Science AMA Series: We are researchers from the University of South Africa and we're putting greenhouse gases directly into actual greenhouses; we thereby capture carbon emissions, reduce water consumption and increase crop yield. Ask Us Anything!

GASESFORGREENHOUSES R/SCIENCE

Water scarcity poses a severe threat to all humankind, with rapidly growing demand pressuring already-constrained water resources, many of which are unsustainable. Figuring out where our water ends up is therefore a crucial step toward finding ways to use it more efficiently and try to ensure that we, as a species, are still around a few generations from now.

Dr Neil Stacey is a young researcher previously known for best known for patented advances in bio-fuels production technology. In late 2016 he set out to use chemical engineering modeling methods to examine water usage in agriculture, which comprises 70% of all of mankind's water consumption.

Professor Diane Hildebrandt lent her considerable support to the project soon after. She is a director of UNISA's IDEAS institute. She has been the recipient of a number of prestigious scientific awards including the Meiring Naude Medal, the Bill Neale-May Gold Medal, the Distinguished Woman Scientist Award and an African Union Scientific Award. She has been the author or co-author of over one hundred and fifty peer-reviewed scientific publications including three textbooks and an invited paper in Science.

By building chemical and thermal models of greenhouses as bio-reactors, we have been able to develop fundamental insights into cause-and-effect relationships in greenhouse design and operation. We found that greenhouse operation is constrained by the necessity of supplying adequate CO2 for photosynthesis. Since CO2 is highly dilute, this constraint demands a very high air-flow through a greenhouse which in turn causes excessive water evaporation and heat losses. Consequently, providing enriched CO2 can drastically reduce the heat and water requirements of a greenhouse. In a paper currently in the final stages of review, we showed that using membrane separation to partially enrich air as a feed can cut water usage considerably.

We also investigated the possibility of using power station flue gas as a source of enriched CO2. In a recent paper, we quantified the potential costs and benefits of diverting flue gases from gas-fired power stations into greenhouses, finding that this approach can achieve large-scale carbon capture without costly separation, while massively boosting agricultural output and drastically reducing water requirements.

And so, we are here to field your questions as we advocate for putting greenhouse gases into actual greenhouses. We'll be back at 12 pm ET to answer your questions, Ask Us Anything!
The AMA is still in progress

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