

## Research Trends to Mitigate Uncertainties in Paris Agreement using Waste Resources

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### Abstract

Paris agreement on climate change is a commitment of global community towards better human life on this planet by restoring favorable environmental conditions. Kyoto Protocol and Paris Agreement have given an alarming thoughtfulness to the countries to save this planet for future generations. But the question arises, why there are uncertainties to implement the agreement perfectly and how to boost actions towards net zero emissions without uncertainties? Drilling and extraction of fossil fuel is never declared as forbidden but its utilization generating greenhouse gases is always criticized. There is a need to introduce some accurate and applied research methodologies for stake holders to make the outcomes certain and quantitatively predictable.

**Keywords:** Paris agreement; Emissions; Pollution

### Introduction

The trends towards renewables at industries always compete with the low prices and high efficiency of fossil fuel in comparison with the renewables. The prevailing biological and biochemical research trends to reduce GHG emissions and pollution by industrial wastes are considered as less efficient or expensive for implementation at industrial level especially in developing countries. Outputs of Kyoto Protocol and expected targets of Paris Agreement may be enhanced and achieved maximally if strategies proposed here can be implemented at the industrial level as mandatory component to reduce emissions and waste effluents. Here, a set of methodologies is presented to get the optimum results cost effectively. Carbon dioxide sequestration through plants and waste water treatment through biological activities are conventional methods which has not been proved as effective methods yet at industrial scale to be implemented globally. A lot of funds have been utilized every year to carry out research activities in these fields but the findings cannot be adopted fully at industrial level especially in developing countries. Currently, there is no effective strategy or scientific methodology for the industries of developing countries to meet the issues of emissions and wastewater treatment cost effectively. There is a dire need to design some urgent and effective approach to treat the emissions and pollutions in the vicinity of an industry by converting these wastes into fuels to address the existing global issues at minimum price. Funding for conventional research to encounter challenges of global warming may be used to ensure maximum outcomes from Paris agreement by some more clear directions to industries.

Emissions increased in 2010–2014 at the rate of 2.75% per year contributing 31.9 to 35.5 Gt of carbon dioxide approximately [1]. But there are reports that Spain has reported remarkable reduction (7.5%) in emissions in 2008. The reduction was largely because of using less coal for electricity generation and shift towards gas and renewables including wind, photovoltaics and biomass [2]. At one side Europe and other technically advanced countries are moving forward to mitigate risks of climate change; there is a move in developing countries to avoid extra expenses by ignoring measures to make emission reductions at their level [3]. It shows, it is not possible to bring the developing countries on the same page to fight for mitigation of emissions at the same level. Here, few strategies or trends are presented to be adopted in developing countries to carry on their business but also reduce emissions without extra expenses.

### Description

Despite of environmental laws and policies, uncertainties in projecting emissions reductions have been reported in developing and technologically advanced countries. Worldwide, coal supplies 29.7 percent of energy use and is responsible for 44 percent of global CO<sub>2</sub> emissions [4]. The United States and China together have contributed about 40% of global CO<sub>2</sub> emissions in 2012, and still there is uncertainty if they can meet the announced targets presented in their Intended Nationally Determined Contributions (INDCs) to mitigate their respective GHG emissions [5]. After a lot of work, brainstorming and expenditures by nations, there is a plan with uncertainties and doubts about targeted goals. Advance countries give their INDCs to mitigate the emissions but developing countries are planning to start awareness programs about emissions and their hazardous effects. Environment has no boundaries, and mitigation in advance countries can be damaged by pollutions from the developing countries. To bring the developing countries on the same page and have the overall results for optimum mitigation, cheaper and very effective strategies need to be implemented as mandatory requirement at the industrial level. If the strategy or technology for mitigation is an open choice for industries in developing countries, the cost of mitigation strategy will be a great barrier for next many decades to be in harmony with the advance countries. It looks uncertain in advance countries but it might be impossible in developing countries where sometimes production cost is reduced by compromising with the quality of the products without caring of hazardous or unhealthy effects on public health. In this situation, the investment to reduce emissions or pollutions can never be expected from developing countries and emission targets may not be achieved globally. There is a need to convert industrial wastewater into fuel, coal based heating need to be compensated to reduce emissions

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and emissions need to be processed for product development at industrial level.

Following strategies can ensure maximum mitigation achievement if implemented on industrial level directly:

Coal based power or thermal production can be associated with the wastewater making coal-wastewater slurry. It is also reported that developing countries are responsible to dispose of their 90% of wastewater into water bodies [6]. Coal and waste water are considered as two separate sources of pollution. A compensation to the polluting potential of these sources is presented here as coal-waste water slurry (CWWS). Coal-water slurry fuel (CWSF) is consists of finely grinded (less than 20 micrometers in diameter) coal particles suspended in water in the presence of emulsifying agent/oil. CWS usually consists of 55-70% of fine dispersed coal particles and 30-45% of water [7]. Usually coal water slurry is prepared by mixing fresh water and coal in the presence of some suspension agent but trends need to be changed by replacing fresh water with wastewater. The pollutions by coal may be compensated by using wastewater and reducing its pollutions by burning it as slurry. There is an option to recover the water from emissions/steam while burning coal water slurry. An industry using coal can develop a system to utilize the same coal as slurry of wastewater from the same industry or other sources.

A number of other industries are producing effluents as potential source of aquatic and environmental pollution. According to UN report, the developing countries are dumping their 70 percent of industrial waste untreated into waters where they pollute the usable water supply [8]. Palm oil mill effluent (POME) is the waste water discharged from the palm oil industries in palm producing countries. Although the palm oil is used extensively in food and nonfood applications at global level but the effluent discharged from palm oil industries has been documented as major pollutant causing irreversible damages to the environment. According to a report from WWF Global, the main source of freshwater pollution from the palm oil industry comes from processing wastes [9]. The same way sugar industries, leather industries and food industries are responsible to contribute fresh water pollution in their region especially in developing countries. In developing countries, the industrial effluents are produced in million tons every year, the research activities and published outcomes usually comes out as methods to produce some products like butanol, ethanol, acetone or other biofuel or biomolecules using small amount of organic matters in effluents at the expense of huge research funds and expert manpower. A lot of literature is published every year with effective new or improved findings to treat wastewater but most of the studies cannot be implemented at industrial level because of high installation cost or low efficiency of the research findings. In order to implement Paris Agreement effectively, trends of industrial wastewater treatment need to be changed to get remarkable contribution from the developing countries. Different types of waste water are produced from different industrial sectors, and most of them can be reused as a fuel medium if processed to make biomass cake or biomass pellets using residual crop waste or other surplus biomass. The same strategy may be extended to use this cake replacing coal at industrial level and can be made available for public for cooking or heating purposes using some efficient or usual stoves. The process may be established by mixing wastewater with biomass and drying of paste using solar evaporator leading to cake or pellet formation of required size.

Carbon dioxide is the main pollutant to make climate change. Technologies are available to capture it and utilize for fuel production but need to be linked with industrial sites using emissions as feedstock

for fuel or synthetic products to avoid any more global warming and environmental damages. Absorption towers are a popular way of removing atmospheric carbon dioxide by using different solvents of which alkaline solutions are a viable option [10]. This carbon dioxide can be converted into carbon monoxide leading to the process called carbon dioxide reforming of methane [11]. Carbon mono oxide can be used as precursor for simple to complex products; Fischer-Tropsch process is also reported as a great tool to adopt zero emission status at industrial level [12]. It should be mandatory for industries to develop such infrastructure at industrial level, the subsidy like facilitation may be made from concerned states and the emissions may be converted into fuel instead of allowing it to increase pollutions. The resulting products would be costly but can be compensated with the research or awareness funds as subsidy, the additional cost may be adjusted to unusual and unproductive research activities. In addition to this, the photochemical cells can be used to produce syngas using water and carbon dioxide and molten carbonate fuel cells may be used to replace generators based on gaseous fuel like syngas or methane.

Technologies like catalytic conversion of carbon dioxide to carboxylic acid derivatives may be supported for implementation at industrial level. The derivatives to capture GHG have also been reported. There is a dire need to work on water vapors mitigation from atmosphere; this type of study may be incentivized to mitigate 60% of the warming effect.

The measures like coal wastewater slurry and biomass wastewater cake/pellet are efficient and cost effective, and can be adopted easily in developing countries. The measures like trapping emissions and converting them into biofuel or products need special attention and state level investment for effective implementation. Otherwise, developing countries may need a century to come to the same page as technologically advanced countries to encounter global warming by treating their emissions or effluents.

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