吐哈油田天然气利用途径

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摘　要　新疆占全国总面积六分之一, 其三大盆地蕴藏着丰富的天然气资源, 且天然气市场潜力很大, 预测 2000 年天然气需求量为 $40\times10^8m^3$, 其中 95% 用于工业。吐哈油田 1997 年公布储量为 $669.27\times10^8m^3$, 1997 年开始向乌鲁木齐市供气 $4\times10^8m^3/a$, 主要用于尿素生产。由于吐哈油田天然气资源综合利用起步较晚, 当前还存在天然气利用不充分, 每年还有不少气在放空; 所生产的 LPG 面临需求量下降, 稳定轻烃不好利用等问题。为此, 结合新疆地区地广人稀, 交通不便, 资源分散等特点, 提出了吐哈油田的天然气宜在新疆内消化, 加工成产品或中间产品面向全国的思路, 寻求依靠科技发展天然气综合利用的有效途径。

主题词　吐哈油田　天然气　资源　综合利用　发展趋势

吐哈油田天然气资源利用现状

1. 资源状况

吐哈油田到 1996 年底共有探明天然气储量 $669.27\times10^8m^3$。其中溶解气 $425.65\times10^8m^3$, 气田气储量 $243.62\times10^8m^3$, 可采储量 $301.29\times10^8m^3$, 预测"九五"将新增储量 $398\times10^8m^3$, 其中气藏气 $80\times10^8m^3$, 溶解气 $218\times10^8m^3$, 可采储量度 $191\times10^8m^3$。

盆地天然气富含轻烃, 目前探明"九五"预测天然气储量中 C_3、C_4(LPG) 2 766.42 $\times10^4$t, C_5^+ (稳定轻烃) 1 536.52 $\times10^4$t, 共计 4 302.94 $\times10^4$t, 其中可采储量 1 595.66 $\times10^4$t。

采用"吐哈全组分模拟系统"对吐哈原油和凝析油的全组分进行了数据处理, 得出可能回收的轻烃产量, 见表 1。

表 1　天然气及轻烃产量预测

年　份	干气 (10^8m^3)	液化气 (10^4t)	稳定轻烃 (10^4t)
1997	2.5	8.4	3.6
1998	5.5	9	4
2000	8	10.6	12
2010	12	16	——

2. 目前利用现状

吐哈油田天然气主要为伴生气, 伴生气须经轻烃回收后才能进一步利用。目前伴生气日产 $230\times10^4m^3$, 现已建成轻烃回收装置 $210\times10^4m^3/d$ 加工能力, 实际处理天然气 $195\times10^4m^3/d$, 1999 年将增加 $120\times10^4m^3$ 气藏气产能, 同时增加 $100\times10^4m^3/d$ 天然气加工能力。天然气经轻烃回收后, 生产出干气和轻烃(即液化石油气和稳定轻烃)。

(1) 干气利用

吐哈油田年产干气 $5.5\times10^8m^3$, 其中 $4\times10^8m^3$ 输往乌鲁木齐市生产化肥和做民用燃料, 少部分作为油田生产及生活, 其中正在建设的甲醇装置将于 2000 年投产。其利用情况见表 2。

表 2　吐哈油田干气利用情况

	项　目	现在 ($\times10^8m^3/a$)	2000 年及以后 ($\times10^8m^3/a$)
企业外部	乌石化	3.3	3.3
	新化	0.66	1.0
	乌鲁木齐市民用	0.036	0.73
	吐鲁番热电联网	——	0.2
	鄯善生活及商业	0.02	0.02
	小　计	4.02	5.25
企业内部	航机发电及气举燃料	0.18	0.18
	生活	0.25	0.25
	甲醇	——	1.0
	小　计	0.43	1.43
	合　计	4.45	6.68

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(2) 轻烃利用

年产轻烃超过 $12\times10^4m^3$, 其中液化石油气 $8\times10^4m^3$, 稳定轻烃 4×10^4t, 除少部分(约 1 000 t) 用于油田生活外, 其余部分外销。

由于国际油价的影响, 液化石油气和稳定轻烃不仅价格不稳定, 且在不同时期, 不同程度地滞销, 尤其是稳定轻烃由于含 C_5 较多(65%) 以上, 蒸气压高, 用户寥寥。

吐哈油田天然气综合利用前景

1. 当前存在的问题

(1) 资源利用不充分。目前产量大于用气量每年放空 $1\times10^8m^3$, 且各装置还存在放空火炬, 即使扩容或新建装置以后, 仍然避免不了部分放空气体。为了消灭火炬, 保护环境, 需对火炬进行改造的同时, 考虑火炬的综合利用。

(2) 综合利用流程短, 效益不好。以甲醇为例, 甲醇装置即将投产, 但国内甲醇供大于求, 市场不容乐观。

(3) 结构单一。如前所述及天然气仅限于发电、化肥及生活, LPG 尽管目前销量还很大, 随着城镇汽化率的提高, 对 LPG 作燃料的需求量也大大降低, 预计到 2010 年, LPG 的作燃料需求将下降 60%, 稳定轻烃由于含 C_5 多, 不好利用, 一直销路不好, 效益不乐观。

2. 利用思路

(1) 由于地域偏远, 交通不便, 天然气应在疆内加工成产品或中间化工产品, 市场要面向全国。

(2) 依靠科技开发成本低效益好的新途径, 对市场销路不好的 LPG 和 NGL 进行再利用。

(3) 油田建设项目与地方建设项目协调一致, 大中城市建设规模较大的化工装置, 对剩余天然气或小区块天然气, 油田内部进行小规模利用。

3. 干气利用途径

(1) 民用及商业用气

由于吐哈至乌鲁木齐市已建成 $6\times10^8m^3$ 输气能力的干气外输管线, 2010 年以前, 可大力发展鄯善、吐鲁番、乌鲁木齐三市的民用和商业用气, 三市现有城镇人口 200 万, 按气化率 80% 计算, 年用气量达 $3.4\times10^8m^3$。

(2) 压缩天然气汽车

压缩天然气汽车(CNGV) 在世界范围内发展较快。其具有发动机积炭少, 节省润滑油、有害气体排放量少、燃料价格低、安全系数高、噪音小等特点。唯一不足是天然气钢瓶重(400~ 500 kg), 影响车辆的载荷 10% 左右。随着 CNGV 技术的不断完善, 天然气汽车的数量不断增大, 到 1994 年为止, 世界范围内已有 100 万辆汽油汽车改装成的天然气汽车, 四川于 1989 年已改装成功。目前一辆汽车改装费用为 7 000~ 11 000 元人民币, 单是节省燃料的费用即可在一年内收回改装成本。

吐哈油田已开始和乌鲁木齐市政府合作将城市公交车、出租车等 1 237 辆具备条件的车辆改装成 CNGV, 这仅仅是一个良好的开始。从保护环境的要求出发, 如在哈密、鄯善、吐鲁番、乌鲁木齐的 312 国道一线建设加气站, 到 2010 年在吐哈盆地及附近区域实现天然气汽车改装率 70% 以上, 城市环境将有巨大改观。

(3) 天然气发电

热电联合循环发电(CHP) 既经济又少污染, 在国外已被大量采用。印度到 2010 年天然气发电站将占 6.8%~ 10.3%, 我国也将加快天然气发电发展, 预计到 2020 年, 天然气发电将占总发电量的 5.6%~ 7.1%。

在新疆这样电力资源相对不足的地区, 天然气发电正好予以补充, 目前, 吐哈油田正在筹建 2.5×10^4kW 天然气发电站, 年需天然气 $6\ 000\times10^4m^3$。

(4) 化肥生产

1997 年, 乌鲁木齐市已建成两座共计 $104\times10^4t/a$ 的化肥生产厂, 年需气量 $4.0\times10^8\sim4.5\times10^8m^3$。新疆是一个农业大省, 以天然气为原料生产化肥, 不仅价格便宜, 满足了新疆的化肥需求, 也为天然气的综合利用开辟了一条有利途径。

(5) 甲醇及甲醇的再利用

由于甲醇装置已经建成, 年需天然气 $1\times10^8m^3$。但国内的甲醇市场已严重失衡, 甲醇厂普遍不景气。因此开辟甲醇的再利用途径已迫在眉睫。

以甲醇为原料的化工产品较多, 市场较好, 用途多, 工艺成熟的能适合于吐哈油田的化工路线如下:

甲醇 ⟶ ⟶甲醛⟶聚甲醛
⟶醋酸⟶醋酐
⟶碳酸二甲酯(DMC)
⟶MTBE(甲基叔丁基醚) 或 TAME(甲基叔戊基醚)

聚甲醛和醋酐均是宝贵的化工原料, 尤其是均聚甲醛的价格在 2.4 万元/t 左右。DMC 可用作有机溶剂、化工原料, 还可和 MTBE 和 TAME 一样用作汽油添加剂, 大幅度提高油品辛烷值。甲醇下游

产品的市场情况见表 3。

表 3　甲醇下游产品市场情况表

名称	国内生产能力 (t/a)	2000 年国内需求量 (t/a)	市场缺口 (t/a)
聚甲醛	3 000	> 29 000	> 27 000
醋酸	420 000	700 000	28 000
醋酐	38 000	138 000	100 000
DMC	1.5	15 000	15 000

4. 液化石油气利用

(1) 民用燃料

随着天然气作为民用燃料走进千家万户, 液化石油气的销量会受到一些影响, 但天然气只能普及到管输沿线的城镇。边远地区和农村将是液化石油气的强大潜在市场。单是新疆农村对液化气的需求即在 50×10^4t/a 以上。

(2) 化工利用

以液化石油气作原料的化工利用如下:

液化石油气 → C_3 → 丙烯

液化石油气 → nC_4 → 顺酐 → 1,4- 丁二醇 → γ- 丁内酯 / 四氢呋喃

液化石油气 → iC_4 → 异丁烯 → MTBE

丙烯是现代石油化工的两个基础原料之一, 可广泛用于生产塑料、丙纶、晴纶、有机玻璃、丁腈橡胶等。

以 nC_4 生产顺酐后分出的 iC_4 正好用于 MTBE 的生产。MTBE 在国外被普遍用于调和汽油, 国内由于产量上不去, 应用较少。但随着含铅汽油被禁止国内 MTBE 的需求量将大幅度增长。

(3) 稳定轻烃利用

由于吐哈油田稳定轻烃含 C_5 高、蒸气压高, 属 I 号轻烃, 一直销路不好。1999 年后, 将其分离成以 C_5 为主要成分的 I 号稳定轻烃和以 C_5^+ 为主要成分的 II 号稳定轻烃。但 I 号稳定轻烃仍有待开发新用途。

① 混合醚。混合醚象 MTBE 一样, 具有较高的辛烷值, 以 I 号稳定轻烃为原料, 进行异构化、脱氢、醚化生成以叔戊基甲基醚(TAME) 为主要成分的混合醚用于调和汽油将具有广阔的前景, 只是工艺尚不成熟。

②溶剂油和单体烃生产。吐哈稳定轻烃不含烯烃, 硫含量低, 是生产工业溶剂的理想原料。以稳定轻烃为原料, 可以生产 6# 、120# 、200# 等溶剂油或 30# 发泡剂等效益好、用途广的工业溶剂油。且工艺简单, 主要设备是精馏塔、换热器、冷凝器和轻油泵等一般设备。

另结合 I 号稳定轻烃降低蒸气压, 可将现有设备进行改造, 将 I 号稳定轻烃分割成液化石油气、纯 C_5 和 II 号稳定轻烃。

③民用燃料。以目前难利用的 I 号稳定轻烃为原料, 依托溶剂油生产装置或 II 号稳定轻烃生产装置, 生产出以 C_5 为主要成分的 I 号稳定轻烃用作民用燃料。以 C_5 作民用燃料较液化气、天然气储运方便、安全且易燃烧, 无灰尘, 不污染环境。

④掺炼汽油。1999 年以后, 吐哈油田将具备 5.5×10^4t 凝析油生产能力, 该凝析油含汽油组分达 40% 以上。不仅能改善汽油馏程, 且经济效益好。凝析油和汽油在吐哈油田的价差达 600 元/t 以上, 凝析油掺炼汽油年经济效益可达 3 000 多万元。

吐哈油田的天然气轻烃工业是油田的第二经济支柱, 如果根据市场情况及时调整产品结构, 进行多元开发, 不仅有利于油田建设的发展, 也将对推动地方经济的发展起到有益的作用。

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今年北海油气勘探、开发和生产支出将缩减 19%

据美国《油气杂志》援引 Mackay 咨询公司的预测报道, 今年北海地区的油气勘探、开发和生产支出将比 1999 年缩减 19%, 将缩减到 276 亿美元。

其中英国的支出将从去年的 138.38 亿美元缩减到 106.75 亿美元; 挪威将从 179.98 亿美元缩减到 149.57 亿美元; 荷兰将从 10.88 亿美元缩减到 10.29 亿美元; 丹麦将从 10.82 亿美元缩减到 8 亿美元; 德国将从 1.36 亿美元增长到 1.7 亿美元。

该公司还预测, 2001~ 2003 年, 北海地区油气勘探、开发和生产开支将分别达 272.98 亿美元、305.38 亿美元和 296.26 亿美元。

(陈　敏　摘)

becoming a non-negligible problem in the business management and administration. In this paper, the advantages, shortcomings and applying limits of gas pipeline crossing and aerial crossing are introduced and the four types of pipe laying, i. e. bare pipe laying without trench, pipe laying by burying in trench, pipe laying by burying without trench and open pipe laying in tunnel, are compared in detail, and it is shown that the open pipe laying in tunnel is the optimum design plan with the best technical and economic benefits in pipeline crossing over large-medium rivers.

SUBJECT HEADINGS: Oil, Natural gas, Oil pipeline, Gas pipeline, Pipeline crossing, River, Design, Project, Economic benefit

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A STUDY OF THE APPLICATION OF POLYURETHANE EPOXY COAL TAR ASPHALT PAINT ON EXTERNAL CORROSION PROTECTION FOR BURIED METALIC STORAGE TANK

Chen Guiyu(Southwest Mining District, Sichuan Petroleum Administration) and Yang Dingwen (Lidalai Practical Chemical Industry Research Institute). *NATUR. GAS IND*. v. 20, no. 2, pp. 87~ 89, 3/ 25/ 2000. (ISSN 1000-0976; **In Chinese)**

ABSTRACT: In view of such characteristics as moist soil, high underground water level, high concentration of chlorion and sulfate ion, various microbions, abundant vegetation and many roots and rhizomas, etc. in Zigong and its nearby regions, Sichuan Province, a lot of experimental and research works for selecting the corrosion-protecting coating for the external wall of both new and old buried tanks are conducted and the coating and corollary paint for treating the residual asphalt on the buried pipeline and oil tank are developed. Through their use in praetice, it is shown that the paint has following advantages: good adhesive force, strong ability to resist water, chemical media and microbial corrosion and easy operation, etc. , being an ideal corrosion-protecting coating for the external wall of buried metalic storage tank.

SUBJECT HEADINGS: Sichuan, Xinan area, Underground storage, Storage tank, Corrosion control, Coating material, Performance, Testing

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WAY TO UTILIZE NATURAL GAS IN TUHA OIL FIELD

Li Guocheng and Chen Huanlong (No. 1 Development Dapartment, Tuha oil field). *NATUR. GAS IND*. v. 20, no. 2, pp. 90~ 92, 3/ 25/ 2000. (ISSN 1000-0976; **In Chinese)**

ABSTRACT: Xinjiang has an area as large as the sixth of the total area of China. There are abundant natural gas resources in the three basins in Xinjiang, so the natural gas market has great potentialities. It is estimated that in 2000, the natural gas requirement will be $40\times10^8 m^3$, of which 95% will be used for industrial departments. The promulgated gas reserves in Tuha oil field in 1997 is $669.27\times10^8 m^3$ and $4\times10^8 m^3$ of gas was supplied to Urumqi city in 1997, which was mainly used for producing area. Because the comprehensive utilization of the natural gas resources in Tuha oil field started relatively late, there exist following problems: the gas being utilized insufficiently, not a little quantity of gas being vented in every year, requirement for LPG produced in the oil field being faced with reduction and the utilization of the stabilized NGL being difficult, etc. Therefore, in view of such characteristics as vast territory but few population, poor transport facilities and dispersed resources, etc. in Xinjiang, a train of thought is proposed, according to which, the natural gas in Tuha oil field should be digested first in Xinjiang, namely it can be processed into product or intermediate product first and then sold in whole country, to explore an effective path for comprehensively utilizing the natural gas by depending on scientific and technical progress.

SUBJECT HEADINGS: Tulufan-Hami oil field, Natural gas, Resources, Comprehensive utilization, Developing trend

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STUDY AND DEVELOPMENT OF THE APPLIED STORAGE TECHNIQUE FOR NATURAL GAS HYDRATE

Shui Biyuan (China Oil and Gas Pipeline Research Institute). *NATUR. GAS IND.* v. 20, no. 2, pp. 93~97, 3/25/2000. (ISSN 1000-0976; **In Chinese**)

ABSTRACT: Natural gas hydrate (NGH) is an ice-cage-like crystalline compound formed from natural gas and water under certain temperature and pressure conditions. One cubic metre of NGH can carry 150~170 m^3 of gas under standard state. Through research, it is shown that NGH can be prepared at 2~6 MPa and 0~20℃ and storaged at -15℃ and normal pressure, and it can be decomposed by heating or by reducing pressure. The reaction rate of NGH can be raised and the physical conditions for applying NGH can be reduced by using some physical and chemical methods. In this paper two applied technological processes of NGH storage and transport technique are given out, which can be respectively applied to the distant transmission of natural gas and gas storage and peak shaving, having a relatively great reference value in practice. Through a comparison and evaluation of NGH with LNG, it is shown that the difficulty of NGH technique is relatively small, its investment can be economized by 1/3~1/4 and it has an incomparable safety. From the point of view of foreign development trend, NGH technique is trending towards practical application in industry. In the future, China should strengthen the study of the applied technique for NGH and develop self applied technology of NGH on the basis of the thermodynamic study. The NGH technique may replace LNG technique and become one of the large-scale storage and transport methods for natural gas, having great potentialities of application and development.

SUBJECT HEADINGS: Natural gas, Hydrate, Storage, Technique, Research, Technological process, Comprehensive evaluation, Developing trend

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QUANTITATIVE RISK ANALYSIS OF NATURAL GAS EXPLORATION PROJECT

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ABSTRACT: In the evaluation of natural gas exploration project, the conventional economic evaluation is an absolutely necessary link and the risk analysis is an important and non-negligible link too. Because the investors are interested not only in the amount of the income brought by their investment, but also and still more in the safety of their investment, namely, if the investment can not be recovered by the scheduled time how much is the probability of loss? For this reason, quantitatively determining the degree of the risk to make the investors to understand how much the probability of loss is and, based on which, making a corresponding feasible decision in time is a problem of interest to both investors and evaluation workers. In this paper, starting with the concept of risk, trying to take the theory of probability, central limit theorem, definition of optimal statistic estimate and economic theory as the basis and according to the concrete situation of the natural gas exploration project, the formula to quantitatively determine the risk is derived. Finally, the application of this formula and the importance of the quantitative risk analysis are expounded in the concrete by way of example.

SUBJECT HEADINGS: Natual gas exploration, Risk analysis, Income, Investment, Statistical analysis

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