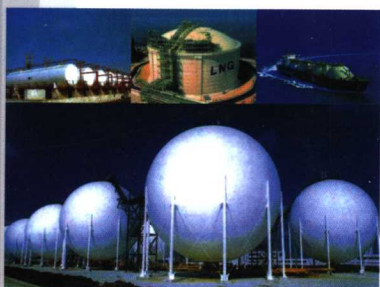


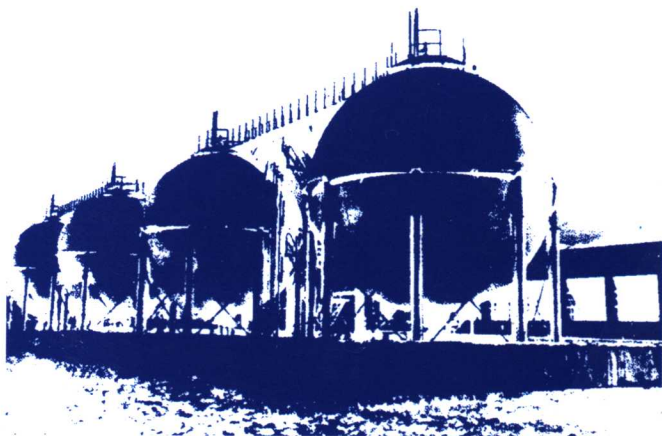
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# 天然气产业链 下游市场风险研究

刘毅军 著



*R*esearch on Natural Gas Industrial Chain  
Downstream Market Risk



石油工业出版社

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## 内 容 提 要

本书是天然气产业链下游市场风险研究的专著，内容主要包括：天然气产业链下游市场风险的含义、发展现状、天然气发电及北京地区天然气市场专题分析、天然气产业链下游市场风险分析、评价指标体系、评价模型、防范对策。

本书可供政府及企业从事能源经济与管理（特别是从事天然气经济与管理）工作的人员阅读、参考，也可供大专院校及相关研究机构的师生及研究人员阅读、参考。

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# 前

Preface

# 言

在世界范围内，天然气是重要的一次能源，且其地位仍在不断上升，而我国只是近年才开始跨地区输送天然气，由此揭开大规模开发利用天然气的序幕。本项研究是以中国天然气产业链正在进入快速成长阶段为背景，针对天然气产业链组成的一种重要能源供求复杂系统，提出了开展天然气产业链下游市场风险研究这一具有现实意义和理论价值的研究题目。

本项研究认为对天然气产业链下游市场风险的认识应该基于从整个天然气产业链的角度，把天然气产业链下游市场视为整个产业链的一个环节，下游市场对于产业链而言代表着需求，需求的波动是下游市场给整体产业链发展带来风险的根源。

天然气产业指进行天然气勘探、开发生产企业和单位的集合；天然气相关产业指天然气输送、储存和以天然气及其副产品为投入构成的不同产业。

天然气产业链指以天然气及其副产品的产出、输送、储存或投入作纽带所形成的上下关联衔接的产业集合。

天然气产业链风险是指由于受风险因素的作用和天然气产业及其相关产业间的相互影响，对产业链发展造成损失的可能性和损失严重程度的综合反映。理论上，它可以划分为两个方面的含义：

(1) 由于受风险因素的作用，影响了产业链的完整性，从而给产业链发展造成风险。

(2) 由于天然气产业及其相关产业间发展的不平衡，由此所导致的产业链风险。

天然气产业链下游市场风险是指由于天然气产业链下游市场受风险因素的作用，导致天然气产业链下游市场需求的波动，再通过天然气产

业及其相关产业间的相互影响的作用，对天然气产业链发展造成损失的可能性和损失严重程度的综合反映。理论上，它也可以划分为两个方面的含义：

(1) 由于天然气产业链下游市场受风险因素的作用，影响了产业链的完整性，从而给产业链发展造成风险。

(2) 从天然气产业链下游市场需求的角度，由于其与天然气产业及其相关产业间发展的不平衡，由此所导致的产业链风险。

本项研究以现有及拟建项目的调研与结构分析法，从整个天然气产业链的角度，对天然气产业链上游的主要供气来源、天然气产业链中游的主要输气管道、天然气产业链下游市场的消费情况进行详细描述。其中下游市场的消费情况按消费类型为主、地区划分为辅的二维划分法，划分为：城市燃用天然气、天然气发电、工业燃料用天然气、化工原料用天然气、其他天然气消费项目五个部分，描述、分析天然气产业链下游市场的系统结构。并专门针对天然气发电和北京天然气区域市场，结合市场发育的历史及天然气特定消费市场（用途和地区）的认识，对系统结构、市场风险形成全面认识。以此为基础，将天然气产业链下游市场划分为七大不同类型的区域市场，并详细分析各区域市场的特点：东北地区，包括辽宁、吉林、黑龙江（三省）；环渤海地区，包括北京、天津、河北、山东（二市二省）；长江三角洲地区，包括上海、江苏、浙江（一市二省）；东南沿海地区，包括福建、广东、海南、广西（三省一区）；中南地区，包括河南、湖北、湖南、江西、安徽（五省）；西南地区，包括四川、重庆、云南、贵州（三省一市）；西北地区，包括甘肃、青海、新疆、陕西、宁夏及内蒙古西部（三省三区）。这七大不同类型的天然气消费市场分别为：东北地区的城市清洁、化工型和工业燃料替代型相交织的混合型天然气市场，环渤海地区的城市清洁型和发电型天然气市场，长江三角洲地区的发电型、城市清洁型和化工型相交织的混合型天然气市场，东南沿海地区的发电型和城市清洁型天然气市场，中南地区的化工型和城市清洁型天然气市场，西南地区的化工型和城市清洁型天然气市场及西北地区的化工型、发电型和城市清洁型并重的混合型天然气市场。

本项研究采用专家调查法，并结合环境分析法，应用系统的观点，识别和分析天然气产业链下游市场的六大类风险因素：竞争风险、用户风险、营销风险、价格风险、结构风险、环境风险；并分析了下游市场

发育阶段风险因素和下游区域市场风险因素；主要围绕天然气产业链上、中、下游各环节气量变化为中心，选用适用的数理经济方法，划分单一风险因素对多节点作用的产业链（下游市场）风险、风险因素的作用在节点间传递的产业链（下游市场）风险、发展不平衡的产业链（下游市场）风险 3 种情况，对 3 种情况的天然气产业链下游市场风险进行了量化描述。

在界定天然气产业链、天然气产业链下游市场、天然气产业链下游市场风险后，运用多种方法，对风险因素进行系统识别和以相互关系为重点的风险因素分析，以此为基础，建立天然气产业链下游市场风险评价指标体系。在建立该指标体系时，首先要明确和遵循一定的基本原则；其次，在建立指标体系时，要特别注意选择那些具有重要控制意义，可受到管理措施直接或间接影响的指标，选择那些具有时间和空间动态特征的指标，选择那些显示变量间相互关系的指标和那些显示与外部环境有交换关系的开放系统特征的指标；再次，采用有效的方法来建立指标体系，在此采用频度统计法、理论分析法、专家咨询法等（频度统计法是对目前有关天然气产业链下游市场研究的报告、论文进行统计，选择那些使用频度较高的指标；理论分析法是对天然气产业链下游市场风险的内涵、特征进行分析综合，选择那些重要的特征指标；专家咨询法是在初步提出评价指标的基础上，征询有关专家的意见，对指标进行调整；如此建立的指标体系称之为一般评价指标体系）方法来甄别和选择指标，尽量满足科学性和系统性；最后，按照层次分析法原理来划分指标体系的层次。按照这样的思路，对识别到的天然气产业链下游市场风险因素进行结构分类，并建立了四层 24 个具体指标的风险评价指标体系。

针对天然气产业链下游市场风险评价指标体系既有定量的指标，也有定性的指标，除少数可以通过统计方法获得，大量的指标只能采用专家评分法的特点选取定性和定量相结合的风险评价方法较为合适。在比较了层次分析法、模糊综合评价法、灰色系统评价法和人工神经网络评价法的优缺点及适用性后，结合目前天然气产业链下游市场风险研究实际，筛选、建立了分区域评价、消费气量为权数求和，层次分析法、聚类分析法、灰色评价法等集成的天然气产业链下游市场风险评价模型。

提出了五个方面 14 条天然气产业链下游市场风险防范的对策：

(1) 以新的监管体制适应天然气产业链的快速发展阶段，包括：转

变天然气产业链监管模式，将监管重点转向天然气管网；加快天然气出厂价格的市场化步伐，反映资源稀缺性；完善天然气下游市场法规建设，为天然气消费利用奠定环境基础。

(2) 增加天然气多元化供给，加快基础设施建设，包括：增加天然气进口的多元化，保障资源供给；尽快实现重点区域市场气源的多元化，加强产业链终端的竞争性；加快主干管网建设，实现全国主干管道联网运行；加大储气设施建设力度，保障用气调峰和基本储备能力。

(3) 高度重视天然气发电和城市燃气发展，包括：正确认识天然气在我国能源消费中的地位，重点发展城市燃气；明确天然气发电在产业链发展中的地位，搞好峰荷电厂布局。

(4) 注意解决区域用气的协调，包括：处理好不同区域消费用气矛盾，优先保障重点市场用气；处理好产气区与非产气区消费用气矛盾，注意产气区用气需求；处理好区域内不同消费用途用气矛盾，优先保障城市燃气。

(5) 建立天然气产业链风险预警系统，包括：开展天然气产业链风险预警理论研究，奠定实践基础；建立天然气产业链风险预警系统，完善预警机制。

国内外对复杂系统的风险研究还处于起步阶段，本项研究主要属于理论性研究，加之我国天然气产业链近年才进入快速成长阶段，资料积累有限，研究成果的实际应用还需在今后进一步研究中加以完善。对天然气产业链下游市场风险的认识是基于整个天然气产业链的角度，把天然气产业链下游市场视为整个产业链的一个环节。此项研究成果是天然气产业链风险理论研究计划的一个阶段成果，将以此为起点继续展开天然气产业链风险理论的研究。希望寄本项研究成果的出版，能够有更多的研究者共同参与研究，对其中的不足和缺陷，恳请广大读者给予批评指正。

## Preface

Natural gas is a kind of important primary energy, and its status continues rising in the whole world. However, natural gas cross - regional transmission has begun in China only in recent years, which makes the beginning of large - scale exploitation and utilization of natural gas. This research deals with natural gas industrial chain downstream market risk. The natural gas industrial chain is entering a stage of rapid growth in China. The researches in this paper are of practical significance and academic value in terms of this important energy supply and demand complex system.

This research suggests that the recognition of natural gas industry chain downstream market risks should be based on the entire natural gas industrial chain and the natural gas downstream market is regarded as a link of the whole industrial chain. The downstream market represents the demand for the industrial chain, and demand fluctuation makes the downstream market bring about risks to the whole industrial chain.

Natural gas industry refers to a set of enterprises engaged in gas exploration, development and production; natural gas correlative industries include the industries of natural gas transport, distribution, and storage as well as other industries with natural gas and its byproducts as inputs. Natural gas industrial chain refers to an interrelated industrial set linked with natural gas and its byproducts production, transport, distribution and storage or input.

Natural gas industrial chain risk refers to the comprehensive reflection of the industry chain losing possibility and severity caused by effect of risk factors and mutual effects between natural gas industry and its correlative industries. Theoretically, two aspects of meaning should be contained:

- (1) Risk factors affect the integrity of industrial chain, and this



results in risks for the development of industrial chain.

(2) Unbalanced development of natural gas industry and its correlative industries causes natural gas industrial chain risks.

Natural gas industrial chain downstream market risk is defined as the comprehensive reflection of the industry chain losing possibility and severity, which is caused by demand fluctuation of the downstream market due to risk factors and mutual effects between natural gas industry and its correlative industries. Theoretically, two aspects of meaning should be contained:

(1) Natural gas industrial chain downstream market is affected by risk factors, and this influences the integrity of industrial chain and results in risk to the industrial.

(2) From the perspective of natural gas industrial chain downstream market demand, the unbalanced development of natural gas industry and its correlative industries cause risks of the natural gas chain.

According to the investigation and structure analysis of the existing and planned projects, and in view of the entire natural gas chain, the research in the paper puts forward detailed descriptions for the following: the main sources of gas supply of the natural gas industrial chain upstream, the main gas transmission pipelines of the mid - stream, and consumption condition of the downstream market. By using the two - dimensional method, the downstream market is divided first according to consumption types and then regions. It can be divided into five consumption types: city gas, gas for electric generation, gas for industrial fuel, gas for chemical raw materials and other consumption types. Describing and analyzing the systematic structure of natural gas industrial chain market, paying special attention to gas for electric generation and the natural gas market of the Beijing area and recognizing the history of market growth and special consumption market (uses and areas) of natural gas provide conditions for fully understanding the formation of the systematic structure and market risks. On the basis of above descriptions, natural gas industrial chain downstream market is divided into seven various types of region market, and the characteristics

of each market are also analyzed in detail. The seven region markets are listed below.

**Types of Regional Market of Natural Gas Industrial Chain Downstream**

Region	Region Contained	Natural Gas Market Type of the Region (arranged by importance)
Northeast Region	Liaoning, Jilin, Heilongjiang	city gas, gas for electric generation, gas for industrial fuel
Around Bohai Region	Beijing, Tianjin, Hebei, Shandong	city gas, gas for electric generation
Yangtze River delta Region	Shanghai, Jiangsu, Zhejiang	gas for electric generation, city gas, gas for chemical raw materials
Southeast coastal Region	Fujian, Guangdong, Hainan, Guangxi	gas for electric generation, city gas
Central South Region	Henan, Hubei, Hunan, Jiangxi, Anhui	gas for chemical raw materials, city gas
Southwest Region	Sichuan, Chongqing, Yunnan and Guizhou	gas for chemical raw materials, city gas
Northwest Region	Gansu, Qinghai, Xinjiang, Shanxi, Ningxia and Nei Monggu	gas for chemical raw materials, gas for electric generation, city gas (equally)

This research adopts Delphi method, environment analysis and the viewpoint of applied system to distinguish and analyze the six kinds of risk factors of natural gas industrial chain downstream market. The six kinds of risk factors are competitive risk, consumer risk, marketing risk, price risk, structure risk and environment risk. Further more, analysis is made for the risk factors in the growing stage of downstream market and the risk factors of the downstream regional markets. Based on gas volume changes of the upstream, mid - stream and downstream nodes, three types of risks are listed: industrial chain (downstream market) risks caused by the effect of single risk factor on the multiple nodes, the industrial chain (downstream market) risks caused by the effects of risk factors transference between the nodes, and the industrial chain (downstream market) risks caused by unbalanced development.

The three types of downstream market risks are described in a quantitative way.

On the basis of defining natural gas industry chain, natural gas industry chain downstream market and natural gas industry chain downstream market risk, systematic identification of risk factors and analysis of the relationship between the risk factors, natural gas industrial chain downstream market risk evaluation index system is established. In the course of establishing the index system, certain fundamental principle should be clearly understood and observed; secondly, special attention should be paid to the selection of those indexes which possess important meaning of control, receive direct or indirect influences of management measures, have dynamic features of time and space, display the mutual relationship between the variables and demonstrate the features of open system that has exchange relationship; thirdly, effective methods are introduced to build the index system; they are frequency statistics method, expert consultation approach and theoretical analysis method (frequency statistics method is used to count up the reports and treatises concerning the market researches of natural gas industrial chain downstream market and to choose the indexes which are used more frequently; theoretical analysis method is used to analyze and synthesize the connotation and features of the gas industrial chain downstream market risks; expert consultation method is used to consult specialists on the bases of preliminarily putting forth evaluation index which may be regulated according to the ideas of specialists. The index system formed in this way is called general index system) . The use of these methods for distinguishing and selecting index should meet scientific and systematic qualities as far as possible. Finally, the levels of index system are divided according to the principles of level analysis method. In accordance with this train of thought, the distinguished downstream market risk factors of gas industrial chain are classified structurally, and the risk evaluation index system is established with 4 levels and 24 specific indexes.

Natural gas industrial chain downstream market risk evaluation

index system has both quantitative index and qualitative index. Except a few indexes that could be obtained by means of statistical method, most indexes can only be obtained by adopting the characteristics of the method of marks given by specialists, and by means of this method, it is suitable to choose an integrated method for evaluating risks qualitatively and quantitatively. After comparing the advantages, defects and suitability of level analysis method, vague comprehensive evaluation method, grey system evaluation method and artificial nerve network method, and in combination with the present research practice of natural gas downstream market risks, a gas industrial chain downstream market risk evaluation model is built up for separated regions evaluation, summation of consumption volume weighted numbers, level analysis method, collection analysis method and grey evaluation method.

The following are the 14 countermeasures in 5 aspects proposed for guarding against the gas industrial chain downstream market risks:

(1) Building new supervising and managing system adaptive to the rapid growth stage of natural gas industrial chain. The system comprises the transformation of natural gas industry chain supervising and managing pattern, the change of supervision and management direction to natural gas pipeline network; the acceleration of the step to marketing of natural gas producer price and reflect resource scarcity, the reflection of resources scarcity; the perfection of laws and regulations of natural gas downstream market for laying environment foundation of natural gas consumption and utilization.

(2) Increasing supply of natural gas and accelerating the construction of fundamental facilities. It comprises the increase of diversified overseas resource utilization and insurance of resources supply; the realization of diversified gas sources of key regional markets and the reinforce of competitiveness of industrial chain terminals; the acceleration of construction of main pipeline network for realizing the node operation of main pipelines in the whole country; the enforce of the construction of gas storage facilities for insuring the gas peak regulations and basic storage.

(3) Devoting much attention to gas for electric generation and city

gas development. It comprises the correct recognition of the status of natural gas in energy consumption of China and emphasis of developing city gas; the clear recognition of the status of gas for electric generation in the industrial chain development and proper design of layout of peak load power plants.

(4) Paying attention to the regional gas consumption coordination. It comprises the reasonable settlement of the contradiction of different regional gas consumption and the priority of ensuring emphatic market gas consumption; the proper settlement of gas consumption contradiction between regions that produce gas and regions that do not produce gas and attention to the demand of gas producing regions; the correct settlement of the gas consumption contradiction between different uses of gas consumption in a region and the priority of city gas consumption.

(5) Establishing natural gas industrial chain risk warning system. It comprises the research on natural gas industrial chain risk warning theory and laying the foundation for practice; the establishment of natural gas industrial chain risk warning system and improvement of warning mechanism.

Research of complex system risk is still in the starting stage both in China and abroad. This research is mainly a theoretical work. In addition, natural gas industrial chain has entered the stage of rapid growth only in recent years in China. Accumulation of related data is limited. Practical application of research achievements still need to be improved in the future. Recognition of natural gas industry chain downstream market risk is from the perspective of the entire natural gas industrial chain. Natural gas industrial chain downstream market is regarded as a link of the entire industrial chain. The research achievement of this project is the result of a period of the theoretical research plan for natural gas industrial chain risk. This is only a starting work. The theoretical research of natural gas industrial chain risk will be carried on. It is hoped that with the publication of research work, more researchers could participate in the work. The writer entreats readers to comment and correct the deficiency and defects in the research.



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