

SUSTAINABLE DEVELOPMENT THROUGH A GLOBAL AGREEMENT POSTS THE KYOTO PROTOCOL AND GEO ENGINEERING: NATURAL GAS VISION 2030.

AUTHOR

1. PATNAIK M. K., 37 Years, B. Tech (Mechanical Engineering), M.M.E (Production Engineering),
2. GAIL (INDIA) LTD, (Earlier Gas Authority of India), Under Ministry of Petroleum & Natural Gas, Govt. of India. Possess over 15 years of exposure in synthesis gas, natural gas, CNG, City gas projects, LPG, propane gas and other Liquid Hydrocarbon business.

KEY WORDS

Emission reduction, Efficiency improvement, GTL, CTL Hydrogen, fuel cells, Climate, Kyoto Protocol, Regulation, Quota trading, Emission trading.

INTRODUCTION

There have been the projections which indicate that global surface temperature will likely rise a further 1.1 to 6.4 °C during the twenty-first century. Increasing global temperature will cause sea level to rise by 0.09 to 0.88 meters and will change the amount and pattern of precipitation likely including an expanse of the subtropical desert regions. Other after effects that includes shrinkage of Arctic, glacier retreat, extinction of various species change in weather, changes in agricultural yields. Industrial revolution has contributed the constant increase in CO₂, NO₂, methane gases and CFCs. There has been a recorded increase in concentration of CO₂ & methane gas to the tune of 36 % & 148 % respectively. Fossil fuel burning has produced about three- quarters of increase in CO₂ over past 20 years. Among the major three fuels- coal, Oil & Natural gas, CO₂ emission from Natural gas is least (33% less than that from coal & 16 % less than that from fuel oil). There is no question; CO₂ production levels must be reduced. What is appropriate and most logical way to allocate and fix the target to reduce emission of GHG country wise or should we propose for a per person basis irrespective of which country he or she lives in. It is debatable as emission level directly depends on the fuel utilization policy of a state and it's economic conditions. Developed countries have already contributed a major chunk of the GHG pie. as a result of their industrial development and now the developing countries are in first track industrialization and also are the worry for continual addition of GHG emission in coming years. Looking at CO₂ production per person puts North Americans far ahead of the rest of the world. The people of developing countries such as that of India and China are currently producing huge levels of CO₂. But in terms of standard of living of an average North American is 5 times better than that of an average person of developing countries. Therefore the idea of fixing target of reduction of GHG emissions country wise sounds more logical. On the contrary, a person living in India, china, USA or Europe, each has the equal right to the resources of the earth including clean air to breathe and to lead a comfortable live hood. Therefore the target of per person finds more logical supports. However, we must not forget that our one and only objective is a sustainable development of mankind, the each and every citizen of the world, by protecting this blue planet from further destruction owing to mishandling of its resources by us.

OBJECTIVE

Natural gas is the fuel of 21st century and is the major contribution of the economy of any developed or developing country. A sustainable development through revolutionary change in the utilization of natural gas in accordance with a globally accepted agreement not limiting to the ongoing debate on Kyoto Protocol, with geo reengineering is the essential driving force for achieving the goal of the proposed program to reduce CO₂ emission by 1 million metric ton per year.

METHODS

The global gas utilization treaty as a supplement to Kyoto Protocol with the following points needs to be elaborated.

Increase in efficiency & fuel economy: for automobiles/ gas engines/ turbines with a range. Change over to CNG/ hybrid technology/ renewable. (Year wise target to be fixed based on vehicle density/economy of the country)

- Reduction in vehicle density/ per capita automobiles – periodic conversion to mass transport means. Regulation should be imposed for registration of 2nd private car by way of putting additional tax with a view to discourage private multiple car ownership.
- Switching over of coal based power generation to gas based/ nuclear fuel based/ biomass. Government must frame out a green fuel utilization policy encouraging use of natural gas, nuclear fuel based power generation.
- Time schedule implementation of GTL (gas to liquids) & CTL (coal to liquid) processes. Coal can be converted to low ash low smoke coke and CTL projects to be implemented. GTL projects are essentially required to monetize low pressure and commercially un viable isolated field gases.
- Introduction of carbon credits in monetary terms and carbon taxes.
- Elimination of waste methane.
- Carbon capture and storage.
- Geo engineering.
- Kyoto Protocol
- Carbon emission trading

Most of the states/countries have their individual gas utilization policy/guideline in place. However, I strongly feel to have a global gas utilization treaty signed by all natural gas producing and consuming countries keeping the main focus on the target for reduction of emission of green house gases. The developing countries like India, China where there is the use polluting coal predominantly for power generation Power plants have a natural life of 40-50 years. To cut domestic emissions of carbon dioxide heavily in the first two decades would require shutting down coal-fired power plants before the end of their utilization period, at great expense, by replacing them with natural gas. It is reported that world coal consumption has gone up by 3.1 percent in 2008 i.e. to the tune of 3.3 billion tonnes of oil equivalent (toe). For years, coal has been the fastest growing fuel -- with obvious implications for global GHG emissions. Combustion of coal is one of the major sources of carbon dioxide emission and that will cause catastrophic climate change if left unchecked. As per the survey done by British oil major, BP Plc. & Energy Information Administration, US Dept. of Energy, coal consumption of China has rose by over 1.4 billion toe, representing over 42.6 percent of global consumption. Similarly India's coal consumption has gone to 231 million toe, accounting for 7 percent of the global consumption. The country wise consumption pattern of coal (top 15 countries) and emission level of carbon dioxide from various fissile fuels are given below.

Country wise annual coal consumption

(Billion tons per annual)

RANK	COUNTRY	CONSUMPTION
1	China	1,310,000,000
2	U. S. A.	1,060,000,000
3	India	339,000,000
4	Russia	298,000,000
5	Germany	265,000,000
6	South Africa	170,500,000
7	Japan	149,500,000
8	Australia	144,170,000
9	North Korea	103,600,000
10	Ukraine	97,200,000
11	Turkey	81,100,000
12	South Korea	71,700,000
13	Greece	70,500,000
14	Canada	67,000,000
15	U.K.	66,100,000

Source: Energy Information Administration, US Dept of energy.

2008 Carbon Dioxide Fact Sheet

COUNTRY/ REGION	OIL MTC/%	NATURAL GAS MTC/%	COAL MTC/%	TOTAL 2008 MTC/%	% CHANGE OVER 2007	% of WORLD
World	3273 40.0%	1575 19.3%	3333 40.7%	8181 100%	+1.78%	100%
Canada	85.0 49.9%	52.0 30.5%	33.3 19.6%	170.3 100%	+1.06%	2.08%
U.S.A.	737.0 44.6%	347.1 21.0%	570.1 34.4%	1654.2 100%	-3.12%	20.22%
E.U.(25)	585.4 51.2%	254.9 22.3%	303.9 26.5%	1144.2 100%	-0.83%	13.99%
E.Eur.+CIS	173.3 25.3%	319.2 46.5%	193.4 28.2%	685.9 100%	+1.72%	8.39%
Australia	35.4 35.6%	12.2 12.3%	51.8 52.1%	99.4 100%	-4.39%	1.22%
Brazil	87.7 75.9%	13.1 11.4%	14.7 12.7%	115.5 100%	+6.92%	1.41%
China	312.0 17.6%	42.0 2.4%	1419.0 80.0%	1773.0 100%	+6.56%	21.67%
France	76.8 68.7%	23.0 20.6%	12.0 10.7%	111.8 100%	+1.10%	1.37%
India	112.5 30.6%	21.5 5.9%	233.5 63.5%	367.5 100%	+7.23%	4.49%
Japan	184.8 50.9%	48.8 13.4%	129.8 35.7%	363.4 100%	-0.27%	4.44%
Rest-of - World	958.6 53.0%	464.4 25.7%	383.9 21.3%	1806.9 100%	+3.20%	22.09%

Source: BP Statistical review of world energy 2008 issue.

It is clearly understood from the above that the coal is still a dominant fuel for both developing and also developed countries and coal and oil are the major source of carbon dioxide emission. Global emissions of carbon dioxide from the three fossil fuels increased +1.78% in 2008 compared to that of in previous year. The fossil fuels accounted for 88.2% of the world's total primary energy consumption in 2008, as compared to 88.0% in 2007.

Energy consumed by non – OECD countries (Organization for Economic Co-operation and Development) are reported has exceeded than that of developed OECD countries. GHG emissions from the three large developing nations ie. Brazil, China and India grew +6.9%, +6.6% and +7.2% respectively. Together these nations accounted for over 27% of the world's emission last year as per a report. As per the BP Statistical review as tabled above, China is now the world's largest single emitter of carbon dioxide from the fossil fuels.

Effective utilization of natural gas is the key to the success of our efforts to achieve a sustainable development by way of helping the reduction of GHGs. The proven reserve of natural gas is as given below.

Natural Gas Reserve (TCF)

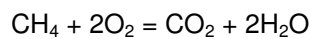
SL.	REGION	RESERVE IN TCF
1	Middle East	2,549
2	Eurasia	2,020
3	Africa	490
4	Asia	415
5	North America	283
6	Central & South America	262
7	Europe & others	235
	TOTAL	6,254

Source: Oil & Gas Journal, Volume 106 no 48, Dec. 22, 2008

Natural gas is nothing but a gas rich in Methane (CH₄) content.

C	=	carbon,	atomic	weight	approximately	12	
H	=	hydrogen,	atomic	weight	approximately	1	
O = oxygen, atomic weight approximately 16							
CH ₄	=	methane,	molecular	weight	approximately	16	
O ₂	=	molecular	oxygen,	molecular	weight	approximately	32
CO ₂	=	carbon	dioxide,	molecular	weight	approximately	44
H ₂ O = water, molecular weight approximately 18							

For combustion of methane



So, combustion of 16 mass units of methane produces 44 mass units of carbon dioxide and 36 mass units of water and in the process 64 mass unit of oxygen is being used.

- water vapor, which contributes 36–72%
- carbon dioxide, which contributes 9–26%
- methane, which contributes 4–9%
- ozone, which contributes 3–7%

Post the Kyoto protocol a global agreement is the most essential for sustainable development of mankind. When the occasion of signing an agreement for mitigation of global warming comes every nation starts at looking each other with the mindset of being a so-called developed or developing nation. Developed nations are made primarily responsible for all the damages done to the mother earth at the cost of industrial development and therefore as per developing nations the maximum share of cost of mitigation or percentage reduction of emission are needs to be borne by the developed nations. Likewise as per developed nations fast moving developing countries are presently contributing more towards emission could be due to adaptation of age old technologies, heavy competition, and lack of automation and therefore developing nations should be the first to come forward for the global agreement for mitigation of global warming.

However we knowingly fail to understand that it is not the time to forcibly fix the responsibilities or targets or stay away from the novel attempt to save the mother earth from further destruction. The price of destruction of environment has to be paid by both developing and developed nations for sure. We have wasted a lot of energy while debating on this matter since 1992, under the United Nations Framework Convention on Climate Change, in 1995 Berlin Mandate, 1997 under Kyoto Protocol with a target 1212, and the Bali Conference in 2007. Therefore every nation has got a specific role to play and even a smallest state cannot be neglected. As framework for climate change mitigation, the developed country commitments to 2020 emission targets will substantially supplement the idea of a post Kyoto protocol. Leaders are those who start and show ways of possibilities and made other to follow. Therefore, the process of mitigation of global warming of emission reduction has to start in practice beyond the conference halls and some nations let it be developed nations should start and move quickly with a view to demonstrate that they are actually serious about the mission.

This will definitely make the developing nations to follow and a sustainable development will come to a reality. Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment for present and future habitants.

An overall sustainable development is constitute of the following three components

1. Environmental sustainability
2. Economical sustainability
3. Socio political sustainability

This can only be achieved by satisfying social, economic and most important environmental factors.

Full participation of developing countries in the post the Kyoto protocol is most essential as although the industrialized countries created the climate problem, the developing countries are the potential sources of substantial increases in GHG emissions in coming years.

With a view to achieve the global set target of stabilizing greenhouse-gas concentrations at between 450ppm and 550ppm carbon-dioxide equivalent, the meaningful production and utilization of natural gas adapting quota trading system within the guideline of Kyoto Protocol is a must. Climate policy at the international level is now moving rapidly towards agreeing an emissions pathway, and distributing responsibilities between countries. Calculation of global warming potential (GWP) and radioactive forcing capacity (RF) for green house gas emitted from all gas needs to be monitored regularly. Gases with lower GWPs are the subject of interest. Geo engineering concept of reduction of green house gas emissions from hydrocarbons by fake plastic trees, greenhouse gas remediation by carbon sequestration projects and by using biomass energy with carbon capture and storage need to be implemented. A global gas utilization policy indicating prescribed emission norms matching that in Kyoto protocol to be made as prerequisite.

The followings points are to be addressed with respect to Kyoto protocol with a view to get it ratified and accepted by all in it's true sprit.

1. Wide variation in emission reduction targets (Suggested to keep a minimum base line practicable target with incentives for higher achievers) Developed countries must accept the fact that the GHG emissions that has happened so far, they have their major contribution. Therefore a rational approach is suggested considering the absorption full or part cost of emission reduction program by developing countries. Developing countries must not be forced to enter in to a huge target at the cost of their GDP.
2. The policy of emission trading needs to be further simplified.
3. Period of implementation or target date of completion should be made realistic. A credible framework that can establish a path for emissions reductions extending throughout the century, not just five years ahead weighted targets should be fixed depending of bearing capacity of the respective countries.
4. Selling of emission credit to other countries or using the carbon credits for inducing more emissions other than enjoying other benefits may not be in the spirit of the protocol – As it is meant for reduction of overall green house gas.
5. Some reason to think that all countries will be willing to join and then comply. This precludes targets that impose enormous economic costs on any major countries in any decades relative to the alternative of dropping out of the treaty.

Some of the other critical attributes which were missing from the Kyoto Protocol also need to be addressed with a view to achieve the reduction in GHG from its present level. Lack of ownership and responsibility by nations was one of the major limitations. All countries including developed and developing countries are needed to extend their full cooperation voluntarily and unconditionally. Attractive incentives for achievers – that is, acceptance of quantitative limits on emissions – by all major countries, including the US and developing countries.

ii) A credible framework that can establish a path for emissions reductions extending throughout the century, not just five years ahead.

iii) Some reason to think that all countries will be willing to join and then comply. This precludes targets that impose enormous economic costs on any major countries in any decades relative to the alternative of dropping out of the treaty.

International climate change negotiations are scheduled for continued further with a view to set a new practicable and logical target post the Kyoto period, at a meeting to be held in Copenhagen 7-18 December 2009. Hopefully this will end with a happy note and will open the gateway for a successful implementation of the emission reduction targets.

CONCLUSION

What I would like to address here that a fully accepted version of volunteered agreement for reducing GHG emissions post the Kyoto Protocol shall be very crucial for the survival of mankind. Each individual, each nation, each continent must come forward with the self convincing concluding view point, with the one and only mission for a sustainable development of entire mankind, before it is too late. We must stay away from the mindset of representing a developed state or a developing state. To me, this is the high time to redefine the actual meaning of a developed state in terms of green revolution not merely in the terms of industrialization or the comfort standard of living at the cost of nature. Time has come to come forward to work towards the betterment of the mankind and to aim for how to derive the maximum from the reserve of 6254 Trillion Cubic Feet (TCF) of Natural gas without stressing the mother earth beyond her tolerable limits, by implementing geo-engineering with the maximum effective use of cleaner natural gas for transportation and industries- let us call it natural gas re-engineering for the survival of the mankind. The movement and result oriented efforts for a cleaner and emission free environment is the only way for a sustainable growth and would be a precious gift to our future generations

=====