A Fundamentals-based Approach for Scale-up of DAC Technology

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Energy is key for human development as it touches, directly or indirectly, every aspect of our daily activities. As global population increases the demand for energy will also increase and under the "conventional" way of operation, so will the associated emissions and climate issues. Therefore the energy challenge we face is to provide affordable, reliable and clean energy to support sustainable human development. In order to avoid significant environmental and associated social and financial impacts, the Intergovernmental Panel on Climate Change (IPCC) set a target of 1.5 °C on global temperature increase. Meeting this target will likely require a combination of major reductions in greenhouse gases (GHG) emissions from point source streams together with the removal of CO_2 from the atmosphere. While the use of conventional carbon capture technologies has been around for a while, the capture of CO_2 from air is more recent. Direct Air Capture technology offers CO_2 reductions from the atmosphere, similar to natural sinks, however at improved productivity.

ExxonMobil has entered a Joint Development Agreement (JDA) with Global Thermostat (GT) to advance technology to capture and concentrate CO_2 from air. The goal in this area is to develop cost-effective carbon-neutral and/or negative solutions at scale. The nature of this separation brings a number of challenges integrated across different scales which are being addressed using a model-based methodology. The approach focuses on key areas targeting the understanding of fundamentals that drive these processes to identify optimal scalable solutions and potential R&D opportunities. One such key areas looks at the fundamentals of the amine-supported materials used in this JDA to capture CO_2 from very low concentration streams and their close link with the contactor design and cyclic process conditions. This presentation will highlight some of the above activities done within the scope of this JDA and challenges pushing the boundaries of innovation in science and engineering to develop scalable viable solutions to address global climate issues.