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Rare Gases (Neon, Krypton, Xenon) Production, Market and Forecast in Russia and Ukraine

Sample PDF

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Annotation

The present report is **the 1st edition** of the study of the market of rare gases in Russia and in Ukraine.

Research objective is the analysis of the market of rare gases.

Objects of a research are rare gases (neon, krypton, xenon, gas mixtures).

This work represents **a desk research**. As **sources of information** we used data of Federal State Statistics Service of the Russian Federation (Rosstat), the Federal Customs Service of the Russian Federation (FCS of the Russian Federation), data of customs statistics and statistics of rail transportation of the Russian Federation, as well as data of Goskomstat of Ukraine, and of the UNdata and Eurostat databases.

Also data of the industry and regional press, annual and quarterly reports of issuers of securities, the websites of the manufacturing enterprises and consumers of rare gases were employed, as well as the Infomine database and materials of profile conferences.

Main chronological framework of research: 2008-2017.

Geography of research: Russia, Ukraine.

Scope of research: the report consists of **8** parts, contains **80** pages, including **40** tables, **34** Figures, **1** Appendix.

The **chapter 1** (Introduction) gives short characteristic of the market of the industrial gases in Russia and a role of rare gases.

The **chapter 2** considers requirements to quality of various rare gases (state standard specifications, the technical specifications) and outlines their main technical specifications.

The **chapter 3** is devoted to the review of the equipment employed for production of rare gases and technical specifications of the units used.

The **chapter 4** is devoted to production of rare gases – their mixtures and the separated products. The structure of production in Russia and in Ukraine is presented. The main manufacturing companies of rare gases in Russia and in Ukraine, their product ranges, the estimated outputs, and financial performance indicators are also considered.

The **chapter 5** of the review gives data on export and import of rare gases in Russia (2008-2017) and in Ukraine (2013-2017). It presents dynamics of deliveries, the geographical structure, the structure of export and import by types of products and by suppliers/consumers.

The **chapter 6** is devoted to the review of the domestic and export-import prices for different types of rare gases.

The **chapter 7** discusses the uses of rare gases in Russia, gives estimated structures of the use of separate types of rare gases and presents their consumers.

The **chapter 8** provides the analysis of a state and the prospect of the market of rare gases in Russia.

The **Appendix** gives the addresses and contact information of the main participants of the market of rare gases in Russia and in Ukraine.

The target audience of a research:

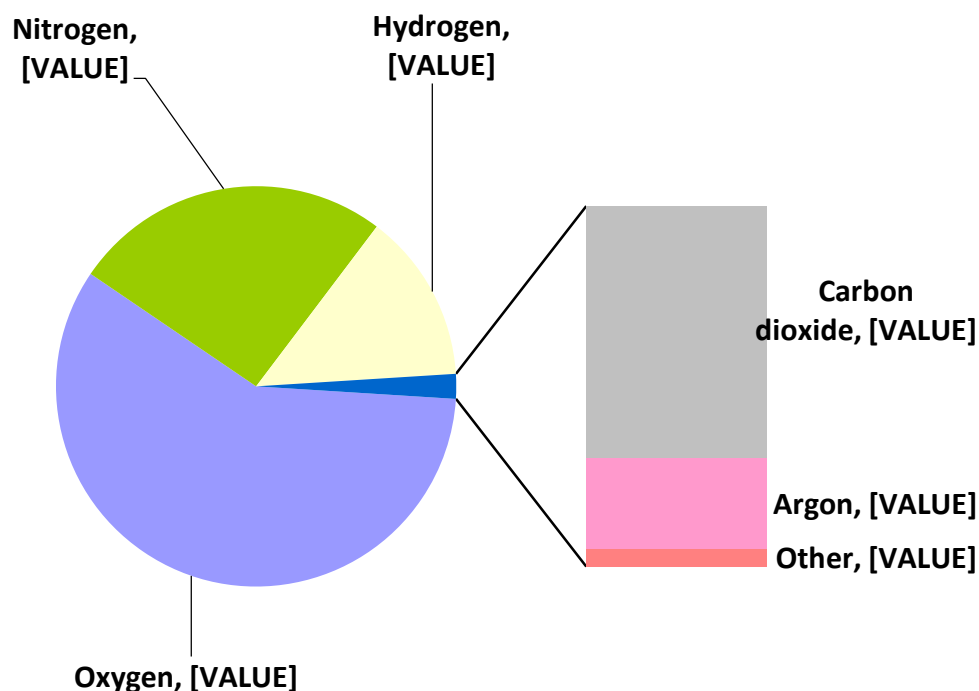
- participants of the market of industrial gases - producers, consumers, traders;
- potential investors.

The offered research may be used as **a handbook** for marketing services and for experts making management decisions on the Russian market of the industrial gases.

1. Introduction

In the Russian structure of production of the industrial gases the share of other gases makes 0.1% (Figure 1), they include helium and rare gases (neon, krypton and xenon).

Figure 1: Structure of production of industrial gases in Russia, %



Source: Infomine

The level of production of rare gases is determined by their low contents in an Earth's atmosphere (Table 1). For example, for production of 1 m³ of neon it is necessary to process more than 50 thousand m³ of air.

Table 1: Content of rare gases in an Earth's atmosphere

| Rare gases | | Helium | Neon | Krypton | Xenon |
|----------------------------|-------------------------|--------|------|---------|-------|
| Chemical formula | | | | | |
| Density at 1 atm and 20 °C | kg/norm. m ³ | | | | |
| Contents in the atmosphere | % (volume) | | | | |
| | % (mass) | | | | |

Source: review of scientific and technical literature

Figure 2: World structure of raw materials for production of krypton and xenon (the krypton-xenon mixture), %

Source: Betzendahl Gas Consultans

Figure 3: Shares of main countries supplying rare gases to the EU (2013-2017), %

Source: Infomine on the basis of data of Eurostat

2. Requirements to quality of rare gases and their mixtures

Table 2: Requirements to quality of krypton and the krypton-xenon mixture (GOST 10219-77)

| Indicator | Krypton | | Krypton-xenon mixture (of the 1st category) |
|---|-------------|------|---|
| | high purity | pure | |
| 1. Volume fraction of krypton, %, at least | | | |
| 2. Volume fraction of xenon, % | | | |
| 3. Volume fraction of nitrogen, %, at most | | | |
| 4. Volume fraction of oxygen, %, at most | | | |
| 5. Volume fraction of methane, %, at most | | | |
| 6. Volume fraction of carbon dioxide, %, at most | | | |
| 7. Volume fraction of steam, %, at most, | | | |
| what corresponds to the saturation temperature of krypton and the krypton-xenon mixture with steam at a pressure of 101.3 kPa (760 mm Hg.), °C, not higher than | | | |

Source: Standartinform

Table 3: Requirements to quality of xenon (GOST 10219-77)

| Indicator | High purity | Pure |
|---|-------------|------|
| 1. Volume fraction of xenon, %, at least | | |
| 2. Volume fraction of krypton, % at most | | |
| 3. Volume fraction of nitrogen, %, at most | | |
| 4. Volume fraction of oxygen, %, at most | | |
| 5. Volume fraction of methane, %, at most | | |
| 6. Volume fraction of carbon dioxide, %, at most | | |
| 7. Volume fraction of steam, %, at most, | | |
| what corresponds to the saturation temperature of xenon with steam at a pressure of 101.3 kPa (760 mm Hg.), °C, not higher than | | |

Source: Standartinform

**Table 4: Requirements to quality of krypton
(TU 2114-004-39791733-2002)**

| Indicator | Brand 5.0 | Brand 5.5 | Brand 5.8 |
|--------------------------------|-----------|-----------|-----------|
| Kr, %, at least | | | |
| Xe, ppm, at most | | | |
| N ₂ , ppm, at most | | | |
| O ₂ , ppm, at most | | | |
| Methane, ppm, at most | | | |
| CO ₂ , ppm, at most | | | |
| H ₂ O, ppm, at most | | | |

Source: review of scientific and technical literature

**Table 5: Requirements to quality of xenon
(TU 2114-003-39791733-2002)**

| Indicator | Brand 5.0 | Brand 5.5 | Brand 5.8 |
|---|-----------|-----------|-----------|
| Xenon Xe, %, at least | | | |
| Krypton Kr, ppm, at most | | | |
| Nitrogen N ₂ , ppm, at most | | | |
| Oxygen O ₂ , ppm, at most | | | |
| O ₂ + Ar, ppm, at most | | | |
| Methane CH ₄ , ppm, at most | | | |
| Carbon dioxide CO ₂ , ppm, at most | | | |
| Steam H ₂ O, ppm, at most | | | |

Source: review of scientific and technical literature

**Table 6: Requirements to quality of neon
(TU 2114-006-39791733-2002)**

| Indicator | Brand 4.0 | Brand 4.8 |
|---|-----------|-----------|
| Neon Ne, %, at least | | |
| Helium He, ppm, at most | | |
| Nitrogen N ₂ , ppm, at most | | |
| Oxygen O ₂ , ppm, at most | | |
| Methane CH ₄ , ppm, at most | | |
| Carbon dioxide CO ₂ , ppm, at most | | |
| Steam H ₂ O, ppm, at most | | |
| Pressure at reference conditions, MPa, at least | | |

Source: review of scientific and technical literature

Figure 6: The key diagram of the unit Khrom-3

Source: review of scientific and technical literature

Table 11: Principal specifications of the KS-0,4 unit of production by OAO Kriogenmash

| Indicator | Value |
|--|-------|
| The processed krypton-xenon concentrate: a volume flow, m ³ /h (at 20 °C; 0.1013 MPa) | |
| The production krypton-xenon mixture: - pressure, MPa | |
| - sum of volume fractions of krypton and xenon, % Kr-Xe | |
| Extraction of krypton and xenon from the processed concentrate, %, at least | |
| The smooth regulation depending on initial flows and volume fractions of a concentrate, with preservation of an indicator of quality of finished products according to GOST 10218-77 | |

* - actually reached indicators; specific power consumption of PKC=0.18 kWh/m³; duration of the work is 8640 h.

Source: OAO Kriogenmash

Figure 7: Flow diagram of separation of helium and neon

Source: review of scientific and technical literature

4. Production of rare gases in Russia and in Ukraine in 2008-2017

4.1. Structure and production volumes

Figure 8: Main participants of the market of rare gases in Russia and Ukraine

Source: Infomine

Figure 9: Block diagram of production and supply of rare gases in Russia and Ukraine

Source: Infomine

**Table 12: Estimated annual production of rare gases
in Russia and in Ukraine, thousand m³**

| Products | Russia | Ukraine |
|----------------------------------|--------|---------|
| Neon mixtures (in terms of neon) | | |
| KXM (krypton-xenon mixture) | | |
| Krypton | | |
| Xenon | | |
| Neon | | |

Source: assessment by Infomine

4.2. Main producers of rare gases in Russia and in Ukraine

Metallurgical companies of Russia

Table 14: Dynamics of export supplies of mixtures of rare gases by the metallurgical enterprises of Russia (without traders) in 2008-2017, thousand m³

| Supplier | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------|------|------|------|------|------|------|------|------|------|------|
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Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Specialized companies of Ukraine and Russia

Table 15: Dynamics of import of mixtures of rare gases by OOO IceBlick and OOO Krioin Engineering from Russia in 2008-2017, thousand m³

| Supplier | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------|------|------|------|------|------|------|------|------|------|------|
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Source: Infomine on the basis of the analysis of customs statistics of Russia

Table 16: Dynamics of export supplies of rare gases by OOO IceBlick and OOO Krioin Engineering in 2015-2017, thousand m³

| Company | 2015 | 2016 | 2017 |
|----------------|------|------|------|
| | | | |
| <i>Neon</i> | | | |
| <i>Krypton</i> | | | |
| <i>Xenon</i> | | | |
| | | | |
| <i>Neon</i> | | | |
| <i>Krypton</i> | | | |
| <i>Xenon</i> | | | |

Source: Infomine on the basis of the analysis of customs statistics of Ukraine

Table 17: Dynamics of export supplies of mixtures of rare gases by OOO Soval in 2008-2017, thousand m³

| Supplier | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------------------------|------|------|------|------|------|------|------|------|------|------|
| Krypton-xenon mixtures | | | | | | | | | | |
| Neon mixtures | | | | | | | | | | |

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Table 18: Key financial performance indicators of OOO Soval in 2008-2016, million rubles

| Indicator | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---------------------|------|------|------|------|------|------|------|------|------|
| Revenue | | | | | | | | | |
| Cost of sales | | | | | | | | | |
| Gross profit (loss) | | | | | | | | | |
| Sales profit | | | | | | | | | |
| Net profit | | | | | | | | | |

Source: GSI

Table 19: Key financial performance indicators of OOO Khrom in 2005-2015, million rubles

| Indicator | 2005 | 2006 | 2007 | 2008 | 2015 |
|---------------------|------|------|------|------|------|
| Revenue | | | | | |
| Cost of sales | | | | | |
| Gross profit (loss) | | | | | |
| Sales profit | | | | | |
| Net profit | | | | | |

Source: GSI

Figure 10: Dynamics of deliveries to export of rare gases by OOO Khrom in 2008-2017, thousand m³

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Table 20: Dynamics of export supplies of rare gases by OOO Akela-N in 2008-2017, thousand m³

| Supplier | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------------|------|------|------|------|------|------|------|------|------|------|
| Krypton | | | | | | | | | | |
| Krypton through traders | | | | | | | | | | |
| Xenon | | | | | | | | | | |
| Xenon through traders | | | | | | | | | | |
| Neon mixtures | | | | | | | | | | |

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Table 21: Key financial performance indicators of OOO Akela-N in 2012-2016, million rubles

| Indicator | 2012 | 2013 | 2014 | 2015 | 2016 |
|---------------------|------|------|------|------|------|
| Revenue | | | | | |
| Cost of sales | | | | | |
| Gross profit (loss) | | | | | |
| Sales profit | | | | | |
| Net profit | | | | | |

Source: GSI

Table 22: Key financial performance indicators of OOO KseMed in 2012-2016, million rubles

| Indicator | | | | | |
|---------------------|--|--|--|--|--|
| Revenue | | | | | |
| Cost of sales | | | | | |
| Gross profit (loss) | | | | | |
| Sales profit | | | | | |
| Net profit | | | | | |

Source: GSI

Table 23: Dynamics of export supplies of rare gases by DP Ingaz in 2015-2017, thousand m³

| Products | Main recipients | 2015 | 2016 | 2017 |
|----------|-----------------|------|------|------|
| Neon | | | | |
| Krypton | | | | |
| Xenon | | | | |

Source: Infomine on the basis of the analysis of customs statistics of Ukraine

Figure 11: Dynamics of export deliveries of rare gases by OAO Moskoks in 2008-2017, thousand m³

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

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| Total: | | | | | | | | | | |

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Figure 15: Structure of supplies of mixtures of rare gases by the companies-exporters (a summary for 2008-2017), %

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Figure 16: Structure of deliveries of krypton and xenon by the companies-exporters (a summary for 2008-2017), %

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

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Import

Figure 17: Dynamics of import of rare gases to the Russian Federation in 2008-2016, m³/thousand dollars

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Figure 18: Structure of the Russian import of rare gases by products (a summary for 2008-2017), %

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Table 30: Directions of import supplies of rare gases by Russia in 2008-2017, m³

| Country | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------------|------|------|------|------|------|------|------|------|------|------|
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| Total: | | | | | | | | | | |

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Table 31: Directions of import deliveries of neon to Russia in 2008-2017, thousand m³

| Country | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------------|------|------|------|------|------|------|------|------|------|------|
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| Total: | | | | | | | | | | |

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

**Figure 19: Geographical structure of the Russian import of rare gases
(a summary for 2008-2017), %**

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

The companies-recipients of different types of imported rare gases in 2008-2017 are presented in Table 32. It is possible to distinguish from them the trading structures (OOO Business-Management), the specialized companies (OOO Akela-N) and direct consumers (the Experimental Design Bureau Fakel).

Over 30% of the received gases go for separation of mixtures and purification of gases, at the same time an overwhelming part (about 50%) – to the lighting engineering (it is generally neon).
\$4.5 thousand in (2008-2017)

The shares of the use in lasers and the space industry (Figure 20) was about 5%.

**Figure 20: Structure of the use of imported rare gases
(a summary for 2008-2017), %**

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Table 32: Main Russian companies-importers of rare gases in 2008-2017, thousand m³

| Importer | Region | Products | Supplier/ manufacturer | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------------|--------|----------|---------------------------|------|------|------|------|------|------|------|------|------|------|
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| <i>Others</i> | | | | | | | | | | | | | |
| Total: | | | | | | | | | | | | | |

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

5.2 Ukraine

Figure 21: Export and import of rare gases in Ukraine (2013-2017), thousand m³

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

Figure 22: Export and import of rare gases in Ukraine (2013-2017), million dollars

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

Table 33: Directions of export supplies of rare gases in Ukraine in 2013-2017, thousand m³

| Importing country | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------|------|------|------|------|------|
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| Total: | | | | | |

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

Table 34: Directions of import supplies of rare gases in Ukraine in 2013-2017, thousand m³

| Country-sender | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------------|------|------|------|------|------|
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| Total: | | | | | |
|---------------|--|--|--|--|--|

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

Figure 23: Structure of export of rare gases in Ukraine by products (2013-2017), %

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

Figure 24: Structure of import of rare gases in Ukraine by products (2013-2017), %

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

Figure 25: Dynamics of export deliveries of krypton and xenon by Ukraine (2015-2017), thousand m³ (2013-2017)

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

Table 35: Main Ukrainian companies-exporters of rare gases in 2015-2017, thousand m³

| Supplier | Region | Products | Producer | Main recipients | 2015 | 2016 | 2017 |
|----------|--------|----------|----------|-----------------|------|------|------|
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Source: Infomine on the basis of the analysis of customs statistics of Ukraine

6. Prices of rare gases in 2012-2018

Figure 26: Prices of sales of the krypton-xenon mixture of joint stock company EVRAZ NTMK in the Russian market (on the terms of FCA) in 2012-2018, thousand rubles/m³

Source: Infomine on the basis of data of the website of the company

Figure 27: Average annual export prices of the krypton-xenon mixture of different Russian suppliers in 2008-2017, dollars/m³

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Figure 28: Average annual import prices of the krypton-xenon mixture in 2008-2016, dollars/m³

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Figure 29: Prices of sales of the neon-helium mixture by OAO NLMK (results of tenders of 2017-2018), rub/m³

Source: Infomine on the basis of the analysis of tenders

Table 36: Average annual export prices of the neon-helium mixture of different suppliers in 2008-2017, dollars/m³

| Exporting company | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------|------|------|------|------|------|------|------|------|------|------|
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Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Figure 30: Average annual export prices of krypton (99.999%) of different suppliers (FCA) in 2008-2017, dollars/m³

Source: Infomine on the basis of the analysis of customs statistics of the Russian Federation

Figure 31: Prices of sales of xenon by different suppliers (results of tenders of 2016-2018), ruble/l

Source: Infomine on the basis of the analysis of tenders

**Table 37: Export prices of the Ukrainian suppliers in 2017
on neon, krypton and xenon of different brands, dollars/m³**

| Product | | | | | |
|--------------------|--|--|--|--|--|
| Neon of 99.999% | | | | | |
| Neon of 99.9993% | | | | | |
| Neon of 99.9999% | | | | | |
| Krypton of 99.999% | | | | | |
| Xenon of 99.999% | | | | | |
| Xenon of 99.9996% | | | | | |
| Xenon of 99.9999% | | | | | |

Source: Infomine on the basis of the analysis of data of customs statistics of Ukraine

7. Consumption of rare gases in Russia in 2010-2017

Table 38: Main fields of use of rare gases in Russia and enterprises-consumers

| Area of consumption | Neon | Krypton | Xenon | Enterprises |
|---------------------|------|---------|-------|-------------|
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Source: Infomine

Figure 32: Dynamics of release of double-glazed windows in Russia (2010-2017), million m²

Source: Rosstat

Table 39: Release of different types of lamps in Russia in 2010-2016, thousand pieces

| Type of lamps | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------------------------------|------|------|------|------|------|------|------|
| Fluorescent two-capped | | | | | | | |
| LED | | | | | | | |
| Compact fluorescent lamp (CFL) | | | | | | | |
| Halogen lamps | | | | | | | |
| Incandescent lamps | | | | | | | |

Source: Rosstat

Figure 33: Release of separate types of lamps with noble gases in Russia (2010-2016, 2010 = 100), %

Source: Infomine on the basis of data of Rosstat

Figure 34: Structure of the use of xenon in various areas (an analysis of results of tenders in 2017), %

Source: Infomine

