

Success and Failure of Natural Gas as Future Fuel

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Abstract

Natural gas is clean and green fuel. The consumption of natural gas is growing day by day in India & world because of its different use in the form of fuel for house hold, industrial & vehicle, feedstock for Fertilizer plant, Petrochemical plant and also it is used primary energy for Power plants to generate electricity. Because of depleting resources, the natural gas has to be used cautiously & optimally. Various authors have tried to provide the significance of natural gas market and challenges vis-a-vis other available renewable energy for its evolution as fuel for 21st century. The objective of paper is to perform a meta-analysis of papers related to evolution of natural gas over the year from 1998 to 2018 and to find out the success/ failure of natural gas as future fuel.

Keywords: Success factor, Natural gas, Future fuel, Viability

I. INTRODUCTION

There are 131 studies from 2000 to 2018 have been taken into consideration for determining the success and failure of natural gas as future fuel. There are several reports which show high success factor of natural gas as future fuel with more consistency in high ranking i.e organization philosophy, previous skill, R&D team characteristic, firm approach, feasibility, cost benefit analysis, global trend, opportunities, relative value, relative price, expertise, penetration to target market, time for market segmentation, and market competition. However on the other end, it is far from consistency when considering the few low ranking success factor like firm structure, R&D concentration, management care, safety, supply & demand of natural gas, challenges and strategic marketing.

In case of India, the goal is to increase share of natural gas consumption to 15% by 2030 from present level of 6%. In case of world also the largest

increase in World's primary energy consumption is attributed to Natural gas as per US energy information administration 2016. As per British Petroleum (BP) global 2015, natural gas contributes 23.8% of primary energy consumption across world. The natural gas market has developed from a mere domestic production & consumption to export oriented natural gas trading hub due to various technologies like LNG transportation by ship and regasification of the same to transport the same through pipeline, Gas hydrates through fracturing method, Coal Bed Methane based natural gas etc.

II. METHODOLOGY

For research purpose, exploratory analysis was conducted by searching the reports, articles, research papers, journals through various online data base like Scopus, Elsevier, IJSR, IJIDR, Researchgate, PNRB report, Petrotech report etc. from the period 1998 to 2018

These papers were analysed according to several criteria like cost benefit analysis, comparison with

renewable gas, change in global trend of natural gas business, Challenges and opportunities for natural gas supply & demand etc.

The aim of the research is to analyse and review the articles, papers & reports conclude into four major factors categorized under Technological & Commercial viability

III. QUALITATIVE ANALYSIS OF N.G LITERATURES

A. Technological Viability

The organization related factor is basically Philosophy, Approach, Skill, Structure and R&D being carried out in different companies under oil & gas industries towards natural gas application for making it a successful future fuel.

The scheme related factor is basically planning & execution of different natural gas projects through Govt. policy & regulation, global trend, management support and on the basis of feasibility study for making natural gas as future fuel.

B. Commercial Viability

The good & service related factor is basically the form of product (CNG, PNG, LPG, LNG) in which the natural gas being used on the basis of relative price, relative value, safety , eco friendly to fill the supply –demand gap in such a way to make the natural gas as future fuel

The market related factor is basically the promotion ,segmentation and penetration in the target market through strategic marketing while facing the challenge from the competitors

IV. RESEARCH MODEL

Considering the nature of the literature to be reviewed, the qualitative analysis has been done . However in order to arrive at a more systematic assessment, we proceed with a rank correlation analysis and round up in Appendix-A. In the 1st step, the qualitative review follows the categories exhibited in Fig:1 . In the 2nd step high ranking

success factors are discussed. In the 3rd step low ranking success factor are reviewed. In the 4th step rank order analysis is presented. In the 5th step, the success and failure of natural gas as future fuel shall be concluded.

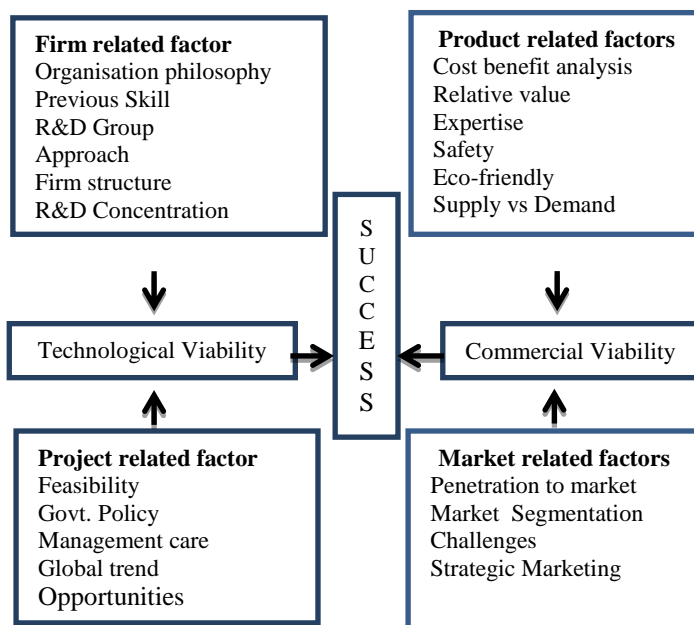


Fig:1 : Factors for Successful of N.G as future fuel

V. HIGH & LOW RANKINGSUCCESS FACTORS

It has been observed that there are four factors concerning the Firm are having high rank i.e Work culture , Past experience , R&D team and firm's strategy and two factors are having low rank i.e Firm structure and R&D concentration towards making natural gas as future fuel.

It has been observed that there are three factors concerning the Project are having high rank i.e Feasibility , Govt. policy & management and one factor is having low rank i.e management care towards making natural gas as future fuel.

It has been observed that there are three factors concerning the Product are having high rank i.e Relative price, Relative quality, Technology and two factor are having low rank i.e Safety and Supply

vs Demand of natural gas towards making natural gas as future fuel.

It has been observed that there are three factors concerning the Market are generally considered as relevant i.e Penetration to target market , Time for market segmentation , Competition and two factor are having low rank i.e Challenges and Strategic Marketing towards making natural gas as future fuel.

VI. QUANTITATIVE ANALYSIS OF N.G LITERATURES

We have already analysed the qualitative analysis of literature as explained above , however for analysing the factors of success & failure of natural gas as future fuel on basis of quantitative analysis of the literature reviewed above , we address two criteria

To what extent the studies of success & failure of natural gas as future fuel consistent with the importance attributed to various success factors

Is the consistence and in-consistency among these studies attribute to Firm , Project , Product, Market related factors.

Seven important studies out of the 131 studies reviewed on the basis of above criteria .The qualitative analysis of the seven studies has been done in Appendix –A and similarly qualitative analysis in the form of ranking of success factors by these seven studies is given in Appendix B. The appendix shows the ranking by importance, from 1 (= most important) to 10 (=least important). A zero value indicates that the factor was not considered or found insignificant.

In order to identify factors that affect the ranking correlations, we divide the factors into groups, using the categories of the above Figure 1. First the factors are divided into two groups:

Firm and project related factors (technological viability)

Product and market related factors (commercial viability)

In deducing these outcomes, one should accept the above qualitative & quantitative literature review in mind. From the Appendix-A, It is observed that most of the research papers are theoretical nature and few are both Theoretical & Empirical in nature. It is also observed from Appendix-A that most of the papers are favoring natural gas as future fuel. Similarly from the Appendix-B, it is observed that the research papers have been analysed on the basis of technological and commercial viability factors which shows most of the factors are favoring with higher rank for success of natural gas as future fuel and few factors are favoring with lower rank for success of natural gas as future fuel.

VII. TABLE & FIGURES

Table-1 : Different pricing of fuel

Rank	Fuel Type	Cost	Mileage(AVG)	Cost per km
1	CNG	52/kg	21	2.47
2	Diesel	65/litre	17	3.82
3	Petrol	75/litre	15	5

Source: project report on CGD in Bangalore (By Akhyakripalini, 2018)

Table-2 : Research on natural gas as per geographical area

S.N	Geographical Area	Qty. of Publisher	% of Publish
1	India	70	54%
2	South East Asia	8	6%
3	Europe	30	23%
4	USA	11	8%
5	Others	12	9%

Source: 131 Nos. research papers , article and reports

Table-3 : Research on natural gas in different time period

S.N	Time Period	Qty. of Publisher	% of Publish
1	2014-2018	85	65
2	2009-2013	38	29
3	2000-2008	8	6

Source: 131 Nos. research papers , article and reports

Table-4: Research on natural gas on different area

S. N	Time Period	Qty. of Publisher	% of Publish
1	CGD BUSINESS	29	22
2	ENERGY SEC.	19	14.5
3	NG MARKET	30	23
4	LPG/LNG MARKET	53	40.5

Source: 131 Nos. research papers,article and reports

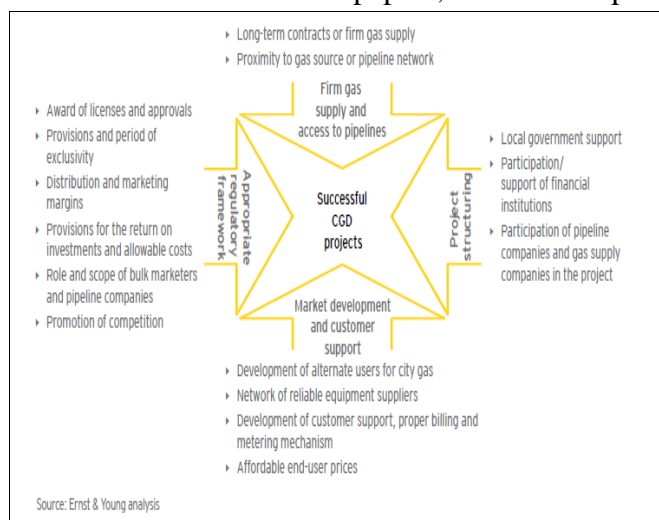


Fig -2 : Factors for Successful of CGD projects
Ref: India's natural gas market (EY,Petrotech-2010)

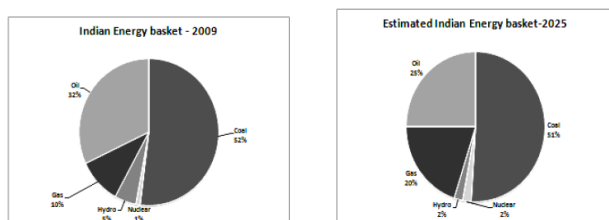


Fig:3 Compare of usage of NG in 2009 and in 2025
Source: Natural gas business & market in India (Subrat & Varun , IJCEA,2013)

VIII. CONCLUSION

In this paper we have studied all the 131 Research papers, Articles & Reports and analyses them in the form of the effect of these papers on the success & failure of natural gas as future fuel . The important and most relevant papers has been taken as reference about their impact on the commercial & technological viability of natural gas as future fuel and by the qualitative and quantitative meta-analysis of seven papers chosen on the basis of their most significance, it can be concluded that though firm structure and management care might have low raking success factor , but most of the factors are in favor of success of natural gas as future fuel.

This is also even supported by the govt. policies and regulation which is a proven fact in case of India where various projects are being executed on war foot basis in the form of LNG deal with America, CGD through the authorisation of geographical areas through PNGRB and laying and commissioning of Urja-ganga project which will connect the natural gas pipeline from north & west to south , east and further to northeast. Similarly in all across world also because of being eco-friendly fuel, the natural gas is having greater share in the primary energy basket.

Also there is news that the Gas Authority of India limited is going to split with separate business subsidiary for gas transportation and another will remain as gas marketing with long term LNG contract and terminals. This will ensure fair access to GAIL pipeline by all energy giants to enter into market thus making the India as gas trading hub like other developed countries

Presently the other source of energy like petrol and diesel price are getting high and domestic production is less and from climate environment point of view , the natural gas will play an important role to bridge the gap of energy demand in India & world . There is also increasing use of technologies for coal bed methane gas m

Compressed Bio gas which will further increase the supply and demand of natural gas .

All the above facts clearly indicate that there is no doubt of the fact that the definitely the natural gas is going to be success in the form of future fuel

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- [14] India's natural gas – A small part of energy mix (Michale Ratner,CRS,2017)
- [15] Gas market in india (EY, 2015) ,
- [16] Analysis of natural gas market in india and the prospective for future development(By Swaminathan Kannan, 2014)

Appendix-A (Typological studies reviewed in this paper (In chronological order)

Name of research paper/ report	Natural gas business & market in India(Sh.SubratSahu& Varun Singh, IJCEA,2013)	Analysis of natural gas market in india and the prospective for future development(By Swaminathan Kannan, 2014)	Meeting demand challenge and emerging LNG market india (Dr.A.K.Balyan, MD & CEO,PLL),2015	Making India a gas based economy,Sh.Subrat Roy ,IJETR,2016 Domestic LPG marketing in Indian perspective (Dr. Amit Vyas &Sh.PiyushParik, IJTR-2016),	India's vision to a gas based economy(CEDIGAZ- 2017)	Investor & Analysis meet ,2018 of GAIL(India) ltd
No. of References taken	11 Nos. in the year 2012	95 Nos. references from the year 2000 to 2014	4nos. report namely Global LNG Database, Energy outlook 20140,Vision 2030, Price sensitivity report	10 Nos. bibliography has been taken as reference / 13 Nos. reference taken from 2001 to 2014	48 Nos. reference taken from the year 2014 to 2017	Report reference taken from CPMA, BP energy outlook , Study by AIE etc.
Method	Theoretical	Theoretical	Theoretical	Theoretical / Empirical	Theoretical	Theoretical
Main results	Natural gas demand will grow with the commissioning of power projects , closed fertilizers and CGD business	Considering energy security, Technology ,NELP, Infrastructure ,Policy , Energy sourcing, Transnational pipeline , sustainability will play imp. Role for gas	India is emerging as major LNG market which will make success the natural gas as future fuel	Natural gas is future fuel because it is cleaner than oil &coal . With development of 100 smart cities will increase the gas sector growth . however success lies on the awareness and carefully innovative scheme	Gas demand in india is a wild card for global gas market. However increased gas demand largely depend on infrastructure and availability of domestic gas	Reform such as peaking power policy, Gas purchase organisation, LPG free zones, Hybrid power , taxation etc. required for success of gas as future fuel

Source: 7 Nos. most significant and important papers out of 131 Nos. research paper , articles and reports in Annexure-I

Appendix-B (Ranking of success factors by importance (0 = Not considered, 10= Most important)

Name of research paper/ report	Natural gas business & market in India,2013	Analysis of natural gas market in india and the prospective for future development(201 4)	Meeting demand challenge and emerging LNG market india2015	Making India a gas based economy, Sh.Subrat Roy ,IJETR,2016 Domestic LPG marketing in Indian perspective -	India's vision to be a gas based economy- 2017	Investor & Analysis meet of GAIL(Indi2018
Factors having high ranking towards Success of Natural gas as future Fuel						
Organisation Philosophy	7	6	5	6	7	8
Previous Skill	8	5	5	6	7	10
R&D team Characteristic	7	6	6	8	6	9
Firm approach	6	6	7	7	8	5
Feasibility	5	6	5	7	7	6
Cost Benefit Analysis	10	6	8	7	8	7
Global Trend	7	6	7	6	10	8
Opportunities	10	3	7	5	10	7
Relative value Relative Price	7	6	5	6	7	8
Expertise	7	6	8	6	10	8
Penetration to target market	7	3	2	3	4	7
Time for marker segmentation	6	6	7	7	10	6
Marketcompetition	7	8	10	6	8	10
Factors having low ranking towards Success of Natural gas as future Fuel i.e Failure of natural gas as future fuel						
Firm Structure	2	1	0	0	0	0
R&D concentration	2	1	0	0	0	2
Management care	8	1	0	0	0	1
Safety	0	1	0	1	2	0
Supply & demand of natural gas	2	1	0	0	2	0
Challengers	1	0	4	2	0	1
Strategic marketing	3	0	2	0	1	2

Source: Factors for Successful of natural gas as future fuel and relevant papers concerned with each factors from 131 papers