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# The Worldwide Horizon of the Natural Gas, the Most Important Player in Energy

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ABSTRACT

The natural gas represents a fossil combustible which has as source of apparition leavings of plants, animals and also, microorganisms which were decomposed and sheathed by dust and sediments. Then, this organic matter compressed and penetrated deeper into Earth's crust, met higher temperatures. The symbiosis between compression and high temperatures generates the carbon chains in the organic matter which achieve thermogenic methane-natural gas.



## 1. Introduction

The natural gas represents a primary source of energy both in the economic sectors and in the domestic consumptions. In the economic sectors, the natural gas is practicable in industrial, commercial and transportation aims, respectively for electricity generation. On the other side, the natural gas is useful in the domestic consumptions for to set going any appliance which is used as heating and cooking.

We know a whole family which reunites many types of natural gas, such as: liquefied natural gas, propane, methane, shale gas, butane, ethane, liquefied petroleum gas and compressed natural gas.

In the countries's top management which reflects the natural gas production in 2020, the United States of America are on the first place with 947,7 billions cubic meters, Russia is on the second position with 693,4 billions cubic meters and Iran is on the third place with 253,8 billions cubic meters. In the worldwide leadership which focuses the natural gas consumption in 2020, the first three positions are occupied by the United States of America with 832 billions cubic meters, Russia with 411,4 billions cubic meters and China with 330,6 billions cubic meters. Also in same year, on the podium which symbolizes the prize award in the management concerning the proved natural gas's worldwide reserves, we can see three countries in pole position: Russia with 37,4 trillions cubic meters, Iran with 32,1 trillions cubic meters and Qatar with 24,7 trillions cubic meters.

In the first section of this original statistical approach, we can „savour" the predictions for the proved natural gas's worldwide reserves, between 2022-2025. In the second episode, we can remark the estimations for the natural gas's worldwide productions, in the same horizon of time. In the third part, we can perceive the forecasts for the natural gas's worldwide consumptions, between 2022-2025.

The method of the variation coefficients and the prediction's method are the principal statistical tools which coloured the dynamics of the phenomenons researched in this original statistical approach. Johann Carl Friedrich Gauss was statistical founder who established the „Least Squares Method", a real mechanism which estimates the parameters from any statistical model.

## 2. The prognosis concerning the proved natural gas's worldwide reserves between 2022-2025

**Table 1 The proved natural gas's worldwide reserves between 2010-2020**

| YEARS | THE PROVED NATURAL GAS'S WORLDWIDE RESERVES (quadrillion cubic feet) $(\lambda_i)$ |
|---|---|
| 2010 | 6,64 |
| 2011 | 6,71 |
| 2012 | 6,81 |
| 2013 | 6,85 |
| 2014 | 6,97 |

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| | |
|---|---|
| 2015 | 6,60 |
| 2016 | 6,59 |
| 2017 | 6,83 |
| 2018 | 6,95 |
| 2019 | 7,02 |
| 2020 | 6,64 |

*Source: „Statista Portal the United States of America"*

- if the statistical task forces's portofolio, which explores the tendency associated with $\lambda$ variable, where $\lambda$ = **the proved natural gas's worldwide reserves**, aims a linear model, $\lambda_{t_i} = a + b \cdot t_i$, *a* and *b* will be [1]:

**Table 2 The pictorial values concerning the proved natural gas's worldwide reserves, if these have a linear reflection**

| YEARS | THE PROVED NATURAL GAS'S WORLDWIDE RESERVES (quadrillion cubic feet) $(\lambda_i)$ | LINEAR TENDENCY | | | | |
|---|---|---|---|---|---|---|
| | | $t_i$ | $t_i^2$ | $t_i\lambda_i$ | $\lambda_{t_i} = a + bt_i$ | $\lvert\lambda_i - \lambda_{t_i}\rvert$ |
| **2010** | **6,64** | -5 | 25 | -33,20 | 6,726363638 | 0,09 |
| **2011** | **6,71** | -4 | 16 | -26,84 | 6,737636365 | 0,03 |
| **2012** | **6,81** | -3 | 9 | -20,43 | 6,748909092 | 0,06 |
| **2013** | **6,85** | -2 | 4 | -13,70 | 6,760181819 | 0,09 |
| **2014** | **6,97** | -1 | 1 | -6,97 | 6,771454546 | 0,20 |
| **2015** | **6,60** | 0 | 0 | 0 | 6,782727273 | 0,18 |
| **2016** | **6,59** | +1 | 1 | +6,59 | 6,794000000 | 0,20 |
| **2017** | **6,83** | +2 | 4 | +13,66 | 6,805272727 | 0,03 |
| **2018** | **6,95** | +3 | 9 | +20,85 | 6,816545454 | 0,13 |
| **2019** | **7,02** | +4 | 16 | +28,08 | 6,827818181 | 0,19 |
| **2020** | **6,64** | +5 | 25 | +33,20 | 6,839090908 | 0,20 |
| **TOTAL** | **74,61** | 0 | 110 | 1,24 | | 1,40 |

$$a = \frac{\sum_{i=1}^{n}\lambda_i \sum_{i=1}^{n} t_i^2 - \sum_{i=1}^{n}\lambda_i t_i \sum_{i=1}^{n} t_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{74{,}61 \cdot 110}{11 \cdot 110} = 6{,}782727273 \quad b = \frac{n\sum_{i=1}^{n}\lambda_i t_i - \sum_{i=1}^{n} t_i \sum_{i=1}^{n}\lambda_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{11 \cdot 1{,}24}{11 \cdot 110} = 0{,}011272727$$

$$v_I = \left[\frac{\sum_{i=1}^{n}\lvert\lambda_i - \lambda_{t_i}^I\rvert}{n} : \frac{\sum_{i=1}^{n}\omega_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{n}\lvert\lambda_i - \lambda_{t_i}^I\rvert}{\sum_{i=1}^{n}\lambda_i} \cdot 100 = \frac{1{,}40}{74{,}61} \cdot 100 = 1{,}88\%$$

- if the statistical task forces's portofolio, which explores the tendency associated with $\lambda$ variable, where $\lambda$ = **the proved natural gas's worldwide reserves**, aims a quadratic model, $\lambda_{t_i} = a + b \cdot t_i + ct_i^2$, *a* and *b* will be [1]:

**Table 3 The pictorial values concerning the proved natural gas's worldwide reserves, if these have a quadratic reflection**

| YEARS | THE PROVED NATURAL GAS'S WORLDWIDE RESERVES (quadrillion cubic feet) $(\lambda_i)$ | PARABOLIC TENDENCY | | | | | |
|---|---|---|---|---|---|---|---|
| | | $t_i$ | $t_i^2$ | $t_i^4$ | $t_i^2\lambda_i$ | $\lambda_{t_i} = a + bt_i + ct_i^2$ | $\lvert\lambda_i - \lambda_{t_i}\rvert$ |
| **2010** | **6,64** | -5 | 25 | 625 | 166,00 | 6,686153848 | 0,05 |
| **2011** | **6,71** | -4 | 16 | 256 | 107,36 | 6,721552449 | 0,01 |
| **2012** | **6,81** | -3 | 9 | 81 | 61,29 | 6,751589745 | 0,06 |
| **2013** | **6,85** | -2 | 4 | 16 | 27,40 | 6,776265735 | 0,07 |
| **2014** | **6,97** | -1 | 1 | 1 | 6,97 | 6,795580420 | 0,17 |
| **2015** | **6,60** | 0 | 0 | 0 | 0 | 6,809533800 | 0,21 |
| **2016** | **6,59** | +1 | 1 | 1 | 6,59 | 6,818125874 | 0,23 |
| **2017** | **6,83** | +2 | 4 | 16 | 27,32 | 6,821356643 | 0,01 |
| **2018** | **6,95** | +3 | 9 | 81 | 62,55 | 6,819226107 | 0,13 |
| **2019** | **7,02** | +4 | 16 | 256 | 112,32 | 6,811734265 | 0,21 |
| **2020** | **6,64** | +5 | 25 | 625 | 166,00 | 6,798881118 | 0,16 |
| **TOTAL** | **74,61** | 0 | 110 | 1958 | 743,80 | | 1,31 |

$$a=\frac{\sum_{i=1}^{n}t_i^4\sum_{i=1}^{n}\lambda_i-\sum_{i=1}^{n}t_i^2\sum_{i=1}^{n}t_i^2\cdot\lambda_i}{n\sum_{i=1}^{n}t_i^4-\left(\sum_{i=1}^{n}t_i^2\right)^2}=\frac{1958\cdot 74{,}61-110\cdot 743{,}80}{11\cdot 1958-110^2}=6{,}8095338 \quad b=\frac{\sum_{i=1}^{n}\lambda_i t_i}{\sum_{i=1}^{n}t_i^2}=\frac{1{,}24}{110}=0{,}011272727$$

$$c=\frac{n\cdot\sum_{i=1}^{n}t_i^2\cdot\lambda_i-\sum_{i=1}^{n}t_i^2\cdot\sum_{i=1}^{n}\lambda_i}{n\sum_{i=1}^{n}t_i^4-\left(\sum_{i=1}^{n}t_i^2\right)^2}=\frac{11\cdot 743{,}80-110\cdot 74{,}61}{11\cdot 1958-110^2}=-0{,}002680652681$$

$$v_{II}=\left[\frac{\sum_{i=1}^{n}\left|\lambda_i-\lambda_{t_i}^{II}\right|}{n}:\frac{\sum_{i=1}^{n}\lambda_i}{n}\right]\cdot 100=\frac{\sum_{i=1}^{n}\left|\lambda_i-\lambda_{t_i}^{II}\right|}{\sum_{i=1}^{n}\lambda_i}\cdot 100=\frac{1{,}31}{74{,}61}\cdot 100=1{,}76\%$$

**-** if the statistical task forces's portofolio, which explores the tendency associated with $\lambda$ variable, where $\lambda$ = **the proved natural gas's worldwide reserves**, aims an exponential model, $\lambda_{t_i}=ab^{t_i}$, *a* and *b* will be [1]:

**Table 4 The pictorial values concerning the proved natural gas's worldwide reserves, if these have an exponential reflection**

| YEARS | THE PROVED NATURAL GAS'S WORLDWIDE RESERVES (quadrillion cubic feet) $(\lambda_i)$ | EXPONENTIAL TENDENCY | | | | | |
|---|---|---|---|---|---|---|---|
| | | $t_i$ | $\lg\lambda_i$ | $t_i\lg\lambda_i$ | $\lg\lambda_{t_i}=\lg a+t_i\lg b$ | $\lambda_{t_i}=ab^{t_i}$ | $\left\|\lambda_i-\lambda_{t_i}\right\|$ |
| **2010** | **6,64** | -5 | 0,822168079 | -4,110840397 | 0,827750812 | 6,725906288 | 0,09 |
| **2011** | **6,71** | -4 | 0,826722520 | -3,306890081 | 0,828460669 | 6,736908813 | 0,03 |
| **2012** | **6,81** | -3 | 0,833147111 | -2,499441336 | 0,829170526 | 6,747929336 | 0,06 |
| **2013** | **6,85** | -2 | 0,835690571 | -1,671381143 | 0,829880384 | 6,758967902 | 0,09 |
| **2014** | **6,97** | -1 | 0,843232778 | -0,843232778 | 0,830590242 | 6,770024526 | 0,20 |
| **2015** | **6,60** | 0 | 0,819543935 | 0 | 0,831300100 | 6,781099236 | 0,18 |
| **2016** | **6,59** | +1 | 0,818885414 | +0,818885414 | 0,832009957 | 6,792192048 | 0,20 |
| **2017** | **6,83** | +2 | 0,834420703 | +1,668841407 | 0,832719815 | 6,803303021 | 0,03 |
| **2018** | **6,95** | +3 | 0,841984804 | +2,525954414 | 0,833429673 | 6,814432170 | 0,14 |
| **2019** | **7,02** | +4 | 0,846337112 | +3,385348449 | 0,834139530 | 6,825579509 | 0,19 |
| **2020** | **6,64** | +5 | 0,822168079 | +4,110840397 | 0,834849388 | 6,836745099 | 0,20 |
| **TOTAL** | **74,61** | 0 | 9,144301106 | 0,078084345 | | | 1,41 |

$$\lg a=\frac{\sum_{i=1}^{n}\lg\lambda_i\sum_{i=1}^{n}t_i^2-\sum_{i=1}^{n}t_i\lg\lambda_i\sum_{i=1}^{n}t_i}{n\sum_{i=1}^{n}t_i^2-\left(\sum_{i=1}^{n}t_i\right)^2}=\frac{9{,}144301106\cdot 110}{11\cdot 110}=0{,}8313001$$

$$\lg b=\frac{n\cdot\sum_{i=1}^{n}t_i\lg\lambda_i-\sum_{i=1}^{n}\lg\lambda_i\sum_{i=1}^{n}t_i}{n\sum_{i=1}^{n}t_i^2-\left(\sum_{i=1}^{n}t_i\right)^2}=\frac{11\cdot 0{,}078084345}{11\cdot 110}=0{,}0007098576895$$

$$v_{\exp}=\left[\frac{\sum_{i=1}^{n}\left|\lambda_i-\lambda_{t_i}^{\exp}\right|}{n}:\frac{\sum_{i=1}^{n}\lambda_i}{n}\right]\cdot 100=\frac{\sum_{i=1}^{n}\left|\lambda_i-\lambda_{t_i}^{\exp}\right|}{\sum_{i=1}^{n}\lambda_i}\cdot 100=\frac{1{,}41}{74{,}61}\cdot 100=1{,}89\%$$

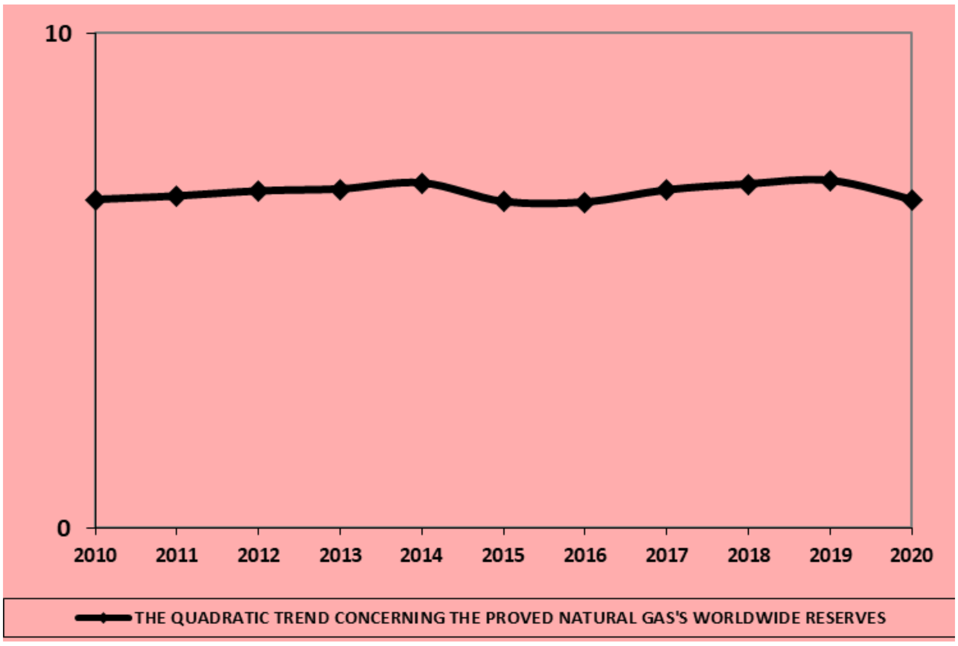
$$v_{II}=1{,}76\%<v_I=1{,}88\%<v_{\exp}=1{,}89\%$$

The pictorial values concerning **the proved natural gas's worldwide reserves** have an overlap on the quadratic reflection $\lambda_{t_i}=a+b\cdot t_i+ct_i^2$

$$\lambda_{2022}^{NATURAL\_GAS'S\_WORLDWIDE\_RESERVES}=6{,}8095338+0{,}011272727\cdot 7+(-0{,}002680652681)\cdot 7^2=6{,}76\_quadrillions\_cubic\_feet$$

$$\lambda_{2023}^{NATURAL\_GAS'S\_WORLDWIDE\_RESERVES}=6{,}8095338+0{,}011272727\cdot 8+(-0{,}002680652681)\cdot 8^2=6{,}73\_quadrillions\_cubic\_feet$$

$$\lambda_{2024}^{NATURAL\_GAS'S\_WORLDWIDE\_RESERVES} = 6{,}8095338 + 0{,}011272727 \cdot 9 + (-0{,}002680652681) \cdot 9^2 = 6{,}69\_quadrillions\_cubic\_feet$$
$$\lambda_{2025}^{NATURAL\_GAS'S\_WORLDWIDE\_RESERVES} = 6{,}8095338 + 0{,}011272727 \cdot 10 + (-0{,}002680652681) \cdot 10^2 = 6{,}65\_quadrillions\_cubic\_feet$$




**Graph 1 The quadratic reflection for the pictorial values concerning the proved natural gas's worldwide reserves**

## 3. The prognosis concerning the natural gas's worldwide productions between 2022-2025

**Table 5 The natural gas's worldwide production between 2010-2020**

| YEARS | THE NATURAL GAS'S WORLDWIDE PRODUCTIONS (billions cubic meters) $(\xi_i)$ |
|---|---|
| 2010 | 3150,8 |
| 2011 | 3258,0 |
| 2012 | 3326,8 |
| 2013 | 3366,1 |
| 2014 | 3437,9 |
| 2015 | 3511,7 |
| 2016 | 3552,1 |
| 2017 | 3676,2 |
| 2018 | 3852,9 |
| 2019 | 3976,2 |
| 2020 | 3853,7 |

*Source: „Statista Portal the United States of America"*

- if the statistical task forces's portofolio, which explores the tendency associated with $\xi$ variable, where $\xi$ = **the natural gas's worldwide production,** aims a linear model, $\xi_{t_i} = a + b \cdot t_i$, *a* and *b* will be [1]:

**Table 6 The pictorial values regarding the natural gas's worldwide productions, if these have a linear reflection**

| YEARS | THE NATURAL GAS'S WORLDWIDE PRODUCTIONS (billions cubic meters) $(\xi_i)$ | LINEAR TENDENCY | | | | |
|---|---|---|---|---|---|---|
| | | $t_i$ | $t_i^2$ | $t_i\xi_i$ | $\xi_{t_i} = a + bt_i$ | $\lvert\xi_i - \xi_{t_i}\rvert$ |
| 2010 | 3150,8 | -5 | 25 | -15754,0 | 3171,127273 | 20,3 |
| 2011 | 3258,0 | -4 | 16 | -13032,0 | 3250,218182 | 7,8 |
| 2012 | 3326,8 | -3 | 9 | -9980,4 | 3329,309091 | 2,5 |
| 2013 | 3366,1 | -2 | 4 | -6732,2 | 3408,400000 | 42,3 |
| 2014 | 3437,9 | -1 | 1 | -3437,9 | 3487,490909 | 49,6 |
| 2015 | 3511,7 | 0 | 0 | 0 | 3566,581818 | 54,9 |
| 2016 | 3552,1 | +1 | 1 | +3552,1 | 3645,672727 | 93,6 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **2017** | **3676,2** | +2 | 4 | +7352,4 | 3724,763636 | 48,6 |
| **2018** | **3852,9** | +3 | 9 | +11558,7 | 3803,854545 | 49,1 |
| **2019** | **3976,2** | +4 | 16 | +15904,8 | 3882,945454 | 93,3 |
| **2020** | **3853,7** | +5 | 25 | +19268,5 | 3962,036363 | 108,3 |
| **TOTAL** | **39232,4** | 0 | 110 | 8700 | | 570,3 |

$$a = \frac{\sum_{i=1}^{n}\xi_i \sum_{i=1}^{n} t_i^2 - \sum_{i=1}^{n}\xi_i t_i \sum_{i=1}^{n} t_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{39232{,}4 \cdot 110}{11 \cdot 110} = 3566{,}581818 \quad b = \frac{n\sum_{i=1}^{n}\xi_i t_i - \sum_{i=1}^{n} t_i \sum_{i=1}^{n}\xi_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{11 \cdot 8700}{11 \cdot 110} = 79{,}09090909$$

$$v_I = \left[\frac{\sum_{i=1}^{m}\left|\xi_i - \xi_{t_i}^I\right|}{n} : \frac{\sum_{i=1}^{m}\xi_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{m}\left|\xi_i - \xi_{t_i}^I\right|}{\sum_{i=1}^{m}\xi_i} \cdot 100 = \frac{570{,}3}{39232{,}4} \cdot 100 = 1{,}45\%$$

**-** if the statistical task forces's portofolio, which explores the tendency associated with $\xi$ variable, where $\xi$ = **the natural gas's worldwide production,** aims a quadratic model, $\xi_{t_i} = a + b \cdot t_i + ct_i^2$, *a* and *b* will be [1]:

**Table 7 The pictorial values regarding the natural gas's worldwide productions, if these have a quadratic reflection**

| **YEARS** | **THE NATURAL GAS'S WORLDWIDE PRODUCTIONS (billions cubic meters)** $(\xi_i)$ | **PARABOLIC TENDENCY** | | | | | |
|---|---|---|---|---|---|---|---|
| | | $t_i$ | $t_i^2$ | $t_i^4$ | $t_i^2\xi_i$ | $\xi_{t_i} = a + bt_i + ct_i^2$ | $\left\lvert\xi_i - \xi_{t_i}\right\rvert$ |
| **2010** | **3150,8** | -5 | 25 | 625 | 78770,0 | 3141,620280 | 9,2 |
| **2011** | **3258,0** | -4 | 16 | 256 | 52128,0 | 3238,415385 | 19,6 |
| **2012** | **3326,8** | -3 | 9 | 81 | 29941,2 | 3331,276224 | 4,5 |
| **2013** | **3366,1** | -2 | 4 | 16 | 13464,4 | 3420,202797 | 54,1 |
| **2014** | **3437,9** | -1 | 1 | 1 | 3437,9 | 3505,195105 | 67,3 |
| **2015** | **3511,7** | 0 | 0 | 0 | 0 | 3586,253147 | 74,5 |
| **2016** | **3552,1** | +1 | 1 | 1 | 3552,1 | 3663,376923 | 111,3 |
| **2017** | **3676,2** | +2 | 4 | 16 | 14704,8 | 3736,566434 | 60,4 |
| **2018** | **3852,9** | +3 | 9 | 81 | 34676,1 | 3805,821678 | 47,1 |
| **2019** | **3976,2** | +4 | 16 | 256 | 63619,2 | 3871,142657 | 105,1 |
| **2020** | **3853,7** | +5 | 25 | 625 | 96342,5 | 3932,529371 | 78,8 |
| **TOTAL** | **39232,4** | 0 | 110 | 1958 | 390636,2 | | 631,9 |

$$a = \frac{\sum_{i=1}^{n} t_i^4 \sum_{i=1}^{n}\xi_i - \sum_{i=1}^{n} t_i^2 \sum_{i=1}^{n} t_i^2 \cdot \xi_i}{n\sum_{i=1}^{n} t_i^4 - \left(\sum_{i=1}^{n} t_i^2\right)^2} = \frac{1958 \cdot 39232{,}4 - 110 \cdot 390636{,}2}{11 \cdot 1958 - 110^2} = 3586{,}253147$$

$$b = \frac{\sum_{i=1}^{n}\xi_i t_i}{\sum_{i=1}^{n} t_i^2} = \frac{8700}{110} = 79{,}09090909$$

$$c = \frac{n \cdot \sum_{i=1}^{n} t_i^2 \cdot \xi_i - \sum_{i=1}^{n} t_i^2 \cdot \sum_{i=1}^{n}\xi_i}{n\sum_{i=1}^{n} t_i^4 - \left(\sum_{i=1}^{n} t_i^2\right)^2} = \frac{11 \cdot 390636{,}2 - 110 \cdot 39232{,}4}{11 \cdot 1958 - 110^2} = -1{,}967132867$$

$$v_{II} = \left[\frac{\sum_{i=1}^{m}\left|\xi_i - \xi_{t_i}^{II}\right|}{n} : \frac{\sum_{i=1}^{m}\xi_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{m}\left|\xi_i - \xi_{t_i}^{II}\right|}{\sum_{i=1}^{m}\xi_i} \cdot 100 = \frac{631{,}9}{39232{,}4} \cdot 100 = 1{,}61\%$$

**-** if the statistical task forces's portofolio, which explores the tendency associated with $\xi$ variable, where $\xi$ **= the natural gas's worldwide production,** aims an exponential model, $\xi_{t_i} = ab^{t_i}$ , *a* and *b* will be [1]:

**Table 8 The pictorial values regarding the natural gas's worldwide productions, if these have an exponential reflection**

| YEARS | THE NATURAL GAS'S WORLDWIDE PRODUCTIONS (billions cubic meters) $(\xi_i)$ | EXPONENTIAL TENDENCY | | | | | |
|---|---|---|---|---|---|---|---|
| | | $t_i$ | $\lg \xi_i$ | $t_i \lg \xi_i$ | $\lg \xi_{t_i} = \lg a + t_i \lg b$ | $\xi_{t_i} = ab^{t_i}$ | $\left\|\xi_i - \xi_{t_i}\right\|$ |
| **2010** | **3150,8** | -5 | 3,498420837 | -17,49210418 | 3,499697077 | 3160,072722 | 9,3 |
| **2011** | **3258,0** | -4 | 3,512951080 | -14,05180432 | 3,509382288 | 3231,337257 | 26,7 |
| **2012** | **3326,8** | -3 | 3,522026693 | -10,56608008 | 3,519067499 | 3304,208918 | 22,6 |
| **2013** | **3366,1** | -2 | 3,527127014 | -7,054254028 | 3,528752710 | 3378,723948 | 12,6 |
| **2014** | **3437,9** | -1 | 3,536293240 | -3,536293240 | 3,538437921 | 3454,919407 | 17,0 |
| **2015** | **3511,7** | 0 | 3,545517408 | 0 | 3,548123132 | 3532,833192 | 21,1 |
| **2016** | **3552,1** | +1 | 3,550485184 | +3,550485184 | 3,557808343 | 3612,504053 | 60,4 |
| **2017** | **3676,2** | +2 | 3,565399131 | +7,130798261 | 3,567493554 | 3693,971616 | 17,8 |
| **2018** | **3852,9** | +3 | 3,585787737 | +10,75736321 | 3,577178765 | 3777,276398 | 75,6 |
| **2019** | **3976,2** | +4 | 3,599468221 | +14,39787288 | 3,586863976 | 3862,459832 | 113,7 |
| **2020** | **3853,7** | +5 | 3,585877903 | +17,92938951 | 3,596549187 | 3949,564285 | 95,9 |
| **TOTAL** | **39232,4** | 0 | 39,02935445 | 1,065373202 | | | 472,7 |

$$\lg a = \frac{\begin{vmatrix} \sum_{i=1}^{n} \lg \xi_i & \sum_{i=1}^{n} t_i \\ \sum_{i=1}^{n} t_i \lg \xi_i & \sum_{i=1}^{n} t_i^2 \end{vmatrix}}{\begin{vmatrix} n & \sum_{i=1}^{n} t_i \\ \sum_{i=1}^{n} t_i & \sum_{i=1}^{n} t_i^2 \end{vmatrix}} = \frac{\sum_{i=1}^{n} \lg \xi_i \sum_{i=1}^{n} t_i^2 - \sum_{i=1}^{n} t_i \lg \xi_i \sum_{i=1}^{n} t_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} \frac{39,02935445 \cdot 110}{11 \cdot 110} = 3,548123132$$

$$\lg b = \frac{\begin{vmatrix} n & \sum_{i=1}^{n} \lg \xi_i \\ \sum_{i=1}^{n} t_i & \sum_{i=1}^{n} t_i \lg \xi_i \end{vmatrix}}{\begin{vmatrix} n & \sum_{i=1}^{n} t_i \\ \sum_{i=1}^{n} t_i & \sum_{i=1}^{n} t_i^2 \end{vmatrix}} = \frac{n \cdot \sum_{i=1}^{n} t_i \lg \xi_i - \sum_{i=1}^{n} \lg \xi_i \sum_{i=1}^{n} t_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{11 \cdot 1,065373202}{11 \cdot 110} = 0,009685210927$$

$$v_{\exp} = \left[\frac{\sum_{i=1}^{n} \left|\xi_i - \xi_{t_i}^{\exp}\right|}{n} : \frac{\sum_{i=1}^{n} \xi_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{n} \left|\xi_i - \xi_{t_i}^{\exp}\right|}{\sum_{i=1}^{n} \xi_i} \cdot 100 = \frac{472,7}{39232,4} \cdot 100 = 1,20\%$$

$$v_{\exp} = 1,20\% < v_I = 1,45\% < v_{II} = 1,61\%$$

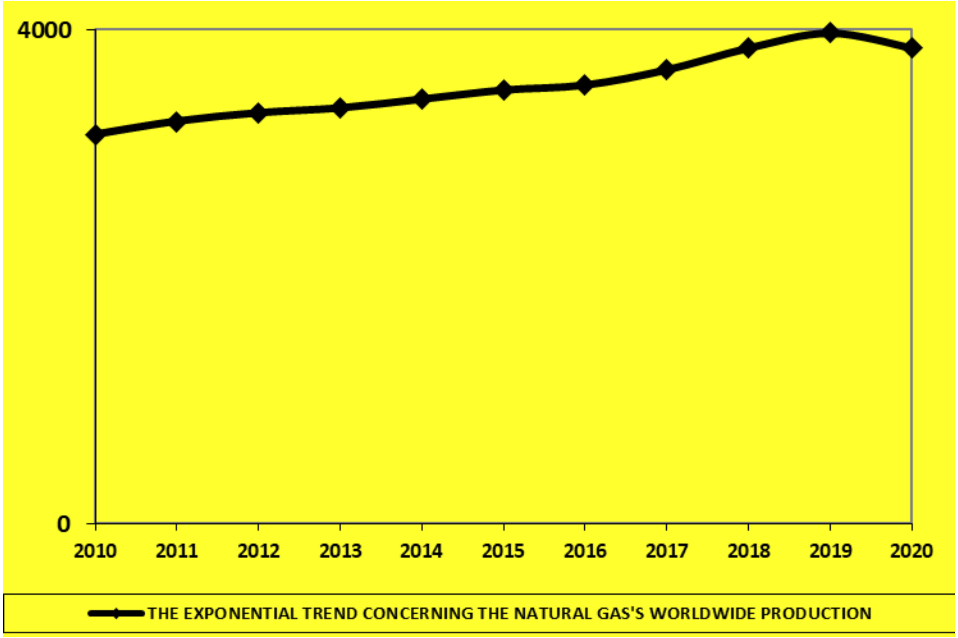
The pictorial values regarding **the natural gas' s worldwide productions** have an overlap on the exponential reflection $\xi_{t_i} = ab^{t_i}$

$$\xi_{2022}^{NATURAL\_GAS\_WORLDWIDE\_PRODUCTION} = 3532,833192 \cdot 1,022551549^6 = 4038,633075\_billions\_cubic\_meters$$

$$\xi_{2023}^{NATURAL\_GAS\_WORLDWIDE\_PRODUCTION} = 3532,833192 \cdot 1,022551549^7 = 4129,710507\_billions\_cubic\_meters$$

$$\xi_{2024}^{NATURAL\_GAS\_WORLDWIDE\_PRODUCTION} = 3532,833192 \cdot 1,022551549^8 = 4222,841876\_billions\_cubic\_meters$$

$$\xi_{2025}^{NATURAL\_GAS\_WORLDWIDE\_PRODUCTION} = 3532,833192 \cdot 1,022551549^9 = 4318,073501\_billions\_cubic\_meters$$




**Graph 2 The exponential reflection for the pictorial values regarding the natural gas's worldwide productions**

### 4. The prognosis regarding the natural gas's worldwide consumptions between 2021-2025

**Table 9 The natural gas's worldwide consumption between 2010-2020**

| YEARS | THE NATURAL GAS'S WORLDWIDE CONSUMPTIONS (billions cubic meters) $(\xi_i)$ |
|---|---|
| 2010 | 3160,5 |
| 2011 | 3235,7 |
| 2012 | 3320,5 |
| 2013 | 3374,6 |
| 2014 | 3400,1 |
| 2015 | 3478,2 |
| 2016 | 3558,6 |
| 2017 | 3653,7 |
| 2018 | 3837,9 |
| 2019 | 3903,9 |
| 2020 | 3822,8 |

*Source: „Statista Portal the United States of America"*

- if the statistical task forces's portofolio, which explores the tendency associated with $\omega$ variable, where $\omega$ = **the natural gas's worldwide consumption**, aims a linear model, $\omega_{t_i} = a + b \cdot t_i$, *a* and *b* will be [1]:

**Table 10 The pictorial values concerning the natural gas's worldwide consumptions, if these have a linear reflection**

| YEARS | THE NATURAL GAS'S WORLDWIDE CONSUMPTIONS (billions cubic meters) $(\omega_i)$ | LINEAR TENDENCY | | | | |
|---|---|---|---|---|---|---|
| | | $t_i$ | $t_i^2$ | $t_i\omega_i$ | $\omega_{t_i} = a + bt_i$ | $\lvert\omega_i - \omega_{t_i}\rvert$ |
| 2010 | 3160,5 | -5 | 25 | -15802,5 | 3147,263636 | 13,2 |
| 2011 | 3235,7 | -4 | 16 | -12942,8 | 3222,292727 | 13,4 |
| 2012 | 3320,5 | -3 | 9 | -9961,5 | 3297,321818 | 23,2 |
| 2013 | 3374,6 | -2 | 4 | -6749,2 | 3372,350909 | 2,3 |
| 2014 | 3400,1 | -1 | 1 | -3400,1 | 3447,380000 | 47,3 |
| 2015 | 3478,2 | 0 | 0 | 0 | 3522,409091 | 44,2 |
| 2016 | 3558,6 | +1 | 1 | +3558,6 | 3597,438182 | 38,8 |
| 2017 | 3653,7 | +2 | 4 | +7307,4 | 3672,467273 | 18,8 |
| 2018 | 3837,9 | +3 | 9 | +11513,7 | 3747,496364 | 90,4 |
| 2019 | 3903,9 | +4 | 16 | +15615,6 | 3822,525455 | 81,4 |
| 2020 | 3822,8 | +5 | 25 | +19114,0 | 3897,554546 | 74,7 |
| TOTAL | 38746,5 | 0 | 110 | 8253,2 | | 447,7 |

$$a = \frac{\sum_{i=1}^{n}\omega_i \sum_{i=1}^{n} t_i^2 - \sum_{i=1}^{n}\omega_i t_i \sum_{i=1}^{n} t_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{38746{,}5 \cdot 110}{11 \cdot 110} = 3522{,}409091 \quad b = \frac{n\sum_{i=1}^{n}\omega_i t_i - \sum_{i=1}^{n} t_i \sum_{i=1}^{n}\omega_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{11 \cdot 8253{,}2}{11 \cdot 110} = 75{,}02909091$$

$$v_I = \left[\frac{\sum_{i=1}^{n}\left|\omega_i - \omega_{t_i}^I\right|}{n} : \frac{\sum_{i=1}^{n}\omega_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{n}\left|\omega_i - \omega_{t_i}^I\right|}{\sum_{i=1}^{n}\omega_i} \cdot 100 = \frac{447{,}7}{38746{,}5} \cdot 100 = 1{,}15\%$$

- if the statistical task forces's portofolio, which explores the tendency associated with $\omega$ variable, where $\omega$ = **the natural gas's worldwide consumption**, aims a quadratic model, $\omega_{t_i} = a + b \cdot t_i + ct_i^2$, *a* and *b* will be [1]:

**Table 11 The pictorial values concerning the natural gas's worldwide consumptions, if these have a quadratic reflection**

| YEARS | THE NATURAL GAS'S WORLDWIDE CONSUMPTIONS (billions cubic meters) $(\omega_i)$ | PARABOLIC TENDENCY | | | | | |
|---|---|---|---|---|---|---|---|
| | | $t_i$ | $t_i^2$ | $t_i^4$ | $t_i^2\omega_i$ | $\omega_{t_i} = a + bt_i + ct_i^2$ | $\left\|\omega_i - \omega_{t_i}\right\|$ |
| **2010** | **3160,5** | -5 | 25 | 625 | 79012,5 | 3162,099301 | 1,6 |
| **2011** | **3235,7** | -4 | 16 | 256 | 51771,2 | 3228,226993 | 7,5 |
| **2012** | **3320,5** | -3 | 9 | 81 | 29884,5 | 3296,332774 | 24,2 |
| **2013** | **3374,6** | -2 | 4 | 16 | 13498,4 | 3366,416643 | 8,2 |
| **2014** | **3400,1** | -1 | 1 | 1 | 3400,1 | 3438,478601 | 38.4 |
| **2015** | **3478,2** | 0 | 0 | 0 | 0 | 3512,518648 | 34,3 |
| **2016** | **3558,6** | +1 | 1 | 1 | 3558,6 | 3588,536783 | 29,9 |
| **2017** | **3653,7** | +2 | 4 | 16 | 14614,8 | 3666,533007 | 12,8 |
| **2018** | **3837,9** | +3 | 9 | 81 | 34541,1 | 3746,507319 | 91,4 |
| **2019** | **3903,9** | +4 | 16 | 256 | 62462,4 | 3828,459720 | 75,4 |
| **2020** | **3822,8** | +5 | 25 | 625 | 95570,0 | 3912,390210 | 89,6 |
| **TOTAL** | **38746,5** | 0 | 110 | 1958 | 388313,6 | | 413,3 |

$$a = \frac{\sum_{i=1}^{n} t_i^4 \sum_{i=1}^{n}\omega_i - \sum_{i=1}^{n} t_i^2 \sum_{i=1}^{n} t_i^2 \cdot \omega_i}{n\sum_{i=1}^{n} t_i^4 - \left(\sum_{i=1}^{n} t_i^2\right)^2} = \frac{1958 \cdot 38746{,}5 - 110 \cdot 388313{,}6}{11 \cdot 1958 - 110^2} = 3512{,}518648$$

$$b = \frac{\sum_{i=1}^{n}\omega_i t_i}{\sum_{i=1}^{n} t_i^2} = \frac{8253{,}2}{110} = 75{,}02909091$$

$$c = \frac{n \cdot \sum_{i=1}^{n} t_i^2 \cdot \omega_i - \sum_{i=1}^{n} t_i^2 \cdot \sum_{i=1}^{n}\omega_i}{n\sum_{i=1}^{n} t_i^4 - \left(\sum_{i=1}^{n} t_i^2\right)^2} = \frac{11 \cdot 388313{,}6 - 110 \cdot 38746{,}5}{11 \cdot 1958 - 110^2} = 0{,}989044289$$

$$v_{II} = \left[\frac{\sum_{i=1}^{n}\left|\omega_i - \omega_{t_i}^{II}\right|}{n} : \frac{\sum_{i=1}^{n}\omega_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{n}\left|\omega_i - \omega_{t_i}^{II}\right|}{\sum_{i=1}^{n}\omega_i} \cdot 100 = \frac{413{,}3}{38746{,}5} \cdot 100 = 1{,}07\%$$

- if the statistical task forces's portofolio, which explores the tendency associated with $\omega$ variable, where $\omega$ = **the natural gas's worldwide consumption**, aims an exponential model, $\omega_{t_i} = ab^{t_i}$, *a* and *b* will be [1]:

**Table 12 The pictorial values concerning the natural gas's worldwide consumptions, if these have an exponential reflection**

| YEARS | THE NATURAL GAS'S WORLDWIDE CONSUMPTIONS (billions cubic meters) $(\omega_i)$ | EXPONENTIAL TENDENCY | | | | | |
|---|---|---|---|---|---|---|---|
| | | $t_i$ | $\lg \omega_i$ | $t_i \lg \omega_i$ | $\lg \omega_{t_i} = \lg a + t_i \lg b$ | $\omega_{t_i} = ab^{t_i}$ | $\lvert \omega_i - \omega_{t_i} \rvert$ |
| **2010** | **3160,5** | -5 | 3,499755795 | -17,49877897 | 3,499601558 | 3159,377770 | 0,7 |
| **2011** | **3235,7** | -4 | 3,509968249 | -14,03987300 | 3,508844557 | 3227,338783 | 8,4 |
| **2012** | **3320,5** | -3 | 3,521203485 | -10,56361045 | 3,518087555 | 3221,718233 | 98,8 |
| **2013** | **3374,6** | -2 | 3,528222302 | -7,056444604 | 3,529679503 | 3385,941910 | 11,3 |
| **2014** | **3400,1** | -1 | 3,531491690 | -3,531491690 | 3,538922502 | 3458,776519 | 58,7 |
| **2015** | **3478,2** | 0 | 3,541354551 | 0 | 3,545816550 | 3514,119695 | 35,9 |
| **2016** | **3558,6** | +1 | 3,551279174 | +3,551279174 | 3,555059548 | 3589,711514 | 31,1 |
| **2017** | **3653,7** | +2 | 3,562732885 | +7,125465770 | 3,564302547 | 3666,929387 | 13,2 |
| **2018** | **3837,9** | +3 | 3,584093655 | +10,75228096 | 3,573545545 | 3745,808277 | 92,1 |
| **2019** | **3903,9** | +4 | 3,591498685 | +14,36599474 | 3,582788543 | 3826,383922 | 77,5 |
| **2020** | **3822,8** | +5 | 3,582381577 | +17,91190789 | 3,594380492 | 3929,890883 | 107,1 |
| **TOTAL** | **38746,5** | 0 | 39,00398205 | 1,016729817 | | | 534,8 |

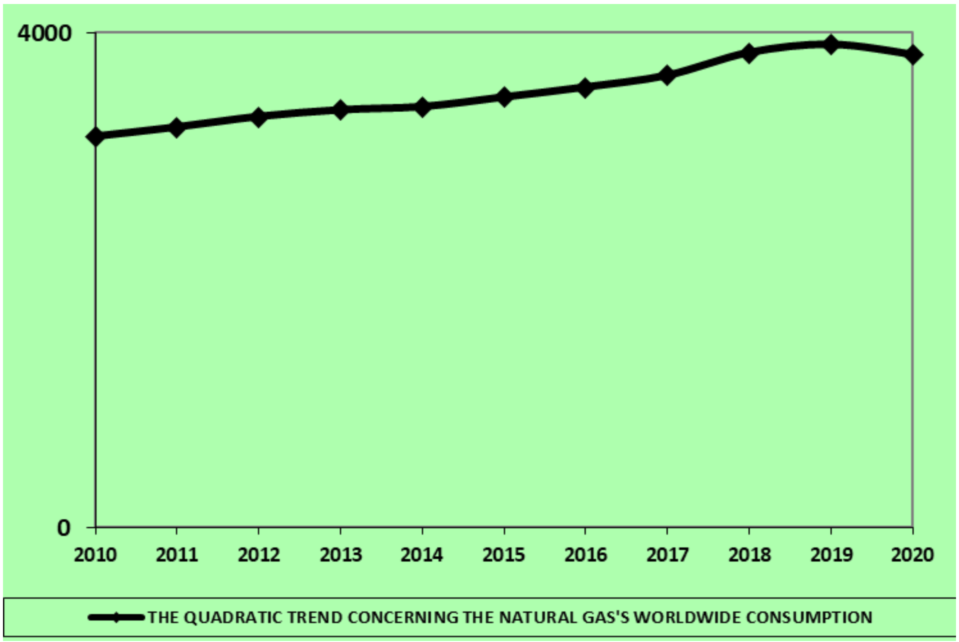
$$\lg a = \frac{\sum_{i=1}^{n} \lg \omega_i \sum_{i=1}^{n} t_i^2 - \sum_{i=1}^{n} t_i \lg \omega_i \sum_{i=1}^{n} t_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{39{,}00398205 \cdot 110}{11 \cdot 110} = 3{,}54581655$$

$$\lg b = \frac{n \cdot \sum_{i=1}^{n} t_i \lg \omega_i - \sum_{i=1}^{n} \lg \omega_i \sum_{i=1}^{n} t_i}{n\sum_{i=1}^{n} t_i^2 - \left(\sum_{i=1}^{n} t_i\right)^2} = \frac{11 \cdot 1{,}016729817}{11 \cdot 110} = 0{,}009242998333$$

$$v_{\exp} = \left[\frac{\sum_{i=1}^{n} \left|\omega_i - \omega_{t_i}^{\exp}\right|}{n} : \frac{\sum_{i=1}^{n} \omega_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{n} \left|\omega_i - \omega_{t_i}^{\exp}\right|}{\sum_{i=1}^{n} \omega_i} \cdot 100 = \frac{534.8}{38746{,}5} \cdot 100 = 1{,}38\%$$

$$v_{II} = 1{,}07\% < v_I = 1{,}15\% < v_{\exp} = 1{,}38\%$$

The pictorial values concerning **the natural gas's worldwide consumptions** have an overlap on the quadratic reflection $\omega_{t_i} = a + b \cdot t_i + ct_i^2$




**Graph 3 The quadratic reflection for the pictorial values concerning the natural gas's worldwide consumptions**

$$\omega_{2022}^{NATURAL\_GAS\_WORLDWIDE\_CONSUMPTION} = 3512{,}518648 + 75{,}02909091 \cdot 6 + 0{,}989044289 \cdot 6^2 = 3998{,}3\_billions\_cubic\_meters$$
$$\omega_{2023}^{NATURAL\_GAS\_WORLDWIDE\_CONSUMPTION} = 3512{,}518648 + 75{,}02909091 \cdot 7 + 0{,}989044289 \cdot 7^2 = 4086{,}2\_billions\_cubic\_meters$$
$$\omega_{2024}^{NATURAL\_GAS\_WORLDWIDE\_CONSUMPTION} = 3512{,}518648 + 75{,}02909091 \cdot 8 + 0{,}989044289 \cdot 8^2 = 4176{,}1\_billions\_cubic\_meters$$
$$\omega_{2025}^{NATURAL\_GAS\_WORLDWIDE\_CONSUMPTION} = 3512{,}518648 + 75{,}02909091 \cdot 9 + 0{,}989044289 \cdot 9^2 = 4267{,}9\_billions\_cubic\_meters$$

## 5. Conclusions

We can see a real regress concerning the estimations for the proved natural gas's worldwide reserves between 2022-2025, from 6,76 quadrillions cubic feet, to 6,65 quadrillions cubic feet. The forecasts regarding the natural gas's worldwide productions in the same period, will be in progress, from 4038,63 billions cubic meters, to 4318,07 billions cubic meters. The prognosis regarding the natural gas's worldwide consumptions will witness a real development in the same horizon of time, from 3998,3 billions cubic meters, to 4267,9 billions cubic meters.

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