

Bringing A Different Meaning To Air Travel

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Combustion of fuels for transport is a major source of air pollution and remains a serious problem in large urban areas. Typical engines burn gasoline to power vehicles and emit carbon dioxide, carbon monoxide and water vapor in the form of exhaust. But what if there were a way to run an engine with a source that's not only cleaner than hydrocarbon fuels but also more abundant?

The answer, according to two researchers, is in the air.

Bharat Raj Singh and Onkar Singh, who detail their work in the *May issue of the Journal of Renewable and Sustainable Energy*, have developed a mathematical model of a small air turbine that would run on compressed air.

The use of compressed air for running an air turbine is more environmentally friendly than typical engines because there is no combustion involved in producing shaft work. Additionally, the abundance of air makes the resource readily available when needed.

The researchers analyzed a small capacity air turbine with vane type rotor. The air turbine is designed to receive compressed air through an inlet port. Once air enters into the turbine and creates impact, it expands inside the rotor vanes and develops rotational torque causing the rotor to rotate with a series of impingement and expansions with each revolution. Expanded air is then released into the atmosphere through an exit port.

Vaned rotor motors are most often used in applications requiring low to medium power outputs. The turbine detailed in the paper is designed to output 4 kW (or 5.1 HP) of power and can be fitted on a motorcycle. In developing countries where light vehicles are a major source of public transport, such technology could be employed to cut emissions substantially.

"In India, the major source of emission is light vehicles and its contribution is around 77.8 percent," says the paper's principal author, Bharat Raj Singh, a researcher at SMS Institute of Technology, Lucknow, India. "In view of zero pollution in this technology, 50 to 60 percent of present emissions can be reduced."

The proposed air turbine, combined with a compressed air cylinder for storage of working fluid, could replace the internal combustion engines currently fitted on motorcycles. Once filled with compressed air (with a pressure of 20 bar), the proposed air turbine and air tank could run a motorcycle for up to 40 minutes. Sizing, shaping and fitting of higher capacity air tanks to store sufficient air for longer runs, however, pose major hurdles.

For now, a person utilizing such a vehicle will need to stop around every 30 Km (19 mi) to re-fill their tank with compressed air.

"[The] desired infrastructure of compressed air filling stations will be needed [and] may be created upon successful implementation of this compressed air technology," Singh says.

The ultimate goal is to use renewable resources like solar and wind energy to compress the air and run not just light vehicles but also domestic appliances, he adds.

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