

The Impact of Economic Factors on Natural Gas Energy

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ABSTRACT

The impact of Natural gas factors in city gas distribution business has been recognized in the literature related to natural gas for at least two decades, however the influence of economic factors on the city gas distribution business has not been considered. This paper develops a research model depicting various economic factors influencing the feasibility study of city gas distribution business at Aburoad and their interrelationship amongst each other. The paper incorporates a measurement model that incorporates both technical & commercial feasibility factors of Natural gas. The technical feasibility factors are Supply, Demand, Infrastructure and Technology. Similarly, the commercial feasibility factors are Application, Competition, Regulation and Marketing. On the basis of the research model, all potential hypotheses were identified and tested empirically to prove the acceptability of the same. The result gives a direction towards future research on feasibility study of CGD business at any particular location, as well as how to maintain and improve the sustainability of the business for a long period.

Keywords

Natural gas, Supply, Demand, Infrastructure, Technology, Application, Competition, Regulation and Marketing

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Introduction

As the product life cycle passes through different phase from introduction to decline through growth & maturity (Kotler, 2000), industries need to redesign and develop the new product application (Urban & Hauser, 1993). In case of oil & gas industries, the product is natural gas which need to be marketed in the form of City gas distribution business aggressively in order to increase the natural gas consumption

In order to sustain in the market with new product development, it has to be customer oriented or customer focus (e.g. Cooper & Kleinschmidt 1987; Griffin & Hauser 1993). When detailed market analysis, customer satisfaction test and field trial is conducted with new product development, then the success rate of product and market share are more as compared to poor marketing (Cooper 1999)

This paper examines the various interrelationships amongst various Natural gas factors in the form of their influence on each other for feasibility study of Natural gas at Aburoad

In this paper, we discuss the Natural gas factors and develops a research model on the basis interactions between the factors. A broad review of the literature provides a hypothetical basis for understanding what the Natural gas factors mean. Next, a research model is designed and hypotheses were tested. Further the model has been extended by analyzing the interlinkages of Technical & Commercial feasibility study as identified in the literature survey and empirical research. Finally, the results were discussed in order to support the effectiveness of research

Literature Review

Various authors have tried to provide the significance of natural gas market and challenges vis a vis other available renewable energy for it's evolvment as fuel for 21st

century. It is observed from meta –analysis of literature related to evolvment of natural gas over the year from 1998 to 2018 that the perspective of natural gas as future fuel is having more high ranking success factors.

There are 100 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 Organisation 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 marker segmentation, & Marketcompetition However on the other end, it is far from consistency when considering the few low raking success factor like Firm Structure, R&D concentration, Management care, Safety, Supply & demand of natural gas, Challenges, Strategic marketing. But in totality we can understand that the high ranking success factors are more as compared to low ranking success factor for considering natural gas as future fuel.

2.1 Segregation of literatures on different aspects of Natural Gas

In order to segregate the 100 Nos. literatures into different aspects, they are grouped under 3 categories i.e City Gas Distribution (CGD) business, Natural gas Market and Energy Security. It is observed that there are @37 Nos. literature grouped under CGD business, @37 Nos. literature grouped under Natural gas market and 26 Nos. grouped under Energy security.

2.2 Segregation of literatures on different time period of research done

In order to segregate the 100 Nos. literatures into different time period, they are grouped under 3 categories i.e Time

period 1998-2008, Time period 2009-2013 and time period 2014 -2018. It is observed that there are @ 6% literature research have been done in the Time period 2000-2008, @29% literature research have been done in the Time period 2009-2013 and @ 65% literature research have been done in the Time period 2014-2018. This means as the time progresses there has been more research done on different aspects of Natural gas business.

2.3 Segregation of literatures on different Geographical area

In order to segregate the 100 Nos. literatures into different Geographical area , they are grouped under 3 categories i.e Asia , Europe and America . It is observed that @ 70 % of the research on natural gas has been done in Asian Countries as compared to @20% in European countries and @10% research done in USA . From the above data , it is understood that there has been more research done in Asian Countries which include India , which is giving a clear indication there is golden chance and opportunity for the natural gas as successful future fuel

Research Methodology.

An experimental study was conducted to assess the determinants of Natural gas factors which actually affect the feasibility study of CGD business at Aburoad. On the basis of an exhaustive literature review, Interview with consumers and industry specialists, discussion with various researchers, the Natural gas factors were identified and tested through a research model. The objective of the research model was to collect information related to the following specific areas:

Phase one: To get the insight of industry experts, managers, analyst about the Natural gas factors which could be helpful in feasibility of CGD business at Aburoad

Phase two: To get the consumer insight about the various factors which influence their buying behavior and can be incorporated in the feasibility study of CGD business

3.1 Survey instrument design and sample selection

The research model comprised of a set of questionnaires designed to obtain the feedback from the respondents. The respondents from which the final sample were chosen consisted of consumers chosen randomly from different areas of Aburoad namely RIICO industrial area , Manpur area , Talheti Area & Aburoad city area. Similarly , the managers/industry experts were taken from four sectors viz. Marbel factory , Gas Agencies and other small industries . A random sampling procedure was utilized to choose the sample.

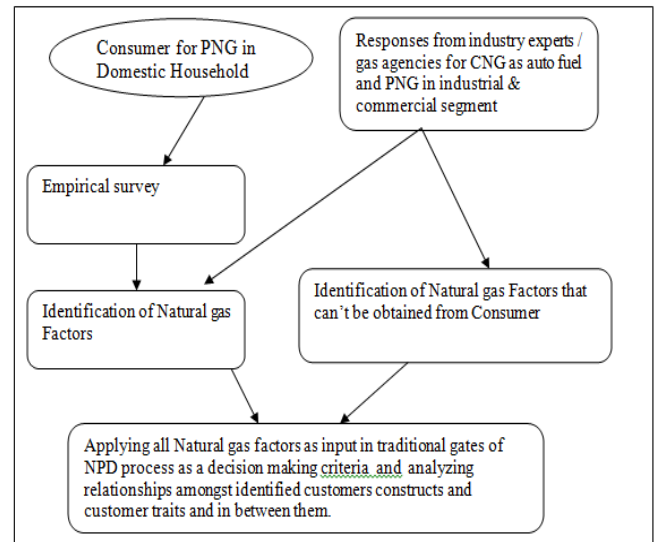


Fig 1: Depiction of research methodology

3.2 Methodology

In this paper we have taken a set of interlinkages among Natural gas factors that describes a research model for investigating the interrelationship amongst each other. Normality conditions of data collected were checked and found significant, Reliability tests were performed using Cronbach Alfa method, and found to be significant. Finally, multiple regressions (SPSS-19) was used to find out the path coefficients. R2 was for Overall model predictive fit.

3.3 Measures

The natural gas factors were taken from previous studies to ensure content validity. The Natural gas factor Supply & Demand are based on trust taken from Gefen et al. (2003). The Natural gas factor Infrastructure & Technology are based on satisfaction taken from Wang et al., 2001; Doll et al., (1988). The Natural gas factor Application and Competition are based on Perceived value taken from Lassar et al. (1995). The Natural gas factor Regulation and Marketing are based on loyalty taken from Chaudhuri and Holbrook (2001). Natural gas Policy & feasibility of CGD business are based on commitment taken from the Pritchard et al. (1999). The response of all questions were grouped from “strongly disagree” to “strongly agree” using the Likert scales (1~5).

3.4 Subjects

The data has been collected from 608 respondents in order to test the effectiveness of research model it has been done in such way that @3 Nos. questionnaire for each natural gas factor and feasibility study are set and respondents were asked to circle their level of agreement from Strongly agree to Strongly disagree on a 5 point Likert scale.

Proposed Model with feasibility study of CGD business at Aburoad

Here we are proposing a model in which the interrelationship of various Natural gas factors are depicted.

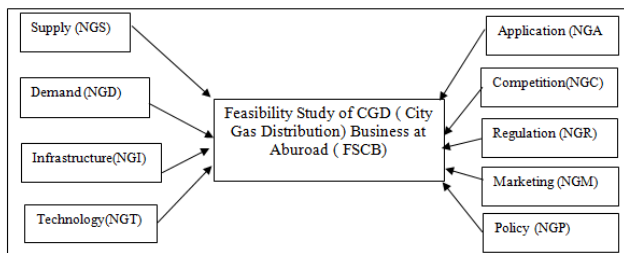


Fig 2 Depiction of Interrelationship amongst various Natural gas factors for Technical and commercial feasibility of CGD business at Aburoad

Results

Measurement Assessment

5.1 Exploratory factor analysis

The validity test of the data collected and put into the research model is done to ensure that it should be discriminant validity as per Straub’s (1989). In order to investigate the difference between supply, demand , infrastructure , technology, application, competition, regulation , marketing & policy, the principal components factor analysis was conducted.

Table 1: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.938
Bartlett's Test of Sphericity	Approx. Chi-Square	27161.149
	df	435
	Sig.	.000

Table 2: Rotated Component Matrix (Rotation converged in 6 iterations.)

	Component									
	1	2	3	4	5	6	7	8	9	10
NGS1	.898									
NGS2	.929									
NGS3	.900									
NGD1						.715				
NGD2						.817				
NGD3						.822				
NGI1			.826							
NGI2			.864							
NGI3			.844							
NGT1				.816						
NGT2				.857						
NGT3				.826						
NGA1									.783	
NGA2									.633	
NGA3									.644	
NGC1										.576
NGC2										.627
NGC3										.770
NGR1		.817								
NGR2		.864								
NGR3		.857								
NGM1						.806				
NGM2						.844				
NGM3						.858				
NGP1							.701			
NGP2							.798			
NGP3							.815			
FSCB					.787					
FSCB2					.837					
FSCB3					.827					

Extraction Method: Principal Component Analysis (Rotation Method: Varimax with Kaiser Normalization.).

Table 3: Reliability-scale

Factors	Cronbach's Alpha
NGS	.927
NGD	.911
NGI	.917
NGT	.916
NGA	.915
NGC	.908
NGR	.917
NGM	.916
NGP	.910
FSCB	.907

Reliability was evaluated by using Cronbach’s alpha. It is observed that all the values are above 0.8, beyond value recommended by Nunnally (1978).

5.2 Confirmatory factor analysis

In the confirmatory factor analysis, discriminant validity for the research models is evaluated on the basis of interaction among natural gas factors Fornell and Larcker (1981) and it is found that discriminant validity is achieved.

Research Hypotheses

The hypotheses were formulated on the basis of effect of natural gas factors on the feasibility study of natural gas business at Aburoad as per detail given below:-

- H1: The Supply will positively affect the Feasibility of CGD business at Aburoad
- H2: The Demand will positively affect the Feasibility of CGD business at Aburoad
- H3: The Infrastructure will positively affect the Feasibility of CGD business at Aburoad
- H4: The Technology will positively affect the Feasibility of CGD business at Aburoad
- H5 : The Application will positively affect the Feasibility of CGD business at Aburoad
- H6 : The Competition will positively affect the Feasibility of CGD business at Aburoad
- H7 : The Regulation will positively affect Feasibility of CGD business at Aburoad
- H8 : The Marketing will positively affect the Feasibility of CGD business at Aburoad
- H9: The Policy will positively affect the Feasibility of CGD business at Aburoad

Final Outcome of MODEL with Feasibility study as focal point

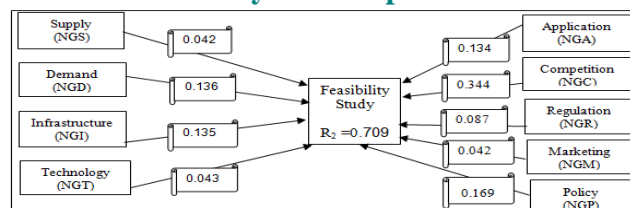
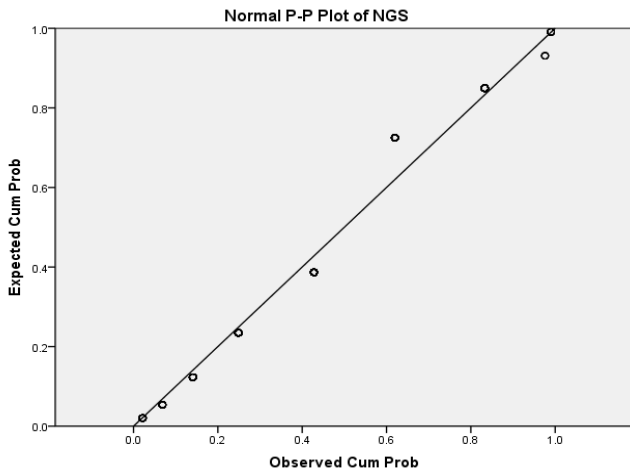


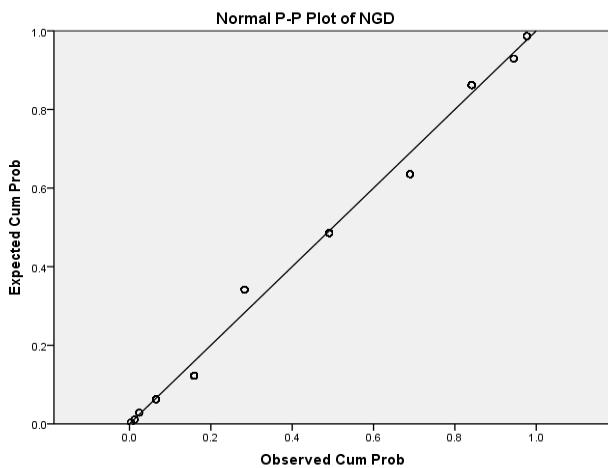
Fig 3: Path coefficients of various components in the proposed model

7.1 Definition of Independent and Dependent Variable
Independent Variable:

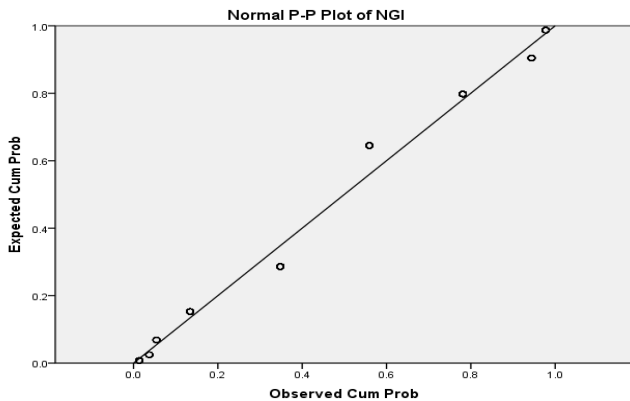
NGS : Natural Gas Supply from various sources either through domestic or imported to the concerned location through various gas agencies



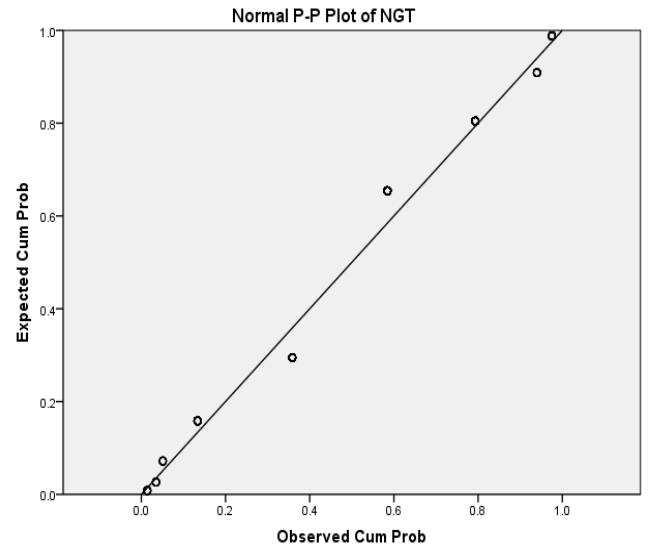
NGD : Natural Gas Demand from various consuming sectors like Household sector , Industrial sector and Transportation sector



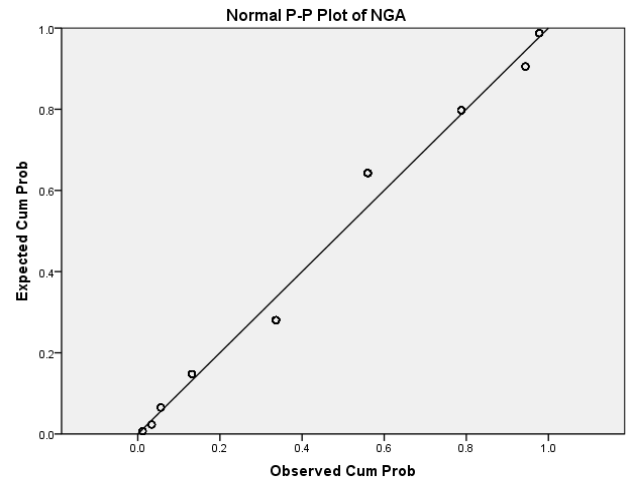
NGI : Natural Gas Infrastructure in terms of availability of cross country natural gas pipeline ,Compressor station , CNG station etc.



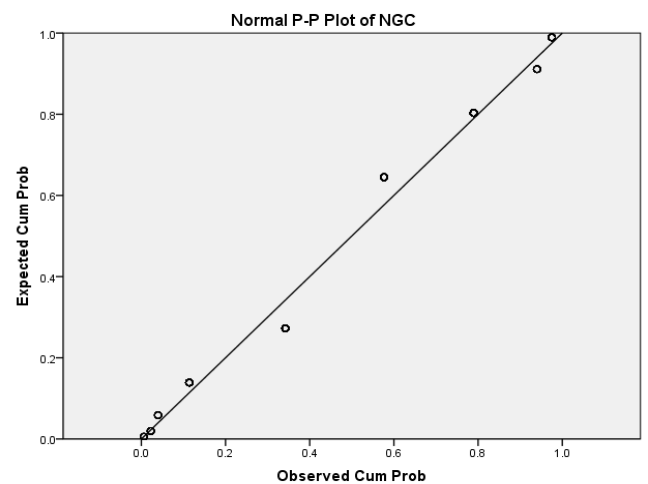
NGT : Natural gas Technology in the innovative use of natural gas in various sectors to increase the consumption of natural gas



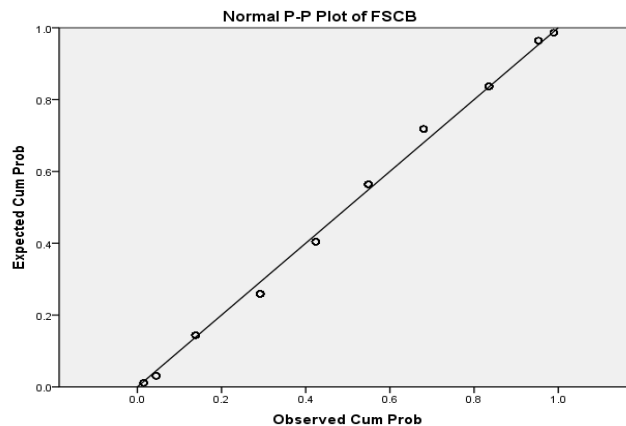
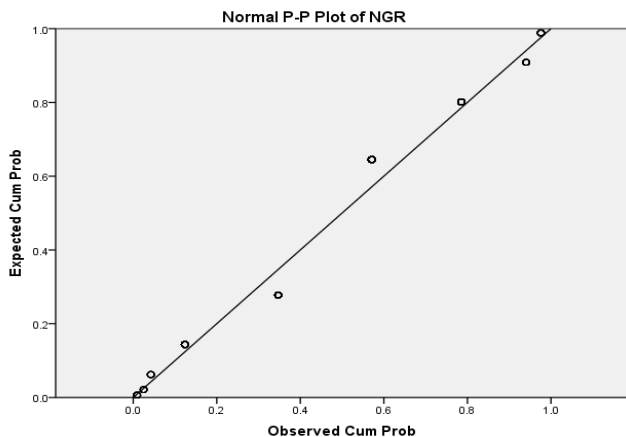
NGA :Natural gas application in the form of PNG(Piped Natural Gas) & CNG (Compressed Natural Gas)



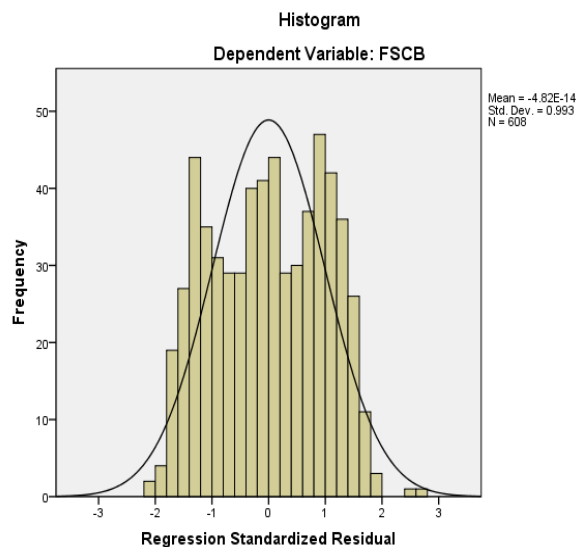
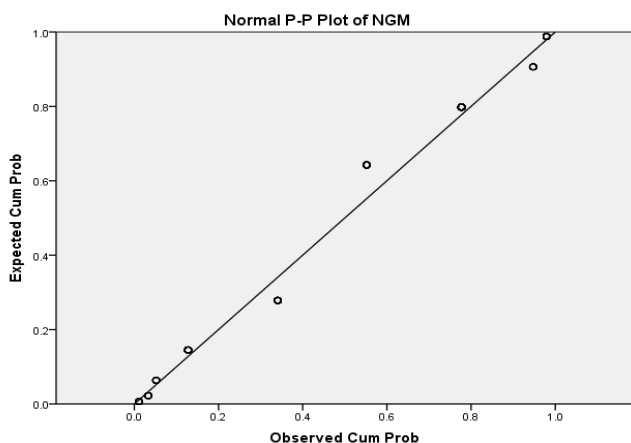
NGC : Competition of Natural gas among other alternative fuel and other agencies in volved in such type business activities



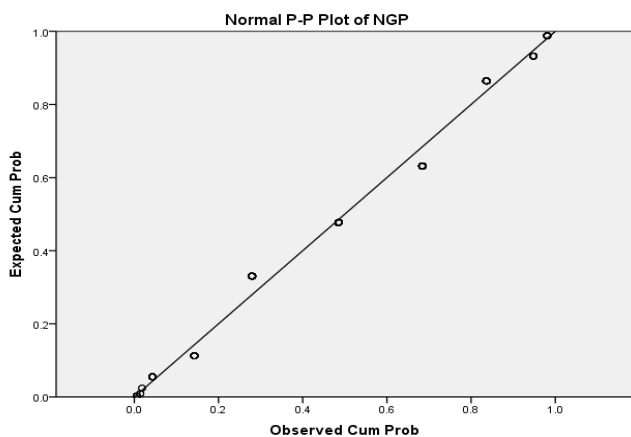
NGR : Natural gas regulation is basically the local govt. regulation to increase the usage of natural gas among various sectors to reduce the air pollution and adverse effect on climate change



NGM : Natural gas marketing is basically to do the retail marketing strategically to the targeted population through increased awareness among the consumer about safety and benefit of natural gas in day to day life.



NGP: Natural gas policy is the policy formed by the local govt. to increase the consumption of natural gas in the CGD business and control the consumption in the power & fertilizer sector so as to make the natural gas business is feasible in the retail sector



Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1(Constant)	-.217	.128		1.705	.089		
NGS	.042	.028	.039	1.511	.131	.746	1.341
NGD	.136	.033	.148	4.111	.000	.376	2.661
NGI	.135	.034	.118	4.019	.000	.561	1.781
NGT	.043	.035	.038	1.226	.221	.519	1.928
NGA	.134	.036	.116	3.721	.000	.502	1.991
NGC	.344	.049	.289	7.036	.000	.289	3.465
NGR	.087	.034	.074	2.514	.012	.563	1.776
NGM	.042	.035	.036	1.198	.231	.542	1.844
NGP	.169	.034	.179	4.925	.000	.368	2.715

a. Dependent Variable: FSCB

Hypothesis testing for Feasibility study of CGD business at Aburoad

Dependent Variable : Feasibility Study of Natural gas business at Aburoad which is dependent on 9 Nos. natural gas factors

After Hypothesis testing for Feasibility study of CGD business at Aburoad using the regression analysis through SPSS 19.0. Accordingly the β -values & t-values in the hypothesized model have been presented in Figure 2. In hypotheses H1, H2, H3, H4, H5, H6, H7, H8, H9 we scrutinize the influence of Supply, Demand, Infrastructure,

Technology, Application, Competition, Regulation, Marketing and Policy on Feasibility study of CGD business at Aburoad. As expected, Infrastructure ($\beta=0.135$, $t\text{-value}=2.06$), Demand ($\beta=0.136$, $t\text{-value}=4.019$), Application($\beta=0.134$, $t\text{-value}=3.721$), Competition($\beta=0.344$, $t\text{-value}=7.036$), Policy($\beta=0.169$, $t\text{-value}=4.925$) had a strong positive influence on the technical feasibility and Supply ($\beta=0.042$, $t\text{-value}=1.511$), Technology ($\beta=.043$, $t\text{-value}=1.226$), Regulation ($\beta=.087$, $t\text{-value}=2.514$), and Marketing ($\beta=0.042$, $t\text{-value}=1.198$) had a substantial progressive effect on the technical feasibility. Therefore, hypotheses H1, H2, H3, and H4 were sustained with overall fitness of model ($R^2=70.9\%$, $F\text{-value}=161.706$).

Discussion

This study investigated the direct effects of Supply, Demand, Infrastructure, Technology, Regulation Application, Competition, Regulation, Marketing and Policy on Feasibility study of CGD business at Aburoad .

The results indicate that Infrastructure, Demand, Application, Competition & Policy exerting a stronger influence than Supply, Technology, Regulation & Marketing on the feasibility study of CGD (City Gas Distribution) business at Aburoad .

The competition has the highest influence on the feasibility study of CGD (City Gas Distribution) business at Aburoad which means that the management needs to take steps to build up the competition amongst their counter parts in the other oil & gas industries so that they can hope to get necessary demand from the consumers them which can be used to improve the pricing of natural gas

As per study conducted by Anirbid Sircar, Shreya Sahajpal, Kriti Yadav(2017), Journal of Petroleum Engineering & Technology, ISSN: 2231-1785 (Online), ISSN: 2321-5178 in the paper "Challenges & Issues in Natural Gas Distribution Industry" the supply, Infrastructure, innovation in technology, regulation & policy are the challenges and issues which are effecting natural gas distribution business and accordingly gas industries and government should focus on this.

As per HDFC Bank Investment Advisory Group (2016) study on "Oil and Natural gas : City gas Distribution", the key factor for city gas distribution industries are competition with alternative fuel, supply priority for different allocation, regulation for growth, Infrastructure development at different geographical location, Auto fuel vision & policy 2025. Also it is observed that innovation, customer support, product/service itself, and transaction process influence consumer satisfaction (Wang et al., 2001) thus paving the way for feasibility of CGD business.

As per study conducted by Mir Hosein Mousavi1, Haniyeh Sedaghat Kalmarzi, Younes Nademi (2015), International Journal of Review in Life Sciences on the paper "The Rebound Effect of Natural Gas Consumption in Iranian Household Sector", it is observed that demand, policy and innovative technology are affecting the natural gas business predominantly.

The present study has attempted to provided some useful information about Natural gas factors in addition to already identified in previous studies. Oil & Gas Industries can use these factors into consideration for enhancing their

understanding of feasibility study and to take necessary corrective actions to improve the city gas distribution business

Conclusions

The contributions of this feasibility study in CGD business are two types. First, it has tried to find out the successful of feasibility study on the basis literature review and secondly the effect of various natural gas factors like Supply, Demand, Infrastructure, Technology, Regulation Application, Competition, Regulation, Marketing and Policy on feasibility study of CGD business were studied. It was concluded in both the study that competition plays a important role in feasibility study of CGD business at Aburoad..

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