

## Reducing gas leaks during repairs

We strive to minimize natural gas leaks into the atmosphere from scheduled repairs and equipment failures at oil and gas production facilities.

While detecting gas leaks, Russian LUKOIL Group entities are governed by regulatory documents, federal

regulations, Russian oil and gas industry rules, and corporate standards<sup>1</sup>.

At production facilities, portable and stationary gas-leak control tools are used. Based on the results of audits and diagnostic work, repairs are scheduled for pipelines that transport gas and for

gas collection and compression facilities (compressor stations). Equipment audits and diagnostic work are performed as scheduled.

## ENERGY CONSERVATION



The effective utilization of fuel and energy resources is a priority for LUKOIL Group entities, and serves to boost the overall operational efficiency of LUKOIL Group.



**Our goal** is to increase the energy efficiency of the production activities of LUKOIL Group entities. Target indicators for activities are established within energy conservation programs.

In the Russian entities of LUKOIL Group an energy management system, in compliance with the international standard ISO 50001:2012, has been implemented. As of December 31, 2018, Certificates of Compliance of energy management systems with the ISO 50001 standard were held by 25 entities of the Group, and covered 68.2% of workers.

The Energy Conservation Program of LUKOIL Group Entities for 2018 and 2019-2020 in Russia is under way; there are now road maps for improving operational efficiency up to 2020. The Center for Developing New Business Areas was set up to coordinate projects in the sphere of innovative technologies in the electrical energy sector and to develop a new energy infrastructure.

Based on the results of 2018 operations, all scheduled activities were completed in full, and savings targets were achieved for each type of energy.

### Energy resource savings achieved, based on the results of implementing the Energy Conservation Program of LUKOIL Group Entities in Russia

	2016	2017	2018
Electric energy, million kWh	82	66	98
Heat energy, thousand Gcal	57	186	101
Boiler and furnace fuel, thousand tons of oil equivalent	76	181	135

In industrial consumption most electrical energy is used by oil and gas extraction entities, while other types of energy resources are used mainly by oil-refining and petrochemical entities.

The development of in-house (supporting) energy generation is performed directly at the deposits

of the Group and meets the needs of production in electric and thermal energy due to APG efficient use. The further development of securing generation (as part of work to build a gas-turbine thermal power plant in Perm Territory) and the commissioning of eight steam generation plants in the Republic of Komi has been scheduled.

The specific consumption indicator of electrical energy at Russian oil and gas extraction enterprises was stable in 2016-2018, and stood at 20.6 kWh per ton of extracted liquid.

<sup>1</sup> FZ-116 "On the Industrial Safety of Hazardous Production Facilities," FZ-22 "On Amending the Federal Law 'On the Industrial Safety of Hazardous Production Facilities,'" STO LUKOIL 1.19.1-2012, Federal Regulations and Rules "Rules for the Safe Operation of Infield Pipelines."

### Specific consumption of fuel and power resources by oil refining LUKOIL Group entities, GJ/tons of product

	2018
<b>Total for LUKOIL Group, including</b>	<b>3.7</b>
Russian LUKOIL Group entities	3.7
Foreign LUKOIL Group entities	3.5

**Notes.** 1) Information is provided on an as-produced basis, with due account for cross-supplies, i.e. volumes of petroleum products supplied between LUKOIL Group oil refineries in Russia for further processing. 2) Information is presented inclusive of gas processing products (LLC Permnefteorgsintez) and petrochemical products (LUKOIL Neftohim Burgas AD and ISAB S.r.l.).

Russian commercial power-generating entities use gas as the main raw material for generating electrical and thermal energy. In 2018, generating entities consumed in total 5,042 million cubic meters of natural gas, of which LUKOIL Group entities supplied 5%.

### Total production energy consumption by LUKOIL Group entities

	2016	2017	2018
<b>Production consumption of electrical energy for LUKOIL Group, billion kWh, including:</b>	<b>22.8</b>	<b>22.9</b>	<b>22.6</b>
production consumption of electrical energy for Russian LUKOIL Group entities, billion kWh	19.8	19.8	19.5
including purchases on foreign market	15.0	14.3	13.4
production consumption of electrical energy for foreign LUKOIL Group entities, billion kWh	3.0	3.1	3.1
including purchases on foreign market	1.8	1.8	2.1
<b>Production consumption of thermal energy for LUKOIL Group, million Gcal, including:</b>	<b>24.5</b>	<b>27.2</b>	<b>29.1</b>
production consumption of thermal energy for Russian entities of LUKOIL Group, million Gcal	18.3	21.2	22.7
including purchases on foreign market	6.0	7.3	3.6
production consumption of thermal energy for foreign entities of LUKOIL Group, million Gcal	6.2	6.0	6.4
including purchasing	1.2	1.1	1.2
<b>Production consumption of boiler and furnace fuel for LUKOIL Group, million tons of oil equivalent, including:</b>	<b>9.8</b>	<b>10.8</b>	<b>12.0</b>
production consumption of boiler and furnace fuel for Russian entities of LUKOIL Group, million tons of oil equivalent	7.5	8.6	9.7
production consumption of boiler and furnace fuel for foreign entities of LUKOIL Group, million tons of oil equivalent	2.3	2.2	2.3
<b>Total production energy consumption by LUKOIL Group entities, million GJ</b>	<b>362.7</b>	<b>397.4</b>	<b>416.0</b>

**Notes.** 1) Total production energy consumption by LUKOIL Group entities = Consumption of non-renewable types of fuel + Electric energy and thermal energy purchased for production consumption. The consumption of non-renewable fuels = Consumption of boiler and furnace fuel (fuel consumption for the generation of electrical and thermal energy at in-house generation facilities is taken into account).

Volumes of electrical and thermal energy transferred to third-party consumers, as well as utility consumption of electricity/heat are not included in production consumption and are accounted for separately.

2) Conversion is performed as per GOST R 51750-2001: 1 thousand kWh = 3.6 GJ, 1 Gcal = 4.19 GJ, 1 ton of oil equivalent = 29.3 GJ.

3) The rise in consumption of thermal energy and boiler and furnace fuel relates to an increased volume of thermal steam formation treatment (LLC LUKOIL-Komi, eight steam generation units commissioned at Yarega and Usa).

4) The limits of the indicator were expanded in 2018 (see Appendix 4). The values of the indicator for 2016 and for 2017 have changed and are indicated in the respective boundaries.



Plans for 2019 and the medium term include projects to boost the cost effectiveness and reliability of production facilities, and activities to optimize the operating modes of current boiler houses and power plants.

## EXAMPLES OF 2018 PROJECTS

The main energy conservation activities in 2018 comprised replacing, optimizing, and implementing energy efficient pumping equipment; using variable frequency drives; replacing and upgrading production equipment with a view to enhancing efficiency; optimizing condensate recycling systems; and upgrading lighting and heating systems.

### **OIL AND GAS EXTRACTION:**

installing complex drives with AC converter-fed motors



One method to improve oil extraction efficiency is to replace traditional asynchronous motors with AC converter-fed ones. Installations with AC converter-fed motors have better functional characteristics and higher resource and power parameters. Comparative tests performed at LUKOIL Group entities demonstrated a decrease in power consumption in the range of 10 to 60%.

### **OIL REFINING:**

boosting the operational efficiency of the furnace's heat reclamation system



Increasing the operational efficiency of the heat reclamation system achieved via the thermal insulation of the gas duct along the section from the exit from the convection heater to the entrance to the air heater, sealing the air heater, installing a heat-exchange unit to pre-heat the air before the air heater using spent steam or water condensate, as well as via thermal insulation of the air heater. This makes it possible to boost the furnace efficiency, reduce fuel consumption by 2.5-4%, and improve the operational reliability of heat reclamation system equipment in the furnace.

### **OIL PRODUCT SUPPLY:**

use of heat pumps at fuel stations



To provide fueling facilities with hot water, heating, and cooling facilities, a heat-pump based technology has been implemented. A comparative analysis of electrical energy consumption at fuel stations operating under such a format demonstrates a 20-35% reduction in annual costs on account of this measure.