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Recognizing the Potential to Reduce GHG Emissions Through Air Transportation Electrification

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Introduction

Advances in electric aircraft development provide opportunities for new Regional Air Mobility services that can enhance the connectivity of regions by using underutilized existing airport infrastructure and integrating the use of electrified ground transportation. This research project seeks to determine how RAM using electric/hybrid electric aircraft can provide new high-speed transportation for high-priority passenger and cargo movement within Fresno County and connections to coastal urban centers.

As the rapidly emerging development and deployment of zero-emission aircraft powered by battery/hybrid electric motors are revealed to the public and begin to enter service, state and local governments around the country should begin to evaluate the potential of this technology to improve connectivity, reduce greenhouse gas (GHG) emissions, and generate new economic activity. There are over 140 public-use airports in California with 32 of those in the San Joaquin Valley. Many of these airports are in proximity to the growing population and commerce centers, particularly in the San Joaquin Valley, but are underutilized. The development of advanced electric/hybrid electric is opening the door to using these airports for both passenger and freight movement through significantly reduced operation costs associated with electric propulsion.

Study Methods

When analyzing the potential for electric aircraft to replace some ground transportation options, it is necessary to look at the distances traveled in different scenarios and then select the aircraft best suited to fulfill the mission. For this, we examined the GHG emissions of conventional fuel versus electric aircraft for high-speed zero-emission transport of high-priority passengers and freight. The analysis method used by the study involved VISION, a model developed by the Argonne National Laboratory

Transportation Systems Assessment Group, which provides estimates of the potential energy use, oil use, and carbon emission impacts of vehicle technologies, light, and heavy, and alternative fuels through the year 2050. This allowed for the model to track vehicular turnover internally to calculate aggregate fuel consumption. The next step consisted of finding out the total emissions per person commuting in different transportation modes. This was possible by dividing the total emissions per vehicle type in 2017 by the average occupancy of each category.

Electric aircraft provide opportunities for Regional Air Mobility services that enhance connectivity using existing airport infrastructure and ground transportation.

Findings

Results of the analysis found that some combination of coal gasification with carbon capture and sequestration and/or nuclear energy would likely be necessary to promote carbon intensities for hydrogen and electricity reductions. Biofuels, in contrast, would not be able to allow major reductions in carbon emission reductions by themselves due to supply constraints. However, combining such alternate fuels with other solutions could potentially achieve greater results.

This project evaluated the GHG emissions for relatively small aircraft currently used in the San Joaquin Valley to provide air charter services for flights from Fresno to the Bay Area and Los Angeles region, and the numbers are significant. Fortunately, zero-emission electric propulsion for this class of aircraft is now becoming a reality with the advent of aircraft such as the Eviation Alice and electric propulsion conversions for Cessna 208 Caravans.

Policy/Practice Recommendations

It is anticipated that by 2030 zero-emission electric aircraft will be supplanting existing turbine and piston-powered aircraft in air charter and flight training operations, driven by lower costs of operation and lower noise for communities where these aircraft operate. The lower cost of operation for electric propulsion aircraft will make them more competitive with ground modes for larger numbers of people. Further, the time savings for flying vs. ground transport will open many new opportunities for smaller communities in California to have greater connectivity with the larger urban centers, thereby improving the economies of these communities.

About the Authors

Dr. Roa is currently an Assistant Professor at California State University, Fresno. The aim of Dr. Roa's research is to make air transportation sustainable. This includes researching renewable energy supplies to support the aviation industry's transition to fully electric systems, as well as evaluating required modifications and additions to airport infrastructure in order to accommodate new technologies.

Mr. Oldham is the President/CEO of New Vision Aviation, Inc. A general aviation pilot since 1974, Mr. Oldham is the project lead for the Sustainable Aviation Project that has deployed four Pipistrel Alpha Electro aircraft in Fresno County and developed the first network of electric aircraft charging infrastructure in the United States.

Marina Lima has a master's degree in Civil Engineering. Marina's particular interest in air transportation comes from her lifelong passion for traveling all over the world. Marina's research is focused on investigating air mobility technologies for a more sustainable air transportation in terms of operation, regulation, market and infrastructure.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2223

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