ENERGY POLICY

PROBLEMS OF EUROPEAN COMMODITY SECURITY AND SUSTAINABLE DEVELOPMENT OF THE CENTRAL ASIA-CAUCASUS REGION

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Introduction

The Russia-Ukraine "gas wars" and the cold winter that hit Southern and Central Europe in January 2006 and 2009[1] highlighted Europe's commodity insecurity and its dependence on Russian good will. In all fairness, it should be noted that some studies on this topic appeared even before the "cold winter" of 2009,[2] but their

[1] See: J. Stern, *Russia-Ukraine Gas Crisis of January 2006*, Oxford Institute for Energy Studies, Oxford, 2006; A. Kovacevic, *The Impact of the Russia-Ukraine Gas Crisis in the South Eastern Europe*, Oxford Institute for Energy Studies, Oxford, 2009, and others.

[2] See: N. Campaner, *The Eastern Vector of Russian Oil and Gas Exports: What Impact on the EU Energy Security?* 5th European PHD Gas Seminar, University Paris-Dauphine, CGEMP, Paris, 2007; D. Finon, C. Locatelli, "Russian and European Gas Interdependence: Can Market Forces Balance Out Geopolitics?" *Cahier de Recherche*

impact on the leadership of the European Commission was insignificant, to put it mildly. This is evident from the fact that prior to the 2009 crisis the International Energy Agency did not see any pitfalls in European energy security.[3]

The James A. Baker III Institute for Public Policy was much more far-sighted. Back in 2005 it already argued the need to reduce, as far as possible, Russia's influence on the energy sector and developed a model for international trade in gas known as the Baker Institute World Gas Trade Model (BIWGTM).[4]

Thus, there is evidence of Europe's commodity insecurity, and any international conflicts interrupting the steady flow of raw materials to this region can have grave consequences for the daily life of Europeans and the stability of their democratic governments.

The prospects of sustainable development of the Central Asia-Caucasus region are directly associated with Europe's resource security and economy.[5] Already implemented projects (Baku-Tbilisi-Ceyhan oil pipeline and Baku-Erzurum gas pipeline) have fundamentally changed the geopolitical and geo-economic situation in the region and in the whole of Europe.

In this article, we try to analyze the extent to which new projects will affect Europe's commodity security and sustainable development trends in the Central Asia-Caucasus region.

Having at our disposal extensive statistical material on global commodity flows,[6] we have decided to use this material to analyze the problem of Europe's commodity security and to identify the "black holes" in the highly complex infrastructure of its markets.

We analyze the following types of commodities that have a decisive effect on economic development: oil, gas, coal, iron, copper, lead, zinc, and gold. Other commodity markets of no less importance to sustainable development have no decisive influence on macroeconomic parameters.[7]

LEPII, série EPE, No. 41 bis, 2007, pp. 1-38; A. Loskot-Strachota, *The Russian Gas for Europe*, Ośrodek Studiów Wschodnich, Warsaw, 2006, and others.

[3] See: *World Energy Outlook 2008*, International Energy Agency, Paris, 2008.

[4] See: P. Hartley, K.B. Medlock, *Political and Economic Influences on the Future World Market for Natural Gas*, Geopolitics of Gas Working Paper Series, Energy Forum, James A. Baker III Institute for Public Policy, Rice University, Washington, D.C., 2005.

[5] See: E. Ismailov, V. Papava, *The Central Caucasus: Problems of Geopolitical Economy*, Nova Science Publishers, New York, 2008; idem, *Rethinking Central Eurasia*, Johns Hopkins University-SAIS; Stockholm, Institute for Security and Development Policy, Washington, D.C., 2010, available at [http://www.silkroadstudies.org/new/inside/publications/Rethinking.html]; V. Papava, "The Economic Challenges of the Black Sea Region: The Global Financial Crisis and Energy Sector Cooperation," *Southeast European and Black Sea Studies*, Vol. 10, No. 3, 2010; A. Tvalchrelidze, A. Silagadze, G. Keshelashvili, D. Gegia, *Socio-Economic Development Program for Georgia*, Nekeri, Tbilisi, 2011 (in Georgian); A. Silagadze, "Current Financial and Monetary Trends in Georgia," *The Caucasus & Globalization*, Vol. 4, Issue 1-2, 2010, pp. 51-65; A. Silagadze, S. Gelashvili, "Gegenwärtige Finanzlage und Monetäre Aspekte in Georgien," *Universität Postdam*, No. G-10, 2009, S. 15-25; A. Silagadze, M. Tokmarishvili, *Challenges of the Post-Communist Financial-Currency Policy*, Nova Science Publishers, Inc., New York, 2009; T. Basilia, A. Silagadze, T. Chikvaidze, *Post-Transformation: Georgian Economy at the Threshold of XXI Century*, Tbilisi, 2001 (in Georgian), and others.

[6] See: A. Tvalchrelidze, *Economics of Commodities and Commodity Markets*, Nova Science Publishers, Inc., New York, NY, 2011.

[7] See: Ibidem.

Relationship between Gross Domestic Product and Commodity Consumption in Europe

In our analysis, we used the World Bank Data Base, which contains information on gross domestic product (GDP) for all U.N. member countries,[8] and extensive statistical material.[9]

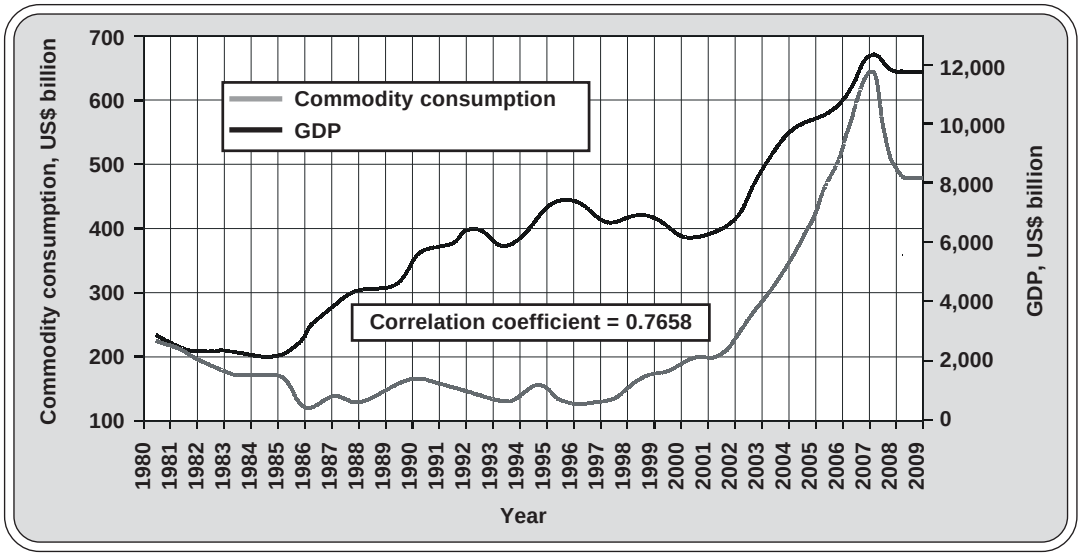
[8] See: *World Bank Data Base*, available at[http://worldbank.org/Indicators/].

[9] See: *BP Statistical Review of World Energy*, BP p.l.c., London, 2011; *World Oil Outlook*, Organization of the Petroleum Exporting Countries, Paris, 2009; *Natural Gas Information*, International Energy Agency, Paris, 2008; *International*

Figure 1 shows the relationship between the consumption of the above commodities and European GDP in 1980-2009. Consumption here was calculated as the sum of the products of the volume of commodities used and their average annual wholesale price in current U.S. dollars.

Figure 1

Relationship between GDP and Commodity Consumption in Europe



The high value of the correlation coefficient allows the mathematical modeling of this relationship or, in other words, makes it possible to describe GDP in terms of commodity consumption.

Indeed,[10] based on classical definitions,[11] GDP can be expressed by the following formula:

$$GDP = \sum_i (P_i S_i) + \sum_i \left(P_i^n F_n\right) + A_s \ , \qquad (1)$$

Coal Markets Outlook. The End of the Boom, Wood & Macenzie, Barlow Jenker, and Hill & Associates, New York, 2008; J.D. Jorgenson, "Iron Ore," in: *Mineral Commodity Summaries*, U.S. Geological Survey & U.S. Department of the Interior, Reston, 2009, pp. 81-82; *Iron Ore Market 2008-2010*, Trust Fund on Iron Ore Information, U.N. Conference on Trade and Development, Geneva, 2009; M. Fendon, "Iron and Steel," in: *U.S. Geological Survey Minerals Yearbook 2007*, U.S. Geological Survey & U.S. Department of the Interior, Reston, 2009, pp. 37.1-37.18; *The World Copper Factbook*, International Copper Study Group, Lisbon, 2008; *Copper. Commodity Profile*, British Geological Survey, Natural Environment Research Council, Keyworth, Nottingham, 2008; T.J. Brown, L.E. Hetherington, S.D. Hannis, T. Bide, A.J. Benham, N.E. Idoine, P.A.J. Lusty, *World Mineral Production 2003-2007*, British Geological Survey, Natural Environment Research Council, Keyworth, Nottingham, 2009; *Mirovaia statistika*, available at [http://www.mineral.ru/Facts/stat/index.html]; *Mirovye tseny na syrio*, available at [http://www.mineral.ru/Facts/Prices/index.html]; *Lead and Zinc Statistics*, Vol. 46, No. 2, 2006; *Modern and Ancient Gold Prices. Only Gold*, available at [http://www.onlygold.com]; *L'état du monde 2008*, Éditions La Découverte, Paris, 2007; "Chapter I. Statistics of Grain and Feed," in: *Agricultural Statistics 2010*, United States Department of Agriculture, National Agricultural Statistics Service, United States Government Printing Office, Washington, 2010, pp. I.1-I.44; *World Coffee Production. Total Production Crop Years 2000/01 to 2008/09*, World Coffee Organization, London, 2009; *Fundamental Factors Affecting Agricultural and Other Commodities*, Research & Product Development, CME Group, Chicago, 2009, and many others.

[10] See: A. Tvalchrelidze, op. cit.

[11] See: J.D. Sachs, F.B. Larrain, *Macroeconomics in the Global Economy*, Simon & Schuster, New York, 1993.

where GDP is the gross domestic product,

P_i is the weighted average annual price of the i-th commodity,

S_i is the annual volume of consumption of the i-th commodity,

P_i^n is the price of final product n made from the i-th commodity,

F_n is the volume of sales of the n-th product, and

A_s is the value added of all services (government, insurance, finance, education, health care, etc.).

It is clearly evident that the foreign trade balance is indirectly involved in Equation (1). By excluding the services-generated "information noise" and denoting commodity consumption by x and GDP by y, it is possible to build a regression equation linking these two independent variables[12]:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_p x_{ip} + \varepsilon_i \ , \tag{2}$$

where ε_i is the remainder of the equation $\vec{x} = \begin{pmatrix} x_{11} & ... & x_{1p} \\ ... & ... & ... \\ x_{n1} & ... & x_{np} \end{pmatrix}$, (3)

and coefficient β, determined by the least squares method,[13] means that the standard deviation in points ($\overline{x_i}$, $\overline{y_i}$) should be minimum, which is achieved at the extreme of the regression

$$F(\overrightarrow{\beta_n}) = \sum_{n=1}^{p} \left[\overline{y_n} - B(\overline{x_n} \ , \ \overrightarrow{\beta_n}) \right]^2 . \tag{4}$$

This technique makes it possible to calculate coefficients, standard deviation and remainder even in the nonlinear cases that we consider.

Figure 2 (on p. 114) presents a model of the relationship between commodity consumption and GDP in Europe expressed by a quadratic regression equation.

Thus, commodity consumption has a great impact on Europe's economic development. At the same time, European commodity markets are not protected and depend on imports to a very significant extent.

Figure 3 (on p. 114) shows the ratio of commodity production in Europe to European commodity consumption in 2009. Statistical data are taken from the cited literature and from many other sources.[14] It is clearly evident that Europe cannot be self-sufficient in any type of strategic raw materials.

Let us take a closer look at the main types of strategic resources required by Europe and at the relevant infrastructure.

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[12] See: V.L. Mironov, A.Yu. Suranov, *Issledovanie sluchainykh signalov*, Barnaul University Publishers, Barnaul, 2001; A.G. Tvalchrelidze, *Poleznye iskopaiemye i mineralnaia resursnaia baza Gruzii*, Rudy i Metally Publishers, Moscow, 2006.

[13] See: *Least Squares Regression Line*, available at [http://www.une.edu.au].

[14] See: "Uranium," in: *Annual Energy Review 2008*, Energy Information Administration, Washington, D.C., 2009, pp. 273-280; *Uranium 2007: Resources, Production and Demand*, OECD Nuclear Energy Agency & International Atomic Energy Agency, Paris, 2008; L.A. Corathers, "Manganese," in: *U.S. Geological Survey Minerals Yearbook 2007*, U.S. Geological Survey & U.S. Department of Interior, Reston, 2009, pp. 47.1-47.20; *Nickel Production*, available at [http://www.chemlink.com.au]; P. Klapwijk, *World Silver Survey 2009. Presentation*, GFMS, New York, 2009; J.F. Carlin, Jr. "Tin," in: *U.S. Geological Survey Minerals Yearbook 2006*, U.S. Geological Survey & U.S. Department of the Interior, Reston, 2008, pp. 77.1-77.12, and others.

Figure 2

Model of Relationship between GDP and Commodity Consumption in Europe

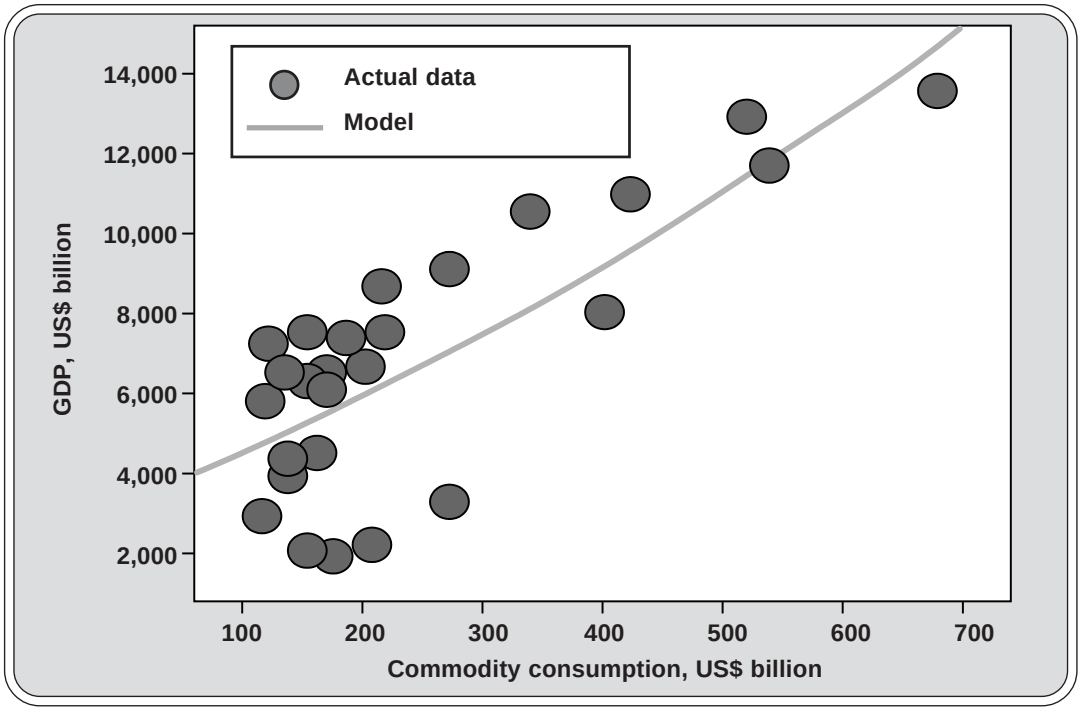
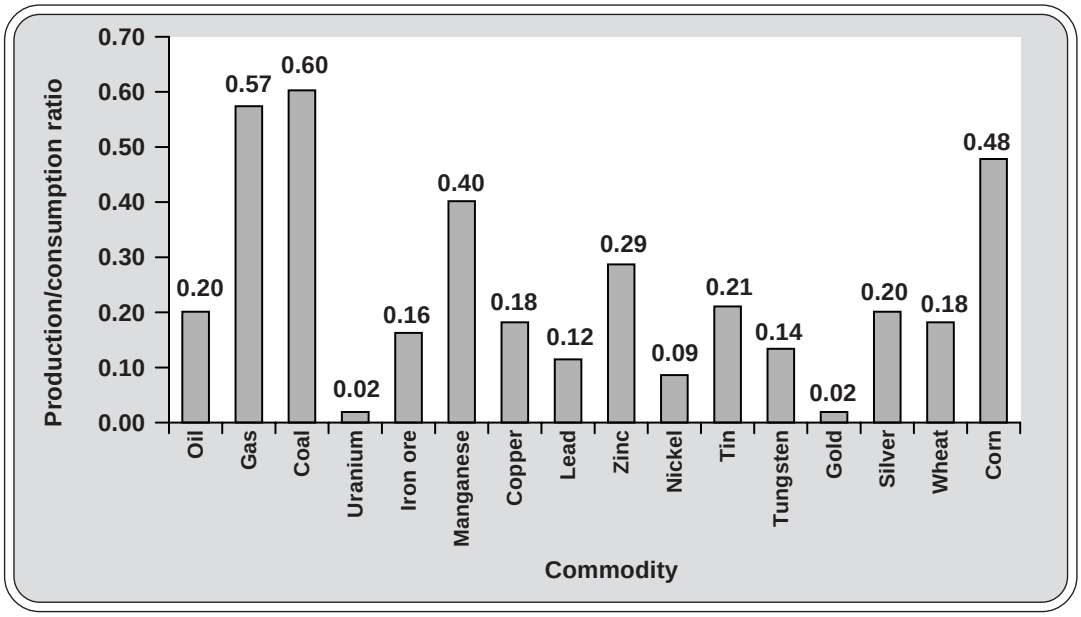


Figure 3

Ratio of Basic Commodity Production to Consumption in Europe



Consumption of Energy Resources

Table 1, based on cited and some other sources,[15] describes the average energy consumption structure in Europe.

Table 1

Structure of Energy Consumption in Europe

Energy Source	%
Hydropower	4.43
Crude oil	40.35
Natural gas	24.85
Coal	18.02
Green energy	0.22
Nuclear energy	12.13

Clearly, preference is given to conventional energy resources such as oil, natural gas, coal, nuclear power and partially hydropower, whereas green energy, despite significant efforts in recent years,[16] is still in its infancy.

A comparison of these data with those in Figure 2 will make it clear that Europe's energy security totally depends on the development of an appropriate infrastructure (oil and gas pipelines, oil, gas and coal ports, tanker terminals, etc.).

To sort out this problem, let us consider Figure 4 and several tables.

Figure 4 (on p. 116) presents the system of Europe's strategic oil pipelines, whose detailed description was published earlier.[17] It demonstrates that this system is either linked to the Druzhba system or connects oil ports with oil refining facilities.

Table 2 describes the main oil ports in Europe,[18] whose total throughput is more than 570 million tons of crude oil, or 18.84% of the throughput of all oil ports in the world.[19]

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[15] See: *2007 Survey of Energy Resources*, World Energy Council, London, 2008; *International Energy Outlook 2009*, Energy Information Administration, U.S. Department of Energy, Washington, D.C. 20585, 2009; *Oil and Gas Industry and Investment Overview*, Five States Energy Company LLC, Dallas, 2005, and others.

[16] See: *Renewables 2010. Global Status Report. Renewable Energy Policy Network for the 21st Century*, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, Eschborn, 2010.

[17] See: A. Tvalchrelidze, op. cit.

[18] See: *Overview of Cargo Turnover. Port of Hamburg*, available at [http://www.hafen-hamburg.de]; *Grand port maritime du Havre. Statistics*, available at [http://www.havre-port.fr]; *Tableau general des trafics. Grand port maritime de Marseille*, available at [http://www.marseille-port.fr]; *Port of Barcelona Traffic Statistics*, available at [http://www.apb.es]; *Port of Leixões*, available at [https://www.apdl.pt]; *Focus on Ports*, Palgrave Macmillan Publishers, London, 2007; *Port of Antwerp. Maritime Cargo Statistics*, available at [http://www.portofantwerp.com]; *Factual Report on the European Port Sector*, European Sea Ports Organization, Brussels, 2007; *Port of Naantali: Annual Report 2009*, Naantali, Finland, 2010; *Port of Tallinn: Consolidated Annual Report of the Year Ended 31st of December 2009*, Estonia, Tallinn, 2010; *Port of Ventspils*, available at [http://www.portofventspils.com]; *Port of Klaipeda*, available at [http://www.portofklaipeda.lt/en.php/statistics]; *Thessaloniki Port Authority S.A. Statistics*, available at [http://www.thpa.gr]; *Port of Omisalj*, available at [http://www.jadroagent.com/omisalj.htm]; *Annual Report: Constanța Port*, National Company Maritime Ports Administration S.A., Constanța, Romania, 2010.

[19] See: A. Tvalchrelidze, op. cit.

Figure 4

System of Strategic Oil Pipelines in Europe

Table 2

Main Oil Ports in Europe

Port	Country	Throughput, million tons/year
Wilhelmshaven	Germany	30.92
Hamburg	Germany	14.70
Marseille	France	55.20
Le Havre	France	30.26
Dunkirk	France	10.21
Trieste	Italy	30.24
Genoa	Italy	15.46
Algeciras	Spain	15.96
Barcelona	Spain	10.10

Table 2 (continued)

Port	Country	Throughput, million tons/year
Leixões	Portugal	7.64
Milford Haven	UK	21.90
Grimsby and Immingham	UK	14.00
London	UK	12.00
Southampton	UK	10.30
Forth	UK	9.70
Cork	Ireland	5.88
Dublin	Ireland	2.49
Antwerp	Belgium	25.43
Bergen	Norway	60.92
Narvik	Norway	12.00
Karmsund	Norway	10.10
Brofjord	Sweden	16.44
Göteborg	Sweden	15.37
Naantali	Finland	2.68
Fredericia	Denmark	10.27
Statoil-Havnen	Denmark	8.35
Gdansk	Poland	10.73
Tallinn	Estonia	36.00
Ventspils	Latvia	20.02
Klaipeda-Butinge	Lithuania	7.14
Larnaca	Cyprus	2.03
Thessaloniki	Greece	8.12
Vlore	Albania	8.55
Omisalj	Croatia	7.68
Constanța	Romania	8.58
Burgas	Bulgaria	6.88
TOTAL		574.25

Table 3 characterizes the European tanker fleet,[20] whose total carrying capacity is 68.9 million tons of crude oil (37% of the capacity of the world tanker fleet).

Table 3

European Tanker Fleet

Company	Headquarters	Capacity, million tons
Frontline	Oslo	16.08
Euronav	Antwerp	9.43
Angelicoussis Group	Athens	8.30
Tsakos Group	Athens	6.13
BW Shipping Managers	Oslo	5.17
Dynacom	Athens	4.85
Maersk	Copenhagen	4.85
BP	London	4.40
Thenamaris	Athens	3.55
Torm	Copenhagen	3.51
Minerva Marine	Athens	2.63
TOTAL		68.90

Thus, Europe has a well-developed infrastructure for the supply and distribution of crude oil, whose sources are diversified, i.e., there are no real threats in this sector.

The situation with infrastructure for natural gas is different. Europe annually consumes 492.5 billion cubic meters (bcm) of natural gas, or 15.54% of world consumption.[21]

The stable operation of the gas sector of the energy industry requires a developed infrastructure that includes (along with the gas pipeline system considered below) underground gas storage (UGS) facilities, import terminals for liquefied natural gas (LNG) and an appropriate fleet of LNG carriers.

Table 4 contains information on Europe's underground gas storages,[22] whose total capacity is 84.6 bcm, and peak withdrawal rate, 1.56 bcm per day. In winter, Europe consumes about 345 bcm of gas, or 1.72 bcm per day. Thus, the maximum deliverability of gas storage facilities roughly corresponds to daily demand, but their capacity can meet only 24.5% of winter demand. In other words, in winter European gas stocks will last, on average, only 40 days.

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[20] See: "Tanker Fleet," *Tanker Shipping Review*, March 2008, pp. 1-66; *World Tanker Fleet. Pacific LA Marine Terminal LLC*, available at [http://www.pacificenergypier400.com].

[21] Calculations based on BP statistical data (*BP Statistical Review of World Energy 2011*).

[22] See: S. Khan, *Underground Storage of Gas. Report of Working Committee 2. Triennium 2003-2006*, International Gas Union, Amsterdam, 2006; *Current State and Issues Concerning Underground Natural Gas Storage. Docket No. AD04-11-000*, Federal Energy Regulation Commission, Washington, D.C., 2004; E.V. Levykin, *Podzemnye gazokhranilishcha*, available at [http://www.cultinfo.ru/fulltext/1/001/008/007/951.htm].

Table 4

Underground Gas Storage Facilities in Europe

Country	Number of UGS Facilities	Capacity, million cubic meters	Peak Withdrawal Rate, million cubic meters/day
Austria	5	2,849	32.2
Belgium	2	635	23.0
Bulgaria	1	502	3.3
Croatia	1	558	5.0
Czech Republic	8	2,891	45.4
Denmark	2	840	13.0
France	15	11,683	189.3
Germany	42	19,149	462.9
Hungary	5	3,610	47.5
Ireland	1	210	2.1
Italy	10	17,415	296.1
Latvia	1	4,400	51.0
Netherlands	4	5,000	171.0
Poland	6	1,652	20.2
Rumania	5	3,694	26.0
Slovak Republic	2	2,740	33.4
Spain	2	2,366	12.5
Sweden	1	9	2.0
UK	6	4,364	128.5
TOTAL	119	84,567	1,564.4

The situation with liquefied natural gas infrastructure is even more tragic. Table 5, which describes European LNG import terminals,[23] shows that the total capacity of their gas storage facilities is only 3.3 million cubic meters (mcm) of liquefied gas, while their LNG regasification capacity is 147.8 mcm, or less than 0.03% of annual gas consumption in Europe.

Thus, the main burden associated with gas transportation falls on gas pipelines.

[23] See: *Natural Gas Information.*

Table 5

Liquefied Natural Gas Import Terminals in Europe

Country	Name	Regasification Capacity, million cubic meters/year	Storage Capacity, thousand cubic meters
Belgium	Zeebrugge	9.0	261
Greece	Revithoussa	2.2	130
Spain	Barcelona	24.8	540
	Bilbao	12.0	300
	Cartagena	18.0	287
	Huelva	18.1	460
	Sagunto	12.0	300
UK	Isle of Grain	7.9	200
	Total	84.9	1,887
France	Fos-sur-Mer	12.0	150
	Montoir-de-Bretagne	17.2	360
Italy	Panigaglia	5.7	100
Portugal	Sines	8.9	240
	Total	29.2	510
TOTAL		147.8	3,328

Figure 5 shows Europe's strategic gas pipelines and their links to the export pipelines of different countries.[24] As we see, the internal system of gas pipelines is very diversified but, excluding the gas fields of the North Sea, it is connected only with the pipeline leading from Algeria to Bologna, and also with the Urengoy-Uzhgorod, Cherepovets-St. Petersburg and Blue Stream pipelines.

This implies that most of the gas supplied to the European market comes either directly from Russia or from Turkmenistan (via Russia). In this connection, we cannot understand how even after the 2006 Russia-Ukraine gas conflict (but before the "cold winter" of 2009) experts could regard the European gas infrastructure as sufficient to ensure the energy security of the European Union (EU).[25] The experts of the James A. Baker III Institute for Public Policy were more far-sighted: in 2004, they

[24] See: A. Tvalchrelidze, op. cit.; *The Atlas of Gas Pipelines in CIS, Baltic States & Europe*, available at [http://www.neftekarta.ru]; *World Pipelines Maps-Crude Oil (petroleum) Pipelines-Natural Gas Pipelines-Products Pipelines*, available at [http://www.theodora.com/pipelines].

[25] See, for example: S. Lochner, D. Bothe, M. Lienert, "Analyzing the Sufficiency of European Gas Infrastructure — The Tiger Model," in: *International Conference ENERDAY 2007*, ENERDAY, Dresden, 2007, pp. 16-32.

Figure 5

System of Strategic Gas Pipelines in Europe

predicted serious gas conflicts with Russia and advised Europe to develop its infrastructure in every possible way.[26]

In our opinion, the quickest way to remedy the situation is through the rapid construction of the Bacton (UK)-Groningen (The Netherlands) gas pipeline,[27] development of the Nabucco project[28] and massive construction of LNG import terminals.

Nabucco is a project for the construction of a new pipeline to connect gas fields in the Caspian region and Central Asia with Western Europe (through the Caspian Sea, Azerbaijan, Georgia, Turkey, Bulgaria, Romania and Hungary), so providing access to the gas distribution system of Austria, a major European transit country. The gas pipeline, ending at Baumgarten (Austria), will be about 3,300 km long. According to experts, its throughput will be 31 bcm per year in the first phase, and 50-60 bcm in the second phase. The current estimated cost of the project is EUR 7.9 billion.

[26] See: B. Hauhe, *The Changing Structure of World Gas Markets: Natural Gas Trade and its Benefits*, Geopolitics of Gas Working Paper Series, Energy Forum, James A. Baker III Institute for Public Policy, Rice University, Washington, D.C., 2004.

[27] See: *BBL—A Gas Pipeline from Balgzand (The Netherlands) to Bacton (UK)*, available at [http://www.bblcompany.com].

[28] See: *Nabucco. Project Description/Pipeline Route*, available at [http://www.nabucco-pipeline.com].

This project will benefit not only Europe by helping it to diversify gas supplies, but also the whole Central Asia-Caucasus region, primarily Turkmenistan, a major gas exporter in the region. Today Turkmen gas is supplied to the European market exclusively through the Russian gas pipeline system; taking advantage of this circumstance, Russia buys Turkmen gas at very low prices. According to estimates,[29] Turkmenistan's annual financial losses exceed $4 billion.

An even more significant possibility is to encourage Iran to enter international gas markets. Today Iran is the world's second-largest gas producing country after Russia: its annual gas production is 138.5 bcm (compared to Russia's 588.9 bcm in 2010). Thus, Iran's involvement in the Nabucco project (if it abandons its nuclear program) will help democratize the country and reduce geopolitical risks.[30] This will also have a positive effect on European security.

Mining and Ferrous and Non-Ferrous Metallurgy

Excluding BHP Billiton (Australian mining giant),[31] Barrick Gold (the world's largest Canadian gold mining company),[32] Newmont Mining Corporation (U.S. company, the world's second-largest gold producer),[33] Gold Fields Co. (South African gold mining company, the fourth-largest in the world),[34] Freeport-McMoRan Copper & Gold, Inc. (U.S. mining company, the world's largest copper producer)[35] and Codelco Corp (national copper corporation of Chile),[36] virtually all other mining companies of the world are registered in Europe.

It should be noted, however, that their worldwide activities are characterized by minimum production in the European countries themselves. For example, the commercial interests of Xstrata Plc include South America, Asia, Oceania and Africa,[37] and Rio Tinto Plc has spread its tentacles throughout the world.[38] The De Beers Group, the world's largest diamond producer, has its headquarters in Switzerland.[39] Perhaps the only exception here is the Polish company KGHM Polska Miedź SA,[40] a globally important copper and silver producer: it exploits only its own national resources.

Meanwhile, it is Europe that sets the trends in world metal markets. For example, international prices of gold and other precious metals are traditionally established (daily) through teleconferences[41] by members of the London Bullion Market Association (LBMA) and major international banks (Scotia-Mocatta, Barclays Capital, Deutsche Bank, Société Générale and others). Non-ferrous metal prices are set by the London Metal Exchange.[42]

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[29] See: A. Tvalchrelidze, op. cit.
[30] See: Ibidem.
[31] See: *Resourcing the Future. Annual Report 2008*, BHP Billiton, Melbourne, 2009.
[32] See: *Barrick. Annual Report 2008*, Barrick Gold, Toronto, 2009.
[33] See: *Newmont Mining Corporation. Annual Report*, CO, Newmont Mining Co., Denver, 2008.
[34] See: *Gold Fields Securing the Future. Gold Fields Annual Report*, Gold Fields Co., Johannesburg, 2008.
[35] See: *Freeport-McMoRan Annual Report*, Freeport-McMoRan Copper & Gold, Inc., Phoenix, AZ, 2009.
[36] See: *Codelco Annual Report*, Codelco, Santiago, Chile, 2009.
[37] See: *Xstrata Annual Report*, Xstrata Plc, Zug, Switzerland, 2009.
[38] See: *Keeping the World Moving. Rio Tinto Annual Report*, Rio Tinto Plc, London, 2008.
[39] See: *A Diamond is Forever. Operating and Financial Review*, De Beers Group, London, 2009.
[40] See: *KGHM Polska Miedź S.A.*, available at [http://www.kghm.pl].
[41] See: *London Gold Fixing*, available at [http://www.goldfixing.com/home.htm].
[42] See: *London Metal Exchange*, available at [http://lme.co.uk].

But in the foreseeable future the situation may change because metal markets are gradually migrating to Southeast Asia. Even today the largest copper consumer is China,[43] while the Shanghai Futures Exchange in the past 10 years has risen to second place in the world in non-ferrous metal trading.[44]

Things are not much better in ferrous and non-ferrous metallurgy. The world's largest steel producer is Luxembourg-based ArcelorMittal S.A. (with annual production of more than 100 million tons of steel).[45] But Europe, which produces about 209 million tons of steel a year, controls only 15.6% of its world production (for comparison, China produces 489 million tons of steel a year).[46]

Table 6 shows the top ten steel producing countries in Europe,[47] which account for more than 80% of European production. But their share in the world steel market is insignificant. Let us note, for example, that Germany, Europe's most economically developed country and the largest European steel producer, controls just over 3.5% of the world market, while China has 36.5%.

Table 6

List of European Countries by Steel Production

Country	Share of Production, %	
	in Europe	in the world
Germany	22.76	3.62
Italy	15.00	2.39
France	9.03	1.44
Spain	8.63	1.37
UK	6.70	1.07
Belgium	5.16	0.82
Poland	4.98	0.79
Czech Republic	3.31	0.53
Austria	3.22	0.51
Netherlands	3.00	0.48
TOTAL	81.79	13.02

The situation in the non-ferrous metal market is also problematic for Europe. As an example let us consider copper, although our analysis holds for other metals as well.

World copper mine production is slightly over 15 million tons of copper in concentrate, and its major producer is Chile (5.5 million tons). Europe produces only about 664 thousand tons of copper a year, with a steady decline in production.[48]

[43] See: A. Rowley, *Copper Outlook—Still Tight after All This Time*, London Metal Exchange, London, 2008.
[44] See: *Shanghai Futures Exchange*, available at [http://www.shfe.com.cn].
[45] See: *World Steel in Figures*, International Iron and Steel Institute, Brussels, 2008.
[46] See: *Top Steel Producers*, World Steel Association, available at [http://www.worldsteel.org].
[47] See: A. Tvalchrelidze, op. cit.
[48] See: Ibidem.

Every year, the world produces about 21 million tons of copper metal (from primary and secondary raw materials), and Europe controls 11.9% of the world market. For comparison, China produces 16.95% of the total, Mexico 15.92%, and Chile 14.04%.[49]

In Table 7, European countries are ranked by production of copper metal.

Table 7

List of European Countries by Copper Production

Country	Share of Production, %	
	in Europe	in the world
Germany	26.71	3.18
Poland	21.39	2.55
Belgium	15.81	1.88
Spain	12.36	1.47
Sweden	8.58	1.02
Finland	4.41	0.53
Austria	3.27	0.39
Bulgaria	2.81	0.33
TOTAL	95.34	11.35

As can be seen from Table 7, more than 95% of the European market is controlled by only eight countries, but their share of world copper production is quite modest. At the same time, let us note that Germany, Belgium, Spain, France, Italy and Poland have a number of world-class metallurgical and electrochemical plants with a total capacity of 3.3 million tons of copper metal a year.[50] This figure exceeds the total production of copper metal in the whole of Europe by 32.6%. Such a sharp decline in economic indicators is due to the fact that plants have either come to a halt or are operating below capacity.

The conclusion from this brief survey is simple: there is a need for a second wave of production growth.

But the "reanimation" of ferrous and non-ferrous metallurgy is impossible without the involvement of the Central Asia-Caucasus region. Today the market of iron and polymetallic ores is almost totally segmented, and the leading role is played by China.[51] Meanwhile, there are significant untapped reserves of ferrous and non-ferrous metals in Kazakhstan, Kyrgyzstan, Uzbekistan, Armenia, Georgia, Azerbaijan and other countries.[52] The activity of international mining companies in the region still leaves much to be desired, and there are objective reasons for this.[53]

[49] See: Ibidem.
[50] See: *The World Copper Factbook*.
[51] See: A. Rowley, op. cit.
[52] See: A. Tvalchrelidze, op. cit.
[53] See: A. Tvalchrelidze, A. Silagadze, G, Keshelashvili, D. Gegia, op. cit.

In addition, a cause for concern here is that the companies active in the region are mainly Canadian, South African and Australian, while there is virtually no evidence of European activity. Meanwhile, estimates show[54] that the capitalization of these resources with investments amounting to tens of billions of U.S. dollars can create a total net present value of about 1 trillion dollars with a profitability of more than 60%.

All of this leads to the following conclusion: Europe has an opportunity to revive production and economic growth. Moreover, there is no need to fear a lack of a market because the market is in deficit and will remain so in the coming decades.[55]

It should also be noted that the development of ferrous and non-ferrous metallurgy in the South Caucasian countries will undoubtedly accelerate their integration into the EU.

Europe's Role in International Commodity Markets

Table 8 ranks the world's largest commodity exchanges based on the number of futures contracts traded annually on the exchange.[56] For Europe, the table paints quite a sad picture:

1. Only three European exchanges are among the top 20 exchanges in the world, and all of them are located in London.
2. These three exchanges account for only 17% of the 1.4 billion futures contracts traded globally.
3. At the same time, 42.36% of futures contracts are traded on U.S. exchanges, and 25.69% on Chinese exchanges. The exchanges of Southeast Asia as a whole (including China) account for 38.42% of commodity contracts traded globally.

Thus, the leading country in this area is so far the United States, mainly due to oil supply contracts.[57] But the commodity markets of Southeast Asia in general and China in particular are gradually gaining strength and moving into the premier league of financial markets. This means that Europe is losing, step by step, its leading role in international financial affairs.

However, there is undoubtedly a rational way out of the current situation.

According to the World Bank,[58] the market capitalization of companies in Armenia, Azerbaijan and Georgia is insignificant; the same applies to the countries of Central Asia and Turkey. The establishment of a regional commodity exchange under EU auspices[59] implies a number of positive effects. Namely, it will:

(1) have a beneficial effect on the business environment in the region;

[54] See: Ibidem.
[55] See: A. Tvalchrelidze, op. cit.
[56] See: Ibidem; *Commodities Trading. IFSL Research*, International Financial Services, London, 2008.
[57] See: *Oil Markets and Prices: The Brent Market and the Formation of World Oil Prices*, Oxford Institute for Energy Studies, Oxford Press, Oxford, 2007; R.K. Kaufmann, *World Oil Markets: Living Off the Past, Planning for the Future*, Boston University Press, Boston, 2005.
[58] See: *World Bank Data Base*.
[59] See: A. Tvalchrelidze, A. Silagadze, G. Keshelashvili, D. Gegia, op. cit.

Table 8

Twenty Largest Commodity Exchanges in the World

Exchange	Index	Country	Number of Futures Contracts Traded, million
New York Mercantile Exchange	NYMEX	U.S.	353
Dalian Commodity Exchange	DCE	China	186
Chicago Board of Trade	CBOT	U.S.	173
ICE Futures Europe	ICE	UK	138
Zhengzhou Commodity Exchange	ZCE	China	93
London Metal Exchange	LME	UK	93
Shanghai Futures Exchange	SFE	China	86
Multi Commodity Exchange	MCX	India	69
ICE Futures U.S.	ICE U.S.	U.S.	50
Tokyo Commodity Exchange	TOCOM	Japan	47
National Commodity and Derivatives Exchange India	NCDEX	India	35
Brazilian Mercantile and Futures Exchange	BM&F	Brazil	26
Chicago Mercantile Exchange	CME	U.S.	21
Tokyo Grain Exchange	TGE	Japan	20
Liffe Derivatives Market	LDE	UK	11
Central Japan Commodity Exchange	C-COM	Japan	7
Kansas City Board of Trade	KSBT	U.S.	5
Winnipeg Commodity Exchange	WCE	Canada	3
Malaysia Derivatives Exchange	MDEX	Malaysia	3
JSE Securities Exchange	JSE-SE	S. Africa	2

(2) accelerate regional economic development;

(3) create economic prerequisites for a sharp increase in regional security;

(4) strengthen Europe's role in international commodity markets.

Main Conclusions

1. There are still no guarantees of energy security in Europe. The problem of diversifying gas sources is particularly pressing because Europe depends (directly or indirectly) on supplies from Russia.
2. The only way out of the current situation is the accelerated construction of the Bacton (UK)-Groningen (The Netherlands) gas pipeline, the development of the Nabucco project and the construction of LNG import terminals. Nabucco will ensure a new level of relations between Europe and the Central Asia-Caucasus region. This will lead both to a higher degree of energy security in Europe and to the region's sustainable economic development. It is particularly important to include Iran (eventually) in the Nabucco project (if it abandons its nuclear program), which will help to democratize that country and reduce geopolitical risks.
3. Europe has built up significant metallurgical capacity, but this sector depends almost entirely on imports of raw materials. As a result, metallurgical facilities are idle, and the most developed European countries are beginning to experience serious economic problems. The metallurgical sector is in need of urgent "reanimation" because otherwise this entire market will be taken over by China. But the resurgence of ferrous and non-ferrous metallurgy is impossible without the involvement of the Central Asia-Caucasus region with its significant untapped reserves of ferrous and non-ferrous ores. There is no need to fear a lack of a metal market: the market is in deficit and will remain so in the decades ahead. Moreover, the development of ferrous and non-ferrous metallurgy in the countries of the South Caucasus, along with purely economic benefits, will promote their integration into the EU.
4. Europe is gradually losing its leading place in commodity markets, and this place is increasingly claimed by the Southeast Asian countries. Nevertheless, there is undoubtedly a rational way out of the current situation: to involve the countries of the Central Asia-Caucasus region in international financial markets. This will help both to accelerate regional economic development and to strengthen Europe's role in international commodity markets.
5. Mathematical modeling has shown that the sustainability of European economic development will depend to a significant extent on how deeply the EU analyzes the global challenges and what instruments it finds to overcome their negative impact.