Combating Climate Change: A Study on India
Avyukt Sachdeva
Student
Sanskriti School, Delhi-NCR, India

Abstract:
This paper develops on an approach towards combating climate change for India. India is projected to have the highest population in the world and being the third largest consumer of coal it’s important for India to set a standard for other south Asian countries to do the same. Finally, the paper will discuss methods which can be utilized to significantly reduce the GHG (Greenhouse Gases) produced by the South Asian Peninsula. Overall, the paper analyses how production of methane from atmospheric carbon dioxide will help the country reduce emissions to reach the goals set by its carbon policy. The paper also slightly delves into the use of a certain species of pink seaweed to reduce CH4 from cow belching.

I. INTRODUCTION

Although India ranks ninth by Climate Change Performance Index a lot of work needs to be done by all the countries of the world if we want to reduce or stabilize the rate at which the global temperature increases. A Carbon Brief analysis found India’s emissions could increase 90% between 2014-30, even if the Paris Pledge is met. The pledge says India’s goals represent the “utmost ambitious action in the current state of development” while also criticising the response of developed countries to global warming calling it “tepid and inadequate.” The country has pledged a 33-35% reduction in the “emissions intensity” of its economy by 2030, compared to 2005 levels by reducing GHG production. India is also very vulnerable to climate change, notably due to the melting of the Himalayan glaciers and changes to the monsoon. Around 13% of India’s population does not yet have access to electricity which shows that due to the current climate policy of India it isn’t able to meet energy demand. While more than half still rely on traditional biomass (dung, wood, etc) for cooking. Its GHG emissions in 2015 stood at 3,571m tonnes of CO2 equivalent (MtCO2e), according to data compiled by the Potsdam Institute for Climate Impact Research (PIK). Emissions increased over three-fold since 1970. India is clear that in order to achieve its Paris Pledge, it will depend heavily on climate finance, technology transfer and capacity building support from developed countries. Estimating that it will need at least $2.5tn up to 2030, from both domestic and international funds.

II. THE CLIMATE CHANGE CHALLENGE

Natural Gas has never played a prominent role in India’s energy mix, making up only 6% of energy consumption in 2017. Half of India’s current gas imports are largely from Qatar, the US, Australia and Russia. A parliamentary panel recently concluded that more than half of the country’s 25GW of gas power plants have been “stranded” by a lack of domestic gas and the high price of imports. India has reportedly considered “emergency stockpiles” of gas, similar to strategic oil reserves. As was covered in the introduction India heavily relies upon “climate finance, technology transfer and capacity building support from developed countries”, as only 6 out of the 26 Developed Nations have ranked high on the Climate Change Performance Index. As is evident certain countries are failing to meet the Paris Agreement and a few from developed nations are criticizing the Paris Agreement and some are pulling out of the agreement. The main problems India is currently facing with restraining climate change and global warming are failure for developed nations to provide technological help, not reaching energy demands with the current climate policy, increasing CH4 production due to cattle farming and combating climate change while making sure the climate change policies don’t disproportionately affect low-income households.

III. POSSIBLE SOLUTIONS

There is a way of producing one of the cleanest fuels – methane – from the pre-existing existing CO2 in the atmosphere. The process could be completed in three drastically simple steps which would allow developing nations like India to take charge of their greenhouse gas emissions.

1. Electrolysis of Water
2. Taking CO2 out of the atmosphere in the form of dry ice
3. Sabatier Reaction

Primarily, it would be essential to conduct and electrolysis of water and then take hydrogen gas from the cathode – allowing the oxygen to remain in the container.

\[ 2H_2O + \text{Electricity} \rightarrow 2H_2 + O_2 \]

On the other hand, in the second step wherein one would cool down the purified air so that no solid debris enters the machine. After this the air is cooled down to -78.5°C or 194.65 K. This is done so that the carbon dioxide is removed from the atmosphere.

\[ CO_2(g) \rightarrow CO_2 \]

For this physical process we require the same amount of energy required for the sublimation of CO2 as it is equal to the energy required to freeze vapors of CO2 into solid state, however, with opposite signs. The sublimation energy of CO2 is 25.2 kJ/mol. In the final step, for the Sabatier Reaction one would require the extracted H2, CO2 and 165 kJ/mol energy in the form of heat.
$CO_2 + 4H_2 \Delta \rightarrow CH_4 + 2H_2O$

Recent studies utilizing the red macro algae Asparagopsis taxiformis show the potential of the decrease in methane (CH4) production up to 99% when added to cow’s fodder at 2% concentration. These experiments have shown significant reductions in CH4 without compromising the health of the cattle or their beef and milk. A. taxiformis was assessed for its capacity to lessen methane creation from cows producing dairy widely adapted in California, the biggest milk producing state in the US. Since these practices aren’t just theoretical as is evident by its use in California. Not just that but these species of seaweed are present in heavy concentration on the Indian West Coast.

IV. FEASIBILITY OF SOLUTION

It is evident that 1 mol of methane has 890.4 kJ/mol energy and produces 810kJ/mol upon combustion, to find out if it is worth financially to do all this we can add the energy used up in step 1 through 3 and subtract that from the amount of energy in 1 mol methane and if the number is a positive one we know that the entire process is worth the energy and time. We also need to subtract the energy required to convert methane from gaseous state to liquid state as the majority of methane is used in liquid form.

1. Step 1 = 237 kJ/mol
2. Step 2 = 25.2 kJ/mol
3. Step 3 = 165 kJ/mol
4. Condensation = 8.17kJ/mol
5. CH4 = 810kJ/mol

$$810 - 165 - 25.2 - 2 * 237 - 8.17 = 137.63 \text{ kJ/mol}$$

Therefore, if we multiply the energy required for electrolysis of water by 2 because in the reaction of step 2 we used 2 mol H2O for 2 mol H2 but in the reaction in step 3 we used 4 mol of H2. This shows that this process is providing us with a profit of 137.63kJ/mol, not just carbon neutral but is carbon positive as this process is providing us with energy literally from thin air. This does not require us to dig deep into the earth for decomposed dinosaur bones and instead produces the most versatile and eco-friendly fuel. If used correctly this process could be used in a larger cyclic process in which we create energy from the products of the combustion the fuel created.

V. SOLUTION DIAGRAM

VI. RESULT

According to the PPAC(Petroleum Planning & Analysis Cell), India has spent USD 111.9 billion on oil imports in 2018-19, up from USD 87.8 billion in the previous fiscal year. The bill for import was USD 64 billion in 2015-16. For the current fiscal, it projected crude oil imports to rise to 233 million tonnes and foreign exchange spending on it to increase marginally to USD 112.7 billion. However, If we are able to produce methane and perform reactions on it to produce propane (LPG) and butane (Gasoline) then the need for importing petroleum would decrease mostly. We can use the money saved to further the need to curb greenhouse gases. Since the majority of CH4 produced as a greenhouse gas in India are from cattle we can decrease their production through the use of “Asparagopsis.” As previously mentioned this seaweed is found on the west coast of India. The funding from oil imports can be used to have an experiment for the use of Asparagopsis in a particular state to see how it affects the state’s greenhouse gas emission. We will also be noticing a rapid decrease in the CO2 percentage in the emissions as the country would be producing hydrocarbons through the atmospheric CO2. This also helps lower income households who mainly depend on animal husbandry for their income as well as upon LPG and CNG reserves for use at home for cooking and since most public buses in India run on CNG, India is a country very different from its counterparts which is why a specific and different plan is needed for it to combat climate change.

VII. REFERENCES

[4]. https://www.researchgate.net/publication/235901602_Bioactivity_of_the_red_algae_Asparagopsis_taxiformis_collected_from_the_Southwestern_coast_of_India
[6]. https://www.climate-change-performance-index.org/
[7]. https://economictimes.indiatimes.com/industry/energy/oil-gas/indias-oil-import-dependence-jumps-to-84-pc/articleshow/69183923.cms?from=mdr