National Research University “Higher School of Economics”
Institute of statistical studies and Economics of Knowledge
Foresight Centre

Foresight of nanoindustry economic impact

The case of Russia

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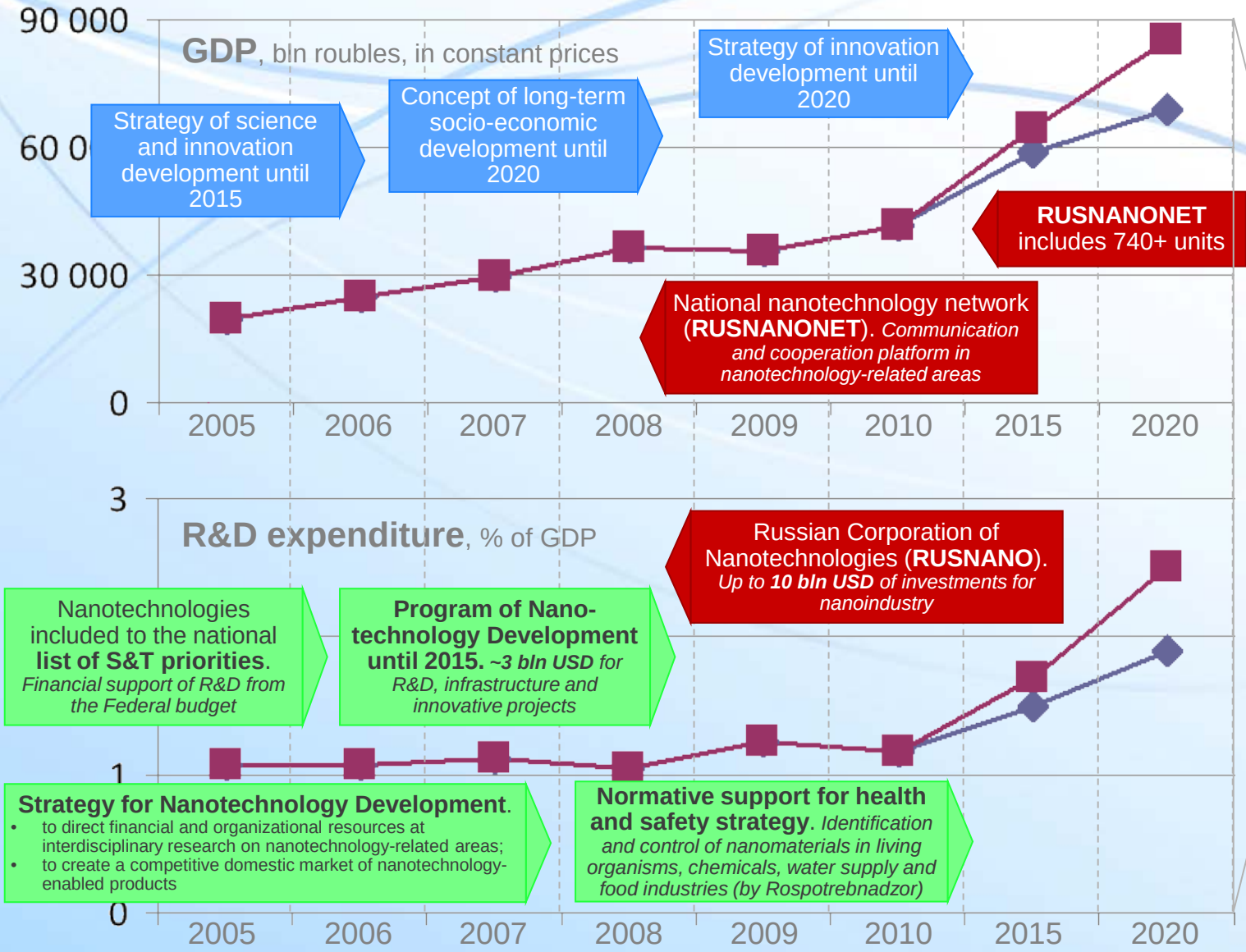
International Symposium on Assessing the Economic Impact of Nanotechnology
Session: Exploring the Quantitative Dimension of the Economic Impact of Nanotechnology
27-28 March 2012, Washington DC

Priority setting for Russian nanoindustry. *Policy context*



Next steps?

Priority setting. *Top-down approach*

Trends: global vs national

Economy	Instututions
Ecology and security	Human development

Challenges

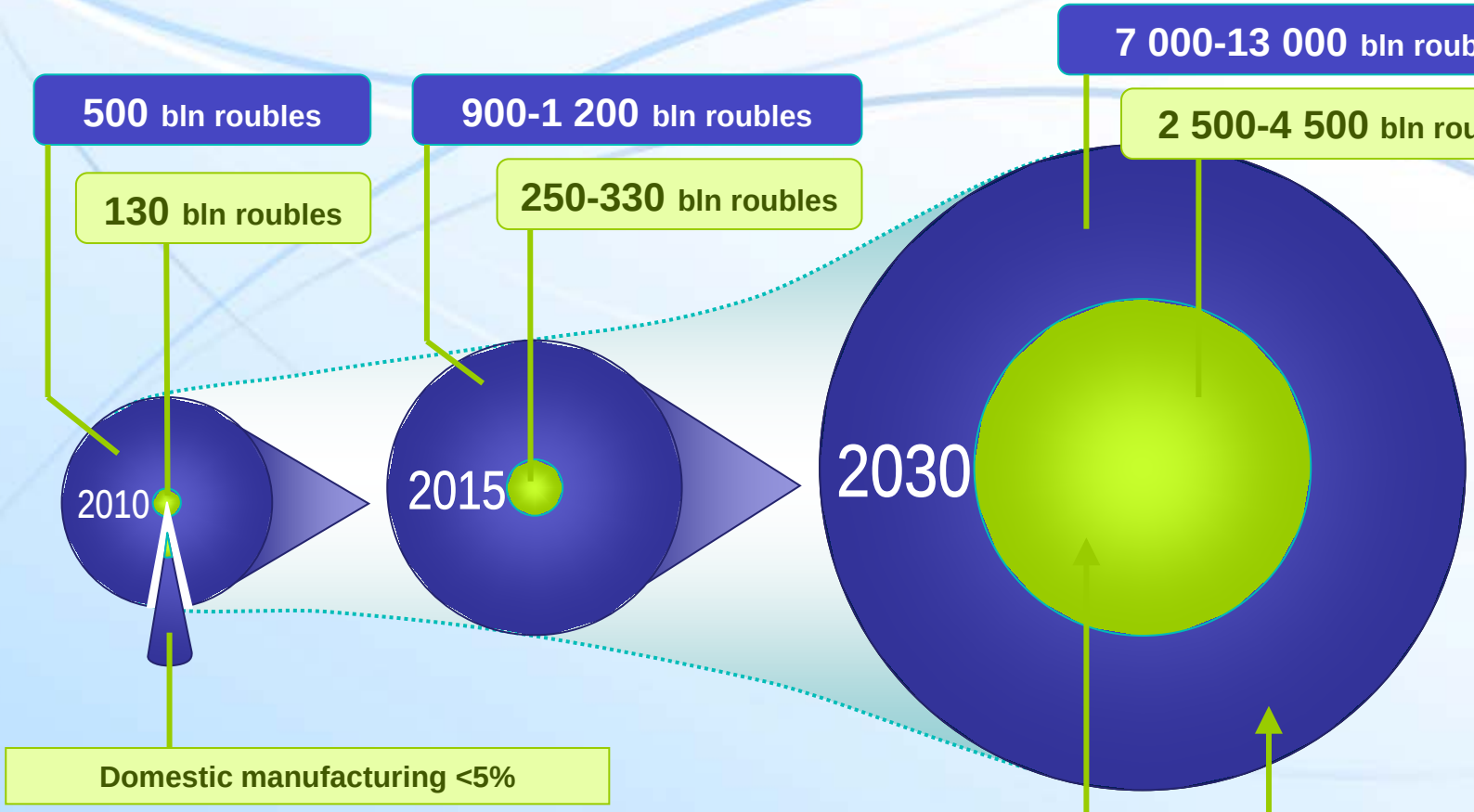
Anticipated socio-economic changes

Expected impact on nanoindustry

Future nanoindustry markets

Anticipated demand for nano-enabled products

in constant prices 2010



Domestic manufacturing <5%

The foreseen ranges correspond to pessimistic and optimistic scenarios

Categories A+D
(elementary products & equipment)

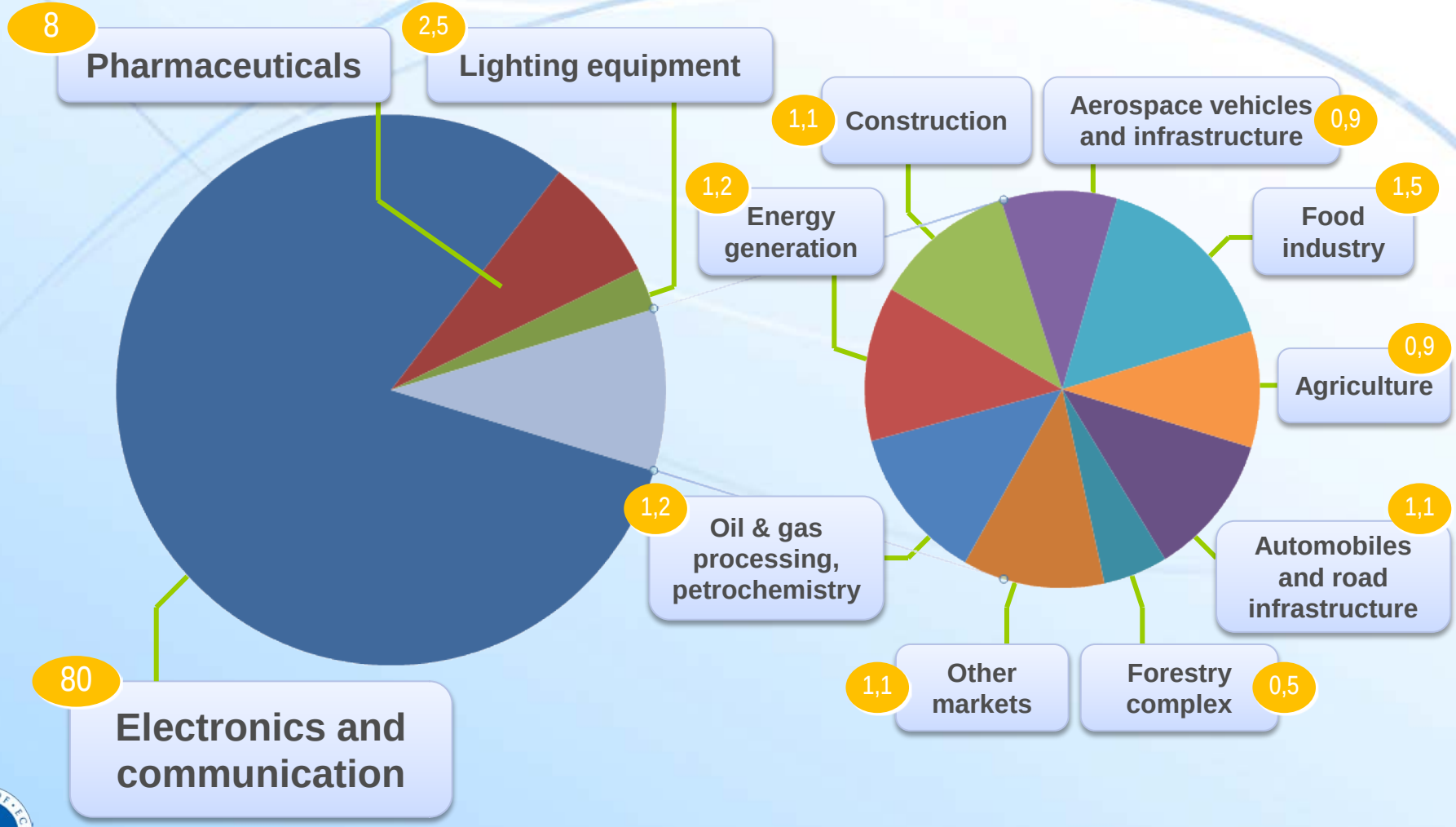
Categories B+C
(products containing nanocomponents & services)

(RUSNANO Board meeting, minutes #10 of 21.06.2011)

Anticipated structure of nanoindustry market

Prevalence of electronics in middle-term period

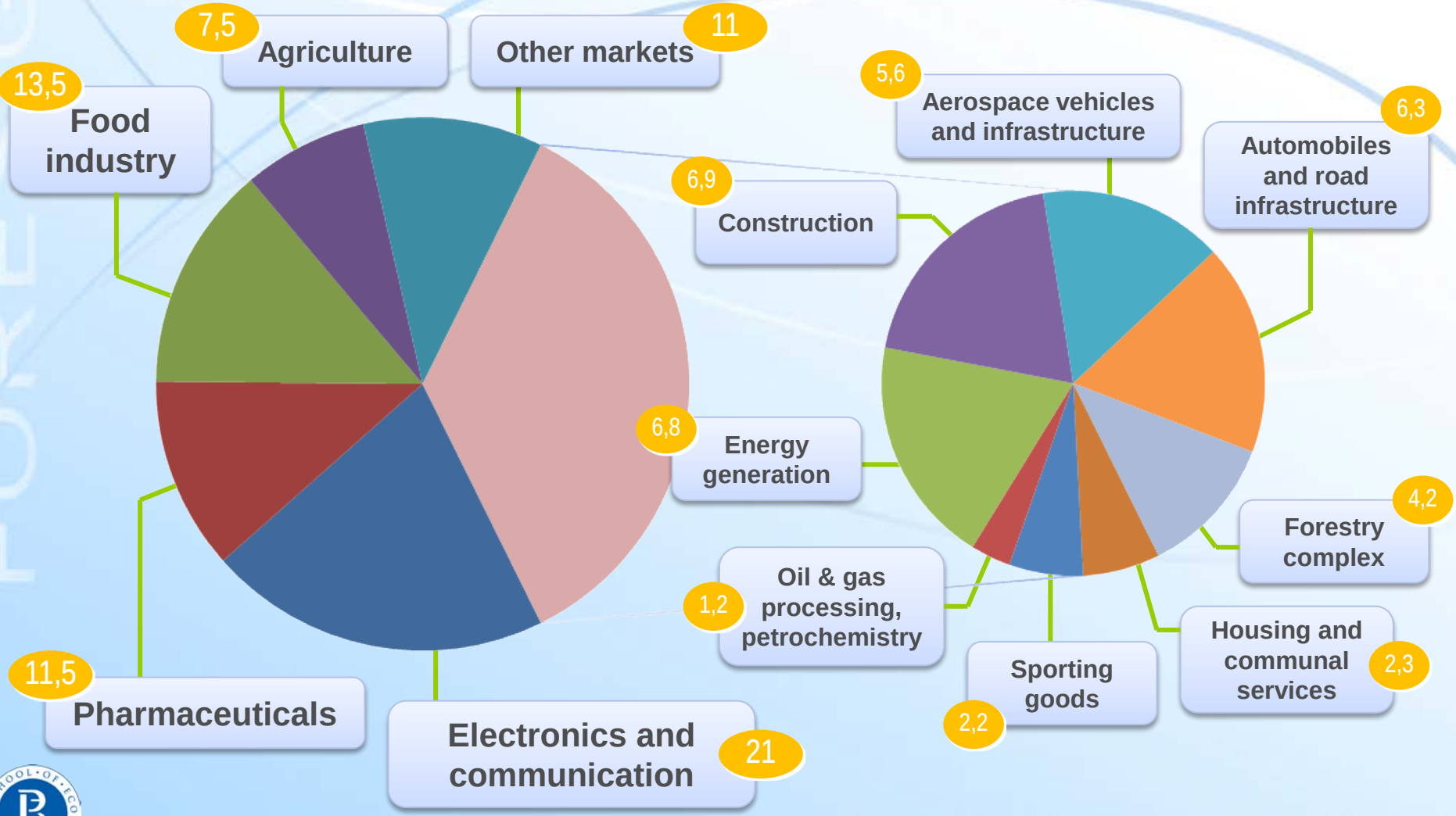
2015, moderate scenario, % of total nano-enabled products market



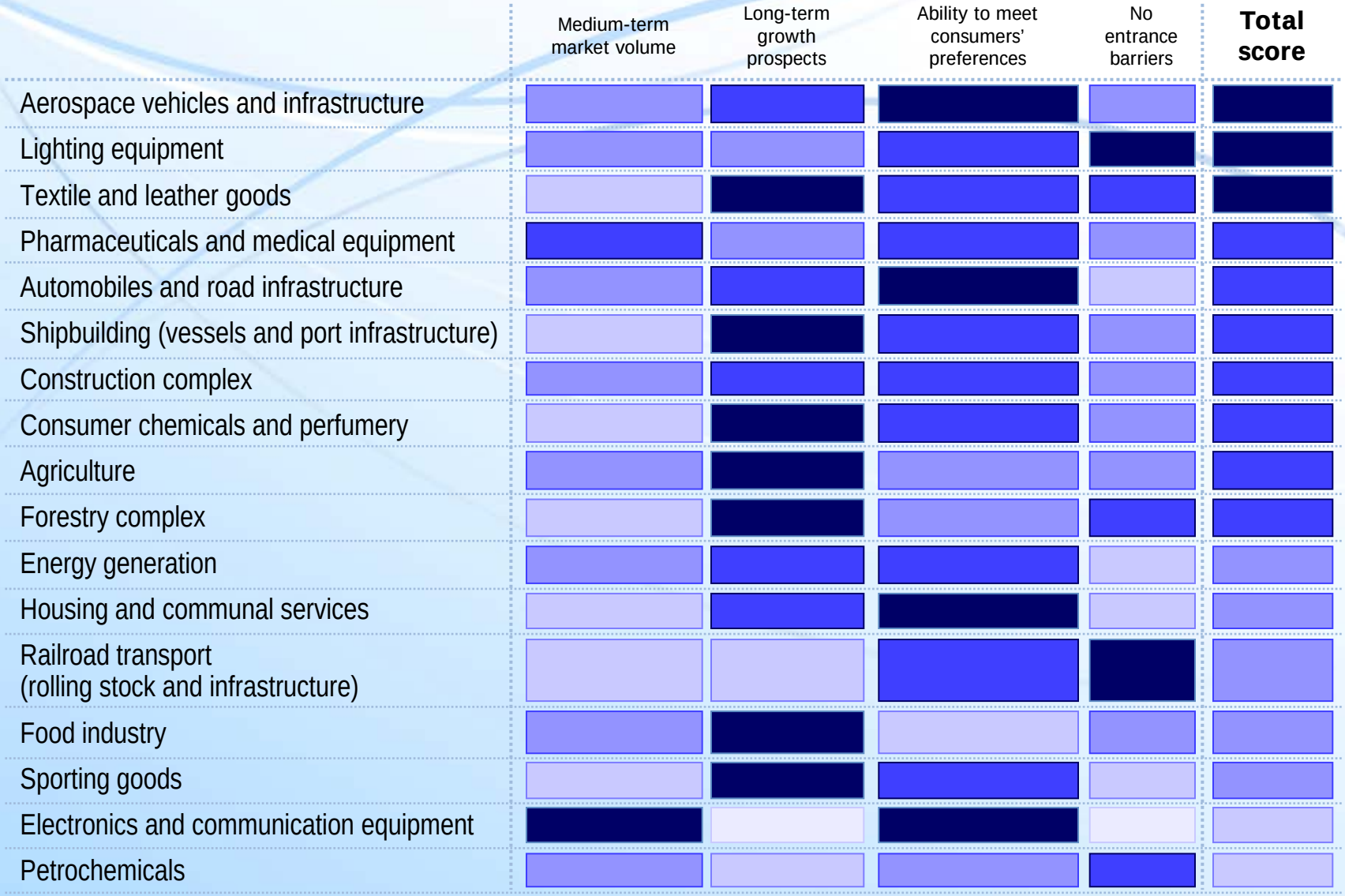
Long-term perspective

Diffusion of nanotechnology solutions in different areas

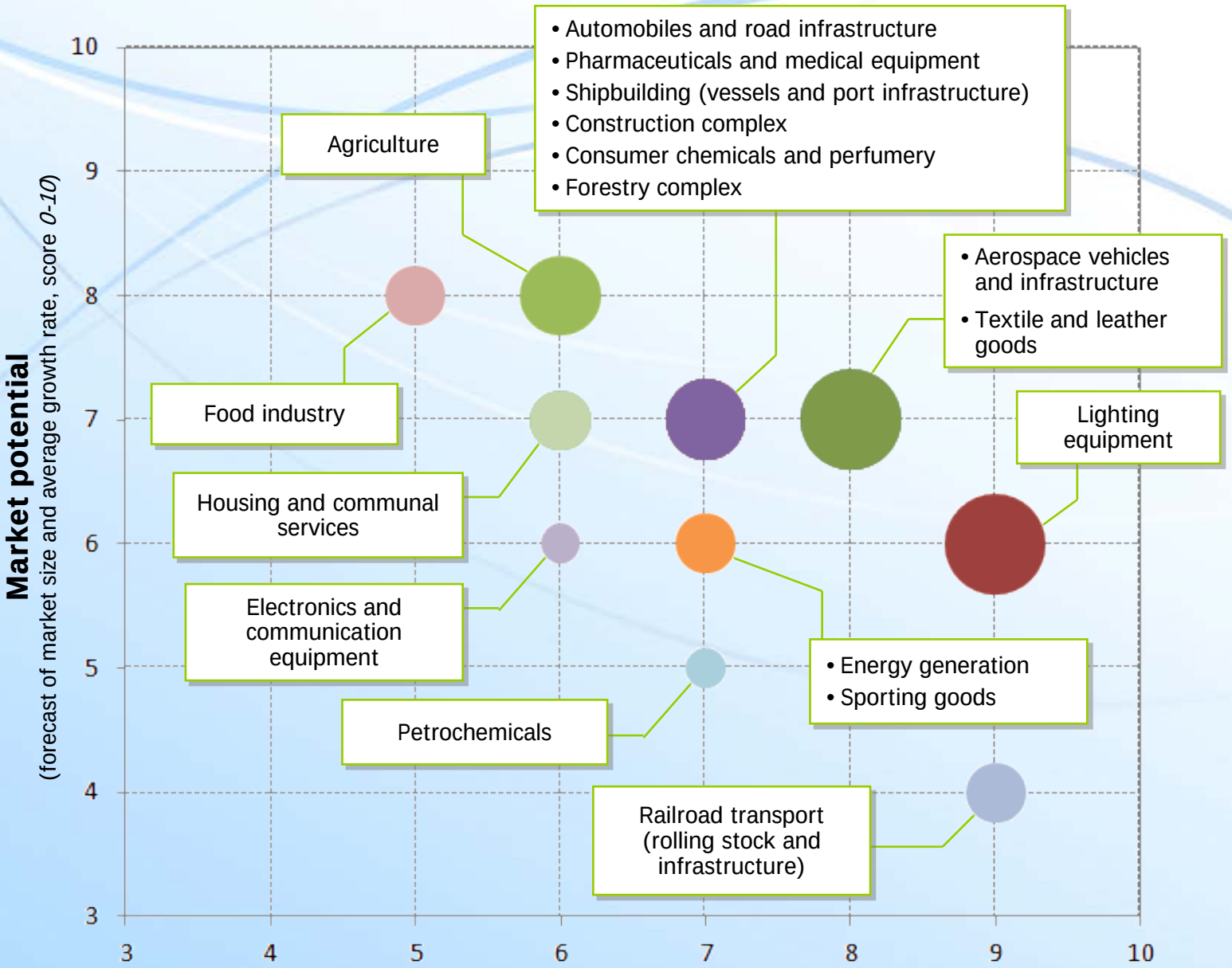
2030, moderate scenario, % of total nano-enabled products market



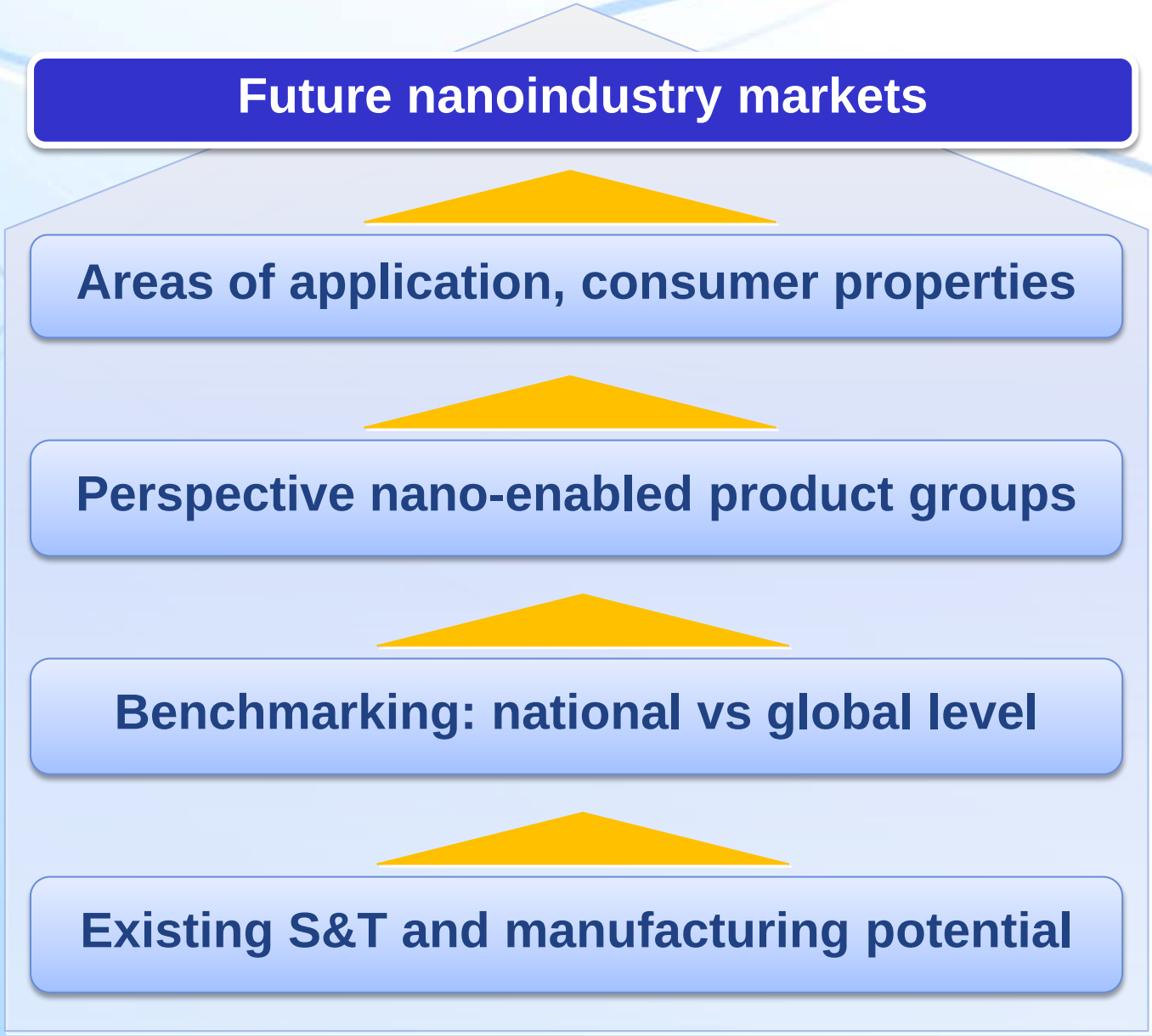
Nanoindustry market potential. *Additional factors*



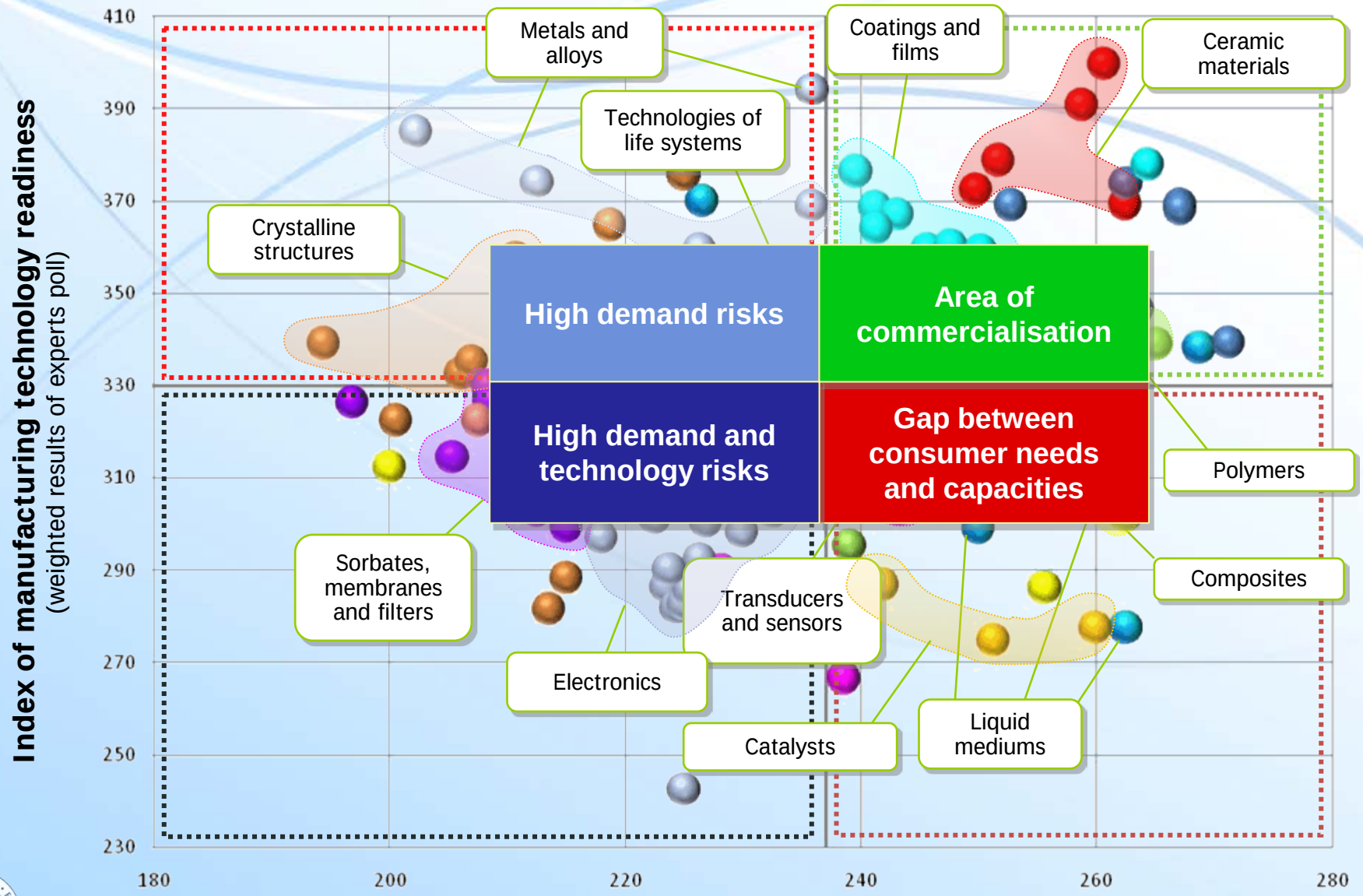
Nanoindustry market potential *vs* opportunities of it's use



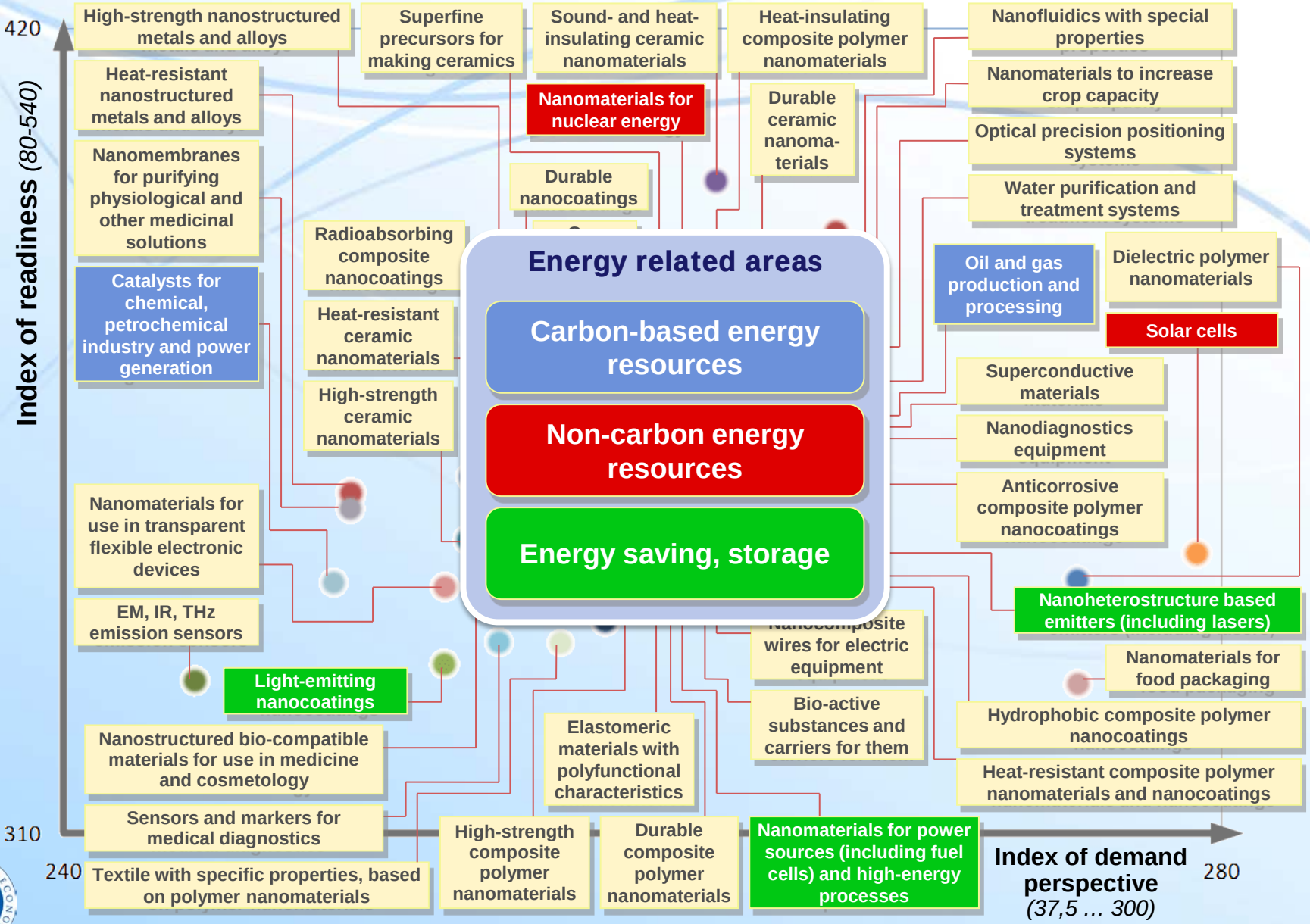
Priority setting. *Bottom-up approach*



Perspective nano-enabled product groups. *Issues for policy making*



Top-ranking product groups. *Close linkage to energy sector*



Carbon-based energy. *Improving efficiency using nanocatalysts*

Russian market of catalysts for oil processing (2030)

450 mln USD — Hydroskimming

- Alumina / cobalt-molybdenum or nickel-molybdenum
- Alumina / nano-modified cobalt-molybdenum
- Nebula

150 mln USD — Catalytic cracking

- Bead aluminosilicate zeolite-containing
- Microspheric aluminosilicate zeolite-containing (average particle diameter 10-150 mkm)
- Microspheric aluminosilicate zeolite-containing with optimized content of rare-earth elements (dust-like with average particle diameter 10-70 mkm)

85 mln USD — Isomerization

- Chlorinated alumina; zirconium oxide promoted with sulfate, molybdate, or tungstate ions
- Based on mordenite-type zeolites (containing sodium in a volume of 2-3 ppm) modified with 0.4-0.5% whgt. platinum
- Based on fluorinated alumina or ZSM-5 type medium-porous zeolites

70 mln USD — Catalytic Reforming

- Zeolitic, platinum containing
- Platinum on alumina

3 mln USD — Production of Isopropyl Benzene

- BETA zeolite
- MCM-22

35 mln USD — Hydrocracking

- On the basis of amorphous alumosilicates containing sulfide nano-particles of NiWS phase
- On the basis of crystalline alumosilicates (zeolites) containing sulfide nano-particles of NiWS phase
- On the basis of crystalline alumosilicates (zeolites) containing platinum nanoparticles

45 mln USD — Processing of Associated Petroleum Gas

- Cobalt or iron nanoparticles
- Membrane-catalytic
- Alumina-based metal-oxide for synthesis of dimethyl ether from associated petroleum gas
- On the basis of ZSM-5 type zeolites
- Powdered micron systems composed of nickel and iron nano-particles
- Iron or nickel nano-dispersed

25 mln USD — Isobutane-Butylene Alkylation

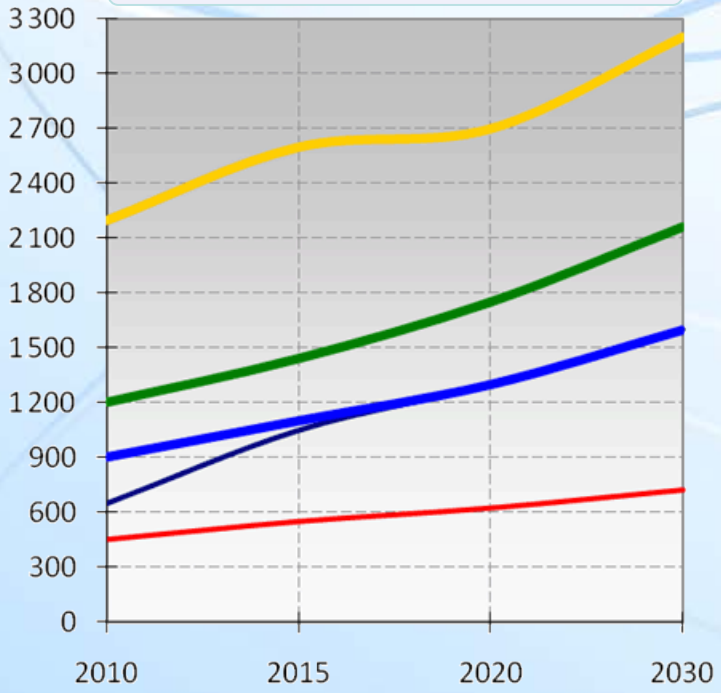
- Sulfuric acid
- Fluorine hydride
- Y type (faujasite)

2 mln USD — Production of Ethyl Benzene

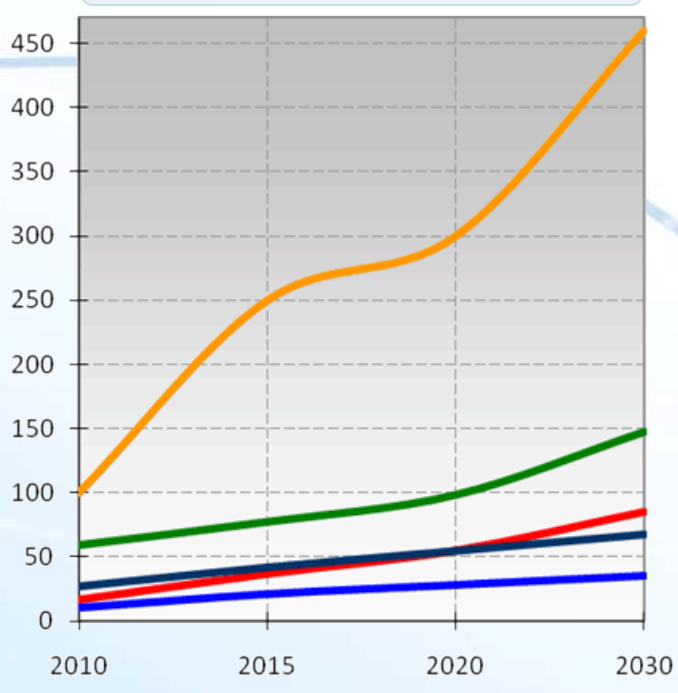
- Transalkylation, type Y
- ZSM-5 (pentasil)
- BETA zeolite
- MCM-22

Future market for key oil processing catalysts

World market *(mln USD)*



Russian market *(mln USD)*



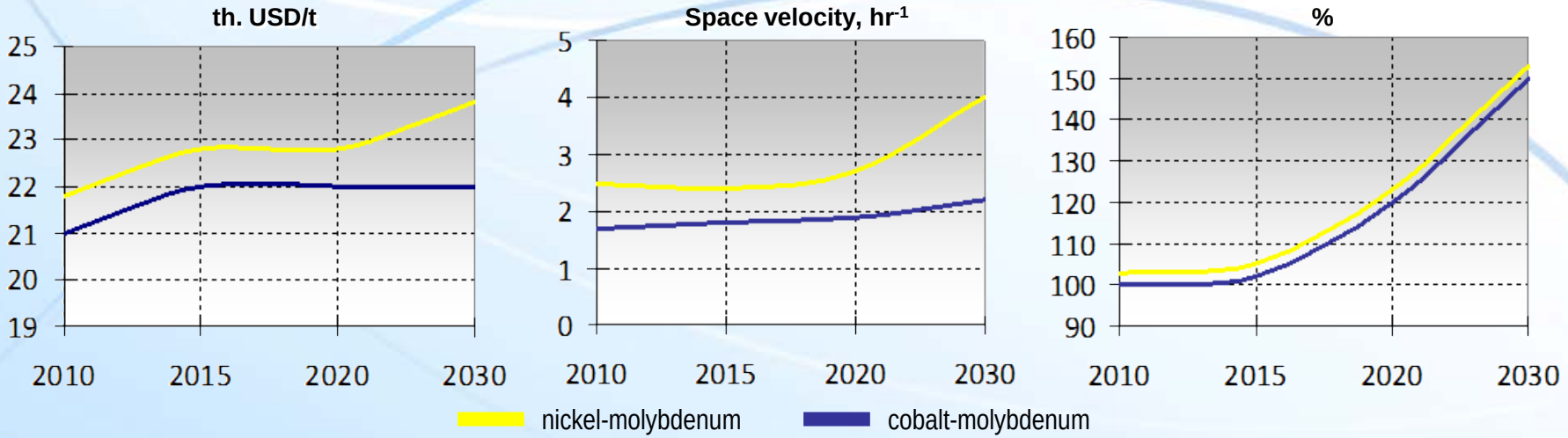
Drivers of Russian market

	Catalytic cracking			Hydroskimming		
	2015	2020	2030	2015	2020	2030
Number of units	26	25	25	64	65	75-80
Annual consumption of catalysts, th. t/year	19	20	23	6	8	11

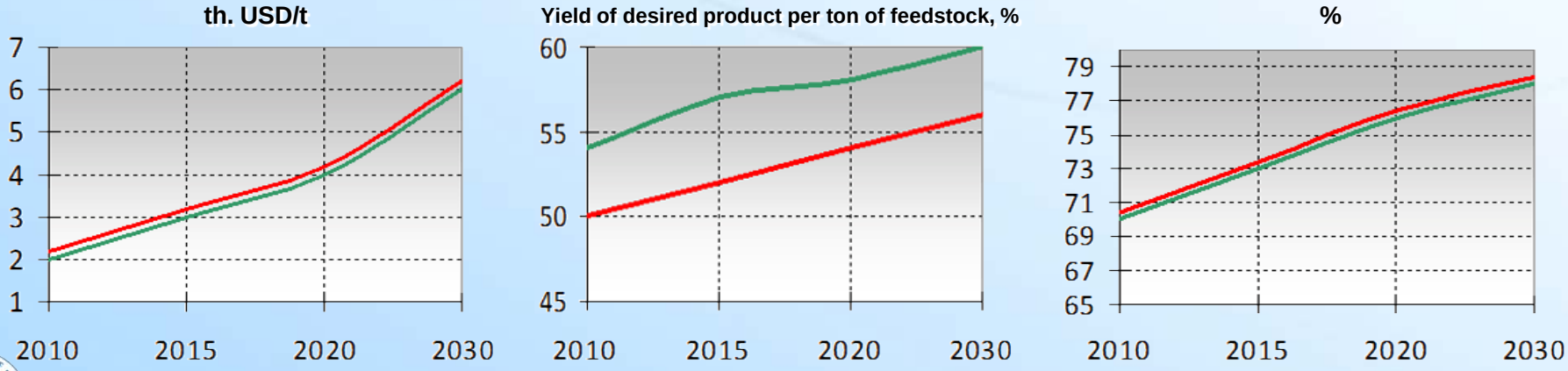
Target characteristics of catalysts. *Focus on competitiveness*

Average price | **Productivity** | **Activity**

Hydroskimming

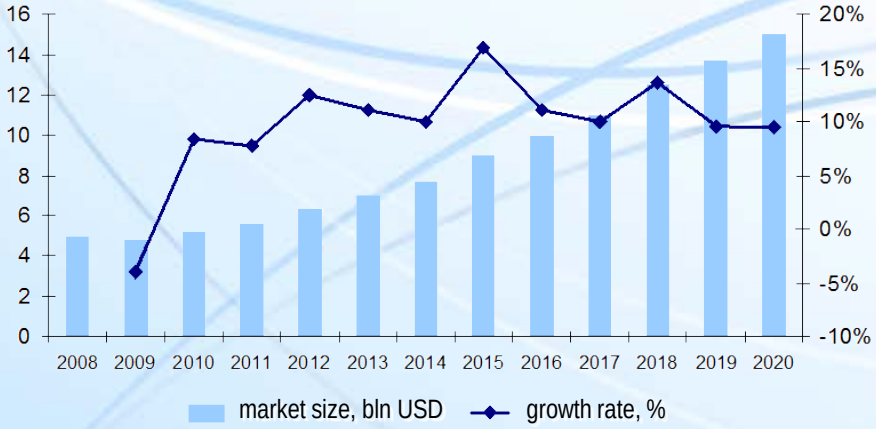


Catalytic cracking

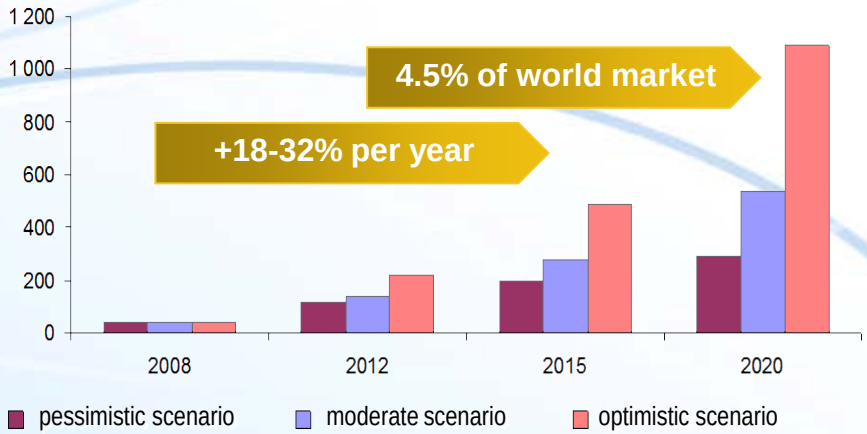


Energy efficiency. *New technologies of lighting*

World LED market

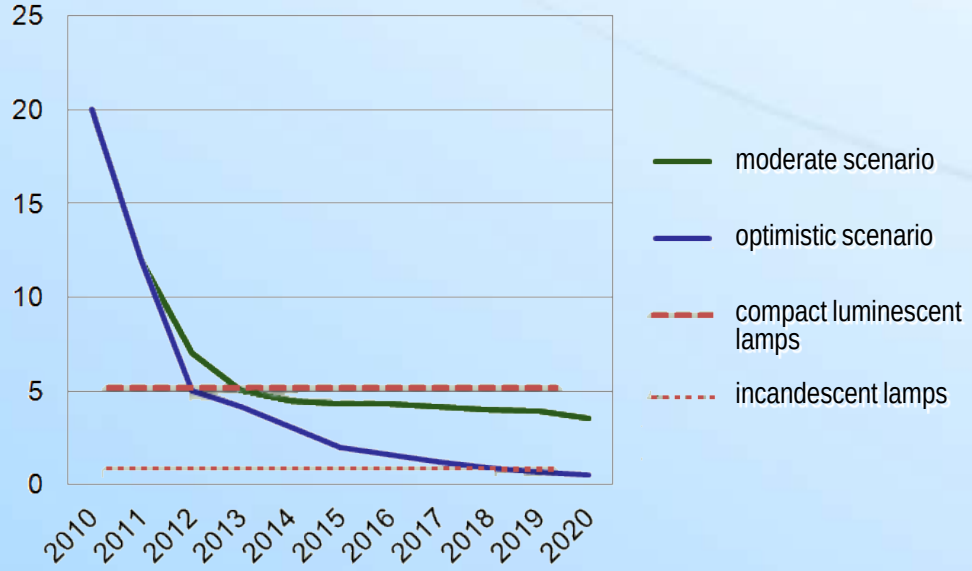


Russian LED market *(bln USD)*

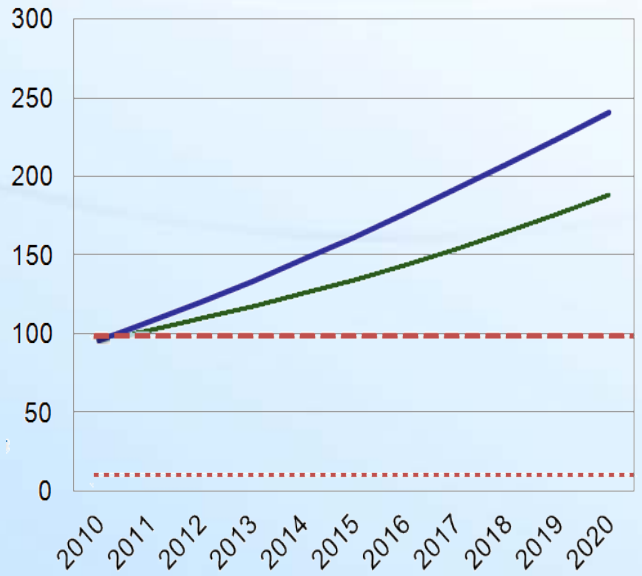


Competitive level of nano-enabled products

Price of light *(USD/klm)*



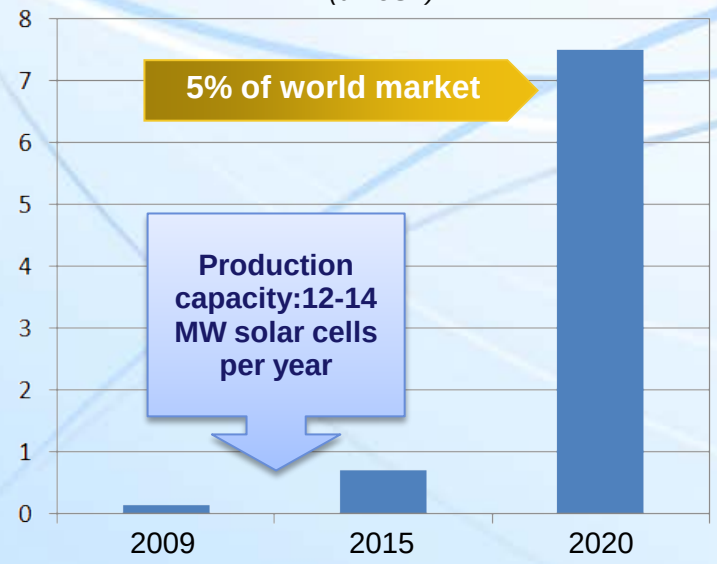
Light efficiency *(lm/W)*



Solar cells. *Perspective nanoindustry sector*

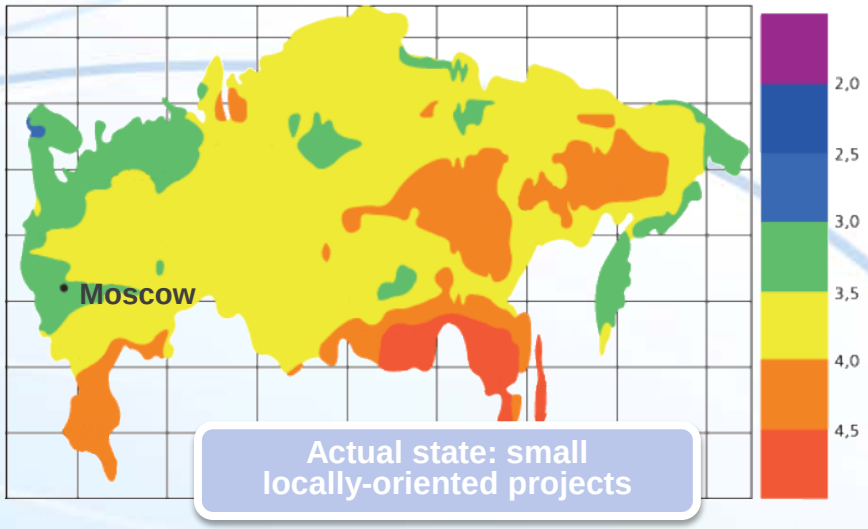
Russian market of photovoltaic elements

(bln USD)



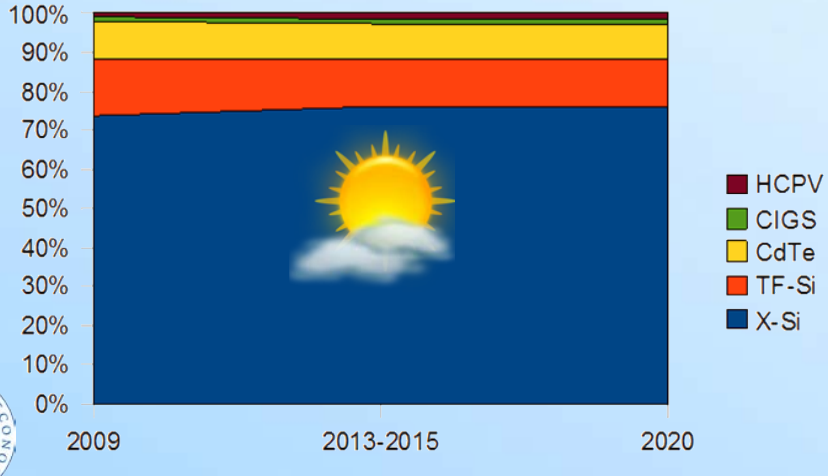
Average daily solar radiation in Russia

(kWh/m²)



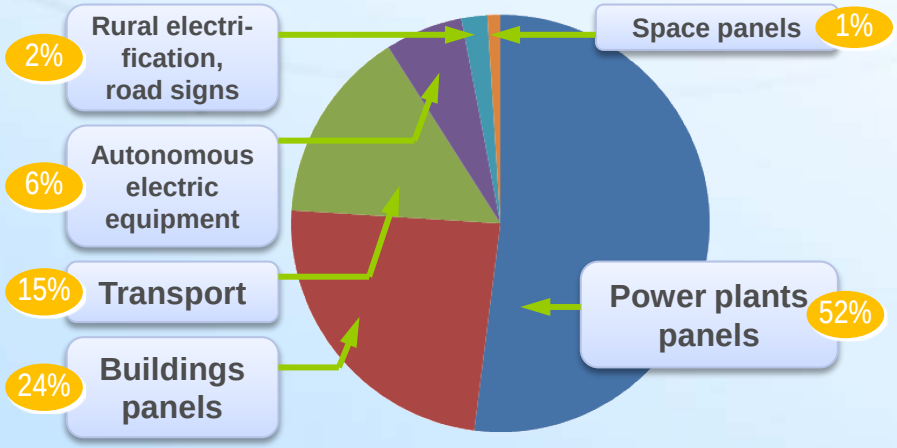
Anticipated market structure

By technological groups



Source: Lux Research, Inc.

By areas of application (2020)



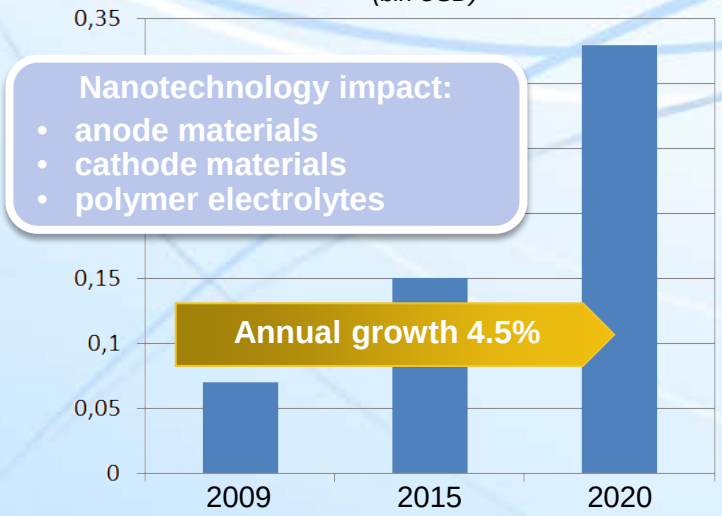
Source: Lux Research, Inc.

Energy storage

Chemical power sources

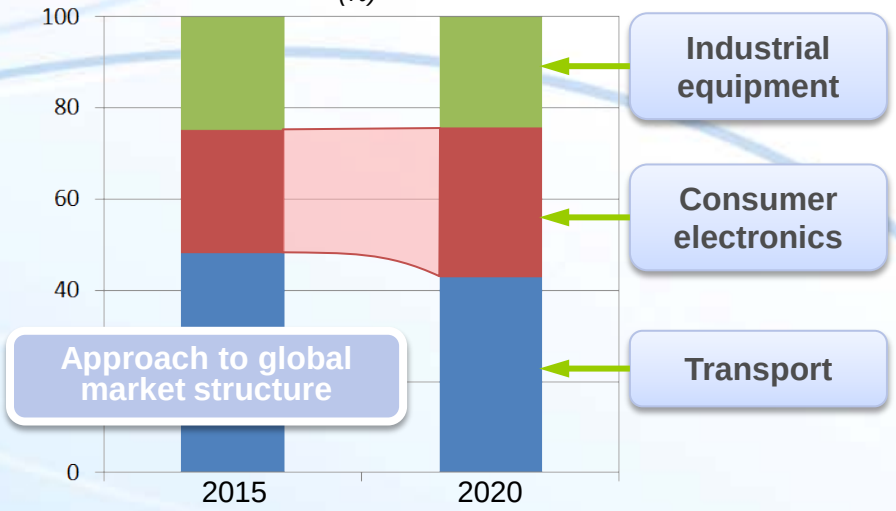
Manufacturing of lithium batteries in Russia

(bln USD)



Market structure by areas of application

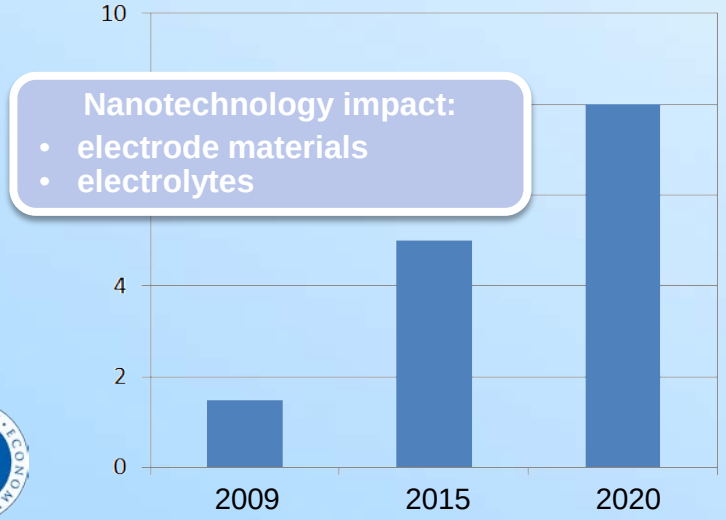
(%)



Supercondensers

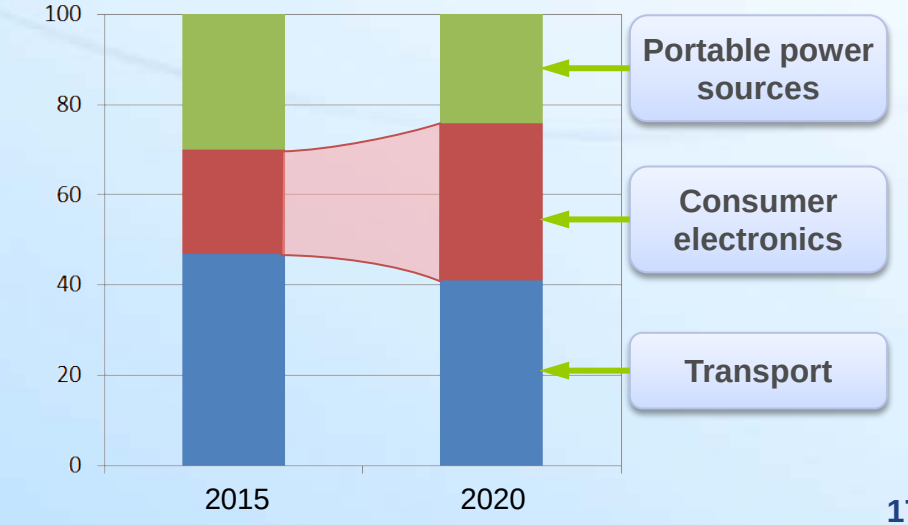
Manufacturing of supercondensers in Russia

(mln USD)



Market structure by areas of application

(%)

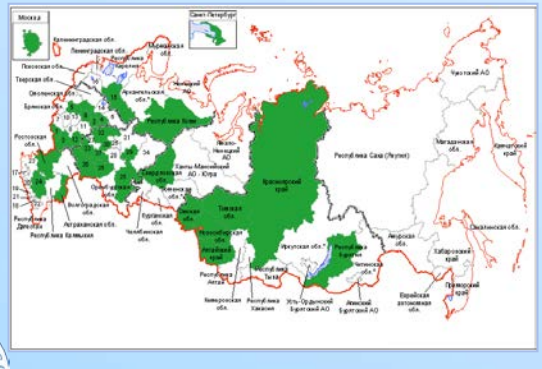


Methodological background: *expert study*

Round 1

- Consultations with 91 international experts
- Inter-industrial panel (144 experts)
- Expert polls (524 responses)
- 9 permanent thematic panels (519 experts)
- Discussion of results (4 expert panels)

Over **250** organisations from **30** regions



Round 2

348 Russian experts interviewed

Experts from the industry – **17%**
(top managers, heads of engineering, technological and design departments)

Experts from the academia – **83%**
(2/3 of them – Doctors of Science)

1,300 Russian experts polled by email

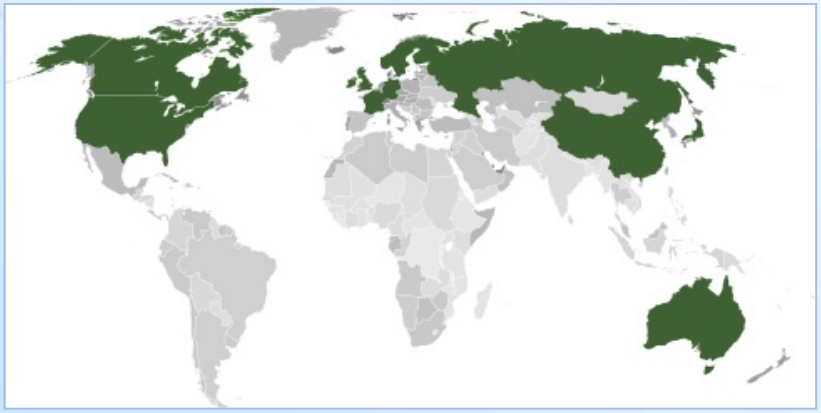
Experts from industry **– 14%**

Experts from academia **– 86%**

101 international experts interviewed

Representatives of leading nanotechnology R&D centres
USA – 35 experts,
UK – 21, Canada – 14,
China – 11, Germany – 7,
other countries – 13.

Discussion of results with managers of large companies



Methodological background: *analysis of future nanoindustry markets*

Information sources (1100+)

- Scenarios for global and Russian economy: *harmonised with S&T Foresight – 2030 and Strategy of socio-economic development until 2020*
- Official documents of the RF Government (forecasts, programmes, strategies)
- Trend, market and sectoral reports (by international organisations, leading industry actors, analytical agencies)
- S&T reports
- Statistical monitoring of nanoindustry (HSE)
- Sociologic survey "People's Innovation Readiness" (HSE)

Forecast of sectoral markets by segments until 2030

Forecast of nano-enabled product markets until 2030

Discussion and refinement of results

- Comparing with forecasts by RUSNANO project companies
- Comparing with results obtained by Lux Research, BCC Research, Frost&Sullivan, Research.Techart etc.
- Verification by experts and leading industry players

Top-down *vs* bottom-up

Promising nano-enabled product groups

- Delphi study
- Discussions in expert panels

Demand potential for product groups (A, B, C, D)

On the basis of "Provisional Guidelines on Classifying Nano-Enabled Products" *(approved by RUSNANO Board, minutes #10 of 21.06.2011)*

NATIONAL RESEARCH UNIVERSITY

Thank you!

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