DESFA
Hellenic Gas Transmission System Operator S.A.

April 2018

# Annual Gas Balancing Planning for the Year 2019

## 1. Introduction

The present plan is developed in terms of Paragraph 2.γ of Article 68 of the Law 4001/2011 according to which the Operator of National Natural Gas System (DESFA S.A.) (hereafter 'Operator') is responsible for balancing of the National Natural Gas System (NNGS) as defined in the NNGS Network Code (hereinafter 'Code') and the provisions of Article 46 of the Annual Gas Balancing Planning.

In terms of paragraph 1 of Article 46 of the Code, the Operator submits to the Regulatory Authority of Energy (RAE) the Annual Gas Balancing Planning for the next Year, which, as well as each modification thereof shall be approved by RAE and published at the Operator's responsibility.

Within the framework of its above-mentioned competence and in accordance with the provisions of Chapter 8 of the Code, the Operator shall undertake Balancing Actions through (a) the purchase and sale of Balancing Gas in the form of Short Term Standard Products (hereinafter STSPs) auctioned at the Operator's Balancing Platform and / or (b) use of Balancing Services through Balancing Services Agreements that may be concluded by the Operator, either following a relevant tender, either in accordance with the provision of paragraph 1 of Article 91 of the Law 4001/2011, with Users or third parties concerning the supply and delivery of Balancing Gas Quantities to the NNGS, following the approval by RAE of the Annual Gas Balancing Planning.

According to 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 Balancing Gas Quantities, such as the total annual Quantity of Natural Gas for Balancing for sale/purchase, the estimated allocation thereof during the Year and the forecast of the Quantity that is expected to be covered by using Balancing Services, and (c) the specification of the required contract characteristics or the combination of contracts required to be concluded by the Operator, at its discretion, to provide Balancing Services, and (d) estimation about the capacity of NNGS that may be used by the Operator for Balancing.

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 serviced via the National Natural Gas Transmission System (NNGTS), the geographical distribution of consumptions, the elimination of technical limitations affecting the operation of the System and, especially, each event that has led to, or may lead to, in its estimation, congestion of Emergency Level Crises, the maintenance requirements of the NNGS sections, the existing Gasification Capacity and Transmission Capacity at Entry and Exit Points, relevant historical data, as well as the criteria of the provision

of paragraph 2 of Article 8 of Regulation (EU) No 312/2014.

## 2. Gas Balancing

Balancing Gas is considered to be the Natural Gas required for the gas balancing of NNGTS. The Balancing Gas Quantity is injected / discharged to / from the NNGTS over a specific period of time in order to balance the Natural Gas Deliveries with Receptions (during the same period of time) in order to ensure in each case the reliable, safe and efficient operation of the NNGS.

The Operator undertakes Balancing Actions to:

a) maintain the Transmission Network within its operational limits, which concern the minimum and the maximum NNGTS Linepack within the range of 20.5 and 26 million $Nm^3$, respectively, at the end of the Day; and / or

b) achieve a state of storage in the NNGTS Linepack within the range of [22.3 – 24.3] million $Nm^3$, in order to ensure the cost-effective and efficient operation of the NNGTS during the Day.

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

1. its estimations about the Natural Gas demand;
2. the most recent data on Confirmed Natural Gas Deliveries and Receptions of Transmission Users at the NNGTS Entry and Exit Points, respectively;
3. the most recent measurement data;
4. the prevailing NNGTS pressure, and
5. the ability of NNGTS storage capacity.



## 3. Estimation of Natural Gas demand in Year 2019

For the estimation of the Natural Gas demand for the Year 2019, the high demand scenario for the specific Year was taken into account, as referred in the NNGS Development Plan for the Years 2018-2027, due to the high positive deviations observed in the first quarter of 2019 and therefore it is estimated that the Natural Gas consumption will be at **4.214 mil. $Nm^3$** in the Year 2019. The estimated Natural Gas demand per consumer category is presented in more detail in Table 1.

| 2019 | Power Production ($Nm^3$) | Rest Consumers ($Nm^3$) | Total Consumption ($Nm^3$) |
|---|---|---|---|
| **January** | 257,685,672 | 202,706,722 | 460,392,394 |
| **February** | 197,078,897 | 143,466,500 | 340,545,397 |
| **March** | 216,729,578 | 148,879,626 | 365,609,204 |

| | | | |
|---|---|---|---|
| **April** | 169,437,688 | 97,497,496 | 266,935,184 |
| **May** | 211,183,364 | 73,057,929 | 284,241,293 |
| **June** | 228,501,560 | 66,139,502 | 294,641,062 |
| **July** | 236,465,334 | 87,220,641 | 323,685,975 |
| **August** | 244,951,149 | 88,923,133 | 333,874,283 |
| **September** | 246,004,214 | 112,068,733 | 358,072,946 |
| **October** | 205,041,612 | 123,131,599 | 328,173,211 |
| **November** | 210,136,132 | 146,708,858 | 356,844,990 |
| **December** | 286,493,784 | 214,329,469 | 500,823,253 |
| **Total** | **2,709,708,985** | **1,504,130,207** | **4,213,839,192** |

*Table 1: Forecast of Natural Gas demand per consumer category in Year 2019*

It is noted that the abovementioned quantities do not include the forecast of the Development Plan for the reverse flow quantities. through the Reverse Flow Exit Point 'Sidirokastro'.

## 4. Balancing Gas Quantities

During the previous Years and the first quarter of the Year 2018, the Balancing Gas Quantity was calculated on a daily basis, as the difference between the total Daily Natural Gas Quantity measured at the NNGTS Entry Point 'AGIA TRIADA' and the total Natural Gas Quantity that was confirmed to be injected in the NNGTS by the Operator, via the abovementioned Entry Point, during the same Day on behalf of all Transmission Users that had booked Transmission Capacity at the specific Entry Point.

In Diagram 1 below the following are presented: (a) Monthly Gas Quantities purchased by the Operator and injected to the NNGTS at the period 01/2016 – 03/2018 and (b) the estimation of the Operator regarding the Monthly Balancing Gas Quantities for sale, so as to preserve the Natural Gas Linepack Quantity in the NNGTS lower than 24.3 mil. $Nm^3$, through Short Term Standard Products in Balancing Platform during the specific period, as a percentage of the respective Monthly Natural Gas Receptions.

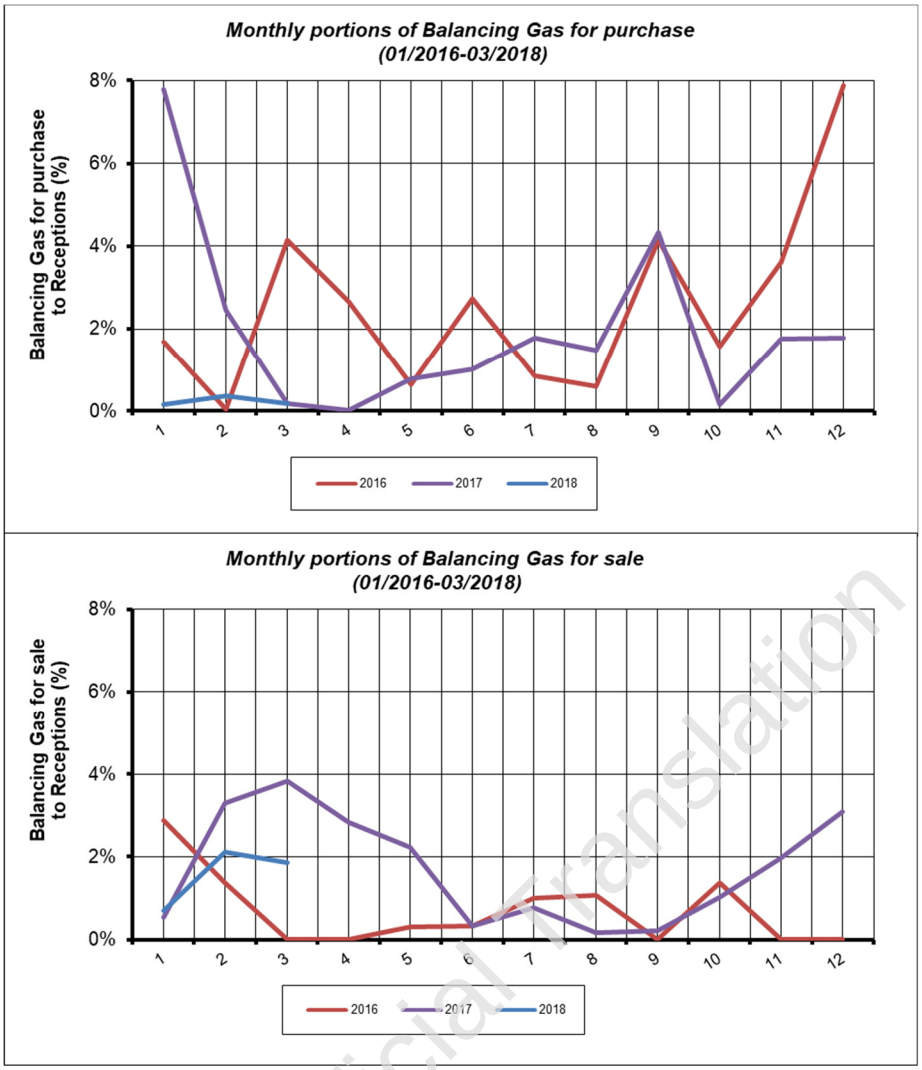


*Diagram 1: Monthly Portions of Balancing Gas Quantities to Natural Gas Receptions for the period 01/2016 – 03/2018*



Considering the above, and in order for the Operator to extract as reliably as possible an estimation of the necessary Balancing Gas Quantities for purchase and sale required for each Month of the Year 2019, applied the following methodology:

- Calculation of the average of the percentages of Balancing Gas Quantities at the Natural Gas Receptions $\overline{(x)}\%$ for the sample of twenty-seven (27) values for each Month of the period 01/2016 – 03/2018 (see Annex 2). The results of those calculations in case of Balancing Gas Quantities sale and purchase are presented in Table 2.

| Month | Balancing Gas Purchase $\overline{(x)}\%$ | Balancing Gas Sale $\overline{(x)}\%$ |
|---|---|---|
| January | 3.21 | 1.38 |
| February | 0.95 | 2.27 |
| March | 1.54 | 1.90 |
| April | 1.34 | 1.42 |
| May | 0.71 | 1.26 |
| June | 1.87 | 0.33 |
| July | 1.32 | 0.88 |
| August | 1.05 | 0.62 |
| September | 4.25 | 0.11 |
| October | 0.87 | 1.20 |
| November | 2.68 | 0.99 |
| December | 4.83 | 1.55 |

*Table 2*

- Calculation of estimated Balancing Gas Quantities for sale and purchase for every Month of the Year 2019, as the average of Balancing Gas Quantities participation rate in the respective Monthly Natural Gas Receptions for the period 01/2016 – 03/2018 (see Table 2 above) multiplied with the Operator estimation of the corresponding NNGTS Monthly Natural Gas Receptions for the Year 2019 (see Table 1 above).

Taking into consideration the above methodology, the Operator's estimations for the Monthly distribution of Balancing Gas in Year 2019 are presented in Table 3[1] below – an overall Table with the Operator's estimation for the Monthly Natural Gas demand per consumption category and estimation of the Balancing Gas in Year 2019 is given in Annex 1.



| **Month of the Year 2019** | **Balancing Gas Purchase (kWh)** | **Balancing Gas Sale (kWh)** |
|---|---|---|
| January | 169,405,235 | 72,828,419 |
| February | 37,084,487 | 88,612,405 |
| March | 64,540,376 | 79,627,737 |
| April | 41,001,927 | 43,449,804 |
| May | 23,133,384 | 41,053,612 |
| June | 63,158,024 | 11,145,534 |
| July | 48,976,920 | 32,651,280 |
| August | 40,185,180 | 23,728,392 |
| September | 174,443,219 | 4,515,001 |
| October | 32,727,741 | 45,141,712 |
| November | 109,624,607 | 40,495,657 |
| December | 277,284,293 | 88,983,572 |
| **Total** | **1,081,565,393** | **572,233,125** |

*Table 3: Estimation for the Monthly distribution of Balancing Gas purchase and sale for the Year 2019*

*[1] For the conversion of the volume units ($Nm^3$) to energy units (kWh), the weighted (flow) average of the Gross Calorific Value of the Entry Points of the NNGTS for Year 2017 was used, i.e. 11,46 kWh / $Nm^3$*

In accordance with the provisions of Article 44A of the Network Code, the Operator undertakes Balancing Actions through:

1. The purchase and sale of Balancing Gas in the form of Short-term Standard Products (STPSs) through Auctions in the Balancing Platform, and/or
2. The use of Balancing services when the following reasons are met:
    - it was not possible to purchase/sell the required Balancing Gas Quantity through Short-term Standard Products, and/or
    - in its estimation, it is unlikely to purchase/sell the required Balancing Gas Quantity through Short-term Standard Products, and/or
    - in its estimation, the use of these products is not, or is not likely to provide, the necessary response to maintain the Transmission System within its operational limits, and/or
    - due to the urgent need for safe, economical and efficient operation of the NNGS, an auction cannot be conducted.

Based on the above and taking into account:

1. the assumption that the Operator will perform Balancing Actions in the Year 2019 through purchase of Balancing Gas Quantities in the form of Short Term Standard Products, via auctions to the Balancing Platform, provided that the NNGTS Natural Gas Linepack estimation at the end of a Day of the specific Year is in the range of [21.5 – 22.3] mil. $Nm^3$, and
2. the NNGTS Balancing Gas Quantities historical data, of the twenty-seven (27) Months of the period 01/2016 – 03/2018,

the Operator calculated the percentage of the estimated Balancing Gas Quantities expected to be covered through the use of Balancing Services, $X\%$, for Year 2019 on the basis of the following methodology:

$$X\% = \frac{\sum_{i=1}^{n} BG_{service}}{\sum_{j=1}^{k} BG} * 100$$

where:

- $\sum_{i=1}^{n} BG_{service}$ : The sum of Balancing Gas Quantities injected into the NNGTS for each Day (i)

where the NNGTS Natural Gas Linepack was below the level of 21.5 mil. $Nm^3$ at the end of the Day d, when the Balancing Gas injection took place,

- $\sum_{j=1}^{k} BG$: The sum of Balancing Gas Quantities injected into the NNGTS for each Day (j) for of the twenty-seven (27) Months of the period 01/2016 – 03/2018,

- n : the amount of Days of the twenty-seven (27) Months of the period 01/2016 – 03/2018 during which Balancing Gas Quantities were injected into the NNGTS when the NNGTS Natural Gas Linepack was below the level of 21.5 mil. $Nm^3$ at the end of the Day d,

- k : the amount of Days of the twenty-seven (27) Months of the period 01/2016 – 03/2018 during which Balancing Gas Quantities were injected into the NNGTS

Based on the above, it is evident that, during the period 01/2016 – 03/2018, 25% of the Balancing Gas Quantities injected into the NNGTS took place when the NNGTS Natural Gas Linepack was below the level of 21.5 mil. $Nm^3$ at the end of the injection Day.

However, due to the fact that the purchase of Balancing Gas Quantities through STSPs via Balancing Platform will be implemented, according to the No. 123/2018 RAE decision, from 01.07.2018 and therefore no safe conclusions can be drawn, based on historical data, for its contribution to load balancing, the Operator halves the above percentage and ultimately estimate that 40% of the estimated Balancing Gas Quantities for the Year 2019, as represented in Table 3 above, will be covered via Balancing Services by the Operator.



## 5. Balancing Services Agreement

According to RAE decision no 1210/2018 and aiming at the orderly, economical and efficient operation of the NNGS, the Operator will conclude Balancing Service Agreements with Natural Gas suppliers, which will be chosen after an international tender procedure, 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 Year 2019.

## 6. Part of NNGS Capacity for Gas Balancing for the Year 2019

The Operator, taking into account the strong variation of the required Daily Balancing Gas Quantity during a Year, proposes the methodology of determining the part of the NNGS capacity - which according to Section 5 above refers to part of the LNG Facility Re-Gasification Capacity and of the Transmission Capacity for Delivery of the NNGTS Entry Point 'Agia Triada'

- which can be used for Balancing Actions through the use of Balancing Services by the Operator during the Year 2019, based on the efficient and economic operation of the NNGS and improve the level of Transmission and LNG Facility Services to Users.

The Operator, taking into account the historical data of twenty-seven (27) Months (see Annex 3) of the period 01/2016-03/2018, the above mentioned in Section 4 herein, according to which 40% of the estimated Balancing Gas Quantities will be covered by the use of Balancing Services, and correlating the maximum Daily Balancing Gas Quantity per Month with the corresponding sum of the Users' Booked Transmission Capacity for Receptions proposes the application of the following methodology for the calculation of the Monthly NNGS Capacity estimated to be required for Balancing Services by the Operator during the Year 2019:

$$\Delta \mathrm{E}_{M,2019} = 0,4 * (OA_{M,2019} * \mathrm{E}\Delta \mathrm{M}_{M,2019}),$$

where:

- $OA_{M,2019} = \dfrac{\dfrac{AQ_{\mathrm{E}\Xi(\max)_{M,2018}}}{\Delta \mathrm{M}_{M,2018}} + \dfrac{AQ_{\mathrm{E}\Xi(\max)_{M,2017}}}{\Delta \mathrm{M}_{M,2017}} + \dfrac{AQ_{\mathrm{E}\Xi(\max)_{M,2016}}}{\Delta \mathrm{M}_{M,2016}}}{3}$, [2]

- $AQ_{\mathrm{E}\Xi(\max)_{M,Y}}$ : the maximum Daily Balancing Gas Quantity (kWh/Day) of the Month M of the Year Y,

- $\Delta \mathrm{M}_{\mathrm{M,Y}}$ : the sum of the Booked Transmission Capacity for Reception (kWh/Day) that was booked by all Users, during the Day of the injection to the NNGTS of the maximum Daily Balancing Gas Quantity in the Month M of the Year Y; and

- $\mathrm{E}\Delta \mathrm{M}_{M,2019} = \dfrac{(\Delta \mathrm{M}_{M,2018} + \Delta \mathrm{M}_{M,2017} + \Delta \mathrm{M}_{M,2016})}{3}$

Based on the above methodology, the Operator's estimation of the NNGS Capacity that will be required for Gas Balancing is shown on Table 4.



[2] *For the calculation of the Monthly Capacity of the NNGS, for the Year 2018, only historical data for the first quarter of Year 2018 were used.*

| Month of the Year 2019 | NNGS Capacity for Gas Balancing (kWh/Day) |
|---|---|
| **January** | 8,938,120 |
| **February** | 6,207,638 |
| **March** | 4,734,725 |
| **April** | 9,000,390 |
| **May** | 4,905,233 |
| **June** | 5,876,387 |
| **July** | 9,639,986 |
| **August** | 3,988,619 |
| **September** | 9,577,867 |
| **October** | 4,492,892 |
| **November** | 8,263,153 |
| **December** | 12,991,423 |

*Table 4*

## ANNEX 1

## Monthly Estimation of Natural Gas Demand by Consumption Category and Estimation of Balancing Gas Quantities

| 2019 | Power Production | Rest Consumers | Total Consumptions | | Balancing Gas (kWh) | |
|---|---|---|---|---|---|---|
| | $Nm^3$ | $Nm^3$ | $Nm^3$ | kWh | Purchase | Sale |
| January | 257,685,672 | 202,706,722 | 460,392,394 | 5,277,421,637 | 169,405,235 | 72,828,419 |
| February | 197,078,897 | 143,466,500 | 340,545,397 | 3,903,630,186 | 37,084,487 | 88,612,405 |
| March | 216,729,578 | 148,879,626 | 365,609,204 | 4,190,933,536 | 64,540,376 | 79,627,737 |
| April | 169,437,688 | 97,497,496 | 266,935,184 | 3,059,845,328 | 41,001,927 | 43,449,804 |
| May | 211,183,364 | 73,057,929 | 284,241,293 | 3,258,223,136 | 23,133,384 | 41,053,612 |
| June | 228,501,560 | 66,139,502 | 294,641,062 | 3,377,434,415 | 63,158,024 | 11,145,534 |
| July | 236,465,334 | 87,220,641 | 323,685,975 | 3,710,372,696 | 48,976,920 | 32,651,280 |
| August | 244,951,149 | 88,923,133 | 333,874,283 | 3,827,160,023 | 40,185,180 | 23,728,392 |
| September | 246,004,214 | 112,068,733 | 358,072,946 | 4,104,546,334 | 174,443,219 | 4,515,001 |
| October | 205,041,612 | 123,131,599 | 328,173,211 | 3,761,809,332 | 32,727,741 | 45,141,712 |
| November | 210,136,132 | 146,708,858 | 356,844,990 | 4,090,470,424 | 109,624,607 | 40,495,657 |
| December | 286,493,784 | 214,329,469 | 500,823,253 | 5,740,875,623 | 277,284,293 | 88,983,572 |
| ***Total*** | **2,709,708,985** | **1,504,130,207** | **4,213,839,192** | **48,302,722,670** | **1,081,565,393** | **572,233,125** |



**Note:**

For the conversion of the volume units (Nm3) to energy units (kWh), the weighted (flow) average of the Gross Calorific Value of the Entry Points of the NNGTS for Year 2017 was used, i.e. 11,46 kWh / $Nm^3$.

## ANNEX 2

## Historical data of Balancing Gas Quantities for the period 01/2016 – 03/2018

| Year | Month | Balancing Gas Quantity (kWh) | Total Natural Gas Reception (kWh) |
|---|---|---|---|
| 2016 | January | 74,820,058 | 4,447,322,732 |
| 2016 | February | 1,450,052 | 2,995,110,685 |
| 2016 | March | 130,726,921 | 3,143,897,866 |
| 2016 | April | 73,101,674 | 2,747,656,094 |
| 2016 | May | 17,580,300 | 2,729,762,617 |
| 2016 | June | 100,369,361 | 3,686,749,451 |
| 2016 | July | 32,123,024 | 3,738,268,502 |
| 2016 | August | 19,769,897 | 3,248,473,968 |
| 2016 | September | 141,761,030 | 3,412,475,564 |
| 2016 | October | 63,890,982 | 4,034,826,451 |
| 2016 | November | 150,893,630 | 4,184,522,242 |
| 2016 | December | 477,392,332 | 6,050,835,827 |
| 2017 | January | 540,877,969 | 6,946,505,608 |
| 2017 | February | 117,197,361 | 4,781,834,244 |
| 2017 | March | 6,579,382 | 3,588,213,860 |
| 2017 | April | 572,636 | 3,133,727,834 |
| 2017 | May | 26,646,453 | 3,438,797,913 |
| 2017 | June | 42,980,087 | 4,259,273,923 |
| 2017 | July | 78,471,723 | 4,412,217,830 |
| 2017 | August | 68,037,975 | 4,569,288,298 |
| 2017 | September | 175,584,119 | 4,046,320,375 |
| 2017 | October | 5,755,886 | 3,899,478,985 |
| 2017 | November | 89,224,718 | 5,104,160,387 |
| 2017 | December | 95,094,488 | 5,371,047,520 |
| 2018 | January | 8,759,835 | 5,378,022,418 |
| 2018 | February | 16,799,159 | 4,636,666,451 |
| 2018 | March | 10,340,188 | 3,642,557,277 |

## ANNEX 3

### Historical data of maximum Balancing Gas Quantity and the Booked Transmission Capacity for Reception on the Day of maximum Balancing Gas Quantity

| Month | Year | Maximum Balancing Gas Quantity (kWh/Day) | Booked Transmission Capacity on the Day of maximum Balancing Gas Quantity (kWh/Day) |
|---|---|---|---|
| January | 2018 | 2,150,961 | 205,017,055 |
| | 2017 | 47,888,707 | 213,650,808 |
| | 2016 | 17,775,886 | 202,034,949 |
| February | 2018 | 16,137,286 | 210,528,114 |
| | 2017 | 32,237,224 | 197,877,154 |
| | 2016 | 953,091 | 159,366,467 |
| March | 2018 | 3,919,103 | 182,570,523 |
| | 2017 | 4,838,317 | 177,805,116 |
| | 2016 | 22,858,040 | 139,771,325 |
| April | 2017 | 0 | |
| | 2016 | 22,475,843 | 132,358,674 |
| May | 2017 | 13,741,273 | 158,546,110 |
| | 2016 | 10,931,382 | 148,030,927 |
| June | 2017 | 13,952,473 | 194,889,944 |
| | 2016 | 15,091,032 | 163,426,319 |
| July | 2017 | 25,104,674 | 182,194,032 |
| | 2016 | 23,118,868 | 188,574,676 |
| August | 2017 | 10,735,492 | 190,684,505 |
| | 2016 | 9,157,403 | 165,442,157 |
| September | 2017 | 24,784,287 | 187,003,880 |
| | 2016 | 23,092,467 | 173,066,305 |
| October | 2017 | 2,010,327 | 156,281,828 |
| | 2016 | 22,163,419 | 189,325,274 |
| November | 2017 | 20,452,678 | 200,325,577 |
| | 2016 | 20,627,584 | 168,565,191 |
| December | 2017 | 23,644,338 | 220,839,660 |
| | 2016 | 41,634,746 | 230,251,406 |