

CONTENT

Introduction	7
Chapter 1. Gas industry as a subject of system analyses	9
1.1. Conceptual issues.....	9
1.2. Mineral resource base.....	12
1.3. Gas production.....	13
1.4. Import of gas.....	14
1.5. Gas consumers.....	14
1.5.1. Forecasting of internal demand for gas.....	15
1.5.2. Forecasting of export network gas to neighboring countries.....	15
1.5.3. Forecasting of LNG export.....	16
1.6. Gas storing.....	16
1.7. Gas processing.....	17
1.8. Gas supply.....	17
1.9. Gas balance scenarios.....	17
1.10. Gas transport.....	18
1.11. Methodology of gas industry development optimization.....	20
Chapter 2. Analysis of subsystems of gas industry	24
2.1. Objects of the mineral and raw material base.....	24
2.1.1. Modeling in gas and oil geology.....	24
2.1.2. The procedure of geo-economic estimation of localized hydro-carbon resources and reserves with allowance made for risk factor.....	40
2.2. Gas production objects.....	61
2.2.1. Methodology of system approach.....	61
2.2.2. Reservoir gas production.....	65
2.3. Gas processing.....	67
2.3.1. Natural gas treatment by gas-chemical methods.....	67
2.3.2. Modern gas processing.....	69
2.4. Underground gas storages.....	71
2.4.1. Simulation of gas storage processes.....	71

2.4.2. Gas storage capacities	76
2.5. Internal consumption	78
2.5.1. Methods of gas consumption scenarios development	78
2.5.2. Factor significance analyses for gas consumption.....	96
2.6. Forecasting of gas import and export dynamic rates	100
2.7. Facilities of gas supply system	108
2.7.1. Gas supply facilities.....	109
2.7.2. Determination of the expected natural gas demand.....	111
2.7.3. Specific economical parameters of development of individual gas supply facilities	112
2.7.4. Specific economical parameters of the gas supply system development by individual hubs of the gas transportation network..	113
2.8. Optimization of developing and reconstructing gas transport system units	114
2.8.1. Topological formation of a perspective gas transportation system...	114
2.8.2. Present and perspective analyses of gas pipeline technical conditions	116
2.8.3. Specific arc weight evaluations	121
2.8.4. Gas balance options	123
2.8.5. The gas flow optimization accounting for trends of the reconstruction and development of gas production, processing, transportation and storage facilities based on the long-run income maximization approach.....	126
2.9. Detailed analyses of reconstruction and development optimization results at the level of gas industry facilities.....	132
2.9.1. Analysis of main gas pipeline facilities.....	133
2.9.2. Optimization approaches to reconstruction and development of GTS facilities	134
Chapter 3. Object analyses of gas industry subsystems.....	143
3.1. Analysis of gas production objects	143
3.1.1. General benchmarks	143
3.1.2. Analysis of offshore gas production objects.....	147
3.2. Raw materials for gas refining	153
3.2.1. Marketing.....	153
3.2.2. Gas processing facilities.....	153
3.2.3. Input data for the development of gas-processing master plan`.....	154
3.3. Analysis of gas storage facilities.....	157
3.3.1. Principles and arrangements of UGS.....	157
3.3.2. Underground gas storages in aquifers.....	159
3.3.3. Underground gas storages in depleted gas fields.....	163
3.3.4. Underground gas storages in oil (oil-and-gas) fields.....	165

3.3.5. Underground gas storages in rock salt.....	166
3.4. Analysis of gas supply subsystem facilities.....	168
3.5. Analysis of main gas transportation facilities.....	174
3.5.1. Calculation of natural gas properties and gas flow.....	174
3.5.2. Hydraulic and thermal calculations for linear portion of a pipeline.....	183
3.5.3. Basic formulas and relations for calculations for gas-compressor plants, groups of gas-compressor plants, compressor facilities and stations.....	185
3.6. Evaluation of adequacy of gas industry development variants.....	190
Chapter 4. Syntheses of gas industry as a complex system	195
4.1. Identification of needs in material and technical resources required for implementation of the gas sector development strategy	195
4.2. Identification of investment requirements needed for implementation of the strategy of the gas sector development	197
4.3. Conceptual issues of technogenic risk assessment methodology	201
4.3.1. Basic principles of technogenic risk analyses	201
4.3.2. Accounting of influence of technical, technological, natural, climatic and other factors on territorial and/or temporal distribution of incident rate on main gas pipelines	204
4.4. Environmental impact assessment in the course of implementation of the gas industry development strategy	214
4.4.1. Methodological problems of ecosystem impact assessment	215
4.4.2. Classification of geocological risks in the gas sector.....	219
4.5. Cost-effectiveness assessment of implementation of the gas sector development strategy	229
4.5.1. Basic principles of cost-effectiveness assessment.....	229
4.5.2. Optimization of the gas sector development strategy	230
4.6. Methodology of development and enhancement of standardization system in oil and gas industry.....	232
4.6.1. Structure of regulatory documents	232
4.6.2. Organizational structure pertaining to standardization	236
4.7. Quantitative risk assessment related to the gas sector development and their hedging	238
4.7.1. Procedures of risk assessment and management	238
4.7.2. Damage calculations.....	242
4.7.3. Risk management and hedging.....	245
Chapter 5. System's risk minimization in the frame works of master plan for strategic development of gas industry.....	251
5.1. Analysis of risks related to the gas industry development.....	251

5.2. Minimization of systemic risks through development of gas production, transportation and consumption facilities in the gas industry	256
5.3. Complex minimization of risks at the gas industry facilities.....	269
5.4. Specific features of risks pertaining to development of gas bearing regions	272
5.4.1. Approaches to risk assessment and management	272
5.4.2. Methodology of scenario generation for multivariant development of new gas bearing regions	274
5.4.3. Analysis of risk scenarios of the gas industry development	275
5.5. Minimization of system risks when working out the strategy of the gas industry development	277
5.6. Working out state support measures for the gas industry development....	285
5.6.1. Proposals in the area of subsurface use	286
5.6.2. Pricing, tariff, fiscal and customs policy	286
5.6.3. Attraction of investment	287
5.6.4. Proposals in the area of environmental policy.....	287
Conclusions.....	289
Annex	291
Glossary – definitions.....	292
References.....	294