Annual Gas Balancing Planning for 2017

April 2016

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 gas 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 that is approved by RAE and published under the Operator's responsibility. 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 2017

Taking into consideration the NNGS Development Study for the period 2016-2025, the historical data of Natural Gas consumption in the NNGTS, the Users' estimation about the Natural Gas demand for the Year 2017 and the expected completion date of the ongoing and planned expansion projects in the NNGTS, it is estimated that the Natural Gas consumption will be at **3.292 mil. Nm^3** at the Year 2017. The estimated Natural Gas demand per consumer category is presented in more detail in Table 1.

2017	Power Production (Nm^3)	Other Consumers (Nm^3)	Total Consumption (Nm^3)
January	231,055,680	180,454,818	411,510,498
February	142,011,636	155,646,283	297,657,919
March	118,487,809	139,948,879	258,436,688
April	82,414,636	80,037,579	162,452,215
May	125,781,460	69,722,582	195,504,042
June	154,070,090	64,553,469	218,623,559
July	206,801,968	70,959,927	277,761,895
August	198,826,911	61,324,956	260,151,867
September	182,627,984	76,839,513	259,467,497
October	158,712,144	86,530,680	245,242,824
November	179,563,598	102,318,381	281,881,979
December	241,457,023	181,731,174	423,188,197
Total	***2,021,810,939***	***1,270,068,241***	***3,291,879,180***

Table 1: Forecast of Natural Gas demand per consumer category in Year 2017

4. Natural Gas Balancing Quantities

During the Year 2016 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 Balancing Gas Quantities that were injected into the NNGTS within the period 04/2013 – 03/2016 are shown, as a percentage of the respective Monthly Natural Gas Off-Takes.

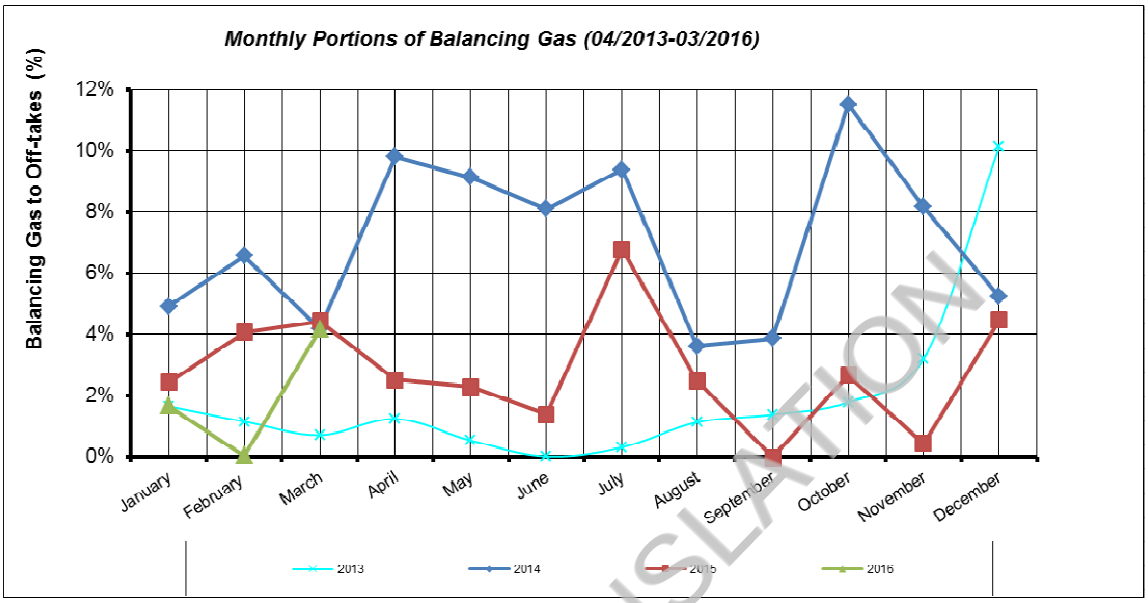

Diagram 1: Monthly Portions of Balancing Gas to Total Natural Gas Off-takes in the period 04/2013 –03/2016

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 2017, 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 04/2013 - 03/2016 (see Annex 2). The results of this calculation are presented in Table 2 below:

Month	$\overline{(x)}\%$
January	3.01
February	3.56
March	4.27
April	4.53
May	3.99
June	3.17
July	5.5
August	2.42
September	1.76
October	5.33
November	3.95
December	6.61

Table 2

- Calculation of the estimated Balancing Gas for each Month of the Year 2017 by multiplying the average participation rate of the Balancing Gas and the respective Monthly Natural Gas Off-Takes during the period of 04/2013-03/2016 (see Table 2 above) with the Operator's estimations about the Monthly Natural Gas Off-Takes in the NNGTS during the Year 2017 (see Table 1 above).

Taking into consideration the above methodology, the Operator's estimation for the Monthly distribution of Balancing Gas in Year 2017 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 2017 is given in Annex 1.

Finally, taking into consideration the Operator's Natural Gas demand estimation for the Year 2017, it is estimated **that the maximum Daily consumption in Year 2017 will be 17,855,496 Nm^3 (approximately 205,520 MWh).**

Month in 2017	Balancing Gas (Nm^3)[1]	Balancing Gas (MWh)
January	12,386,466	142,568
February	10,596,622	121,967
March	11,035,247	127,016
April	7,359,085	84,703
May	7,800,611	89,785
June	6,930,367	79,769
July	15,276,904	175,837
August	6,295,675	72,463
September	4,566,628	52,562
October	13,071,443	150,452
November	11,134,338	128,156
December	27,972,740	321,966
Total	**134,426,126**	**1,547,244**

Table 3: Estimation of the Balancing Gas quantities allocation in Year 2017

5. NNGS capacity booking for Gas Balancing in 2017

During the Year 2016 (as well as in the previous Years), the NNGTS balancing needs were covered by the Entry Point 'AGIA TRIADA'. For the Year 2017 the Operator taking into account:

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

[1] *For the conversion of volume units (Nm^3) to energy units (MWh) the flow-weighted average Gross Calorific Value for the Year 2015 was used, i.e. 11.51 MWh / 1000 Nm^3.*

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 2017, considering the 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 2017 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 2017. 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 04/2013 to 03/2016 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 2017:

$$\Delta E_{M,2017} = OA_{M,2017} * E\Delta M_{M,2017}$$ [2]

where:

[2] *For the calculation of the Monthly Booked Re-gasification Capacity of LNG Facility for the Months January to March of the Year 2017 the historical data of the corresponding Months of the Years 2016, 2015 and 2014 was taken into account.*

- $OA_{M,2017} = \dfrac{\dfrac{AQ_{\text{EΞ(max)}_{M,2015}}}{\Delta \text{M}_{M,2015}} + \dfrac{AQ_{\text{EΞ(max)}_{M,2014}}}{\Delta \text{M}_{M,2014}} + \dfrac{AQ_{\text{EΞ(max)}_{M,2013}}}{\Delta \text{M}_{M,2013}}}{3}$;

- $AQ_{\text{EΞ(max)}_{M,Y}}$: the maximum Daily Balancing Gas Quantity (MWh/Day) used by the Operator during the Month M of the Year Y;

- $\Delta \text{M}_{\text{M,Y}}$: 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

- $\text{E}\Delta \text{M}_{M,2017} = \dfrac{(\Delta \text{M}_{M,2015} + \Delta \text{M}_{M,2014} + \Delta \text{M}_{M,2013})}{3}$.

Based on the above methodology, the Operator proposes the Monthly Booking of the Re-gasification Capacity of LNG Facility ($\Delta \text{E}_{M,2017}$) and equal Transmission Capacity at the corresponding Entry Point 'AGIA TRIADA' for Gas Balancing purposes during the Year 2017, 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' ($\Delta \text{E}_{M,2017}$) (MWh/Day)
January	**25,111,921**
February	**17,174,838**
March	**20,342,683**
April	**26,888,598**
May	**14,877,853**
June	**11,560,580**
July	**29,542,200**
August	**17,144,043**
September	**8,956,584**
October	**20,155,111**

November	**27,070,509**
December	**29,734,874**

Table 4

6. Gas Balancing Agreement

Aiming at the orderly, economical and efficient operation of the NNGS during the Year 2017, 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 01.01.2017 08:00 – 01.01.2018 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 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 2017 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.

ANNEX 1

Operator's forecast for Monthly Demand of Natural Gas per Consumption Category and Estimation of Balancing Gas in Year 2017

2017	Power Generation	Other Consumers	Total Consumption		Balancing Gas	
	Nm^3	Nm^3	Nm^3	MWh	Nm^3	MWh
January	231,055,680	180,454,818	411,510,498	4,736,486	12,386,466	142,568
February	142,011,636	155,646,283	297,657,919	3,426,043	10,596,622	121,967
March	118,487,809	139,948,879	258,436,688	2,974,606	11,035,247	127,016
April	82,414,636	80,037,579	162,452,215	1,869,825	7,359,085	84,703
May	125,781,460	69,722,582	195,504,042	2,250,252	7,800,611	89,785
June	154,070,090	64,553,469	218,623,559	2,516,357	6,930,367	79,769
July	206,801,968	70,959,927	277,761,895	3,197,039	15,276,904	175,837
August	198,826,911	61,324,956	260,151,867	2,994,348	6,295,675	72,463
September	182,627,984	76,839,513	259,467,497	2,986,471	4,566,628	52,562
October	158,712,144	86,530,680	245,242,824	2,822,745	13,071,443	150,452
November	179,563,598	102,318,381	281,881,979	3,244,462	11,134,338	128,156
December	241,457,023	181,731,174	423,188,197	4,870,896	27,972,740	321,966
Total	***2,021,810,939***	***1,270,068,241***	***3,291,879,180***	**37,889,530**	**134,426,126**	**1,547,244**

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 2015, 11.51 MWh /1,000 Nm^3, was used.

ANNEX 2

Historical Data of Balancing Gas in the period 04/2013-03/2016

Year	Month	Balancing Gas (MWh)	Total Natural Gas Off-takes (MWh)
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
2013	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
2015	April	51,037	2,023,024
2015	May	37,943	1,656,990
2015	June	22,813	1,635,570
2015	July	208,034	3,063,913
2015	August	60,826	2,438,362
2015	September	0	2,558,138
2015	October	94,938	3,535,893
2015	November	13,451	2,965,947
2015	December	214,260	4,793,191
2016	January	75,015	4,458,886
2016	February	1,454	3,002,898
2016	March	131,067	3,143,819

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	2014	34,618,181	204,051,000
	2015	22,403,849	237,284,175
	2016	17,822,103	202,560,240
February	2014	30,180,088	175,252,000
	2015	22,190,280	201,680,861
	2016	955,569	159,780,820
March	2014	18,605,522	158,241,299
	2015	18,742,249	174,709,615
	2016	22,917,471	140,134,730
April	2013	5,850,678	195,756,000
	2014	35,570,048	96,729,800
	2015	22,109,353	160,692,815
May	2013	14,114,170	187,689,000
	2014	16,652,215	102,048,800
	2015	9,801,407	156,597,785
June	2013	172,271	213,083,000
	2014	16,943,989	125,416,000
	2015	156,597,785	143,191,815
July	2013	11,096,858	212,938,000
	2014	34,592,621	107,557,000
	2015	28,547,658	138,710,185
August	2013	10,160,157	212,708,000
	2014	12,099,019	119,185,000
	2015	24,592,738	135,671,815
September	2013	9,482,776	196,914,000
	2014	14,825,781	122,964,000
	2015	0	0
October	2013	13,631,348	196,802,000
	2014	23,752,580	136,268,140
	2015	19,948,877	158,517,925
November	2013	42,074,206	211,310,000
	2014	33,585,641	157,920,300
	2015	10,265,328	125,961,945
December	2013	30,555.324[3]	236,603,000
	2014	25,530,572	177,042,600
	2015	32,000,601	177,113,495

[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.*