Innovation Challenge Fund (ICF)

Concept Note Template

<table>
<tr><td>1.</td><td>Name / Organisation</td><td>Prof D C Kothari, University of Mumbai</td></tr>
<tr><td>2.</td><td>Email address / Phone number</td><td>kothari@physics.mu.ac.in</td></tr>
<tr><td>3.</td><td>Title of Project</td><td>Hydrogen Powered Drones for Rural Development using Green Hydrogen</td></tr>
<tr><td>4.</td><td>Application for ICF Cluster</td><td>Future Mobility, Maharashtra</td></tr>
<tr><td>5.</td><td>Co-Members of the Consortium *
(Type – Indian Academia, Indian Business, International Academia, International Business, Indian non-commercial organisation, International non-commercial organisation, Other - specify)

* Information not mandatory for the concept note stage.</td><td>
<table>
<tr><th>#</th><th>Organization</th><th>Type</th></tr>
<tr><td>1.</td><td>University of Mumbai</td><td>Academia</td></tr>
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<tr><td>6.</td><td>If you do not already have agreed consortium members, please indicate here the kind of partners you would like to hear from.</td><td>1. Manufacturers of heavy duty hydrogen powered drones based on fuel cells
2. Manufacturers of Electrolysers
3. Government of Maharashtra</td></tr>
<tr><td>7.</td><td>Are you content for us to publish your concept note on our web platform in order to encourage potential consortium members to reach out to you?</td><td>Yes</td></tr>
<tr><td>8.</td><td>Funding Requested (up to £250k)</td><td>£250k</td></tr>
<tr><td>9.</td><td>Co-funding provided (if any) and source</td><td>No</td></tr>
<tr><td>10.</td><td>Please summarise your Innovation Challenge Fund research project in one sentence. 350 character limit</td><td>We will create a prototype Hydrogen Powered Drone Delivery System, along with Green Hydrogen Infrastructure, for quick delivery of medicines / food during pandemics / natural disasters and essential goods during the normal times, for one of the envisaged 36 hubs in 36 districts covering the whole of Maharashtra.</td></tr>
<tr><td>11.</td><td colspan="2">Please describe your project further. What problem does your pilot seek to address? Who are the potential beneficiaries and other stakeholders? What are the inputs and activities, and what are the outputs? What does success look like after 12 months of funded research? How will your solution reach the market place? 2500 character limit</td></tr>
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	Hydrogen economy is a promising solution for mitigating the climate change. Drones or Unmanned Air Vehicles (UAVs) operational for long durations and for heavy loads can be made techno-economically feasible only by hydrogen powered fuel cells. Heavy duty UAVs (HD-UAVs) are suitable for quick delivery of medicines / food during pandemics / natural disasters and essential goods during the normal times. Frequency of natural disasters has increased because of the climate change, and one needs to be ready for facing these challenges. HD-UAVs with multi-spectrum cameras and sensors are also useful for precision farming and harvest optimization. Farming has to be made climate-change-proof, and the precision farming and harvest optimizations would enable one to overcome this problem. As experienced from the recent Covid-19 pandemic and the floods in India, it was seen that the most affected communities are marginal poor communities cut-off from transport and communication in vastly spread under-developed rural areas and migrant workers in urban areas. Hydrogen economy if made techno-economically viable using green hydrogen, it would solve the climate change challenge caused by the greenhouse gases. We plan to use electrolyser run by solar or hydropower to produce hydrogen; thus hydrogen will be zero-carbon source. Hydrogen-powered drone is one application in which the use of hydrogen wins over the other power sources. For example 5000 Watt Lithium battery weighing 20 kg can run a drone for 20 minutes, but with same weight of Hydrogen-tank with fuel cell can run it for 60 minutes. We plan to create one demonstration unit covering 15000 sq-km area with One heavy-duty hydrogen powered drone to provide services to the community living in the region. The unit will act as a hub for the region covering a radius of 70 km. An app (like Uber) will be developed for booking the service in normal times. During pandemic or disaster periods it will be used for critical mission applications. Hydrogen filing station will be developed using the green hydrogen produced by water electrolysis. A team will be trained to run the centre. The unit will run commercially with no-profit-no-loss basis. We along with the Government of Maharashtra will prepare a plan for creating one such hub in every district of Maharashtra (total 36 districts). A business model will be created to run a similar centre for commercial use.	
12.	What is 'technological' about your proposed solution and why might this be appropriate to the challenge areas? *1000 character limit*	Technology part is of connecting hydrogen economy to UAV technology for mission critical applications. Another part is of developing a platform like Uber for booking drones. Third part is of innovations in producing green hydrogen.
13.	Is your proposed solution a response to the impacts of COVID-19, or an effort to contain the pandemic? If so, please explain. *1000 character limit*	Heavy duty UAVs (HD-UAVs) are suitable for quick delivery of medicines / food during pandemics / natural disasters and essential goods during the normal times. Frequency of natural disasters has increased because of the climate change, and one needs to be ready for facing these challenges.
14.	Does your proposed solution contribute to combatting climate change or promoting a greener planet? If so, please explain.	We propose to use high technology and sustainable methods in this project. Hydrogen economy if made techno-economically viable using green hydrogen, it would solve the climate change challenge caused by the

	1000 character limit	greenhouse gases. We plan to use electrolyser run by solar or hydropower to produce hydrogen; thus hydrogen will be zero-carbon source. In hydropower a lot of power remains unused: hydroelectric plants reduce production at night due to a lack of customers, so water flows unused. Continuous production with the use of excess capacity for the production of hydrogen increases production capacity and increases the economic efficiency of power generation while using hydrogen as a substitute for fossil energy sources. HD-UAVs with multi-spectrum cameras and sensors are also useful for precision farming and harvest optimization. Farming has to be made climate-change-proof, and the precision farming and harvest optimizations would enable one to overcome this problem.
15.	How is your proposal relevant to the development challenges of India? *1000 character limit*	As experienced from the recent Covid-19 pandemic and the floods in India, it was seen that the most affected communities are marginal poor communities cut-off from transport and communication in vastly spread under-developed rural areas and migrant workers in urban areas. By using Drones, we are frog-leaping in providing necessary services to the most under-served people in the most critical times of their lives
16.	What consideration have you made of gender in developing your concept? Could your project address gender inequality or other kinds of inequality? *1000 character limit*	We address the economic in-equality by providing services to the poor communities. We address the urban-rural divide by providing similar services in rural areas as those getting in urban areas. We address the social in-equality by proving services to all. We will address gender in-equality by recruiting more females in our team
	Notes: *Please be kindly reminded of the primary criteria: relevance to the environmental and/or C19 agenda. See boxes 13 and 14.* *Except box 5, all boxes require mandatory response.* *In the interests of fairness, proposals that exceed the character limits will not be considered.*	