PERSPECTIVES OF BIOECONOMY IN RUSSIA

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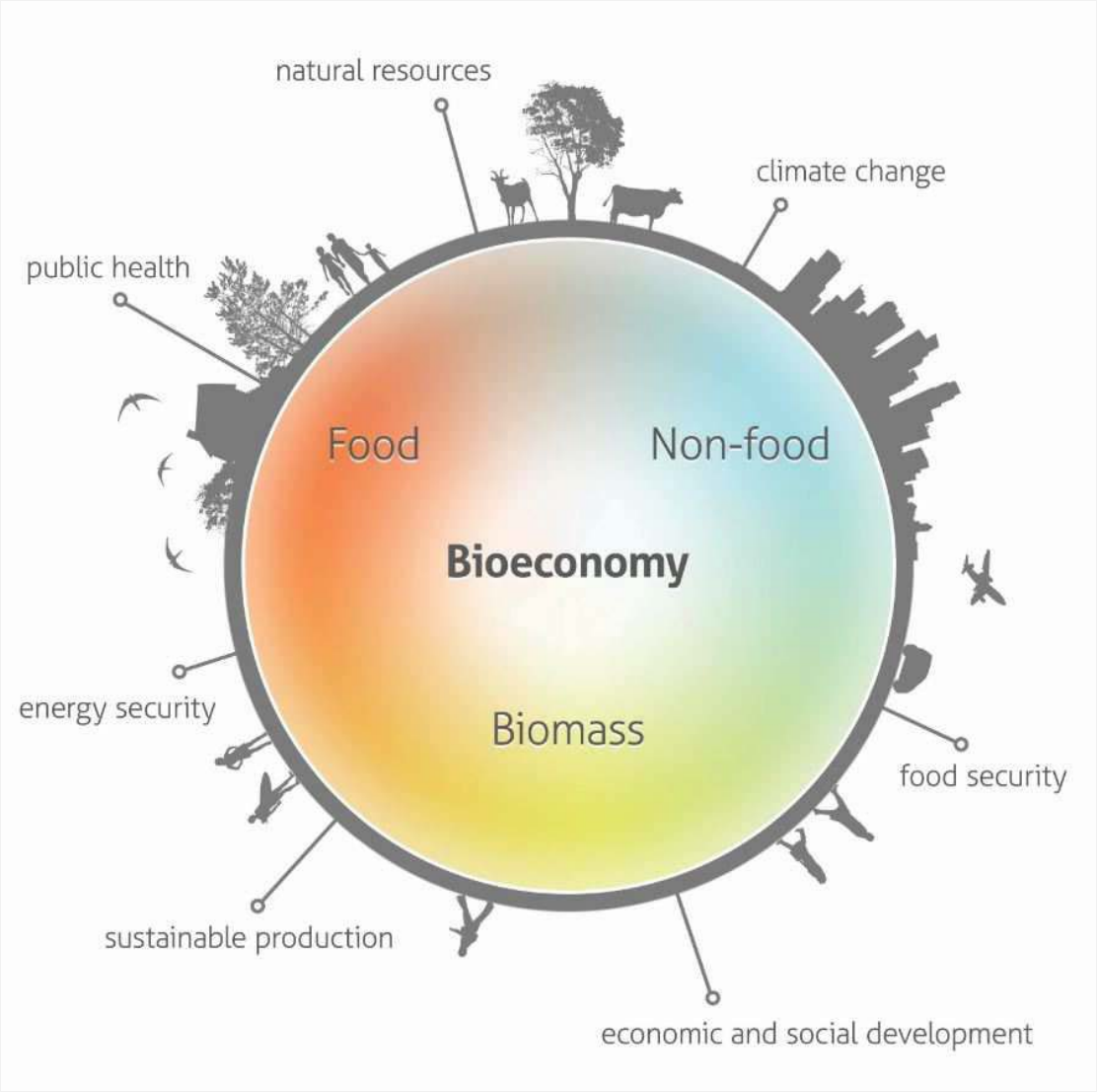
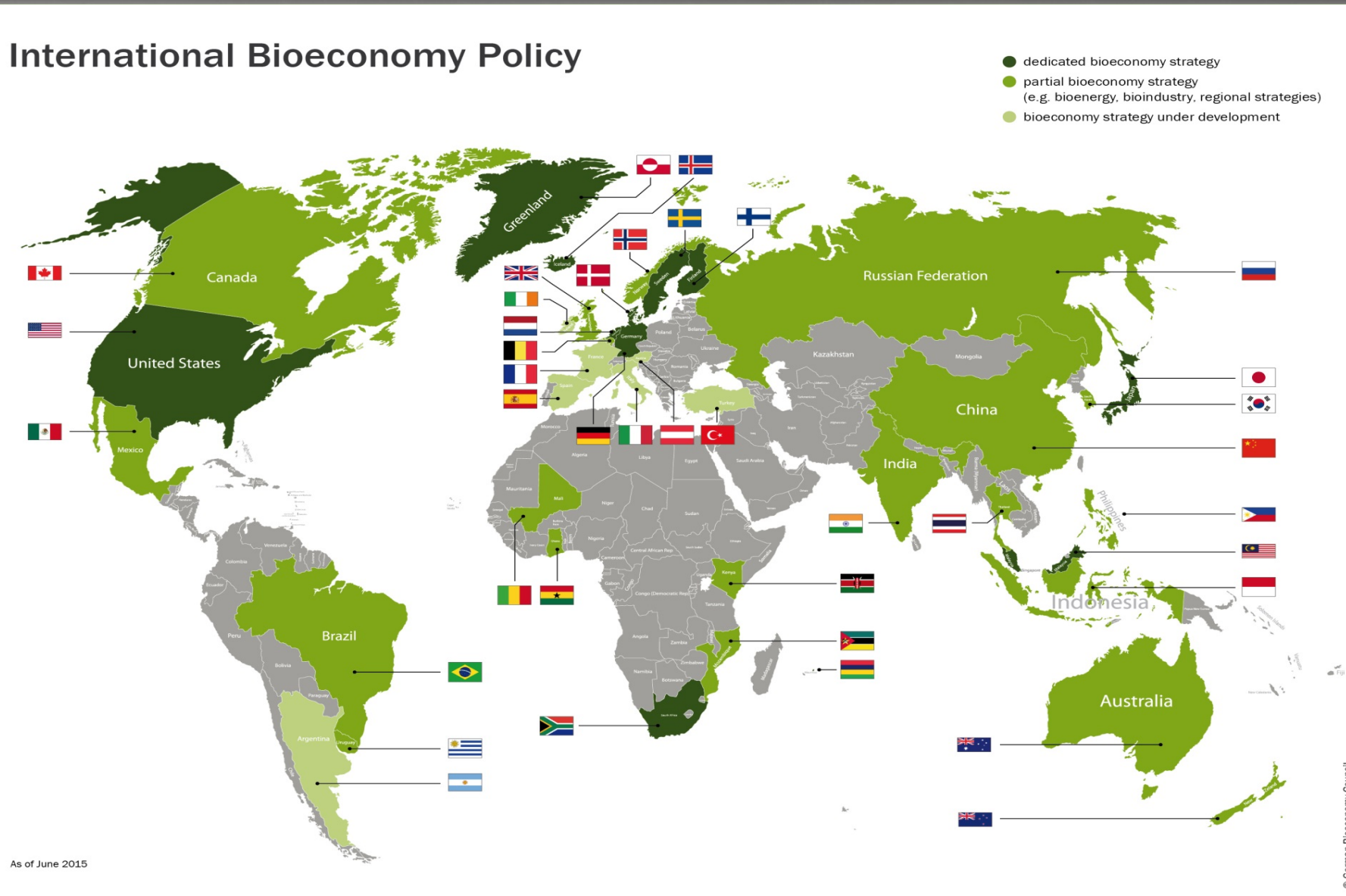
Bioeconomy definition



- A economy where biotechnology contributes to a significant share of economic output
- Main components of the bioeconomy:
  - use of advanced genomic and complex cell technologies to develop new products and processes
  - use of renewable biomass and efficient bioprocesses to support sustainable production and ensure environment protection
  - integration of the biotechnology knowledge and applications across different economy sectors

- Main development drivers:
  - Sustainable development
  - Climate change
  - Energy suffiency
  - Development of agriculture
  - Regional specifics

Bioeconomy as a global concept



Foreign initiatives in the field of Bioeconomy

NATIONAL BIOECONOMY BLUEPRINT

INNOVATING FOR SUSTAINABLE GROWTH: A BIOECONOMY FOR EUROPE

NATIONAL RESEARCH STRATEGY BIOECONOMY 2030

BIOTECHNOLOGY AND AUSTRALIAN AGRICULTURE

BIOECONOMY INITIATIVE MALAYSIA

BIO2020 - a starting point

- Government orders (01.04.2011) drafting of the “Program of development of the biotechnologies in the Russian Federation”, signed by Prime Minister on 24.04.2012
- BIO2020 main goals
  - To initiate bioeconomy development in Russia
  - To support new economy segments associated with industrial biotechnology
  - Important changes in legislation and standards
  - To stimulate and develop already existing priority market segments for biotech products - agrobio, food

The strategic goal is the level of bioeconomy
~ 1 % of GDP by 2020
~3 % of GDP by 2030

Program documents

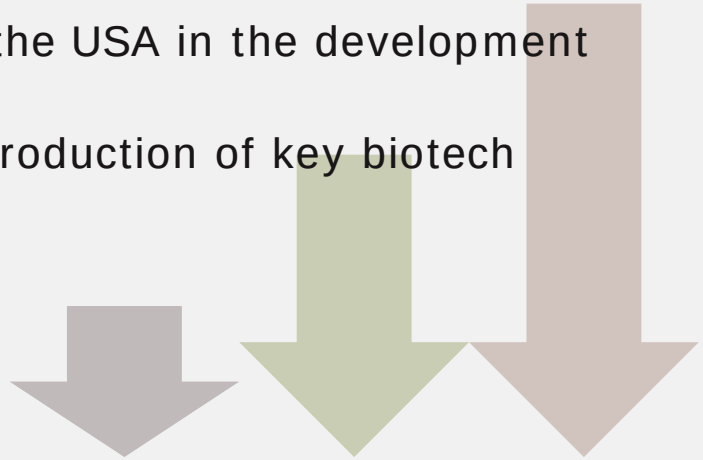
APRIL 2012	Complex program of biotechnology development in the Russian Federation – **BIO2020**
NOV 2012	Inter-ministerial **Working group** for the development of biotechnologies under the leadership of deputy prime-minister A.Dvorkovich
JULY 2013	**RoadMap** «Development of biotechnology and genetic engineering» - approved by Prime Minister
APRIL 2014	**Subprogram «Industrial biotechnologies»** to SP «Development of industry and increase his competitiveness for the period up to 2020»
APRIL 2014	**Technical Committee** «Biotechnology» established by Rosstandart
AUG 2015, SEPT 2017	Actualization of the **RoadMap** «Development of biotechnology and genetic engineering»
APRIL 2016	**National Technology Initiative (NTI)**, with priorities relevant to biotechnology and bioeconomy (**FoodNet**)
July 2016	Presidential Decree on **State R&D policy in support of agriculture**
DECEMBER 2016	**Strategy of the Scientific and Technology Development** of the Russian Federation

Why Russia needs industrial biotechnologies

In the early 90s the USSR was **second** to the USA in the development of microbiological industry

In modern Russia compared to the USSR production of key biotech products decreased by:

- enzymes - 25 times
- antibiotics - 12 times
- feed protein - 6 times



FOR EXAMPLE

Agrobiotechnology world market:

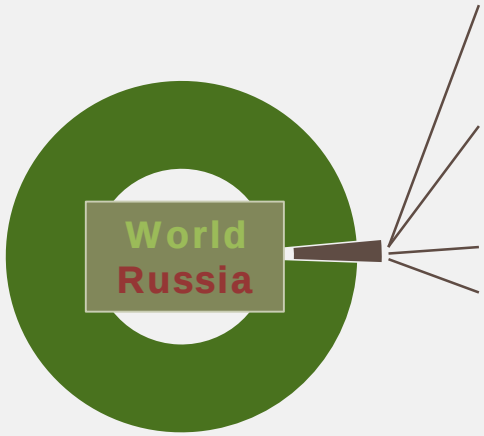
- 2013 – 26.4 B$
- 2014 – 27.8 B$
- 2030 – 50% of agricultural produce will be obtained with the use of biotechnology

By 2020 market will increase up to 60 billion dollars with 11.0% AGR

Frost & Sullivan

Products	Imports, %
Lysine	70
Other essential amino acids	100
Vitamins	100
Feed enzymes	70-80
Technical enzymes for biomass processing	80-90
Biological plant protection agents	30-50
Probiotics for animals	20-30
Biofertilizers and biostimulators	10-30
Starter cultures for silage	10-20

Issue of national security



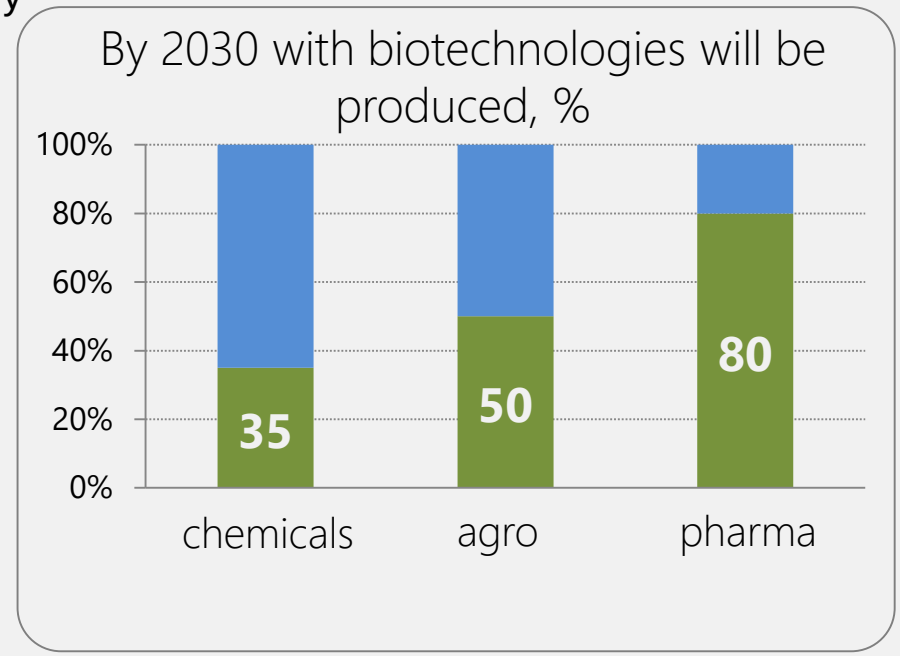
0.1% share of the RF in global biotech production (**5-7% in 1990**)

1.5% share of the RF in global consumption of biotech products

2.0% share of the RF in global population

2.8% contribution of the Russian Federation to the global economy

Global biotechnology market by 2025 will reach $ 2 trillion, showing growth rates from 5-7 up to 30 % for some segments



What is biotech/bioeconomy for Russia?

- Growing demand for biotech products all around the world
- Modernization of industry and agriculture, sustainable development of the Russian economy
- Ensuring food and drug security
- The need of job creation in distant regions, rural areas and so called «mono-cities»
- **The threat of losing traditional sales markets and devaluation of main export products due to replacement by the products obtained from renewables**

Main competitive advantages of Russia

- Oil and gas
- Mineral resources
- **Forestation, 1180 mln.ha**
  - 20 % of world's forest resources
  - 50 % of coniferous forests
- **Land (fertile, arable)**
  - 10% of arable land, 195 mln.ha
  - 60% of most productive world black soils are located in Russia and Ukraine
  - About 20 mln.hectars of arable land are temperately out of agricultural production
  - Grain harvest >100 mln.t, projected surplus up to 30 mln.t
- **Water**
  - water resources, 30,000 m^3 per capita
  - irrigated land, 86,000 m^2 per capita
- **BIOMASS**

Russia *vs* World

World	Russia	Assessment
Program documents		
USA, Europe, China, Brazil….	BIO-2020, RoadMap	+
State procurement		
50 % fuel for the Navy and the U.S. air force by 2050	Preferences and/or programs are missing	-
Biofuel		
Renewable Fuel Standard (RFS) – the basis for the attractiveness of the U.S. market	Subject to the excise tax, scheduled to be waved by December 2016, awaiting decision by the PM	+ / -
Industrial biotechnologies		
Bioplastics: Coke (500,000 t/year by 2020), Pepsiko, Heinz, P&G, Walmart… II-generation Bioethanol 60,000 tons/year, Italy… SCP from methane, Calista, USA (20,000 t/year 2019, 200,000 by 2021)	Several large projects initiated. Biotech engineering centers. Support of R & D	+ / -

Specifics of the current momentum

Sustainable growth of the resource base

- The surplus of grain
- Constantly increasing amount of waste

Critical dependence on imports

>90 % for main segments

Restrictions on the use of GMOs

No biofuels

The Embargo / Sanctions

The trajectory of biotechnology development in the Russian Federation is specific and differs, sometimes considerably, from the global trends

The priorities of industrial biotechnology in Russia

The agricultural sector

Feed proteins

Feed additives, including enzymes and amino acids

Biofertilizers

Plant protection products

Growth stimulators

Chemical industry

Organic acids and alcohols

Bioethanol?

Pulp and paper industry

Chlorine-free bleaching

Environment protection

Anaerobic digesters

Biodestructors (oil spills, etc.)

Recycling and valorization of waste

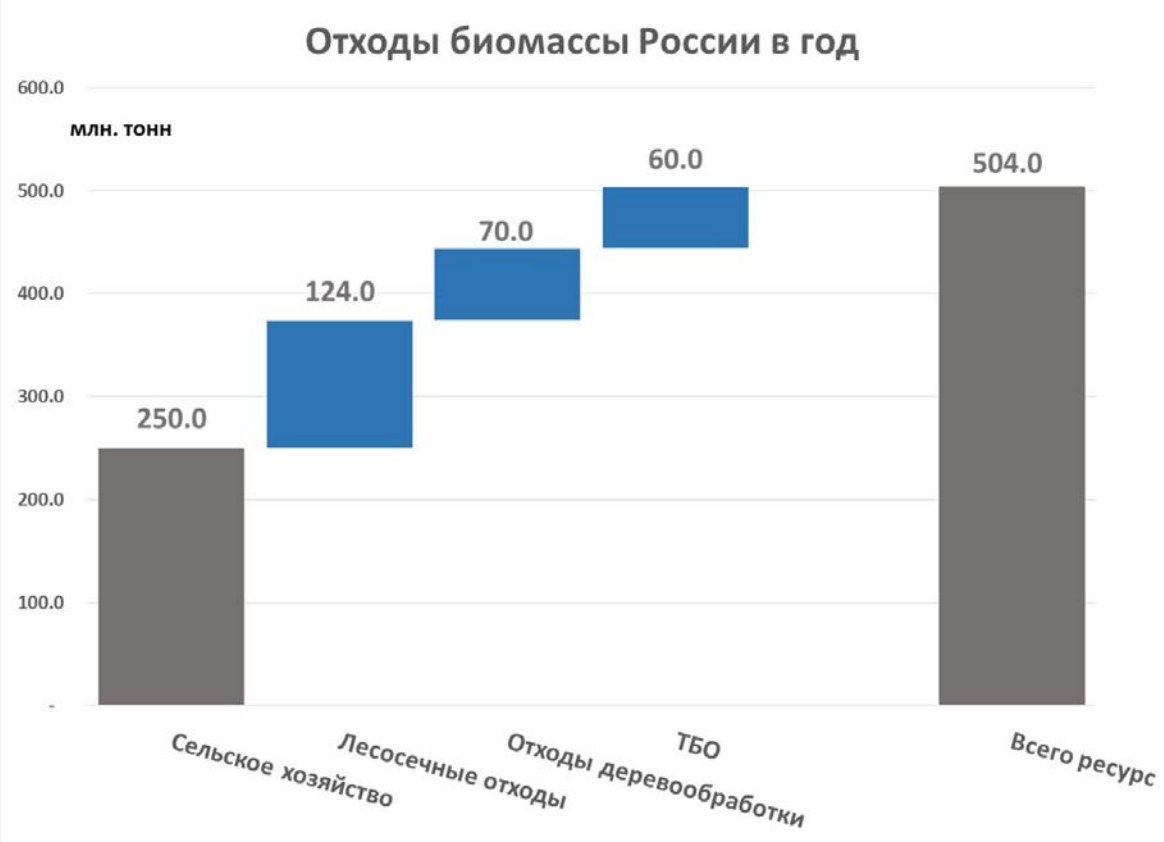
Agriculture

Woodworking, timber, pulp and paper mill

Food industry

Substitution of imports in all segments

Bioenergy from waste



- Total energy production - **1000 mln.T** of conditional fuel
- Organic fraction of
  - agricultural waste – **80 mln.T** of conditional fuel
  - municipal waste – **10 mln.T** of conditional fuel

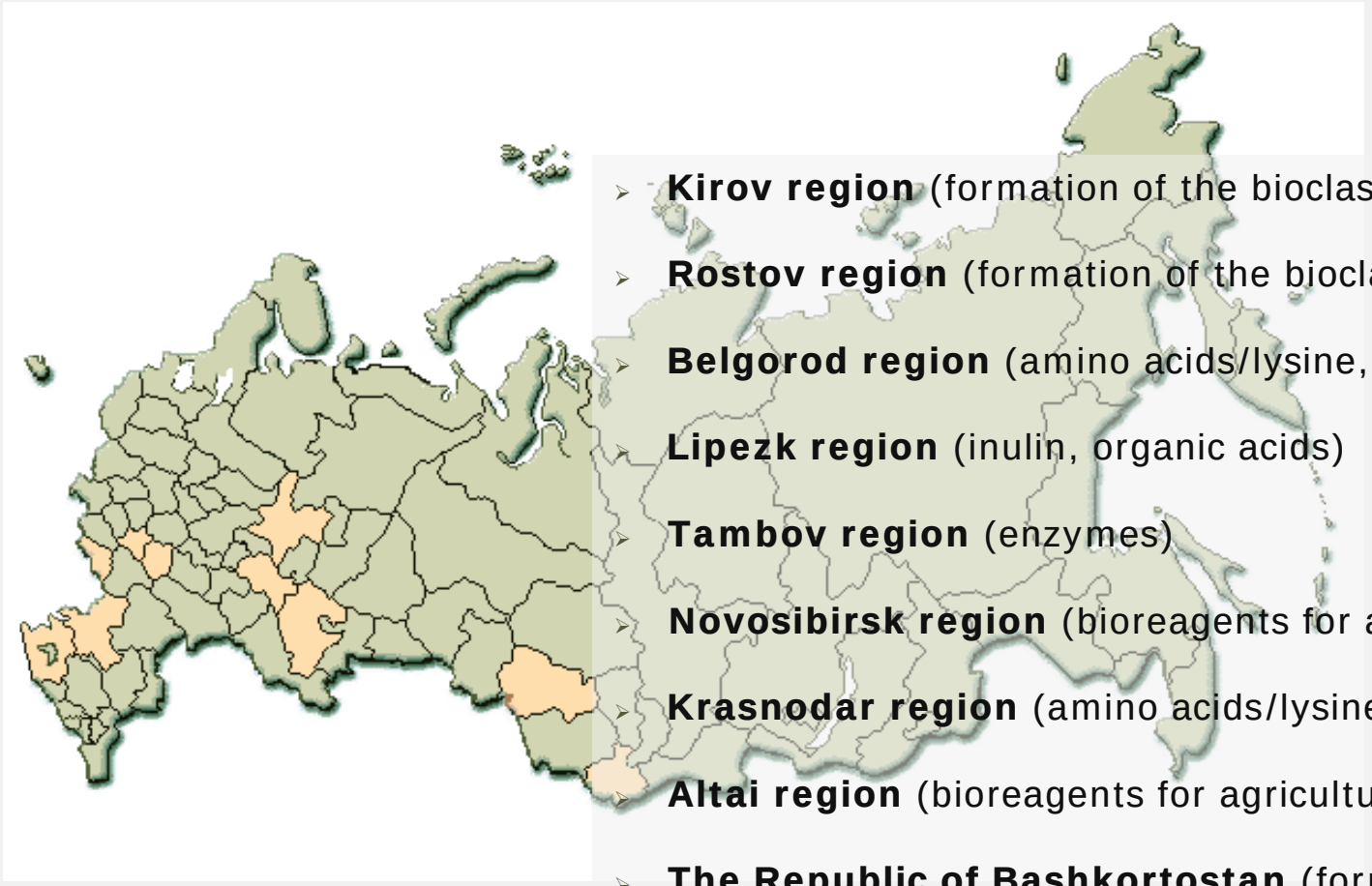
Green tariffs support clean environment

1 м³ biogas =

2 – 2.2 kWh of energy
AND
2.8 – 4.1 kWh of heat
OR
equivalent to 0.6 L diesel

- Grid companies are entitled to by from the suppliers of renewable energy up to 5 % of the total energy losses within a region (Governmental decree N47 from 23.01.2015)
- Methodology of green tariff calculation from suppliers of renewable energy established (30.09.2015, FAS)
- Green tariff 12-15 Rbl/kWh (wholesale 2-2.5, spot 4-5)
- Total capacity of installable biogas stations, assuming 5 % losses, **870 MWt**
- 8 regions of RF - functioning tariffs, 4 – pending in 2017, Moscow and Moscow region, SPb and Leningrad region – in progress

Biogeography of the Russian Federation – innovation-active regions



- **Kirov region** (formation of the bioclaster)
- **Rostov region** (formation of the bioclaster)
- **Belgorod region** (amino acids/lysine, threonine)
- **Lipezk region** (inulin, organic acids)
- **Tambov region** (enzymes)
- **Novosibirsk region** (bioreagents for agriculture)
- **Krasnodar region** (amino acids/lysine)
- **Altai region** (bioreagents for agriculture)
- **The Republic of Bashkortostan** (formation of the bioclaster)
- **The Republic of Tatarstan** (formation of the bioclaster)

Some visible projects

- **Plants for complex processing of grain**
  - ✓ 12 projects in 10 regions

- **Three lysine production plants**
  - ✓ Belogorye-Genetika (Belgorod)
  - ✓ The group of companies "Russian agricultural trust"- Evonik, Germany (Rostov)
  - ✓ Ishim plant

- **Industrial enzymes**
  - ✓ Tambov region, Agroferment

- **LLC «Biotechnology»**
  - ✓ Construction of 3 plants for processing of sunflower meal (feed protein, sugars, pellets).

- **ROSTECH state corporation / EastAgro**
  - ✓ The biocluster in the Lipetsk region (inulin, fructo-oligosacharides)

Some visible projects

- **Gaprin (InterBiotechnology, MedCob-Bio, UniBio)**
  - ✓ Microbial protein (CSP) from natural gas

- **Titan, Omsk**
  - ✓ The production of ETBE using bioethanol

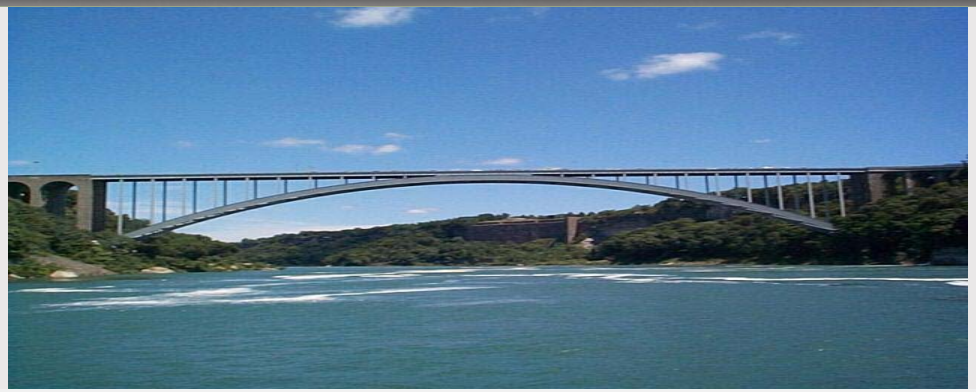
- **Bioethanol (North Ossetia)**
  - ✓ 9 plants to be retrofitted
  - ✓ 35 mln dL per annum

- **Bioenergy/Green tariffs (Virea Energy)**
  - ✓ Utilization of waste gas at the dump for municipal waste (Leningrad region)
  - ✓ 2.4 МВт

- **Bioenergy/Green tariffs (Biogazenergostroy)**
  - ✓ Plans to build 30 stations in the regions of Russia
  - ✓ A pilot station for biogas with capacity of 4.5 MW (project.

Bridging the gap. Technology platform

R&D



Biotech products

Raw materials	• Ensuring stable supply chain. Creation of new value added chains
Biorefinery	• Optimization of technological processes through R&D, scaling-up (pilot, demonstration, operational levels)
Markets, regulation	• Market development for biotech products. Improvement of state regulation mechanismsСовершенствование механизмов госрегулирования

Role of TP

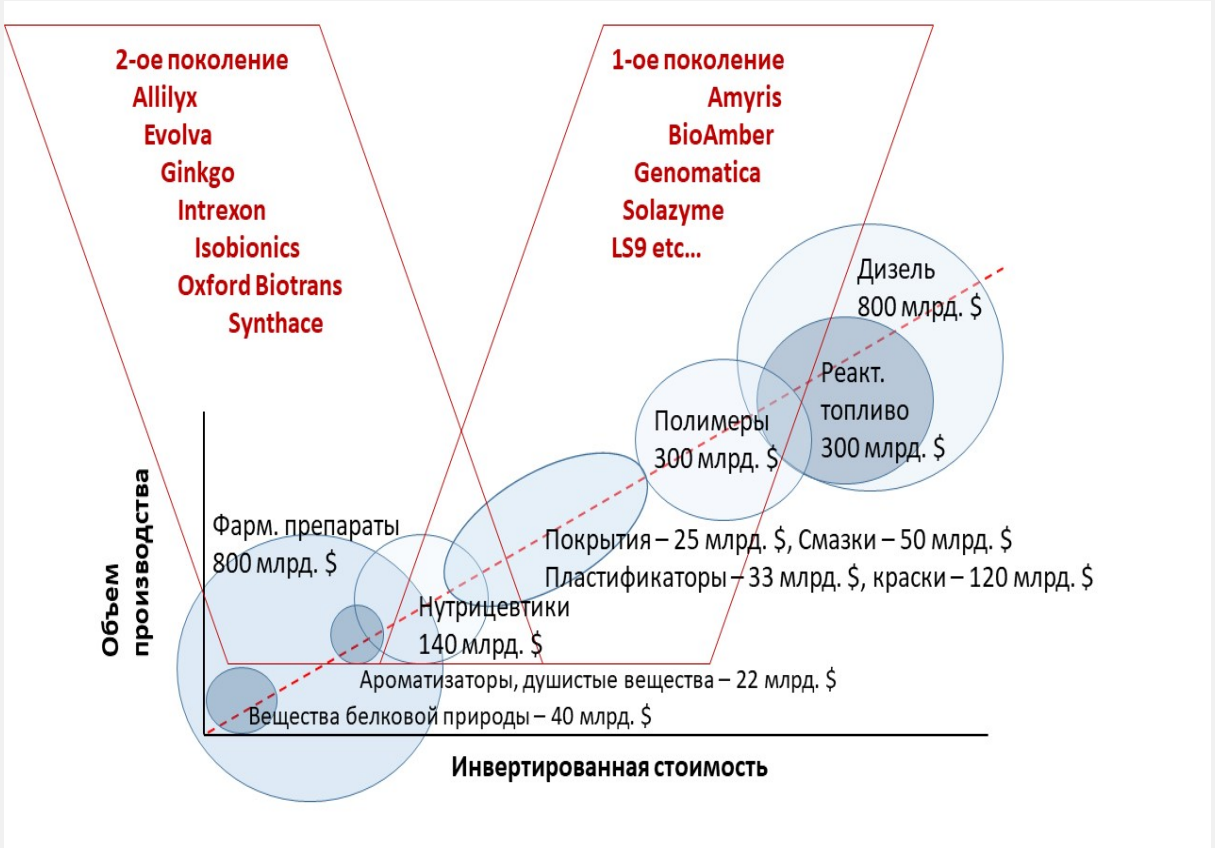

fuel/ energy
foresters
materials
horticulture
agrofood
pulp/ paper
chemicals
farmers
pharmaceuticals

Aims of ETP by 2020

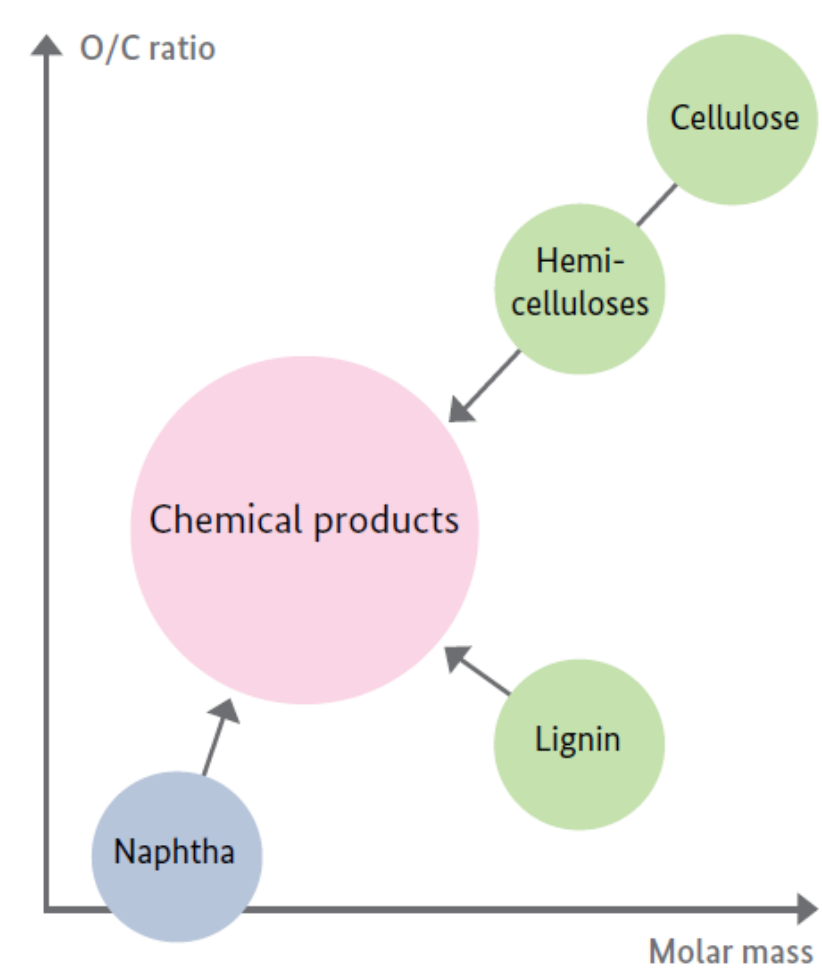
- to put **15%** of underutilized land back into production **(35% by 2030)**
- **10%** increase in biomass supply in Europe by 2020 (**20% by 2030**)
- mobilisation and utilisation of waste from various biobased sources to be increased to **15%** of the total amount in 2020 (**25% in 2030**)
- **400.000** new skilled jobs in 2020 (**700.000 by 2030)**
- **15%** reduced import of protein (e.g. soy) for feed in Europe in 2020 (**50% by 2030**)
- **10%** reduced import of inorganic fertilizers applied to feedstock production (**25% by 2030**)
- **20%** of the chemicals and materials production in Europe will be biobased by 2020 (**30% to 2030**)
- biobased polymers and composites at comparable quality-price ratio compared to the fossil alternatives will be **5 times** higher than today (**factor 10 in 2030**)
- Bio-based Industries Joint Undertaking (BBI JU)
  - 2.7 BEUR private investment + 1 BEUR from EC
  - 65 project funded
  - at least **5** first-of-its-kind flagship plants will be realised to optimise technology for biomass conversion

World trends that will affect Russia

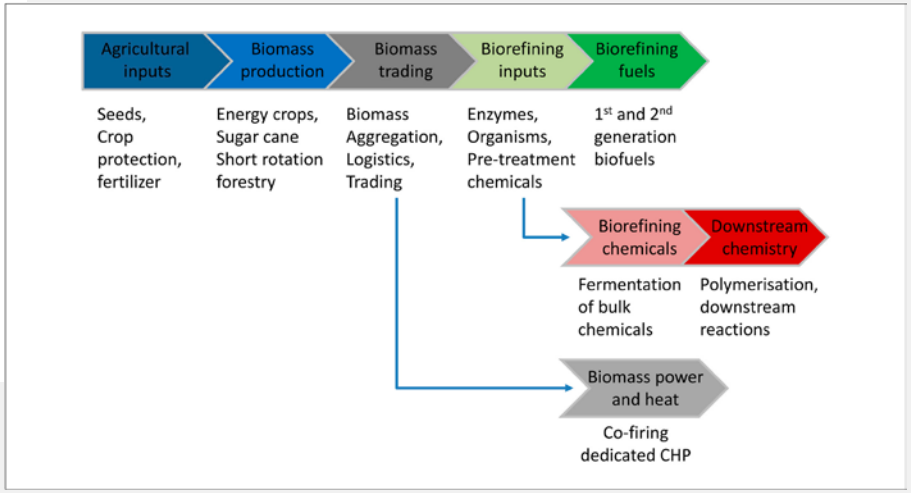
- Biofules are Bioeconomy drivers but:
  - 100 % of the cars with ICE will be substituted by electric cars by 2050, and 50 % - by 2030
  - Fuel consumption will be reduced by 20 % by 2025, by 50 % by 2030, etc.
- Future of biofuels?
- From high volume-low margin to low volume-high margin products?



Biorefinery *vs* Petrochemical



Biorefinery	Petrochemical
Complex logistics and value chains	Highly optimized and integrated
Low yields, low titres, diluted water solutions	Intensive
Greater variety of building blocks, complex molecules leading to new materials	Few simple building blocks
Renewable feedstock	Fossil



Conclusions & Challenges

- Bioeconomy in Russia is still in the state of infancy compared to the developed economies, however, over the last years dramatic changes occurred on the Russian biotech landscape
  - Bioeconomy/biotechnology are coming into focus of top decision makers
  - Big business started to get interested in the industrial and agrobio technologies
- Systematic change of the legislation required
  - GMO issue
- Subsidies to conventional economy sectors (chemicals, fossil energy, etc.) hinder bioeconomy development
- Creation of markets, stimulation of biotech businesses, support of infrastructure, active regional policies
- Sanctions and food embargo create a lot of opportunities to local business
- **The next few years will show how important is biotechnology and bioeconomy to the state, to the business community and civil society**

The Future is **GREEN**