



Comparison of European energy scenarios: a producers view

Vladimir Feygin, Vitaly Protasov
Institute for Energy and Finance
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The research on models and scenarios of energy development

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- An Analysis of available Energy Sector Forecasts and Scenarios (FaS): assumptions, methodology, results, uncertainties
- In the network of EU-Russia Energy Dialog (Thematic Group on Strategies, Forecasts and Scenarios)
- In support from the Ministry of Energy of Russia and from Gazprombank Ltd.
- More than 40 different scenarios are already investigated

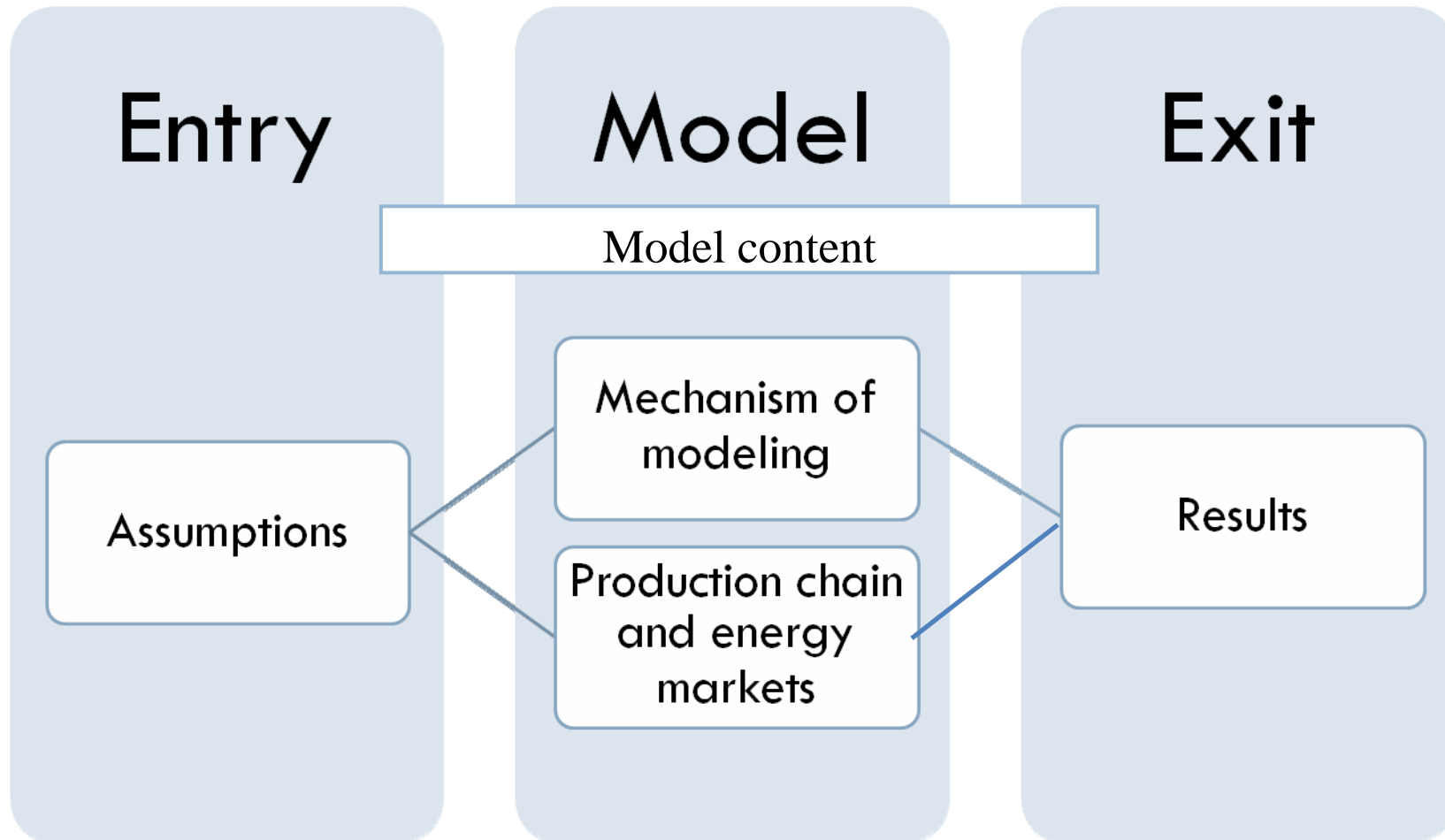
Differences in methodological approach of EU and Russian teams

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- EU approach: model, based on economic, political, pricing, etc assumptions. Modeling of behavior of economic agents. Integrated analysis
- Russia approach: interaction of ministries, companies, research institutes and experts. Creating “rational” ways of energy development. Models play supportive role
- We need to bring together Russia and EU approaches to improve quality of FaS, use results of each other’s analysis in mutual needs

Methodology: the main parts of analysis

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Comparison: model content

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Model content	WEM (IEA)	IGU	POLES (WETO, WETO-H2, WEC)	PRIMES (ETT-2030, SSER, etc)
Time horizon	Till 2030, 5 year step	Till 2030, 5 year step	Till 2050-2010, 10 year step	Till 2030, 5 year step
Geography	World: 24 regions	World: 7 regions	World: 47 regions	EU (27+)
Production chain	Investments, production, export-import, consumption, CO2 emission	production, export-import, consumption	production, export-import, consumption, CO2 emission	Investments, production, import, consumption, CO2 emission
Number of primary energy sources	7 in forecasts (9 in analysis)	5 in forecasts	8 in forecasts	9 in forecasts (24 in analysis)

Comparison: assumptions

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Assumptions	WEM (IEA)	IGU	POLES (WETO, WETO-H2, WEC)	PRIMES (ETT-2030, SSER, etc)
Global trends	Quick development of unconventional gas, changes in LNG market structure, economic crisis influence	Unconventional gas, development of LNG market, government regulation of gas industry	Alternative energy sources, especially hydrogen. Outdated energy trends	Government energy policy (especially «20-20-20» program, renewables development)
Construction of new production and infrastructure objects	Analysis of projects, investments, costs of production and transportation	Analysis of projects	No	Analysis of projects
Consistency and realism of assumptions	High prices on CO2 emission	Assumptions are not agreed with each other. Information about assumptions is not sufficient	Assumptions are not published	Assumption on advance gas prices growth isn't realistic. High prices on CO2 emissions
Technologies	Detailed analysis. Rate of technology development is exogenous. CCS and advanced biofuel will be after 2020	Significant role of CCS (20% coal power plants) by 2030	Detailed analysis. Endogenous technological education	Detailed analysis. CCS is proposed to be after 2020. Although model results show the opposite.
Value of price, macroeconomic, demographic and other assumptions	High oil prices (\$100/bbl), GDP growth assumptions take into account economic crisis	Moderate oil prices (\$60-80/bbl)	GDP growth assumptions don't take into account economic crisis	Scenarios of moderate (\$60/bbl) and high (\$100/bbl) oil prices, too high gas prices. GDP growth assumptions don't take into account economic crisis

Comparison: Mechanism of modeling

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Mechanism of modeling	WEM (IEA)	IGU	POLES (WETO, WETO-H2, WEC)	PRIMES (ETT-2030, SSER, etc)
Instruments	Econometric, balance, simulation	Balance	Econometric, balance, simulation	Game theory, balance, simulation
Approaches	top-down, bottom-up	top-down, bottom-up	top-down, bottom-up	top-down, bottom-up
Data	OECD, UN, WB, IMF	IEA, DGTren, EIA, expert estimates	UN, CEPII	Results of POLES, Prometheus, SCENES, GEM-E3, data of UN, ESAP, IFP, ODYSEE, MURE,
General structure of exogenous and endogenous factors	International energy prices - assumption	International energy prices - assumption	International energy prices are model results (assumption of PRIMES)	International energy prices - assumption
Non-typical factors	Ecology, energy security	Energy security	Ecology	Ecology, energy security

Comparison: Production chain and energy markets (1)

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Production chain and energy markets	WEM (IEA)	IGU	POLES (WETO, WETO-H2, WEC)	PRIMES (ETT-2030, SSER, etc)
Reserves	Detailed analysis field by field	Analysis by countries and regions	Discovery and development of fields are modeled	No
Investments	Detailed analysis	No	Modeling	Analysis
Capacity limits	Analysis of capacity utilization level	Project analysis	No	No
Energy markets	There is no exact information about inclusion of contracts into model. Government policy is analyzed	Analysis of contracts and government policy on gas markets	There is no exact information about inclusion of contracts into model. Government policy is analyzed	Contracts aren't included into model. Probably rejection of long-term contracts is proposed
Composition of consumers	5 industry sectors, 5 household types, service sector, transport by type of fuel, power plants	Power plants, industry, households, transport and others	15 sectors of final consumption, power plants	12 industry sectors (26 subsectors), 5 service sectors, 4 types of households, 4 types of transport, power plants

Comparison: Production chain and energy markets (2)

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Production chain and energy markets	WEM (IEA)	IGU	POLES (WETO, WETO-H2, WEC)	PRIMES (ETT-2030, SSER, etc)
Pricing	International prices are defined by iterative procedure to equalize demand and supply. End-user price are calculated from international prices through not clear mechanism	Oil price is an assumption	Prices are modeled	International prices for coal, oil and gas are assumptions. End-user prices are modeled
Demand elasticity	Price elasticity of demand is not a point of a model. Income elasticity of demand is a regressor	No	No	No
Government policy	Detailed analysis of government policy (3600 government policies). Subsidies are gradually reduced	Government policy and subsidies are analyzed	Government policy and subsidies aren't analyzed	Government policy is analyzed, but subsidies are not
Ecology, CO2 emission	Emissions are modeled. Detailed analysis especially in an alternative scenario. It forms a special module of a model	Emissions are modeled.	An influence of «climate strategies» is modeled	Emissions are modeled. Detailed analysis especially for «20-20-20» program. It forms special module of a model

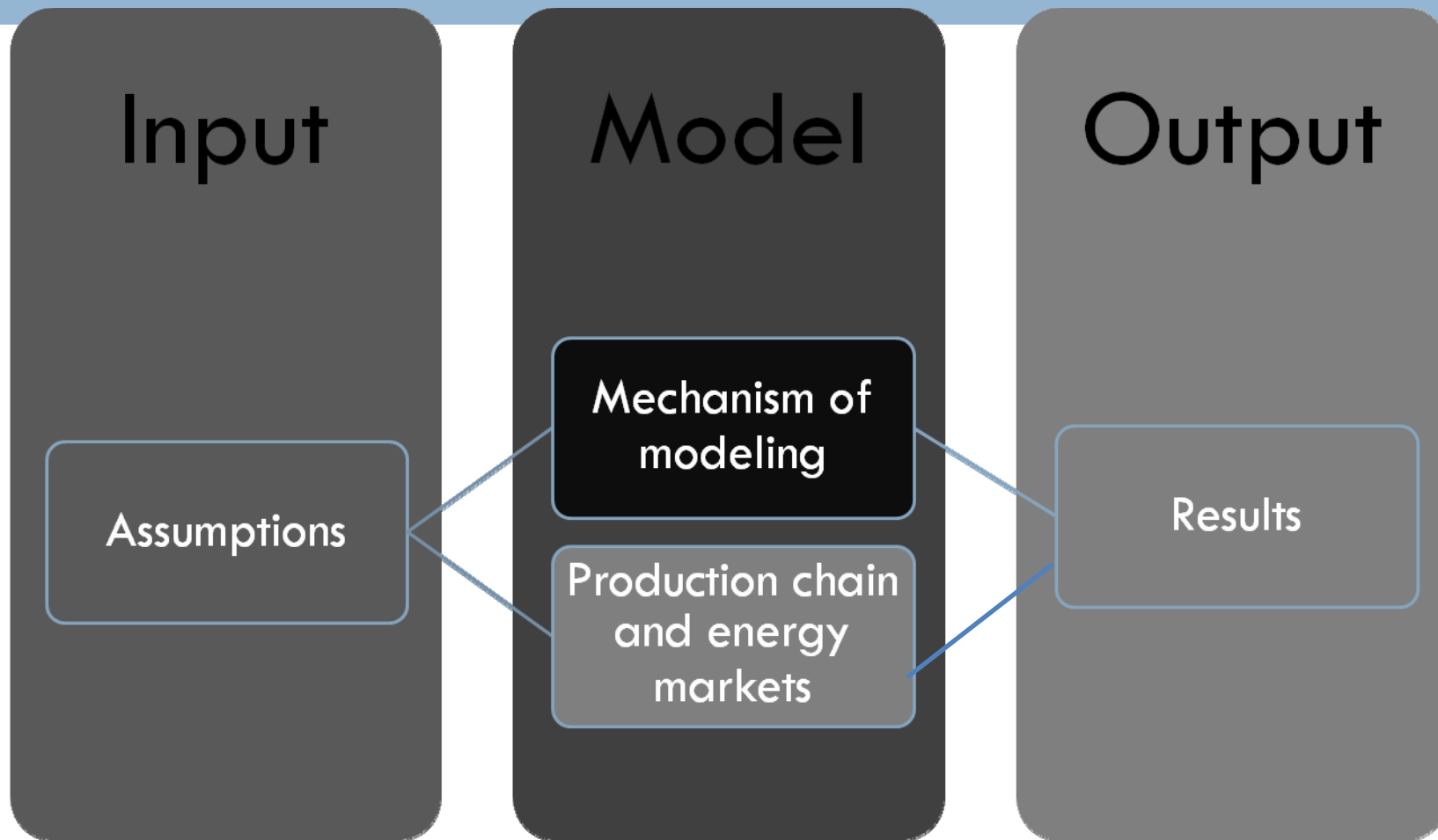
Comparison: results

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Results	WEM (IEA)	IGU	POLES (WETO, WETO-H2, WEC)	PRIMES (ETT-2030, SSER, etc)
Energy Balance Structure	Growth of RES share especially in 450 scenario. Small growth of gas in base scenario and decrease in an alternative one. Substantial growth of share of nuclear energy in 450 scenario	Increase of gas and coal shares; decrease of oil, nuclear and RES shares	Increase of RES, nuclear shares; decrease of oil and coal shares. Stability for natural gas	Growth of RES share, decrease of traditional energy sources share. Values depend on different scenarios. In the late scenarios gas share decreases intensively
Values of end-user price	Unknown	Unknown	Unknown	Unknown
Consequences of scenario realization	Aren't taken into account	Aren't taken into account	Aren't taken into account	Aren't taken into account
Import of natural gas from Russia to EU	Increase of volumes and share in Reference scenario. Uncertainty in 450	It was taken into analysis, but forecast is not published	No	Decrease of volume and share (in consumption) in the late scenarios

Modeling is viewed as a set of black (grey?) boxes

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New modeling approaches?

Assumptions: EU GDP growth

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- PRIMES EU GDP assumptions are a little bit higher than in WEO

2015-2030	Before crisis		In crisis	
	PRIMES-2007	WEO-2007	PRIMES-2009	WEO-2009
Annual GDP growth rate	1,9	1,8	1,9	1,8

EU population growth

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- Demographic assumptions are almost equal
- Persistence of demographic process simplify an analysis

Scenario	PRIMES-2007	WEO-2009		
Period	2000-2020	1990-2007	2007-2015	2007-2030
Annual growth rate, %	0,2	0,3	0,2	0

Comparison of assumptions: prices

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- Gas price in EU in 2020 in PRIMES is 16% higher than in WEM-2009 (with almost equal oil prices)
- PET (TIMES) uses forecast from WEO-2008

2020	IEA (2009)		PRIMES (2008)		Factual		
	Ref	450	BL, NEP	BL, NEP - HOG	2006	2007	2008
Prices	Ref	450	BL, NEP	BL, NEP - HOG	2006	2007	2008
Oil, \$/barr	100	90	61,1	100,1	61,8	69,3	97,2
Gas-EU, \$/MBTU	12,1	11	8,28	13,95	6,6	6,6	10,3
Oil/Gas	8,26	8,18	7,38	7,18	9,30	10,56	9,42

Assumptions: prices

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- In 2005-2020 in PRIMES oil prices rise at 12-84%, while gas prices at 33-124%
- Gas price oil link? Reasons for higher gas price growth?

Price ratio		2010		2020	
\$'2005/barrel	2005	MOG	HOG	MOG	HOG
Oil/gas	1,58	1,31	1,51	1,33	1,29
Oil/coal	3,68	3,98	4,41	4,16	4,14
Gas/coal	2,34	3,03	2,93	3,13	3,2

Source: Second Strategic Energy Review, 2008

ETS price

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	PRIMES				IEA-2009	
EU ETS Price \$/tone CO ₂	BL	NEP	NSAT	NSAT- CDM	BAU	«450»
2020	27,5	51,25	34,16	24	43	50
2030	no data	no data	38,8	27,28	54	110

Gas balance in EU, 2020, mtoe

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Scenarios	PRIMES				ENTSOG*		
	BL-2007	BL-2007-HOG	NEP	NEP-HOG	BL-2009	No policy-2009	2009
Consumption	505	443	399	345	462	513	555,7
Net import	390	330	291	245	351	401	438,4
Import dependence, %	77,2	74,5	72,9	71	75,9	78,2	78,9

Scenarios	RES-2020 (PET, TIMES)				Eurogas	IEA	
	BL	BL-RES	BL-RES-20	BL, HOG	Brussels, 2009	Ref	450
Consumption	429	414,9	464	539,1	578	463	429
Net import	332,2	318,1	324,6	425,4	480	349	321
Import dependence, %	77,4	76,7	70	78,9	83,0	75,4	74,8

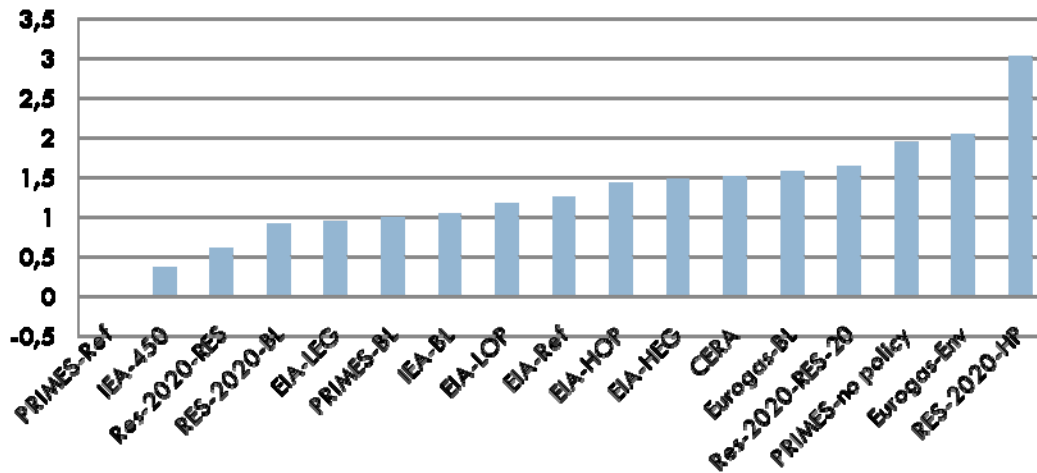
HOG = High oil and gas prices; for ENTSOG - 2019

Importance of average growth rates analysis

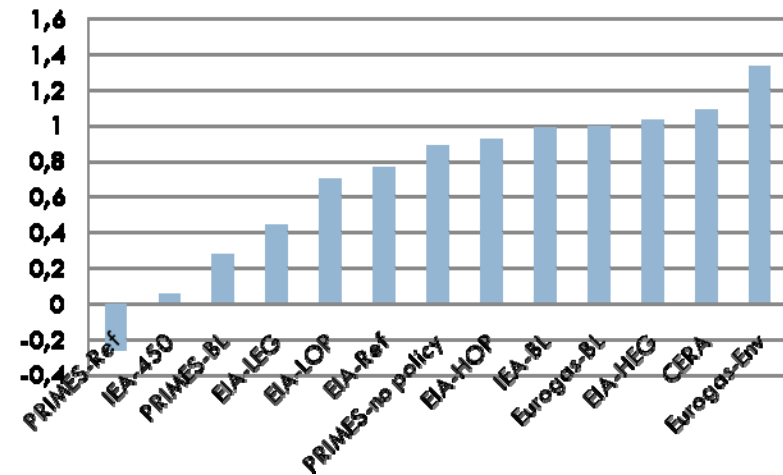
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- Problem of different base year data
- Problem of different units (incl. calorific values of gas)

Growth rates of gas demand in EU-27 or OECD-Europe in 2009-2020 (2009 and 2010 forecasts)



Growth rates of gas demand in EU-27 and OECD-Europe in 2009-2030

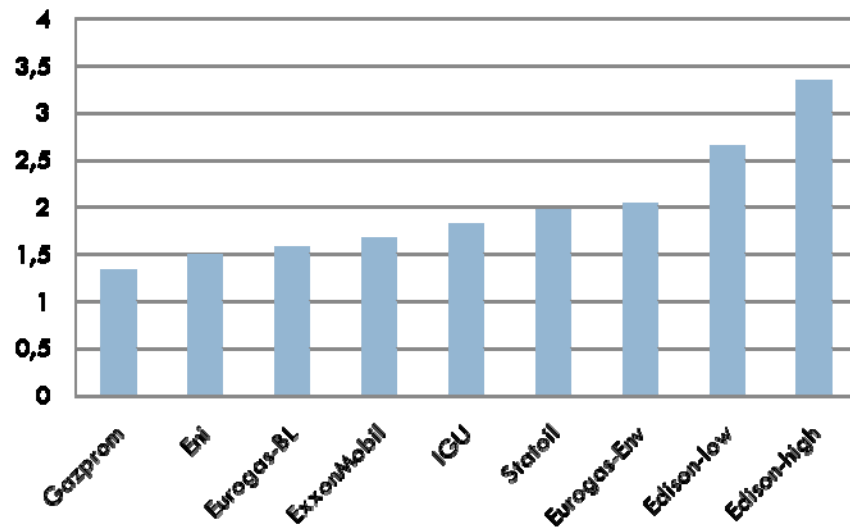


Gas producers forecasts

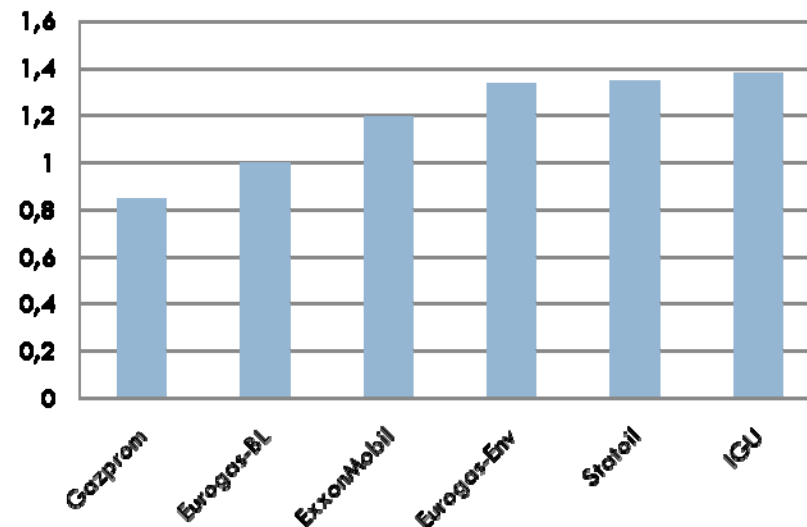
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- Gas producers are more optimistic

**Growth rates in 2009/2010 - 2020
in Europe**



**Growth rates in 2009/2010 -
2030 in Europe**



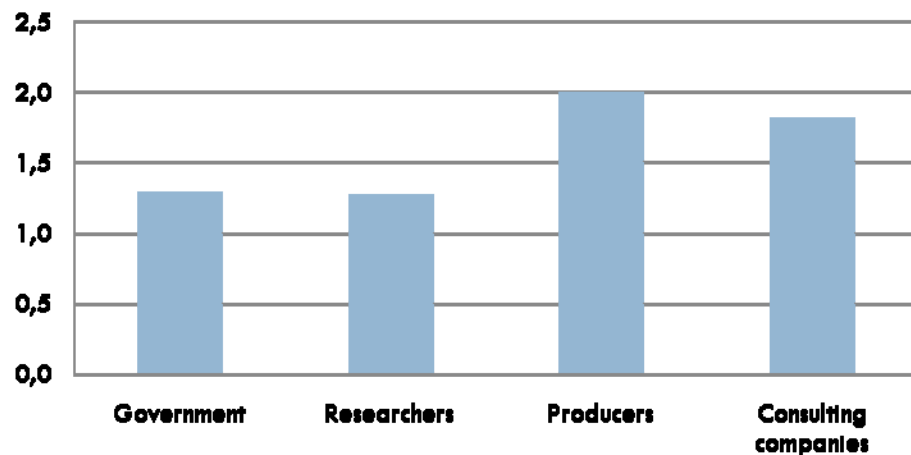
Note: Eurogas and Eni for EU-27, ExxonMobil, Gazprom, Statoil for OECD-Europe, Edison for EU-27+Turkey+Norway+Switzerland, IGU for EU-27+Turkey+Norway+Switzerland+Balkans; Eni, Statoil, IGU from 2010, others from 2009
Sources: company data

Comparison of scenario groups by authors

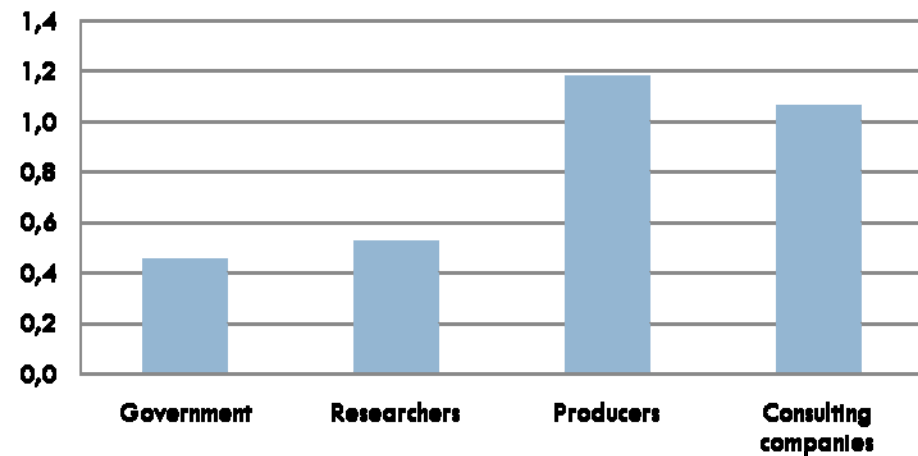
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- Groups of scenarios:
 - Governmental (usually are provided by research institutes)
 - Independent research of institutes and international organizations
 - Producers scenarios
 - Consulting companies scenarios

Growth rates 2009-2020 in Europe



Growth rates 2009-2030 in Europe



Note: Government: EIA, PRIMES, ENTSOG (9 scenarios); Researchers: IEA, RES-2020 (PET, TIMES) (6 scenarios); Producers: Eurogas, ExxonMobil, Gazporm, Edison, Eni, Statoil, IGU (9 scenarios); Consulting companies: CERA, Wood Mackenzie, LEA, IEC (6 scenarios)

Conclusions and open questions

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- Uncertainties – objective and subjective
- Forecasts of models differ a lot from each other
- It seems to be only one way to make efficient progress - cooperation of EU, Russia and World experts at permanent base with proper governmental support
 - Importance of growth rates analysis
 - Optimism of producers and consulting agencies
- In 2020-2030 gas consumption increase looks to be lower than in 2009-2020

Conclusions and open questions (2)

- Some questions yet without comprehensive answers:
 - IEA-2009 pessimistic view on role of gas (both for the EU and US: coal renaissance while gas is stagnant);
 - EU-2009 press on biomass and EU-2010 press on wind:
 - detailed understanding of an economic impact of various scenarios on consumer prices; role and scale of subsidies; degree of certainty on technological shifts etc.
- EU-2008 Alternative scenarios look now far from being the only way to reach “20-20-20” targets
- Current dramatic shift in views on the US gas perspectives
- Development of an information panel on available scenarios and forecasts
- Necessity to intensify efforts in expert evaluation of scenarios and on harmonization of forecasts



Thank you for your attention!