Annual Gas Balancing Planning for 2016

April 2015

1. Introduction

The present plan is developed in terms of Paragraph 2.c of Article 68 of the Law 4001/2011 that assigns liability to the Hellenic Gas Transmission System Operator (DESFA) S.A. for load balancing of the National Natural Gas System (NNGS) and according to the provisions in the Article 46 of the Network Code for the regulation of Natural Gas System (hereafter 'Code'), referring to the Annual Gas Balancing Planning and the Operational Gas Offsetting.

In terms of paragraph 1.A of Article 46 of the Code, the Operator submits to the Regulatory Authority of Energy (RAE) the Annual Gas Balancing Planning for the following Year (as well as any amendment) that is approved by RAE and published by the Operator. Furthermore, in accordance with the provisions of paragraph 1.C of Article 46 of the Code, the Operator proposes to RAE with regards of the NNGS part booked by the Operator for Gas Balancing.

Under the aforementioned competence and in accordance with the provisions of paragraph 2.c. Article 68 of Law 4001/2011, the Operator may conclude, following a tender procedure, and through transparent, non-discriminatory and market-based rules contracts with Suppliers for the purchase and delivery of Natural Gas for Gas Balancing purposes, under the approved (by RAE) Annual Gas Balancing Planning. In accordance with paragraph 2 of Article 46 of the Code, the Annual Gas Balancing Planning includes in particular: (a) Forecasts of the Operator for the development of Natural Gas demand per category of Customers with regards to the existing Transmission Capacity of the Transmission System, (b) forecast with regards to the necessary Quantities of Natural Gas for Gas Balancing, such as the total annual Quantity of Natural Gas for Balancing, the estimated allocation thereof during the Year, the maximum Supply and the maximum daily Quantity of Natural Gas for Balancing and (c) determination of the required characteristics of the Balancing Agreement or combination of Balancing Agreements that the Operator must enter.

In accordance with paragraph 3 of Article 46 of the Code, for the development of the Annual Gas Balancing Planning, the Operator takes into consideration particularly the NNGS Development Plan, the total demand of Natural Gas served via the National Natural Gas Transmission System (NNGTS), the geographic distribution of consumptions, the elimination of technical limitations concerning the operation of the System and, particularly, each event that has lead, or is going to lead, as per its discretion to a congestion, Emergency, access denial or Transit prohibition, the maintenance requirements of the NNGS components, the existing Natural Gas Transmission Agreements, the existing LNG Facility Usage Agreements, as well as the Connected System Agreements entered.

2. Balancing Gas

Balancing Gas is the quantity of Natural Gas injected into the NNGTS by the Operator during a specified time period in order to reach balance between the Deliveries and Off-takes of Natural Gas in that time period and to ensure the reliable, safe and efficient operation of NNGS. In terms of its competency and liability, the Operator secures the aforementioned balance, taking into consideration the losses and the stored quantities of Natural Gas in the NNGTS.

The Operator undertakes Balancing Actions so as to:

a) maintain the Transmission Network within its operational limits; and

b) achieve a state of storage in the Transmission Network pipeline other than the predicted according to the expected Deliveries and Off-takes in that Gas Day, which is consistent with the economic and efficient operation of the Transmission Network.

When performing Balancing Acts, the Operator takes into account the following:

a) its estimations about the Natural Gas demand;

b) the Daily Nominations of the Transmission Users as well as information about the allocated and measured Natural Gas quantities; and

c) the Natural Gas pressure in the NNGTS.

3. Forecast for Natural Gas demand in Year 2016

Taking into consideration the NNGS Development Study for the period 2015-2024, the historical data of Natural Gas consumption in the NNGTS, the Users' estimation about the Natural Gas demand for the Year 2016 and the expected completion dates of the ongoing and planned expansion projects in the NNGTS, it is estimated that the Natural Gas consumption will be at **3.863 mil. Nm^3** in Year 2016. The estimated Natural Gas demand per consumer category is presented in more detail in Table 1.

2016	Power Production (Nm^3)	Other Consumers (Nm^3)	Total Consumption (Nm^3)
January	156,678,014	197,162,917	353,840,931
February	174,400,625	167,327,473	341,728,098
March	194,089,948	156,843,515	350,933,463
April	199,411,676	100,802,933	300,214,609
May	219,268,691	95,826,178	315,094,869

June	165,300,133	98,170,122	263,470,255
July	263,250,474	96,052,511	359,302,985
August	200,679,864	80,803,087	281,482,952
September	187,146,448	102,966,474	290,112,922
October	168,626,126	111,880,637	280,506,763
November	262,050,421	135,233,163	397,283,584
December	134,403,003	194,738,869	329,141,872
Total	**2,325,305,423**	**1,537,807,880**	**3,863,113,303**

Table 1: Forecast of Natural Gas demand per consumer category in Year 2016

4. Natural Gas Balancing Quantities

During the Year 2015 as well as in the previous Years, the calculation of the Balancing Gas is performed outturn on a Daily basis, as the difference between the total quantity of Natural Gas measured at the NNGTS Entry Point 'AGIA TRIADA' during each Day and the total quantity of Natural Gas which was nominated to be injected to the NNGTS through the said Point during the same Day on behalf of all Transmission Users who had booked Delivery Transmission Capacity at the above Entry Point.

In Diagram 1 below, the Monthly Quantities of Balancing Gas that were injected into the NNGTS within the period 04/2012 – 03/2015 are shown, as a percentage of the respective Monthly Natural Gas Off-Takes.

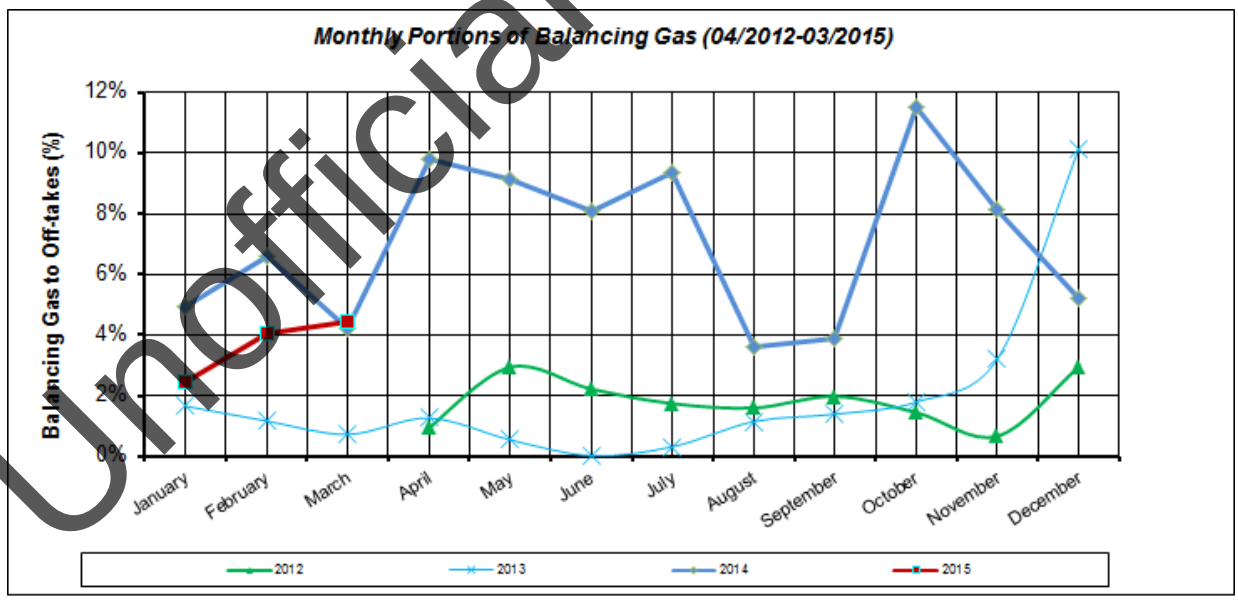

Diagram 1: Monthly Portions of Balancing Gas to Total Natural Gas Off-takes in the period 04/2012 –03/2015

Taking the above into consideration, so as DESFA to extract as an (as possible) reliable estimation about the Balancing Gas Quantity that will be required during the Year 2015, the

methodology described below was followed:

- Calculation ***of the average participation rates of Balancing Gas to Natural Gas Off-Takes*** ($\overline{x\%}$) ***for the sample of thirty-six (36) values of Balancing Gas for each Month of the period 04/2012 - 03/2015 (see Annex 2).*** The results of this calculation are presented in Table 2 below:

Month	$\overline{(x)\%}$
January	3.01
February	3.94
March	3.12
April	4.00
May	4.21
June	3.45
July	3.81
August	2.12
September	2.42
October	4.92
November	4.02
December	6.10

Table 2

- Calculation of the estimated Balancing Gas for each Month of the Year 2016 by multiplying the average participation rate of the Balancing Gas and the respective Monthly Natural Gas Off-Takes during the period of 04/2012-03/2015 (see Table 2 above) with the Operator's estimations about the Monthly Natural Gas Off-Takes in the NNGTS during the Year 2016 (see Table 1 above).

Taking into consideration the above methodology, the Operator's estimation for the Monthly distribution of Balancing Gas in Year 2016 is calculated and listed in Table 3 – an overall Table with the Operator's forecast for the Monthly demand of Natural Gas per consumption category and estimation for the Balancing Gas in Year 2016 is given in Annex 1.

Finally, taking into consideration the NNGS Development Study for the years 2015-2024, it is estimated **that the maximum Daily consumption in Year 2016 will be 17,548,468 Nm^3 (approximately 200,760 MWh).**

Month in 2016	Balancing Gas (Nm^3)[1]	Balancing Gas (MWh)
January	10,650,612	121,843
February	13,464,087	154,029
March	10,949,124	125,258
April	12,008,584	137,378
May	13,265,494	151,757
June	9,089,724	103,986
July	13,689,444	156,607
August	5,967,439	68,268
September	7,020,733	80,317
October	13,800,933	157,883
November	15,970,800	182,706
December	20,077,654	229,688
Total	**145,954,628**	**1,669,720**

Table 3: Estimation of the Balancing Gas quantities allocation in Year 2016

5. NNGS capacity booking for Gas Balancing in 2016

During the Year 2015 as well as in the previous Years, the NNGTS balancing needs were covered by the Entry Point 'AGIA TRIADA'. For the Year 2016 the Operator taking into account:

i. the topology and the construction characteristics of the NNGTS;

ii. the Technical, Booked and Available Capacity of the NNGTS Entry Points;

iii. the geographic allocation of the Users Natural Gas Off-takes in the NNGTS;

iv. the evolution of the NNGS expansion and upgrade projects',

v. the connection of new consumers in the south part of the NNGTS; and

vi. The availability of Balancing Gas procurement from more than one Suppliers,

proposes the continuation of the Balancing Gas injection via the same Entry Point (i.e. 'AGIA TRIADA').

The Operator, taking into account the strong variation of the required Daily Balancing Gas quantities during a Year, proposes the methodology of determining the part of the NNGS Capacity that should be booked for Gas Balancing during the Year 2016, considering the

[1] *For the conversion of volume units (Nm^3) to energy units (MWh) the flow-weighted average Gross Calorific Value for the Year 2014 was used, i.e. 11.44 MWh / 1000 Nm^3.*

NNGS efficient and economic operation and the improvement of the level of provided Transmission and LNG Facility Use services to Users. Below, the estimated maximum Daily quantity of Balancing Gas per Month of the Year 2016 is estimated, taking into account the seasonal variations shown, based on historical data, that size and accordingly determines the Re-gasification Capacity of LNG Facility and the Delivery Transmission Capacity that should be booked in the Entry Point 'AGIA TRIADA' for Gas Balancing purposes per Month of the Year 2016. In this way the part of the NNGS that needs to be booked for Balancing Gas purposes during the said Year is estimated with the utmost precision and the available, for the NNGS Users, Transmission and Regasification Capacity is maximized.

The Operator, taking into account the historical data of thirty-six (36) Months (see Annex 3) of the period from 04/2012 to 03/2015 and correlating the maximum Daily Balancing Gas Quantity per Month with the corresponding sum of the Users Booked Transmission Capacity, proposes the application of the following methodology for the calculation of the Monthly Booked Re-gasification Capacity of LNG Facility and the Delivery Transmission Capacity in the Entry Point 'AGIA TRIADA' for Gas Balancing during the Year 2016:

$$\Delta E_{M,2016} = OA_{M,2016} * E\Delta M_{M,2016}$$ [2]

where:

- $OA_{M,2016} = \dfrac{\dfrac{AQ_{E\Xi(\max)_{M,2014}}}{\Delta M_{M,2014}} + \dfrac{AQ_{E\Xi(\max)_{M,2013}}}{\Delta M_{M,2013}} + \dfrac{AQ_{E\Xi(\max)_{M,2012}}}{\Delta M_{M,2012}}}{3}$;
- $AQ_{E\Xi(\max)_{M,Y}}$: the maximum Daily Balancing Gas Quantity (MWh/Day) used by the Operator during the Month M of the Year Y;
- $\Delta M_{M,Y}$: the sum of the Booked Reception Transmission Capacity (MWh/Day) that was booked by all Users, according to the Transmission Contracts that had been concluded with the Operator, during the Day of the maximum Daily Balancing Gas Quantity in the Month M of the Year Y; and
- $E\Delta M_{M,2016} = \dfrac{(\Delta M_{M,2014} + \Delta M_{M,2013} + \Delta M_{M,2012})}{3}$.

Based on the above methodology, the Operator proposes the Monthly Booking of the Re-gasification Capacity of LNG Facility ($\Delta E_{M,2015}$) and equal Transmission Capacity at the corresponding Entry Point 'AGIA TRIADA' for Gas Balancing purposes during the Year 2016, according to the following Table 4:

Month of the Year 2016	Monthly Re-gasification Capacity of LNG Facility Booking and equal Transmission Capacity at the corresponding Entry Point 'AGIA TRIADA' ($\Delta E_{M,2015}$) (MWh/Day)
January	**28,585.440**
February	**22,250.247**
March	**16,225.257**
April	**26,335.085**
May	**19,676.822**
June	**12,412.101**
July	**31,431.262**
August	**15,527.846**
September	**16,412.303**
October	**18,445.836**
November	**31,683.040**
December	**28,630.026**

Table 4

6. Gas Balancing Agreement

Aiming at the orderly, economical and efficient operation of the NNGS during the Year 2016, the Operator will conclude a framework agreement with Natural Gas suppliers, which will be chosen after an international bid, as it is defined in paragraph 2.c of Article 68 of the Law 4001/2011 and in paragraph 2 of Article 47 of the Code, for the supply of Balancing Gas during the period 01.01.2016 08:00 – 01.01.2017 08:00.

The supply of Balancing Gas will take place in the context of a request fulfillment of the Operator to supply Balancing Gas issued by the Operator to the prequalified Suppliers. The choice of the supplier will be based on criteria that will be specified in the framework agreement and relate, among others, with the lower supply price offered and the fulfillment of the Operator's request in terms of the LNG

[2] *For the calculation of the Monthly Booked Re-gasification Capacity of LNG Facility for the Months January to March of the Year*

quantity and the delivery date.

Furthermore, taking into consideration:

- the restricted LNG Facility Storage;
- the continuously increasing demand (from Users' sides) for access to the LNG Facility;
- the requirements in Code and particularly in Chapter 11 for the terms of access to the LNG Facility (Temporary LNG Storage Period, Minimum Re-gasification Capacity); and
- the size of LNG vessels that are available in the LNG Market;

in the framework agreement for the LNG supply for Gas Balancing purposes, the authority of the Operator to specify the LNG quantity and its time delivery will be established, so that the smooth operation of the Greek Natural Gas market is not upset, in accordance with the requirements of the Code. Given the lack of confirmation of the Operator's estimations about the required Natural Gas Quantities for balancing purposes for the Year 2016 and the procedure of choosing the final Supplier, the abovementioned agreement will not contain imposing restrictions such as minimum supply quantity or payment clauses irrespective of LNG off-takes.

2016 the historical data of the corresponding Months of the Years 2015, 2014 and 2013 was taken into account.

ANNEX 1

Operator's forecast for Monthly Demand of Natural Gas per Consumption Category and Estimation of Balancing Gas in Year 2016

2016	Power Generation	Other Consumers	Total Consumption		Balancing Gas	
	Nm^3	Nm^3	Nm^3	MWh	Nm^3	MWh
January	156,678,014	197,162,917	353,840,931	4,047,940	10,650,612	121,843
February	174,400,625	167,327,473	341,728,098	3,909,369	13,464,087	154,029
March	194,089,948	156,843,515	350,933,463	4,014,679	10,949,124	125,258
April	199,411,676	100,802,933	300,214,609	3,434,455	12,008,584	137,378
May	219,268,691	95,826,178	315,094,869	3,604,685	13,265,494	151,757
June	165,300,133	98,170,122	263,470,255	3,014,100	9,089,724	103,986
July	263,250,474	96,052,511	359,302,985	4,110,426	13,689,444	156,607
August	200,679,864	80,803,087	281,482,952	3,220,165	5,967,439	68,268
September	187,146,448	102,966,474	290,112,922	3,318,892	7,020,733	80,317
October	168,626,126	111,880,637	280,506,763	3,208,997	13,800,933	157,883
November	262,050,421	135,233,163	397,283,584	4,544,924	15,970,800	182,706
December	134,403,003	194,738,869	329,141,872	3,765,383	20,077,654	229,688
Total	**2,325,305,423**	**1,537,807,880**	**3,863,113,303**	**44,194,016**	**145,954,628**	**1,669,720**

Note:

For the conversion from volume units (Nm^3) to energy units (MWh), the flow-weighted average of the Gross Calorific Value for the Year 2014, 11.44 MWh /1,000 Nm^3, was used.

ANNEX 2

Historical Data of Balancing Gas in the period 04/2012-03/2015

Year	Month	Balancing Gas (MWh)	Total Natural Gas Off-takes (MWh)
2012	April	28,012	2,987,063
2012	May	94,858	3,221,059
2012	June	65,280	2,939,329
2012	July	68,602	3,931,588
2012	August	51,433	3,216,331
2012	September	67,153	3,392,642
2012	October	47,074	3,256,661
2012	November	22,637	3,370,714
2012	December	143,331	4,859,392
2013	January	72,030	4,338,906
2013	February	43,303	3,704,069
2013	March	23,036	3,170,101
2013	April	33,604	2,663,735
2013	May	15,163	2,764,231
2013	June	733	3,450,947
2013	July	12,128	3,797,580
2013	August	40,536	3,529,914
2013	September	46,614	3,343,058
2013	October	54,734	3,047,919
2013	November	97,268	3,022,643
2013	December	478,531	4,726,813
2014	January	190,417	3,872,371
2014	February	226,574	3,447,859
2014	March	116,535	2,778,722
2014	April	233,828	2,387,452
2014	May	169,081	1,852,339
2014	June	177,268	2,188,495
2014	July	244,848	2,611,102
2014	August	77,925	2,151,066
2014	September	87,247	2,252,278
2014	October	244,825	2,126,091
2014	November	235,136	2,880,373
2014	December	169,023	3,225,548
2015	January	88,157	3,604,697
2015	February	124,483	3,059,056
2015	March	123,982	2,787,440

ANNEX 3

Historical Data of the Maximum Balancing Gas Quantity and the Booked Reception Transmission Capacity of Users

Month	Year	Maximum Balancing Gas Quantity (MWh/Day)	Sum of Booked Reception Transmission Capacity of all Users during the Day of the Maximum Balancing Gas Quantity (MWh/Day)
Januray	2013	21,359.393	345,420.059
	2014	34,618.181	204,051.000
	2015	22,403.849	237,284.175
February	2013	11,063.306	224,425.170
	2014	30,180.088	175,252.000
	2015	22,190.280	201,680.861
March	2013	9,317.808	207,891.000
	2014	18,605.522	158,241.299
	2015	18,742.249	174,709.615
April	2012	7,525.117	263,889.237
	2013	5,850.678	195,756.000
	2014	35,570.048	96,729.800
May	2012	18,105.618	306,529.529
	2013	14,114.170	187,689.000
	2014	16,652.215	102,048.800
June	2012	12,737.126	282,106.059
	2013	172.271	213,083.000
	2014	16,943.989	125,416.000
July	2012	18,356.632	343,545.755
	2013	11,096.858	212,938.000
	2014	34,592.621	107,557.000
August	2012	19,662.496	343,230.755
	2013	10,160.157	212,708.000
	2014	12,099.019	119,185.000
September	2012	19,835.461	327,976.059
	2013	9,482.776	196,914.000
	2014	14,825.781	122,964.000
October	2012	7,383.802	281,791.059
	2013	13,631.348	196,802.000
	2014	23,752.580	136,268.140
November	2012	7,396.172	281,791.059
	2013	42,074.206	211,310.000
	2014	33,585.641	157,920.300
December	2012	25,959.609	302,105.059
	2013	30,555.324[3]	236,603.000
	2014	25,530.572	177,042.600

[3] *It is noted that the Balancing Gas Quantity required on 12.12.2013, i.e. 71,976.300 MWh, was not taken into consideration due to Early Warning situation in the NNGS during the said Day. The Balancing Gas Quantity required on 05.12.2013, i.e. 30,555.324 MWh, was used for the calculations.*