

NEW EDUCATIONAL AND RESEARCH SYSTEM OF KAZAN FEDERAL UNIVERSITY

Strategic Academic Units – drivers of KFU’s growth

TRANSLATIONAL 7P MEDICINE (23 %)

Creating new solutions in human health care through the development of **Personalized Translational Medicine** on the basis of innovative model of **Transdisciplinary Biomedical Education** and interdisciplinary research.

Transfer Platforms



ECO OIL (14 %)

Generation, concentration and global distribution of competences in the field of **energy-saving, eco-friendly, effective (EEE) technologies** of exploration, production, refining and petrochemistry of unconventional hydrocarbon reserves

Transfer Platforms



ASTROCHALLENGE (9 %)

Advanced education based on modern research and development in the field of astronomy, astrophysics, radiophysics, geodesy, ecology, management of territorial development.

Transfer Platforms



TEACHER XXI (27 %)

Model of unique reflective and research-oriented pedagogical education, adaptive to the transformations of human, society and environment.

Transfer Platforms



% - involvement of research and teaching staff



STRATEGIC ACADEMIC UNIT “ECO OIL”

Global energy and resources for the materials of the future

Global Challenges

Growth of energy consumption

- Increase of the population up to 25% by 2040 and improving quality of life will lead to increase of energy consumption up to 50%. It will demand involving new energy sources.

Global warming

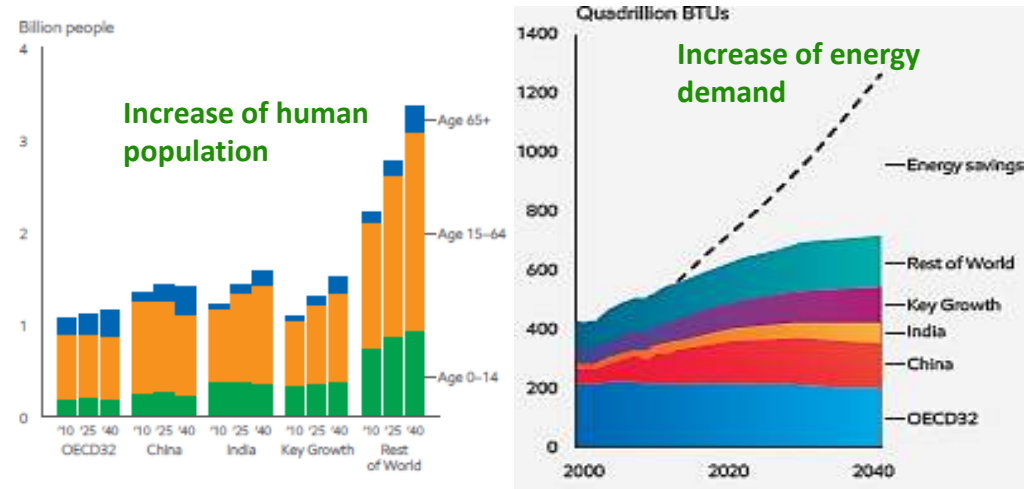
- Warming as a reason of global disasters;
- Further warming will dramatically change the appearance of the Earth;
- Warming is a factor strengthening greenhouse effect (release of permafrost's methane).

Environmental pollution

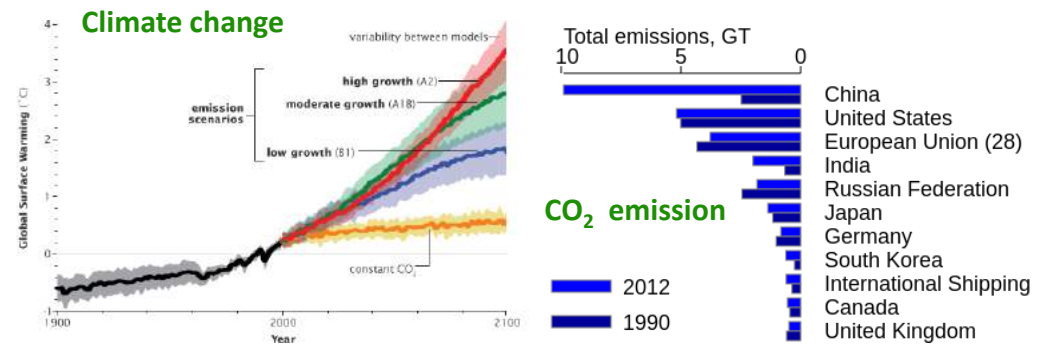
- Air and water pollution caused by production and combustion of coal (the most ecologically harmful energy production on the planet);
- Ecologically unfriendly oil production methods leading to the pollution of groundwater and soil;
- Risks of global accidents in nuclear energy production.

Oil price decline

- Cutting-down social programs and instability in hydrocarbon exporting countries, including Russia;
- Increase of political instability in the world and human migration.



ExxonMobil, The outlook for energy: A View to 2040



United Nations Climate Change Conference, December 2015

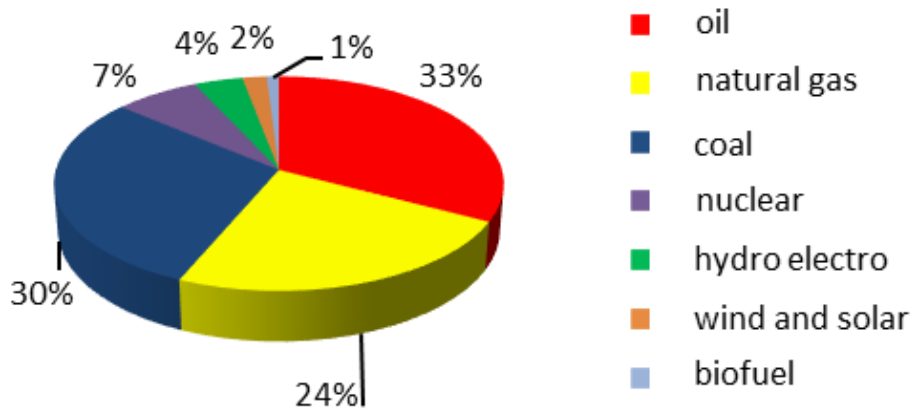


BBC, Bloomberg

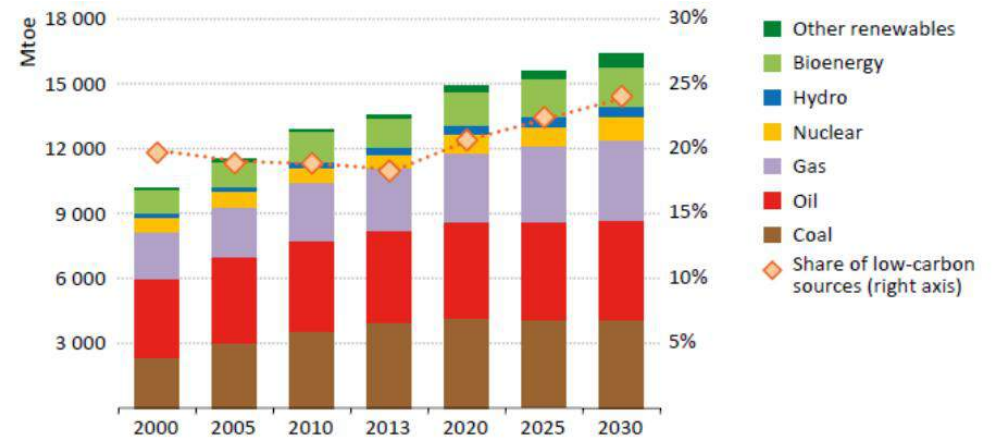
Primary Energy Sources: yesterday, today, tomorrow

Primary Energy sources 2014

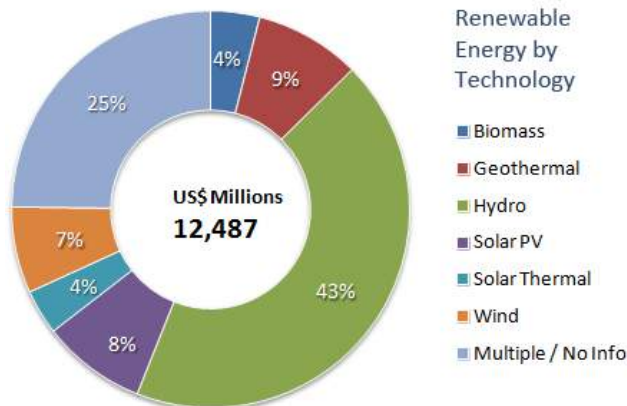
BP Statistical Review of World Energy
2015. "Distribution of energy sources
in the world"



Dynamics of primary energy sources' changes 2030-2040



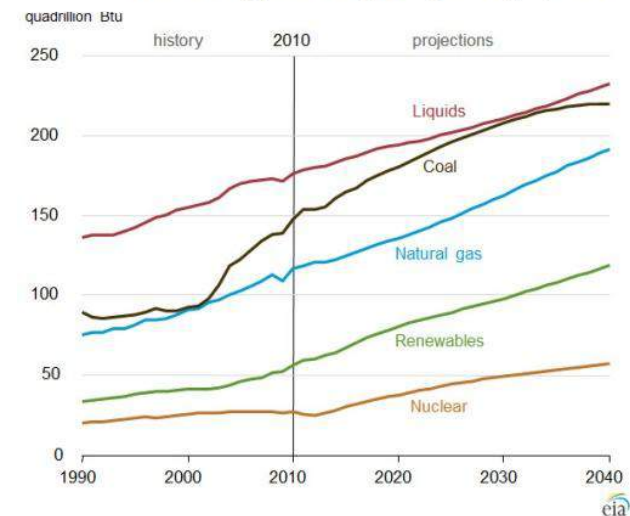
The ratio between the alternative energy sources



Source: World Bank Data, 2007-2012

The share of alternative energy sources in 2014 was 14%, and according to all the forecasts it will be increased up to 25% by the middle of the century. Coal and hydrocarbons will remain the main sources of energy.

World energy consumption by fuel type, 1990-2040



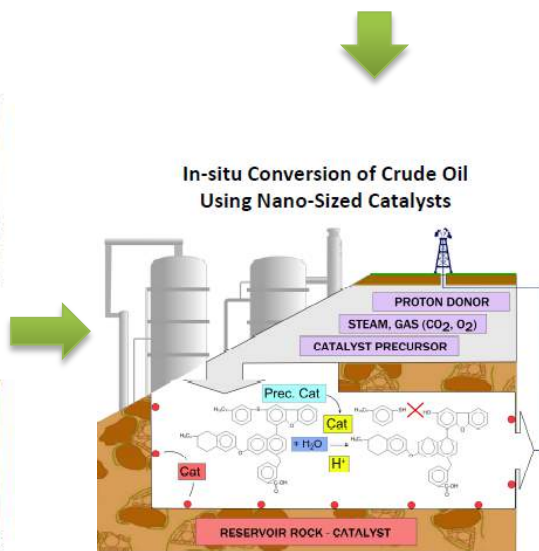
Our Solutions

REFUSAL OF COAL

(because of its non-efficiency and environmental impact) in favor of oil and natural gas

- Reduction of air, soil and water pollution;
- Reduction of greenhouse gases emissions.

High technologies of hydrocarbon production and refining – an alternative to ecologically unfriendly development and energy production.

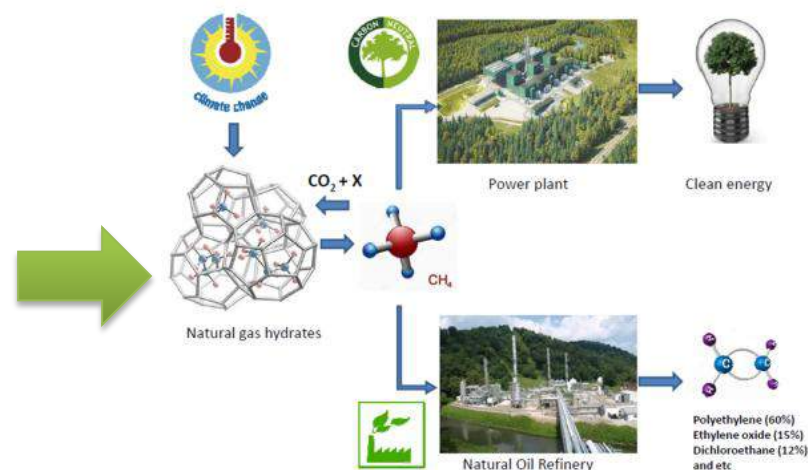
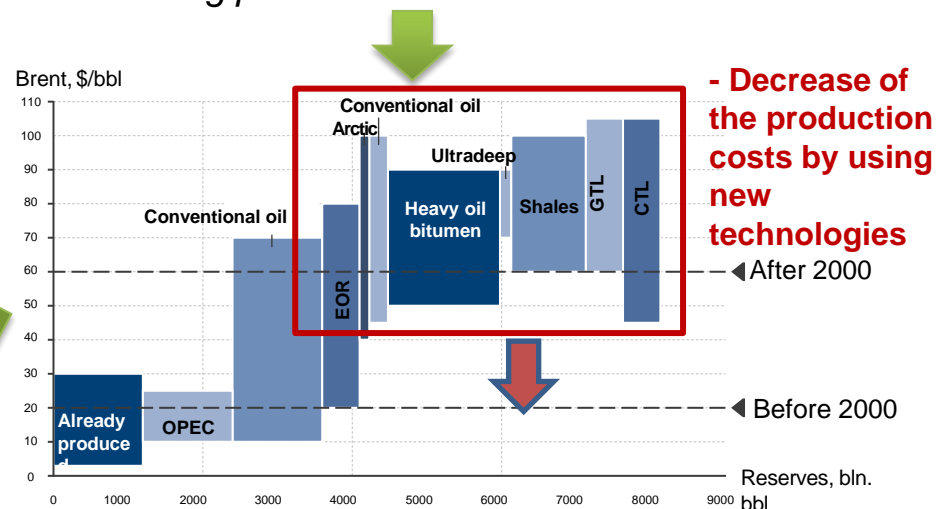


INCREASE of natural gas (methane) share in energy production through involvement of new sources

- Reduction of greenhouse gases and toxic emissions;
- Reducing energy consumption;
- Cost-effective technologies of gas-hydrates production (the pure energy source for 200 years).

IMPROVING the energy saving, eco-friendliness and effectiveness of hydrocarbons extraction (EEE-technologies)

- Reducing the industrial and acid-forming gases emissions
- Reducing energy consumption
- Reducing production costs

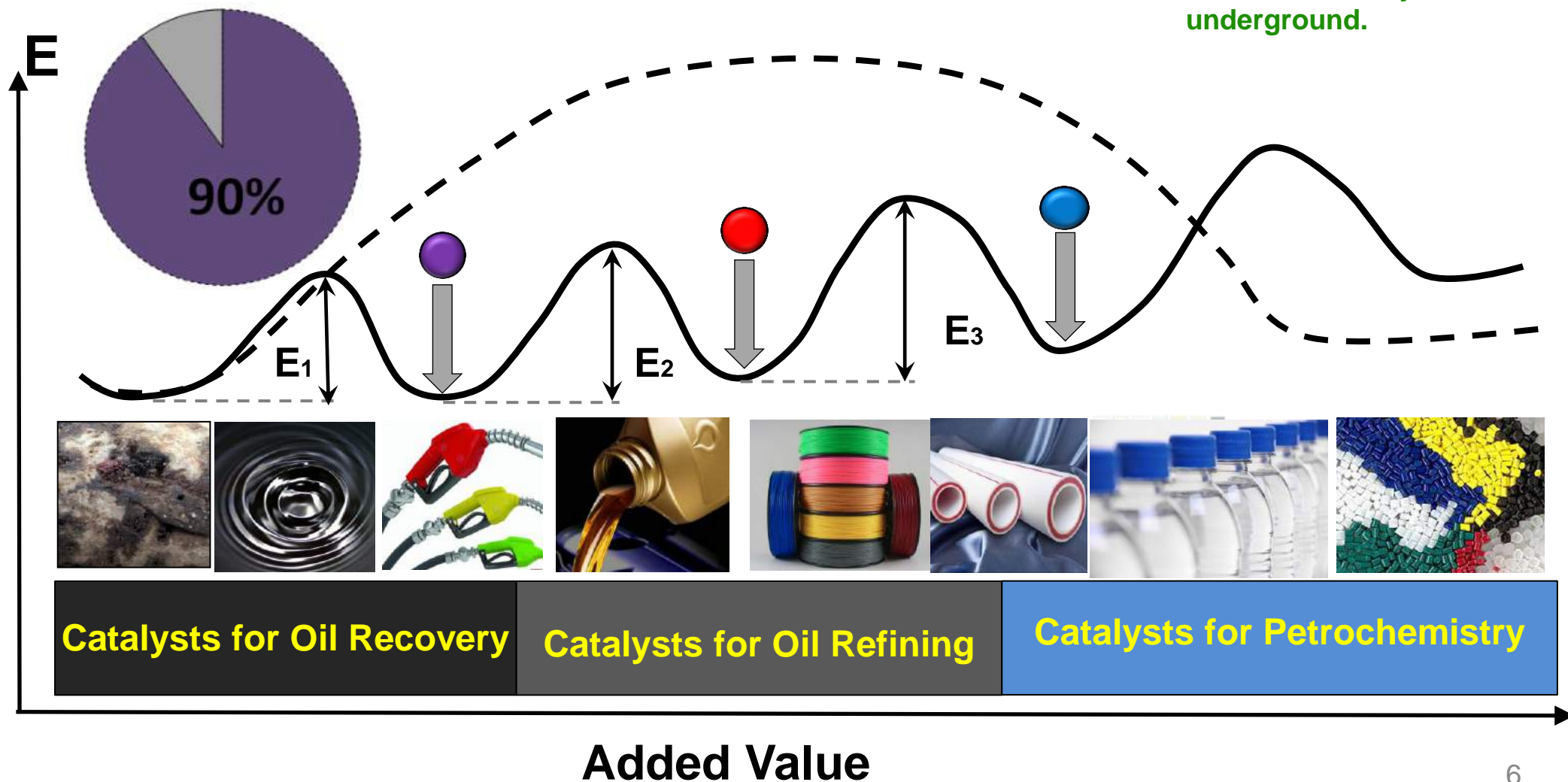


Catalysis as a basis for EEE-technologies

90% of the processes and technologies in petrochemical and oil refining industries are based on the usage of catalysts

WE DEVELOP CATALYSTS FOR ALL AREAS OF OIL AND GAS INDUSTRY.

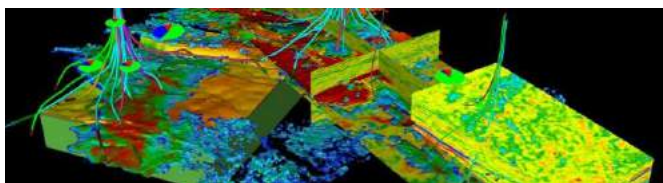
Catalysts for Oil Recovery help to begin production of hydrocarbon-based materials already underground.



Our Uniqueness (Why in KFU?)

Competences

Unique KFU's Schools – geological (exploration of great number of Volga-Ural and West Siberia regions), chemical (the birthplace of organic chemistry), mathematical school (leaders in reservoir simulation).



Pilot Oilfields

Pilot oilfields together with JSC Tatneft for testing new technologies for recovery of heavy oil, bitumens and shale oil.



Existing Projects

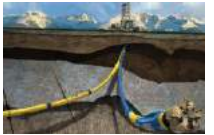
Projects in the field of production of heavy oil and bitumens together with Russian and international companies .



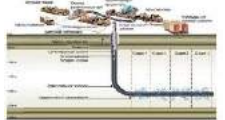
Our experience

We created unique technologies of underground oil refining - in-situ catalytic conversion of hydrocarbons
In the XX century there were two revolutions in oil recovery.

Horizontal Drilling



Hydraulic Fracturing



We are making the third revolution:
development of technologies of “underground oil refining”



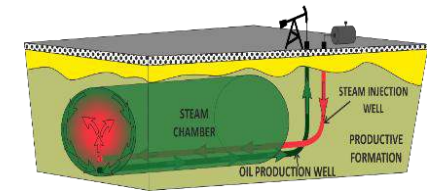
Joint catalysts factory with JSC Nizhnekamskneftekhim

Factory was opened on October 29, 2014. Square – 7 200 sq.m. Capacity - 2 500 tons per year. Engineering staff – 100 employees.



Project “SAGD” with JSC Tatneft

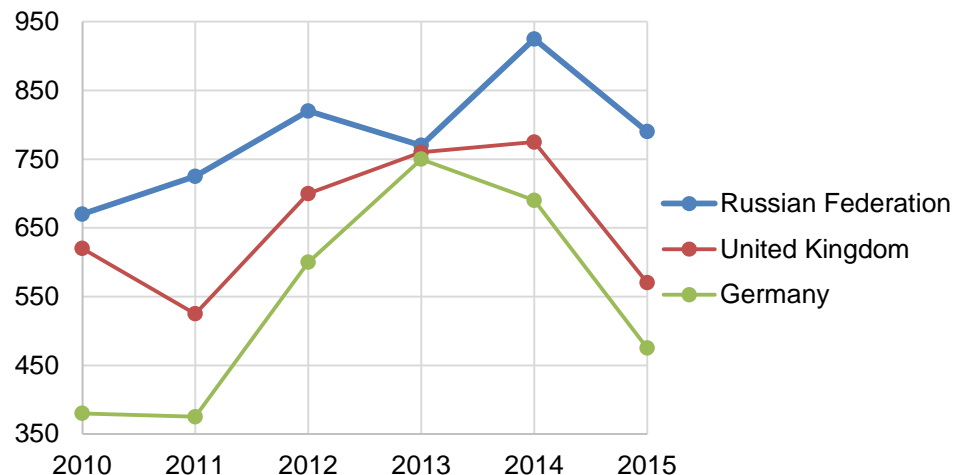
We have established the basis for information support of the control and management of unconventional hydrocarbon production.



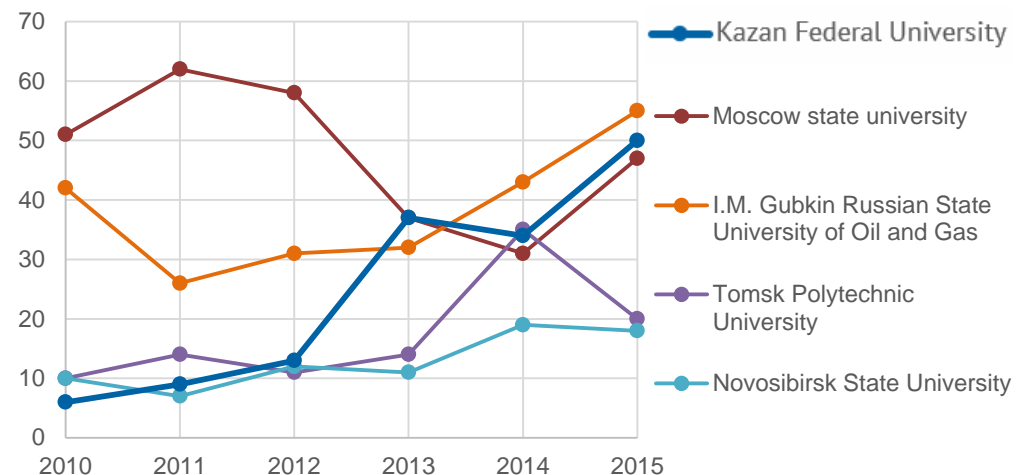
Intensification of heavy oil recovery by SAGD method using catalytic oil upgrading



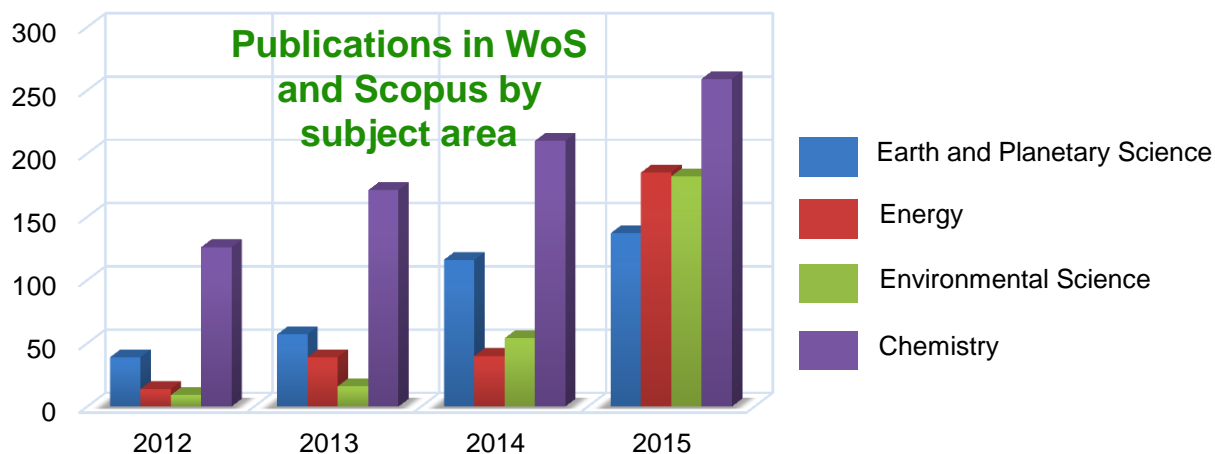
Our Positions and Publications



Russia is number one in Europe in publications in “Fuel Technology” area (3rd place in the world after the USA and China)



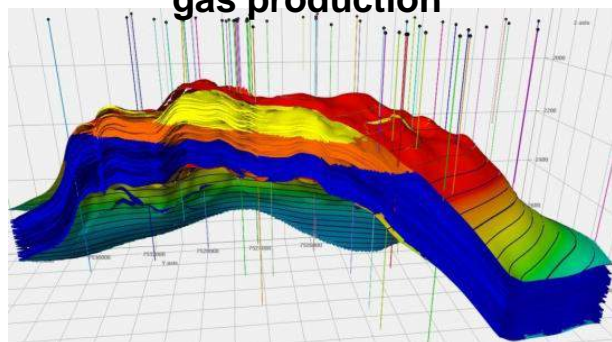
In 2015 Kazan Federal University took the second place among Russian Universities in the number of publications in “Fuel Technology” area



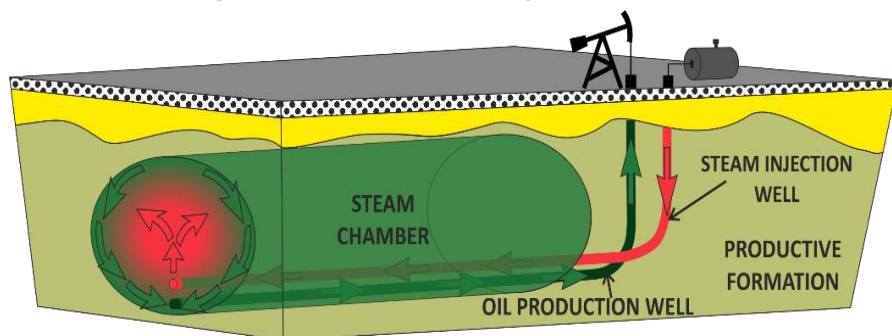
During the last 5 years Kazan University increased the number of publications in “Fuel Technology” subject area by almost a factor of 10

Important engineering & technical projects of the StrAU

Search and exploration of hydrocarbon resources deposits, 3D reservoir modeling, development of effective methods for oil and gas production



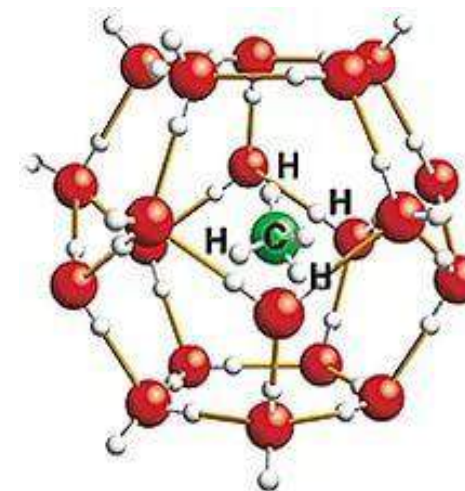
Development of new technologies of 3rd generation for cost-effective production of hard-to-recover hydrocarbon reserves – “underground oil refining”



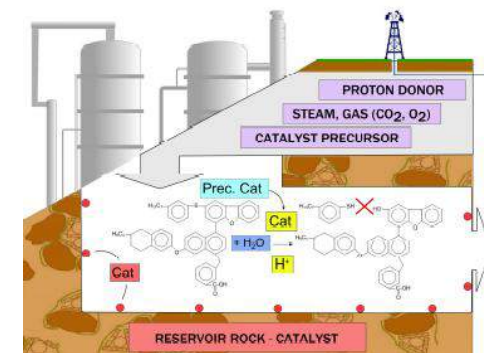
Assessment and prevention of environmental risks



Innovative solutions in the field of gas chemistry: the study of gas hydrates and gas processing



Development of catalysts for oil production, refining and petrochemistry





Structure of the StrAU

Institute of
Geology and
Petroleum
Technologies

Butlerov
Institute of
Chemistry

Institute of
Physics

Lobachevsky
Institute of
Mathematics
and Mechanics

Institute of
Environmental
Sciences

Institute of
Computational
Mathematics
and Information
Technologies

Higher School
of Information
Technologies
and Information
Systems

Centre of Excellence in hydrocarbon reservoir development simulation

- 3DGEO Centre
- Geochemistry Laboratory
- Organic Geochemistry Laboratory
- Petrophysical Research Laboratory
- Geophysical Field Research Laboratory
- Seismology and Computational Geophysics Laboratory

Centre of Excellence in research and development of complex technologies for recovery of unconventional reserves of oil on the basis of thermal and thermo-catalytic methods

- Thermal Analysis and Calorimetry Laboratory
- Laboratory of Rheological Properties of Crude Oil and Oil Products
- Laboratory of In-Situ Oil Conversion
- Laboratory of Physical Organic Chemistry of Crude Oil
- Laboratory of Combustion Front Monitoring Research

- Laboratory of NMR and Molecular Dynamics of Hydrocarbon Systems
- Laboratory of Information Support of Oil and Gas Industry

Centre of Excellence in development of catalysts for oil production, refining and petrochemistry

- Laboratory Centre of Heterogeneous Catalysis
- Laboratory of Catalysts for In-Situ Oil Conversion
- Laboratory of Homogenous Catalysis

- Laboratory of Hydrodynamic Simulation in Geosciences
- Laboratory of Modeling of Complex Physical Chemical Systems

- Laboratory of Development of Hydrocarbon Reservoirs Environmental Monitoring "BioControl"
- Centre of Engineering Surveys

- Laboratory for Supercomputing in Oil and Gas Industry
- Laboratory of Geoinformation Technologies and Systems

- Laboratory of Environmental Data Analysis

Educational System

Main principles:

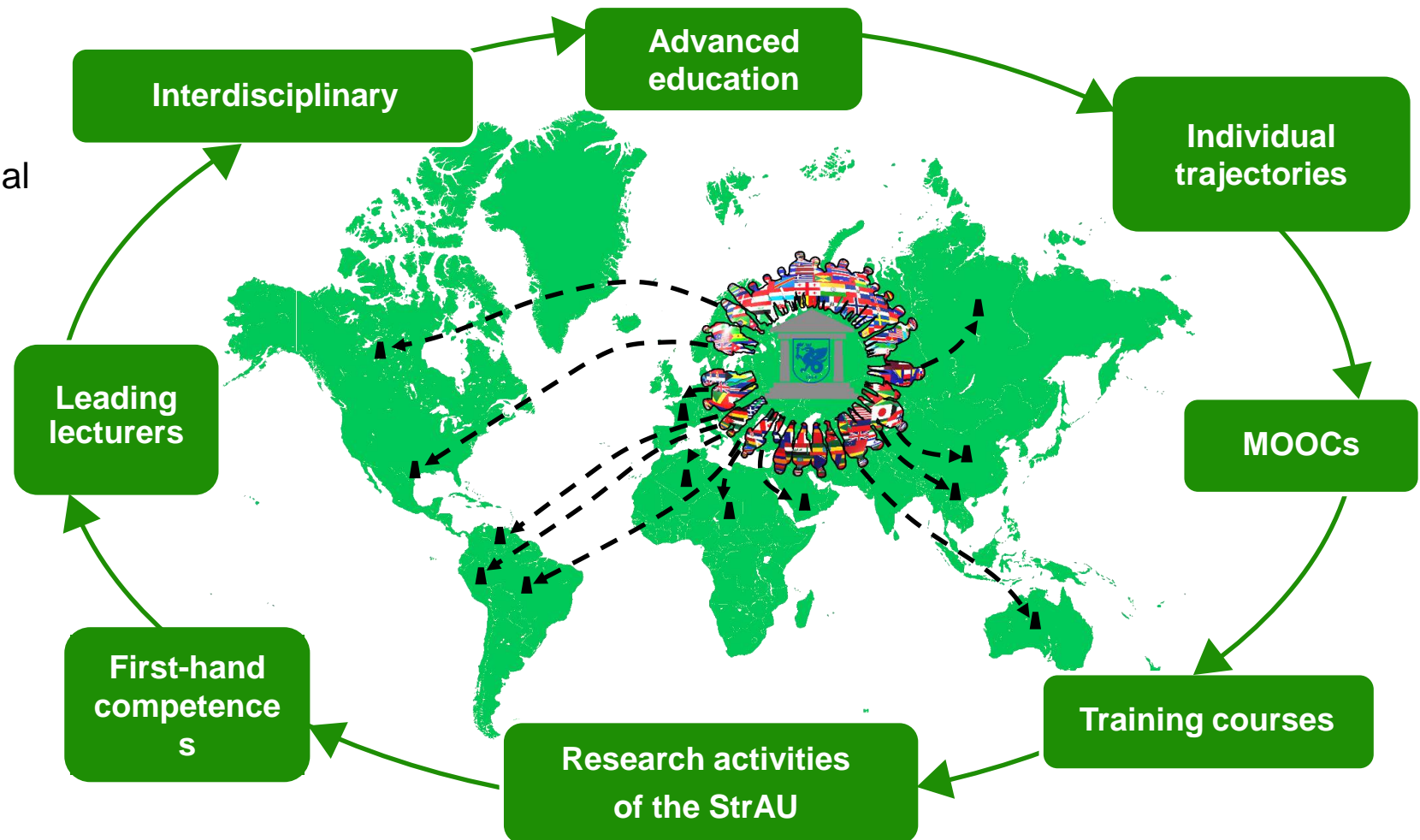
Internationalization; Inclusiveness on each level; Life-Long Learning

Students from:

- Exporting oil and gas countries;
- Countries possessing significant unconventional hydrocarbons reserves.

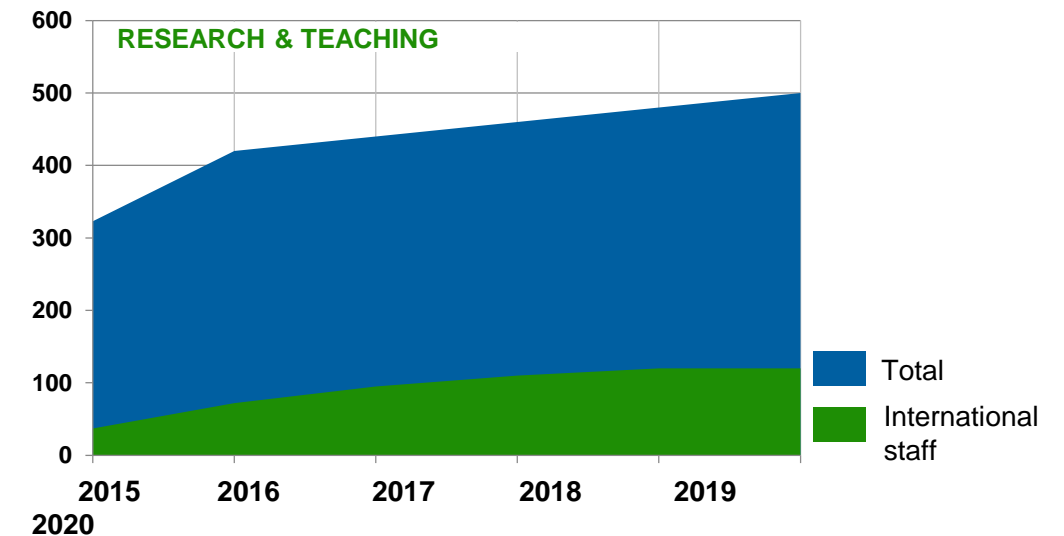
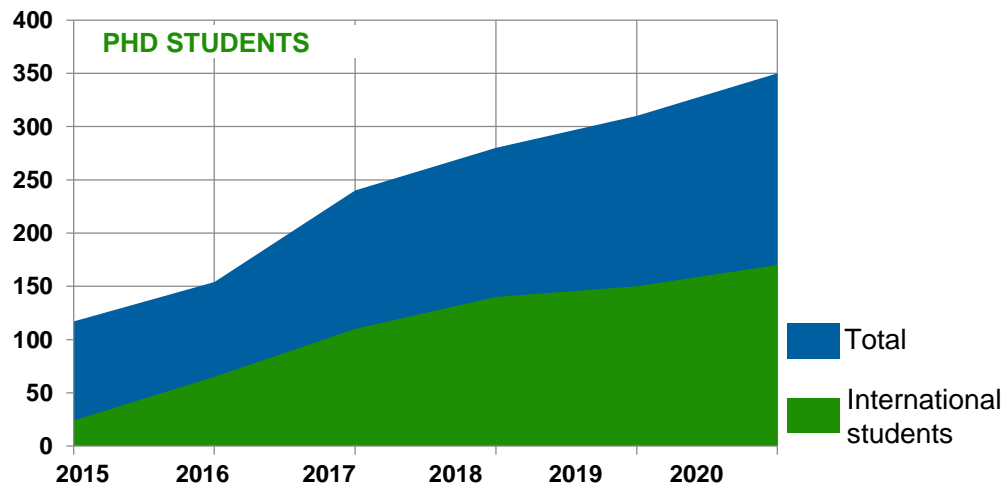
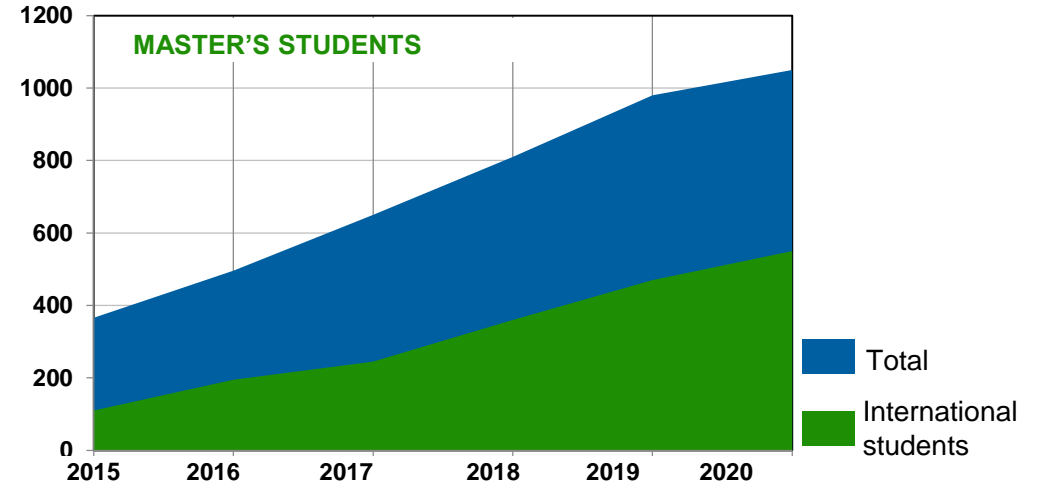
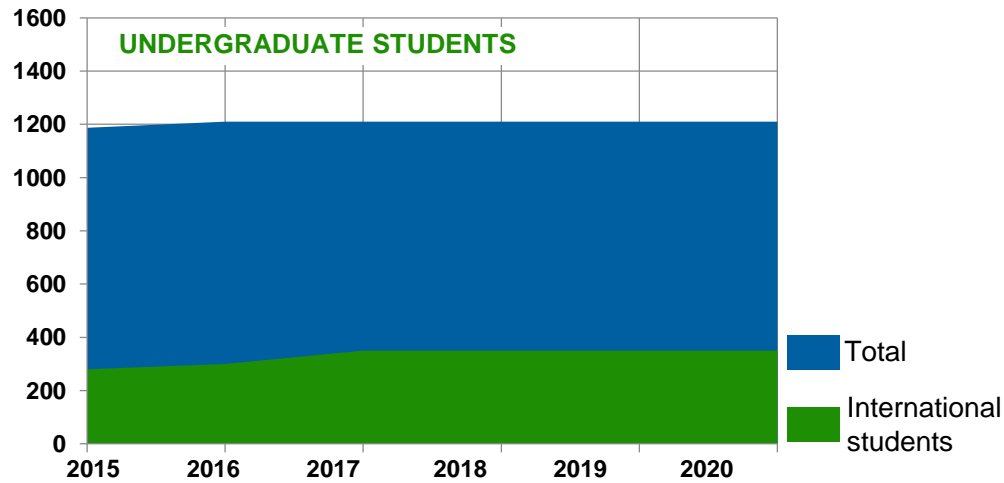
Inclusiveness and interdisciplinary on each level of education:

- Geologists;
- Chemists;
- Physicists;
- Mathematicians;
- Engineers;
- Ecologists;
- and etc.



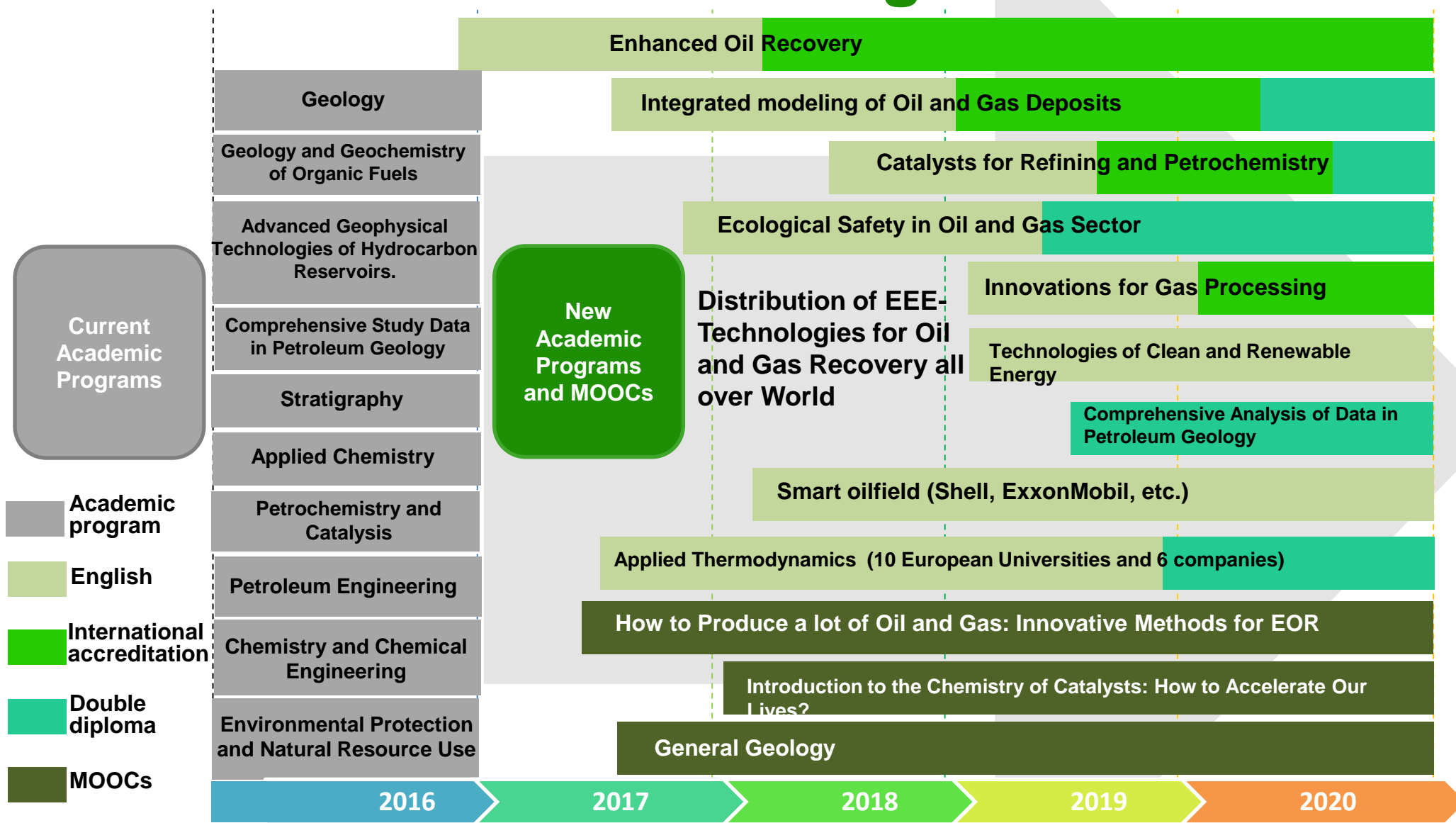


Numbers of students and research & teaching staff

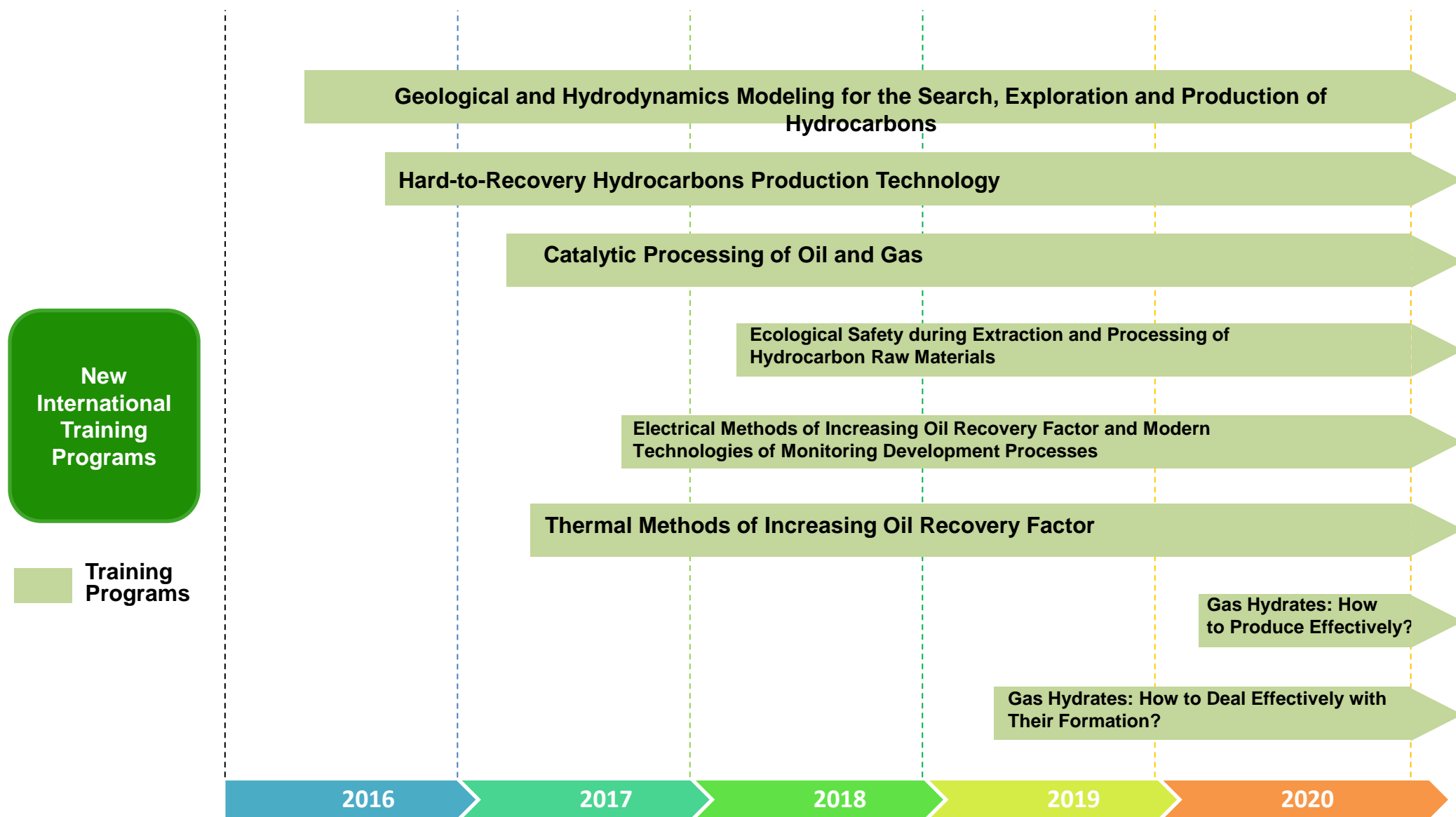




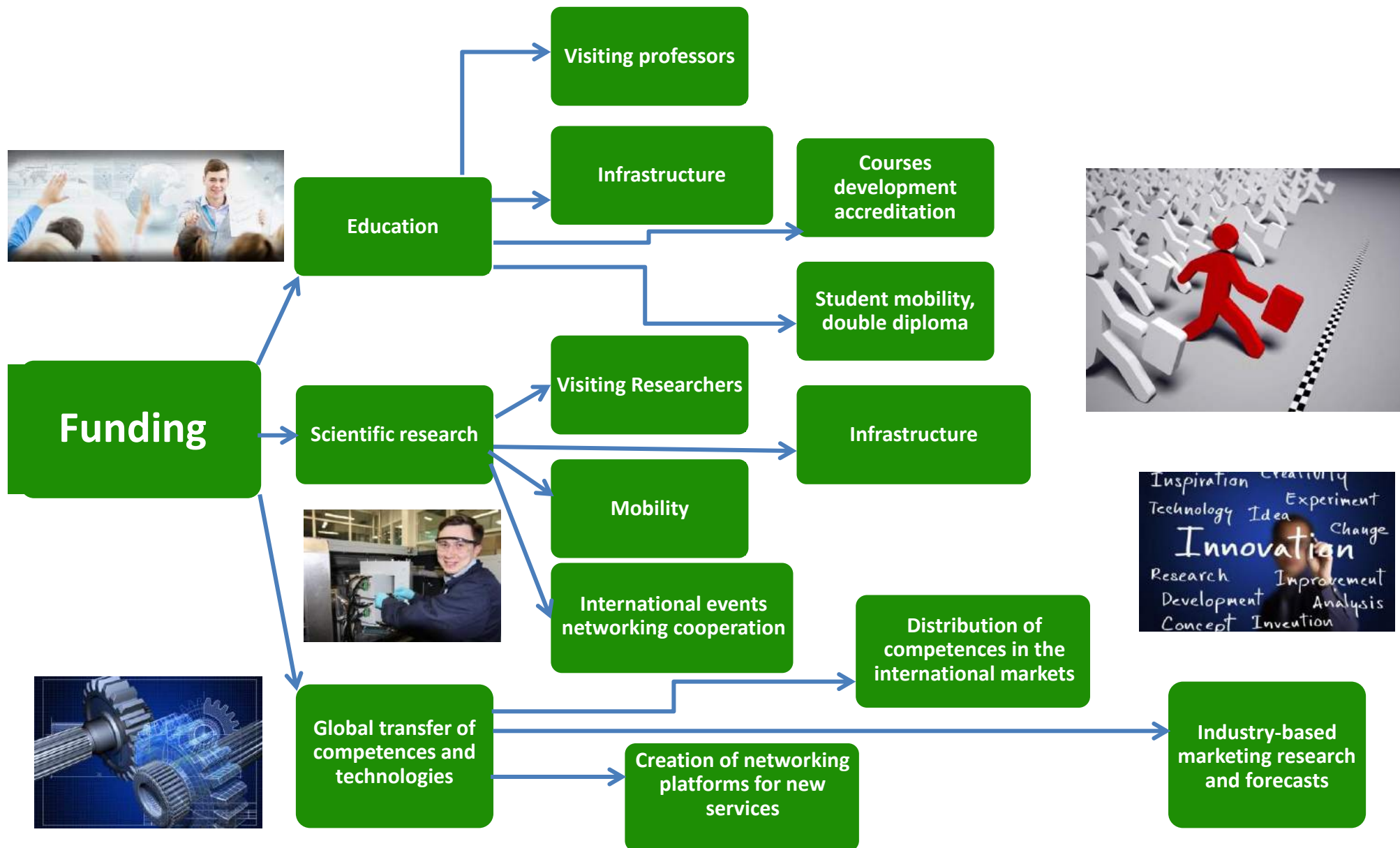
Academic Programs



New Training Programs



What we want to support and develop



Major goals to be achieved in 2020:



2020

- 9 Innovative enterprises
- Revenues from non-budgetary funds 1450 mln RUB
- The share of third-party contributions in the budget structure of the StrAU – more than 70 %
- The share of international professors, lecturers and researchers - more than 20 % of the total staff
- The share of international students among all StrAU's students – 40%
- The share of PhD and Master's students – more than 50 %