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Researchers launch race to develop sustainable COVID-19 vaccine delivery

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Scientists are launching a major new research project in India that will help to engineer an efficient and sustainable delivery mechanism – ready to get an eventual COVID-19 vaccine to billions of people around the globe.

Researchers racing to develop, test and manufacture an effective coronavirus vaccine will also need to distribute the drug globally, but universal vaccine access is already a major challenge, particularly in low-income countries across the global South - partly due to the lack of robust cold-chains.

The Global Alliance for Vaccines and Immunization estimates that only 10% of health care facilities in the world's poorest countries have a reliable electricity supply while in some countries less than 5% of health centres have vaccine-qualified refrigerators.

Backed by the Shakti Sustainable Energy Foundation, experts from the University of Birmingham and Heriot-Watt University, Edinburgh are joining forces with non-profit, commercial and academic partners to begin investigating the scale of challenge involved in distributing a potentially temperature-sensitive COVID-19 vaccine.

Toby Peters, Professor of Cold Economy at the University of Birmingham, commented: *"Universal vaccine access is already a major challenge. With COVID-19, rapid mass immunisation will probably be required; maintaining a continuous cold chain to rapidly transport and deliver COVID-19 vaccines to all communities, many where electricity supply and cooling infrastructure is often non-existent or unreliable, will be a daunting task.*

"Given most of the technologies deployed today will still be in operation in the next decade, the emergence of sustainable and off-grid cold-chain devices allows us the opportunity to create sustainable solutions for COVID-19 vaccine deployment that also can deliver resilient and sustainable health cold-chain systems as a lasting legacy."

Shubhashis Dey, Associate Director of Shakti Sustainable Energy Foundation commented: *"COVID-19 related mass immunization requirements offer us an opportunity to not only increase our vaccine production, but also create a robust logistics cold chain system that can handle the country's overall vaccine needs. The vaccination program will require millions of citizens of all age group to be vaccinated within a short span of time. Our effort is designed to help India overcome this massive logistic challenge sustainably and create a model of global adoption."*

Research in India led by Centre for Environment Education, and supported by commercial partners such as Zanotti (a part of the Daikin Group), Sure Chill and Nexleaf Analytics, will begin addressing on the group research to address a number of questions that will be key to solving the cold-chain conundrum, including:

- Does any country have the infrastructure, resources and planning capability to meet the demand of COVID-19 immunisation, while still meeting current vaccine needs?
- If not, what infrastructure and training do we need in place?
- What are the short- and long-term infrastructure financing requirements to create such an efficient vaccine delivery system?
- Can we achieve this sustainably – economically, socially and environmentally?

Clean cold experts from the University of Birmingham and Heriot-Watt University are already working with Indian counterparts Centre for Environment Education and MP Ensystems to explore how integrated 'Community Cooling Hubs' can integrate food cold chains with other cold-dependent services such as community health facilities, social facilities and even emergency services.

Professor Phil Greening, from the Centre for Sustainable Road Freight at Heriot-Watt University, commented: "We may have 12-18 months to engineer a robust, efficient distribution system to ensure any vaccine for COVID-19 can reach the world's population, whether they are in urban or remote rural areas.

"A radical approach like community cooling hubs could help meet the different communities' cooling needs in a clean, affordable and sustainable way while helping to safeguard people's health.

"There will be many knowns and unknowns in facing the coronavirus challenge, but a vaccine is one of the very few exit strategies around which scientists and government are aligned."

The World Health Organisation (WHO) estimates that, as a result of broken cold-chain, there are more than 1.5 million deaths globally from vaccine-preventable diseases every year - 30% of which are among children under five. WHO estimates that more than 25% of some vaccines may be wasted globally every year because of temperature control and logistics failure.

Researchers at the University of Birmingham and Heriot-Watt University believe that their work in this area will ultimately help to:

- Develop a short- to medium-term crisis exit solution aimed to deliver COVID-19 vaccine in a safe, efficient and clean manner, while still maintaining routine vaccine deliveries.
- Create a long-term contingency framework through establishment of logistics specifically for medicine, blood, vaccines, that is cost-effective, sustainable and responsive to different levels of challenge – basic needs, natural disasters/ regional epidemics, national pandemics.
- Deliver lasting value by meeting current unmet and future vaccine demand.

Professor Peters added: *"Ultimately, we need a global effort to prepare the vaccine and in parallel a global strategy to develop the appropriate sustainable and legacy equitable cold chains and achieve this with minimum environmental impact.*

"Out-of-the-box thinking is needed if we are to define sustainable and inclusive solutions that can be delivered quickly and at scale to beat this pandemic and unlock connections between COVID-19 vaccine deployment, sustainable cold chain and development of clean energy infrastructure."