

SEAMless Mobility: Pathway to Zero Emission Future Without Congestion

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Summary

Population growth in general and of the middle class in particular will place greater pressures on transportation. As an increasing percentage of the global population moves into urban areas, this will result in greater traffic congestion and pollution. This presentation promotes a sustainable transportation model as a pathway to zero emissions and significantly reduced pressure on road infrastructure. SEAMless Mobility: Shared, Electric, Autonomous, Multimodal Mobility based on data shared seamlessly with consumers through technology. Complete information, including pricing reflecting environmental impact of every trip, will allow consumers to make more sustainable travel decisions.

Keywords: autonomous, car-sharing, EV, mobility, sustainability

1 Introduction

The global population is expected to reach 8 billion people by 2025 and urban areas will be home to approximately two-thirds of the world's citizens (from 54% in 2014) [1]. Every day, 216,000 births increase the planet's population. Every day, more than 200,000 people move to densely populated cities or expanding suburbs. Cities are becoming increasingly crowded and the road/highway infrastructure is increasing congested.

According to Daimler's CEO, Dieter Zetsche [2], the increased population translates into great news for the automotive industry. By 2025, the world's automotive market will have grown by about 30%, resulting in sales of almost 100 million passenger cars per year or 270,000 new cars every day. Can our cities, can our planet handle this many vehicles? Is this a sustainable transportation solution?

2 Demographic changes

2.1 Population growth

Consider the following: every month, the global urban population increases by 5 million people. That is the equivalent to a rather large-population city appearing every month.

The following graphic representations from UNICEF depict countries "with urban populations exceeding 100,000. Circles are scaled in proportion to urban population size." The fuchsia areas show populations where more than 75% is urbanization; the yellow areas depict 50-75% urbanization; the blue 25-50% urbanization and the green, less than 25% urbanization.

By 2050, predominantly rural jurisdictions (green) will have disappeared, giving way to clearly urbanized areas (yellow and fuchsia coloured circles). By then, few countries will experience urbanization of less than

50%. In fact, North America is expected to be 90% urbanized while most European countries' populations will be more than 80% urban and China's population will be 73% urban. The number of megacities (population of 10 million or more) is expected to balloon from 28 today to 41 by 2030. [3]

Large-scale urbanization will be accompanied by significant demographic changes, including a growing middle class, a shift in the age of the population as well as a tremendous rise in the number of people with disabilities.

2.2 Growth in the middle class

As the population grows, so does the middle class. According to the OECD, the "world's middle class will swell from 2 billion to almost 5 billion by 2030" and "global middle-class spending should rise from \$21 trillion today to \$51 trillion in 2030". [4]

These consumers will demand a higher standard of living and greater access to mobility. Many will seek to access the convenience that the individual passenger vehicle affords.

By 2025, worldwide transport-related greenhouse gas emissions will be 30% higher than 2005 levels. Transport energy bills will also skyrocket and higher levels of energy consumption could pose a threat to global energy security. Traffic congestion will bring cities worldwide to a standstill. Can the Earth sustain more than two billion vehicles? [5] Clearly our generally inefficient transportation systems will lead to gridlock in most cities.

Driverless vehicles offer a more sustainable transportation solution.

2.3 Aging population & the disabled

Decreasing mortality and declining fertility rates result in an aging population. Globally, the number of older persons (aged 60+) is expected to more than double, from 841 million in 2013 to more than 2 billion in 2050. [6]

These older individuals remain increasingly healthy and active. They will demand access to mobility. However, millions of older individuals are incapable of driving. Consider that in Canada alone, it is estimated that more than 120,000 people hold a valid driver's license and suffer from some form of dementia [7]. With an aging population, this number will increase considerably.

In a decade, we can expect to have 1.2 billion disabled individuals. Many of these individuals will be among the aging.

These older and disabled individuals, many living on fixed incomes, cannot afford to use taxi services regularly to get around. With the relatively high levels indebtedness of many governments, it is already difficult to provide the required healthcare to this segment. It will almost be impossible to guarantee transportation services to the elderly. A lower-cost, easily accessible mobility solution needs to be provided.

3 Environmental implications of electric vehicles

As reiterated at the 2014 UN Climate Change Conference (December 2014, Lima, Peru), the overarching goal is to reduce GHG emissions in order to limit the global temperature increase.

Transportation is a key contributor to greenhouse gas emissions and climate change. CO₂ emissions from transportation represent 23% globally and 30% in OECD countries of "overall CO₂ emissions from fossil fuel combustion. The sector accounts for approximately 15% of overall GHG emissions" and "road sector emissions dominate transport emissions with light-duty vehicles accounting for the bulk of emissions". The trend is worrisome. Global CO₂ emissions from transport have increased by 45% between 1990 and 2007 and under a "business-as-usual" scenario, "including many planned efficiency improvements, global CO₂ emissions from transport are expected to continue to grow by approximately 40% from 2007 to 2030". [8]

But cleaner cars do not resolve the problems associated with inadequate infrastructure and related waste in time and resources. The number of vehicles on our roads must be rationalized and better adapted to our needs.

Despite the fact that numerous models of electric vehicles are available and that the large majority of motorized trips can be undertaken with EVs, numerous factors contribute to keeping electric vehicles a small minority of cars circulating on our roads. Some of these factors include a higher initial purchase price, lack of understanding of EVs by consumers, range anxiety, an underdeveloped public charging infrastructure and lack of availability in jurisdictions where zero emission vehicles are not regulated by law.

In many jurisdictions around the world, government incentives and relatively lower electricity prices, combine to make electric vehicle ownership and operation financially more advantageous than conventional vehicle ownership.

4 Limited public funding available

Most governments, facing economic difficulties, cannot continue to build new highways and infrastructure or to subsidize a transit system that incurs systemic losses despite its increasing popularity to meet the urban demographic boom and rising congestion.

Smart vehicles can be part of the solution as they can help users choose the best transit routes, avoid accidents and thus help reduce congestion.

5 SEAMless™ Mobility: Sustainable transportation solution that can help lower congestion

5.1 Multimodal transportation

The economic difficulties of recent years combined with an increased number of mobility options for urbanites have resulted in many of the latter turning to car sharing, ride sharing, biking, walking and transit for their mobility needs.

A report by Morgan Stanley calculated that cars are generally only used for about 4% of their lives. This means that the world's \$20 trillion car fleet achieves only 4% utilization, leaving 8.4 trillion hours per year not used. Sharing is therefore an important part of a sustainable mobility solution. [9]

While Western culture is still strongly tied to the automobile, car sharing is gaining popularity thanks to its numerous environmental and economic benefits. In fact, car sharing is growing in importance, as a form of urban mobility, around the world.

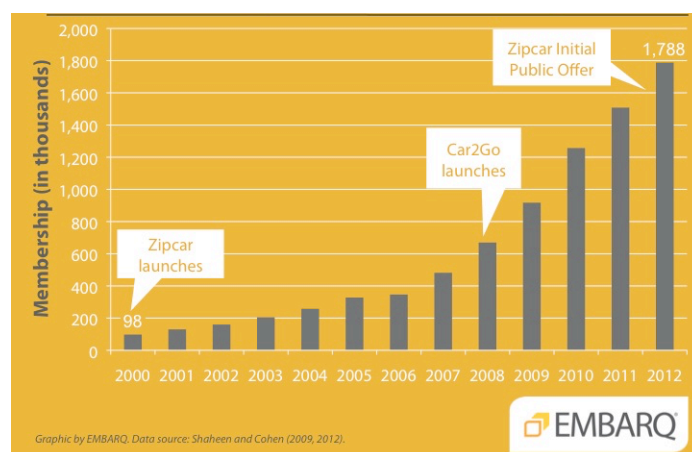


Figure 10. Global growth of car sharing [10]

Ride hailing, fuelled by ease of use and access, is also gaining in popularity as a form of urban mobility.

All these forms of mobility (transit (including buses, metros, trains), taxi services, car sharing, ride hailing) are resulting in a more sustainable transportation solution for urban environments. In Helsinki, for example, the municipal government is aiming to eliminate personal vehicle ownership by providing residents with an efficient, easy to use, flexible, well-coordinated, convenient and relatively inexpensive public transit

system. This system will allow people to “purchase mobility in real time, straight from their smartphones”. This is a perfect example of multimodality being used to create a sustainable transportation system. The introduction of a single pass providing access to a fully integrated transportation network in a multimodal ecosystem will provide commuters with complete, affordable, on-demand mobility solutions that will make individual car ownership pointless. [11]

5.2 Complete information incentivizing citizens for making environmentally respectful decisions

The Helsinki example [11] is based on technology connecting mobility service information and providing it to consumers so that they can make informed decisions.

But such connected urban networks can only be developed if the different mobility actors agree to integrate their services to build a real connected transportation system. While some car manufacturers have embraced the rise in multimodality, some consider it as a threat to their established market and business model. Daimler is one of the automotive OEMs that have demonstrated a tremendous ability to adapt to this changing transportation ecosystem. Consider the fact that Daimler has vertically integrated forward into the car sharing space with Car2Go. Consider the fact that it is one of the leading developers of driverless technology. Consider the fact that it recently acquired mytaxi and RideScout.

To ensure that an integrated mobility system is as environmentally friendly as possible, it should incentivize residents to make the correct mobility decisions. The saying “what gets rewarded, gets done” should be the basis of such a mobility incentive program where citizens are invited to select the least polluting mobility option among a variety of options presented on their smartphones.

5.3 Driverless / Automated vehicle technology

Driverless technology is being discussed increasingly in the news. The annual Consumer Electronics Show has been dominated by driverless technology advancements over the last couple of years. Allowing technology to drive the vehicle presents tremendous opportunity for a more sustainable, accessible and safer mobility. Further, given that vehicles are available whenever one needs them makes the driverless vehicle the ideal shared vehicle.

Some of the numerous benefits associated with this technology are discussed following.

- **Safety:** Today, more than 1.2 million people are killed annually in car-related collisions and multiples more are injured. It is estimated that 93% of these collisions are caused by human error. [8] By eliminating such human error, we can save lives and avoid costly and painful injuries.
- **Ease of use and lower cost:** If vehicles can be summoned through the use of an app on a smartphone, vehicle ownership is not as necessary or convenient as it is today. As mentioned earlier in this text, in a context where passenger cars are utilized on average 4% per day, usage makes more sense than ownership. Moreover, usage is less costly than ownership.
- **Accessibility:** Such vehicles can provide safe mobility to our elderly and disabled, allowing them to remain autonomous, maintain their quality of life and be productive (in the case of the disabled who work outside their homes), all without placing additional pressure on governments to provide costly transportation services.
- **Fluidity in circulation:** Shared driverless vehicles will drive in closer proximity to one another. They will also navigate streets and highways with driving behaviours that promote fluidity in circulation. Such fluidity among shared vehicles will increase the capacity of existing road and highway infrastructure.
- **Better use of time:** The time currently spent driving, sitting in traffic or looking for a parking space can be better utilized. Time in the vehicle can be productive or restful. Upon reaching one’s destination, the user need no longer look for a place to park as the vehicle moves on to its next assignment.
- **Better use of urban space:** If vehicles are being shared, fewer vehicles are required and urban spaces need not be packed with parking areas on streets and in buildings. These parking spaces can be used for green spaces, for example, or for rental properties allowing municipalities to collect additional tax revenue.

- Environmental friendliness: Today, drivers waste significant time and fuel looking for a parking space and sitting in traffic. Further, driving habits of many motorists result in inefficient use of fuel. If a driverless vehicle had to park (most would move from user to user, instead of parking), it would have the “intelligence” required to move into a parking spot without driving around wasting fuel and time. In addition, a connected intelligent vehicle would be able to determine the optimal route, minimizing the energy required. Finally, its driving techniques would result in a more efficient use of energy.

5.4 The link between electric and driverless

Several respected organizations around the world, including Électricité de France (EDF) [12], have made the connection between electric propulsion and driverless technology. In fact, driverless technology is a facilitator for electrification of transportation. Today, a motorist purchases a vehicle that meets ALL of his/her road travel needs, including those rare trips of several hundred kilometres. Given the limited autonomy of most electric vehicle models on the market today, these rare lengthy trips would require the motorist to make numerous stops for recharging (assuming there are charging stations available along the route). So, despite the fact that an electric vehicle would meet the large majority of travel needs of motorists, most EVs are not ideal for all trips. At least not yet!

In a shared, driverless vehicles context, the passenger need not think about vehicle autonomy or charging. The intelligent vehicle takes care of all that and more. The shared driverless electric vehicle would be ideal for most urban travel. Further, for a fleet operator, the electric vehicle, in many jurisdictions, is less expensive to operate than its conventional counterpart.

Having urban fleets of predominantly electric driverless vehicles will therefore result in a more sustainable, less polluting transportation system.

5.5 Tomorrow’s transportation will be SEAMless™

Tomorrow’s transportation system will offer SEAMless™ mobility. It will be fully automated and electric but it will also be shared and multimodal. Multimodal transportation networks, combining car- and bike-sharing solutions, railway, metro (subway) and bus networks, are facilitated by complete information available (possible mobility options with time and cost) free of charge on a smartphone. Apps, such as RideScout, are already providing much of this information. The seamless interconnectivity between the various modes of transportation is often what’s missing today.

Already, multimodal systems are evident with transit systems partnering with car sharing providers, for example. In Montreal, the transit property (Société de transport de Montréal) offers consumers packages to purchase bus passes and gain access to Communauto car sharing at reduced rates. Car sharing vehicles are often conveniently located around Montréal metro stations to help customers with the first/last mile connection. The SuperHUB project in the European Union is another example of multimodality.

5.6 Environmental impact

A SEAMless Mobility system will mean that the most environmentally responsible and cost-effective form of transportation is utilized to move an urban population. Articulated buses traveling with two passengers on a Sunday morning will be a thing of the past. A centrally controlled traffic system will ensure driverless pods or other vehicles, combined with trains/ subways/ other large transit can bring a user from point A to point B efficiently.

5.7 Government vision and planning are required

The revolutionary change in mobility that will take place within the coming decade will create tremendous opportunity as new industries and business models are shaped. Numerous businesses, will however be disrupted and others obliterated. Those that feel threatened by this change will try to delay its introduction. Governments need not only recognize the need for change to achieve sustainable mobility but be visionary enough to pave the way for such change. To minimize the pain associated with labour displacement and to maximize the benefits of this change in transportation, governments need to start planning the SEAMless™ mobility systems of tomorrow. This includes developing a roadmap that takes infrastructure, people and systems into consideration.

Given the ease of using this hassle-free form of mobility, where the vehicle picks users up and drops them off at their destination, where one can be work or sleep while in the vehicle, it may encourage an increase in the number of vehicle km travelled. Government foresight, planning and regulation is required to ensure that automated vehicles are used in sustainable manner, maximizing use of the shared, electric mobility modes.

6 Conclusion

With a growing, highly urbanized population, moving to a more sustainable transportation system is not an option. The SEAMless™ Mobility model should be one that governments strive to achieve by laying the groundwork today. Given the number of stakeholders that will be involved to achieve such a system, as well as conflicting interests that will need to be weighed against environmental considerations, the work needs to begin immediately and extend beyond the four-year government terms.

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Catherine Kargas, MBA, is Vice President at MARCON where, over the last 25 years, she has provided market research and business strategy consulting services to private and public sector organizations operating in variety of industries, including transportation, insurance and energy. Catherine is the Chair of Electric Mobility Canada, the national organization promoting electrification of transportation in all its forms, and founding member of the Transportation Evolution Institute. Catherine completed undergraduate studies in Marketing and International Business at McGill University. She also holds an MBA in Strategy from McGill University.