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Magnecular Cleaning Coal Combustion Via Magne Gas Additive

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Abstract: Fossil fuels are contributing the largest share in meeting up energy demands of urban lifestyle across the globe. May it be gasoline or coal, all sort of fossil fuels are drilled out of earth crust to burn on the earth surface creating huge burden on air quality. Incomplete combustion of fossil fuels causes pollution of carbon monoxide and other gases. It also eats away the breathable oxygen from atmosphere. Rampant use of coal in power sector causes above problems adding to the global warming phenomenon. Magnecules and magnehydrogen are seen to be best additives to fossil fuels which can effectively enhance the combustion efficiency of fossil fuels. Present paper discusses the enhancement in combustion efficiency of fossil fuels in terms of increased utility of carbon and improved quality of emission reducing the amount of obnoxious gases.

Keywords: Coal Combnustion, Magnecules, Magnegas

1. Introduction

The new clean combustible gas, magnegas [1, 2], developed by Italian-American Scientist Ruggero Maria Santilli [1, 2], posses precisely a magnecular structure from which it has got its name. Clean water or even the sewage water can be converted to magnegas by systematic introduction to electric arc generating a high current in microseconds [3-5]. The gaseous product, so obtained, is unusual in behavior from its physical and chemical properties point of view [3]. It is a kind of short range polymeric product with two molecules of gas being bonded by a magnetic force of attraction than the conventional covalent bond. Structural detail of the properties of this gas is still a subject of discussions for about a decade. Spectroscopic results and their interpretations are of great interest of the chemists. This is mainly due to the characteristics of this new matter which are beyond the scope of interpretation of many spectroscopic and chromatographic instruments available in market. But apart from all these discussions, the most striking feature of Magnegas is that it is proving to be a promising fuel of the 21st century. So far, the success of this fuel is reported as alternative fuel in automobile sector [3-5]. Some high energy gas fuelled fields like metal cutting tools are also working successfully on this fuel.

Another potential direction of energy studies of magnegas is that the hybrid of this fuel with fossil fuels is expected to show enhanced combustion efficiency. Magnetized hydrogen from magnegas burns with elevated temperature and helps in complete combustion of carbon in coal and hydrocarbon in gasoline. Thus Hy-Diesel, Hy-Gasoline, Hy-Coal are the new age terms coined by Santilli [5].

Present paper is aimed to discuss the possibilities of a technology to use magnegas as an additive to coal in order to enhance the combustion efficiency of coal. Another equally important aspect of study is to estimate the environmental benefits of using magnegas and/or magnehydrogen as additive to reduce the emission of green house gases and limit suppress the global warming phenomenon in its long term use.

1.1. Present Global Energy Scenario

The whole world is thriving for energy in terms of electricity for industrial and agricultural development. Electricity is one of the fundamental forms of energy of modern world. From industrial production to basic amenities and luxurious life, everything is dependent on electricity. Major part of the electricity comes from coal and nuclear power plants. But rampant use of fossil fuels like coal is a cause of worry for future. A water heater uses about two tons of coal a year. And a refrigerator consumes half-ton a year [6-8]. Even though many of us don't ever see coal, we use several tons of it every year! The rapid depleting reservoirs of coal along with dirty nature of this cheap fuel are a cause of worry for whole world due to increasing pollution and global warming from emitted gases.

Use of fossil fuels like gasoline, diesel and coal is causing a huge loss to the ecosystem across entire globe. These fuels are limited in stock and the way we are burning them, is leaving them incompletely burnt. Thus it is a dual loss in terms of energy as well environmental damage. Automobile and electricity generation are the two important sectors using large quantity of fossil fuel. Out of the two, electricity generation is at the top! Coal-fired power plants are largest emitter of majority green house gases. Switching over to natural gas is one of the possible ways for coal fired power plants, but limited supply of natural gas does not meet the requirements in developing countries. In such case, coal remains favorite fuel for generation of power in most of the largely populated countries. Coal-fired power plants currently fuel 41% of global electricity [7-10].

Coal produces 44 % of the total electricity of United States and also contributes as single largest source of pollution [7]. 68% of the total electricity of India comes from coal fired power plants [8,10]. In US, up to 353 coal-fired generators in 31 states (out of a national total of 1,169) are ripe for retirement, equal to a total of 59 gigawatt of power generating capacity. Collectively they represent as much as 18 percent of the country's coal-generating capacity and approximately six percent of the nation's power [8, 9]. In 2011, approximately 42 percent of United State's electricity was produced by burning coal [7]. But by 2012, more than three-quarters of coal-fired power plants of U.S. have outlived their 30-year life span, with 17 percent being older than half a century. Most are inefficient, operating far below both their power generation potential and the most efficient coal units on the power grid. More or less similar is the situation in all other nations obtaining large share of the electricity from coal.

1.2. Problem with Combustion of Fossil Fuels

In all, the fossil fuel combustion is a serious cause for damage of environmental conditions. Limited and steeply depleting sources of fossil fuels along with pollution due to combustion are causing great worry for the future health scenario of all living beings.

The extremely serious environmental problems caused by the disproportionate combustion of fossil fuels are well documented by Prof. R. M. Santilli as follows [4]:

(1) The combustion of fossil fuels releases in our atmosphere about sixty millions metric of tons carbon dioxide CO_2 per day that are responsible for the first large environmental problem known as "global warning" or "green house effect" [10, 11]. Of these only 30 million metric tons are estimated to be recycled by our ever decreasing forests. This implies the release in our atmosphere of about thirty million metric tons of unrecycled green house gases per day, which release is the cause of the "global warming" now visible to everybody through climactic episodes such as floods, tornadoes, hurricanes, etc. of increasing catastrophic nature.

(2) The combustion of fossil fuels causes the permanent removal from our atmosphere of about 21 million metric tons of breathable oxygen per day, a second, extremely serious environmental problem known as "oxygen depletion." [4]. Even though not disclosed by political circles and newsmedia, the very admission of an "excess" CO_2 in our atmosphere (that is, CO_2 no longer recycled by plants) is an admission of oxygen depletion because the "O_2 in the excess CO_2" was originally breathable oxygen. Hence, by recalling the atomic weight of CO_2 and O_2, we have the value $32/44 \times 30 \times 10^6 = 21.8 \times 10^8$ tons of lost oxygen per day.

(3) The combustion of fossil fuels releases in our atmosphere about fifteen million metric tons of carcinogenic and toxic substances per day [4]. This third, equally serious environmental problem is euphemistically referred to by the news media as "atmospheric pollution", while in reality it refers to the primary source of the widespread increase of cancer in our societies. For instance, it has been established by various medical studies (generally suppressed by supporters of the oil cartel) that unless of genetic origin, breast cancer is due to the inhaling of carcinogenic substances in fossil fuels exhaust. These studies have gone so far as to establish that breast cells are very receptive to a particular carcinogenic substance in fossil fuel exhaust. After all, responsible citizens should remember and propagate (rather than myopically suppress) the fact that the U. S. Environmental Protection Agency has formally admitted that diesel exhaust is carcinogenic.

1.3. Problem with Combustion of Coal for Power

Combustion of coal is associated with emission of significant quantity of volatile matter and carbon monoxide. This is a loss in terms of energy and also causing pollution due to release of green house gases (CHs and CO).

As listed in Annexure A of Kyoto Protocol, the six major greenhouse gases are Carbon dioxide (CO_2); Methane (CH_4); Nitrous oxide (N_2O); Hydro fluorocarbons (HFCs); Per-fluorocarbons (PFCs); and Sulphur hexafluoride (SF_6) [9]. Out of these six gases, three most common gases in significantly large quantity are emitted from coal fired power plants. In burning fossil fuel like coal, about 60% of the energy in the original fuel is literally thrown through the fluke, and so is the related cost, due to the notoriously poor combustion [8]. Thus, majority of the combustible and energetic content is lost unutilized in the process.

In addition, majority of the old power plants lack essential modern pollution controls, so they damage public health. The sulfur they emit causes acid rain. The mercury they release poisons waterways and fish and causes neurological damage in children [9]. The soot they emit creates smog that causes lung disease, premature death, and triggers asthma attacks [10,11]. Burning coal demands billions of gallons of cooling water from vulnerable rivers and lakes, and leaves behind vast quantities of toxic ash residuals, while coal mining causes extensive and lasting damage both to human health and the natural environment [12].

If we look into the exact process through a deeper eye, it is seen that the coal, when heated up, gets converted into the carbon monoxide at first. Then the CO is converted to CO_2. Also, at the same time, some of the carbon combines with hydrogen to form volatile HCs. CO and HCs being gases, tend to escape out of the combustion chamber where there is a need to convert maximum gaseous content into their final oxidation products to get maximum energy. However, in reality, only part of the carbon monoxide is converted into its dioxide and a very few of the volatile matter is burnt. Thus the emission is largely containing carbon monoxide and HCs which are a waste of energy on one side and a cause of pollution and global warming on the other side.

Conversion of CO to CO_2 in atmosphere causes thermal pollution due to exothermic nature of this conversion. Depletion of breathable oxygen in the ambient air adds to the gravity of the problem. 18 to 20 ton of coal is burnt for generation of 1 MW energy. Thus a 2000 MW power plant burns about 40000 ton of coal per day and release a huge volume of gases in atmosphere.

Initial generation of heat in furnace causes formation of volatile matter. Further conversion of coal leads to formation of CO. Both of these gases are vulnerable to move upward and thus cause release along with emission. Although, black carbon is not directly emitted from the coal fired power plant in routine condition, but the possibility cannot be ruled out for smaller coal burning units like potteries and brick production.

Most of the Indian coal-fired power plants emit about 1 ton CO_2 per MW. Observed range of data obtained from Central Electricity Authority (CEA) for the year 2012-13 for all coal-fired power plants show a range of 0.9 to 2.1 ton specific emission of CO_2. Despite all the evils associated with combustion of coal, it can't be discarded altogether because of the issues of economy associated with it. Evaluation of the economic competitiveness of coal generators and comparison of the cost of electricity from individual coal-fired electricity generating units with the cost of electricity generated from an average natural gas power plant shows that cleaning the combustion of coal in coal fired power plants will be costlier. Specifically, if a coal-fired generator— after installing any needed pollution controls—would be more expensive to operate than a typical cleaner-burning and more efficient natural gas combined-cycle [6].

A graphical representation of the SPM emitted from a power plant over a period of 4 years show the exact scenario of emission.

Figure 1 and Figure 2 depict 20 readings from a period of about 4 years showing the emission exceeding prescribed limits on many occasions. Both of these units are about 30 years old.

Despite numerous problems associated with combustion of coal, still we cannot think of scrapping all coal fired power plants, because coal is the cheapest of all other energy sources. Being solid, it is easy in handling and operations as compared to natural gas which is cleaner to coal. Further, location of coal reservoirs adds a lot to the geographical restrictions of the economy of coal fired power plants. In India, there are large coal reservoirs available in central Indian states. These coal reservoirs invite coal fired power plants to these regions and no other alternate fuel can meet up this requirement in any other part of the country.

Table 1. *Year wise electricity generation and CO_2 emission from coal fired power plants in India [15].*

Sr. No.	Year Factor	2008-09	2009-10	2010-11	2011-12	2012-13
1	Net Generation (GWh)	467298.3811	495,343	516,877	562,991	633,793
2	Absolute Emissions (tCO_2)	510877863.2	534154395.8	554,435,897	596,550,869	666,699,576
3	Specific Emissions (t CO_2/MWh)	1.18	1.17	1.19	1.14	1.14

Thus it is more positive approach to think of a cleaner additive to coal than going for alternate fuel. Additive which is not restricted to any geographical area will be more helpful for economy and cleaner process of coal fired power plants.

It is known in chemistry that hydrogen is the best additive to improve combustion, with consequential improvement of the environmental quality of the exhaust. In fact, hydrogen has the biggest flame temperature and speed among all known fuels. Consequently, the injection of hydrogen as an additive in the flame of fossil fuels burns the uncombusted component of the exhausts in a way proportional to the used percentage of hydrogen. But, use of hydrogen as additive has several limitations and restrictions. Limitations are mainly due to cost and difficulty in handling.

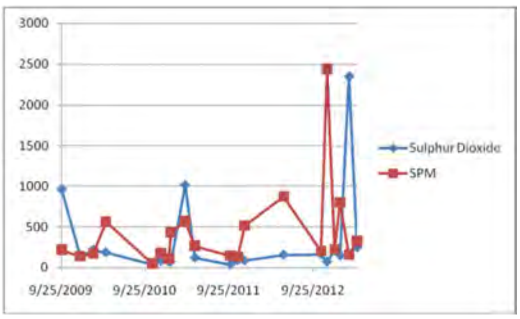

Figure 1. *Graphical representation of emission of SO_2 and SPM from a 250 MW unit-1 of Chandrapur Super Thermal Power Plant. The X-axis showing dates of collection and Y-axis represents emission in mg/Nm^3 (Year of commissioning-1983).*

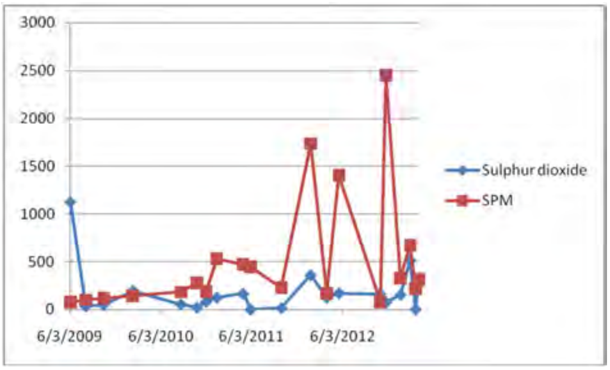

Figure 2. *Graphical representation of emission of SO_2 and SPM from a 250 MW unit-2 of Chandrapur Super Thermal Power Plant. The X-axis showing dates of collection and Y-axis represents emission in mg/Nm^3 (Year of commissioning-1984).*

2. Magnegas - the Best Option for Hydrogen as Additive at Present

Looking at the energy requirement of world and our dependency on coal for power, it seems to have no direct alternative any next morning. Continuing with the same scenario of combustion of this dirty fuel will create a miserable environmental situation in next one or two decades only.

Coal is and will be the major and cheap source of power generation in many countries. India, a developing country, and a 1/6th population of globe, is largely dependent on coal as a major source of energy for generation of electricity. Out of 1,50,000MW of total energy capacity, approximately 78,000 MW comes from coal fired thermal power plants. These power plants are mainly situated in places where there is ample coal under the earth surface. Burning coal itself is a dirty process with heavy emission of green house gases. Further coal mining has its own adverse effect on land and water in the area which ultimately ruins the agriculture and causes rehabilitation of people. One of the serious problems in burning coal for electricity is the incomplete combustion that results in loss of at least 30% fuel as uncombusted hydrocarbon, hence lesser thermal efficiency and increased cleaning cost of exhaust system and pollution control. As the data of emission shows significant quantity of carbon monoxide emitting out, it is a multi directional loss to the environment. Excavation of fossil fuel itself is against environmental balance and incomplete combustion causes decreased combustion efficiency along with heavy release of poisonous gas, carbon monoxide. Further conversion of carbon monoxide to oxide in the atmosphere is causing thermal pollution. Hence the priority need is clean combustion of the existing fossil fuel and utilizing the maximum available carbon of the fuel. This can be done by injecting magnegas [3, 4, 13] along with the conventional fossil fuel.

The property of magnecules [3, 4] to undergo magnecular combustion [1-4] with high energy output is due to weak magnecular bond. This is exploited for the industrial development of new clean fuels such as magnegas. MagneGas is a good additive for the cleaning of fossil fuel exhaust because:

1. When produced from the recycling of water-base liquid wastes, magnegas contains about 65% hydrogen, thus qualifying as an effective additive to improve fossil fuel combustion;
2. The remaining components of magnegas are rich in oxygen, thus helping to alleviate the large oxygen depletion caused by fossil fuel combustion and

The cost of magnegas is competitive over that of fossil fuel, particularly when produced by the electric power plants, because of the reduced cost of electricity and the possibility of producing magnegas from the recycling of city sewage, with a consequential income that covers most of the operating costs of PlasmaArcFlow Recyclers.

Therefore, it is a high time to come up with a realistic solution to clean the combustion of coal in power and other small coal using sectors like brick making to cement and metallurgical industries.

The only viable option is to add a suitable additive for cleaner co combustion process. Pure hydrogen gas can meet up the thermodynamic requirements but it is not viable due to safety and economical reasons. Therefore, magnegas can prove to be a better additive for co combustion with coal.

Magnegas can be synthesized on site by using any source of water and applying the famous technique pioneered by Prof. R. M. Santilli.

The magnegas can be used along with coal as additive for effective co combustion. Flame temperature of magnegas is upto 10500º F which helps in combustion of all the carbon and traces of nitrogen and sulphur to their final oxidation products in the combustion chamber itself. This ensures complete combustion of carbon to generate maximum energy. It also helps to burn all the volatile matter formed due to internal reaction of carbon and hydrogen from coal. Localized combustion of all combustible elements from coal is the main objective which can be best fulfilled by using magnegas as an additive for co combustion with coal. Some experiments are already conducted by Magnegas Corp. in collaboration with various partners across Europe, U.S. and Australia and they have reported a positive outcome of the experimental trials [3].

Magnegas achieves a flame temperature of about 3800ºC. This high temperature helps in combustion of all combustible matter, thus enhancing the energy output of process. Further, it is also observed in the earlier studies that co combustion of magengas has reduced the carbon dioxide emission by about 30 to 40% and reduced emission of carbon monoxide [3].

Below mentioned is a tabulated interpretation of the results of combustion of coal in comparison with co-combustion of magnegas and coal.

Table 2. *Comparison of flue gases and stack temp in combustion of coal and coal+magnegas, Courtesy:www.magengas.com/reports/cocombustion [3].*

Factor	Coal	Coal+Magnegas
Oxygen	11%	13%
Carbon Dioxide(CO2)	15%	9%(40%)
Carbon monoxide (CO)	58ppm	28ppm (52%)
Nitrous oxide (NOx)	160ppm	46ppm (71%)
Stack temp	37100 C 700 F	~29900 C 5400 F

As magnehydrogen would be more energetic than magnegas due to resemblance of MH with hydrogen, magnehydrogen can be used in place of magnegas as a refinement to the co combustion experiment. The first independent experimental verification of the new species of Santilli MagneHydrogen was achieved in October 11, 2011, by D. Day [14-16] of the Eprida Laboratory, 3020 Canton Road Suite 104, Marietta, GA, via the use of a VSA station for the separation of MH from MG, the use of a GC-TCD for the measurement of the percentage of hydrogen in the separated gas, and the use of conventional methods for the measurement of molecular weight. In this way, Day achieved a species of MH with about 97.5% pure Hydrogen, while having 3.89 times the specific weight of H_2, and a consequential energy content of 1167 BTU/scf.

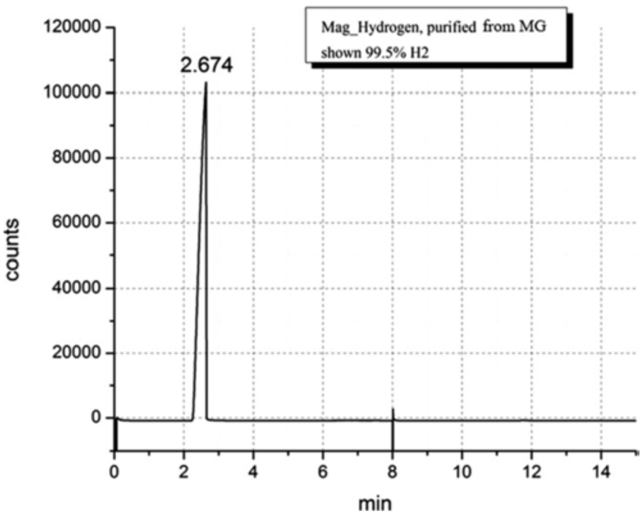

Figure 3. *GC-TCD scan of MagneHydrogen showing no appreciable difference of MH with pure hydrogen [13].*

As reported by Prof. Yang [3] from an industrial viewpoint, it is sufficient to achieve a species of MH with at least 3.3 the specific weight of H_2 to have the same energy content of 1000 BTU/scf of Natural Gas (NG). In fact, under said conditions, MH would avoid the current needs to liquefy Hydrogen in order to achieve a sufficient range, since MH can be compressed like NG. Additionally, the magnecular structure of MH avoids the traditional seepage of Hydrogen through the walls [14, 15], thus allowing long term storage that is currently prohibited by molecular Hydrogen due to current environmental laws.

Magnehydrogen is a cluster species and about 7.4 times heavier than hydrogen. These anomaly to conventional gaseous molecules help in reducing the leakage of these novel species from pipeline. Permeability issues needs to be answered while passing hydrogen through pipeline but magnehydrogen has a advantage due to its polymeric nature. Moreover, energetically it is equivalent to hydrogen and generates a high flame temperature which can prove key to cleaner combustion of coal.

Thus magnehydrogen is the closest choice to replace hydrogen as an additive and in some physical properties discussed above, it is even better to hydrogen.

Indian coal is known for its high ash content. Coal-fired power plants generate a huge quantity of ash which is an environmental problem. As per the estimates Magnegas Corporation based on studies conducted at their place, there is an elimination of particulate matter when using magnegas with coal as additive. This estimate is a source of hope for cleaning the combustion of coal-fired power plants in many states of India. Central Indian coal mines deliver a coal with ash as high as 38 to 40% and the fly ash emitting from the coal-fired power plants is a cause of land, soil and air pollution in the area.

The high temperature generated due to addition of magnegas can facilitate chemical gasification reaction occur easily in a reactor. Mixing of pulverized coal can enhance the ability of process. Even biomass and combustible garbage can be burnt with this additive. The high temperature attained inside the combustion place must be converting the ash into glass slag kind of material.

A power plant of 2340MW capacity using high ash central Indian coal consumes 40 to 45 thousand ton coal per day. The average ash content in this coal is 35%. Estimated ash per annum is ~5100000 ton/yr. Ash generation per annum as reported by this power plant ~3600000 ton/yr. Thus ~1500000 ton/yr is the fly ash generation. Assuming 98.5% efficiency of ESP, ash liberated through stack in the atmosphere is 22500ton/yr. This ash deposits in the surrounding area and pollute the ecological factors like lake, small water streams and farmland.

With addition of the magnegas, the conversion of ash into fusible mass will minimize the pollution due to fly ash.

As carbon will be converted in totality to its dioxide, the total obtainable energy will be increased. This, in fact, is the goal of overall process which will increase the energy efficiency of the coal combustion process.

As CO is highly reactive and it is difficult to measure the enthalpy of formation of CO practically by calorimeter, a simple calculative approach is described below [16].

$$\text{C (graphite)} + \tfrac{1}{2}\,O_2 \rightarrow \text{CO (g)} \quad \Delta H_1 = ?$$

$$\text{CO (g)} + \tfrac{1}{2}\,O_2 \rightarrow CO_2\text{ (g)} \quad \Delta H_2 = -283.0 \text{ kJ/mol}$$

$$\text{C (graphite)} + O_2 \rightarrow CO_2\text{ (g)} \quad \Delta H_3 = -393.5 \text{ kJ/mol}$$

Hess's law gives:

$$\Delta H_1 = \Delta H_3 - \Delta H_2 = -393.5 + 283.0 = -110.5 \text{ kJ/mol}$$

For every elemental carbon released in stack as carbon monoxide, we are gaining 110.5kJ/mol and loosing 283.0 kJ/mol of energy. Thus, loss amounts to 256% per mol.

This loss would be eliminated with the addition of magnegas which helps in complete combustion of carbon to CO_2.

Many metallurgical processes use heat liberated in operations to generate power. Increased waste heat due to magnegas as additive can be used effectively. An example of the availability of waste heat is given as follows [17, 18]:

In a furnace, the exhaust gases are leaving the furnace at 900°C at the rate of 2100 m^3/hour. The total heat recoverable at 180°C final exhaust can be calculated as

$$Q = V \times \rho \times C_p \times \Delta T$$

Q is the heat content in kcal

V is the flow rate of the substance in m^3/hr

ρ is density of the flue gas in kg/m^3

C_p is the specific heat of the substance in kcal/kg °C

Heat available (Q) = 2100 x 1.19 x 0.24 x (900-180) = 4,31,827 kcal/hr

Not only the metallurgical operations but the small power plants also utilise the waste heat thrown out of the stack. The term "combined cycle" describes the combination of two thermodynamic cycles, with the gas turbine (Brayton cycle) burning natural or synthetic gas from coal/residuals/oil, and its hot exhaust gas powering a small steam power plant (Rankine cycle). Combined Cycle Power Plants (CCPPs) can achieve a thermal efficiency higher than 60% today, compared to single cycle gas power plants which are limited to efficiencies of around 35 to 42% [19]. In place of natural gas, coal fired power plant using pulverized coal can also work on two cycles to increase electricity output. Also, when the total heat content in waste heat recovery is dependent on difference in temperature (ΔT), 8 to 9 times increase due to addition of magnegas will certainly increase the efficiency of waster recovery process.

In developing countries like India, there is a great deal of disparity in urban and rural life quality. In India, 42 percent of rural households use kerosene for lighting. By contrast, about 93 percent of urban households use electricity for lighting and only about 6 percent use kerosene. On average, a rural household receives six hours of electricity supply from the grid during the off-peak period (usually afternoon and night). The cost of lighting a rural household includes the cost of grid supply and the cost of kerosene. The loss of electricity in grid is also significant to be noted [20].

Distributed power generation in small capacity can serve the purpose of extending availability of electricity to rural households. This will also save losses in distribution and local employment generation is possible for rural population.

There are a few small capacity power plants established on cooperative basis in few states of India. The village community uses locally available coal, biomass and other combustible waste to generate power of few kW which is sufficient to meet their electricity requirement. These power plants are based on a crude, steam engine principle, and can't be equipped with modern pollution control facility. The overall economy does not permit use of costly ESPs.

If such small power plants are supplied with magnegas, which can be generated on site, it will help to increase the combustion efficiency of original fuel. It will also improve the quality of emission, thereby, supporting clean atmosphere.

The old age power plants of less capacity can also be run on coal + magnegas hybrid fuel to improve the efficiency of combustion. As these power plants are not suitable to be equipped with modern pollution control facility, they are emitting beyond permissible limit. Scale up of the present experimental results obtained by Magnegas Corporation can give a good solution to improve the economy of these power plants.

A bottom up model for combustion of coal with magnegas was proposed by the authors and it is still under consideration for experiments. This model study will mainly focus on Indian coal and thermal power units in India. The outcome of study can help to devise a scaled up process of co combustion of magengas and coal which can serve the purpose of all coal-firing industries in India. Apart from larger coal based power plants, there are many captive to micro power plants operated on co operative basis in villages. These power plants meet up the energy requirement of those villages. Due to lack of any sophisticated emission controlling technologies, these power plants emit a high amount of poisonous gases like CO_2, CO and NOx. Due to low stack height of these steam engine based power units, the workers are exposed to poor health and environmental conditions. The clean up aimed with co combustion of coal with magengas can provide better environmental conditions to workers in small coal fired units.

3. Conclusion

In the present paper we discussed the possibilities of using magnegas as an additive to coal in order to enhance the combustion efficiency of coal. To justify the need of novel fuel like magnegas, initially we have discussed the present scenario of energy sources and their fulfilment, problems associated with combustion of fossil fuels especially coal and their effects leading to global warming and oxygen depletion and need of mankind to find alternate fuels due to devastating effects of burning fossil fuels. Then with the short introduction to the new fuel magnegas which posses the magnetically bonded molecules and magnecules and hence justified the lower energy for its combustion called as "magnecular combustion" when used independently as well as mixed with coal as an additive for its complete and clean combustion. Hence its has been emphasized in this paper that the priority need is clean combustion of the existing fossil fuel and utilizing the maximum available carbon of the fuel which can be done by injecting magnegas along with the conventional fossil fuel.

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