

Study Research Objectives:

Pakistan is currently under a progressive and economic boom since the inception of China-Pakistan Economic Corridor projects that plan to add more than 28000 MW of energy into the national grid by 2030. This immense increase in energy production sector will progress the economy exponentially but its implications on environment will be a perturbing factor as most of this energy projects are fossil fuel projects. Based on our condition as a developing nation, the sustainable approach is to work in parallel with the renewable and low cost fossil fuel energy project with sustainable technologies. So, being an engineer in 1320 MW Sahiwal coal power plant by Huaneng Shandong Ruyi Energy , my research focus is primarily based on two industrial sustainable technologies that match with my experience and where I can polish my expertise for advanced research in United States: Salinity Gradient Solar Pond & Carbon Capture and Storage technology. The objective is to propose these technological solutions in my own entrepreneurial firm that can transfer this knowledge base to the policy making bodies of Pakistan.

My first research focus is on sustainable Carbon dioxide Capture and Storage technologies for industries. Although greenhouse effect from Carbon Dioxide is less compared to other GHG's but their emission amount makes them greatest contributor to GHG's. To control these emissions, CCS technology can absorb the 99.5% pure Carbon dioxide from the emitting flue gas. The Huaneng group of China built the pilot scale amine-based CCS plant at Gaobeidian coal-fired power plant in Beijing with Carbon dioxide capture capacity of 3,000 tons per annum. After successful pilot scale project, Huaneng group placed a larger commercial demonstrating CCS plant in Shanghai Shindongku II power plant where I received my international training. The plant facility successfully captured 120,000 tons of Carbon dioxide per annum. The Carbon dioxide obtained had food grade purity to fulfill demand of Shanghai city for welding, dry ice and beverages plants.

However only 3 % of flue gas was treated because the novelty of this project requires much more extensive research before it can be built for treatment of large industrial flue gases. The project later halted mainly due to copious production of Carbon dioxide compared to its demand. In order to make this technologies economically feasible for industries, I plan to research upon this technology and its alternative products that can be obtained and used in our daily life. Flue Gas Desulfurizers are constructed in industries all around the world because of its sustainability since its by product gypsum is used in cement industries hence making it economically feasible. Similarly the product of this Carbon capturing technology needs to be converted into some usable form or their end control alternatives needs to be evaluated.

Another focus of my research is on sustainable waste utilizing technology known as Salinity Gradient Solar pond (SGSP). It is a zero discharge system which allows for the storing thermal solar radiations in pond filled with brine obtained from different industrial wastes. Thermal energy stored in brine during summers can be conserved for longer periods and can be extracted through heat exchanger in winters. I am proud to say that I am the Pioneer member of the team for constructing and researching First Pilot scale Salinity Gradient Solar Pond of Pakistan funded by an International NGO, Water Aid. After extensive research on this project, we were able to establish density gradient in the pond necessary for the Thermal energy storage. As I have practical experience of this technology, I believe that this program will provide me a perfect platform for my further advanced research on optimizing the heat storage, as US houses world's largest SGSP at EL Paso Texas.

These two novel technologies can be a promising solution to Pakistan's Industries making them greener. CCS technology can reduce the CO₂ emissions of up to 80-90 % from large industries of Pakistan especially from our booming power sector. While SGSP has the potential to tackle brine

management problems of our industry while at the same time using that waste to store thermal energy from Solar. Upon completion of my degree from US through Fulbright, I want to initiate Pakistan's first ever entrepreneurial venture which will focus on two facet: EPC sustainable technology solution to carbon plus brine producing industries & consulting services/ knowledge-base to policy makers at government level, main focus being on Punjab government since the institutional framework of these coal power plants can only be changed through advising government organizations to fund on sustainable, environmental friendly technologies.