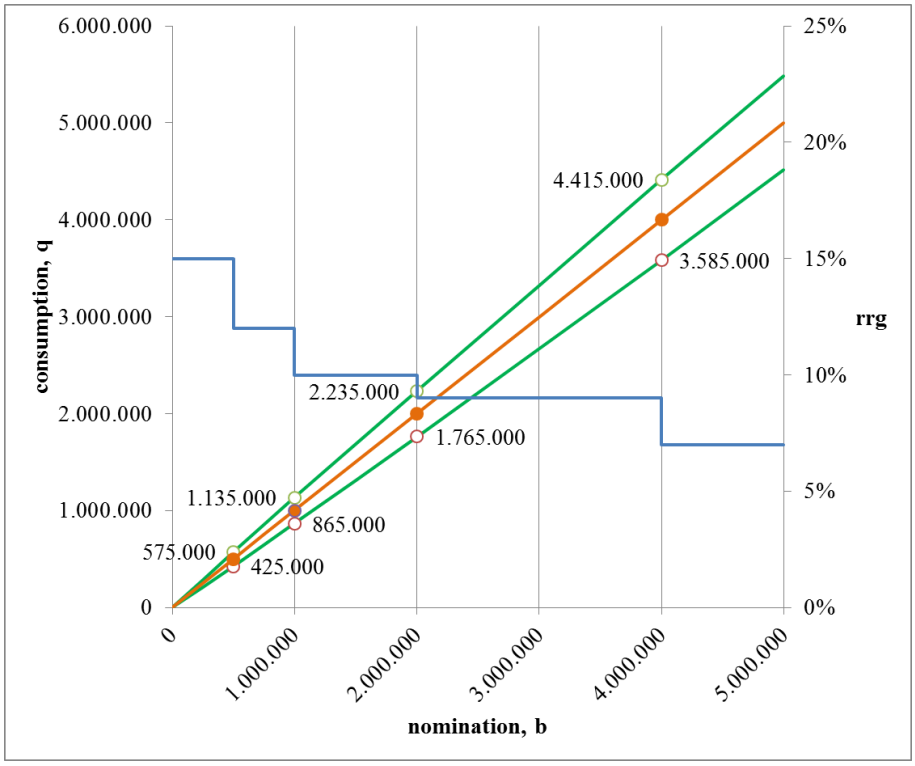


Figure 3.4: Tolerance limits of consumption with respect to nomination for the entry points.

The components of (3.9) are tabulated in Table 3.7 for the exit points.

Table 3.7: Equation components of the regulation penalty for exit points.

$b_{[pj]}$	$k_{rc[j]}$	$h_{rc[j]}$	$r_{rg[j]}$
0 – 100,000	0	$b_{rc[pj]}$	+/- 1.00
100,001 – 250,000	+/- 100,000	$b_{rc[pj]}$ – 100,000	+/- 0.12
250,001 – 1,000,000	+/- 118,000	$b_{rc[pj]}$ – 250,000	+/- 0.10
1,000,001 – 2,000,000	+/- 193,000	$b_{rc[pj]}$ – 1,000,000	+/- 0.06
2,000,001 and above	+/- 235,000	$b_{rc[pj]}$ – 2,000,000	+/- 0.04

To visualize, consumption amount, q, should be in between the green lines shown in the Figure 3.5 for the exit points.

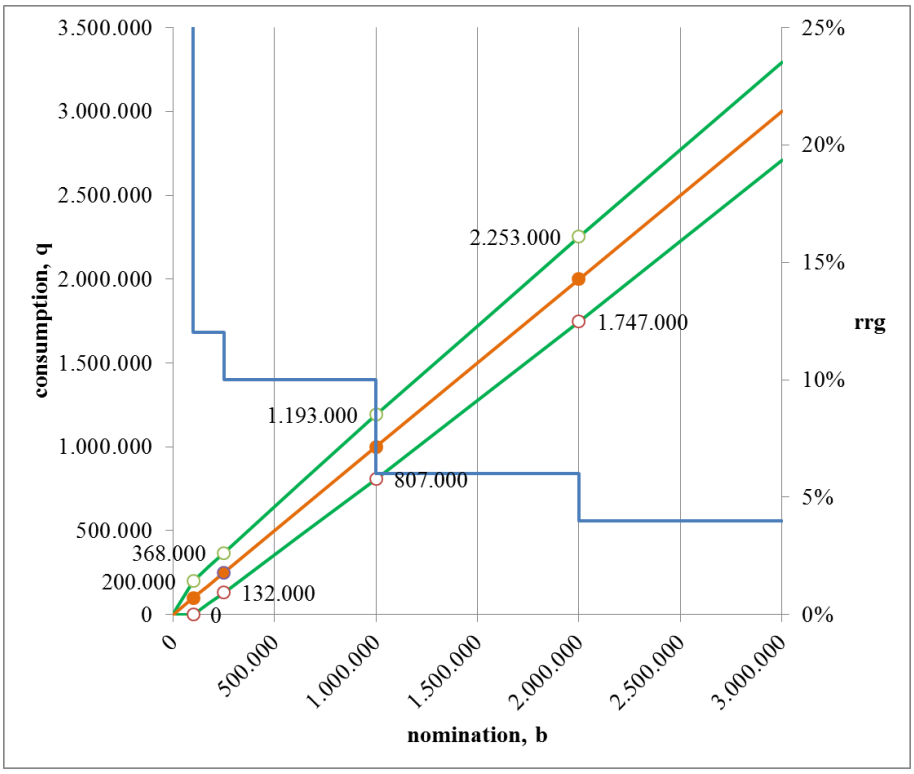


Figure 3.5: Tolerance limits of consumption with respect to nomination for the exit points.

Tolerance limits for the regulation penalty is schematically shown in Figure 3.6.

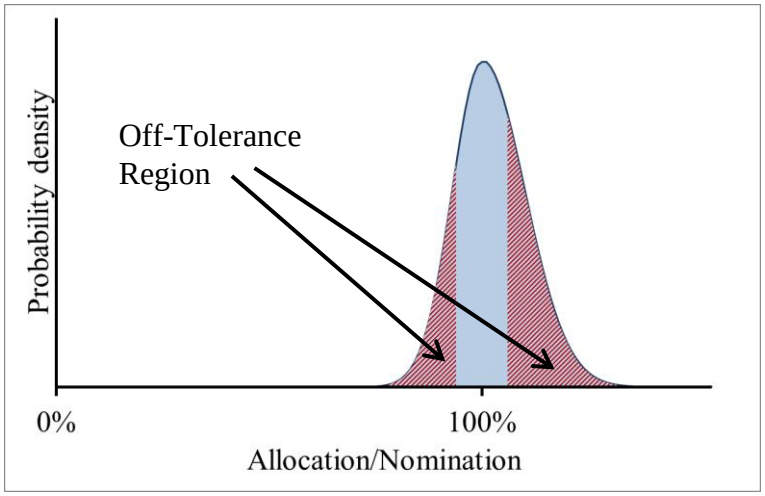


Figure 3.6: Schematic representation of tolerance limits.

Calculation of the annual regulation penalty cost:

$$\delta_{[pj]} = b_{[pj]} - q_{[pj]} \quad \textbf{(3.10a)}$$

$$e_{rg[pj]} = \max\{0, (|\delta_{[pj]}| - T_{rg[pj]})\} \times g_{ts} \times \alpha_{rg} \quad \textbf{(3.10b)}$$

$$E_{rg[pn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{rg[pj]} \quad \textbf{(3.10c)}$$

$$E_{rg[p]} = \sum_{n=1}^{N} E_{rg[pn]} \quad \textbf{(3.10d)}$$

$$E_{rg} = \sum_{p} E_{rg[p]} \quad \textbf{(3.10e)}$$

According to EMRA Board Resolution Nr.2970, α_{rg}=0.10

Unbalance penalty cost

By the unbalance penalty, it is aimed that all the shippers are forced to correctly estimate total demand of the all consumers they supply and inject the necessary gas to the GRID.

Article 3.3.1 of NOP describes the calculation of unbalance penalty cost.

The tolerance limits of the GRID balance is calculated by using a piecewise linear equation:

$$T_{ub[j]} = \left|k_{ub[j]} + \left(h_{ub[j]} \times r_{ub[j]}\right)\right| \quad \textbf{(3.11a)}$$

While calculating the GRID balance tolerance, customers supplied through virtual delivery points are excluded. The reason is that to prevent shippers from abusing the methodology by buying and selling a huge amount of gas through an virtual point at the same day to increase their tolerance limits. The components of (3.11a) are tabulated in Table 3.8 for the GRID balance.

Table 3.8: Equation components of the GRID balance for the unbalance penalty.

$\beta_{[j]}$	$k_{ub[j]}$	$h_{ub[j]}$	$r_{ub[j]}$
0 – 500,000	0	$\beta_{[j]}$	+/- 0.12
500,001 – 1,000,000	+/- 60,000	$\beta_{[j]}$ – 500,000	+/- 0.08
1,000,001 – 2,000,000	+/- 100,000	$\beta_{[j]}$ – 1,000,000	+/- 0.06
2,000,001 – 4,000,000	+/- 160,000	$\beta_{[j]}$ – 2,000,000	+/- 0.05
4,000,001 and above	+/- 260,000	$\beta_{[j]}$ – 4,000,000	+/- 0.04

$$\beta_{[j]} = \sum_{i=1}^{m_s} q_{[sij]} - \sum_{i=1}^{(m_{ct}+m_{cs})} q_{[cij]} \quad \textbf{(3.11b)}$$

To visualize, consumption amount, q, should be in between the green lines shown in the Figure 3.7 for the real exit points.

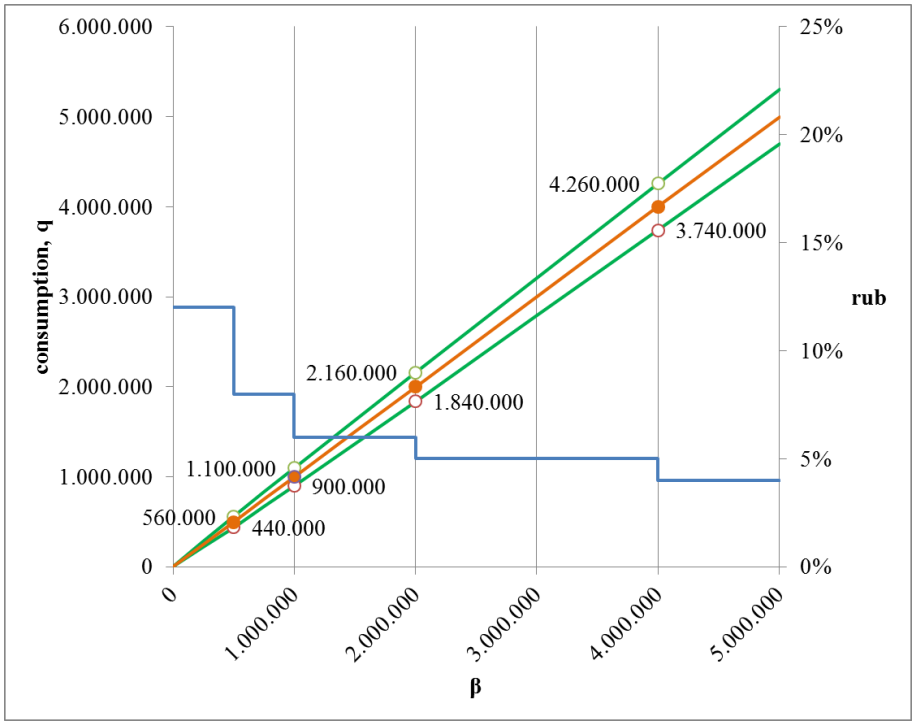


Figure 3.7: Tolerance limits of consumption with respect to β.

For the all customers and suppliers of the Company, the unbalance equation:

$$\Delta_{ct[j]} = \sum_{i=1}^{m_{ct}} \left(b_{[ctij]} - q_{[ctij]}\right) \geq 0 \qquad \textbf{(3.12a)}$$

$$\Delta_{cs[j]} = \sum_{i=1}^{m_{cs}} \left(b_{[csij]} - q_{[csij]}\right) = 0 \qquad \textbf{(3.12b)}$$

$$\Delta_{cr[j]} = \sum_{i=1}^{m_{cr}} \left(b_{[crij]} - q_{[crij]}\right) \qquad \textbf{(3.12c)}$$

$$\Delta_{st[j]} = \sum_{i=1}^{m_{st}} \left(b_{[stij]} - q_{[stij]}\right) \geq 0 \qquad \textbf{(3.12d)}$$

$$\Delta_{ss[j]} = \sum_{i=1}^{m_{ss}} \left(b_{[ssij]} - q_{[ssij]}\right) = 0 \qquad \textbf{(3.12e)}$$

$$\Delta_{sr[j]} = \sum_{i=1}^{m_{sr}} \left(b_{[srij]} - q_{[srij]}\right) \quad \textbf{(3.12f)}$$

Combined unbalance equation of the Company at day j:

$$\Delta_{[j]} = \sum_{i=1}^{m_c} \left(b_{[cij]} - q_{[cij]}\right) - \sum_{i=1}^{m_s} \left(b_{[sij]} - q_{[sij]}\right) \quad \textbf{(3.13a)}$$

$$\Delta_{[j]} = \Delta_{ct[j]} + \Delta_{cs[j]} + \Delta_{cr[j]} - \Delta_{st[j]} - \Delta_{ss[j]} - \Delta_{sr[j]} \quad \textbf{(3.13b)}$$

It is said that if $\Delta_{[j]}$ greater than 0, Company is in the positive unbalance state at the day j and in the negative unbalance state vice versa.

According to the EMRA Board Resolution Nr.2970 coefficients for calculating unbalance cost are defined separately for the positive and negative unbalance states, which are given in Table 3.9. For the negative unbalance state, coefficient is defined such that the equation includes the balancing gas cost. Since in the CUSTOM balancing gas cost is calculated separately, coefficients for the negative unbalance state are modified.

Table 3.9: Coefficients for Unbalance Penalty.

Period	$\alpha_{ubpt[n]}$	$\alpha_{ubng[n]}$	$\alpha_{ubaddmax}$	**N**
Summer	0.08	0.02	13	5-8
Winter	0.02	0.08	51	1-3, 11-12
Interlude	0.05	0.05	21	4, 9-10

Noting that the sum of α_{ubpt} and α_{ngpt} is equal to 1 every time, α_{ub} can be defined.

$$\alpha_{ub[j]} = 0.05 + \left(\frac{\Delta_{[j]}}{\left|\Delta_{[j]}\right| + \varepsilon} \times \frac{\alpha_{ubpt[j]} - \alpha_{ubng[j]}}{2}\right) \quad \textbf{(3.14a)}$$

Moreover, for the extreme positive unbalance state, where off-tolerance amount is higher than in-tolerance amount in the day j, an additional coefficient α_{ubadd} is defined. By the EMRA Board Resolution Nr.4347, a cap $\alpha_{ubaddcap}$ is also defined.

$$\alpha_{ubadd[j]} = \max\left\{\alpha_{ubaddcap[j]}, \frac{\Delta_{[j]} - T_{ub[j]}}{T_{ub[j]} + \varepsilon}\right\} \times \theta_{ex}\left(\Delta_{[j]} - 2 \times T_{ub[j]}\right) \quad \textbf{(3.14b)}$$

To sum up,

$$e_{ub[j]} = \theta_{ex}\left(\left|\Delta_{[j]}\right| - T_{ub[j]}\right) \times \left(\left|\Delta_{[j]}\right| - T_{ub[j]}\right) \times P_{dgf[j]} \times \alpha_{ub[j]} \times \max\left\{1, \alpha_{ubadd[j]}\right\} \quad \textbf{(3.14c)}$$

$$E_{ub[n]} = \sum_{j=J_{n-1}+1}^{J_n} e_{ub[j]} \quad \textbf{(3.14d)}$$

$$E_{ub} = \sum_{n=1}^{N} E_{ub[n]} \quad \textbf{(3.14e)}$$

3.2.3.6 Low-pressure penalty cost

Every shipper having a real entry point capacity application has to guarantee the specifications of the natural gas to enter the GRID, either by import or production. According to the Article 11.2.6 of the NOP, pressure of the gas at point p at day j, $\rho_{[pj]}$, should be above a specified limit, ρ_{cut}. In the NOP, ρ_{cut}=50 Bars.

$$e_{lp[pj]} = \theta_{ex}\left(\rho_{cut} - \rho_{[pj]}\right) \times \alpha_{lp} \times \left(g_{lp} + \left(\rho_{cut} - \rho_{[pj]}\right)\right) \times P_{dgf[j]} \times q_{[pj]} \quad \textbf{(3.15a)}$$

For 2014, α_{lp}=0.00055 and g_{lp}=1.

$$E_{lp[pn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{lp[pj]} \quad \textbf{(3.15b)}$$

$$E_{lp[p]} = \sum_{n=1}^{N} E_{lp[pn]} \quad \textbf{(3.15c)}$$

$$E_{lp} = \sum_{p} E_{lp[p]} \quad \textbf{(3.15d)}$$

3.2.4 Total license and GRID costs

Annual cost of owning a license ($I_{license}$) and using the grid (I_{grid}) are calculated by (3.16a) and (3.16b):

$$I_{license} = E_{ylf} + E_{ptf} \quad \textbf{(3.16a)}$$

$$I_{grid} = E_{rc} + E_{ic} + E_{oc} + E_{ts} + E_{rg} + E_{ub} + E_{lp} \quad \textbf{(3.16b)}$$

3.3 The Structure of Natural Gas Sales and Purchase Agreements (GSPAs)

Terms and conditions of natural gas sales and purchase agreements (GSPAs) are liberally agreed between parties and kept strictly confidential. As the author being a sector professional, he is well aware of the agreement structure and so the fictional terms and conditions are capable to represent the corresponding ones in the genuine agreements.

Although there are many terms in a contract; this thesis study focuses on the terms of duration, amount, price structure and penalties of the contracts. Costs caused by guarantee letter, moratorium interest, non-disclosure terms, and other legal obligations will be left to the further studies.

3.3.1 Duration

The duration of the agreements may vary from few days (day ahead spot trade agreement) to many years (import agreements).

As it is mentioned while defining capacity reservation cost, STC is signed for one year. Accordingly, agreements less than one year are all classified as spot trades and will be disregarded in the structure of CUSTOM. Since our aim is to guarantee a certain amount of profit at the beginning of the year by the CUSTOM, any spot trade creating an extra profit will become a bonanza and affect the profit of the company positively at the end of the year. Though, amount that might be subject to spot trade will be calculated.

Consequently, any GSPA will be considered as a contract of one year during this thesis study, even if it is an extended agreement from the previous year. Distinctively, a prolonged contract will be exempt from the stamp tax.

3.3.2 Amount

3.3.2.1 Annual contract quantity (ACQ)

Whether the contract lasts more than one year or not, annual contract quantity (ACQ) is strictly defined. All other amounts are defined with respect to ACQ.

3.3.2.2 Lunar contract quantity (LCQ) and daily contract quantity (DCQ)

Daily contract quantity (DCQ) might be defined in two different methods. First method uses ACQ, while the second method uses lunar contract quantity (LCQ).

If the contract is a flat profile contract ($v_{flt[y]}=1$), then DCQ would be equal all the year round. If not ($v_{flt[y]}=0$), then an LCQ is defined for each month and DCQ would be equal all along the month. Additionally in a flat profile contract, a daily tolerance coefficient, $0<\alpha_{odt}\leq 1$, is defined to provide some flexibility.

$$z_{[yj]} = v_{flt[y]} \times \frac{A_{[y]}}{J \times \alpha_{odt[y]}} + \left(1 - v_{flt[y]}\right) \times \frac{Z_{[yn]}}{J_n - J_{n-1}} \qquad \textbf{(3.17a)}$$

LCQ values are defined by a similar approach for the month n.

$$Z_{[yn]} = v_{flt[y]} \times (J_n - J_{n-1}) \times \frac{A_y}{J \times \alpha_{odt[y]}} + \left(1 - v_{flt[y]}\right) \times Z_{[yn]} \qquad \textbf{(3.17b)}$$

DCQ value is the maximum amount that customer may ask, and nominations above this amount are subject to unilateral approval of the supplier. Although the supplier has approved Over-DCQ nomination, it does not mean that the supplier guarantees to deliver such amount. Supplier would be liable for DCQ amount only, in other words.

There may be defined an additional fee for Over-DCQ nominations which would involve liability to the supplier in some contracts. For the sake of simplicity, these cases will be considered as an additional spot trade.

To prevent the annual contract to be turned into a seasonal contract by the customer, minimum amounts that customer may nominate are also defined. Similar to the Over-DCQ nominations, nominations less than minimum daily amount are subject to unilateral approval of the supplier.

$$z_{wd[yj]} = \alpha_{wd[y]} \times z_{[yj]} \qquad \textbf{(3.18a)}$$

$$z_{nd[yj]} = \alpha_{nd[y]} \times z_{[yj]} \qquad \textbf{(3.18b)}$$

$$z_{hd[yj]} = \alpha_{hd[y]} \times z_{[yj]} \qquad \textbf{(3.18c)}$$

Minimum daily amounts are defined by using three different ratios; for working days, non-working days, and holidays separately.

3.3.2.3 Minimum annual quantity (MAQ) and minimum summer quantity (MSQ)

By nature, natural gas consumption increases in wintertime and decreases in summertime. On the contrary, producer - exporter companies demands a flat consumption on the year round and a secured cash import every year during the contract period. To ensure importer company to satisfy these demands, minimum annual quantity (MAQ) and minimum summer quantity (MSQ) are defined by the producer - exporter company. Inherently, these obligations are reflected to every sales contract, from importer to wholesaler, and wholesaler to end consumer. MAQ is calculated by (3.19).

$$A_{maq[y]} = \alpha_{maq[y]} \times A_{[y]} - U_{maq[y]} \quad \textbf{(3.19)}$$

MAQ is sometimes referred as Take-or-Pay (TOP) amount owing to the penalty proposed in case the customer fails to purchase it. As it is obvious by the naming, customer is obligated to pay at least the cost of MAQ in the contract year. While some contracts require the full payment for the shortfall, some may require a portion of that.

Customer may have right to withdraw the paid but not taken gas due to the MAQ obligation in a few years limited time, after purchasing the relevant year's MAQ first. This amount is referred as Make-up gas and in case the gas price increases until the acceptance of Make-up gas, the difference should also be paid by the customer.

To secure a flat shaped consumption profile along the year, a certain amount of the gas is forced to be purchased in the summer period, starting at the beginning of April and ends at the end of September. MSQ also has a similar calculation equation as MAQ.

$$A_{msq[y]} = \alpha_{msq[y]} \times A_{[y]} - U_{msq[y]} \quad \textbf{(3.20)}$$

Unlike the MAQ penalty, MSQ penalty is a small percentage of the cost of the non-purchased quantity and has no Make-up option. In case the customer is obligated to pay both of the MAQ and MSQ penalties, then MSQ penalty, which is already paid at the end of the summer period, gets subtracted from the MAQ penalty in order not to charge penalty for the same amount repeatedly.

If supplier does not deliver the nominated amount despite the customer nominates properly, the undelivered amount gets subtracted from the MAQ and MSQ.

The undelivered amount, $u_{[yj]}$, is calculated daily and then, undelivered amounts for the whole year and for the summer period, $U_{maq[y]}$ and $U_{msq[y]}$ respectively, are calculated afterwards for the contract y.

$$u_{[yj]} = \theta_{ex}\left(\min\left(z_{[yj]}, b_{[yj]}\right) - q_{[yj]}\right) \times \left(\min\left(z_{[yj]}, b_{[yj]}\right) - q_{[yj]}\right) \quad \textbf{(3.21a)}$$

$$U_{[yn]} = \sum_{j=J_{n-1}+1}^{J_n} u_{[yj]} \quad \textbf{(3.21b)}$$

$$U_{maq[y]} = \sum_{n=1}^{12} U_{[yn]} \quad \textbf{(3.21c)}$$

$$U_{msq[y]} = \sum_{n=4}^{9} U_{[yn]} \quad \textbf{(3.21d)}$$

3.3.2.4 Customer operation flexibility

Amount definitions provide some flexibility options to the customer. Three extreme cases are studied to see the minimum sales amount, which are namely Balanced Safe, MinStart Safe and MaxStart Safe extreme cases, and all satisfy MAQ and MSQ obligations. Additionally, one more extreme case, FullACQ, is also studied to see the maximum sales amount.

To understand the reason, consider that the Engineer is trying to adjust the contracts for the upcoming year. Since the purchase and sales contracts would not match perfectly, he has to make a choice among two options.

First option is that total DCQ of the sales contracts would be less than the total DCQ of the purchase contracts, so he will be able to supply any amount that customers may ask during the contract period. This approach would keep him safe from paying penalty to the customers for undelivered amounts. However, in case the customers do not purchase the complete amount, then he would not be able to sell at the full capacity. Moreover, in this case the Engineer usually carries the risk of jeopardizing his own purchase contracts, and may face to MAQ and MSQ penalties to pay.

On the other hand, as another option, he may choose to secure his purchase contracts obligations which most probably jeopardize the sales contracts. Some days, if the all customers nominate their DCQ, the total amount he has to supply may be less than the amount he may ask from his suppliers. So there would be undelivered gas, which has a cost to The Company as paid penalty to the customers. The likelihood of this situation is quite high since the natural gas demand is correlated to the weather conditions and in the cold days almost all of the customers nominates DCQ.

Four extreme consumer behaviors are mathematically modelled in this thesis study. Determining the probability of each case is left to the further studies.

FullACQ extreme case

FullACQ represents the case that at the end of the year customer has purchased 100% of the ACQ.

$$B_{FullACQ[yn]} = \frac{Z_{[yn]}}{\sum_{n=1}^{12} Z_{[yn]}} \times A_{[y]} \quad \textbf{(3.22)}$$

$B_{FullACQ[yn]}$ represents the total nominated amount as per contract y in the month n. That amount might be less than the LCQ ($Z_{[yn]}$) because of the daily tolerance coefficient, α_{odt}, which is defined in Section 3.3.2.2. By the Equation 3.22, a balanced distribution through the year is achieved.

Balanced Safe extreme case

Balanced Safe represents the case that at the end of the year customer has purchased 100% of MAQ, of which the amount equal to 100% of MSQ has been purchased in the summer period.

$$B_{Balanced[yn]} = \left[v_{summer[n]} \times \frac{Z_{[yn]}}{\sum_{n=4}^{9} Z_{[yn]}} \times A_{msq[y]}\right] + \left[\left(1 - v_{summer[n]}\right) \times \frac{Z_{[yn]}}{\sum_{n=1}^{12} Z_{[yn]} - \sum_{n=4}^{9} Z_{[yn]}} \times \left(A_{msq[y]} - A_{msq[y]}\right)\right] \quad \textbf{(3.23)}$$

Where, $v_{smr[n]}$=1 for n={4, 5, …, 9}, is summer period validator. In the winter period $v_{smr[n]}$=0.

MinStart Safe extreme case

MinStart Safe extreme case is a profile of the customer who obeys the contract amount obligations but jeopardize the purchase contracts of supplier. This customer starts the year with the purchasing of the minimum daily amount that has to be nominated, and this behavior lasts as long as possible. When a certain day, of which the customer has to purchase complete DCQ amount in the rest of the summer period and/or year, comes, it starts nominating full DCQ amount every day and fulfills the contractual amount obligations at the end of the year successfully.

A sequential algorithm is used to generate MinStart Safe extreme case distribution.

$$B_{MinStart[y9]} = Z_{min[y9]} + \min\left\{\underbrace{\left(Z_{[y9]} - Z_{min[y9]}\right)}_{>0}, \underbrace{\max\left\{0, \left(A_{msq[y]} - \sum_{n=4}^{9} Z_{min[yn]}\right)\right\}}_{\geq 0}\right\} \quad \text{(3.24a)}$$

$$B_{MinStart[y8]} = Z_{min[y8]} + \min\left\{\left(Z_{[y8]} - Z_{min[y8]}\right), \max\left\{0, \left(A_{msq[y]} - \sum_{n=4}^{8} Z_{min[yn]} - B_{MinStart[y9]}\right)\right\}\right\} \quad \text{(3.24b)}$$

$$B_{MinStart[y7]} = Z_{min[y7]} + \min\left\{\left(Z_{[y7]} - Z_{min[y7]}\right), \max\left\{0, \left(A_{msq[y]} - \sum_{n=4}^{7} Z_{min[yn]} - \sum_{n=8}^{9} B_{MinStart[yn]}\right)\right\}\right\} \quad \text{(3.24c)}$$

$$B_{MinStart[y6]} = Z_{min[y6]} + \min\left\{\left(Z_{[y6]} - Z_{min[y6]}\right), \max\left\{0, \left(A_{msq[y]} - \sum_{n=4}^{6} Z_{min[yn]} - \sum_{n=7}^{9} B_{MinStart[yn]}\right)\right\}\right\} \quad \text{(3.24d)}$$

$$B_{MinStart[y5]} = Z_{min[y5]} + \min\left\{\left(Z_{[y5]} - Z_{min[y5]}\right), \max\left\{0, \left(A_{msq[y]} - \sum_{n=4}^{5} Z_{min[yn]} - \sum_{n=6}^{9} B_{MinStart[yn]}\right)\right\}\right\} \quad \text{(3.24e)}$$

$$B_{MinStart[y4]} = Z_{min[y4]} + \min\left\{\left(Z_{[y4]} - Z_{min[y4]}\right), \max\left\{0, \left(A_{msq[y]} - Z_{min[y4]} - \sum_{n=5}^{9} B_{MinStart[yn]}\right)\right\}\right\} \quad \text{(3.24f)}$$

Customer has now satisfied the MSQ obligation.

$$B_{MinStart[y12]} = Z_{min[y12]} + \min\left\{\underbrace{\left(Z_{[y12]} - Z_{min[y12]}\right)}_{>0}, \underbrace{\max\left\{0, \left(A_{maq[y]} - \sum_{n=4}^{9} B_{MinStart[yn]} - \sum_{n=1}^{3} Z_{min[yn]} - \sum_{n=10}^{12} Z_{min[yn]}\right)\right\}}_{\geq 0}\right\}}_{\geq 0} \quad \textbf{(3.24g)}$$

$$B_{MinStart[y11]} = Z_{min[y11]} + \min\left\{\left(Z_{[y11]} - Z_{min[y11]}\right), \max\left\{0, \left(A_{maq[y]} - \sum_{n=4}^{9} B_{MinStart[yn]} - \sum_{n\prime=1}^{3} Z_{min[yn]} - \sum_{n\prime=10}^{11} Z_{min[yn]} - B_{MinStart[y12]}\right)\right\}\right\} \quad \textbf{(3.24h)}$$

$$B_{MinStart[y10]} = Z_{min[y10]} + \min\left\{\left(Z_{[y10]} - Z_{min[y10]}\right), \max\left\{0, \left(A_{maq[y]} - \sum_{n=4}^{9} B_{MinStart[yn]} - \sum_{n=1}^{3} Z_{min[yn]} - Z_{min[y10]} - \sum_{n=11}^{12} B_{MinStart[y12]}\right)\right\}\right\} \quad \textbf{(3.24i)}$$

$$B_{MinStart[y3]} = Z_{min[y3]} + \min\left\{\left(Z_{[y3]} - Z_{min[y3]}\right), \max\left\{0, \left(A_{maq[y]} - \sum_{n=4}^{12} B_{MinStart[yn]} - \sum_{n=1}^{3} Z_{min[yn]}\right)\right\}\right\} \quad \textbf{(3.24j)}$$

$$B_{MinStart[y2]} = Z_{min[y2]} + \min\left\{\left(Z_{[y2]} - Z_{min[y2]}\right), \max\left\{0, \left(A_{maq[y]} - \sum_{n=3}^{12} B_{MinStart[yn]} - \sum_{n=1}^{2} Z_{min[yn]}\right)\right\}\right\} \quad \textbf{(3.24k)}$$

$$B_{MinStart[y1]} = Z_{min[y1]} + \min\left\{\left(Z_{[y1]} - Z_{min[y1]}\right), \max\left\{0, \left(A_{maq[y]} - \sum_{n=2}^{12} B_{MinStart[yn]} - Z_{min[y1]}\right)\right\}\right\} \quad \textbf{(3.24l)}$$

Customer has now satisfied both MSQ and MAQ obligations.

Note that if $\alpha_{msq[y]}$ is not defined properly, it becomes useless since the minimum amount that could be purchased in the summer period would be bounded below by the monthly minimum amounts.

$$A_{msq[y]} < \sum_{n=4}^{9} Z_{min[yn]} \xrightarrow{yields} \sum_{n=4}^{9} B_{MinStart[yn]} = \sum_{n=4}^{9} Z_{min[yn]} > A_{msq[y]} \quad \textbf{(3.25a)}$$

Proper definition of $\alpha_{msq[y]}$ yields;

$$A_{msq[y]} = \sum_{n=4}^{9} B_{MinStart[yn]} > \sum_{n=4}^{9} Z_{min[yn]} \quad \textbf{(3.25b)}$$

Whether $\alpha_{msq[y]}$ is defined properly or not, it is secured that no MSQ Penalty occurs for the contract y.

Similarly, if $\alpha_{maq[y]}$ is not defined properly, it becomes useless since the minimum amount that could be purchased in the summer period would be bounded below by the summation of MSQ amount and daily minimum amounts of the winter period.

$$A_{maq[y]} < \sum_{n=4}^{9} B_{MinStart[yn]} + \sum_{n=1}^{3} Z_{min[yn]} + \sum_{n=10}^{12} Z_{min[yn]} \xrightarrow{yields}$$
$$\sum_{n=1}^{12} B_{MinStart[yn]} = \sum_{n=1}^{3} Z_{min[yn]} + \sum_{n=4}^{9} B_{MinStart[yn]} + \sum_{n=10}^{12} Z_{min[yn]} > A_{maq[y]} \quad \textbf{(3.25c)}$$

Proper definition of $\alpha_{maq[y]}$ yields;

$$A_{maq[y]} = \sum_{n=1}^{12} B_{MinStart[yn]} > \sum_{n=1}^{12} Z_{min[yn]} \quad \textbf{(3.25d)}$$

MaxStart Safe extreme case

MaxStart Safe extreme case is another profile of the customer who obeys the contract amount obligations but jeopardize the purchase contract of the supplier. This customer starts the year with the purchasing of the complete DCQ amount it has to nominate, and this behavior lasts as long as possible. When a certain day comes, it starts nominating minimum daily amounts every day and hence fulfills the contractual amount obligations at the end of the year.

The same sequential algorithm as MinStart Safe extreme case is used to define distribution of MaxStart Safe extreme case. Distinctively, this algorithm starts calculating from the 4th month, and ends by calculating for 12th month.

3.3.2.5 Customer profiles

Flat profile contract

A sample flat profile contract's amount determiners are listed in the Table 3.10, which is actually "ct1" which is investigated in the sample case study.

Table 3.10: Amount determiners of a sample flat profile contract.

Definition	Symbol	Value
Annual Contract Quantity	$A_{[y]}$	100,000,000 Sm^3
Daily Tolerance Coefficient	$\alpha_{odt[y]}$	0.9
Coefficient of Minimum Daily Amount	$\alpha_{wd[y]} = \alpha_{nd[y]} = \alpha_{hd[y]}$	0.5
Coefficient of Minimum Annual Quantity	$\alpha_{maq[y]}$	80%
Coefficient of Minimum Summer Quantity	$\alpha_{maq[y]}$	40%

It could be seen in the Figure 3.8 that, without violating the contract, consumer has ability to adjust the monthly amounts.

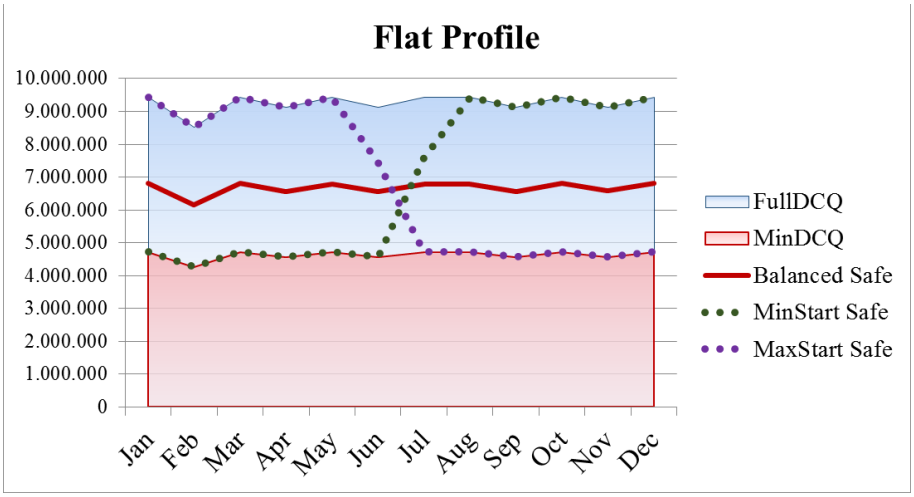


Figure 3.8: Monthly amounts of the sample flat profile contract.

- Blue layout represents the maximum allowable monthly amounts.
- Red layout represents the minimum allowable monthly amounts.
- Red solid line represents the Balanced Safe extreme case.
- Green dotted line represents MinStart Safe extreme case.
- Purple dotted line represents MaxStart Safe extreme case.

Predominant winter profile contract

A sample predominant winter profile contract's amount determiners are listed in the Table 3.11, which represents household consumption and studied as "ct2" in the sample case study indeed.

Table 3.11: Amount determiners of a sample predominant winter profile contract.

Definition	Symbol	Value
Annual Contract Quantity	$A_{[y]}$	150,000,000 Sm^3
Lunar Contract Quantity – 1	$Z_{[y1]}$	22,000,000 Sm^3
Lunar Contract Quantity – 2	$Z_{[y2]}$	20,000,000 Sm^3
Lunar Contract Quantity – 3	$Z_{[y3]}$	12,000,000 Sm^3
Lunar Contract Quantity – 4	$Z_{[y4]}$	9,000,000 Sm^3
Lunar Contract Quantity – 5	$Z_{[y5]}$	6,000,000 Sm^3
Lunar Contract Quantity – 6	$Z_{[y6]}$	5,000,000 Sm^3
Lunar Contract Quantity – 7	$Z_{[y7]}$	5,000,000 Sm^3
Lunar Contract Quantity – 8	$Z_{[y8]}$	6,000,000 Sm^3
Lunar Contract Quantity – 9	$Z_{[y9]}$	8,000,000 Sm^3
Lunar Contract Quantity – 10	$Z_{[y10]}$	12,000,000 Sm^3
Lunar Contract Quantity – 11	$Z_{[y11]}$	20,000,000 Sm^3
Lunar Contract Quantity – 12	$Z_{[y12]}$	25,000,000 Sm^3
Coefficient of Minimum Daily Amount	$\alpha_{wd[y]} = \alpha_{nd[y]} = \alpha_{hd[y]}$	0.7
Coefficient of Minimum Annual Quantity	$\alpha_{maq[y]}$	85%
Coefficient of Minimum Summer Quantity	$\alpha_{maq[y]}$	25%

In the Figure 3.9, the visual representation of the predominant winter profile is prepared with the same manner as in Figure 3.8.

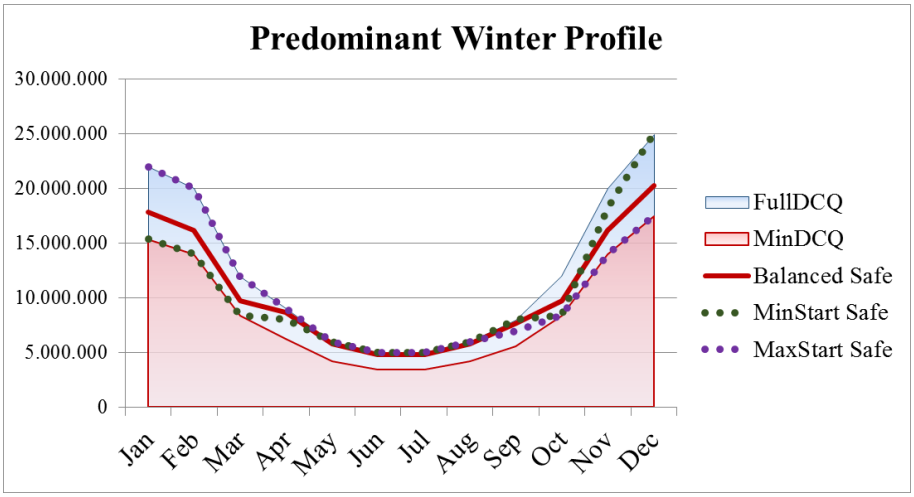


Figure 3.9: Monthly amounts of the sample predominant winter profile contract.

Predominant summer profile contract

A sample predominant summer profile contract is represented schematically in Figure 3.10, which is named as "ct3" in the sample case study. Details are available at the Appendix.

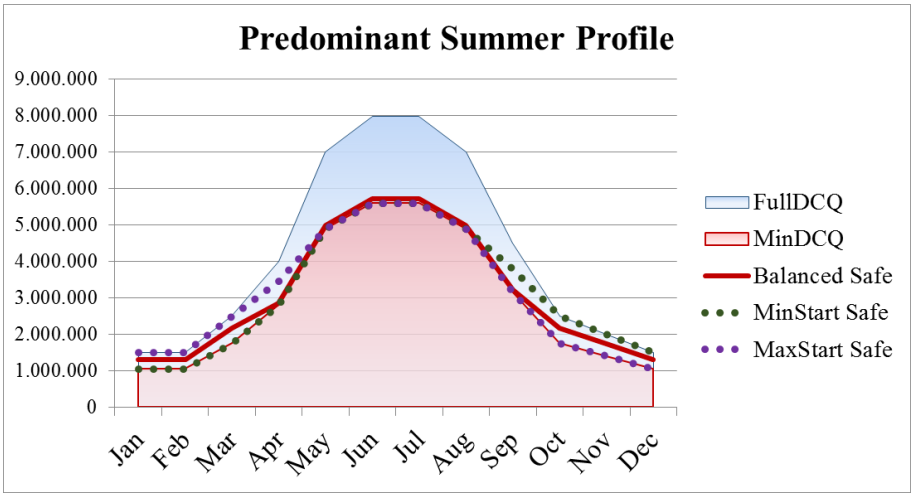


Figure 3.10: Monthly amounts of the sample predominant summer profile contract.

3.3.2.6 Portfolio balancing

Let's assume The Company has a long term purchase contract, of which's determiners are listed in the Table 3.12.

Table 3.12: Amount determiners of a sample flat profile purchase contract.

Definition	Symbol	Value
Annual Contract Quantity	$A_{[y]}$	300,000,000 Sm^3
Daily Tolerance Coefficient	$\alpha_{odt[y]}$	0.95
Coefficient of Minimum Daily Amount	$\alpha_{wd[y]} = \alpha_{nd[y]} = \alpha_{hd[y]}$	0.7
Coefficient of Minimum Annual Quantity	$\alpha_{maq[y]}$	80%
Coefficient of Minimum Summer Quantity	$\alpha_{maq[y]}$	38%

Summing up all the sales contracts' extremes case by case, overall Full DCQ, Balanced Safe, MinStart Safe and MaxStart Safe curves of the customers are found as shown in Figure 3.11.

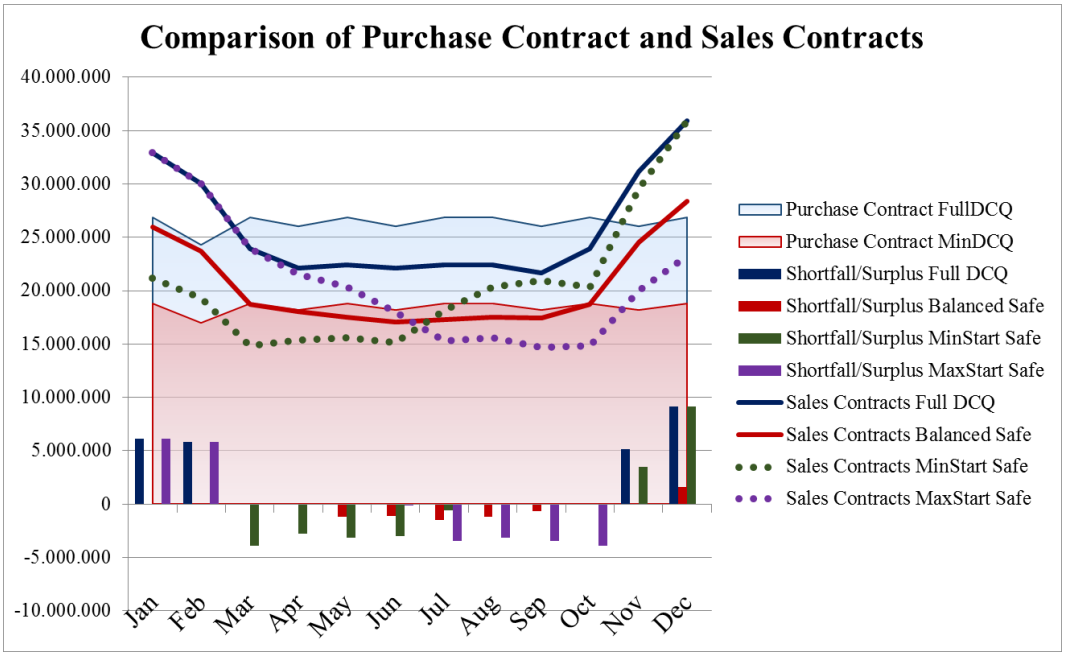


Figure 3.11: Comparison graph of sales and purchase contracts.

The bars on the horizontal axis of the graph represent the shortfall or surplus amount for each case in the comparison graph. Each shortfall means undelivered gas which will be subject to penalty for the Company to pay to the buyers. Also each surplus means unpurchased gas which will again be subject to penalty for the Company, to pay its supplier this time. CUSTOM aims to maximize the profit of the company, considering these penalties also. CUSTOM gives the results separately. To obtain a combined solution, probability of these extremes should be determined correctly, of which the methodology is subject of the further studies.

3.3.3 Price structure

As similar to all other terms and conditions, price equation is also determined freely between parties and kept strictly confidential. In this thesis study, three widely used price structure will be instructed.

3.3.3.1 Fixed price

The simplest price equation is the fixed price, which is determined in the USD currency usually.

This price structure involves no risk to buyer except the risk of increasing exchange rate. Especially if the buyer is a production & exportation company which has USD income, this price structure might be appropriate in order to get rid of fluctuation of the energy cost.

$$P_{fix[yn]} = P_{fixUSD[y]} \times R_{[n]} \qquad \textbf{(3.26a)}$$

3.3.3.2 BOTAS-indexed price

As it is stated in the Section 2.2, BOTAS owns the vast majority of the import contracts, so the local natural gas market. Moreover, as being a state owned company, BOTAS does not refuse any end consumer and applies the same tariff according to the classification announced in the BOTAS web page. Also, since BOTAS has numerous customers, no strict take-or-pay amount or other daily maximum and minimum amount limits are applied to the end consumer.

As GRID is operated by BOTAS and the specifications or interruption conditions of the natural gas are identically same at the delivery point regardless of the company who invoices the end consumer, there isn't any possible competition area for the natural gas trading company except the price competition.

Considering these facts, none of the natural gas trading companies has chance to gain any customer of BOTAS unless offering a guaranteed lower price, which is secured by a discount rate, $d_{[y]}$, applied to a defined tariff basket.

$$P_{bts[yn]} = \left(1 - d_{[y]}\right) \times \left(c_{th[y]}\, P_{th[n]} + c_{te[y]} P_{te[n]} + c_{tz[y]} P_{tz[n]}\right) \qquad \textbf{(3.26b)}$$

For the year 2014, there are three different tariffs are defined at the BOTAS web page, of which's price are announced every month.

- Rank – 1, applicable to household customers and eligible consumers whose annual consumption amount is equal or less than 300,000 Sm^3.
- Rank – 2, applicable to eligible customers consuming more than 300,000 Sm^3 per year.
- Consumers resided in organized industrial zones.

BOTAS prices are closely related with politics. By the decision of government, since the beginning of 2013,

- Price of household is $P_{th[n]}$= 0.778405 TL/Sm^3,
- Price of eligible customers is $P_{te[n]}$= 0.717783 TL/Sm^3, and
- Price of the organized industrial zone is $P_{tz[n]}$= 0.714194 TL/Sm^3.

3.3.3.3 Oil-indexed price

International long-term contract prices are defined by negotiation once and then updated periodically to reflect the developments in the global oil & gas market.

In the price equation, the reference market data is defined clearly. Reference market spot gas price is chosen among the credible hub prices, such as Henry Hub (Louisiana - USA), Zeebrugge Hub (Belgium), Title Transfer Facility – TTF (virtual point, Netherlands), National Balancing Point – NBP (virtual point, UK), etc.

Not only gas spot price but also oil and oil products spot price are used as a reference, while building up a future contract gas price equation. Similarly, this reference price is chosen among credible ones, such as WTI Cushing Spot (Oklahoma - USA), Dated Brent Spot (Oklahoma – USA), etc.

Certainly, the data supplier company is chosen precisely among the credible ones, such as Reuters, Platts, Argus, ICIS, etc.

For instance, "*Ultra Low Sulphur Diesel-Barges Fob Rotterdam-Platts European means that the price for a Pricing Date will be that day's Specified Price per metric ton of Ultra Low Sulphur Diesel, stated in U.S. Dollars, published under the heading "Barges FOB Rotterdam: ULSD" in the issue of Platts European that reports prices effective on that Pricing Date*." would be the phrase in the contract which describes a reference commodity. (EFET, 2014)

A fictional equation based on oil and oil products will be introduced to represent the complexity of the future contract natural gas price in this thesis study.

$$\dot{P}_{oil[yn]} = \left(\left(P_{roil[y]} \times \left(c_{go[y]} \frac{P_{go[n]}}{P_{rgo[y]}} + c_{lsf[y]} \frac{P_{lsf[n]}}{P_{rlsf[y]}} + c_{hsf[y]} \frac{P_{hsf[n]}}{P_{rhsf[y]}}\right) \times \frac{GCV_{[pn]}}{GCV_{ref}} + K_{1[yn]}\right) + K_{2[y]}\right) \times R_{[n]} \quad \textbf{(3.26c)}$$

Oil-indexed gas price (P_{oil}) is updated by using the negotiated reference gas price (P_{roil}) and an oil products basket price change, at the beginning of every quarter year, in our example. Oil products basket contains price of gasoil (P_{go}), light sulphur fuel oil (P_{lsf}) and heavy sulphur fuel oil (P_{hsf}).

$$P_{oil[y1]} = P_{oil[y2]} = P_{oil[y3]} = \dot{P}_{oil[y1]} \quad \textbf{(3.26d)}$$

$$P_{oil[y4]} = P_{oil[y5]} = P_{oil[y6]} = \dot{P}_{oil[y4]} \quad \textbf{(3.26e)}$$

$$P_{oil[y7]} = P_{oil[y8]} = P_{oil[y9]} = \dot{P}_{oil[y7]} \quad \textbf{(3.26f)}$$

$$P_{oil[y10]} = P_{oil[y11]} = P_{oil[y12]} = \dot{P}_{oil[y10]} \quad \textbf{(3.26g)}$$

To prevent the price of natural gas do of fluctuating sharply because of the momentary changes in the price of oil products, moving average method is used in our example. As the moving average period, previous three quarter of the price calculation month is chosen.

$$P_{go[n]} = \frac{1}{9} \times \sum_{i=(n-9)}^{(n-1)} P_{go[i]} \quad \textbf{(3.26h)}$$

$$P_{lsf[n]} = \frac{1}{9} \times \sum_{i=(n-9)}^{(n-1)} P_{lsf[i]} \quad \textbf{(3.26i)}$$

$$P_{hsf[n]} = \frac{1}{9} \times \sum_{i=(n-9)}^{(n-1)} P_{hsf[i]} \quad \textbf{(3.26j)}$$

The actual gross calorific value of the gas changes every moment. It is measured at the delivery point physically and every day, an average value, $GCV_{[pj]}$ is calculated. At the end of the month, weighted average of the gross calorific value for month n at

the delivery point p ($GCV_{[pn]}$) is calculated. This value is used to correct the price to reflect the physical quality of gas in terms on energy it contains per cubic meter, since the reference price is determined per normal cubic meter (q̇, the measured volume of gas regardless of the calorie that contains).

$$GCV_{[pn]} = \frac{\sum_{j=(J_{n-1}+1)}^{J_n} \left(GCV_{[pj]} \times \dot{q}_{[pj]}\right)}{\sum_{j=(J_{n-1}+1)}^{J_n} \dot{q}_{[pj]}} \qquad \textbf{(3.26k)}$$

In Turkey, gross calorific value of natural gas is denominated by Sm^3 (standard cubic meter). By definition, 1 Sm^3 gas contains 9155 kcal = 10.64 kWh of energy, i.e. GCV_{ref}=9155 kcal/m^3.

Although it is intended to obtain a smooth price curve by the methodology used to build up the equation structure, short term effects are also considered by an extra additive, $K_{1[yn]}$, which is a piecewise function of monthly average of Dated Brent Spot price, $P_{brt[n]}$.

K_1 is calculated by using a piecewise linear equation:

$$K_{1[yn]} = \alpha_{k1[n]} \times r_{k1[n]} \qquad \textbf{(3.26l)}$$

The components of (3.26l) are tabulated in Table 3.13.

Table 3.13: Components of K_1 calculation equation.

$\mathbf{P_{brt[n]}}$	$\boldsymbol{\alpha_{k1[n]}}$	$\mathbf{r_{k1[n]}}$
$0 - h_{11}$	1	$k_{1^+[y]}$
$(h_{11}+\varepsilon) - h_{12}$	$\frac{k_{1^+[y]}}{h_{k12[y]} - h_{k11[y]}}$	$h_{k12[y]} - P_{brt[n]}$
$(h_{12}+\varepsilon) - h_{13}$	1	0
$(h_{13}+\varepsilon) - h_{14}$	$\frac{k_{1^-[y]}}{h_{k13[y]} - h_{k14[y]}}$	$h_{k13[y]} - P_{brt[n]}$
$(h_{14}+\varepsilon)$ and above	1	$k_{1^-[y]}$

The relationship between K_1 and P_{brt} is represented schematically in the Figure 3.12.

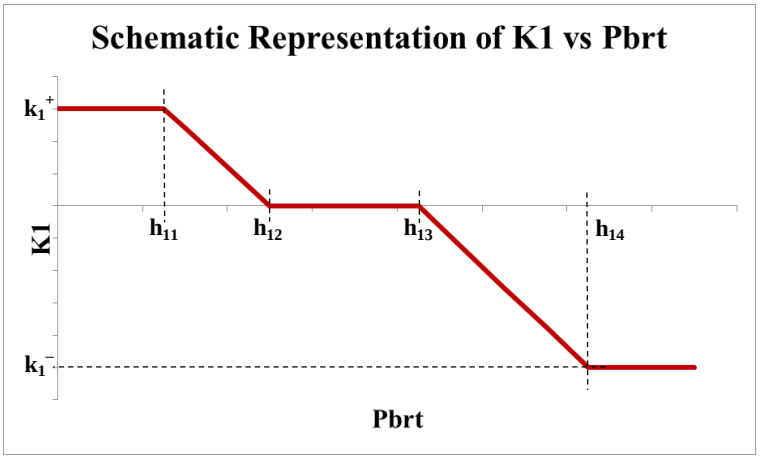


Figure 3.12: The relation between K_1 and P_{brt}.

K_2 is the additional price which is seen in back-to-back agreements usually. The company who is buying natural gas with a price equation resells it with an agreed profit added on the same equation.

3.3.3.4 Price equation

Summing up all above equations (3.26a – 3.26l), the price equation is found.

$$P_{gas[yn]} = v_{fix[y]} \times P_{fix[yn]} + v_{bts[y]} \times P_{bts[yn]} + v_{oil[y]} \times P_{oil[yn]} \qquad \textbf{(3.26m)}$$

where, v are validators and only one of them could be equal to 1 while the others are equal to 0.

3.3.4 Penalties

With an agreement, customer agrees to buy and supplier agrees to sell a certain amount of natural gas. It means that customer faces to penalties in case it does not buy at least the agreed volume (MAQ & MSQ) and supplier faces to penalties in case it does not supply the agreed volume (DCQ) successfully.

3.3.4.1 Penalties for the supplier

Deficiency penalty cost

With the agreement, customer earns right to purchase the amount of DCQ every day. As it is mentioned in Section 3.3.2, The Company may have chosen to sign supply

contract more than the purchase contracts could satisfy for some days, assuming that that it's not likely for all customers to nominate DCQ for the same day.

However, if case the total nomination of customers exceeds the total DCQ of supply contracts of The Company, it goes into default and would not be able to supply the nominations of customers. Then a default penalty, which is a certain percentage of natural gas price, occurs in order The Company to compensate the possible loss of the customers. Different percentages are determined for the summer period (α_{us}) and the winter period (α_{uw}), which is obviously higher in winter than the summer.

In practice, it is usually possible to ask Over-DCQ from the supplier but obtaining it is subject to the unilateral acceptance of the supplier. So, the CUSTOM will not take the mercy of the supplier of The Company into account.

To calculate the cost of default penalty, the amount of default of each customer should be calculated first. For the extreme case, consider that all of the customers are nominated DCQ. To supply the demand, The Company also nominated DCQ to all of the suppliers and obtained it, but the total gathered amount is less than the total demand of the customers. Then the amount equations for the default day j′;

$$b_{[cxj\prime]} = z_{[cxj\prime]} \tag{3.27a}$$

$$b_{[sxj\prime]} = z_{[sxj\prime]} = q_{[sxj\prime]} \tag{3.27b}$$

$$u_{[j\prime]} = \sum_{i=1}^{m_c} b_{[cij\prime]} - \sum_{i=1}^{m_s} q_{[sij']} = \sum_{i=1}^{m_c} z_{[cij\prime]} - \sum_{i=1}^{m_s} z_{[sij\prime]} > 0 \tag{3.27c}$$

The total undelivered gas for the day j′, $u_{[j]}$ will be shared among customers fairly.

$$q_{[yj\prime]} = z_{[yj\prime]} - u_{[yj\prime]} = b_{[yj\prime]} - u_{[yj\prime]} \tag{3.28a}$$

$$\varphi_{[j\prime]} = \frac{u_{[j\prime]}}{\sum_{i=1}^{m_c} z_{[cij\prime]}} \tag{3.28b}$$

$$u_{[cyj\prime]} = \varphi_{[j\prime]} \times z_{[cyj\prime]} \tag{3.28c}$$

Then the cost of the undelivered gas will be;

$$\Phi_{def[j]} = \sum_{i=1}^{m_c} z_{[cij]} - \sum_{i=1}^{m_s} z_{[sij]} \quad \textbf{(3.29a)}$$

$$e_{def[cyj]} = \theta_{ex}\left(\Phi_{def[j]}\right) \times u_{[cyj]} \times \alpha_{def[cyj]} \times P_{gas[cyj]} \quad \textbf{(3.29b)}$$

$$E_{def[cyn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{def[cyj]} \quad \textbf{(3.29c)}$$

$$E_{def[cy]} = \sum_{n=1}^{N} E_{def[cyn]} \quad \textbf{(3.29d)}$$

$$E_{def} = \sum_{y=1}^{m_c} E_{def[cy]} \quad \textbf{(3.29e)}$$

Cost of surplus gas

Although there isn't any penalty proposed for the case of surplus gas, this case will be investigated here because of the similar structure of the deficiency penalty cost.

Similar to the Over-DCQ contracting, The Company may take the risk of guaranteed selling amount less than the purchase contracts obligate to be purchased for some days. In those days, it may be possible that all the customers nominate the minimum amount (MinDCQ) they are obligated to. Then the surplus amount will be left to the GRID, at the price of balancing gas, $P_{dgf[j]}$. In other words, that gas will be purchased anyway and will be sold to BOTAS at the price BOTAS determined for that month.

Letting $\alpha_{dd[y]}$ is one of the $\alpha_{wd[y]}$, $\alpha_{nd[y]}$ or $\alpha_{hd[y]}$ depending on the timing of day j″, the amount equations for the j′, which is the surplus day becomes;

$$b_{[cxj'']} = q_{[cxj'']} = \alpha_{dd[cxj'']} \times z_{[cxj'']} \quad \textbf{(3.30a)}$$

$$b_{[sxj'']} = q_{[sxj'']} = \alpha_{dd[sxj'']} \times z_{[sxj'']} \quad \textbf{(3.30b)}$$

$$q_{dgf[j'']} = \sum_{i=1}^{m_s} b_{[sij'']} - \sum_{i=1}^{m_c} b_{[cij'']} > 0 \quad \textbf{(3.30c)}$$

Leaving gas to GRID is a sales operation, hence in the CUSTOM it is placed at the sales side. The cost of that gas is;

$$\Phi_{sur[j]} = \sum_{i=1}^{m_s} \left(\alpha_{dd[sij]} \times z_{[sij]}\right) - \sum_{i=1}^{m_c} \left(\alpha_{dd[cij]} \times z_{[cij]}\right) \quad \textbf{(3.31a)}$$

$$e_{sur[j]} = \theta_{ex}\left(\Phi_{sur[j]}\right) \times \Phi_{sur[j]} \times q_{dgf[j]} \times P_{dgf[j]} \quad \textbf{(3.31b)}$$

$$E_{sur[n]} = \sum_{j=J_{n-1}+1}^{J_n} e_{sur[j]} \quad \textbf{(3.31c)}$$

$$E_{sur} = \sum_{n=1}^{N} E_{sur[n]} \quad \textbf{(3.31d)}$$

3.3.4.2.Penalties for the customer

Minimum summer quantity (MSQ) penalty cost

Customer is obligated to pay the penalty for the gas which promised to be purchased but not taken in the summer period. MSQ penalty is added to the invoice of September (n=9) as it is calculated as follows:

$$P_{msq[y]} = \frac{1}{6} \times \sum_{n=4}^{9} P_{gas[yn]} \quad \textbf{(3.32a)}$$

$$\Phi_{msq[y]} = A_{msq[y]} - \sum_{n=4}^{9} Q_{[yn]} \quad \textbf{(3.32b)}$$

$$E_{msq[y]} = \theta_{ex}\left(\Phi_{msq[y]}\right) \times \Phi_{msq[y]} \times P_{msq[y]} \times \gamma_{msq[y]} \quad \textbf{(3.32c)}$$

$\gamma_{msq[y]}$ is the penalty coefficient.

Minimum annual quantity (MAQ) penalty cost

Similarly, customer is obligated to pay the cost of the gas that promised to be purchased but not taken during the year. In case the customer is obligated to pay both of the MAQ and MSQ penalties, then MSQ penalty, which is already paid at the end of the summer period, gets subtracted from the MAQ penalty in order not to charge

penalty for the same amount repeatedly. MAQ penalty is added to the invoice of December (n=12) as it is calculated as follows:

$$P_{maq[y]} = \frac{1}{N} \times \sum_{n=1}^{N} P_{gas[yn]} \quad \textbf{(3.33a)}$$

$$\Phi_{maq[y]} = A_{maq[y]} - Q_{[y]} \quad \textbf{(3.33b)}$$

$$E_{maq[y]} = \theta_{ex}\left(\Phi_{maq[y]}\right) \times \Phi_{maq[y]} \times P_{maq[y]} \times \gamma_{maq[y]} - E_{msq[y]} \quad \textbf{(3.33c)}$$

$\gamma_{maq[y]}$ is the penalty coefficient.

3.3.5 Other costs

3.3.5.1 Reflected costs

Reflected costs are costs of GRID operation which are invoiced to the customers for those who want items are invoiced separately, while the other customers ask a price including everything.

Customers may not agree to pay all of the reflected costs but accept to pay few of them, so a reflection validator for each cost, $v_{reflect,x[y]}$, is defined for every cost item for each contract. For the same contract, reflection validators are independent of each other.

Reflected reserved capacity cost

Customer accepts that the supplier has made capacity reservation for it at the inlet point p_{in}, and the delivery point p_{out}. Noting that it is possible for the supplier to apply any amount at any point, customer only accepts the cost of reservation of DCQ amount every day. Inlet point, which the gas has entered the GRID, and the delivery point should be stated clearly in the contract.

$$e_{rc[yj]} = z_{[yj]} \times \left(g_{rc[p_{in}]} + g_{rc[p_{out}]}\right) \quad \textbf{(3.34a)}$$

$$E_{rc[yn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{rc[yj]} \quad \textbf{(3.34b)}$$

$$E_{rc[y]} = \sum_{n=1}^{N} E_{rc[yn]} \quad \textbf{(3.34c)}$$

$$I_{rc[y]} = v_{reflect,rc[y]} \times E_{rc[y]} \quad \textbf{(3.34d)}$$

Reflected idle capacity cost

If supplier reserves idle capacity for the demand of the customer only at any point p, customer is charged for the reserved idle capacity amount. Entry point, delivery point and the idle capacity amount should be stated clearly in the contract.

$$e_{ic[yj]} = \left(z_{ic[p_{in}j]} \times g_{rc[p_{in}]} + z_{ic[p_{out}j]} \times g_{rc[p_{out}]}\right) \times \alpha_{ic[n]} \quad \textbf{(3.35a)}$$

$$E_{ic[yn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{ic[yj]} \quad \textbf{(3.35b)}$$

$$E_{ic[y]} = \sum_{n=1}^{N} E_{ic[yn]} \quad \textbf{(3.35c)}$$

$$I_{ic[y]} = v_{reflect,ic[y]} \times E_{ic[y]} \quad \textbf{(3.35d)}$$

Reflected over-capacity penalty cost

If the consumption of the customer exceeds the DCQ of it, then the supplier may charge customer for the cost of over-capacity penalty. Supplier is not obligated to prove to customer if BOTAS has really fined supplier with the over-capacity penalty at the day j.

$$e_{oc[yj]} = \max\left\{0, \left(q_{[yj]} - z_{[yj]}\right)\right\} \times \left(g_{rc[p_{in}]} + g_{rc[p_{out}]}\right) \times \alpha_{oc[n]} \quad \textbf{(3.36a)}$$

$$E_{oc[yn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{oc[yj]} \quad \textbf{(3.36b)}$$

$$E_{oc[y]} = \sum_{n=1}^{N} E_{oc[yn]} \quad \textbf{(3.36c)}$$

$$I_{oc[y]} = v_{reflect,oc[y]} \times E_{oc[y]} \quad \textbf{(3.36d)}$$

Reflected transmission service cost

If the delivery point is a real outlet point (p=0.y), then the transmission service fee occurs and supplier may charge customer for that cost.

$$e_{ts[yj]} = q_{[yj]} \times g_{ts} \quad \textbf{(3.37a)}$$

$$E_{ts[yn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{ts[yj]} \quad \textbf{(3.37b)}$$

$$E_{ts[y]} = \sum_{n=1}^{N} E_{ts[yn]} \quad \textbf{(3.37c)}$$

$$I_{ts[y]} = v_{reflect,ts[y]} \times E_{ts[y]} \quad \textbf{(3.37d)}$$

Reflected regulation penalty cost

Supplier may charge customer for the difference between its nomination and the consumption. Supplier is not obligated to prove to customer if BOTAS has really fined supplier with the grid balancing participation fee at the day j.

Tolerances ($T_{rg[p_{in}yj]}$ and $T_{rg[p_{out}yj]}$) are calculated as it is described in Section 3.2.3.5, but by using nomination ($b_{[yj]}$) and consumption ($q_{yj]}$) volumes of the customer.

$$\delta_{[yj]} = b_{[yj]} - q_{[yj]} \quad \textbf{(3.38a)}$$

$$e_{rg[pj]} = \left(\max\{0, |\delta_{[yj]}| - T_{rg[p_{in}yj]}\} + \max\{0, |\delta_{[yj]}| - T_{rg[p_{out}yj]}\}\right) \times g_{ts} \times \alpha_{rg} \quad \textbf{(3.38b)}$$

$$E_{rg[yn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{rg[yj]} \quad \textbf{(3.38c)}$$

$$E_{rg[y]} = \sum_{n=1}^{N} E_{rg[yn]} \quad \textbf{(3.38d)}$$

$$I_{rg[y]} = v_{reflect,rg[y]} \times E_{rg[y]} \quad \textbf{(3.38e)}$$

Reflected unbalance penalty cost

Reflected unbalance penalty cost is calculated similar to the calculation of reflected regulation penalty cost.

Tolerance ($T_{ub[yj]}$) and the penalty itself ($e_{ub[yj]}$) are calculated as it is described in Section 3.2.3.5, but by using nomination ($b_{[yj]}$) and consumption ($q_{[yj]}$) volumes of the customer.

$$\delta_{[yj]} = b_{[yj]} - q_{[yj]} \quad \textbf{(3.39a)}$$

$$e_{ub[yj]} = \max\{0, |\delta_{[yj]}| - T_{ub[yj]}\} \times P_{dgf[j]} \times \alpha_{ub[j]} \times \max\{1, \alpha_{ubadd[j]}\} \quad \textbf{(3.39b)}$$

$$E_{ub[yn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{ub[yj]} \quad \textbf{(3.39c)}$$

$$E_{ub[y]} = \sum_{n=1}^{N} E_{ub[yn]} \quad \textbf{(3.39d)}$$

$$I_{ub[y]} = v_{reflect,ub[y]} \times E_{ub[y]} \quad \textbf{(3.39e)}$$

Reflected low-pressure penalty cost

If an inlet point is stated clearly in the agreement for the supplied natural gas, then low-pressure penalty cost may be reflected to the customer. The calculation procedure is same as in described in Section 3.2.3.6.

$$e_{lp[yj]} = \theta_{ex}(\rho_{cut} - \rho_{[pj]}) \times \alpha_{lp} \times \left(g_{lp} + (\rho_{cut} - \rho_{[pj]})\right) \times P_{dgf[j]} \times q_{[yj]} \quad \textbf{(3.40a)}$$

$$E_{lp[yn]} = \sum_{j=J_{n-1}+1}^{J_n} e_{lp[yj]} \quad \textbf{(3.40b)}$$

$$E_{lp[y]} = \sum_{n=1}^{N} E_{lp[yn]} \quad \textbf{(3.40c)}$$

$$I_{lp[y]} = v_{reflect,lp[y]} \times E_{lp[y]} \quad \textbf{(3.40d)}$$

3.3.5.2 Shared costs

Some costs, such as stamp tax cost, might have been decided to be shared between parties.

$$I_{st[y]} = \omega_{st[y]} \times E_{st[y]} \tag{3.41}$$

In the sample case study, $\omega_{st[y]}$=50% for all cases, which is the common practice.

3.3.6 Invoice

Invoice is prepared at the end of the month, including all monthly costs.

$$Q_{[yn]} = \sum_{j=J_{n-1}+1}^{J_n} q_{[yj]} \tag{3.42a}$$

$$I_{[yn]} = Q_{[yn]} \times P_{gas[yn]} + I_{rc[yn]} + I_{ic[yn]} + I_{oc[yn]} + I_{ts[yn]} + I_{rg[yn]} + I_{ub[yn]} + I_{lp[yn]} - E_{def[yn]} \tag{3.42b}$$

$$I_{[y]} = E_{maq[y]} + E_{msq[y]} + I_{st[y]} + \sum_{n=1}^{N} I_{[yn]} \tag{3.42c}$$

3.4 Profit equation

Annual profit or loss of the company due to the natural gas trade is calculated as follows:

$$\boldsymbol{I} = \underbrace{\sum_{i=1}^{m_c} I_{[ci]}}_{Sales\ Contracts} \underbrace{- \sum_{i=1}^{m_s} I_{[si]}}_{Purchase\ Contracts} \underbrace{-I_{grid}}_{\substack{Cost\ of\ Grid \\ Operation}} \underbrace{-I_{licence}}_{\substack{Cost\ of \\ License}} \underbrace{-E_{st}}_{\substack{Cost\ of \\ Agreements}} \underbrace{+E_{sur}}_{\substack{Sales\ to \\ GRID}} \tag{3.43}$$

CUSTOM, calculates the Equation 3.42 for any possible customer and/or supplier set. In the sample case study, only five alternative sets are investigated.

These calculations are executed for each estimation of the price data, such as USD rate, oil prices, BOTAS tariffs, etc. In the sample case study, two different scenarios for each data set are proposed, which resulted 2^3=8 different estimations.

These estimations are used just to see if the CUSTOM is working properly. Projecting the prices or rates for futures is out of the scope of the contract optimization engineer. Outsourced data should be used for decision, which again would not guarantee a certain amount of profit at the end of the year.

4. SAMPLE CASE STUDY

CUSTOM is a decision helper algorithm which could be used by professionals not occupied in the Turkish natural gas market. It is programmable by any programming language, or it could be used in any optimization problem regarding the market. This Case Study is prepared to demonstrate how CUSTOM works step by step to make the logic behind the equations clear.

4.1 Price Estimations

As they are described in the thesis study, three different price structures are offered in order to calculate contract prices, which are namely fixed price, BOTAS-indexed price and Oil-indexed price structures.

When a contract is signed, each party has an expectation about the gas price constituents for the upcoming year. These data are used to calculate the expected gas price and to decide on whether the negotiated price equation is profitable or not.

Making future price estimations are under the job description of risk management and finance departments usually. For demonstration purposes, it is assumed that two different estimations for each constituents set are readily known by the Engineer.

First constituents set is currency, which is estimated to increase in the following year in both forecasts. First scenario, Low Rise Scenario, assumes 1% increase in each month, and the second one, high Rise Scenario, assumes 3.5% increase in each month.

Second constituents set is BOTAS Tariff, which is absolutely unpredictable. Since the beginning of 2013, no change has occurred in the BOTAS prices, where in 2012 there were three rises; 20% in April, 10% in October and 8.5% at the end of the year. (BOTAS, 2014) Hence, two forecasts are offered which are No Rise Scenario, and Rise Scenario. It is assumed that in June 20% increase occurs in the Rise Scenario.

Last but not least, third constituents set covering Oil and Oil Product Data are forecasted as Slight Increase Scenario and Dramatic Decrease Scenario.

These three scenarios and forecasted price data are summarized in Table 4.1.

Table 4.1: Price equations constituent data forecasts.

Price Expectations													
Month (n)		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Currency (R[n])													
Low Rise Scenario	USD/TL	2.2000	2.2220	2.2442	2.2667	2.2893	2.3122	2.3353	2.3587	2.3823	2.4061	2.4302	2.4545
			1%	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
High Rise Scenario	USD/TL	2.2000	2.2770	2.3567	2.4392	2.5246	2.6129	2.7044	2.7990	2.8970	2.9984	3.1033	3.2119
			3.5%	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*
BOTAŞ Tariff													
No Rise Scenario	**Household Pth[n]**	TL/Sm3	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405
				0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Eligible Pte[n]	TL/Sm3	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783
				0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Industrial Ptz[n]	TL/Sm3	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194
				0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Rise Scenario	**Household Pth[n]**	TL/Sm3	0.778405	0.778405	0.778405	0.778405	0.778405	0.934086	0.934086	0.934086	0.934086	0.934086	0.934086	0.934086
				0%	*0%*	*0%*	*0%*	*20%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Eligible Pte[n]	TL/Sm3	0.717783	0.717783	0.717783	0.717783	0.717783	0.897229	0.897229	0.897229	0.897229	0.897229	0.897229	0.897229
				0%	*0%*	*0%*	*0%*	*25%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Industrial Ptz[n]	TL/Sm3	0.714194	0.714194	0.714194	0.714194	0.714194	0.892743	0.892743	0.892743	0.892743	0.892743	0.892743	0.892743
				0%	*0%*	*0%*	*0%*	*25%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Oil and Oil Products Data													
Slight Increase Scenario	**Gas Oil Pgo[n]**	USD/gal	300.000	300.450	300.901	301.352	301.804	302.257	302.710	303.164	303.619	304.074	304.530	304.987
				0.15%	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*
	Light Sulphur Fuel Oil Plsf[n]	USD/ton	700.000	701.400	702.803	704.208	705.617	707.028	708.442	709.859	711.279	712.701	714.127	715.555
				0.20%	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*
	Heavy Sulphur Fuel Oil Phsf[n]	USD/ton	550.000	550.825	551.651	552.479	553.307	554.137	554.969	555.801	556.635	557.470	558.306	559.143
				0.15%	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*
	Dated Brent Oil Pbrt[n]	USD/bbl	110.000	111.100	112.211	113.333	114.466	115.611	116.767	117.935	119.114	120.305	121.508	122.724
				1.00%	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*
Dramatic Decrease Scenario	**Gas Oil Pgo[n]**	USD/gal	300.000	298.500	297.008	295.522	294.045	292.575	291.112	289.656	288.208	286.767	285.333	283.906
				-0.50%	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*
	Light Sulphur Fuel Oil Plsf[n]	USD/ton	700.000	691.600	683.301	675.101	667.000	658.996	651.088	643.275	635.556	627.929	620.394	612.949
				-1.20%	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*
	Heavy Sulphur Fuel Oil Phsf[n]	USD/ton	550.000	541.750	533.624	525.619	517.735	509.969	502.320	494.785	487.363	480.053	472.852	465.759
				-1.50%	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*
	Dated Brent Oil Pbrt[n]	USD/bbl	110.000	106.700	103.499	100.394	97.382	94.461	91.627	88.878	86.212	83.625	81.117	78.683
				-3.00%	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*
	Gross Calorific Value GCV[n]	Kcal/Nm3	9050	9040	9005	8995	8990	8990	9000	9005	9025	9005	9010	9020
				-0.11%	*-0.39%*	*-0.11%*	*-0.06%*	*0.00%*	*0.11%*	*0.06%*	*0.22%*	*-0.22%*	*0.06%*	*0.11%*

By taking one forecast from each constituents set, future price data estimations are generated. As an example, Estimation 1 assumes Low Rise Scenario in Currency, No Rise Scenario in BOTAS Tariff and Slight Increase Scenario in Oil and Oil Products. With the same manner, 2^3=8 different price estimations are generated. Each contract price is investigated under these 8 different Estimations.

4.2 Negotiated Contracts

It is assumed that, there exists eleven contracts to decide on, where three of them are purchase contracts, and the rest of them are sales contract, from the point of view of the Company. According to the GSPA Addressing System, they are numbered as tabulated in Table 4.2.

Table 4.2: Negotiated contracts.

Address	Contract	Delivery Point	Profile	Price Structure
ct1=c1=1	Sales	Transfer	Flat	Fixed
ct2=c2=2	Sales	Transfer	Winter	BOTAS-Index
ct3=c3=3	Sales	Transfer	Summer	BOTAS-Index
cs1=c4=4	Sales	National Balancing	Flat	Oil-Index
cs2=c5=5	Sales	National Balancing	Flat	Oil-Index
cr1=c6=6	Sales	Real	Flat	BOTAS-Index
cr2=c7=7	Sales	Real	Flat	Fixed
cr3=c8=8	Sales	Real	Winter	Fixed
st1=s1=9	Purchase	Transfer	Winter	BOTAS-Index
ss1=s2=10	Purchase	National Balancing	Flat	Fixed
sr1=s3=11	Purchase	Real	Flat	Oil-Index

Five alternative sets are generated for comparison purposes. If it were programmed by another tool than excel, all possible alternatives might be investigated. Contract nr.11 is assumed to be an import contract which is signed for twenty years, so that contract is common in all alternative sets. Alternative sets are tabulated in Table 4.3.

Table 4.3: Alternative sets.

Set	Sales Contracts								Purchase Contracts		
	Transfer P.			N.B.P.		Real P.			T.P.	N.B.P.	R.P.
	1	2	3	4	5	6	7	8	9	10	11
Alternative 1	√			√	√	√		√			√
Alternative 2		√	√	√		√				√	√
Alternative 3				√			√		√		√
Alternative 4				√	√		√	√			√
Alternative 5	√	√	√			√			√	√	√

Details of each contract are summarized in the Appendix Section A.2. Two pages are dedicated for each contract. On the left hand side page, there exist the information of amounts. Annual, lunar and daily contract quantities are tabulated first, and then lunar total consumption of four different extreme case assumptions follow, which are namely FullACQ, Balanced Safe, MinStart Safe and MaxStart Safe.

On the right hand side page, price equations results are given. Depending upon the contract terms, only one of three price structure are calculated, where the rest results zero. Fixed price and BOTAS-Indexed price structures result in two different forecasts, while Oil-Indexed price structure results in four since both Oil and Oil Products data and Currency data are involved in the Oil-Indexed price equation.

Summary tables of the contracts are presented in the subsections; Appendix Section A.2.1 for resultant amounts and Appendix Section A.2.2. for resultant prices.

4.3 Comparison of Alternative Sets

This section is dedicated to the alternatives to compare. Every alternative set is presented one by one in Appendix Section A.3.

Sales contracts and purchase contracts are summed up to see the total demand and total supply situation. As an example, comparison of total supply and total demand is given in Figure 4.1 for the Alternative 1.

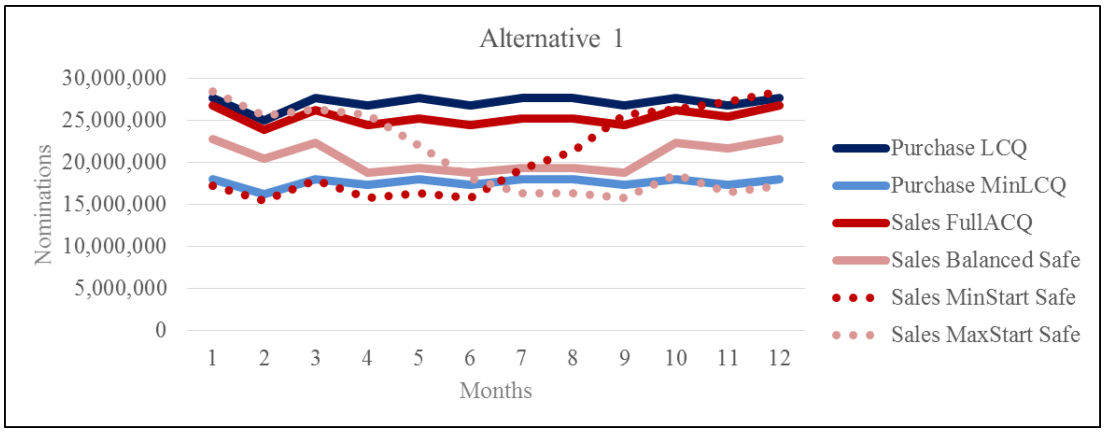


Figure 4.1: Nomination amount balance of Set - Alternative 1.

It is seen from the graph that, The Company would not be able to supply total demand of the customers in January and February if the real demand of customers of The Company becomes similar to MaxStart Safe case. Also this situation results a surplus gas at the second half of the year, which assumed to be sold to grid at balancing gas price.

In the subsections, detailed calculation of Alternative 1 is also presented. Appendix Section A.3.1 is dedicated for the amount calculations of Alternative 1 in four sheets.

First sheet includes total nominations of customers, and shortfall / surplus situation of The Company, which effects the amount of undelivered gas or sales to grid. Deficiency coefficient is a number that shows what percentage of the nominated gas will not be delivered to customers.

Second and third sheets are reserved for the total delivered gas for extreme cases.

Fourth sheet shows the purchased gas of The Company for four extreme cases.

Appendix Section A.3.2. contains the Profit / Loss calculations of Alternative-1, FullACQ extreme case under different estimations. In 4 sheets, every future price estimations are calculated and tabulated. In Table 4.4, future price estimations are described.

Table 4.4: Future price estimations.

	Currency		BOTAS Tariff		Oil and Oil Products	
	Low Rise	**High Rise**	**No Rise**	**Rise**	**Slight Increase**	**Dramatic Decrease**
Estimation 1	√		√		√	
Estimation 2	√		√			√
Estimation 3	√			√	√	
Estimation 4	√			√		√
Estimation 5		√	√		√	
Estimation 6		√	√			√
Estimation 7		√		√	√	
Estimation 8		√		√		√

These calculations are done for MinStart Safe, MaxStart Safe and Balanced Safe cases also for Alternative 1, and of course, for other four Alternative cases. For the sake of simplicity, calculation tables are not represented in this thesis study.

4.4 Results of Sample Case Study

In the Appendix Section A.4.1 difference of revenue of sold gas and cost of purchased gas is tabulated. Green filled cells represent the positive difference and the red filled cells represent the negative difference. The tone of the color is subject to the greatness of the number. As an example, comparison matrix for the FullACQ case is shown in Table 4.5.

Table 4.5: Gas cost difference comparison matrix for FullACQ case.

FullACQ					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Est 1	31,093,612	34,657,048	22,569,902	28,444,802	38,781,819
Est 2	24,299,471	27,597,987	16,630,326	21,650,662	29,977,783
Est 3	46,399,015	66,018,257	21,100,251	28,444,802	66,775,587
Est 4	37,570,098	58,959,196	15,160,675	19,615,886	57,971,551
Est 5	19,811,148	3,767,949	27,960,382	33,164,850	12,565,221
Est 6	11,524,887	-4,867,088	20,733,978	24,878,589	1,835,405
Est 7	35,116,552	35,129,158	26,490,731	33,164,850	40,558,989
Est 8	26,830,290	26,494,121	19,264,327	24,878,589	29,829,173

This level of detail is thought to be enough for some decision makers.

It is seen that Alternative 2 and Alternative 5 are the ones which the greatest profit could be earned in case the real economic data becomes closer to Estimation 3 or Estimation 4 during the contract period. At this level of detail, Alternative 5 has no risk of loss, and hence a decision maker may choose it.

To show the importance of costs described in this thesis study, License Cost (Annual License Fee, E_{ylf}, and Participation Fee, E_{ptf}), Taxes (E_{st}), Reserved Capacity Cost (E_{rc}), and Deficiency Costs (E_{def}) are calculated in Appendix Section A.4.2. For the FullACQ case, the comparison matrix of total of above-mentioned costs is shown in Table 4.6.

Table 4.6: Comparison matrix of other costs for FullACQ caACQ case.

FullACQ					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Est 1	2,319,816	3,429,391	2,779,814	2,981,829	4,790,423
Est 2	2,320,527	3,434,623	2,780,288	2,982,540	4,790,423
Est 3	2,327,469	3,553,957	2,779,814	2,981,829	4,982,308
Est 4	2,327,162	3,559,189	2,780,288	2,981,523	4,982,308
Est 5	2,328,334	3,441,279	2,794,317	2,998,349	4,869,618
Est 6	2,329,203	3,448,029	2,794,896	2,999,217	4,869,618
Est 7	2,335,987	3,342,333	2,794,317	2,998,349	4,660,411
Est 8	2,336,856	3,572,595	2,794,896	2,999,217	5,061,504

In the Appendix Section A.4.3. the overall profit / loss comparison matrices are represented. As an example, matrix of FullACQ case is shown in Table 4.7.

Table 4.7: Comparison matrix of overall profit / loss for FullACQ case.

FullACQ					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Est 1	28,773,795	31,227,657	19,790,088	25,462,973	33,991,396
Est 2	21,978,944	24,163,364	13,850,039	18,668,122	25,187,360
Est 3	44,071,546	62,464,300	18,320,437	25,462,973	61,793,278
Est 4	35,242,936	55,400,007	12,380,387	16,634,363	52,989,242
Est 5	17,482,814	326,670	25,166,065	30,166,501	7,695,602
Est 6	9,195,684	-8,315,117	17,939,083	21,879,371	-3,034,213
Est 7	32,780,565	31,786,825	23,696,414	30,166,501	35,898,578
Est 8	24,493,434	22,921,526	16,469,432	21,879,371	24,767,669

Just a little bit of more detail is included and it is seen that in Alternative 5, there might be a risk of loss in case Estimation 5 comes true, which was not seen when just the gas prices are compared.

5. CONCLUSION

In this thesis study, costs in the Turkish natural gas market are defined in details, as well as the structure of natural gas sales and purchase agreements.

CUSTOM should be considered as a core model for those who want to study Turkish natural gas market, but not a sector professional.

It is concluded that, agreed natural gas prices are not enough to decide on the contracts to be signed. Price volatilities, consumption / production characteristics, costs caused by regulations and legislations, and terms of agreements are all strongly capable to effect the resulting profit and loss expectation.

As the Turkish natural gas market liberalization process continues, the number of traders and eligible end consumers will increase. As an immediate result, number of contracts to be negotiated will be scaled up. Without a proven scientific model and a computer program running it; it will not be easy for companies to construct correct set of contracts which provides optimum profit/loss expectation.

CUSTOM will be enhanced in the further studies in order to structure a complete business decision helper model.

Enhanced CUSTOM (E-CUSTOM) might be able to (but not limited to),

- result a combined profit matrix, as well as the separate extreme case matrices,
- include cash flow analysis; featuring operational costs, cost of financing and taxes,
- feature the effects of unbalanced operation habits of customers by probabilistic methods,
- feature module of the use of natural gas storage facilities
- include the effect of LNG trading options,
- include the effect of short term / spot trading options,
- define key performance indicators (KPI) for suppliers and consumers so as to be used as a credit score depending upon their unbalance characteristics, etc.

Turkish natural gas market is still very immature. Inevitably, in the following years market structure needs to be improved. With the new pipeline projects, such as TANAP, South Stream, TAP, etc. Turkish market will become much integrated to the European, so to Global market.

Moreover, production capacity of Turkey is also not enough to supply the demand already, and will not be enough in the future as well, since the demand increases continuously.

These facts force Turkish natural gas market to operate on the basis of import contracts. Managing the sales and purchase contracts successfully is a fatal issue for the companies and should be studied with an interdisciplinary approach.

CUSTOM aimed to put the first brick to the wall.

BIBLIOGRAPHY

Akkurt, M., Demirel, O. F., & Zaim, S. (2010). Forecasting Turkey's Natural Gas Consumption by Using Time Series Methods. *European Journal of Economic and Political Studies*, *3*(2), 1–21.

Aras, H., and Aras, N. (2004). Forecasting Residential Natural Gas Demand. *Energy Sources*, *26*(5), 463–472. doi:10.1080/00908310490429740

Balat, M. (2010). Security of energy supply in Turkey: Challenges and solutions. *Energy Conversion and Management*, *51*(10), 1998–2011. doi:10.1016/j.enconman.2010.02.033

Boots, M. G., Rijkers, F. A. M., & Hobbs, B. F. (2003). *GASTALE : An oligopolistic model of production and trade in the European gas market* (pp. 1–36).

Deloitte Turkey. (2012). Turkey's Natural Gas Market – Expectations and developments 2012. İstanbul. Özen E.

De Mello Sant Ana, P. H., De Martino Jannuzzi, G., & Valdir Bajay, S. (2009). Developing competition while building up the infrastructure of the Brazilian gas industry. *Energy Policy*, *37*(1), 308–317. doi:10.1016/j.enpol.2008.09.044.

Dorigoni, S., Graziano, C., & Pontoni, F. (2010). Can LNG increase competitiveness in the natural gas market *Energy Policy*, *38*(12), 7653–7664. doi:10.1016/j.enpol.2010.08.004

Egging, R., Holz, F., & Gabriel, S. a. (2010). The World Gas Model. *Energy*, *35*(10), 4016–4029. doi:10.1016/j.energy.2010.03.053

Erdogdu, E. (2007). Regulatory reform in Turkish energy industry: An analysis. *Energy Policy*, *35*(2), 984–993. doi:10.1016/j.enpol.2006.02.011.

Erturk, M., and Turut-Asik, S. (2011). Efficiency analysis of Turkish natural gas distribution companies by using data envelopment analysis method. *Energy Policy*, *39*(3), 1426–1438. doi:10.1016/j.enpol.2010.12.014.

Gabriel, S. a., Rosendahl, K. E., Egging, R., Avetisyan, H. G., & Siddiqui, S. (2012). Cartelization in gas markets: Studying the potential for a "Gas OPEC." *Energy Economics*, *34*(1), 137–152. doi:10.1016/j.eneco.2011.05.014.

Gokgoz, F., and Atmaca, M. E. (2012). Financial optimization in the Turkish electricity market: Markowitz's mean-variance approach. *Renewable and Sustainable Energy Reviews*, *16*(1), 357–368. doi:10.1016/j.rser.2011.06.018.

Hacisalihoglu, B. (2008). Turkey's natural gas policy. *Energy Policy*, *36*(6), 1867 1872. doi:10.1016/j.enpol.2008.02.001.

Hauteclocque, A. De, & Glachant, J. M. (2009). Long-term energy supply contracts in European competition policy: Fuzzy not crazy. *Energy Policy*, *37*(12), 5399–5407. doi:10.1016/j.enpol.2009.07.054.

IEA. (2013). *Oil & Gas Security - Emergency Response of IEA Countries*. 2013 Turkey. Paris: International Energy Agency.

Jirutitijaroen, P., Kim, S., Kittithreerapronchai, O., & Prina, J. (2013). An optimization model for natural gas supply portfolios of a power generation company. *Applied Energy*, *107*, 1–9. doi:10.1016/j.apenergy.2013.02.020.

Kalashnikov, V. V., Matis, T. I., & Pérez-Valdés, G. a. (2010). Time series analysis applied to construct US natural gas price functions for groups of states. *Energy Economics*, *32*(4), 887–900. doi:10.1016/j.eneco.2009.11.006.

Konoplyanik, A. A. (2012). Russian gas at European energy market : Why adaptation is inevitable. *ESR*, *1*(1), 42–56. doi:10.1016/j.esr.2012.02.001.

Melikoglu, M. (2013). Vision 2023: Forecasting Turkey's natural gas demand between 2013 and 2030. *Renewable and Sustainable Energy Reviews*, *22*, 393–400. doi:10.1016/j.rser.2013.01.048.

PwC Turkey. (2014). Liberalising Natural Gas in Turkey. İstanbul.

SOCAR (2014) *SOCAR Turkey Official Web Page* Retrieved May 04, 2014, from http://www.socar.com.tr/en/content/socar-gas-trade-inc.

Spott, M. (1999). A theory of possibility distributions. *Fuzzy Sets and Systems*, *102*(2), 135–155.

Wilson, P. I. (1997). Deregulation and natural gas trade relationships: lessons from the Alberta-California experience. *Energy Policy*, *25*(10), 861–869.

Zwart, G., & Mulder, M. (2006). *NATGAS: a model of the European natural gas market*.Retrieved from http://ideas.repec.org/p/cpb/memodm/144.html

APPENDIX – SAMPLE CASE STUDY

A.1 Scenarios

Price Expectations													
Month (n)		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Currency (R[n])													
Low Rise Scenario	USD/TL	2.2000	2.2220	2.2442	2.2667	2.2893	2.3122	2.3353	2.3587	2.3823	2.4061	2.4302	2.4545
			1%	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*	*1%*
High Rise Scenario	USD/TL	2.2000	2.2770	2.3567	2.4392	2.5246	2.6129	2.7044	2.7990	2.8970	2.9984	3.1033	3.2119
			3.5%	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*	*3.5%*
BOTAŞ Tariff													
No Rise Scenario	**Household Pth[n]**	TL/Sm3	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405	0.778405
				0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Eligible Pte[n]	TL/Sm3	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783	0.717783
				0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Industrial Ptz[n]	TL/Sm3	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194	0.714194
				0%	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Rise Scenario	**Household Pth[n]**	TL/Sm3	0.778405	0.778405	0.778405	0.778405	0.778405	0.934086	0.934086	0.934086	0.934086	0.934086	0.934086	0.934086
				0%	*0%*	*0%*	*0%*	*20%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Eligible Pte[n]	TL/Sm3	0.717783	0.717783	0.717783	0.717783	0.717783	0.897229	0.897229	0.897229	0.897229	0.897229	0.897229	0.897229
				0%	*0%*	*0%*	*0%*	*25%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
	Industrial Ptz[n]	TL/Sm3	0.714194	0.714194	0.714194	0.714194	0.714194	0.892743	0.892743	0.892743	0.892743	0.892743	0.892743	0.892743
				0%	*0%*	*0%*	*0%*	*25%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Oil and Oil Products Data													
Slight Increase Scenario	**Gas Oil Pgo[n]**	USD/gal	300.000	300.450	300.901	301.352	301.804	302.257	302.710	303.164	303.619	304.074	304.530	304.987
				0.15%	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*
	Light Sulphur Fuel Oil Plsf[n]	USD/ton	700.000	701.400	702.803	704.208	705.617	707.028	708.442	709.859	711.279	712.701	714.127	715.555
				0.20%	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*	*0.20%*
	Heavy Sulphur Fuel Oil Phsf[n]	USD/ton	550.000	550.825	551.651	552.479	553.307	554.137	554.969	555.801	556.635	557.470	558.306	559.143
				0.15%	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*	*0.15%*
	Dated Brent Oil Pbrt[n]	USD/bbl	110.000	111.100	112.211	113.333	114.466	115.611	116.767	117.935	119.114	120.305	121.508	122.724
				1.00%	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*	*1.00%*
Dramatic Decrease Scenario	**Gas Oil Pgo[n]**	USD/gal	300.000	298.500	297.008	295.522	294.045	292.575	291.112	289.656	288.208	286.767	285.333	283.906
				-0.50%	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*	*-0.50%*
	Light Sulphur Fuel Oil Plsf[n]	USD/ton	700.000	691.600	683.301	675.101	667.000	658.996	651.088	643.275	635.556	627.929	620.394	612.949
				-1.20%	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*	*-1.20%*
	Heavy Sulphur Fuel Oil Phsf[n]	USD/ton	550.000	541.750	533.624	525.619	517.735	509.969	502.320	494.785	487.363	480.053	472.852	465.759
				-1.50%	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*	*-1.50%*
	Dated Brent Oil Pbrt[n]	USD/bbl	110.000	106.700	103.499	100.394	97.382	94.461	91.627	88.878	86.212	83.625	81.117	78.683
				-3.00%	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*	*-3.00%*
	Gross Calorific Value GCV[n]	Kcal/Nm3	9050	9040	9005	8995	8990	8990	9000	9005	9025	9005	9010	9020
				-0.11%	*-0.39%*	*-0.11%*	*-0.06%*	*0.00%*	*0.11%*	*0.06%*	*0.22%*	*-0.22%*	*0.06%*	*0.11%*

Customer, Transfer Point - 1 Amount Calculations

y	ct1	c1	1

p	10	**A[1]**	100,000,000	**αmaq[1]**	80%	**Amaq[1]**	80,000,000	**αodt[1]**	0.9
pin	1	**vflt[1]**	1	**αmsq[1]**	40%	**Amsq[1]**	40,000,000	**αdd[1]**	0.5

	Z[1.1]	Z[1.2]	Z[1.3]	Z[1.4]	Z[1.5]	Z[1.6]	Z[1.7]	Z[1.8]	Z[1.9]	Z[1.10]	Z[1.11]	Z[1.12]
LCQ	9,436,834	8,523,592	9,436,834	9,132,420	9,436,834	9,132,420	9,436,834	9,436,834	9,132,420	9,436,834	9,132,420	9,436,834
minLCQ	4,718,417	4,261,796	4,718,417	4,566,210	4,718,417	4,566,210	4,718,417	4,718,417	4,566,210	4,718,417	4,566,210	4,718,417

	z[1.1]	z[1.2]	z[1.3]	z[1.4]	z[1.5]	z[1.6]	z[1.7]	z[1.8]	z[1.9]	z[1.10]	z[1.11]	z[1.12]
DCQ	304,414	304,414	304,414	304,414	304,414	304,414	304,414	304,414	304,414	304,414	304,414	304,414
minDCQ	152,207	152,207	152,207	152,207	152,207	152,207	152,207	152,207	152,207	152,207	152,207	152,207

FullACQ

Total	Summer	Q[1.1]	Q[1.2]	Q[1.3]	Q[1.4]	Q[1.5]	Q[1.6]	Q[1.7]	Q[1.8]	Q[1.9]	Q[1.10]	Q[1.11]	Q[1.12]
100,000,000	**50,136,986**	8,493,151	7,671,233	8,493,151	8,219,178	8,493,151	8,219,178	8,493,151	8,493,151	8,219,178	8,493,151	8,219,178	8,493,151

Balanced Safe

Total	Summer	Q[1.1]	Q[1.2]	Q[1.3]	Q[1.4]	Q[1.5]	Q[1.6]	Q[1.7]	Q[1.8]	Q[1.9]	Q[1.10]	Q[1.11]	Q[1.12]
80,000,000	**40,000,000**	6,813,187	6,153,846	6,813,187	6,557,377	6,775,956	6,557,377	6,775,956	6,775,956	6,557,377	6,813,187	6,593,407	6,813,187

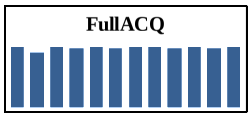
MinStart Safe

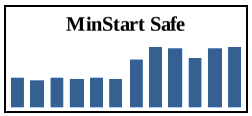
Total	Summer	Q[1.1]	Q[1.2]	Q[1.3]	Q[1.4]	Q[1.5]	Q[1.6]	Q[1.7]	Q[1.8]	Q[1.9]	Q[1.10]	Q[1.11]	Q[1.12]
80,000,000	**40,000,000**	4,718,417	4,261,796	4,718,417	4,566,210	4,718,417	4,566,210	7,579,909	9,436,834	9,132,420	7,732,116	9,132,420	9,436,834

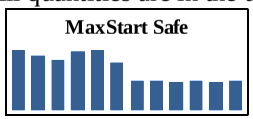
MaxStart Safe

Total	Summer	Q[1.1]	Q[1.2]	Q[1.3]	Q[1.4]	Q[1.5]	Q[1.6]	Q[1.7]	Q[1.8]	Q[1.9]	Q[1.10]	Q[1.11]	Q[1.12]
80,000,000	**40,000,000**	9,436,834	8,523,592	8,036,530	9,132,420	9,436,834	7,427,702	4,718,417	4,718,417	4,566,210	4,718,417	4,566,210	4,718,417

All quantities are in the unit of Sm^3







Customer, Transfer Point - 1 Price Calculations

vfix[y]	1
Pfix[1]	0.310000

αuw[1]	0.07
αus[1]	0.03

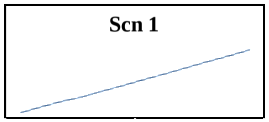
vbts[y]	0

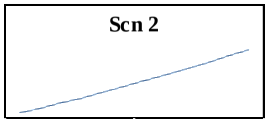
voil[y]	0

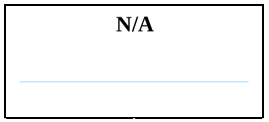
		[1.1]	[1.2]	[1.3]	[1.4]	[1.5]	[1.6]	[1.7]	[1.8]	[1.9]	[1.10]	[1.11]	[1.12]
Pfix[1]	**Scn 1**	0.682000	0.688820	0.695708	0.702665	0.709692	0.716789	0.723957	0.731196	0.738508	0.745893	0.753352	0.760886
	Scn 2	0.682000	0.705870	0.730575	0.756146	0.782611	0.810002	0.838352	0.867694	0.898064	0.929496	0.962028	0.995699
Pbts[1]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[1] Scn1	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[1] Scn2	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

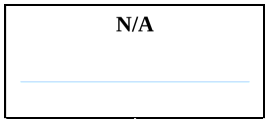
		Pgas[1.1]	Pgas[1.2]	Pgas[1.3]	Pgas[1.4]	Pgas[1.5]	Pgas[1.6]	Pgas[1.7]	Pgas[1.8]	Pgas[1.9]	Pgas[1.10]	Pgas[1.11]	Pgas[1.12]
Pgas[1]	**Scn 1**	0.682000	0.688820	0.695708	0.702665	0.709692	0.716789	0.723957	0.731196	0.738508	0.745893	0.753352	0.760886
	Scn 2	0.682000	0.705870	0.730575	0.756146	0.782611	0.810002	0.838352	0.867694	0.898064	0.929496	0.962028	0.995699
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3









Customer, Transfer Point - 2 Amount Calculations

y	ct2	c2	2

p	10	**A[2]**	150,000,000	**αmaq[2]**	85%	**Amaq[2]**	127,500,000	**αodt[2]**	1
pin	1	**vflt[2]**	0	**αmsq[2]**	25%	**Amsq[2]**	37,500,000	**αdd[2]**	0.7

	Z[2.1]	Z[2.2]	Z[2.3]	Z[2.4]	Z[2.5]	Z[2.6]	Z[2.7]	Z[2.8]	Z[2.9]	Z[2.10]	Z[2.11]	Z[2.12]
LCQ	22,000,000	20,000,000	12,000,000	9,000,000	6,000,000	5,000,000	5,000,000	6,000,000	8,000,000	12,000,000	20,000,000	25,000,000
minLCQ	15,400,000	14,000,000	8,400,000	6,300,000	4,200,000	3,500,000	3,500,000	4,200,000	5,600,000	8,400,000	14,000,000	17,500,000

	z[2.1]	z[2.2]	z[2.3]	z[2.4]	z[2.5]	z[2.6]	z[2.7]	z[2.8]	z[2.9]	z[2.10]	z[2.11]	z[2.12]
DCQ	709,677	714,286	387,097	300,000	193,548	166,667	161,290	193,548	266,667	387,097	666,667	806,452
minDCQ	496,774	500,000	270,968	210,000	135,484	116,667	112,903	135,484	186,667	270,968	466,667	564,516

FullACQ

Total	Summer	Q[2.1]	Q[2.2]	Q[2.3]	Q[2.4]	Q[2.5]	Q[2.6]	Q[2.7]	Q[2.8]	Q[2.9]	Q[2.10]	Q[2.11]	Q[2.12]
150,000,000	**39,000,000**	22,000,000	20,000,000	12,000,000	9,000,000	6,000,000	5,000,000	5,000,000	6,000,000	8,000,000	12,000,000	20,000,000	25,000,000

Balanced Safe

Total	Summer	Q[2.1]	Q[2.2]	Q[2.3]	Q[2.4]	Q[2.5]	Q[2.6]	Q[2.7]	Q[2.8]	Q[2.9]	Q[2.10]	Q[2.11]	Q[2.12]
127,500,000	**37,500,000**	17,837,838	16,216,216	9,729,730	8,653,846	5,769,231	4,807,692	4,807,692	5,769,231	7,692,308	9,729,730	16,216,216	20,270,270

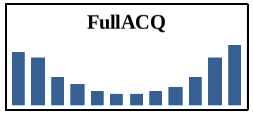
MinStart Safe

Total	Summer	Q[2.1]	Q[2.2]	Q[2.3]	Q[2.4]	Q[2.5]	Q[2.6]	Q[2.7]	Q[2.8]	Q[2.9]	Q[2.10]	Q[2.11]	Q[2.12]
127,500,000	**37,500,000**	15,400,000	14,000,000	8,400,000	7,500,000	6,000,000	5,000,000	5,000,000	6,000,000	8,000,000	7,200,000	20,000,000	25,000,000

MaxStart Safe

Total	Summer	Q[2.1]	Q[2.2]	Q[2.3]	Q[2.4]	Q[2.5]	Q[2.6]	Q[2.7]	Q[2.8]	Q[2.9]	Q[2.10]	Q[2.11]	Q[2.12]
127,500,000	**37,500,000**	22,000,000	20,000,000	8,100,000	9,000,000	6,000,000	5,000,000	5,000,000	6,000,000	6,500,000	8,400,000	14,000,000	17,500,000

All quantities are in the unit of Sm^3



Customer, Transfer Point - 2 Price Calculations

vfix[y]	0

vbts[y]	1
d[2]	0.50%
cth[2]	1
cte[2]	0
ctz[2]	0

voil[y]	0

αuw[2]	0.04
αus[2]	0.02

		[2.1]	[2.2]	[2.3]	[2.4]	[2.5]	[2.6]	[2.7]	[2.8]	[2.9]	[2.10]	[2.11]	[2.12]
Pfix[2]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pbts[2]	**Scn 1**	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513
	Scn 2	0.774513	0.774513	0.774513	0.774513	0.774513	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416
Poil[2] Scn1	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[2] Scn2	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

		Pgas[2.1]	Pgas[2.2]	Pgas[2.3]	Pgas[2.4]	Pgas[2.5]	Pgas[2.6]	Pgas[2.7]	Pgas[2.8]	Pgas[2.9]	Pgas[2.10]	Pgas[2.11]	Pgas[2.12]
Pgas[2]	**Scn 1**	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513
	Scn 2	0.774513	0.774513	0.774513	0.774513	0.774513	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3

Scn 1	Scn 2	N/A	N/A
			

Customer, Transfer Point - 3 Amount Calculations

y	ct3	c3	3

p	10	**A[3]**	50,000,000	**αmaq[3]**	75%	**Amaq[3]**	37,500,000	**αodt[3]**	1
pin	1	**vflt[3]**	0	**αmsq[3]**	55%	**Amsq[3]**	27,500,000	**αdd[3]**	0.7

	Z[3.1]	Z[3.2]	Z[3.3]	Z[3.4]	Z[3.5]	Z[3.6]	Z[3.7]	Z[3.8]	Z[3.9]	Z[3.10]	Z[3.11]	Z[3.12]
LCQ	1,500,000	1,500,000	2,500,000	4,000,000	7,000,000	8,000,000	8,000,000	7,000,000	4,500,000	2,500,000	2,000,000	1,500,000
minLCQ	1,050,000	1,050,000	1,750,000	2,800,000	4,900,000	5,600,000	5,600,000	4,900,000	3,150,000	1,750,000	1,400,000	1,050,000

	z[3.1]	z[3.2]	z[3.3]	z[3.4]	z[3.5]	z[3.6]	z[3.7]	z[3.8]	z[3.9]	z[3.10]	z[3.11]	z[3.12]
DCQ	48,387	53,571	80,645	133,333	225,806	266,667	258,065	225,806	150,000	80,645	66,667	48,387
minDCQ	33,871	37,500	56,452	93,333	158,065	186,667	180,645	158,065	105,000	56,452	46,667	33,871

FullACQ

Total	Summer	Q[3.1]	Q[3.2]	Q[3.3]	Q[3.4]	Q[3.5]	Q[3.6]	Q[3.7]	Q[3.8]	Q[3.9]	Q[3.10]	Q[3.11]	Q[3.12]
50,000,000	**38,500,000**	1,500,000	1,500,000	2,500,000	4,000,000	7,000,000	8,000,000	8,000,000	7,000,000	4,500,000	2,500,000	2,000,000	1,500,000

Balanced Safe

Total	Summer	Q[3.1]	Q[3.2]	Q[3.3]	Q[3.4]	Q[3.5]	Q[3.6]	Q[3.7]	Q[3.8]	Q[3.9]	Q[3.10]	Q[3.11]	Q[3.12]
37,500,000	**27,500,000**	1,304,348	1,304,348	2,173,913	2,857,143	5,000,000	5,714,286	5,714,286	5,000,000	3,214,286	2,173,913	1,739,130	1,304,348

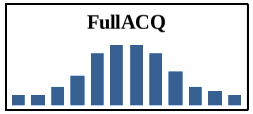
MinStart Safe

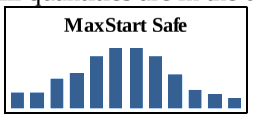
Total	Summer	Q[3.1]	Q[3.2]	Q[3.3]	Q[3.4]	Q[3.5]	Q[3.6]	Q[3.7]	Q[3.8]	Q[3.9]	Q[3.10]	Q[3.11]	Q[3.12]
37,500,000	**27,500,000**	1,050,000	1,050,000	1,900,000	2,800,000	4,900,000	5,600,000	5,600,000	4,900,000	3,700,000	2,500,000	2,000,000	1,500,000

MaxStart Safe

Total	Summer	Q[3.1]	Q[3.2]	Q[3.3]	Q[3.4]	Q[3.5]	Q[3.6]	Q[3.7]	Q[3.8]	Q[3.9]	Q[3.10]	Q[3.11]	Q[3.12]
37,500,000	**27,500,000**	1,500,000	1,500,000	2,800,000	3,350,000	4,900,000	5,600,000	5,600,000	4,900,000	3,150,000	1,750,000	1,400,000	1,050,000

All quantities are in the unit of Sm^3





Customer, Transfer Point - 3 Price Calculations

vfix[y]	0

αuw[3]	0.08
αus[3]	0.04

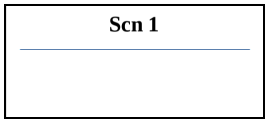
vbts[y]	1
d[3]	7.00%
cth[3]	0
cte[3]	0.4
ctz[3]	0.6

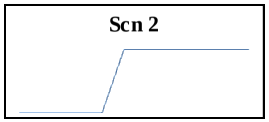
voil[y]	0

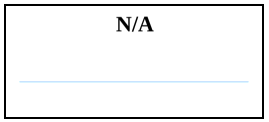
		[3.1]	[3.2]	[3.3]	[3.4]	[3.5]	[3.6]	[3.7]	[3.8]	[3.9]	[3.10]	[3.11]	[3.12]
Pfix[3]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pbts[3]	**Scn 1**	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536
	Scn 2	0.665536	0.665536	0.665536	0.665536	0.665536	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919
Poil[3] Scn1	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[3] Scn2	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

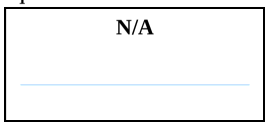
		Pgas[3.1]	Pgas[3.2]	Pgas[3.3]	Pgas[3.4]	Pgas[3.5]	Pgas[3.6]	Pgas[3.7]	Pgas[3.8]	Pgas[3.9]	Pgas[3.10]	Pgas[3.11]	Pgas[3.12]
Pgas[3]	**Scn 1**	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536
	Scn 2	0.665536	0.665536	0.665536	0.665536	0.665536	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3









Customer, National Balancing Point - 1 Amount Calculations

y	cs1	c4	4

p	10	**A[4]**	20,000,000	**αmaq[4]**	90%	**Amaq[4]**	18,000,000	**αodt[4]**	0.95
pin	1	**vflt[4]**	1	**αmsq[4]**	42%	**Amsq[4]**	8,400,000	**αdd[4]**	0.75

	Z[4.1]	Z[4.2]	Z[4.3]	Z[4.4]	Z[4.5]	Z[4.6]	Z[4.7]	Z[4.8]	Z[4.9]	Z[4.10]	Z[4.11]	Z[4.12]
LCQ	1,788,032	1,614,996	1,788,032	1,730,353	1,788,032	1,730,353	1,788,032	1,788,032	1,730,353	1,788,032	1,730,353	1,788,032
minLCQ	1,341,024	1,211,247	1,341,024	1,297,765	1,341,024	1,297,765	1,341,024	1,341,024	1,297,765	1,341,024	1,297,765	1,341,024

	z[4.1]	z[4.2]	z[4.3]	z[4.4]	z[4.5]	z[4.6]	z[4.7]	z[4.8]	z[4.9]	z[4.10]	z[4.11]	z[4.12]
DCQ	57,678	57,678	57,678	57,678	57,678	57,678	57,678	57,678	57,678	57,678	57,678	57,678
minDCQ	43,259	43,259	43,259	43,259	43,259	43,259	43,259	43,259	43,259	43,259	43,259	43,259

FullACQ

Total	Summer	Q[4.1]	Q[4.2]	Q[4.3]	Q[4.4]	Q[4.5]	Q[4.6]	Q[4.7]	Q[4.8]	Q[4.9]	Q[4.10]	Q[4.11]	Q[4.12]
20,000,000	**10,027,397**	1,698,630	1,534,247	1,698,630	1,643,836	1,698,630	1,643,836	1,698,630	1,698,630	1,643,836	1,698,630	1,643,836	1,698,630

Balanced Safe

Total	Summer	Q[4.1]	Q[4.2]	Q[4.3]	Q[4.4]	Q[4.5]	Q[4.6]	Q[4.7]	Q[4.8]	Q[4.9]	Q[4.10]	Q[4.11]	Q[4.12]
18,000,000	**8,400,000**	1,635,165	1,476,923	1,635,165	1,377,049	1,422,951	1,377,049	1,422,951	1,422,951	1,377,049	1,635,165	1,582,418	1,635,165

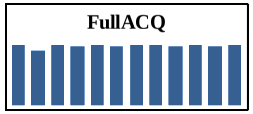
MinStart Safe

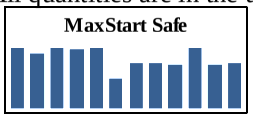
Total	Summer	Q[4.1]	Q[4.2]	Q[4.3]	Q[4.4]	Q[4.5]	Q[4.6]	Q[4.7]	Q[4.8]	Q[4.9]	Q[4.10]	Q[4.11]	Q[4.12]
18,000,000	**8,400,000**	1,341,024	1,211,247	1,341,024	1,297,765	1,341,024	1,297,765	1,341,024	1,392,069	1,730,353	2,188,320	1,730,353	1,788,032

MaxStart Safe

Total	Summer	Q[4.1]	Q[4.2]	Q[4.3]	Q[4.4]	Q[4.5]	Q[4.6]	Q[4.7]	Q[4.8]	Q[4.9]	Q[4.10]	Q[4.11]	Q[4.12]
18,000,000	**8,400,000**	1,788,032	1,614,996	1,788,032	1,730,353	1,788,032	901,802	1,341,024	1,341,024	1,297,765	1,770,151	1,297,765	1,341,024

All quantities are in the unit of Sm^3





Customer, National Balancing Point - 1 Price Calculations

vfix[y]	0

vbts[y]	0

voil[y]	1
Proil[4]	0.290000
cgo[4]	0.5
clsf[4]	0.3
chsf[4]	0.2

αuw[4]	0.09
αus[4]	0.05

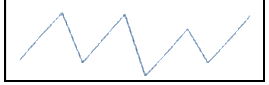
		CGVref[4]	9155	hk11[4]	90	k1+[4]	0.020
		Prgo[4]	295	hk12[4]	100	k1-[4]	-0.030
		Prlsf[4]	699	hk13[4]	110	K2[4]	0.023
		Prhsf[4]	554	hk14[4]	120		

		[4.1]	[4.2]	[4.3]	[4.4]	[4.5]	[4.6]	[4.7]	[4.8]	[4.9]	[4.10]	[4.11]	[4.12]
Pfix[4]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pbts[4]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[4] Scn1	**USD**	0.309202	0.309202	0.309202	0.299755	0.299755	0.299755	0.289268	0.289268	0.289268	0.282279	0.282279	0.282279
	Curr Scn 1	0.680244	0.687046	0.693917	0.679444	0.686238	0.693100	0.675540	0.682295	0.689118	0.679195	0.685987	0.692847
	Curr Scn 2	0.680244	0.704052	0.728694	0.731157	0.756747	0.783233	0.782285	0.809665	0.838003	0.846379	0.876003	0.906663
Poil[4] Scn2	**USD**	0.309202	0.309202	0.309202	0.308733	0.308733	0.308733	0.321251	0.321251	0.321251	0.320227	0.320227	0.320227
	Curr Scn 1	0.680244	0.687046	0.693917	0.699793	0.706791	0.713859	0.750233	0.757735	0.765312	0.770500	0.778205	0.785987
	Curr Scn 2	0.680244	0.704052	0.728694	0.753055	0.779412	0.806692	0.868780	0.899187	0.930659	0.960160	0.993765	1.028547

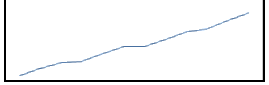
		Pgas[4.1]	Pgas[4.2]	Pgas[4.3]	Pgas[4.4]	Pgas[4.5]	Pgas[4.6]	Pgas[4.7]	Pgas[4.8]	Pgas[4.9]	Pgas[4.10]	Pgas[4.11]	Pgas[4.12]
Pgas[4]	**Scn 1.1**	0.680244	0.687046	0.693917	0.679444	0.686238	0.693100	0.675540	0.682295	0.689118	0.679195	0.685987	0.692847
	Scn 1.2	0.680244	0.704052	0.728694	0.731157	0.756747	0.783233	0.782285	0.809665	0.838003	0.846379	0.876003	0.906663
	Scn 2.1	0.680244	0.687046	0.693917	0.699793	0.706791	0.713859	0.750233	0.757735	0.765312	0.770500	0.778205	0.785987
	Scn 2.2	0.680244	0.704052	0.728694	0.753055	0.779412	0.806692	0.868780	0.899187	0.930659	0.960160	0.993765	1.028547

All quantities are in the unit of TL/Sm^3

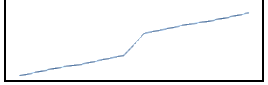
Scn 1.1



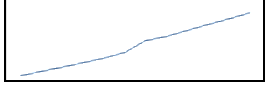
Scn 1.2



Scn 2.1



Scn 2.2



Customer, National Balancing Point - 2 Amount Calculations

y	cs2	c5	5

p	10	**A[5]**	10,000,000	**αmaq[5]**	90%	**Amaq[5]**	9,000,000	**αodt[5]**	0.95
pin	1	**vflt[5]**	1	**αmsq[5]**	42%	**Amsq[5]**	4,200,000	**αdd[5]**	0.75

	Z[5.1]	Z[5.2]	Z[5.3]	Z[5.4]	Z[5.5]	Z[5.6]	Z[5.7]	Z[5.8]	Z[5.9]	Z[5.10]	Z[5.11]	Z[5.12]
LCQ	894,016	807,498	894,016	865,177	894,016	865,177	894,016	894,016	865,177	894,016	865,177	894,016
minLCQ	670,512	605,624	670,512	648,882	670,512	648,882	670,512	670,512	648,882	670,512	648,882	670,512

	z[5.1]	z[5.2]	z[5.3]	z[5.4]	z[5.5]	z[5.6]	z[5.7]	z[5.8]	z[5.9]	z[5.10]	z[5.11]	z[5.12]
DCQ	28,839	28,839	28,839	28,839	28,839	28,839	28,839	28,839	28,839	28,839	28,839	28,839
minDCQ	21,629	21,629	21,629	21,629	21,629	21,629	21,629	21,629	21,629	21,629	21,629	21,629

FullACQ

Total	Summer	Q[5.1]	Q[5.2]	Q[5.3]	Q[5.4]	Q[5.5]	Q[5.6]	Q[5.7]	Q[5.8]	Q[5.9]	Q[5.10]	Q[5.11]	Q[5.12]
10,000,000	**5,013,699**	849,315	767,123	849,315	821,918	849,315	821,918	849,315	849,315	821,918	849,315	821,918	849,315

Balanced Safe

Total	Summer	Q[5.1]	Q[5.2]	Q[5.3]	Q[5.4]	Q[5.5]	Q[5.6]	Q[5.7]	Q[5.8]	Q[5.9]	Q[5.10]	Q[5.11]	Q[5.12]
9,000,000	**4,200,000**	817,582	738,462	817,582	688,525	711,475	688,525	711,475	711,475	688,525	817,582	791,209	817,582

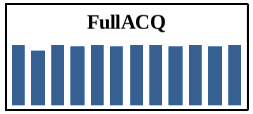
MinStart Safe

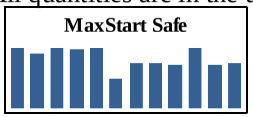
Total	Summer	Q[5.1]	Q[5.2]	Q[5.3]	Q[5.4]	Q[5.5]	Q[5.6]	Q[5.7]	Q[5.8]	Q[5.9]	Q[5.10]	Q[5.11]	Q[5.12]
9,000,000	**4,200,000**	670,512	605,624	670,512	648,882	670,512	648,882	670,512	696,035	865,177	1,094,160	865,177	894,016

MaxStart Safe

Total	Summer	Q[5.1]	Q[5.2]	Q[5.3]	Q[5.4]	Q[5.5]	Q[5.6]	Q[5.7]	Q[5.8]	Q[5.9]	Q[5.10]	Q[5.11]	Q[5.12]
9,000,000	**4,200,000**	894,016	807,498	894,016	865,177	894,016	450,901	670,512	670,512	648,882	885,076	648,882	670,512

All quantities are in the unit of Sm^3





Customer, National Balancing Point - 2 Price Calculations

vfix[y]	0

vbts[y]	0

voil[y]	1

Proil[5]	0.290000	CGVref[5]	9155	hk11[5]	90	k1+[5]	0.020
cgo[5]	0.5	Prgo[5]	295	hk12[5]	100	k1-[5]	-0.030
clsf[5]	0.3	Prlsf[5]	699	hk13[5]	110	K2[5]	0.019
chsf[5]	0.2	Prhsf[5]	554	hk14[5]	120		

αuw[5]	0.09
αus[5]	0.05

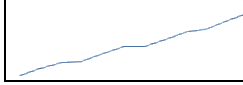
		[5.1]	[5.2]	[5.3]	[5.4]	[5.5]	[5.6]	[5.7]	[5.8]	[5.9]	[5.10]	[5.11]	[5.12]
Pfix[5]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pbts[5]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[5] Scn1	**USD**	0.305202	0.305202	0.305202	0.295755	0.295755	0.295755	0.285268	0.285268	0.285268	0.278279	0.278279	0.278279
	Curr Scn 1	0.671444	0.678158	0.684940	0.670377	0.677081	0.683852	0.666199	0.672860	0.679589	0.669570	0.676266	0.683029
	Curr Scn 2	0.671444	0.694944	0.719267	0.721400	0.746649	0.772782	0.771467	0.798469	0.826415	0.834386	0.863590	0.893815
Poil[5] Scn2	**USD**	0.305202	0.305202	0.305202	0.304733	0.304733	0.304733	0.317251	0.317251	0.317251	0.316227	0.316227	0.316227
	Curr Scn 1	0.671444	0.678158	0.684940	0.690727	0.697634	0.704610	0.740891	0.748300	0.755783	0.760876	0.768485	0.776169
	Curr Scn 2	0.671444	0.694944	0.719267	0.743298	0.769314	0.796240	0.857963	0.887991	0.919071	0.948166	0.981352	1.015700

		Pgas[5.1]	Pgas[5.2]	Pgas[5.3]	Pgas[5.4]	Pgas[5.5]	Pgas[5.6]	Pgas[5.7]	Pgas[5.8]	Pgas[5.9]	Pgas[5.10]	Pgas[5.11]	Pgas[5.12]
Pgas[5]	**Scn 1.1**	0.671444	0.678158	0.684940	0.670377	0.677081	0.683852	0.666199	0.672860	0.679589	0.669570	0.676266	0.683029
	Scn 1.2	0.671444	0.694944	0.719267	0.721400	0.746649	0.772782	0.771467	0.798469	0.826415	0.834386	0.863590	0.893815
	Scn 2.1	0.671444	0.678158	0.684940	0.690727	0.697634	0.704610	0.740891	0.748300	0.755783	0.760876	0.768485	0.776169
	Scn 2.2	0.671444	0.694944	0.719267	0.743298	0.769314	0.796240	0.857963	0.887991	0.919071	0.948166	0.981352	1.015700

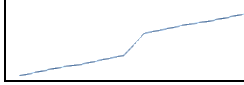
All quantities are in the unit of TL/Sm^3

Scn 1.1

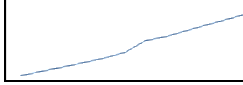
Scn 1.2



Scn 2.1



Scn 2.2



Customer, Real Point - 1 Amount Calculations

y	cr1	c6	6

p	0.cr1	**A[6]**	150,000,000	**αmaq[6]**	80%	**Amaq[6]**	120,000,000	**αodt[6]**	0.95
pin	1	**vflt[6]**	1	**αmsq[6]**	37%	**Amsq[6]**	55,500,000	**αdd[6]**	0.65

	Z[6.1]	Z[6.2]	Z[6.3]	Z[6.4]	Z[6.5]	Z[6.6]	Z[6.7]	Z[6.8]	Z[6.9]	Z[6.10]	Z[6.11]	Z[6.12]
LCQ	13,410,238	12,112,473	13,410,238	12,977,650	13,410,238	12,977,650	13,410,238	13,410,238	12,977,650	13,410,238	12,977,650	13,410,238
minLCQ	8,716,655	7,873,107	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655

	z[6.1]	z[6.2]	z[6.3]	z[6.4]	z[6.5]	z[6.6]	z[6.7]	z[6.8]	z[6.9]	z[6.10]	z[6.11]	z[6.12]
DCQ	432,588	432,588	432,588	432,588	432,588	432,588	432,588	432,588	432,588	432,588	432,588	432,588
minDCQ	281,182	281,182	281,182	281,182	281,182	281,182	281,182	281,182	281,182	281,182	281,182	281,182

FullACQ

Total	Summer	Q[6.1]	Q[6.2]	Q[6.3]	Q[6.4]	Q[6.5]	Q[6.6]	Q[6.7]	Q[6.8]	Q[6.9]	Q[6.10]	Q[6.11]	Q[6.12]
150,000,000	**75,205,479**	12,739,726	11,506,849	12,739,726	12,328,767	12,739,726	12,328,767	12,739,726	12,739,726	12,328,767	12,739,726	12,328,767	12,739,726

Balanced Safe

Total	Summer	Q[6.1]	Q[6.2]	Q[6.3]	Q[6.4]	Q[6.5]	Q[6.6]	Q[6.7]	Q[6.8]	Q[6.9]	Q[6.10]	Q[6.11]	Q[6.12]
120,000,000	**55,500,000**	10,986,264	9,923,077	10,986,264	9,098,361	9,401,639	9,098,361	9,401,639	9,401,639	9,098,361	10,986,264	10,631,868	10,986,264

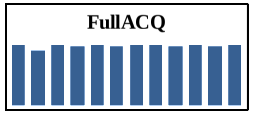
MinStart Safe

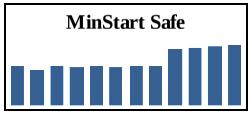
Total	Summer	Q[6.1]	Q[6.2]	Q[6.3]	Q[6.4]	Q[6.5]	Q[6.6]	Q[6.7]	Q[6.8]	Q[6.9]	Q[6.10]	Q[6.11]	Q[6.12]
120,000,000	**55,500,000**	8,716,655	7,873,107	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655	8,716,655	12,479,092	12,805,696	12,977,650	13,410,238

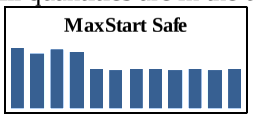
MaxStart Safe

Total	Summer	Q[6.1]	Q[6.2]	Q[6.3]	Q[6.4]	Q[6.5]	Q[6.6]	Q[6.7]	Q[6.8]	Q[6.9]	Q[6.10]	Q[6.11]	Q[6.12]
120,000,000	**55,500,000**	13,410,238	12,112,473	13,108,508	12,479,092	8,716,655	8,435,472	8,716,655	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655

All quantities are in the unit of Sm^3







Customer, Real Point - 1 Price Calculations

vfix[y]	0

vbts[y]	1
d[6]	1.00%
cth[6]	0.15
cte[6]	0.75
ctz[6]	0.1

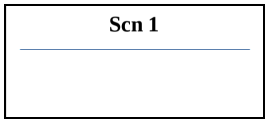
voil[y]	0

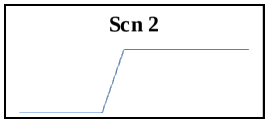
αuw[6]	0.07
αus[6]	0.03

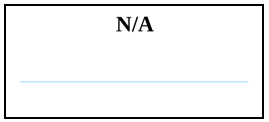
		[6.1]	[6.2]	[6.3]	[6.4]	[6.5]	[6.6]	[6.7]	[6.8]	[6.9]	[6.10]	[6.11]	[6.12]
Pfix[6]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pbts[6]	**Scn 1**	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252
	Scn 2	0.719252	0.719252	0.719252	0.719252	0.719252	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286
Poil[6] Scn1	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[6] Scn2	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

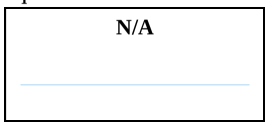
		Pgas[6.1]	Pgas[6.2]	Pgas[6.3]	Pgas[6.4]	Pgas[6.5]	Pgas[6.6]	Pgas[6.7]	Pgas[6.8]	Pgas[6.9]	Pgas[6.10]	Pgas[6.11]	Pgas[6.12]
Pgas[6]	**Scn 1**	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252
	Scn 2	0.719252	0.719252	0.719252	0.719252	0.719252	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3









Customer, Real Point - 2 Amount Calculations

y	cr2	c7	7

p	0.cr2	**A[7]**	250,000,000	**αmaq[7]**	85%	**Amaq[7]**	212,500,000	**αodt[7]**	0.9
pin	1	**vflt[7]**	1	**αmsq[7]**	40%	**Amsq[7]**	100,000,000	**αdd[7]**	0.7

	Z[7.1]	Z[7.2]	Z[7.3]	Z[7.4]	Z[7.5]	Z[7.6]	Z[7.7]	Z[7.8]	Z[7.9]	Z[7.10]	Z[7.11]	Z[7.12]
LCQ	23,592,085	21,308,980	23,592,085	22,831,050	23,592,085	22,831,050	23,592,085	23,592,085	22,831,050	23,592,085	22,831,050	23,592,085
minLCQ	16,514,460	14,916,286	16,514,460	15,981,735	16,514,460	15,981,735	16,514,460	16,514,460	15,981,735	16,514,460	15,981,735	16,514,460

	z[7.1]	z[7.2]	z[7.3]	z[7.4]	z[7.5]	z[7.6]	z[7.7]	z[7.8]	z[7.9]	z[7.10]	z[7.11]	z[7.12]
DCQ	761,035	761,035	761,035	761,035	761,035	761,035	761,035	761,035	761,035	761,035	761,035	761,035
minDCQ	532,725	532,725	532,725	532,725	532,725	532,725	532,725	532,725	532,725	532,725	532,725	532,725

FullACQ

Total	Summer	Q[7.1]	Q[7.2]	Q[7.3]	Q[7.4]	Q[7.5]	Q[7.6]	Q[7.7]	Q[7.8]	Q[7.9]	Q[7.10]	Q[7.11]	Q[7.12]
250,000,000	**125,342,466**	21,232,877	19,178,082	21,232,877	20,547,945	21,232,877	20,547,945	21,232,877	21,232,877	20,547,945	21,232,877	20,547,945	21,232,877

Balanced Safe

Total	Summer	Q[7.1]	Q[7.2]	Q[7.3]	Q[7.4]	Q[7.5]	Q[7.6]	Q[7.7]	Q[7.8]	Q[7.9]	Q[7.10]	Q[7.11]	Q[7.12]
212,500,000	**100,000,000**	19,162,088	17,307,692	19,162,088	16,393,443	16,939,891	16,393,443	16,939,891	16,939,891	16,393,443	19,162,088	18,543,956	19,162,088

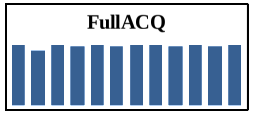
MinStart Safe

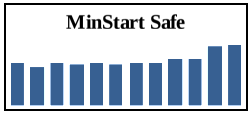
Total	Summer	Q[7.1]	Q[7.2]	Q[7.3]	Q[7.4]	Q[7.5]	Q[7.6]	Q[7.7]	Q[7.8]	Q[7.9]	Q[7.10]	Q[7.11]	Q[7.12]
212,500,000	**100,000,000**	16,514,460	14,916,286	16,514,460	15,981,735	16,514,460	15,981,735	16,514,460	16,514,460	18,493,151	18,131,659	22,831,050	23,592,085

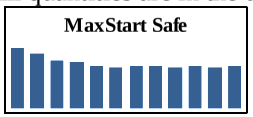
MaxStart Safe

Total	Summer	Q[7.1]	Q[7.2]	Q[7.3]	Q[7.4]	Q[7.5]	Q[7.6]	Q[7.7]	Q[7.8]	Q[7.9]	Q[7.10]	Q[7.11]	Q[7.12]
212,500,000	**100,000,000**	23,592,085	21,308,980	18,588,280	18,493,151	16,514,460	15,981,735	16,514,460	16,514,460	15,981,735	16,514,460	15,981,735	16,514,460

All quantities are in the unit of Sm^3







Customer, Real Point - 2 Price Calculations

vfix[y]	1
Pfix[7]	0.305000

αuw[7]	0.08
αus[7]	0.04

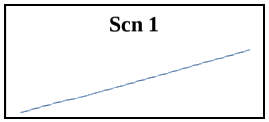
vbts[y]	0

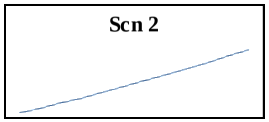
voil[y]	0

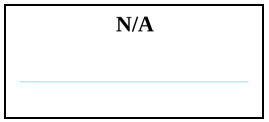
		[7.1]	[7.2]	[7.3]	[7.4]	[7.5]	[7.6]	[7.7]	[7.8]	[7.9]	[7.10]	[7.11]	[7.12]
Pfix[7]	**Scn 1**	0.671000	0.677710	0.684487	0.691332	0.698245	0.705228	0.712280	0.719403	0.726597	0.733863	0.741201	0.748613
	Scn 2	0.671000	0.694485	0.718792	0.743950	0.769988	0.796938	0.824830	0.853699	0.883579	0.914504	0.946512	0.979640
Pbts[7]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[7] Scn1	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[7] Scn2	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

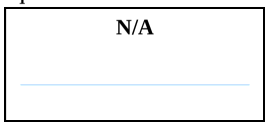
		Pgas[7.1]	Pgas[7.2]	Pgas[7.3]	Pgas[7.4]	Pgas[7.5]	Pgas[7.6]	Pgas[7.7]	Pgas[7.8]	Pgas[7.9]	Pgas[7.10]	Pgas[7.11]	Pgas[7.12]
Pgas[7]	**Scn 1**	0.671000	0.677710	0.684487	0.691332	0.698245	0.705228	0.712280	0.719403	0.726597	0.733863	0.741201	0.748613
	Scn 2	0.671000	0.694485	0.718792	0.743950	0.769988	0.796938	0.824830	0.853699	0.883579	0.914504	0.946512	0.979640
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3









Customer, Real Point - 3 Amount Calculations

y	cr3	c8	8

p	0.cr3	**A[8]**	25,000,000	**αmaq[8]**	80%	**Amaq[8]**	20,000,000	**αodt[8]**	1
pin	1	**vflt[8]**	0	**αmsq[8]**	25%	**Amsq[8]**	6,250,000	**αdd[8]**	0.6

	Z[8.1]	Z[8.2]	Z[8.3]	Z[8.4]	Z[8.5]	Z[8.6]	Z[8.7]	Z[8.8]	Z[8.9]	Z[8.10]	Z[8.11]	Z[8.12]
LCQ	3,000,000	2,500,000	2,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	2,500,000	2,500,000	3,000,000
minLCQ	1,800,000	1,500,000	1,500,000	900,000	900,000	900,000	900,000	900,000	900,000	1,500,000	1,500,000	1,800,000

	z[8.1]	z[8.2]	z[8.3]	z[8.4]	z[8.5]	z[8.6]	z[8.7]	z[8.8]	z[8.9]	z[8.10]	z[8.11]	z[8.12]
DCQ	96,774	89,286	80,645	50,000	48,387	50,000	48,387	48,387	50,000	80,645	83,333	96,774
minDCQ	58,065	53,571	48,387	30,000	29,032	30,000	29,032	29,032	30,000	48,387	50,000	58,065

FullACQ

Total	Summer	Q[8.1]	Q[8.2]	Q[8.3]	Q[8.4]	Q[8.5]	Q[8.6]	Q[8.7]	Q[8.8]	Q[8.9]	Q[8.10]	Q[8.11]	Q[8.12]
25,000,000	**9,000,000**	3,000,000	2,500,000	2,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	2,500,000	2,500,000	3,000,000

Balanced Safe

Total	Summer	Q[8.1]	Q[8.2]	Q[8.3]	Q[8.4]	Q[8.5]	Q[8.6]	Q[8.7]	Q[8.8]	Q[8.9]	Q[8.10]	Q[8.11]	Q[8.12]
20,000,000	**6,250,000**	2,578,125	2,148,438	2,148,438	1,041,667	1,041,667	1,041,667	1,041,667	1,041,667	1,041,667	2,148,438	2,148,438	2,578,125

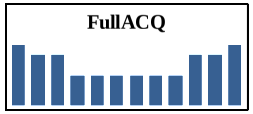
MinStart Safe

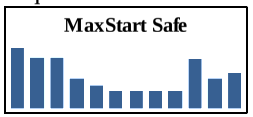
Total	Summer	Q[8.1]	Q[8.2]	Q[8.3]	Q[8.4]	Q[8.5]	Q[8.6]	Q[8.7]	Q[8.8]	Q[8.9]	Q[8.10]	Q[8.11]	Q[8.12]
20,000,000	**6,250,000**	1,800,000	1,500,000	2,450,000	900,000	900,000	900,000	900,000	1,150,000	1,500,000	2,500,000	2,500,000	3,000,000

MaxStart Safe

Total	Summer	Q[8.1]	Q[8.2]	Q[8.3]	Q[8.4]	Q[8.5]	Q[8.6]	Q[8.7]	Q[8.8]	Q[8.9]	Q[8.10]	Q[8.11]	Q[8.12]
20,000,000	**6,250,000**	3,000,000	2,500,000	2,500,000	1,500,000	1,150,000	900,000	900,000	900,000	900,000	2,450,000	1,500,000	1,800,000

All quantities are in the unit of Sm^3





Customer, Real Point - 3 Price Calculations

vfix[y]	1
Pfix[8]	0.340000

αuw[8]	0.07
αus[8]	0.05

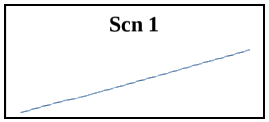
vbts[y]	0

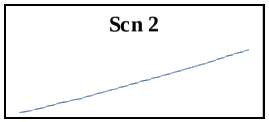
voil[y]	0

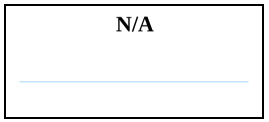
		[8.1]	[8.2]	[8.3]	[8.4]	[8.5]	[8.6]	[8.7]	[8.8]	[8.9]	[8.10]	[8.11]	[8.12]
Pfix[8]	**Scn 1**	0.748000	0.755480	0.763035	0.770665	0.778372	0.786156	0.794017	0.801957	0.809977	0.818077	0.826257	0.834520
	Scn 2	0.748000	0.774180	0.801276	0.829321	0.858347	0.888389	0.919483	0.951665	0.984973	1.019447	1.055128	1.092057
Pbts[8]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[8] Scn1	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[8] Scn2	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

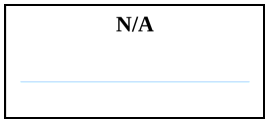
		Pgas[8.1]	Pgas[8.2]	Pgas[8.3]	Pgas[8.4]	Pgas[8.5]	Pgas[8.6]	Pgas[8.7]	Pgas[8.8]	Pgas[8.9]	Pgas[8.10]	Pgas[8.11]	Pgas[8.12]
Pgas[8]	**Scn 1**	0.748000	0.755480	0.763035	0.770665	0.778372	0.786156	0.794017	0.801957	0.809977	0.818077	0.826257	0.834520
	Scn 2	0.748000	0.774180	0.801276	0.829321	0.858347	0.888389	0.919483	0.951665	0.984973	1.019447	1.055128	1.092057
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3









Supplier, Transfer Point - 1 Amount Calculations

y	st1	s1	9

p	10	**A[9]**	20,000,000	**αmaq[9]**	95%	**Amaq[9]**	19,000,000	**αodt[9]**	1
pin	1	**vflt[9]**	0	**αmsq[9]**	25%	**Amsq[9]**	5,000,000	**αdd[9]**	0.7

	Z[9.1]	Z[9.2]	Z[9.3]	Z[9.4]	Z[9.5]	Z[9.6]	Z[9.7]	Z[9.8]	Z[9.9]	Z[9.10]	Z[9.11]	Z[9.12]
LCQ	2,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	2,500,000
minLCQ	1,750,000	1,750,000	1,400,000	700,000	700,000	700,000	700,000	700,000	700,000	1,400,000	1,750,000	1,750,000

	z[9.1]	z[9.2]	z[9.3]	z[9.4]	z[9.5]	z[9.6]	z[9.7]	z[9.8]	z[9.9]	z[9.10]	z[9.11]	z[9.12]
DCQ	80,645	89,286	64,516	33,333	32,258	33,333	32,258	32,258	33,333	64,516	83,333	80,645
minDCQ	56,452	62,500	45,161	23,333	22,581	23,333	22,581	22,581	23,333	45,161	58,333	56,452

FullACQ

Total	Summer	Q[9.1]	Q[9.2]	Q[9.3]	Q[9.4]	Q[9.5]	Q[9.6]	Q[9.7]	Q[9.8]	Q[9.9]	Q[9.10]	Q[9.11]	Q[9.12]
20,000,000	**6,000,000**	2,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	2,500,000

Balanced Safe

Total	Summer	Q[9.1]	Q[9.2]	Q[9.3]	Q[9.4]	Q[9.5]	Q[9.6]	Q[9.7]	Q[9.8]	Q[9.9]	Q[9.10]	Q[9.11]	Q[9.12]
19,000,000	**5,000,000**	2,500,000	2,500,000	2,000,000	833,333	833,333	833,333	833,333	833,333	833,333	2,000,000	2,500,000	2,500,000

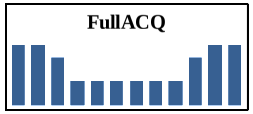
MinStart Safe

Total	Summer	Q[9.1]	Q[9.2]	Q[9.3]	Q[9.4]	Q[9.5]	Q[9.6]	Q[9.7]	Q[9.8]	Q[9.9]	Q[9.10]	Q[9.11]	Q[9.12]
19,000,000	**6,000,000**	1,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	2,500,000

MaxStart Safe

Total	Summer	Q[9.1]	Q[9.2]	Q[9.3]	Q[9.4]	Q[9.5]	Q[9.6]	Q[9.7]	Q[9.8]	Q[9.9]	Q[9.10]	Q[9.11]	Q[9.12]
19,000,000	**6,000,000**	2,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	1,500,000

All quantities are in the unit of Sm^3



Supplier, Transfer Point - 1 Price Calculations

vfix[y]	0

αuw[9]	0.09
αus[9]	0.04

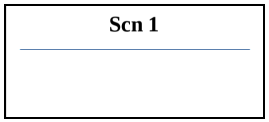
vbts[y]	1
d[9]	4.00%
cth[9]	0
cte[9]	1
ctz[9]	0

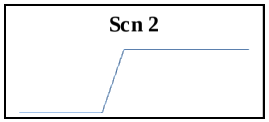
voil[y]	0

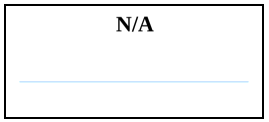
		[9.1]	[9.2]	[9.3]	[9.4]	[9.5]	[9.6]	[9.7]	[9.8]	[9.9]	[9.10]	[9.11]	[9.12]
Pfix[9]	Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pbts[9]	Scn 1	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072
	Scn 2	0.689072	0.689072	0.689072	0.689072	0.689072	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340
Poil[9] Scn1	USD	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[9] Scn2	USD	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

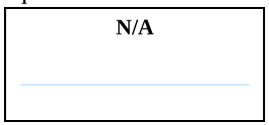
		Pgas[9.1]	Pgas[9.2]	Pgas[9.3]	Pgas[9.4]	Pgas[9.5]	Pgas[9.6]	Pgas[9.7]	Pgas[9.8]	Pgas[9.9]	Pgas[9.10]	Pgas[9.11]	Pgas[9.12]
Pgas[9]	Scn 1	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072
	Scn 2	0.689072	0.689072	0.689072	0.689072	0.689072	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3









Supplier, National Balancing Point - 1 Amount Calculations

y	ss1	s2	10

p	10	**A[10]**	50,000,000	**αmaq[10]**	80%	**Amaq[10]**	40,000,000	**αodt[10]**	0.92
pin	1	**vflt[10]**	1	**αmsq[10]**	37%	**Amsq[10]**	18,500,000	**αdd[10]**	0.65

	Z[10.1]	Z[10.2]	Z[10.3]	Z[10.4]	Z[10.5]	Z[10.6]	Z[10.7]	Z[10.8]	Z[10.9]	Z[10.10]	Z[10.11]	Z[10.12]
LCQ	4,615,843	4,169,148	4,615,843	4,466,945	4,615,843	4,466,945	4,615,843	4,615,843	4,466,945	4,615,843	4,466,945	4,615,843
minLCQ	3,000,298	2,709,946	3,000,298	2,903,514	3,000,298	2,903,514	3,000,298	3,000,298	2,903,514	3,000,298	2,903,514	3,000,298

	z[10.1]	z[10.2]	z[10.3]	z[10.4]	z[10.5]	z[10.6]	z[10.7]	z[10.8]	z[10.9]	z[10.10]	z[10.11]	z[10.12]
DCQ	148,898	148,898	148,898	148,898	148,898	148,898	148,898	148,898	148,898	148,898	148,898	148,898
minDCQ	96,784	96,784	96,784	96,784	96,784	96,784	96,784	96,784	96,784	96,784	96,784	96,784

FullACQ

Total	Summer	Q[10.1]	Q[10.2]	Q[10.3]	Q[10.4]	Q[10.5]	Q[10.6]	Q[10.7]	Q[10.8]	Q[10.9]	Q[10.10]	Q[10.11]	Q[10.12]
50,000,000	**25,068,493**	4,246,575	3,835,616	4,246,575	4,109,589	4,246,575	4,109,589	4,246,575	4,246,575	4,109,589	4,246,575	4,109,589	4,246,575

Balanced Safe

Total	Summer	Q[10.1]	Q[10.2]	Q[10.3]	Q[10.4]	Q[10.5]	Q[10.6]	Q[10.7]	Q[10.8]	Q[10.9]	Q[10.10]	Q[10.11]	Q[10.12]
40,000,000	**18,500,000**	3,662,088	3,307,692	3,662,088	3,032,787	3,133,880	3,032,787	3,133,880	3,133,880	3,032,787	3,662,088	3,543,956	3,662,088

MinStart Safe

Total	Summer	Q[10.1]	Q[10.2]	Q[10.3]	Q[10.4]	Q[10.5]	Q[10.6]	Q[10.7]	Q[10.8]	Q[10.9]	Q[10.10]	Q[10.11]	Q[10.12]
40,000,000	**18,500,000**	3,000,298	2,709,946	3,000,298	2,903,514	3,000,298	2,903,514	3,000,298	3,000,298	3,692,079	3,706,671	4,466,945	4,615,843

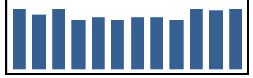
MaxStart Safe

Total	Summer	Q[10.1]	Q[10.2]	Q[10.3]	Q[10.4]	Q[10.5]	Q[10.6]	Q[10.7]	Q[10.8]	Q[10.9]	Q[10.10]	Q[10.11]	Q[10.12]
40,000,000	**18,500,000**	4,615,843	4,169,148	3,810,899	3,692,079	3,000,298	2,903,514	3,000,298	3,000,298	2,903,514	3,000,298	2,903,514	3,000,298

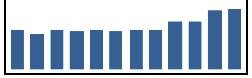
All quantities are in the unit of Sm^3

FullACQ

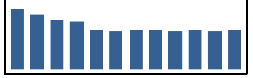
Balanced Safe



MinStart Safe



MaxStart Safe



Supplier, National Balancing Point - 1 Price Calculations

vfix[y]	1
Pfix[10]	0.300000
αuw[10]	0.09
αus[10]	0.05

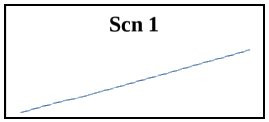
vbts[y]	0

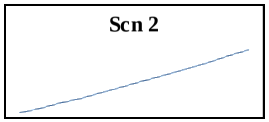
voil[y]	0

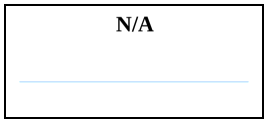
		[10.1]	[10.2]	[10.3]	[10.4]	[10.5]	[10.6]	[10.7]	[10.8]	[10.9]	[10.10]	[10.11]	[10.12]
Pfix[10]	**Scn 1**	0.660000	0.666600	0.673266	0.679999	0.686799	0.693667	0.700603	0.707609	0.714685	0.721832	0.729051	0.736341
	Scn 2	0.660000	0.683100	0.707009	0.731754	0.757365	0.783873	0.811309	0.839704	0.869094	0.899512	0.930995	0.963580
Pbts[10]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[10] Scn1	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[10] Scn2	**USD**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 1	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Curr Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

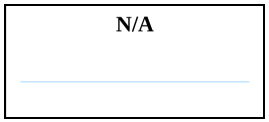
		Pgas[10.1]	Pgas[10.2]	Pgas[10.3]	Pgas[10.4]	Pgas[10.5]	Pgas[10.6]	Pgas[10.7]	Pgas[10.8]	Pgas[10.9]	Pgas[10.10]	Pgas[10.11]	Pgas[10.12]
Pgas[10]	**Scn 1**	0.660000	0.666600	0.673266	0.679999	0.686799	0.693667	0.700603	0.707609	0.714685	0.721832	0.729051	0.736341
	Scn 2	0.660000	0.683100	0.707009	0.731754	0.757365	0.783873	0.811309	0.839704	0.869094	0.899512	0.930995	0.963580
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

All quantities are in the unit of TL/Sm^3









Supplier - Real Point - 1 Amount Calculations

y	sr1	s3	11

p	1	**A[11]**	300,000,000	**αmaq[11]**	80%	**Amaq[11]**	240,000,000	**αodt[11]**	0.92
pin	1	**vflt[11]**	1	**αmsq[11]**	37%	**Amsq[11]**	111,000,000	**αdd[11]**	0.65

	Z[11.1]	Z[11.2]	Z[11.3]	Z[11.4]	Z[11.5]	Z[11.6]	Z[11.7]	Z[11.8]	Z[11.9]	Z[11.10]	Z[11.11]	Z[11.12]
LCQ	27,695,057	25,014,890	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057
minLCQ	18,001,787	16,259,678	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787

	z[11.1]	z[11.2]	z[11.3]	z[11.4]	z[11.5]	z[11.6]	z[11.7]	z[11.8]	z[11.9]	z[11.10]	z[11.11]	z[11.12]
DCQ	893,389	893,389	893,389	893,389	893,389	893,389	893,389	893,389	893,389	893,389	893,389	893,389
minDCQ	580,703	580,703	580,703	580,703	580,703	580,703	580,703	580,703	580,703	580,703	580,703	580,703

FullACQ

Total	Summer	Q[11.1]	Q[11.2]	Q[11.3]	Q[11.4]	Q[11.5]	Q[11.6]	Q[11.7]	Q[11.8]	Q[11.9]	Q[11.10]	Q[11.11]	Q[11.12]
300,000,000	**150,410,959**	25,479,452	23,013,699	25,479,452	24,657,534	25,479,452	24,657,534	25,479,452	25,479,452	24,657,534	25,479,452	24,657,534	25,479,452

Balanced Safe

Total	Summer	Q[11.1]	Q[11.2]	Q[11.3]	Q[11.4]	Q[11.5]	Q[11.6]	Q[11.7]	Q[11.8]	Q[11.9]	Q[11.10]	Q[11.11]	Q[11.12]
240,000,000	**111,000,000**	21,972,527	19,846,154	21,972,527	18,196,721	18,803,279	18,196,721	18,803,279	18,803,279	18,196,721	21,972,527	21,263,736	21,972,527

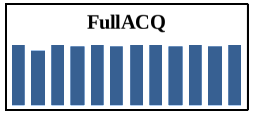
MinStart Safe

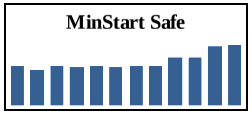
Total	Summer	Q[11.1]	Q[11.2]	Q[11.3]	Q[11.4]	Q[11.5]	Q[11.6]	Q[11.7]	Q[11.8]	Q[11.9]	Q[11.10]	Q[11.11]	Q[11.12]
240,000,000	**111,000,000**	18,001,787	16,259,678	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787	18,001,787	22,152,472	22,240,024	26,801,668	27,695,057

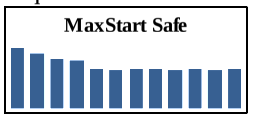
MaxStart Safe

Total	Summer	Q[11.1]	Q[11.2]	Q[11.3]	Q[11.4]	Q[11.5]	Q[11.6]	Q[11.7]	Q[11.8]	Q[11.9]	Q[11.10]	Q[11.11]	Q[11.12]
240,000,000	**111,000,000**	27,695,057	25,014,890	22,865,396	22,152,472	18,001,787	17,421,084	18,001,787	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787

All quantities are in the unit of Sm^3







Supplier - Real Point - 1 Price Calculations

vfix[y]	0

vbts[y]	0

voil[y]	1

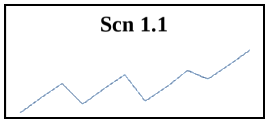
Proil[11]	0.280000	CGVref[11]	9155	hk11[11]	90	k1+[11]	0.013
cgo[11]	0.4	Prgo[11]	295	hk12[11]	100	k1-[11]	-0.020
clsf[11]	0.3	Prlsf[11]	699	hk13[11]	110	K2[11]	0.000
chsf[11]	0.3	Prhsf[11]	554	hk14[11]	120		

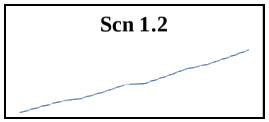
αuw[11]	0.08
αus[11]	0.04

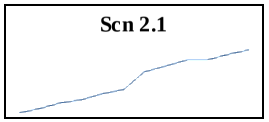
		[11.1]	[11.2]	[11.3]	[11.4]	[11.5]	[11.6]	[11.7]	[11.8]	[11.9]	[11.10]	[11.11]	[11.12]
Pfix[11]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Pbts[11]	**Scn 1**	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Scn 2	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Poil[11] Scn1	**USD**	0.276427	0.276427	0.276427	0.269885	0.269885	0.269885	0.262629	0.262629	0.262629	0.258635	0.258635	0.258635
	Curr Scn 1	0.608138	0.614220	0.620362	0.611739	0.617857	0.624035	0.613329	0.619462	0.625657	0.622303	0.628526	0.634811
	Curr Scn 2	0.608138	0.629423	0.651453	0.658299	0.681340	0.705186	0.710243	0.735102	0.760830	0.775483	0.802625	0.830717
Poil[11] Scn2	**USD**	0.276427	0.276427	0.276427	0.275476	0.275476	0.275476	0.281722	0.281722	0.281722	0.278971	0.278971	0.278971
	Curr Scn 1	0.608138	0.614220	0.620362	0.624412	0.630656	0.636963	0.657919	0.664498	0.671143	0.671234	0.677946	0.684726
	Curr Scn 2	0.608138	0.629423	0.651453	0.671937	0.695454	0.719795	0.761879	0.788545	0.816144	0.836459	0.865735	0.896036

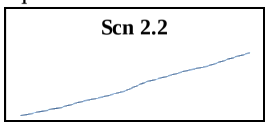
		Pgas[11.1]	Pgas[11.2]	Pgas[11.3]	Pgas[11.4]	Pgas[11.5]	Pgas[11.6]	Pgas[11.7]	Pgas[11.8]	Pgas[11.9]	Pgas[11.10]	Pgas[11.11]	Pgas[11.12]
Pgas[11]	**Scn 1.1**	0.608138	0.614220	0.620362	0.611739	0.617857	0.624035	0.613329	0.619462	0.625657	0.622303	0.628526	0.634811
	Scn 1.2	0.608138	0.629423	0.651453	0.658299	0.681340	0.705186	0.710243	0.735102	0.760830	0.775483	0.802625	0.830717
	Scn 2.1	0.608138	0.614220	0.620362	0.624412	0.630656	0.636963	0.657919	0.664498	0.671143	0.671234	0.677946	0.684726
	Scn 2.2	0.608138	0.629423	0.651453	0.671937	0.695454	0.719795	0.761879	0.788545	0.816144	0.836459	0.865735	0.896036

All quantities are in the unit of TL/Sm^3









Amounts Summary Sheet (Sheet 1/3)

Contract														
y			Z[y1]	Z[y2]	Z[y3]	Z[y4]	Z[y5]	Z[y6]	Z[y7]	Z[y8]	Z[y9]	Z[y10]	Z[y11]	Z[y12]	ΣZ[y]
ct1	c1	1	9,436,834	8,523,592	9,436,834	9,132,420	9,436,834	9,132,420	9,436,834	9,436,834	9,132,420	9,436,834	9,132,420	9,436,834	111,111,111
ct2	c2	2	22,000,000	20,000,000	12,000,000	9,000,000	6,000,000	5,000,000	5,000,000	6,000,000	8,000,000	12,000,000	20,000,000	25,000,000	150,000,000
ct3	c3	3	1,500,000	1,500,000	2,500,000	4,000,000	7,000,000	8,000,000	8,000,000	7,000,000	4,500,000	2,500,000	2,000,000	1,500,000	50,000,000
cs1	c4	4	1,788,032	1,614,996	1,788,032	1,730,353	1,788,032	1,730,353	1,788,032	1,788,032	1,730,353	1,788,032	1,730,353	1,788,032	21,052,632
cs2	c5	5	894,016	807,498	894,016	865,177	894,016	865,177	894,016	894,016	865,177	894,016	865,177	894,016	10,526,316
cr1	c6	6	13,410,238	12,112,473	13,410,238	12,977,650	13,410,238	12,977,650	13,410,238	13,410,238	12,977,650	13,410,238	12,977,650	13,410,238	157,894,737
cr2	c7	7	23,592,085	21,308,980	23,592,085	22,831,050	23,592,085	22,831,050	23,592,085	23,592,085	22,831,050	23,592,085	22,831,050	23,592,085	277,777,778
cr3	c8	8	3,000,000	2,500,000	2,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	2,500,000	2,500,000	3,000,000	25,000,000
st1	s1	9	2,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	2,500,000	20,000,000
ss1	s2	10	4,615,843	4,169,148	4,615,843	4,466,945	4,615,843	4,466,945	4,615,843	4,615,843	4,466,945	4,615,843	4,466,945	4,615,843	54,347,826
sr1	s3	11	27,695,057	25,014,890	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057	326,086,957

FullACQ														
y			B[y1]	B[y2]	B[y3]	B[y4]	B[y5]	B[y6]	B[y7]	B[y8]	B[y9]	B[y10]	B[y11]	B[y12]	B[y]=A[y]
ct1	c1	1	8,493,151	7,671,233	8,493,151	8,219,178	8,493,151	8,219,178	8,493,151	8,493,151	8,219,178	8,493,151	8,219,178	8,493,151	100,000,000
ct2	c2	2	22,000,000	20,000,000	12,000,000	9,000,000	6,000,000	5,000,000	5,000,000	6,000,000	8,000,000	12,000,000	20,000,000	25,000,000	150,000,000
ct3	c3	3	1,500,000	1,500,000	2,500,000	4,000,000	7,000,000	8,000,000	8,000,000	7,000,000	4,500,000	2,500,000	2,000,000	1,500,000	50,000,000
cs1	c4	4	1,698,630	1,534,247	1,698,630	1,643,836	1,698,630	1,643,836	1,698,630	1,698,630	1,643,836	1,698,630	1,643,836	1,698,630	20,000,000
cs2	c5	5	849,315	767,123	849,315	821,918	849,315	821,918	849,315	849,315	821,918	849,315	821,918	849,315	10,000,000
cr1	c6	6	12,739,726	11,506,849	12,739,726	12,328,767	12,739,726	12,328,767	12,739,726	12,739,726	12,328,767	12,739,726	12,328,767	12,739,726	150,000,000
cr2	c7	7	21,232,877	19,178,082	21,232,877	20,547,945	21,232,877	20,547,945	21,232,877	21,232,877	20,547,945	21,232,877	20,547,945	21,232,877	250,000,000
cr3	c8	8	3,000,000	2,500,000	2,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	2,500,000	2,500,000	3,000,000	25,000,000
st1	s1	9	2,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	2,500,000	20,000,000
ss1	s2	10	4,246,575	3,835,616	4,246,575	4,109,589	4,246,575	4,109,589	4,246,575	4,246,575	4,109,589	4,246,575	4,109,589	4,246,575	50,000,000
sr1	s3	11	25,479,452	23,013,699	25,479,452	24,657,534	25,479,452	24,657,534	25,479,452	25,479,452	24,657,534	25,479,452	24,657,534	25,479,452	300,000,000

All quantities are in the unit of Sm^3

Amounts Summary Sheet (Sheet 2/3)

Balanced Safe														
y			B[y1]	B[y2]	B[y3]	B[y4]	B[y5]	B[y6]	B[y7]	B[y8]	B[y9]	B[y10]	B[y11]	B[y12]	B[y]
ct1	c1	1	6,813,187	6,153,846	6,813,187	6,557,377	6,775,956	6,557,377	6,775,956	6,775,956	6,557,377	6,813,187	6,593,407	6,813,187	80,000,000
ct2	c2	2	17,837,838	16,216,216	9,729,730	8,653,846	5,769,231	4,807,692	4,807,692	5,769,231	7,692,308	9,729,730	16,216,216	20,270,270	127,500,000
ct3	c3	3	1,304,348	1,304,348	2,173,913	2,857,143	5,000,000	5,714,286	5,714,286	5,000,000	3,214,286	2,173,913	1,739,130	1,304,348	37,500,000
cs1	c4	4	1,635,165	1,476,923	1,635,165	1,377,049	1,422,951	1,377,049	1,422,951	1,422,951	1,377,049	1,635,165	1,582,418	1,635,165	18,000,000
cs2	c5	5	817,582	738,462	817,582	688,525	711,475	688,525	711,475	711,475	688,525	817,582	791,209	817,582	9,000,000
cr1	c6	6	10,986,264	9,923,077	10,986,264	9,098,361	9,401,639	9,098,361	9,401,639	9,401,639	9,098,361	10,986,264	10,631,868	10,986,264	120,000,000
cr2	c7	7	19,162,088	17,307,692	19,162,088	16,393,443	16,939,891	16,393,443	16,939,891	16,939,891	16,393,443	19,162,088	18,543,956	19,162,088	212,500,000
cr3	c8	8	2,578,125	2,148,438	2,148,438	1,041,667	1,041,667	1,041,667	1,041,667	1,041,667	1,041,667	2,148,438	2,148,438	2,578,125	20,000,000
st1	s1	9	2,500,000	2,500,000	2,000,000	833,333	833,333	833,333	833,333	833,333	833,333	2,000,000	2,500,000	2,500,000	19,000,000
ss1	s2	10	3,662,088	3,307,692	3,662,088	3,032,787	3,133,880	3,032,787	3,133,880	3,133,880	3,032,787	3,662,088	3,543,956	3,662,088	40,000,000
sr1	s3	11	21,972,527	19,846,154	21,972,527	18,196,721	18,803,279	18,196,721	18,803,279	18,803,279	18,196,721	21,972,527	21,263,736	21,972,527	240,000,000

MinStart Safe														
y			B[y1]	B[y2]	B[y3]	B[y4]	B[y5]	B[y6]	B[y7]	B[y8]	B[y9]	B[y10]	B[y11]	B[y12]	B[y]
ct1	c1	1	4,718,417	4,261,796	4,718,417	4,566,210	4,718,417	4,566,210	7,579,909	9,436,834	9,132,420	7,732,116	9,132,420	9,436,834	80,000,000
ct2	c2	2	15,400,000	14,000,000	8,400,000	7,500,000	6,000,000	5,000,000	5,000,000	6,000,000	8,000,000	7,200,000	20,000,000	25,000,000	127,500,000
ct3	c3	3	1,050,000	1,050,000	1,900,000	2,800,000	4,900,000	5,600,000	5,600,000	4,900,000	3,700,000	2,500,000	2,000,000	1,500,000	37,500,000
cs1	c4	4	1,341,024	1,211,247	1,341,024	1,297,765	1,341,024	1,297,765	1,341,024	1,392,069	1,730,353	2,188,320	1,730,353	1,788,032	18,000,000
cs2	c5	5	670,512	605,624	670,512	648,882	670,512	648,882	670,512	696,035	865,177	1,094,160	865,177	894,016	9,000,000
cr1	c6	6	8,716,655	7,873,107	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655	8,716,655	12,479,092	12,805,696	12,977,650	13,410,238	120,000,000
cr2	c7	7	16,514,460	14,916,286	16,514,460	15,981,735	16,514,460	15,981,735	16,514,460	16,514,460	18,493,151	18,131,659	22,831,050	23,592,085	212,500,000
cr3	c8	8	1,800,000	1,500,000	2,450,000	900,000	900,000	900,000	900,000	1,150,000	1,500,000	2,500,000	2,500,000	3,000,000	20,000,000
st1	s1	9	1,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	2,500,000	19,000,000
ss1	s2	10	3,000,298	2,709,946	3,000,298	2,903,514	3,000,298	2,903,514	3,000,298	3,000,298	3,692,079	3,706,671	4,466,945	4,615,843	40,000,000
sr1	s3	11	18,001,787	16,259,678	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787	18,001,787	22,152,472	22,240,024	26,801,668	27,695,057	240,000,000

All quantities are in the unit of Sm^3

Amounts Summary Sheet (Sheet 3/3)

MaxStart Safe														
y			B[y1]	B[y2]	B[y3]	B[y4]	B[y5]	B[y6]	B[y7]	B[y8]	B[y9]	B[y10]	B[y11]	B[y12]	B[y]
ct1	c1	1	9,436,834	8,523,592	8,036,530	9,132,420	9,436,834	7,427,702	4,718,417	4,718,417	4,566,210	4,718,417	4,566,210	4,718,417	80,000,000
ct2	c2	2	22,000,000	20,000,000	8,100,000	9,000,000	6,000,000	5,000,000	5,000,000	6,000,000	6,500,000	8,400,000	14,000,000	17,500,000	127,500,000
ct3	c3	3	1,500,000	1,500,000	2,800,000	3,350,000	4,900,000	5,600,000	5,600,000	4,900,000	3,150,000	1,750,000	1,400,000	1,050,000	37,500,000
cs1	c4	4	1,788,032	1,614,996	1,788,032	1,730,353	1,788,032	901,802	1,341,024	1,341,024	1,297,765	1,770,151	1,297,765	1,341,024	18,000,000
cs2	c5	5	894,016	807,498	894,016	865,177	894,016	450,901	670,512	670,512	648,882	885,076	648,882	670,512	9,000,000
cr1	c6	6	13,410,238	12,112,473	13,108,508	12,479,092	8,716,655	8,435,472	8,716,655	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655	120,000,000
cr2	c7	7	23,592,085	21,308,980	18,588,280	18,493,151	16,514,460	15,981,735	16,514,460	16,514,460	15,981,735	16,514,460	15,981,735	16,514,460	212,500,000
cr3	c8	8	3,000,000	2,500,000	2,500,000	1,500,000	1,150,000	900,000	900,000	900,000	900,000	2,450,000	1,500,000	1,800,000	20,000,000
st1	s1	9	2,500,000	2,500,000	2,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	2,000,000	2,500,000	1,500,000	19,000,000
ss1	s2	10	4,615,843	4,169,148	3,810,899	3,692,079	3,000,298	2,903,514	3,000,298	3,000,298	2,903,514	3,000,298	2,903,514	3,000,298	40,000,000
sr1	s3	11	27,695,057	25,014,890	22,865,396	22,152,472	18,001,787	17,421,084	18,001,787	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787	240,000,000

All quantities are in the unit of Sm^3

Price Summary Sheet (Sheet 1/4)

Estimation 1 - Currency "Low Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Slight Increase"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.688820	0.695708	0.702665	0.709692	0.716789	0.723957	0.731196	0.738508	0.745893	0.753352	0.760886	0.720789	0.720468
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536
cs1	c4	4			1	0.680244	0.687046	0.693917	0.679444	0.686238	0.693100	0.675540	0.682295	0.689118	0.679195	0.685987	0.692847	0.685414	0.684289
cs2	c5	5			1	0.671444	0.678158	0.684940	0.670377	0.677081	0.683852	0.666199	0.672860	0.679589	0.669570	0.676266	0.683029	0.676114	0.674993
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252
cr2	c7	7	1			0.671000	0.677710	0.684487	0.691332	0.698245	0.705228	0.712280	0.719403	0.726597	0.733863	0.741201	0.748613	0.709163	0.708847
cr3	c8	8	1			0.748000	0.755480	0.763035	0.770665	0.778372	0.786156	0.794017	0.801957	0.809977	0.818077	0.826257	0.834520	0.790543	0.790191
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072
ss1	s2	10	1			0.660000	0.666600	0.673266	0.679999	0.686799	0.693667	0.700603	0.707609	0.714685	0.721832	0.729051	0.736341	0.697538	0.697227
sr1	s3	11			1	0.608138	0.614220	0.620362	0.611739	0.617857	0.624035	0.613329	0.619462	0.625657	0.622303	0.628526	0.634811	0.620037	0.618680
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

Estimation 2 - Currency "Low Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Dramatic Decrease"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.688820	0.695708	0.702665	0.709692	0.716789	0.723957	0.731196	0.738508	0.745893	0.753352	0.760886	0.720789	0.720468
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536
cs1	c4	4			1	0.680244	0.687046	0.693917	0.699793	0.706791	0.713859	0.750233	0.757735	0.765312	0.770500	0.778205	0.785987	0.732469	0.732287
cs2	c5	5			1	0.671444	0.678158	0.684940	0.690727	0.697634	0.704610	0.740891	0.748300	0.755783	0.760876	0.768485	0.776169	0.723168	0.722991
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252
cr2	c7	7	1			0.671000	0.677710	0.684487	0.691332	0.698245	0.705228	0.712280	0.719403	0.726597	0.733863	0.741201	0.748613	0.709163	0.708847
cr3	c8	8	1			0.748000	0.755480	0.763035	0.770665	0.778372	0.786156	0.794017	0.801957	0.809977	0.818077	0.826257	0.834520	0.790543	0.790191
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072
ss1	s2	10	1			0.660000	0.666600	0.673266	0.679999	0.686799	0.693667	0.700603	0.707609	0.714685	0.721832	0.729051	0.736341	0.697538	0.697227
sr1	s3	11			1	0.608138	0.614220	0.620362	0.624412	0.630656	0.636963	0.657919	0.664498	0.671143	0.671234	0.677946	0.684726	0.646851	0.647599
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

All quantities are in the unit of TL/Sm^3

Price Summary Sheet (Sheet 2/4)

Estimation 3 - Currency "Low Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Slight Increase"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.688820	0.695708	0.702665	0.709692	0.716789	0.723957	0.731196	0.738508	0.745893	0.753352	0.760886	0.720789	0.720468
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.864873	0.877781
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.762593	0.776458
cs1	c4	4			1	0.680244	0.687046	0.693917	0.679444	0.686238	0.693100	0.675540	0.682295	0.689118	0.679195	0.685987	0.692847	0.685414	0.684289
cs2	c5	5			1	0.671444	0.678158	0.684940	0.670377	0.677081	0.683852	0.666199	0.672860	0.679589	0.669570	0.676266	0.683029	0.676114	0.674993
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.820772	0.835274
cr2	c7	7	1			0.671000	0.677710	0.684487	0.691332	0.698245	0.705228	0.712280	0.719403	0.726597	0.733863	0.741201	0.748613	0.709163	0.708847
cr3	c8	8	1			0.748000	0.755480	0.763035	0.770665	0.778372	0.786156	0.794017	0.801957	0.809977	0.818077	0.826257	0.834520	0.790543	0.790191
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.789561	0.803917
ss1	s2	10	1			0.660000	0.666600	0.673266	0.679999	0.686799	0.693667	0.700603	0.707609	0.714685	0.721832	0.729051	0.736341	0.697538	0.697227
sr1	s3	11			1	0.608138	0.614220	0.620362	0.611739	0.617857	0.624035	0.613329	0.619462	0.625657	0.622303	0.628526	0.634811	0.620037	0.618680
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

Estimation 4 - Currency "Low Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Dramatic Decrease"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.688820	0.695708	0.702665	0.709692	0.716789	0.723957	0.731196	0.738508	0.745893	0.753352	0.760886	0.720789	0.720468
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.864873	0.877781
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.762593	0.776458
cs1	c4	4			1	0.680244	0.687046	0.693917	0.699793	0.706791	0.713859	0.750233	0.757735	0.765312	0.770500	0.778205	0.785987	0.732469	0.732287
cs2	c5	5			1	0.671444	0.678158	0.684940	0.690727	0.697634	0.704610	0.740891	0.748300	0.755783	0.760876	0.768485	0.776169	0.723168	0.722991
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.820772	0.835274
cr2	c7	7	1			0.671000	0.677710	0.684487	0.691332	0.698245	0.705228	0.712280	0.719403	0.726597	0.733863	0.741201	0.748613	0.709163	0.708847
cr3	c8	8	1			0.671000	0.677710	0.684487	0.691332	0.698245	0.705228	0.712280	0.719403	0.726597	0.733863	0.741201	0.748613	0.709163	0.708847
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.789561	0.803917
ss1	s2	10	1			0.660000	0.666600	0.673266	0.679999	0.686799	0.693667	0.700603	0.707609	0.714685	0.721832	0.729051	0.736341	0.697538	0.697227
sr1	s3	11			1	0.608138	0.614220	0.620362	0.624412	0.630656	0.636963	0.657919	0.664498	0.671143	0.671234	0.677946	0.684726	0.646851	0.647599
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

All quantities are in the unit of TL/Sm^3

Price Summary Sheet (Sheet 3/4)

Estimation 5 - Currency "High Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Slight Increase"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.705870	0.730575	0.756146	0.782611	0.810002	0.838352	0.867694	0.898064	0.929496	0.962028	0.995699	0.829878	0.825478
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536
cs1	c4	4			1	0.680244	0.704052	0.728694	0.731157	0.756747	0.783233	0.782285	0.809665	0.838003	0.846379	0.876003	0.906663	0.786927	0.783515
cs2	c5	5			1	0.671444	0.694944	0.719267	0.721400	0.746649	0.772782	0.771467	0.798469	0.826415	0.834386	0.863590	0.893815	0.776219	0.772864
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252
cr2	c7	7	1			0.671000	0.694485	0.718792	0.743950	0.769988	0.796938	0.824830	0.853699	0.883579	0.914504	0.946512	0.979640	0.816493	0.812164
cr3	c8	8	1			0.748000	0.774180	0.801276	0.829321	0.858347	0.888389	0.919483	0.951665	0.984973	1.019447	1.055128	1.092057	0.910189	0.905363
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072
ss1	s2	10	1			0.660000	0.683100	0.707009	0.731754	0.757365	0.783873	0.811309	0.839704	0.869094	0.899512	0.930995	0.963580	0.803108	0.798850
sr1	s3	11			1	0.608138	0.629423	0.651453	0.658299	0.681340	0.705186	0.710243	0.735102	0.760830	0.775483	0.802625	0.830717	0.712403	0.708500
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

Estimation 6 - Currency "High Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Dramatic Decrease"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.705870	0.730575	0.756146	0.782611	0.810002	0.838352	0.867694	0.898064	0.929496	0.962028	0.995699	0.829878	0.825478
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513	0.774513
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536	0.665536
cs1	c4	4			1	0.680244	0.704052	0.728694	0.753055	0.779412	0.806692	0.868780	0.899187	0.930659	0.960160	0.993765	1.028547	0.844437	0.839631
cs2	c5	5			1	0.671444	0.694944	0.719267	0.743298	0.769314	0.796240	0.857963	0.887991	0.919071	0.948166	0.981352	1.015700	0.833729	0.828980
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252	0.719252
cr2	c7	7	1			0.671000	0.694485	0.718792	0.743950	0.769988	0.796938	0.824830	0.853699	0.883579	0.914504	0.946512	0.979640	0.816493	0.812164
cr3	c8	8	1			0.748000	0.774180	0.801276	0.829321	0.858347	0.888389	0.919483	0.951665	0.984973	1.019447	1.055128	1.092057	0.910189	0.905363
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072	0.689072
ss1	s2	10	1			0.660000	0.683100	0.707009	0.731754	0.757365	0.783873	0.811309	0.839704	0.869094	0.899512	0.930995	0.963580	0.803108	0.798850
sr1	s3	11			1	0.608138	0.629423	0.651453	0.671937	0.695454	0.719795	0.761879	0.788545	0.816144	0.836459	0.865735	0.896036	0.745083	0.742292
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

All quantities are in the unit of TL/Sm^3

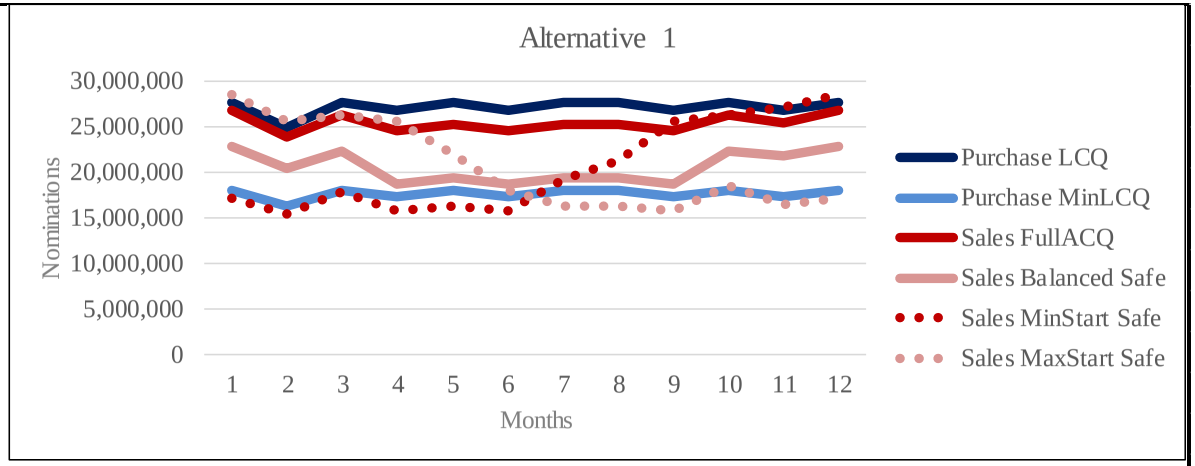
Price Summary Sheet (Sheet 4/4)

Estimation 7 - Currency "High Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Slight Increase"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.705870	0.730575	0.756146	0.782611	0.810002	0.838352	0.867694	0.898064	0.929496	0.962028	0.995699	0.829878	0.825478
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.864873	0.877781
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.762593	0.776458
cs1	c4	4			1	0.680244	0.704052	0.728694	0.731157	0.756747	0.783233	0.782285	0.809665	0.838003	0.846379	0.876003	0.906663	0.786927	0.783515
cs2	c5	5			1	0.671444	0.694944	0.719267	0.721400	0.746649	0.772782	0.771467	0.798469	0.826415	0.834386	0.863590	0.893815	0.776219	0.772864
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.820772	0.835274
cr2	c7	7	1			0.671000	0.694485	0.718792	0.743950	0.769988	0.796938	0.824830	0.853699	0.883579	0.914504	0.946512	0.979640	0.816493	0.812164
cr3	c8	8	1			0.748000	0.774180	0.801276	0.829321	0.858347	0.888389	0.919483	0.951665	0.984973	1.019447	1.055128	1.092057	0.910189	0.905363
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.789561	0.803917
ss1	s2	10	1			0.660000	0.683100	0.707009	0.731754	0.757365	0.783873	0.811309	0.839704	0.869094	0.899512	0.930995	0.963580	0.803108	0.798850
sr1	s3	11			1	0.608138	0.629423	0.651453	0.658299	0.681340	0.705186	0.710243	0.735102	0.760830	0.775483	0.802625	0.830717	0.712403	0.708500
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

Estimation 8 - Currency "High Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Dramatic Decrease"																		
y			fix	bts	oil	Pgas[y1]	Pgas[y2]	Pgas[y3]	Pgas[y4]	Pgas[y5]	Pgas[y6]	Pgas[y7]	Pgas[y8]	Pgas[y9]	Pgas[y10]	Pgas[y11]	Pgas[y12]	Pmaq[y]	Pmsq[y]
ct1	c1	1	1			0.682000	0.705870	0.730575	0.756146	0.782611	0.810002	0.838352	0.867694	0.898064	0.929496	0.962028	0.995699	0.829878	0.825478
ct2	c2	2		1		0.774513	0.774513	0.774513	0.774513	0.774513	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.929416	0.864873	0.877781
ct3	c3	3		1		0.665536	0.665536	0.665536	0.665536	0.665536	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.831919	0.762593	0.776458
cs1	c4	4			1	0.680244	0.704052	0.728694	0.753055	0.779412	0.806692	0.868780	0.899187	0.930659	0.960160	0.993765	1.028547	0.844437	0.839631
cs2	c5	5			1	0.671444	0.694944	0.719267	0.743298	0.769314	0.796240	0.857963	0.887991	0.919071	0.948166	0.981352	1.015700	0.833729	0.828980
cr1	c6	6		1		0.719252	0.719252	0.719252	0.719252	0.719252	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.893286	0.820772	0.835274
cr2	c7	7	1			0.671000	0.694485	0.718792	0.743950	0.769988	0.796938	0.824830	0.853699	0.883579	0.914504	0.946512	0.979640	0.816493	0.812164
cr3	c8	8	1			0.748000	0.774180	0.801276	0.829321	0.858347	0.888389	0.919483	0.951665	0.984973	1.019447	1.055128	1.092057	0.910189	0.905363
st1	s1	9		1		0.689072	0.689072	0.689072	0.689072	0.689072	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.861340	0.789561	0.803917
ss1	s2	10	1			0.660000	0.683100	0.707009	0.731754	0.757365	0.783873	0.811309	0.839704	0.869094	0.899512	0.930995	0.963580	0.803108	0.798850
sr1	s3	11			1	0.608138	0.629423	0.651453	0.671937	0.695454	0.719795	0.761879	0.788545	0.816144	0.836459	0.865735	0.896036	0.745083	0.742292
Balancing Gas Price Pdgf						0.800000	0.800000	0.700000	0.600000	0.500000	0.500000	0.500000	0.500000	0.600000	0.700000	0.800000	0.800000		

All quantities are in the unit of TL/Sm^3

Alternative 1				
	ct1	c1	1	1
	ct2	c2	2	
	ct3	c3	3	
	cs1	c4	4	1
	cs2	c5	5	1
	cr1	c6	6	1
	cr2	c7	7	
	cr3	c8	8	1
	st1	s1	9	
	ss1	s2	10	
	sr1	s3	11	1

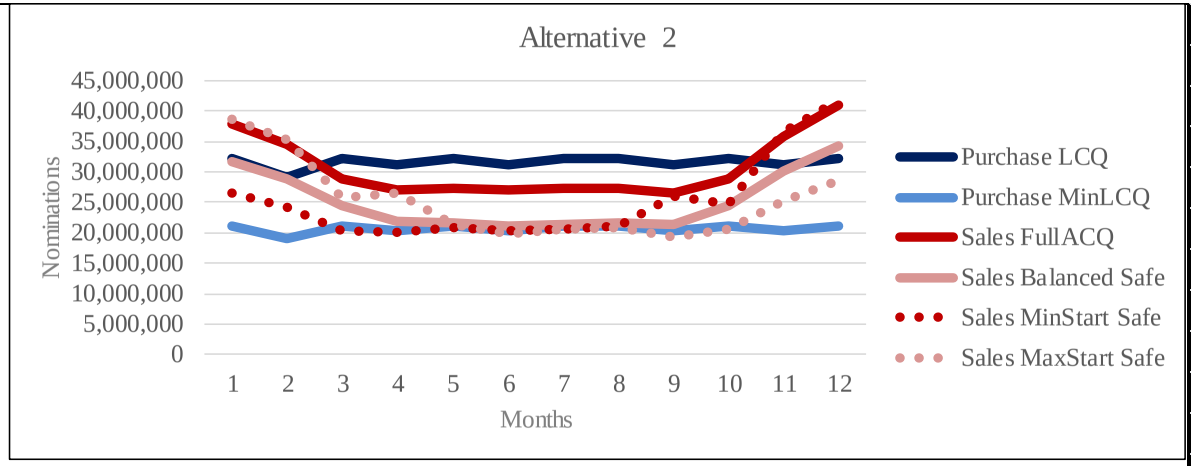


Nominations Balance

	n	1	2	3	4	5	6	7	8	9	10	11	12
Sales	B	B[yc1]	B[yc2]	B[yc3]	B[yc4]	B[yc5]	B[yc6]	B[yc7]	B[yc8]	B[yc9]	B[yc10]	B[yc11]	B[yc12]
	FullACQ	26,780,822	23,979,452	26,280,822	24,513,699	25,280,822	24,513,699	25,280,822	25,280,822	24,513,699	26,280,822	25,513,699	26,780,822
	Balanced Safe	22,830,323	20,440,745	22,400,635	18,762,978	19,353,689	18,762,978	19,353,689	19,353,689	18,762,978	22,400,635	21,747,339	22,830,323
	MinStart Safe	17,246,607	15,451,774	17,896,607	15,848,330	16,346,607	15,848,330	19,208,099	21,391,593	25,707,042	26,320,292	27,205,600	28,529,120
	MaxStart Safe	28,529,120	25,558,560	26,327,085	25,707,042	21,985,536	18,115,878	16,346,607	16,346,607	15,848,330	18,540,299	16,448,330	17,246,607
Purchase	B	B[ys1]	B[ys2]	B[ys3]	B[ys4]	B[ys5]	B[ys6]	B[ys7]	B[ys8]	B[ys9]	B[ys10]	B[ys11]	B[ys12]
	LCQ	27,695,057	25,014,890	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057
	MinLCQ	18,001,787	16,259,678	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787
Shortfall/Surplus	S/S	S/S[1]	S/S[2]	S/S[3]	S/S[4]	S/S[5]	S/S[6]	S/S[7]	S/S[8]	S/S[9]	S/S[10]	S/S[11]	S/S[12]
	FullACQ	0	0	0	0	0	0	0	0	0	0	0	0
	Balanced Safe	0	0	0	0	0	0	0	0	0	0	0	0
	MinStart Safe	755,179	807,904	105,179	1,572,754	1,655,179	1,572,754	0	0	0	0	-403,932	-834,063
	MaxStart Safe	-834,063	-543,670	0	0	0	0	1,655,179	1,655,179	1,572,754	0	972,754	755,179

All quantities are in the unit of Sm^3

Alternative 2				
	ct1	c1	1	
	ct2	c2	2	1
	ct3	c3	3	1
	cs1	c4	4	1
	cs2	c5	5	
	cr1	c6	6	1
	cr2	c7	7	
	cr3	c8	8	
	st1	s1	9	
	ss1	s2	10	1
	sr1	s3	11	1

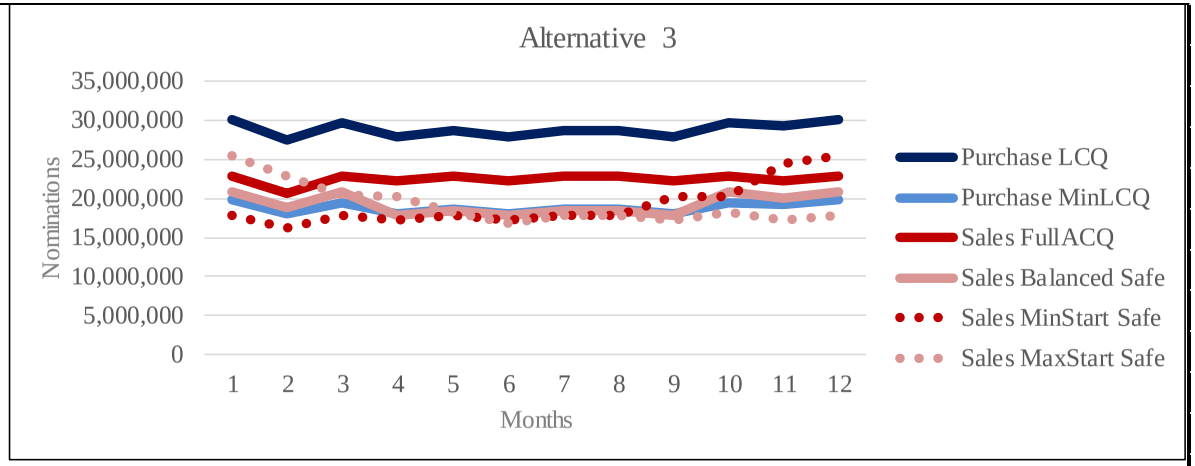


Nominations Balance

n		1	2	3	4	5	6	7	8	9	10	11	12
Sales	B	B[yc1]	B[yc2]	B[yc3]	B[yc4]	B[yc5]	B[yc6]	B[yc7]	B[yc8]	B[yc9]	B[yc10]	B[yc11]	B[yc12]
	FullACQ	37,938,356	34,541,096	28,938,356	26,972,603	27,438,356	26,972,603	27,438,356	27,438,356	26,472,603	28,938,356	35,972,603	40,938,356
	Balanced Safe	31,763,614	28,920,564	24,525,071	21,986,399	21,593,821	20,997,388	21,346,568	21,593,821	21,382,003	24,525,071	30,169,632	34,196,047
	MinStart Safe	26,507,678	24,134,355	20,357,678	20,033,237	20,957,678	20,333,237	20,657,678	21,008,724	25,909,445	24,694,016	36,708,003	41,698,270
	MaxStart Safe	38,698,270	35,227,469	25,796,539	26,559,445	21,404,686	19,937,275	20,657,678	20,957,678	19,383,237	20,636,806	25,133,237	28,607,678
Purchase	B	B[ys1]	B[ys2]	B[ys3]	B[ys4]	B[ys5]	B[ys6]	B[ys7]	B[ys8]	B[ys9]	B[ys10]	B[ys11]	B[ys12]
	LCQ	32,310,899	29,184,038	32,310,899	31,268,612	32,310,899	31,268,612	32,310,899	32,310,899	31,268,612	32,310,899	31,268,612	32,310,899
	MinLCQ	21,002,085	18,969,625	21,002,085	20,324,598	21,002,085	20,324,598	21,002,085	21,002,085	20,324,598	21,002,085	20,324,598	21,002,085
Shortfall/Surplus	S/S	S/S[1]	S/S[2]	S/S[3]	S/S[4]	S/S[5]	S/S[6]	S/S[7]	S/S[8]	S/S[9]	S/S[10]	S/S[11]	S/S[12]
	FullACQ	-5,627,457	-5,357,058	0	0	0	0	0	0	0	0	-4,703,990	-8,627,457
	Balanced Safe	0	0	0	0	0	0	0	0	0	0	0	-1,885,147
	MinStart Safe	0	0	644,406	291,361	44,406	0	344,406	0	0	0	-5,439,391	-9,387,370
	MaxStart Safe	-6,387,370	-6,043,431	0	0	0	387,323	344,406	44,406	941,361	365,279	0	0

All quantities are in the unit of Sm^3

Alternative 3				
	ct1	c1	1	
	ct2	c2	2	
	ct3	c3	3	
	cs1	c4	4	1
	cs2	c5	5	
	cr1	c6	6	
	cr2	c7	7	1
	cr3	c8	8	
	st1	s1	9	1
	ss1	s2	10	
	sr1	s3	11	1

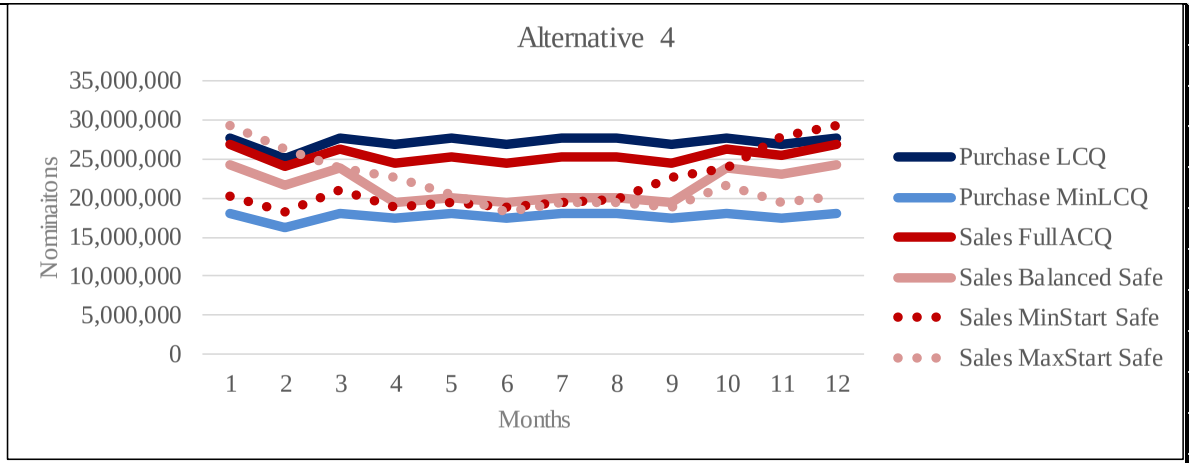


Nominations Balance

	n	1	2	3	4	5	6	7	8	9	10	11	12
Sales	B	B[yc1]	B[yc2]	B[yc3]	B[yc4]	B[yc5]	B[yc6]	B[yc7]	B[yc8]	B[yc9]	B[yc10]	B[yc11]	B[yc12]
	FullACQ	22,931,507	20,712,329	22,931,507	22,191,781	22,931,507	22,191,781	22,931,507	22,931,507	22,191,781	22,931,507	22,191,781	22,931,507
	Balanced Safe	20,797,253	18,784,615	20,797,253	17,770,492	18,362,842	17,770,492	18,362,842	18,362,842	17,770,492	20,797,253	20,126,374	20,797,253
	MinStart Safe	17,855,483	16,127,533	17,855,483	17,279,500	17,855,483	17,279,500	17,855,483	17,906,529	20,223,504	20,319,979	24,561,404	25,380,117
	MaxStart Safe	25,380,117	22,923,977	20,376,312	20,223,504	18,302,491	16,883,538	17,855,483	17,855,483	17,279,500	18,284,611	17,279,500	17,855,483
Purchase	B	B[ys1]	B[ys2]	B[ys3]	B[ys4]	B[ys5]	B[ys6]	B[ys7]	B[ys8]	B[ys9]	B[ys10]	B[ys11]	B[ys12]
	LCQ	30,195,057	27,514,890	29,695,057	27,801,668	28,695,057	27,801,668	28,695,057	28,695,057	27,801,668	29,695,057	29,301,668	30,195,057
	MinLCQ	19,751,787	18,009,678	19,401,787	18,121,084	18,701,787	18,121,084	18,701,787	18,701,787	18,121,084	19,401,787	19,171,084	19,751,787
Shortfall/Surplus	S/S	S/S[1]	S/S[2]	S/S[3]	S/S[4]	S/S[5]	S/S[6]	S/S[7]	S/S[8]	S/S[9]	S/S[10]	S/S[11]	S/S[12]
	FullACQ	0	0	0	0	0	0	0	0	0	0	0	0
	Balanced Safe	0	0	0	350,592	338,945	350,592	338,945	338,945	350,592	0	0	0
	MinStart Safe	1,896,303	1,882,145	1,546,303	841,584	846,303	841,584	846,303	795,258	0	0	0	0
	MaxStart Safe	0	0	0	0	399,295	1,237,546	846,303	846,303	841,584	1,117,176	1,891,584	1,896,303

All quantities are in the unit of Sm^3

Alternative 4				
	ct1	c1	1	
	ct2	c2	2	
	ct3	c3	3	
	cs1	c4	4	1
	cs2	c5	5	1
	cr1	c6	6	
	cr2	c7	7	1
	cr3	c8	8	1
	st1	s1	9	
	ss1	s2	10	
	sr1	s3	11	1

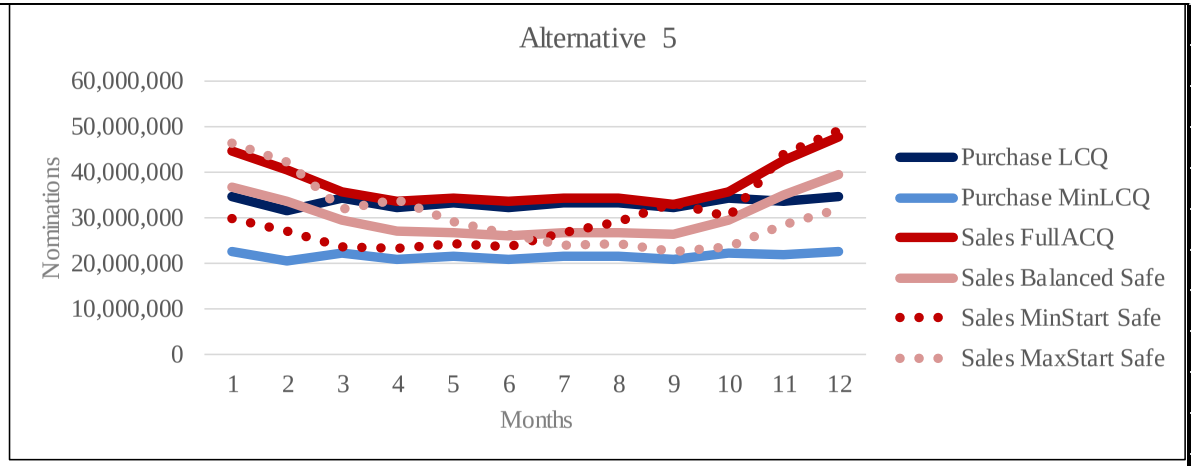


Nominations Balance

	n	1	2	3	4	5	6	7	8	9	10	11	12
Sales	B	B[yc1]	B[yc2]	B[yc3]	B[yc4]	B[yc5]	B[yc6]	B[yc7]	B[yc8]	B[yc9]	B[yc10]	B[yc11]	B[yc12]
	FullACQ	26,780,822	23,979,452	26,280,822	24,513,699	25,280,822	24,513,699	25,280,822	25,280,822	24,513,699	26,280,822	25,513,699	26,780,822
	Balanced Safe	24,192,960	21,671,514	23,763,273	19,500,683	20,115,984	19,500,683	20,115,984	20,115,984	19,500,683	23,763,273	23,066,020	24,192,960
	MinStart Safe	20,325,995	18,233,157	20,975,995	18,828,383	19,425,995	18,828,383	19,425,995	19,752,563	22,588,681	23,914,139	27,926,580	29,274,133
	MaxStart Safe	29,274,133	26,231,475	23,770,328	22,588,681	20,346,507	18,234,439	19,425,995	19,425,995	18,828,383	21,619,687	19,428,383	20,325,995
Purchase	B	B[ys1]	B[ys2]	B[ys3]	B[ys4]	B[ys5]	B[ys6]	B[ys7]	B[ys8]	B[ys9]	B[ys10]	B[ys11]	B[ys12]
	LCQ	27,695,057	25,014,890	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057	27,695,057	26,801,668	27,695,057	26,801,668	27,695,057
	MinLCQ	18,001,787	16,259,678	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787	18,001,787	17,421,084	18,001,787	17,421,084	18,001,787
Shortfall/Surplus	S/S	S/S[1]	S/S[2]	S/S[3]	S/S[4]	S/S[5]	S/S[6]	S/S[7]	S/S[8]	S/S[9]	S/S[10]	S/S[11]	S/S[12]
	FullACQ	0	0	0	0	0	0	0	0	0	0	0	0
	Balanced Safe	0	0	0	0	0	0	0	0	0	0	0	0
	MinStart Safe	0	0	0	0	0	0	0	0	0	0	-1,124,912	-1,579,076
	MaxStart Safe	-1,579,076	-1,216,585	0	0	0	0	0	0	0	0	0	0

All quantities are in the unit of Sm^3

Alternative 5				
	ct1	c1	1	1
	ct2	c2	2	1
	ct3	c3	3	1
	cs1	c4	4	
	cs2	c5	5	
	cr1	c6	6	1
	cr2	c7	7	
	cr3	c8	8	
	st1	s1	9	1
	ss1	s2	10	1
	sr1	s3	11	1



Nominations Balance

n		1	2	3	4	5	6	7	8	9	10	11	12
Sales	B	B[yc1]	B[yc2]	B[yc3]	B[yc4]	B[yc5]	B[yc6]	B[yc7]	B[yc8]	B[yc9]	B[yc10]	B[yc11]	B[yc12]
	FullACQ	44,732,877	40,678,082	35,732,877	33,547,945	34,232,877	33,547,945	34,232,877	34,232,877	33,047,945	35,732,877	42,547,945	47,732,877
	Balanced Safe	36,941,636	33,597,487	29,703,093	27,166,727	26,946,826	26,177,716	26,699,574	26,946,826	26,562,331	29,703,093	35,180,621	39,374,069
	MinStart Safe	29,885,072	27,184,903	23,735,072	23,301,682	24,335,072	23,601,682	26,896,563	29,053,489	33,311,512	30,237,811	44,110,070	49,347,072
	MaxStart Safe	46,347,072	42,136,065	32,045,037	33,961,512	29,053,489	26,463,174	24,035,072	24,335,072	22,651,682	23,585,072	28,401,682	31,985,072
Purchase	B	B[ys1]	B[ys2]	B[ys3]	B[ys4]	B[ys5]	B[ys6]	B[ys7]	B[ys8]	B[ys9]	B[ys10]	B[ys11]	B[ys12]
	LCQ	34,810,899	31,684,038	34,310,899	32,268,612	33,310,899	32,268,612	33,310,899	33,310,899	32,268,612	34,310,899	33,768,612	34,810,899
	MinLCQ	22,752,085	20,719,625	22,402,085	21,024,598	21,702,085	21,024,598	21,702,085	21,702,085	21,024,598	22,402,085	22,074,598	22,752,085
Shortfall/Surplus	S/S	S/S[1]	S/S[2]	S/S[3]	S/S[4]	S/S[5]	S/S[6]	S/S[7]	S/S[8]	S/S[9]	S/S[10]	S/S[11]	S/S[12]
	FullACQ	-9,921,977	-8,994,044	-1,421,977	-1,279,333	-921,977	-1,279,333	-921,977	-921,977	-779,333	-1,421,977	-8,779,333	-12,921,977
	Balanced Safe	-2,130,737	-1,913,449	0	0	0	0	0	0	0	0	-1,412,009	-4,563,169
	MinStart Safe	0	0	0	0	0	0	0	0	-1,042,899	0	-10,341,457	-14,536,173
	MaxStart Safe	-11,536,173	-10,452,027	0	-1,692,899	0	0	0	0	0	0	0	0

All quantities are in the unit of Sm^3

A.3.1 Detailed amount calculations of Alternative 1

Consumptions Balance Sheet - Alternative 1 (Sheet 1/4)														
	n	1	2	3	4	5	6	7	8	9	10	11	12	
Total Nomination of Customers	Zc	Zc[1]	Zc[2]	Zc[3]	Zc[4]	Zc[5]	Zc[6]	Zc[7]	Zc[8]	Zc[9]	Zc[10]	Zc[11]	Zc[12]	Zc
	FullACQ	26,780,822	23,979,452	26,280,822	24,513,699	25,280,822	24,513,699	25,280,822	25,280,822	24,513,699	26,280,822	25,513,699	26,780,822	305,000,000
	Balanced Safe	22,830,323	20,440,745	22,400,635	18,762,978	19,353,689	18,762,978	19,353,689	19,353,689	18,762,978	22,400,635	21,747,339	22,830,323	247,000,000
	MinStart Safe	17,246,607	15,451,774	17,896,607	15,848,330	16,346,607	15,848,330	19,208,099	21,391,593	25,707,042	26,320,292	27,205,600	28,529,120	247,000,000
	MaxStart Safe	28,529,120	25,558,560	26,327,085	25,707,042	21,985,536	18,115,878	16,346,607	16,346,607	15,848,330	18,540,299	16,448,330	17,246,607	247,000,000
Surplus Gas (Balancing Gas Sales)	Q	Q[1]	Q[2]	Q[3]	Q[4]	Q[5]	Q[6]	Q[7]	Q[8]	Q[9]	Q[10]	Q[11]	Q[12]	Q
	FullACQ													0
	Balanced Safe													0
	MinStart Safe	755,179	807,904	105,179	1,572,754	1,655,179	1,572,754							6,468,951
	MaxStart Safe							1,655,179	1,655,179	1,572,754		972,754	755,179	6,611,047
Total Undelivered Gas	U	U[1]	U[2]	U[3]	U[4]	U[5]	U[6]	U[7]	U[8]	U[9]	U[10]	U[11]	U[12]	U
	FullACQ													0
	Balanced Safe													0
	MinStart Safe											403,932	834,063	1,237,995
	MaxStart Safe	834,063	543,670											1,377,733
Defficiency Coefficient	φdef	φdef[1]	φdef[2]	φdef[3]	φdef[4]	φdef[5]	φdef[6]	φdef[7]	φdef[8]	φdef[9]	φdef[10]	φdef[11]	φdef[12]	
	FullACQ													
	Balanced Safe													
	MinStart Safe											0.014847	0.029235	
	MaxStart Safe	0.029235	0.021272											
Total Delivered Gas	Q	Q[1]	Q[2]	Q[3]	Q[4]	Q[5]	Q[6]	Q[7]	Q[8]	Q[9]	Q[10]	Q[11]	Q[12]	TOTAL
	FullACQ	26,780,822	23,979,452	26,280,822	24,513,699	25,280,822	24,513,699	25,280,822	25,280,822	24,513,699	26,280,822	25,513,699	26,780,822	305,000,000
	Balanced Safe	22,830,323	20,440,745	22,400,635	18,762,978	19,353,689	18,762,978	19,353,689	19,353,689	18,762,978	22,400,635	21,747,339	22,830,323	247,000,000
	MinStart Safe	17,246,607	15,451,774	17,896,607	15,848,330	16,346,607	15,848,330	19,208,099	21,391,593	25,707,042	26,320,292	26,801,668	27,695,057	245,762,005
	MaxStart Safe	27,695,057	25,014,890	26,327,085	25,707,042	21,985,536	18,115,878	16,346,607	16,346,607	15,848,330	18,540,299	16,448,330	17,246,607	245,622,267

All quantities are in the unit of Sm^3

Consumptions Balance Sheet - Alternative 1 (Sheet 2/4)														
Total Delivered (Sold) Gas	FullACQ	y	Q[y1]	Q[y2]	Q[y3]	Q[y4]	Q[y5]	Q[y6]	Q[y7]	Q[y8]	Q[y9]	Q[y10]	Q[y11]	Q[y12]	Q[y]
		1	8,493,151	7,671,233	8,493,151	8,219,178	8,493,151	8,219,178	8,493,151	8,493,151	8,219,178	8,493,151	8,219,178	8,493,151	100,000,000
		2													
		3													
		4	1,698,630	1,534,247	1,698,630	1,643,836	1,698,630	1,643,836	1,698,630	1,698,630	1,643,836	1,698,630	1,643,836	1,698,630	20,000,000
		5	849,315	767,123	849,315	821,918	849,315	821,918	849,315	849,315	821,918	849,315	821,918	849,315	10,000,000
		6	12,739,726	11,506,849	12,739,726	12,328,767	12,739,726	12,328,767	12,739,726	12,739,726	12,328,767	12,739,726	12,328,767	12,739,726	150,000,000
		7													
		8	3,000,000	2,500,000	2,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	1,500,000	2,500,000	2,500,000	3,000,000	25,000,000
		Surplus													
		TOT	**26,780,822**	**23,979,452**	**26,280,822**	**24,513,699**	**25,280,822**	**24,513,699**	**25,280,822**	**25,280,822**	**24,513,699**	**26,280,822**	**25,513,699**	**26,780,822**	**305,000,000**
	Balanced Safe	y	Q[y1]	Q[y2]	Q[y3]	Q[y4]	Q[y5]	Q[y6]	Q[y7]	Q[y8]	Q[y9]	Q[y10]	Q[y11]	Q[y12]	Q[y]
		1	6,813,187	6,153,846	6,813,187	6,557,377	6,775,956	6,557,377	6,775,956	6,775,956	6,557,377	6,813,187	6,593,407	6,813,187	80,000,000
		2													
		3													
		4	1,635,165	1,476,923	1,635,165	1,377,049	1,422,951	1,377,049	1,422,951	1,422,951	1,377,049	1,635,165	1,582,418	1,635,165	18,000,000
		5	817,582	738,462	817,582	688,525	711,475	688,525	711,475	711,475	688,525	817,582	791,209	817,582	9,000,000
		6	10,986,264	9,923,077	10,986,264	9,098,361	9,401,639	9,098,361	9,401,639	9,401,639	9,098,361	10,986,264	10,631,868	10,986,264	120,000,000
		7													
		8	2,578,125	2,148,438	2,148,438	1,041,667	1,041,667	1,041,667	1,041,667	1,041,667	1,041,667	2,148,438	2,148,438	2,578,125	20,000,000
		Surplus													
		TOT	**22,830,323**	**20,440,745**	**22,400,635**	**18,762,978**	**19,353,689**	**18,762,978**	**19,353,689**	**19,353,689**	**18,762,978**	**22,400,635**	**21,747,339**	**22,830,323**	**247,000,000**

All quantities are in the unit of Sm^3

Consumptions Balance Sheet - Alternative 1 (Sheet 3/4)														
Total Delivered (Sold) Gas	**MinStart Safe**	**y**	**Q[y1]**	**Q[y2]**	**Q[y3]**	**Q[y4]**	**Q[y5]**	**Q[y6]**	**Q[y7]**	**Q[y8]**	**Q[y9]**	**Q[y10]**	**Q[y11]**	**Q[y12]**	**Q[y]**
		1	4,718,417	4,261,796	4,718,417	4,566,210	4,718,417	4,566,210	7,579,909	9,436,834	9,132,420	7,732,116	8,996,828	9,160,944	79,588,517
		2													
		3													
		4	1,341,024	1,211,247	1,341,024	1,297,765	1,341,024	1,297,765	1,341,024	1,392,069	1,730,353	2,188,320	1,704,662	1,735,758	17,922,035
		5	670,512	605,624	670,512	648,882	670,512	648,882	670,512	696,035	865,177	1,094,160	852,331	867,879	8,961,017
		6	8,716,655	7,873,107	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655	8,716,655	12,479,092	12,805,696	12,784,965	13,018,183	119,415,261
		7													
		8	1,800,000	1,500,000	2,450,000	900,000	900,000	900,000	900,000	1,150,000	1,500,000	2,500,000	2,462,882	2,912,294	19,875,175
		Surplus	755,179	807,904	105,179	1,572,754	1,655,179	1,572,754							6,468,951
		TOT	**18,001,787**	**16,259,678**	**18,001,787**	**17,421,084**	**18,001,787**	**17,421,084**	**19,208,099**	**21,391,593**	**25,707,042**	**26,320,292**	**26,801,668**	**27,695,057**	**252,230,956**
	MaxStart Safe	**y**	**Q[y1]**	**Q[y2]**	**Q[y3]**	**Q[y4]**	**Q[y5]**	**Q[y6]**	**Q[y7]**	**Q[y8]**	**Q[y9]**	**Q[y10]**	**Q[y11]**	**Q[y12]**	**Q[y]**
		1	9,160,944	8,342,282	8,036,530	9,132,420	9,436,834	7,427,702	4,718,417	4,718,417	4,566,210	4,718,417	4,566,210	4,718,417	79,542,800
		2													
		3													
		4	1,735,758	1,580,643	1,788,032	1,730,353	1,788,032	901,802	1,341,024	1,341,024	1,297,765	1,770,151	1,297,765	1,341,024	17,913,373
		5	867,879	790,321	894,016	865,177	894,016	450,901	670,512	670,512	648,882	885,076	648,882	670,512	8,956,686
		6	13,018,183	11,854,822	13,108,508	12,479,092	8,716,655	8,435,472	8,716,655	8,716,655	8,435,472	8,716,655	8,435,472	8,716,655	119,350,294
		7													
		8	2,912,294	2,446,821	2,500,000	1,500,000	1,150,000	900,000	900,000	900,000	900,000	2,450,000	1,500,000	1,800,000	19,859,115
		Surplus							1,655,179	1,655,179	1,572,754		972,754	755,179	6,611,047
		TOT	**27,695,057**	**25,014,890**	**26,327,085**	**25,707,042**	**21,985,536**	**18,115,878**	**18,001,787**	**18,001,787**	**17,421,084**	**18,540,299**	**17,421,084**	**18,001,787**	**252,233,314**

All quantities are in the unit of Sm^3

Consumptions Balance Sheet - Alternative 1 (Sheet 4/4)															
Purchase Fitting Coefficient	φfit		φfit[1]	φfit[2]	φfit[3]	φfit[4]	φfit[5]	φfit[6]	φfit[7]	φfit[8]	φfit[9]	φfit[10]	φfit[11]	φfit[12]	
	FullACQ		0.966989	0.958607	0.948935	0.914633	0.912828	0.914633	0.912828	0.912828	0.914633	0.948935	0.951944	0.966989	
	Balanced Safe		0.824346	0.817143	0.808832	0.700068	0.698814	0.700068	0.698814	0.698814	0.700068	0.808832	0.811417	0.824346	
	MinStart Safe		0.650000	0.650000	0.650000	0.650000	0.650000	0.650000	0.693557	0.772398	0.959158	0.950361	1.000000	1.000000	
	MaxStart Safe		1.000000	1.000000	0.950606	0.959158	0.793843	0.675924	0.650000	0.650000	0.650000	0.669444	0.650000	0.650000	
Total Purchased Gas	FullACQ	y	Q[y1]	Q[y2]	Q[y3]	Q[y4]	Q[y5]	Q[y6]	Q[y7]	Q[y8]	Q[y9]	Q[y10]	Q[y11]	Q[y12]	Q[y]
		9													
		10													
		11	26,780,822	23,979,452	26,280,822	24,513,699	25,280,822	24,513,699	25,280,822	25,280,822	24,513,699	26,280,822	25,513,699	26,780,822	305,000,000
		TOT	**26,780,822**	**23,979,452**	**26,280,822**	**24,513,699**	**25,280,822**	**24,513,699**	**25,280,822**	**25,280,822**	**24,513,699**	**26,280,822**	**25,513,699**	**26,780,822**	**305,000,000**
	Balanced Safe	y	Q[y1]	Q[y2]	Q[y3]	Q[y4]	Q[y5]	Q[y6]	Q[y7]	Q[y8]	Q[y9]	Q[y10]	Q[y11]	Q[y12]	Q[y]
		9													
		10													
		11	22,830,323	20,440,745	22,400,635	18,762,978	19,353,689	18,762,978	19,353,689	19,353,689	18,762,978	22,400,635	21,747,339	22,830,323	247,000,000
		TOT	**22,830,323**	**20,440,745**	**22,400,635**	**18,762,978**	**19,353,689**	**18,762,978**	**19,353,689**	**19,353,689**	**18,762,978**	**22,400,635**	**21,747,339**	**22,830,323**	**247,000,000**
	MinStart Safe	y	Q[y1]	Q[y2]	Q[y3]	Q[y4]	Q[y5]	Q[y6]	Q[y7]	Q[y8]	Q[y9]	Q[y10]	Q[y11]	Q[y12]	Q[y]
		9													
		10													
		11	18,001,787	16,259,678	18,001,787	17,421,084	18,001,787	17,421,084	19,208,099	21,391,593	25,707,042	26,320,292	26,801,668	27,695,057	252,230,956
		TOT	**18,001,787**	**16,259,678**	**18,001,787**	**17,421,084**	**18,001,787**	**17,421,084**	**19,208,099**	**21,391,593**	**25,707,042**	**26,320,292**	**26,801,668**	**27,695,057**	**252,230,956**
	MaxStart Safe	y	Q[y1]	Q[y2]	Q[y3]	Q[y4]	Q[y5]	Q[y6]	Q[y7]	Q[y8]	Q[y9]	Q[y10]	Q[y11]	Q[y12]	Q[y]
		9													
		10													
		11	27,695,057	25,014,890	26,327,085	25,707,042	21,985,536	18,115,878	18,001,787	18,001,787	17,421,084	18,540,299	17,421,084	18,001,787	252,233,314
		TOT	**27,695,057**	**25,014,890**	**26,327,085**	**25,707,042**	**21,985,536**	**18,115,878**	**18,001,787**	**18,001,787**	**17,421,084**	**18,540,299**	**17,421,084**	**18,001,787**	**252,233,314**

All quantities are in the unit of Sm^3

A.3.2 Detailed gas cost difference calculation of FullACQ of Alternative 1

Natural Gas Cost Analysis - FullACQ - Alternative 1 (Sheet 1/4)

Estimation	y	E[y1]	E[y2]	E[y3]	E[y4]	E[y5]	E[y6]	E[y7]	E[y8]	E[y9]	E[y10]	E[y11]	E[y12]	E[y]
Estimation 1 - Currency "Low Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Slight Increase"	1	5,792,329	5,284,099	5,908,755	5,775,331	6,027,521	5,891,415	6,148,674	6,210,160	6,069,931	6,334,985	6,191,937	6,462,318	**72,097,453**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,054,098	1,178,708	1,116,894	1,165,665	1,139,343	1,147,492	1,158,967	1,132,797	1,153,701	1,127,649	1,176,890	**13,707,688**
	5	570,267	520,231	581,730	550,995	575,055	562,070	565,812	571,471	558,566	568,676	555,835	580,107	**6,760,815**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	**107,887,834**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,244,000	1,888,700	1,907,587	1,155,998	1,167,558	1,179,233	1,191,026	1,202,936	1,214,965	2,045,191	2,065,643	2,503,560	**19,766,397**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	14,728,653	16,303,622	14,995,991	15,619,923	15,297,410	15,505,453	15,660,508	15,337,157	16,354,630	16,036,019	17,000,763	**189,126,575**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,638,710	2,294,802	2,436,233	2,470,720	2,478,951	2,342,144	2,710,627	2,646,103	2,506,596	2,911,000	2,772,539	2,885,187	**31,093,612**
Estimation 2 - Currency "Low Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Dramatic Decrease"	y	E[y1]	E[y2]	E[y3]	E[y4]	E[y5]	E[y6]	E[y7]	E[y8]	E[y9]	E[y10]	E[y11]	E[y12]	E[y]
	1	5,792,329	5,284,099	5,908,755	5,775,331	6,027,521	5,891,415	6,148,674	6,210,160	6,069,931	6,334,985	6,191,937	6,462,318	**72,097,453**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,054,098	1,178,708	1,150,345	1,200,577	1,173,467	1,274,368	1,287,112	1,258,048	1,308,795	1,279,241	1,335,102	**14,655,344**
	5	570,267	520,231	581,730	567,721	592,511	579,132	629,250	635,543	621,192	646,223	631,631	659,212	**7,234,643**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	**107,887,834**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,244,000	1,888,700	1,907,587	1,155,998	1,167,558	1,179,233	1,191,026	1,202,936	1,214,965	2,045,191	2,065,643	2,503,560	**19,766,397**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	14,728,653	16,303,622	15,306,651	15,943,508	15,614,315	16,632,729	16,799,056	16,452,197	17,640,582	17,296,920	18,337,521	**197,342,200**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,638,710	2,294,802	2,436,233	2,210,237	2,207,734	2,076,426	1,773,665	1,699,771	1,579,432	1,857,688	1,739,026	1,785,747	**24,299,471**

All quantities are in the unit of TL

Natural Gas Cost Analysis - FullACQ - Alternative 1 (Sheet 2/4)														
Estimation 3 - Currency "Low Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Slight Increase"	**y**	**E[y1]**	**E[y2]**	**E[y3]**	**E[y4]**	**E[y5]**	**E[y6]**	**E[y7]**	**E[y8]**	**E[y9]**	**E[y10]**	**E[y11]**	**E[y12]**	**E[y]**
	1	5,792,329	5,284,099	5,908,755	5,775,331	6,027,521	5,891,415	6,148,674	6,210,160	6,069,931	6,334,985	6,191,937	6,462,318	**72,097,453**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,054,098	1,178,708	1,116,894	1,165,665	1,139,343	1,147,492	1,158,967	1,132,797	1,153,701	1,127,649	1,176,890	**13,707,688**
	5	570,267	520,231	581,730	550,995	575,055	562,070	565,812	571,471	558,566	568,676	555,835	580,107	**6,760,815**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	11,013,110	11,380,214	11,380,214	11,013,110	11,380,214	11,013,110	11,380,214	**123,193,237**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,244,000	1,888,700	1,907,587	1,155,998	1,167,558	1,179,233	1,191,026	1,202,936	1,214,965	2,045,191	2,065,643	2,503,560	**19,766,397**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	14,728,653	16,303,622	14,995,991	15,619,923	15,297,410	15,505,453	15,660,508	15,337,157	16,354,630	16,036,019	17,000,763	**189,126,575**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,638,710	2,294,802	2,436,233	2,470,720	2,478,951	4,487,762	4,927,765	4,863,241	4,652,213	5,128,138	4,918,156	5,102,325	**46,399,015**
Estimation 4 - Currency "Low Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Dramatic Decrease"	**y**	**E[y1]**	**E[y2]**	**E[y3]**	**E[y4]**	**E[y5]**	**E[y6]**	**E[y7]**	**E[y8]**	**E[y9]**	**E[y10]**	**E[y11]**	**E[y12]**	**E[y]**
	1	5,792,329	5,284,099	5,908,755	5,775,331	6,027,521	5,891,415	6,148,674	6,210,160	6,069,931	6,334,985	6,191,937	6,462,318	**72,097,453**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,054,098	1,178,708	1,150,345	1,200,577	1,173,467	1,274,368	1,287,112	1,258,048	1,308,795	1,279,241	1,335,102	**14,655,344**
	5	570,267	520,231	581,730	567,721	592,511	579,132	629,250	635,543	621,192	646,223	631,631	659,212	**7,234,643**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	11,013,110	11,380,214	11,380,214	11,013,110	11,380,214	11,013,110	11,380,214	**123,193,237**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,013,000	1,694,275	1,711,218	1,036,998	1,047,368	1,057,842	1,068,420	1,079,104	1,089,895	1,834,657	1,853,004	2,245,840	**17,731,621**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	14,728,653	16,303,622	15,306,651	15,943,508	15,614,315	16,632,729	16,799,056	16,452,197	17,640,582	17,296,920	18,337,521	**197,342,200**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,407,710	2,100,377	2,239,864	2,091,238	2,087,545	4,100,652	3,868,197	3,793,077	3,599,979	3,864,292	3,672,004	3,745,166	**37,570,098**

All quantities are in the unit of TL

Natural Gas Cost Analysis - FullACQ - Alternative 1 (Sheet 3/4)														
Estimation 5 - Currency "High Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Slight Increase"	**y**	**E[y1]**	**E[y2]**	**E[y3]**	**E[y4]**	**E[y5]**	**E[y6]**	**E[y7]**	**E[y8]**	**E[y9]**	**E[y10]**	**E[y11]**	**E[y12]**	**E[y]**
	1	5,792,329	5,414,893	6,204,887	6,214,895	6,646,830	6,657,551	7,120,251	7,369,460	7,381,346	7,894,350	7,907,082	8,456,625	**83,060,500**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,080,190	1,237,782	1,201,901	1,285,433	1,287,507	1,328,812	1,375,321	1,377,539	1,437,686	1,440,005	1,540,085	**15,747,743**
	5	570,267	533,108	610,885	592,931	634,140	635,163	655,219	678,151	679,245	708,657	709,800	759,131	**7,766,697**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	**107,887,834**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,244,000	1,935,450	2,003,191	1,243,981	1,287,521	1,332,584	1,379,224	1,427,497	1,477,460	2,548,618	2,637,820	3,276,172	**22,793,518**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	15,093,224	17,120,721	16,137,345	17,224,824	17,286,728	17,955,534	18,583,977	18,650,766	20,380,343	20,477,943	22,247,292	**217,445,143**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,638,710	2,146,744	2,099,100	1,983,857	1,792,177	1,493,570	1,691,049	1,429,528	1,132,317	1,372,043	1,084,257	947,796	**19,811,148**
Estimation 6 - Currency "High Rise" / BOTAŞ Tariff "No Rise" / Oil and Oil Products "Dramatic Decrease"	**y**	**E[y1]**	**E[y2]**	**E[y3]**	**E[y4]**	**E[y5]**	**E[y6]**	**E[y7]**	**E[y8]**	**E[y9]**	**E[y10]**	**E[y11]**	**E[y12]**	**E[y]**
	1	5,792,329	5,414,893	6,204,887	6,214,895	6,646,830	6,657,551	7,120,251	7,369,460	7,381,346	7,894,350	7,907,082	8,456,625	**83,060,500**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,080,190	1,237,782	1,237,899	1,323,933	1,326,068	1,475,736	1,527,387	1,529,850	1,630,957	1,633,587	1,747,121	**16,905,993**
	5	570,267	533,108	610,885	610,930	653,390	654,444	728,681	754,184	755,401	805,292	806,591	862,649	**8,345,822**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	9,163,076	8,867,493	9,163,076	8,867,493	9,163,076	**107,887,834**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,244,000	1,935,450	2,003,191	1,243,981	1,287,521	1,332,584	1,379,224	1,427,497	1,477,460	2,548,618	2,637,820	3,276,172	**22,793,518**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	15,093,224	17,120,721	16,471,650	17,581,657	17,644,843	19,260,935	19,935,068	20,006,712	21,982,835	22,088,109	23,996,580	**227,468,779**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,638,710	2,146,744	2,099,100	1,703,549	1,493,094	1,193,297	606,033	306,537	4,838	59,457	-235,535	-490,937	**11,524,887**

All quantities are in the unit of TL

Natural Gas Cost Analysis - FullACQ - Alternative 1 (Sheet 4/4)														
Estimation 7 - Currency "High Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Slight Increase"	**y**	**E[y1]**	**E[y2]**	**E[y3]**	**E[y4]**	**E[y5]**	**E[y6]**	**E[y7]**	**E[y8]**	**E[y9]**	**E[y10]**	**E[y11]**	**E[y12]**	**E[y]**
	1	5,792,329	5,414,893	6,204,887	6,214,895	6,646,830	6,657,551	7,120,251	7,369,460	7,381,346	7,894,350	7,907,082	8,456,625	**83,060,500**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,080,190	1,237,782	1,201,901	1,285,433	1,287,507	1,328,812	1,375,321	1,377,539	1,437,686	1,440,005	1,540,085	**15,747,743**
	5	570,267	533,108	610,885	592,931	634,140	635,163	655,219	678,151	679,245	708,657	709,800	759,131	**7,766,697**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	11,013,110	11,380,214	11,380,214	11,013,110	11,380,214	11,013,110	11,380,214	**123,193,237**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,244,000	1,935,450	2,003,191	1,243,981	1,287,521	1,332,584	1,379,224	1,427,497	1,477,460	2,548,618	2,637,820	3,276,172	**22,793,518**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	15,093,224	17,120,721	16,137,345	17,224,824	17,286,728	17,955,534	18,583,977	18,650,766	20,380,343	20,477,943	22,247,292	**217,445,143**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,638,710	2,146,744	2,099,100	1,983,857	1,792,177	3,639,187	3,908,187	3,646,666	3,277,935	3,589,181	3,229,874	3,164,934	**35,116,552**
Estimation 8 - Currency "High Rise" / BOTAŞ Tariff "Rise" / Oil and Oil Products "Dramatic Decrease"	**y**	**E[y1]**	**E[y2]**	**E[y3]**	**E[y4]**	**E[y5]**	**E[y6]**	**E[y7]**	**E[y8]**	**E[y9]**	**E[y10]**	**E[y11]**	**E[y12]**	**E[y]**
	1	5,792,329	5,414,893	6,204,887	6,214,895	6,646,830	6,657,551	7,120,251	7,369,460	7,381,346	7,894,350	7,907,082	8,456,625	**83,060,500**
	2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	3	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	4	1,155,483	1,080,190	1,237,782	1,237,899	1,323,933	1,326,068	1,475,736	1,527,387	1,529,850	1,630,957	1,633,587	1,747,121	**16,905,993**
	5	570,267	533,108	610,885	610,930	653,390	654,444	728,681	754,184	755,401	805,292	806,591	862,649	**8,345,822**
	6	9,163,076	8,276,327	9,163,076	8,867,493	9,163,076	11,013,110	11,380,214	11,380,214	11,013,110	11,380,214	11,013,110	11,380,214	**123,193,237**
	7	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	8	2,244,000	1,935,450	2,003,191	1,243,981	1,287,521	1,332,584	1,379,224	1,427,497	1,477,460	2,548,618	2,637,820	3,276,172	**22,793,518**
	9	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	10	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	11	16,286,445	15,093,224	17,120,721	16,471,650	17,581,657	17,644,843	19,260,935	19,935,068	20,006,712	21,982,835	22,088,109	23,996,580	**227,468,779**
	Surplus	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	P/L	2,638,710	2,146,744	2,099,100	1,703,549	1,493,094	3,338,915	2,823,171	2,523,675	2,150,455	2,276,595	1,910,082	1,726,201	**26,830,290**

All quantities are in the unit of TL

A.4.1 Summary of gas cost differences

Difference between Gas Sales Revenue and Gas Purchase Cost

FullACQ

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	31,093,612	34,657,048	22,569,902	28,444,802	38,781,819
Est 2	24,299,471	27,597,987	16,630,326	21,650,662	29,977,783
Est 3	46,399,015	66,018,257	21,100,251	28,444,802	66,775,587
Est 4	37,570,098	58,959,196	15,160,675	19,615,886	57,971,551
Est 5	19,811,148	3,767,949	27,960,382	33,164,850	12,565,221
Est 6	11,524,887	-4,867,088	20,733,978	24,878,589	1,835,405
Est 7	35,116,552	35,129,158	26,490,731	33,164,850	40,558,989
Est 8	26,830,290	26,494,121	19,264,327	24,878,589	29,829,173

MinStart Safe

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	25,163,999	29,113,180	20,008,652	24,194,546	25,163,999
Est 2	18,908,479	22,952,901	14,570,139	18,196,188	18,908,479
Est 3	38,557,038	56,407,808	18,587,753	24,194,546	38,557,038
Est 4	30,673,699	50,247,529	13,149,240	16,580,145	30,673,699
Est 5	15,033,985	1,913,754	24,675,374	28,476,742	15,033,985
Est 6	7,352,681	-5,662,310	18,019,033	21,115,284	7,352,681
Est 7	28,427,024	29,208,381	23,254,476	28,476,742	28,427,024
Est 8	20,745,721	21,632,318	16,598,134	21,115,284	20,745,721

Balanced Safe

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	25,045,810	30,839,395	19,032,186	24,044,070	35,077,665
Est 2	19,697,169	24,802,445	13,982,464	18,365,048	27,341,425
Est 3	37,159,299	57,532,453	17,749,327	24,044,070	59,545,266
Est 4	30,182,767	51,495,503	12,699,606	16,737,156	51,809,025
Est 5	16,021,956	3,981,514	23,500,619	28,057,819	11,630,504
Est 6	9,484,365	-3,436,720	17,343,397	21,112,408	2,162,623
Est 7	28,135,446	30,674,572	22,217,760	28,057,819	36,098,105
Est 8	21,597,854	23,256,338	16,060,539	21,112,408	26,630,224

MaxStart Safe

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	24,403,492	29,722,185	19,057,054	23,363,394	33,461,829
Est 2	19,685,192	24,195,427	14,081,541	18,146,507	26,555,093
Est 3	34,875,610	53,761,927	17,819,338	23,363,394	55,994,458
Est 4	28,550,981	48,235,168	12,843,825	16,550,767	49,087,722
Est 5	15,382,100	5,010,228	22,112,897	27,025,778	11,495,899
Est 6	9,655,830	-1,754,291	16,054,255	20,669,676	3,068,940
Est 7	25,854,218	29,049,970	20,875,181	27,025,778	34,028,527
Est 8	20,127,948	22,285,451	14,816,539	20,669,676	25,601,569

All quantities are in the unit of TL

A.4.2 Calculation of other costs

A.4.2.1 Summary of license costs

Licence Costs						
FullACQ		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Licence Fee	16,226	18,390	14,364	16,226	21,303
	Part. Fee 1	110,110	126,431	95,522	108,786	146,338
	Part. Fee 2	110,821	126,878	95,996	109,496	146,338
	Part. Fee 3	117,763	142,112	95,522	108,786	161,282
	Part. Fee 4	117,456	142,559	95,996	108,479	161,282
	Part. Fee 5	118,628	127,390	110,025	125,305	151,245
	Part. Fee 6	119,497	127,935	110,604	126,174	151,245
	Part. Fee 7	126,281	143,071	110,025	125,305	166,190
	Part. Fee 8	127,150	143,616	110,604	126,174	166,190
Balanced Safe		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Licence Fee	13,140	16,019	12,373	13,805	18,885
	Part. Fee 1	89,113	110,473	82,093	92,490	130,110
	Part. Fee 2	89,752	110,894	82,519	93,129	130,110
	Part. Fee 3	95,170	123,819	82,093	92,490	143,203
	Part. Fee 4	94,995	124,241	82,519	92,315	143,203
	Part. Fee 5	96,087	111,383	94,502	106,568	134,372
	Part. Fee 6	96,871	111,899	95,024	107,352	134,372
	Part. Fee 7	102,144	124,729	94,502	106,568	147,465
	Part. Fee 8	102,927	125,246	95,024	107,352	147,465
MinStart Safe		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Licence Fee	13,419	15,401	12,768	13,662	18,039
	Part. Fee 1	90,920	106,045	84,963	91,815	124,391
	Part. Fee 2	91,622	106,486	85,435	92,511	124,391
	Part. Fee 3	97,616	119,692	84,963	91,815	137,506
	Part. Fee 4	97,505	120,133	85,435	91,703	137,506
	Part. Fee 5	98,909	106,978	98,314	106,727	129,021
	Part. Fee 6	99,772	107,519	98,895	107,583	129,021
	Part. Fee 7	105,605	120,625	98,314	106,727	142,135
	Part. Fee 8	106,469	121,166	98,895	107,583	142,135
MaxStart Safe		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Licence Fee	13,419	15,569	12,745	13,657	18,158
	Part. Fee 1	90,282	107,137	84,239	91,191	124,858
	Part. Fee 2	90,880	107,536	84,638	91,789	124,858
	Part. Fee 3	95,518	119,157	84,239	91,191	136,878
	Part. Fee 4	95,313	119,556	84,638	90,991	136,878
	Part. Fee 5	96,193	107,996	95,743	104,169	128,395
	Part. Fee 6	96,923	108,483	96,230	104,899	128,395
	Part. Fee 7	101,429	120,016	95,743	104,169	140,415
	Part. Fee 8	102,159	120,503	96,230	104,899	140,415

All quantities are in the unit of TL

A.4.2.2. Summary of taxes

Stamp Tax					
y	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
ct1	646,536	0	0	0	646,536
ct2	0	1,101,357	0	0	1,101,357
ct3	0	0	0	0	0
cs1	0	0	0	0	0
cs2	63,653	0	0	63,653	0
cr1	1,022,777	1,022,777	0	0	1,022,777
cr2	0	0	1,487,380	1,487,380	0
cr3	0	0	0	0	0
st1	0	0	130,648	0	130,648
ss1	0	312,840	0	0	312,840
sr1	0	0	0	0	0
TOPLAM	**866,483**	**1,218,487**	**809,014**	**775,516**	**1,607,079**

All quantities are in the unit of TL

A.4.2.3. Summary of capacity reservation fees

Capacity Reservation Fee					
y	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
ct1	0	0	0	0	0
ct2	0	0	0	0	0
ct3	0	0	0	0	0
cs1	0	0	0	0	0
cs2	0	0	0	0	0
cr1	993,474	993,474	0	0	993,474
cr2	0	0	1,747,778	1,747,778	0
cr3	222,250	0	0	222,250	0
st1	0	0	0	0	0
ss1	0	0	0	0	0
sr1	127,500	127,500	127,500	127,500	127,500
TOPLAM	**1,343,223**	**1,120,974**	**1,875,278**	**2,097,527**	**1,120,974**

All quantities are in the unit of TL

A.4.2.4. Calculation of deficiency cost

Deficiency Cost Calculation Sheet - FullACQ (Sheet 1/2)

			1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
Estimation 1	Alternative 1	subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		ct1	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct2	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct3	0	0	0	0	0	0	0	0	0	0	0	0	0
		cs1	0	0	0	0	0	0	0	0	0	0	0	0	0
		cs2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr1	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative 2	subtotal	**223,513**	**213,048**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**189,389**	**337,549**	**963,499**
		ct1	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct2	101,099	96,097	0	0	0	0	0	0	0	0	81,024	163,223	441,442
		ct3	11,846	12,386	0	0	0	0	0	0	0	0	13,925	16,831	54,988
		cs1	15,426	14,713	0	0	0	0	0	0	0	0	13,271	22,322	65,732
		cs2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr1	95,142	89,852	0	0	0	0	0	0	0	0	81,170	135,174	401,337
		cr2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative 3	subtotal	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
		ct1	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct2	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct3	0	0	0	0	0	0	0	0	0	0	0	0	0
		cs1	0	0	0	0	0	0	0	0	0	0	0	0	0
		cs2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr1	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr3	0	0	0	0	0	0	0	0	0	0	0	0	0

All quantities are in the unit of TL

Deficiency Cost Calculation Sheet - FullACQ (Sheet 2/2)

			1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
Estimation 1	Alternative 4	subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct1	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct2	0	0	0	0	0	0	0	0	0	0	0	0	0
		ct3	0	0	0	0	0	0	0	0	0	0	0	0	0
		cs1	0	0	0	0	0	0	0	0	0	0	0	0	0
		cs2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr1	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr3	0	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative 5	subtotal	401,093	364,533	62,076	26,129	19,796	27,960	20,193	19,943	16,315	63,263	367,338	527,394	1,916,033
		ct1	89,934	81,783	16,460	6,607	4,870	6,740	4,968	5,018	4,294	17,647	89,435	122,461	450,216
		ct2	151,176	136,998	14,794	5,316	2,503	2,954	2,086	2,503	2,922	14,794	127,850	209,672	673,569
		ct3	17,714	17,658	5,297	4,061	5,019	8,122	5,736	5,019	2,825	5,297	21,972	21,620	120,340
		cs1	0	0	0	0	0	0	0	0	0	0	0	0	0
		cs2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr1	142,269	128,094	25,525	10,145	7,404	10,145	7,404	7,404	6,273	25,525	128,080	173,640	671,907
		cr2	0	0	0	0	0	0	0	0	0	0	0	0	0
		cr3	0	0	0	0	0	0	0	0	0	0	0	0	0

All quantities are in the unit of TL

Deficiency Costs						
FullACQ		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Def 1	0	963,499	0	0	1,916,033
	Def 2	0	968,284	0	0	1,916,033
	Def 3	0	1,072,385	0	0	2,092,974
	Def 4	0	1,077,170	0	0	2,092,974
	Def 5	0	974,428	0	0	1,990,320
	Def 6	0	980,633	0	0	1,990,320
	Def 7	0	859,801	0	0	1,766,168
	Def 8	0	1,089,519	0	0	2,167,261
Balanced Safe		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Def 1	0	74,562	0	0	410,771
	Def 2	0	75,317	0	0	410,771
	Def 3	0	89,821	0	0	453,010
	Def 4	0	90,576	0	0	453,010
	Def 5	0	76,296	0	0	428,034
	Def 6	0	77,285	0	0	428,034
	Def 7	0	91,555	0	0	470,273
	Def 8	0	92,544	0	0	470,273
MinStart Safe		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Def 1	65,790	589,685	0	161,426	1,056,672
	Def 2	66,767	595,188	0	163,507	1,056,672
	Def 3	72,913	711,566	0	161,426	1,232,253
	Def 4	73,142	717,068	0	161,934	1,232,253
	Def 5	76,639	601,816	0	209,133	1,135,007
	Def 6	77,907	608,949	0	211,828	1,135,007
	Def 7	83,762	723,697	0	209,133	1,310,588
	Def 8	85,031	730,830	0	211,828	1,310,588
MaxStart Safe		Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
	Def 1	69,981	496,938	0	152,235	930,861
	Def 2	69,981	496,938	0	152,235	930,861
	Def 3	69,981	496,938	0	152,235	930,861
	Def 4	69,219	496,938	0	150,731	930,861
	Def 5	70,346	497,362	0	153,884	934,114
	Def 6	70,346	497,362	0	153,884	934,114
	Def 7	70,346	497,362	0	153,884	934,114
	Def 8	70,346	497,362	0	153,884	934,114

All quantities are in the unit of TL

Other Costs

FullACQ					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Est 1	2,319,816	3,429,391	2,779,814	2,981,829	4,790,423
Est 2	2,320,527	3,434,623	2,780,288	2,982,540	4,790,423
Est 3	2,327,469	3,553,957	2,779,814	2,981,829	4,982,308
Est 4	2,327,162	3,559,189	2,780,288	2,981,523	4,982,308
Est 5	2,328,334	3,441,279	2,794,317	2,998,349	4,869,618
Est 6	2,329,203	3,448,029	2,794,896	2,999,217	4,869,618
Est 7	2,335,987	3,342,333	2,794,317	2,998,349	4,660,411
Est 8	2,336,856	3,572,595	2,794,896	2,999,217	5,061,504

MinStart Safe					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Est 1	2,366,415	3,035,191	2,769,255	3,126,285	3,909,115
Est 2	2,368,095	3,041,134	2,769,727	3,129,062	3,909,115
Est 3	2,380,235	3,170,719	2,769,255	3,126,285	4,097,811
Est 4	2,380,353	3,176,662	2,769,727	3,126,681	4,097,811
Est 5	2,385,254	3,048,255	2,782,606	3,188,903	3,992,080
Est 6	2,387,386	3,055,929	2,783,186	3,192,454	3,992,080
Est 7	2,399,074	3,183,783	2,782,606	3,188,903	4,180,776
Est 8	2,401,206	3,191,457	2,783,186	3,192,454	4,180,776

Balanced Safe					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Est 1	2,298,819	2,524,495	2,766,384	2,965,534	3,268,934
Est 2	2,299,458	2,525,672	2,766,810	2,966,173	3,268,934
Est 3	2,304,876	2,553,101	2,766,384	2,965,534	3,324,266
Est 4	2,304,701	2,554,278	2,766,810	2,965,359	3,324,266
Est 5	2,305,793	2,527,140	2,778,794	2,979,612	3,290,458
Est 6	2,306,577	2,528,645	2,779,316	2,980,395	3,290,458
Est 7	2,311,850	2,555,745	2,778,794	2,979,612	3,345,791
Est 8	2,312,633	2,557,251	2,779,316	2,980,395	3,345,791

MaxStart Safe					
	Alt 1	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Est 1	2,369,970	2,943,536	2,768,531	3,116,469	3,783,772
Est 2	2,370,568	2,943,935	2,768,930	3,117,067	3,783,772
Est 3	2,375,206	2,955,556	2,768,531	3,116,469	3,795,792
Est 4	2,374,238	2,955,955	2,768,930	3,114,766	3,795,792
Est 5	2,376,245	2,944,820	2,780,034	3,131,096	3,790,562
Est 6	2,376,975	2,945,306	2,780,521	3,131,827	3,790,562
Est 7	2,381,481	2,956,839	2,780,034	3,131,096	3,802,582
Est 8	2,382,211	2,957,326	2,780,521	3,131,827	3,802,582

All quantities are in the unit of TL

Overall Profit / Loss Summary

FullACQ					
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	28,773,795	31,227,657	19,790,088	25,462,973	33,991,396
Est 2	21,978,944	24,163,364	13,850,039	18,668,122	25,187,360
Est 3	44,071,546	62,464,300	18,320,437	25,462,973	61,793,278
Est 4	35,242,936	55,400,007	12,380,387	16,634,363	52,989,242
Est 5	17,482,814	326,670	25,166,065	30,166,501	7,695,602
Est 6	9,195,684	-8,315,117	17,939,083	21,879,371	-3,034,213
Est 7	32,780,565	31,786,825	23,696,414	30,166,501	35,898,578
Est 8	24,493,434	22,921,526	16,469,432	21,879,371	24,767,669

MinStart Safe					
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	22,797,583	26,077,989	17,239,397	21,068,261	21,254,883
Est 2	16,540,384	19,911,766	11,800,412	15,067,126	14,999,363
Est 3	36,176,802	53,237,089	15,818,498	21,068,261	34,459,227
Est 4	28,293,347	47,070,866	10,379,513	13,453,464	26,575,888
Est 5	12,648,732	-1,134,501	21,892,768	25,287,839	11,041,905
Est 6	4,965,296	-8,718,239	15,235,846	17,922,829	3,360,601
Est 7	26,027,951	26,024,599	20,471,870	25,287,839	24,246,248
Est 8	18,344,515	18,440,861	13,814,948	17,922,829	16,564,944

Balanced Safe					
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	22,746,990	28,314,900	16,265,802	21,078,536	31,808,732
Est 2	17,397,711	22,276,772	11,215,654	15,398,876	24,072,491
Est 3	34,854,423	54,979,353	14,982,943	21,078,536	56,221,000
Est 4	27,878,066	48,941,225	9,932,795	13,771,798	48,484,760
Est 5	13,716,163	1,454,374	20,721,825	25,078,207	8,340,046
Est 6	7,177,788	-5,965,365	14,564,081	18,132,013	-1,127,835
Est 7	25,823,596	28,118,827	19,438,966	25,078,207	32,752,314
Est 8	19,285,221	20,699,087	13,281,223	18,132,013	23,284,433

MaxStart Safe					
	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
Est 1	22,033,522	26,778,649	16,288,523	20,246,924	29,678,057
Est 2	17,314,624	21,251,492	11,312,612	15,029,440	22,771,321
Est 3	32,500,404	50,806,371	15,050,807	20,246,924	52,198,666
Est 4	26,176,743	45,279,214	10,074,896	13,436,001	45,291,930
Est 5	13,005,855	2,065,409	19,332,862	23,894,682	7,705,336
Est 6	7,278,855	-4,699,597	13,273,734	17,537,850	-721,622
Est 7	23,472,737	26,093,131	18,095,146	23,894,682	30,225,945
Est 8	17,745,737	19,328,125	12,036,018	17,537,850	21,798,986

All quantities are in the unit of TL

AUTHOR'S BACKGROUND

Alper Acartürk was born in 1985 in Ankara. He has graduated from Middle East Technical University, Department of Electrical and Electronics Engineering in 2009. He has started his professional business life in 2009 at Turcas Petrol, responsible from natural gas and electricity trade operations. In 2010, he has transferred to SOCAR & Turcas Agean Refinery (STAR) Project as project electrical engineer. After his compulsory military service in 2012 as a reserve officer assigned as integrated test engineer, he has returned to natural gas sector with duty of operations senior specialist responsible from contracts and portfolio optimization in Batı Hattı Natural Gas Trade.