

# The Hybrid Compressed-Air Revolution: a New Generation of Eco-Friendly and Self-Sufficient Energy Autonomous Vehicles A case study for Turin Metropolitan Area

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## Abstract

We stand on the brink of an outstanding revolution. The 17 Sustainable Development Goals of the United Nations resolutely encourage an extensive worldwide employment of three pillars of sustainability: Environment, Economy and Society. Regrettably, such objective is yet so far from being achieved. Pollution and PM10 concentrations are administrations' worst nightmare and vehicles running on roads are their major producers. A tremendous number of big cities is ineffectually implementing expensive anti-pollution systems (European directive 2000/69/CE) and adverse health effects (pulmonary, oncologic disorders) are undergoing a rocketing increase. Hybrid Compressed-Air Vehicles (CAV) are now providing the most comprehensive answer to present urban pollution problems and are consolidating as a unique foreseeable successful strategy.

CAVs are vehicles working on pressurized atmospheric gas. Such incredible machines are an outstanding and one-of-a-kind prodigy. In fact, no combustion occurs and toxic emissions are not produced. Furthermore, not only is the environmental issue resolved, but enormous economic savings and peculiar safety conditions are also achieved as no fossil fuels are required. This is why the Indian multinational Tata Motors invested more than USD 30 million to launch a car with a compressed-air engine. The experiment was an astounding success and the company is now planning a full-scale production by 2020. Although pioneering, CAVs are not entirely self-sufficient because air refuelling is required and may take more than 4 hours. Hence, a next generation of hybrid CAV vehicles is emerging. They are an unparalleled perfect blend of 4 different avant-garde technologies: dye-sensitized solar cells (DSSC), nanostructured lightweight and superstrong ceramics, Hydrogen fuel cells and Salt-Water batteries. Remarkably, since such technologies already exist, a renewable energy revolution is going to happen soon. It is thus of primary importance that local administrations get ready to the dawn of a new era.

The paper is divided into three sections. The first one will accurately elu-

cidate the existing anti-pollution European and Italian policies. The second one will provide an extremely detailed description of CAV and the above-mentioned cuttingedge hybrid technology. Finally, the third one will perform a comparative economic analysis of compressed-air vehicles 'introduction in Turin metropolitan area. The present work has been composed profoundly believing that only with such an innovation process, will Turin (and the entire country) be able to achieve its green politics goals (City Council Ordinance no 110, 14/10/2005).

This paper clearly and unequivocally demonstrates that the introduction of CAV automobiles would dramatically cut regional and national expenditure. An economic impact study of a Turin-Milan car trip has been conducted using a diesel, an electric and a CAV car. In the latter case, costs were cut by approximately 50% and further technological implements (hybrid vehicles) may allow a realistic cut by up to 72% in the foreseeable future. The advantages for Turin would be beyond all expectation, because never before has the utopian self-sustainable developmental model been accomplished in an effective metropolitan background.

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### **Samuele Cannas**

Frequenta il 4° anno di Medicina presso la Scuola Superiore Sant'Anna di Pisa. Nel 2017 ha conseguito la laurea di 2° livello *summa cum laude* in Pianoforte Principale presso il Conservatorio di Cagliari. Nel 2015 ha ricevuto l'onorificenza di *Alfiere della Repubblica*, come uno dei 25 migliori studenti d'Italia. È vincitore di numerosi premi nazionali, tra cui 2 Reti di Idee e di molteplici titoli internazionali.

# The Point-to-Point revolution: a Global Network of Ultra-Low-Cost intercontinental narrowbody connections A case study for Turin Caselle Airport

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## Abstract

Hub-and-spoke (H&S) model, and the point-to-point (PTP) model. Notably, PTP networks have been the core of the winning strategy by which Ultra-Low-Cost Carriers (ULCCs) have hugely cut the costs of short/medium-haul travel. Yet, so far, it has never been applicable to long-haul travel, because long range has only been available in large widebody planes, which indeed need a hub-based feeding system to reach a profitable load factor (i.e. high percentage of sold seats).

This is about to change radically, and the reason lies in the extraordinary technological improvements that are making current airplanes an unprecedented miracle of fuel efficiency. As a result, not only are modern jetliners extremely eco-friendly, but they can also benefit from an outstanding increase in range. In April 2018, Airbus announced that their next-gen narrowbody A321LR had flown 178 passengers for 11 hours non-stop, from Toulouse to Mahé (7,610 km). The aviation market was radically shocked. It proves that the PTP model, which brought ULCCs to their tremendous success, can already be applied on world scale also to long-range travel, leading to a massive cost cut. There is a general and widespread consensus in the aviation industry that all this is going to happen, and very soon, since the technologies required already exist. It is thus vital that regional administrations understand the need to take appropriate measures as quickly as possible, so as to benefit from the upcoming PTP revolution.

The paper is structured in three sections. The first one will profusely discuss the pros and cons of the H&S and PTP systems. The second one will analyse in great detail the technical marvels that are making today's airplanes so incredibly fuel efficient. And the third one will examine the case of Turin Caselle airport, and propose an avant-garde development plan that could transform it into the next-gen aviation state-of-the-art. The Author strongly believes that, by such a plan, Italian aviation not only could overcome the ongoing crisis, but even take advantage from it by reorganizing into a modern PTP narrowbody network, thus anticipating all other Euro-

pean countries in this leap forward.

This paper clearly and unequivocally demonstrates, by a reliable and extremely detailed economic simulation of a Turin-New York flight, that the PTP system could cut the operational costs of long-range travel by almost 50% compared to today's gold standard. Combined with a ULCC-like business model, air fares could undergo a cut of up to 80%. Such a change would provoke an unimaginable economic growth for the Turin region, by a monumental boost of both tourism and corporate development. After all, it is no coincidence that the European Commission has defined low-cost flying as a country's economic multiplier, and allocated EUR 26.25 billion in the Connecting Europe Facility (CEF) grant to co-fund projects like the one described in this paper.

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### **Giulio Deangeli**

Allievo Ordinario di Medicina presso la Scuola Sant'Anna di Pisa, classificatosi 1° al concorso nazionale di ammissione. Nel 2013 è vice-campione del mondo di Neuroscienze alla IBB. Nel 2016 vince la borsa di ricerca europea Amgen Scholars a Cambridge, ottenendo il 1° premio. Nel 2018 è il 1° italiano insignito della borsa di ricerca mondiale HIP a Harvard. Vincitore di numerosi premi scientifici fra cui Harvard iGEM Biohackathon e 3 Reti di Idee.

# Sustainable mobility in the Venice lagoon

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## **Abstract**

Sustainable mobility is a crucial issue to consider for town planning. This is especially true for Venice. As one of the most famous cities on water and UNESCO World Heritage Site, high tourist flow is present, which need efficient public services. Moreover, different tasks such as public transport supply of goods, cleaning operations, sanitary service and safety is almost exclusively carried out by means of specific boats. Consequently, each craft operating in the Venice Lagoon should be able to assure safe navigation in different areas: inland waterways, sheltered, coastal and open waters. Beyond that, another issue to be considered is the reduction of both air and noise pollution to improve general comfort of the urban life.

This paper focuses on two projects which enhance sustainable mobility in the Venice Lagoon. The first deals with eco- friendly solution to public waterbuses: a new small passenger craft with hybrid-electric propulsion. An innovative design has been conceived in order to get wave reduction to lower both the impact on buildings and the energy consumption of the craft. Moreover, this hullform would enable the Zero Emission Mode (ZEM) navigation.

Secondly, I will describe responsible tourism's project, promoted by Cooperativa Sestante di Venezia. Boating excursion are organized using a craft equipped with electric engine and solar panels. The organization is partner of the BIOSIRE European Project which aims to establish a shift toward bio-diesel and electric propulsion for vessels in tourist areas.

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## **Margherita Tess**

Born in 1997, Margherita is a Bachelor student of Language, Culture and Society of East Asia at Venice Ca' Foscari University. She's a selected student of the honours university college Ca' Foscari International College, where she studies Environmental Sustainability. Her main areas of interest are Japanese society and environmental justice.

# Roma: mobilità sostenibile tra centro storico e periferie

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## Abstract

Lo scopo del contributo sarà offrire una panoramica esaustiva delle politiche del territorio in materia di mobilità sostenibile nella città di Roma, evidenziando le difficoltà di gestione del servizio di trasporto pubblico locale e ponendo l'attenzione sul rapporto centro-periferie e sulle peculiarità del territorio.

Roma è una città composita, dove ad un centro storico importante, che vede un costante afflusso di turisti, si contrappone la realtà delle periferie, "i dormitori" della città, frequentemente contaminate da degrado e criminalità organizzata. Il trasporto privato su gomma, spesso avvertito come unica possibilità di collegamento per questi quartieri, ha un costo ambientale, economico e sociale insostenibile nel lungo periodo.

D'altra parte, un efficiente sistema di mobilità sostenibile (TPL, ciclabili ecc.), oltre ad alleggerire l'impatto ambientale ed economico, contribuirebbe a rendere meno isolate queste realtà periferiche e costituirebbe una concreta misura di inclusione sociale.

Partendo dall'analisi del report "Living, Moving, Breathing", pubblicato da Green Peace nel Giugno 2018, dove Roma risulta ultima classificata nel ranking sulla mobilità sostenibile, si analizzeranno diverse prospettive di intervento: le politiche dell'amministrazione, come i "punti fermi" del piano PUMS (Piano Urbano Mobilità Sostenibile) Roma; le proposte della cittadinanza attiva, come il progetto "Metrovia, sistema integrato di trasporto su ferro" ed il progetto "Biciplan, la ciclabile infinita"; le ultime novità, come l'introduzione del Congestion Charge nella zona dell'anello ferroviario di Roma ed il referendum consultivo promosso dai Radicali per la messa a gara del servizio di trasporto pubblico finora offerto da ATAC.

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## Silvia Lazzari

Studentessa della Scuola Superiore di Studi Avanzati Sapienza di Roma e laureanda in Giurisprudenza in Diritto Amministrativo. I suoi interessi di ricerca riguardano il rapporto centro-periferie, la gestione dei beni e dei servizi pubblici e gli strumenti di prevenzione della corruzione e contrasto alla criminalità organizzata.