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N°25 | AUTUMN 2017



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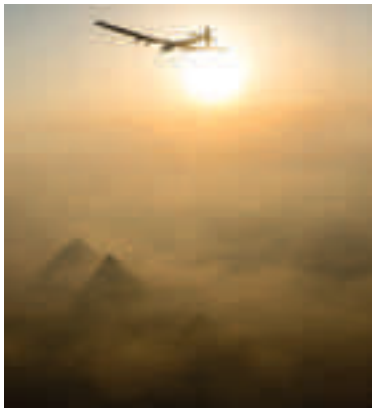
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MOBILITY



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Cover image: End-user about to enjoy a ride with an eCooltra e-scooter in Lisbon.

Source: ElectricFeel

Violeta Bulc

Commissioner for Transport at the European Commission



Europe is on the move and transport is changing. Indeed mobility solutions must evolve in order to better serve the public and the business community, and also to reduce its impact on the environment. Today, transport still relies on oil for 94% of its energy needs. If we do nothing, it will be the single largest polluting sector in Europe by 2030. It is time for action.

We are on the brink of a clean industrial revolution and all sectors will be impacted. Transport is no different, and while there will be some disruption in the short-term, in the medium- and longer-term, the changes will bring about massive benefits.

Digitalisation, decarbonisation, investment and the needs of people will be

Our goal is a safe, secure and zero emissions transport network.

core elements in that change, all being pushed ahead by innovation and investment. The focus now is moving towards **Mobility as a Service** (MaaS) for the end user, rather than a more traditional outlook of owning a private car or bicycle. In the future, our transport network will be fully integrated and largely electrified and automated. This will make mobility much cleaner, safer and more accessible to more people.

The low emission mobility strategy launched by the Commission in summer 2017 aims to do three things:

- > Increase the efficiency of the transport system by making the most of digital technologies, smart pricing and further encouraging the shift to lower emission transport modes, such as railways, walking, cycling or waterborne transport.



> Speed up the deployment of low-emission energy for transport, such as advanced biofuels, electricity or hydrogen. Linked to this, we are promoting a greater use of low and zero-emission, as the third goal of our strategy.

> Lower emissions by for example working hard on getting more electric buses on our roads, through a platform for cities we launched in July 2017. We are also reviewing rules on public procurement to boost the market for electric buses, garbage trucks and other vehicles to create demand and economies of scale.

The last point is part of our legislative package **'Europe on the Move'**, which includes measures aimed at making road transport more efficient, for example using charging to ensure that we make

optimal use of existing infrastructure, thus cutting congestion and needless emissions. This November further initiatives will be put forward by the Commission, including new CO2 limits for cars and vans and an action plan to accelerate the roll out of infrastructure for vehicles running on electricity, hydrogen and natural gas.

I hope you see that there are a great many initiatives being undertaken to improve the transport network. There is no single measure that will make our transport system sustainable, rather a mix of measures will help cut the impact of transport on our environment and by extension on our quality of life. Our goal is a safe, secure and zero emissions transport network. The effort will be gruelling but the reward will be great. 

Today,
transport still
relies on oil
for 94% of
its energy
needs...

Captions: 1. Van Hool A330 FC hydrogen bus. Source: Regionalverkehr Köln GmbH. 2. Aberdeen City Council hydrogen bus fleet. Source: ACC. 3. Hydrogen-powered train called "Coradia iLint". Source: Alstom. 4. International Zero Emission Bus Conference 30 November 2016. Source: CTE/Element Energy.

Thomas Klithav gets a cheaper ride by combining the train and a folding bike. **Source:** City of Aarhus / Smart mobility

Serving mobility

Polis reports how cities don't shy away from new technologies to achieve more sustainable mobility.

Writers: Suzanne Hoadley
and Callum Jones

According to the *Analysis of Walking Potential* by Transport for London (2017), one million daily motorised journeys could be walked in London in less than ten minutes. Congestion is a burden to European cities, on the economy, on people's health and on the environment. One way of reducing congestion is – surprisingly for some? – introducing walking and cycling measures.

The **CIVITAS FLOW** project, of which Polis is a partner, explores the impact

that walking and cycling measures have on transport network performance and congestion. It has been found that when cities take such measures, congestion is reduced. Switching from car to walking and cycling is not always so simple, however, and other ways of reducing congestion must be explored for those who travel longer distances. New technologies can facilitate multimodal journeys, and allow people to combine public transport with other modes – a key aspect to truly challenge the number of private cars in a city.



Wind turbines of one of the largest facilities in the Caribbean.
Source: Found on Wigton Windfarm's website

Transport Technology & Mobility as a Service

Technology not only claims to make our everyday lives easier through saved time and convenience; it is also changing our lifestyles. Transport is not exempt from this change, as devices become increasingly connected and more data on commuting habits and journeys are made available. The concept of **Mobility as a Service** (MaaS) is gaining traction thanks to developments in the private sector linking transport and technology. A shining example of this is the proliferation of ride hailing apps that allow users to plan, book and pay for transport all by smartphone. This integration of functions

has the potential to combine different travel types to make previously impractical journeys more feasible. In practice, this could involve integrating commercial transport services, such as taxis, car- and bike-sharing and car-hire, so that the mobility offer is personalised to a traveller's needs. When transport is integrated in such a way, the convenience of such a model could reduce the need for car ownership.

Treating mobility as a service has a series of implications for the organisation of transport, and many challenges to imple-

mentation. Cities are at the core of transport organisation, so they have a vital role to play in any development of MaaS, even when it is primarily driven by the private sector. Such private sector-developed services should include the input of local and transport authorities to ensure that city and regional transport priorities and policies are supported by the changes. A key challenge is to develop commercial agreements between private firms and public transport operators, who may have previously operated all collective transport alone. This is particularly tricky in the field of data sharing, due to



Real-time travel information is essential for those connecting public transport with other modes. **Photo:** Polis/Dagmar Köhler

privacy concerns, but the sharing of data has already started to take place in some European cities.

There is no single universally-applicable model for MaaS and much will depend on the current level of transport integration in each given city. Some cities already have well-integrated public transport systems, with users able to access multiple modes of transport in their journeys while paying for only one subscription, whereas other cities already have a high level of private sector involvement in the provision of public transport. Polis member

Transport for Greater Manchester is currently leading the MaaS work stream in the Future Cities Catapult, which is developing a brief for MaaS and aims to bring the various interested parties together to join up the work being done in the field. This work will explore the models of MaaS that could be implemented, and how they would work towards meeting cities' goals for their desired transport, environment, health, social and economic outcomes.

In London: 1 million daily motorised journeys could be walked in less than ten minutes!

Dresden's interchange with different modes of mobility meeting at the same station. Source: DVB AG.



Postplatz is an interchange in Dresden where different transport modes share one station.

From MaaS to Multimodality

The opportunities that MaaS could bring are various. If access to mobility is made easier, customers may be more likely to use multimodal transport. For example, with an integrated transport package and the knowledge available on their smartphone, a transport user can know that there is a bike free in a nearby bike-share station, calculate the journey time to a train station and check the train schedule to work out the best time to leave and thus reduce waiting times. All of this can be paid for in one transaction via an app, making the process swifter and more practical.

The benefit is obviously that using a car will become obsolete and to encourage active modes of transport. Switching from a car to a bicycle and then a train, the transport user's health is improved

through more exercise. This also ties in with cities' work to improve conditions for walking and cycling. The FLOW project breaks this down to transport planning and brings walking and cycling on an equal footing with motorised modes in transport modelling. FLOW partner cities have tested these improved modelling tools and assessed the impact of walking and cycling measures. FLOW also collected evidence how walking and cycling reduce congestion, as for example the transformation of Nørrebrogade Street in Copenhagen does, where bike lanes and pavements were widened, bus lanes were installed and speed limits were lowered. This resulted in a 45% drop in car traffic and the same reduction in traffic accidents.¹ Introducing MaaS and imple-

menting congestion-reducing measures such as these simultaneously can ease the transition from car to public transport, cycling and walking.

Local and regional authorities see potential that MaaS could improve mobility for more vulnerable or isolated people who are not able to travel due to disability, age, a lack of affordable options, or a lack of adequate transport provision for example in more remote areas. With the option of sharing a taxi by booking as a group and paying online, a tailored mobility offer can mean that the user can become more mobile, through the previously prohibitive costs being shared amongst a group. Having these options available could be a vital part of a transport authority's efforts to serve all parts of the community.

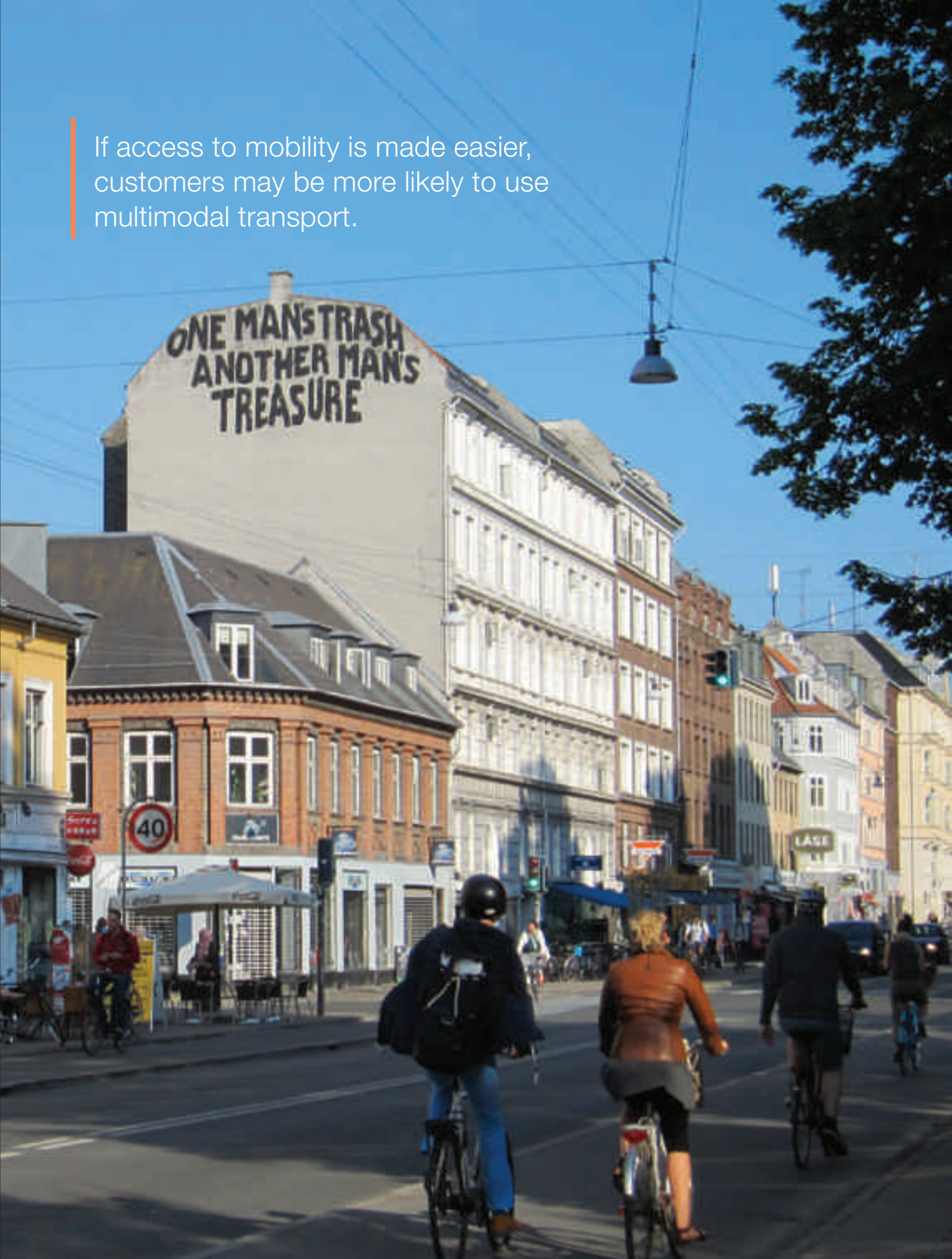
1. ICLEI (2014). In: FLOW: 15 Quick Facts for Cities (2017)

Smart phones facilitate new mobility services.

Source: http://eltis.org/Harry_Schiffer



If access to mobility is made easier, customers may be more likely to use multimodal transport.



What's the Catch?

There are risks that could arise from the introduction of MaaS. Converse to the potential for reduced car use described above, there is a risk that MaaS could encourage higher use of individual modes of transport, such as car- and ride-sharing and taxis, and reduce the likelihood that people will choose to walk or cycle. This is due to the increased ease of use that could lead to people taking the most convenient mode of transport for them, even if it is less beneficial for their health, or increases congestion. Transport planners have trouble forecasting travel routes and mode choices because MaaS is so new. This should change when more pilots of MaaS systems are carried out. Cities need to avoid increased car use with MaaS and

call for greater visibility of public transport and active travel via MaaS; this tandem has been lacking so far.

There has been interest in developing MaaS at European and national levels but this has not been replicated at city and regional levels yet. Polis compiled the perspective of its member cities and regions in a discussion paper on MaaS and found that it is important that city and regional authorities, who play a key role in regulating and providing transport services, contribute to this debate to find answers about the role they play: Should the transport authority be an enabler, a leader or let the MaaS market develop unimpeded?

Cities also need to be able to work out a practical model for commercial agreements between the public and private transport sectors, so that MaaS is introduced in a way that improves mobility for a wide range of citizens, as well as increasing transport efficiency. This would be complemented by introducing measures to make walking and cycling more practical. As with any technological innovation that will have a wide-ranging impact, planning and communication at an early stage can lead to benefits for many years to come: cities must explore MaaS strengths and opportunities while the growing MaaS community needs to better understand cities. 🌀



QUICK FACT 13

One million daily journeys could be walked in less than 10 minutes

LOCATION: London, UK

Download FLOW's "15 Quick Facts for Cities" in 7 languages!

Should the transport authority be an enabler, a leader or let the MaaS market develop unimpeded?



Polis is the network of European cities and regions cooperating for innovative transport solutions. www.polisnetwork.eu

Polis published a discussion paper "Mobility as a Service: Implications for urban and regional transport" (3 September 2017) accessible here: www.polisnetwork.eu/MaaS

The Horizon 2020 FLOW project: developing a user-friendly methodology to assess the effectiveness of walking and cycling measures in addressing urban road congestion: www.h2020-flow.eu



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The Modernisation of Transport: where mobility meets energy efficiency



Writer: Magnus Berntsson

The modernisation and democratisation of means of transports have radically changed our perception of distances and the world in general, while resource scarcity, climate change and geopolitical stakes have obliged us to re-think models of mobility.



Mobility is first of all access – to work, education, goods and services including health, friends and family. Choices in mobility therefore directly affect the competitiveness of territories as well as rural-urban relations, territorial and social cohesion, fairness in terms of health or education, energy security, advancing the circular economy, and so on.

An energy-intensive sector

According to the 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), transport accounts for 14% of global greenhouse gas emissions. Trends in transport are impacted by population growth and changes in demographics as well as by changes in the structure of the economy. And the shift to a service economy considerably increases the weight of transport in greenhouse gas emissions.

Connectivity: essential for regional development

For regions, connectivity is an essential element for economic development. For Europe this is also a question of territorial cohesion, a matter for which the Assembly of European Regions (AER) has consistently been lobbying. This is why members in the AER working group on transport and energy have focused on different aspects of connectivity including railways, regional airports, and electric vehicles. A major aspect of connectivity is now the digitalisation of transports. While digitalisation implies new challenges for regions, for example for health, culture or jobs, it also enable citizens to make more sustainable choices.



Transport accounts for 14% of global greenhouse gas emissions



A major aspect of connectivity is now the digitalisation of transports.



What is “sustainable”?

Defining mobility as sustainable refers to the ability of individuals to provide for their needs without compromising the same privilege to future generations. To minimise the negative impact of greenhouse gas emissions, individuals need information, motivation and/or incentives

to promote more sustainable solutions, for instance, public transport or bicycles, instead of individual cars. The key challenge is to meet environmental, economic and societal sustainability. With the new role of sub-national entities and organisations, after COP21, regions have a crucial role in implementing environmentally responsible and sustainable policies.

Funding climate action

To provide regions with the means to finance climate action AER collaborates closely with the R20 which helps sub-national governments around the world to develop and communicate low-carbon and climate resilient economic development projects.



The ideal pipeline of clean energy projects, however, is not currently happening, even though intergovernmental bodies, national governments, sub-national governments, NGOs, academics, technology providers, public and private financial partners share the same vision and want concrete action. This is due to a number of factors:

- > national and sub-national politicians lack awareness of the long-term political, technical and financial solutions for a sustainable, safe, and

clean economy

- > project developers do not know how to identify, design and communicate the right information to project investors
- > project investors are not sure how low-carbon investments fit into their existing investment instruments and portfolios

The R20 works towards addressing these factors to help build an effective green deal flow at sub-national level. This is made possible by connecting Regions,

Technology and Finance to build sustainable low-carbon projects.

At AER we know that our politicians are here in the name of our citizens and we owe them concrete outputs. Words are not enough when it comes to sustainability, we need to create solutions which will actually impact our territories. This is the essence of our work and the reason why we engage in inter-regional cooperation.



Transport accounts
for 14% of global
greenhouse gas
emissions

Case studies from different AER member regions

Izmir, Turkey

Sustainable mobility at the heart of regional development

Izmir is carrying out a wide-range of actions to improve the sustainability of mobility. With over 4 million inhabitants, Izmir is the third most populous city in Turkey. There are almost 6 million journeys taken in one day in Izmir and two thirds of these are taken in the centre are by vehicle (motor vehicles such as private vehicle, bus, minibus, services, motorcycle). Izmir has set up an impressive range of public transportation including rail (serving 192 kilometres), sea transportation (ferry boats), rubber-tired vehicle transportation, electric buses, bicycles, and the very useful “busses carrying bicycles” allowing passengers to better switch from one public transport to another. These numerous vehicles are optimised by projects and studies that guarantee their proper implementation and usage.

One of the major innovations for more sustainable transport management is the Full Adaptive Traffic Control, Supervision and Information System. This advanced IT system will enable real time management of the different transportation systems, lowering traffic congestion considerably. This will allow for shorter travel times and a decrease in fuel consumption. The Full Adaptive Traffic Administration, Supervision and Information System has won the best project award in all categories at the 2016 Amsterdam Intertraffic Fair.

As Sila Ilgi Akkas, Second Vice President of Izmir Municipal Council says: “Sustainable transports and mobility require a holistic approach which goes far beyond the remit of spatial planners. But more importantly sustainable mobility requires mutual learning and experience sharing because the time is now. Regions have a tremendous potential to make the change happen and they are doing it already.” Izmir hosted the conference “Sustainable Mobility: a brand new world?” organised by the Assembly of European Regions to further exchange on successes and failures in the field of mobility.

Oppland, Norway

Linking waste management to greener transportation

The waste management plant Mjøsanlegget AS in Lillehammer (Oppland-NO) is the result of the growing desire for environmentally-friendly treatment of waste that began in the 1990s in particular with the planning of the 1994 Lillehammer Olympics. The plant has tremendous potential for greener transports as well: during the conversion of food waste into compost and fluid fertilizer, gas is developed; this gas consists mainly of methane. Some of the gas is used by the plant to produce steam for the cooking of the food waste. About 90% of the gas is resold to the waste disposal company GLØR which has been developed a system to purify the gas into fuel. The biogas is sold as fuel by the gas-company AGA. The annual production of biogas at Mjøsanlegget is now 4,3 million Nm³. This represents 2,75 million Nm³ of pure methane, corresponding approximately to 2,7 million liters of diesel/year. This amount can keep 125 buses on the road annually. Currently GLØR is running some of their trucks on this biogas, and another waste disposal company plans to

run its trucks on biogas from 2017. Barriers such as the price of biogas and the biogas distribution infrastructure subsist to develop the use of biogas for public transport while focusing on combatting climate change and prioritising sustainability for regional infrastructure and mobility solutions.

Östergötland, Sweden

Holistic approaches to renewables in public transport

Sustainable mobility is at the heart of the development of Östergötland and Sweden in general. The region has achieved 100% renewable-fuelled public transport thanks to the use of biogas. But the challenge is now how to motivate citizens to opt for the sustainable means of transport that are available for them. This requires a holistic approach, analysing the mobility needs of the population and identifying what triggers their behaviour. The excellency of public transport is a key aspect of the region's transport and mobility strategy.

The construction of Sweden's first high-speed train tracks with the region of

Östergötland right at the heart of the project therefore represents a major aspect of good infrastructure. The tracks will run between the capital – Stockholm – and the second and third largest cities, Gothenburg and Malmö. The first 150 kilometres running from Järna outside of Stockholm to Linköping, the biggest town of Östergötland. This part of the tracks is called Ostlänken ("the Eastern link") and is particularly important for the region as the trains will have the possibility of stopping at stations in both of the region's biggest towns.

Another point of focus is the concept of smart cities and the connection between transport infrastructure and housing. The region's engagement for sustainable mobility includes leading the activities of the AER working group on Transports and Mobility, chaired by Martin Tollén, who explains that "we exchange experiences to better grasp the potential of smart and connected regions, share good practices and address barriers. With the digitalisation of the economy and the growing weight of data management, the working group looks at themes such as connectivity and permeability, in particular intelligent transport systems, seamless transport services; freight management and data; smart green infrastructure and the financing of infrastructure." 



AER is the largest independent political network of regions in wider Europe. Standing by, and working towards, its members' interests, AER provides a platform for best practice exchange on topics ranging from renewables to e-health. www.aer.eu



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Capturing the human element in mobility technology

Bringing together cutting-edge technology and a focus on the user experience has made UIP's flagship mobility platform, Oslo City Bike, one of the world's most efficient bike share systems.

Writer: Ariana Hendrix

Oslo is a city known for its progressive mindset, visible quite literally in the hyper-modern designs that rise over the moody fjord. The harsh angles of the minimalist architecture, painted in a spectrum of gray and cast much of the year against a wintery sky, make it easy to imagine the stereotype of the stoic Scandinavian and the melancholy of Nordic noir. But Oslo

is a city of contrasts, and despite the coldness of its color palate, one does not have to look far to encounter vibrant city streets filled with happy faces—especially since the launch of Oslo City Bike in 2016. With around 9.7 trips per bike per day, it's one of the most efficiently-used bike share systems on Earth. By designing their urban-sharing platform specifi-

cally with users in mind, operator Urban Infrastructure Partner (UIP) is reimagining the future of sustainable urban mobility.

UIP took over the operations of Oslo's previous bike share system in April 2016. With the relaunch, the Norwegian start-up took a technology-driven approach by developing a state-of-the-art software



Urban Infrastructure Partner (UIP) is reimagining the future of sustainable urban mobility.



Oslo's city bikes can be unlocked with the tap of one button in the app.

platform that was carefully designed to fully optimize every element of the system's operations. But while the company's roots are deeply digital, UIP's founders decided early on that they needed to keep their technology grounded by taking a street-level, human perspective in their system development. If the goal of bike sharing is to move more people more effectively through a city, then the most important objective, UIP believes, is to make the service as user-friendly as possible. By combining technology with a hands-on, customer-centric approach, the company wants city biking to be a simple and natural part of people's everyday lives.

Johan Høgåsen-Hallesby, the company's CTO, says that a critical element to creating this kind of real, tangible effect, is managing to convince people actually to choose a city bike – both as a primary mode of transit and as a connective element that “fills the gaps” left by other types of public transportation. For many cities, bike sharing has been introduced as a charming novelty: bicycles are a trendy two-wheel accessory for the modern urbanite and are also a zero-emissions alternative to cars. Providing bike sharing as an option within public transportation is an easy way for a city to show that it's taking steps to become more forward-thinking and eco-friendly. There

is a big difference, however, in having a few bike share stations that contribute to the city's eco-aesthetic but are rarely used, and operating a truly effective bike share scheme that's built for everyday and long-term use.

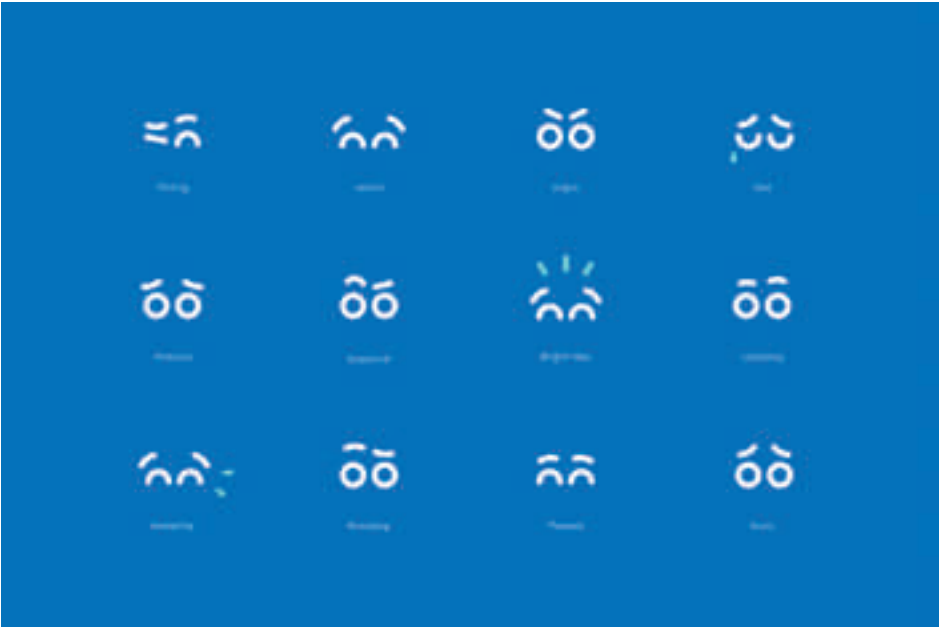
To achieve this kind of daily and continuous usage, Høgåsen-Hallesby explains, the customer experience must be simple and seamless, from the initial sign-up process to the moment that the bike is locked at the end of a trip. For UIP, the first step in achieving this level of usability was to make accessing the system fun, easy, and intuitive. The company's award-winning app, which is used in Oslo and

customizable for other cities, is a critical element of the bike share platform's success. Used for locating, locking, and unlocking bikes, as well as for communicating with the customer service team, the app is the platform's most important

user interface. And if "simple" is the goal, then UIP's solution certainly could not be simpler: the app features only one button. "The fact that our system has so few features is part of our success," says

Høgåsen-Hallesby. "We focus on removing all the obstacles around becoming a user, and on the purpose of what you're actually trying to do: to find a bike, and unlock it. It's as simple as that."

Two-way live communication between a user and a customer experience team member.



Some of the changing expressions of the Oslo City Bike logo.



Oslo City Bike's "one-button app," which also lets users locate available bikes and locks.



Bike-Sharing Urban Mobile Platform

In addition to ensuring easy access, Oslo City Bike is branded and communicated as an integral element of the city's mobility infrastructure. Users expect the type of assistance that they would receive from other forms of public transit. To meet this expectation, UIP created a customer communication strategy that emulates the interaction one might otherwise have with a bus driver or railway worker. Just like someone might walk up to a driver to ask for directions, or when they are wondering about features of the service, UIP wants to create a similar experience for city bikers.

"The differences between public transport and bikes are that, traditionally, you've been by yourself on a bike," explains Høgåsen-Hallesby. "But we've tried to build our model so that as part of the bike experience, you can easily talk to someone through two-way communication. It's a constant dialogue where we have opportunities to adapt to each other." Through the chat function in the app, or through social media, users and members of the customer service team can easily communicate in real time. These interactions improve the users' experience, and help UIP to gather information about user behavior that can be used to develop and improve the system.

The "human element" that goes into the user experience is not just about verbal communication; it's also made visual through the aesthetic of the designs, which were created to connect with users on a personal level. The Oslo City Bike logo is a playful blend of bicycle and emoji-like face, which can be altered to reflect a range of different emotions that are appropriate for different situations. When reporting to users through the user



Oslo City Bikes are a popular choice among locals, both for commuting to work and enjoying the city on weekends.

UIP wants its bikes to be a dynamic element in people's daily lives [...]
If sustainable mobility options feel approachable and enjoyable, people are far more likely to choose them.



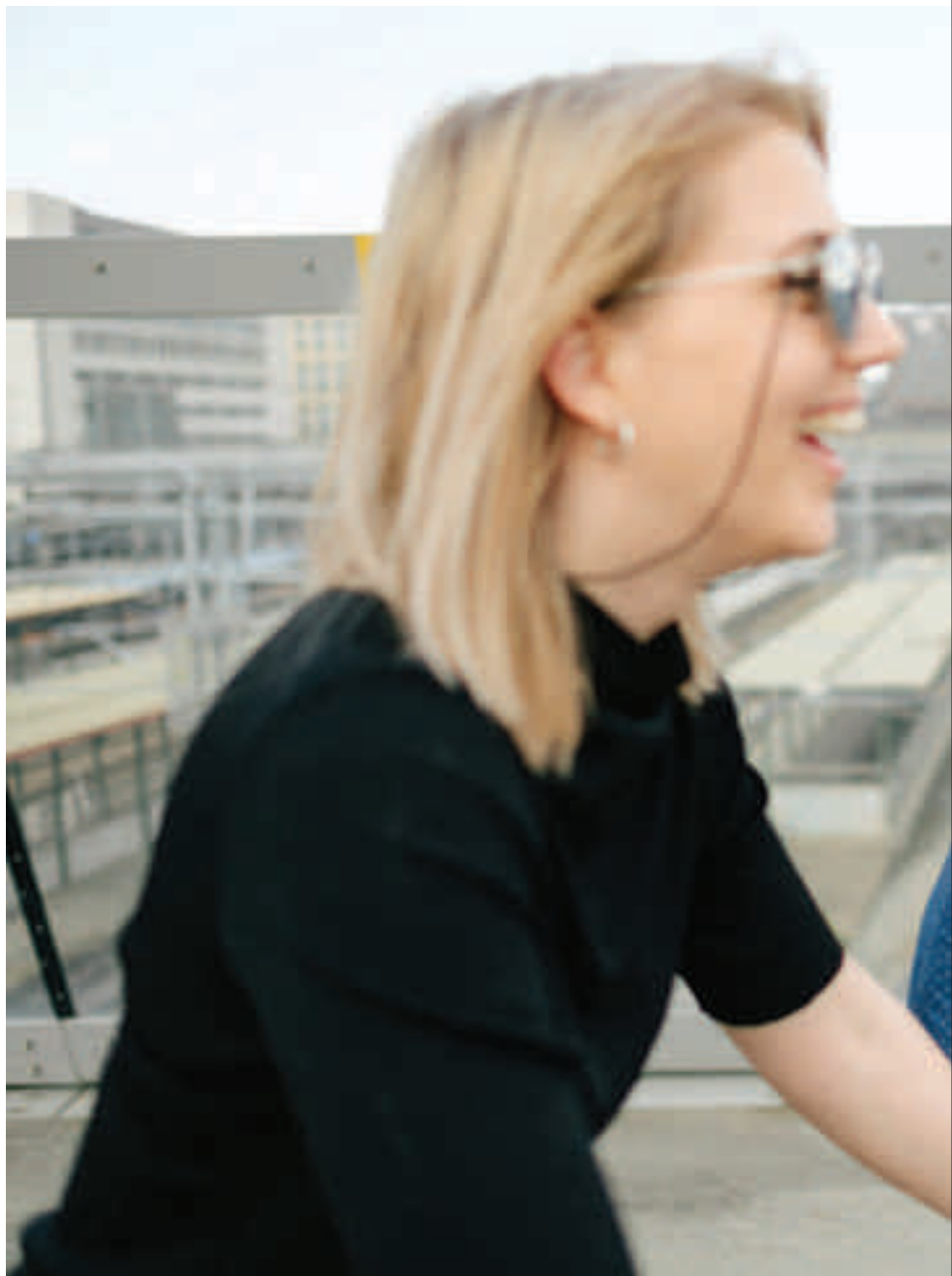
UIP wants city bikes to be a natural part of people's everyday lives.

Bike-Sharing Urban Mobile Platform

interface or social media about changes or disruptions in the system, the bike logo might be “sad,” or “sorry.” When there’s something positive to announce, like the opening of a new station or a special event involving city bikes, the bike logo puts on its “pleased” or “joyful” face. Not only does the expressive design add a light-hearted quality to the brand’s tone, it also helps users to imagine and interpret urban infrastructure in a different way. Sharing platforms like city bikes should not just be hardware standing around the city, hoping to get ridden once or twice a day. UIP wants its bikes to be a dynamic element in people’s daily lives that they can relate to and interact with. If sustainable mobility options feel approachable and enjoyable, people are far more likely to choose them.

At the beginning of 2017, Oslo City Bike introduced another way for the physical product to connect with users on a human level: each of the bikes got a unique name. When city bikers walk up to a station and tap the “unlock bike” button in the app, they’re assigned a bike, which automatically unlocks for them. Giving the bikes names adds a fun element to the experience (“Hey, I got your name on my city bike yesterday!”), and serves a practical purpose for the operations team. When a user reports that a bike is broken, or has a flat tire, he or she can easily locate and report the bike’s identity. This makes retrieving and repairing the bike quicker for the maintenance team, and creates a simpler process for the city biker as he or she engages and assists with the functioning of the system.

But it’s not always smiles, and sometimes not everything goes as planned. The company recognizes that travel – whether by bus, train, or bike – can often be stress-



The long-term UIP goal is to help transform the way people – and cities as a whole – think about traveling by public transport.



In an ideal model, it is the movement of people that shapes the city, and not the other way around.

ful, and there are many frustrations that come with getting where you need to go at a specific time. And it becomes especially stressful when mobility infrastructure is not working as it should be.

“When we designed the system, we wanted to identify the situations where you often communicate with users, which is usually when there are deviations or disruptions in the system,” says Høgåsen-Hallesby. “We know that there are a lot of emotional ups and downs using public transport, so we wanted to create an identity that accommodates that. A lot of psychological thinking has gone into the service we launched. Part of our approach is to try to understand and reciprocate the emotions of users. So when you’re calm, we’re calm, and when you’re angry because something isn’t working like it should be, we’re angry with you. We’re like, ‘yes, you’re right, we have to fix this!’ That’s part of the emotional range that we’ve put into the profile, and it’s an important element of our communication process.”

The frustrations that come with travel can be eased by a good communication strategy, but UIP wants to go even further. This is why the long-term goal is to help transform the way people – and cities as a whole – think about traveling by public transport. Høgåsen-Hallesby says that the entire model of urban mobility is shifting: where city dwellers once had to adapt themselves to the movements of the transit system, technology has opened up possibilities for a new model where the system can respond and adapt to the individual’s behavior. Combining this shift in mindset with the movement toward less station-dependent bike sharing reveals a fundamental change in what role shared mobility can play for public



Using city bikes with public transportation can help eliminate the need for cars in busy city centers.

transport overall. In an ideal model, it is the movement of people that shapes the city, and not the other way around.

“That’s my favorite perspective on this: transportation used to be about you going to a place you don’t want to go, at a time that doesn’t fit you, to get on a bus or a train. And we can flip that around, so that transportation needs can adapt to where you are and when you want to go. A lot of this is created through a dialogue between users and technology, where you’re using it and giving it signals about how you want to use it, which improves the system.”

To achieve this shift in urban mobility, the first step is to convince many more people to use sharing platforms like city bikes as their preferred mode of transit.

Operators like UIP need a large user base to collect the kind of data and research that is required to develop effective solutions. Oslo’s usage rates are so high because UIP has chosen a strategy that works to engage and attract users, while also incorporating bike sharing into the urban culture. As the company expands to more locations, their sharing platforms will continue to adapt to local cultures on street level, blending urban sharing into the fabric of each city.

The overall goal of modern urban transportation must be to guide city-dwellers away from private cars and toward more sustainable modes of mobility. Whether that means using a bike for the entire journey, or as a collective element within public transit, much of the work to be done

involves educating people about how they can choose smarter travel methods. As city populations continue to rise, the urgency for more space- and resource-efficient transportation will soon become one of the most critical urban challenges.

With high levels of usage, like the ones seen in Oslo, bike sharing helps decrease congestion and pollution. And when the operator focuses on increasing the number of trips per bike per day, like UIP does, the system’s own resources are used in a more sustainable way. Creating friendly and efficient sharing solutions can make someone’s day a little easier, and has the potential to give urban mobility a cleaner, healthier, and smarter future. 🌀



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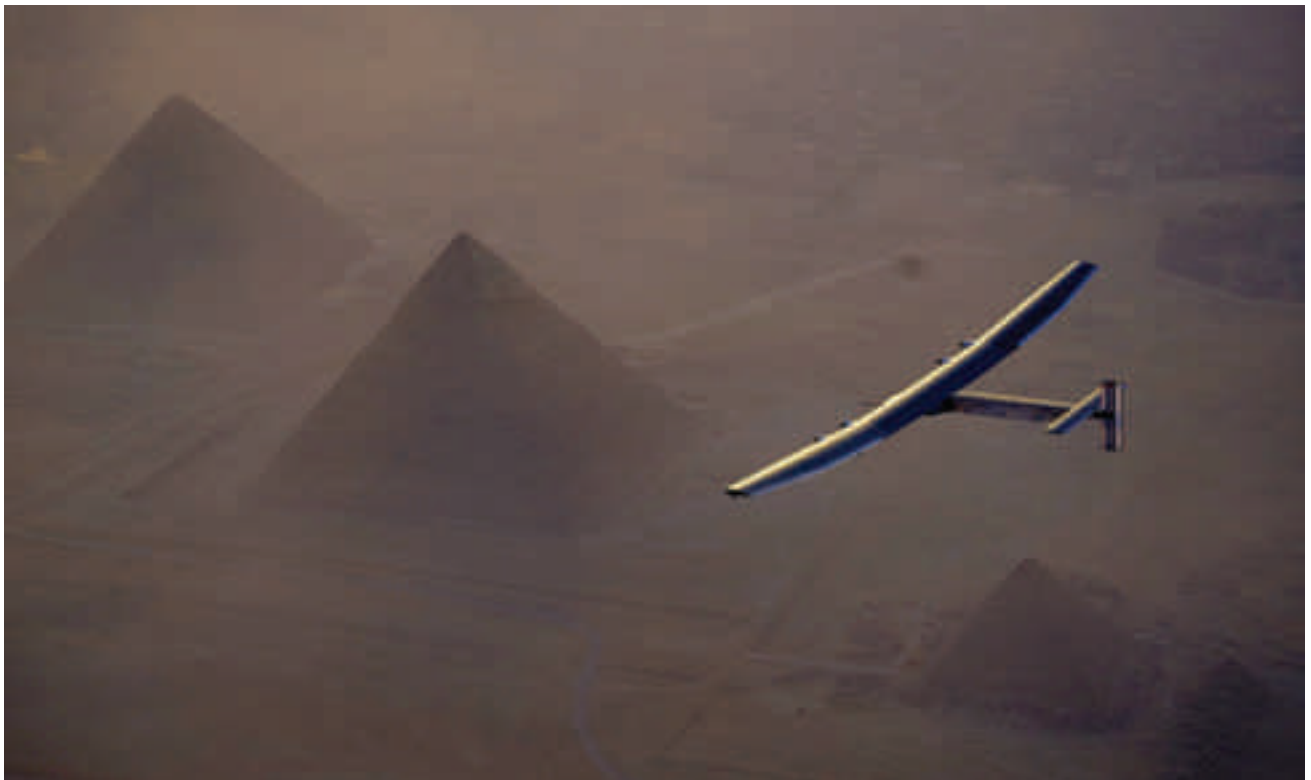
China's very first tricable ropeway went into public service in July 2017 in Lushan, a popular destination for local resident and tourists. In order to upgrade the infrastructure and improve comfort for visitors, the Doppelmayr/Garaventa Group was entrusted with the task of building a modern ropeway installation. **Source:** Doppelmayr/Garaventa.







Solar Impulse plane landing in India during first Round-the-World Solar Flight. **Source:** Solar Impulse



Overflying the Pyramids in Egypt during the first round-the-world flight only powered by the sun with no fuel and polluting emissions. **Source:** Solar Impulse



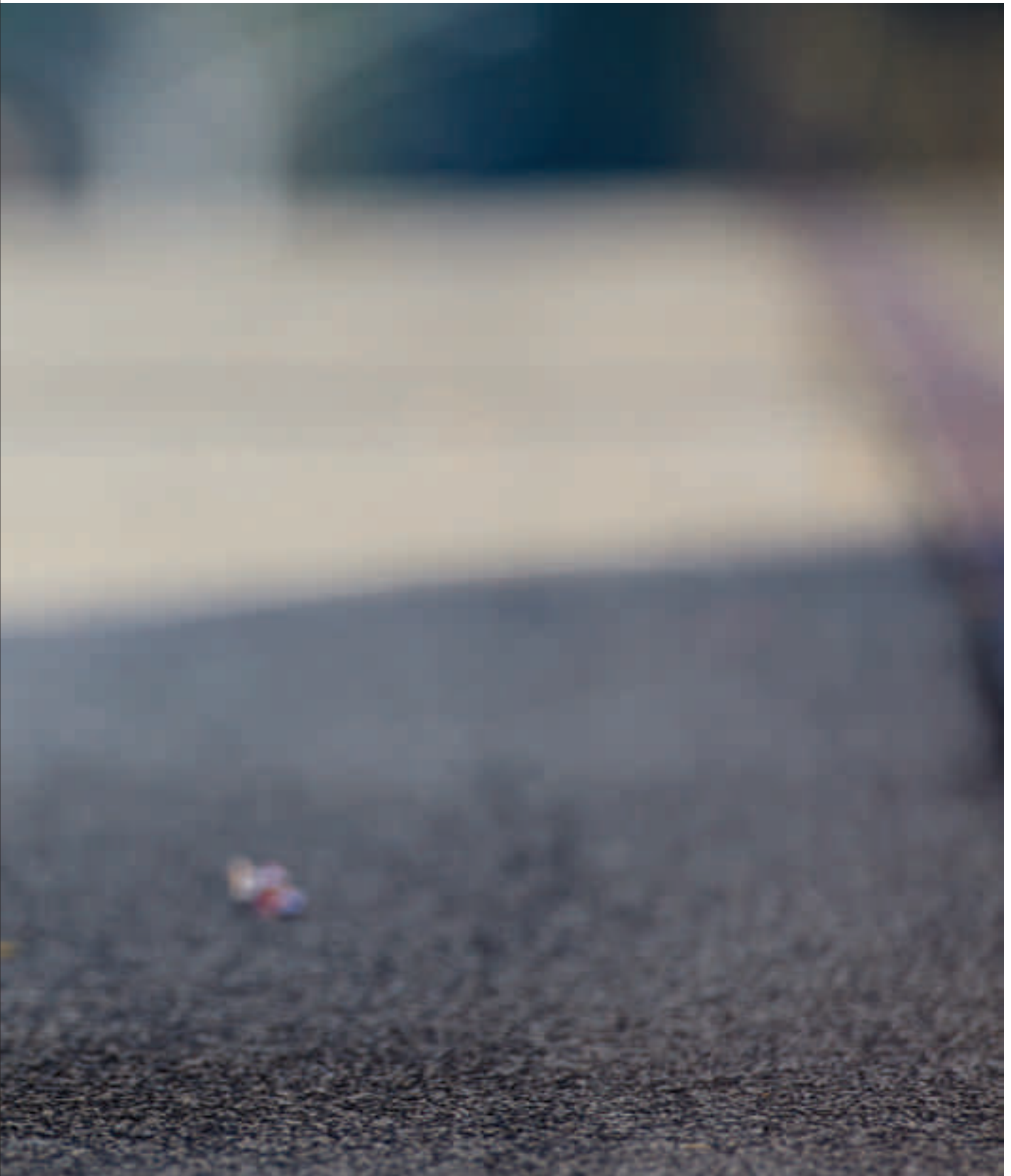
The first flight of HY4, the first zero emission aircraft powered by hydrogen in September 2016 in Stuttgart. Find out more: www.multitalent-h2.com **Source:** DLR, CC-BY 3.0



Technical test flights with the hydrogen plane HY4 in Slovenia. Find out more: www.multitalent-h2.com **Source:** DLR, CC-BY 3.0



The Copenhagen Wheel is a sleek red hub that turns nearly any bike into a smart electric hybrid containing a custom motor, advanced sensors, control systems,



and a battery. **Source:** Max Tomasinelli







(Previous page) Artificial sun: Inspecting the world's largest solar simulator that generates climate-friendly, regenerative fuels including hydrogen.



(This page) The first Hyperloop One test track in Nevada, April 2017 presents a new mode of transportation that moves freight and people quickly, safely, on-demand and directly. **Source:** Hyperloop One



The world's only hydrogen fuel cell passenger train Coradia iLint by Alstom is a new CO₂-emission-free regional train. In March 2017, it successfully performed the



first test run at 80 km/h in Salzgitter, Lower Saxony, Germany. **Source:** Alstom



Uber launched the speedboat service UberBoat in Croatia in July 2017.





The hydrogen passenger car Toyota Mirai is the World Green Car being Winner of the 2016 World Car Wards. **Source:** Toyota



Electric Car Sharing in Copenhagen, Denmark. **Source:** DriveNow

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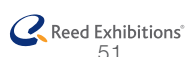
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Electric vehicles enabling renewable energy

The electrification of transport is gaining prevalence but the large-scale deployment of electric vehicles (EVs) has yet to be achieved. The smart coordination of EV demand could create a paradigm shift for both the transport and power sectors to support integrating variable renewable power growth through improvements in the flexibility of power systems and the cost reduction of power system investments.

Writers: Elisa Asmelash and Remi Cerdan

Electric vehicles – small numbers but fast growth

The transport sector is a key driver of economic development and welfare and, alongside the power sector, is the main global greenhouse gases (GHG) emitter, according to EUROSTAT. Contrary to the power sector, transport still relies heavily on fossil-derived fuels, mainly petroleum-based fuels. In the European Union (EU), GHG emissions from the transport sector since 1990 have increased by

15% while those of energy production have decreased by 25%, which caused the share of GHG in the transport sector to rise from 11% to 27% of the total emissions.

The main contributors to such high GHG emissions are private cars, which account for 58% of total EU GHG emissions, according to EUROSTAT, despite the fact

that clean energy technological solutions already exist to replace fossil fuels with electricity (electric vehicles) and hydrogen (fuel cell vehicles). Among these options, EVs have strong and concrete potential to reduce dependence on fossil fuels by relying on hybrid systems (with a classic engine and an electric engine) or full electric systems.

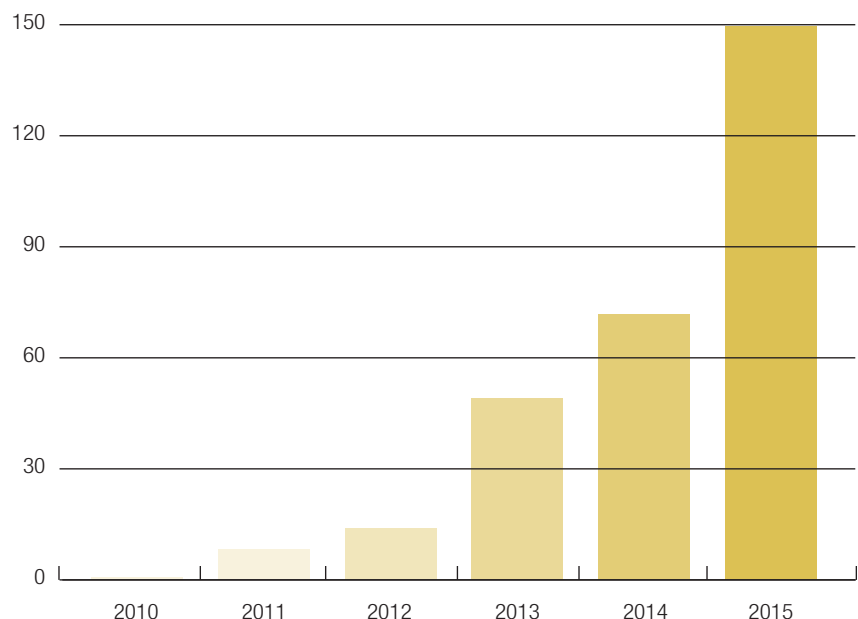


Since 1990, GHG emissions from the EU transport sector have increased by 15% while those of energy production have decreased by 25%

In recent years, EVs have witnessed impressive growth around the world. As reported by the International Energy Agency (IEA)¹, registrations of electric cars hit a new record in 2016, with over 750,000 sales worldwide. China is by far the largest EV market in 2016, with 336,000 new electric cars registered, followed by the United States (US), where EV registrations in 2016 rebounded to 160,000 units after a slight drop in the previous years. Similar growth has also been observed in the EU (Figure 1) where sales numbers are not as impressive but several European countries are seeing significant EV uptake rates, such as Norway and the Netherlands. Norway is the clear pacesetter in Europe with EVs adding up to 6.2% of total car sales in 2013, followed by the Netherlands with EVs at more than 4% of new car sales.² Generally speaking however, despite the market growth rate and some economic incentives, the share of EVs in Europe is still small compared to its full potential, as EVs represent only 1 in 700 vehicles



Figure 1: Total sales of electric vehicles in the EU-28
Number of electric vehicles sold (thousands)



Source: 'Electric vehicles in Europe', European Environment Agency, 2016.

1. 'Global EV Outlook 2017', International Energy Agency, 2017. Available here: www.iea.org/publications/freepublications/publication/GlobalEVO Outlook2017.pdf

2. 'Electric vehicles in Europe: gearing up for a new phase?', Amsterdam Round Tables in collaboration with McKinsey&Company, April 2014.



An electric future

The gradually increasing momentum behind EV adoption suggests growth will continue in the coming years and that EVs will play an important role in Europe's mobility going forward. The main factors behind such growth are threefold.

1 The cost of EV manufacturing will fall significantly and faster than expected.

The key to this trend lies in R&D improvements, especially in the battery pack that powers the car, which can easily account for about one third of the cost of the entire vehicle. However, the recent fall in cost of batteries powering the cars will consequently lower the cost of manufacturing EVs. This drop in the cost of batteries is based on modest improvements in the production processes (such as battery chemistry) and on the economies of scale, rather than on major breakthroughs in battery technologies.

2 Numerous policies promote and improve the profitability of electric cars.

These are quite diverse and seek to influence technology (industry investment decisions) and behaviours (consumer vehicle choices). In line with the pledges of the CoP21 Paris Agreement, several commitments were made by governments and car-makers alike to increase electro-mobility to levels compatible with a 'less than 2 degrees pathway'. Several countries set targets for EV promotion and some have even defined a year by which they plan to ban the sale of petrol and diesel cars. Similarly,

several car-makers announced how they intend to promote EVs through investments and targets.

3 The development of electric car-sharing systems in major cities.

In this context, the city of Paris was the first major European city which deployed a public electric car-sharing program called **Autolib'**. This successful implementation of a public electric car-sharing program in a city as crowded and spatially challenged as Paris shows that it can be implemented everywhere.

Several scenarios have been established to predict the embrace of EVs in the future, all pointing at a EV revolution hitting hard in the next decades. Models predict that EVs in the EU will range from 20-90 million units representing between 7-32% of the total fleet.¹ Such growth, even in the pessimistic scenario, would have major impacts beyond the transport sector and primarily on the power sector, as the switch from fossil fuels to electricity will obviously increase global electricity demand. For instance, within the above-mentioned scenario, the electricity demand rises from 47 TWh to 202 TWh, which represents the annual production of 4 and 19 nuclear plants respectively. To be in line with GHG reductions, increased demand must be filled with renewable energy capacities: keeping the same 2015 energy mix of fossil fuels would drastically impede the potential gain on emissions (Figure 2).



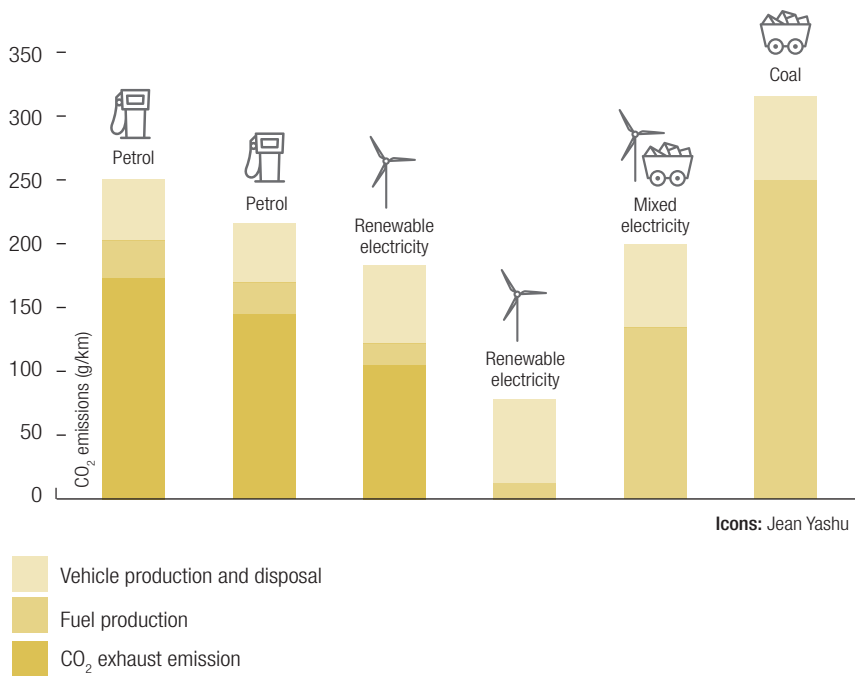
1. Impacts of Electric Vehicles - Deliverable 5 - Impact analysis for market uptake scenarios and policy implications, 2011. Available here: https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/d5_en.pdf

Electric Mobility Integrating Renewables

The transmission and distribution of additional production will have to adapt, especially in countries with aging infrastructure and/or in remote areas where the extra demand due to electric vehicles may exceed the capacities of the local grid, triggering major power cuts from household to country levels.

At first glance, EV development will demand major investments in the power sector from generation to transmission and distribution. However, a deeper analysis shows that the energy transition to renewables proves that EVs constitute a key enabler towards the creation of new interactions with the electricity grid and of greater flexibility with the power system.

Figure 2: Range of life-cycle CO2 emissions for different vehicles and fuel types



Renewable energy + electric vehicles = new paradigm

Electricity is a very special asset.

The golden rule for the management of an electric grid is that production must always be equal to the consumption. Historically, this equation has been solved thanks to a mix of fossil fuels and in some cases, uranium to cover the base load production and demand peaks. The production of electricity could be fully planned given the specificities of each source, such as low reacting coal and nuclear plants being used for the base-line production whereas highly-reacting gas and oil plants being used during

peak hours. In the context of a transition towards renewable energies, the classic production schemes become obsolete and create a strong need for innovative models to re-organise the production of electricity.

Introducing electric vehicles changes the situation, creating a vast new electric storage capacity which can be equal to almost half of installed renewable energy capacities.¹ For instance, EV batteries can be used in several ways at each stage of their life time. They can be used as means of direct electricity storage while charging individually or as a means of stationary storage for second hand batteries. Power utilities would be able to store extra electricity coming from renewables when the production exceeds the demand and have stored power ready and usable when needed. Storage of extra power would allow more renewable-installed capacity as the surplus of production could be easily kept in the EV batteries. And the batteries could release their stored electricity into the grid to compensate for insufficient production. In a country with a high share of solar power production, EV owners would be incentivised to charge vehicles during the day, when solar production is at his maximum, while at night, owners could choose between not charging their vehicles and selling their stored electricity into the grid.² Implementing

such a splendid scheme requires three key considerations:

- 1 Having a very accurate knowledge of electric production and demand at every given time.
- 2 Knowing precisely both the location of the installed charging devices, such as at users' workplace for daytime charging vs. in the users' households for night time charging.
- 3 Changing the charging habits of EV owners: a 'regular' charging pattern of our daily electric appliances would most likely create additional issues in the management of electric grids and create potential deeper gaps between consumption and production especially during peak hours; a 'smart' charging pattern, involving an optimal scheduling of EV battery charging, could allow both high EV penetration (without requiring any upgrades to the existing electricity infrastructure) and the possibility of managing EVs as storage units, thus providing ancillary services to network operators.



1. 'Electric Vehicles – Technology Brief'. International Renewable Energy Agency, February 2017. Available here: www.irena.org/DocumentDownloads/Publications/IRENA_Electric_Vehicles_2017.pdf

2. P. Nunes et al 'Synergies between electric vehicles and solar electricity penetrations in Portugal', 2013. Available here: www.evs27.org/download.php?i=papers/EVS27-6180373.pdf

The renewable road ahead

The link between developing renewables and integrating EVs is straightforward. New renewable-installed capacity can provide sufficient electricity for electric vehicles charging and EVs can provide the necessary storage capacity to achieve grid stability and optimisation of intermittent renewables production. However, three main barriers need to be overcome to implement smart charging:

1 Real time management of electric production, consumption and storage requires a large amount of data and innovative management software. The analysis should be country specific and needs to include its specific energy mix. The implementation of smart grids equipment plays a capital role in acquiring the necessary data, but the correct analysis of such data is still lacking appropriate software packages.

2 A new regulatory framework is needed to define the links between all stakeholders including electric regulators, owners, power producers, etc, on the legal, technical and financial issues. This framework should address the disclosure and management of EV user private data.

3 The uncertainty in EV drivers' behaviour together with their scepticism is one of the biggest caveats to solve for the optimal integration of EVs in power systems. Efficient incentives should be put in place to convince the users to integrate their vehicles with a given electricity grid.

EVs are making fast progress, sales are rising and the overall outlook is positive in most scenarios. Not only do they represent a very promising technology

to replace fossil fuels in the transport sector but they are also a key enabler to the development of renewable energy. At the end of the day, electric vehicles are a replacement technology, and will not decrease the number of metal boxes on our roads. Who will jump the curve and find the next mode of transporting humans independently and efficiently? ☀️





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e-Scooter Sharing: A New Dimension of Individual Mobility

Shared-mobility services are changing the world of transportation. By offering end-users new ways to move around in cities, bike-sharing, car-sharing, and ride-sharing complement public transport with more individual mobility solutions. As they match the growing trend towards not owning a car (that is associated with high congestion, high pollution, and the shortage/expense of parking space) these new shared-mobility services are flourishing at a global scale. The newest trend is e-scooter sharing: having started in Barcelona, Paris, and San Francisco less than 18 months ago, it combines with digital technologies to provide even more innovative and more individual transportation solutions.

Writer: Eric Keogh

Individual
electric
mobility
- “green” and
convenient

Electric vehicles (EV) bring enormous advantages to urban dwellers: they run at very low noise levels and are environmentally-friendly, emitting absolutely no greenhouse gases at source. Not surprisingly, EVs enjoy growing popularity: according to the International Energy Agency's “Global EV Outlook 2017”, EV registration hit a record high in 2016 with

over 750,000 units sold worldwide – much of which is owed to a favorable policy environment. It is not surprising, then, that the latest trend in shared-mobility systems is e-scooter sharing: according to the same report, the current stock of

End-user about to enjoy a ride with an eCooltra e-scooter in Lisbon. **Source:** ElectricFeel

On average, a typical trip is around 4 km long and takes 15 minutes, most of end-customers use the e-scooter sharing system to cover the last mile from public transport to their destination.



Individual Mobility e-Scooter Sharing

electric two-wheelers has reached an estimated 200-230 million units in 2016.

Apart from environmental considerations, e-scooter riders enjoy a plus in convenience: traffic jams are not a problem anymore, nor is finding a parking spot. While the same benefits also apply for bikes, scooters are faster thus allowing users to cover greater distances and also to travel effortlessly uphill where some people would not be able to cycle. The key to market acceptance, however, is high vehicle “density”: users must find vehicles quickly and nearby when they need a ride – a key challenge for shared mobility operators.



The 3 layers that constitutes a shared mobility system, **Source:** ElectricFeel

Ideal complement to mass transportation

Outstanding providers are rewarded with quick success. eCooltra, a subsidiary of the Spanish two-wheelers rental company Cooltra, is an impressive example: in less than two years, the company launched e-scooter sharing systems with a total fleet of 1,400 units in four cities: Barcelona, Madrid, Lisbon, and Rome. During these two years, eCooltra won more than 100,000 end customers – today, it is one of the largest e-scooter sharing operators worldwide. By year-end 2017, eCooltra will extend its overall fleet to 3,000 units; by year-end 2019 the company wants to be present in more than 20 cities across Europe.

Another example is Cityscoot. A French start-up, Cityscoot currently runs 1,000 e-scooters in Paris; plans are to add 500 more before the end of 2018. This fast pace of fleet growth is a strategy all market leaders seem to have in common: they are well aware that high vehicle “density” is key to providing an outstanding level of service, and also to increase the visibility of the brand across a city. According to Cityscoot, the average number of rentals per day was 6,000 in June 2017. Their mobility system was launched officially in June 2016, and just one year later they had registered over 500,000 rentals, with more than 2 million km traveled.

A glance at the company’s statistics provides further interesting insights: close to 90% of Cityscoot users are men who work or live in Paris; on average, a typi-

cal trip is around 4 km long and takes 15 minutes, most of end-customers use the e-scooter sharing system to cover the last mile from public transport to their destination. So, e-scooter sharing system do not replace mass transportation but complement them in granting users individual and convenient mobility.

eCooltra and Cityscoot are not the only ones. In less than 18 months, close to 20 cities in the world have introduced e-scooters sharing systems; some of them – like Barcelona and Paris – even have several of them. In May 2017, the worldwide fleet amounted to more than 5,000 e-scooters; according to shared-mobility experts it may well reach more than 7,500 vehicles by year-end (estimate: ElectricFeel).

Someone riding a scooter in traffic.
Source: Dreamstime

New technologies unlock new service opportunities...

Use of the e-scooter sharing system is simple and convenient: users pay per minute or based on other time-related schemes; while maintenance, cleanliness, insurance, and charging of the vehicle are all guaranteed by the provider. Most providers keep two different-sized helmets stored in the saddle, some also a disposable hygiene cap and/or a blanket for protection against bad weather.

A special element can be found in Taiwan: users are invited to contribute actively to the viability of the mobility system by exchanging empty batteries against full ones at more than 300 battery-swapping stations across the city. In Europe, mobile service teams take care of battery changes: as batteries contain lithium, European legislators are less likely to permit swapping stations, so there is no battery-swapping station network to date. The city of Paris is planning to implement a network of charging stations, but lack of space is still a challenge.

Lately, a new trend has emerged: on-demand shared-mobility systems without fixed stations. Within a defined perimeter, users can rent, drive, and drop off e-scooters in any of the designated parking areas. A simple smartphone app enables them to locate the nearest vehicle and make a tentative reservation for 15 min, leaving enough time for them to go and pick it up. A telematics device inside the vehicle (equipped with GPS and network connectivity) permits them to locate and unlock it without a key or a card. Smart phones communicate with the vehicle via 3G or Bluetooth; all users need to do is download the provider's app and

By the end of 2017, eCooltra will extend its overall fleet to 3,000 units;

go through a registration process. ID or driver's licenses can usually be uploaded directly to the app. All rental and end-user information is transferred from smart phones to the management platform of the operator via the cloud.



eCooltra service launch in Madrid in April 2017, from left to right: Moritz Meenen (Co-Founder and CEO at ElectricFeel), Ramón Ledesma (General Director at Gerentia), Oriol Marimon (CEO eCooltra), Arturo Perez de Lucia Gonza (General Director of AEDIVE, the Spanish electric vehicle association).
Source: eCooltra



... And new approaches to system operation

Control room for shared mobility operations. **Source:** ElectricFeel

Digitalization has been instrumental in bringing new means of transportation to shared-mobility users. But that is not all: it has also created new ways of operating these systems. After all, finding, booking, and riding an e-scooter are just one side of the coin – the other is the host of back-end activities required to manage customer registrations and feedback, vehicle availability, efficient battery exchange, vehicle safety and cleanliness, billing and invoicing. New technologies help address these challenges thus providing a basis for profitable business models and even a tangible competitive advantage.

The management platform is essential as it can support both managers and field staff in monitoring the status of every

vehicle in real time, and thus in detecting potential problems promptly. A special mobile app can be used – in this case, by service staff – which provides helpful instructions. With innovative digitalized solutions, tasks are generated by supervisors and automatically by the system. Big data and algorithms jointly work to determine the priorities to be tackled by the operator in order to provide the best possible service quality to mobility customers – and all activities are managed simultaneously.

Last but not least, digitalization also provides for machine learning, which helps operators manage complexity. Any given shared-mobility system generates an infinite amount of data. Machine learning

permits forecasting user demands and maintenance trends in real time, based on usage patterns and technical data. For shared-mobility providers, leveraging these innovative technologies is a key to sustainable and successful business models.

By the end of 2019, eCooltra wants to be present in more than 20 cities across Europe.

Operator profiles are changing

Along with technological progress, the profiles of e-scooter sharing providers has changed; the same is true for new entrants in the bike-sharing market, such as Mobike and Ofo in China. As mentioned before, new bike and e-scooter sharing system have something in common: both have migrated from station-based systems to free-floating systems.

There are two main reasons. (1) station-based systems, quite obviously, require an extensive infrastructure stretching across entire cities. Take, for instance, the London bike-sharing system Santander Cycles that provide 11,500 bikes that can be docked and retrieved at 750 stations located all over the city. Or take the Vélib

system in Paris, with more than 1,000 stations in the city center only, plus a few hundred more in the suburbs.

And (2) traditional bike-sharing systems are more difficult to implement, as they are public. The city issues a call for tenders, then awards the contract to a private operator. Decisions on the numbers of bikes and stations remain with the city. Private operators wishing to open a new station-based mobility system need the city's official approval. Free-floating systems, by contrast, do not require such approval.

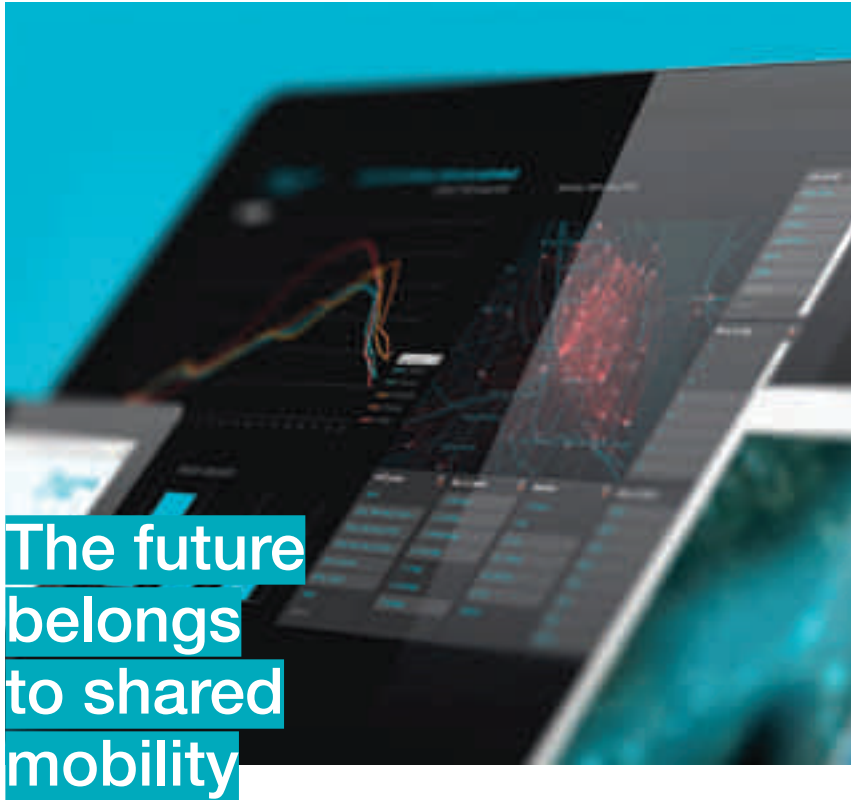
Most e-scooters operators are newly established companies; others have their roots in the cars rental sector. Often, private operators take the initiative and open a mobility system in a given city, without explicitly asking the authorities' permission, and rely on their customers for observing local parking and traffic regulations. In some cases, mayors are delighted when new mobility systems

are launched, especially when they do not need to invest any public funds. For instance, Anne Hidalgo, the Mayor of Paris, announced that Cityscoot had the city's full support. In a few other cases, free-floating systems have been perceived as an invasion of the public space – but this is mainly true for bike-sharing systems, which are much easier to implement (both financially and operationally). For instance, some municipalities in China have complained about thousands of bicycles being parked anarchically all across the city, quite literally resulting in “heaps” of bikes. According to Shanghai authorities, there are approximately 1.6 million shared bikes in the city, about one for every 16 residents. Chinese municipalities have therefore introduced new regulations for private sharing system operators; in case of violations authorities will scrap vehicle fleets or charge fines. E-scooter sharing systems are still far from reaching this problem dimension.

A new trend has emerged: on-demand shared-mobility systems without fixed stations.



ElectricFeel customizable app for end-users showing how to locate & rent vehicles. **Source:** ElectricFeel



Management platform to run shared mobility systems. **Source:** ElectricFeel

New bike and e-scooter sharing system have migrated from station-based systems to free-floating systems

E-scooter sharing is just beginning and clearly bringing a shift to the world of mobility, which can help relieve our cities of pollution, congestion, and noise, thus contributing to everyone's well-being. The future will show how municipalities will deal with this new mobility solution.

Experts expect new regulatory frameworks for private shared-mobility operators to be introduced but authorities usually show support to green mobility alternatives. Also, profiles of private operators are likely to change. Municipal and large electricity providers have been

showing a great interest in the mobility market, in particular in shared electric vehicles. Their involvement may trigger the next industry turn, in which longer-term issues such as the charging infrastructure may be addressed.

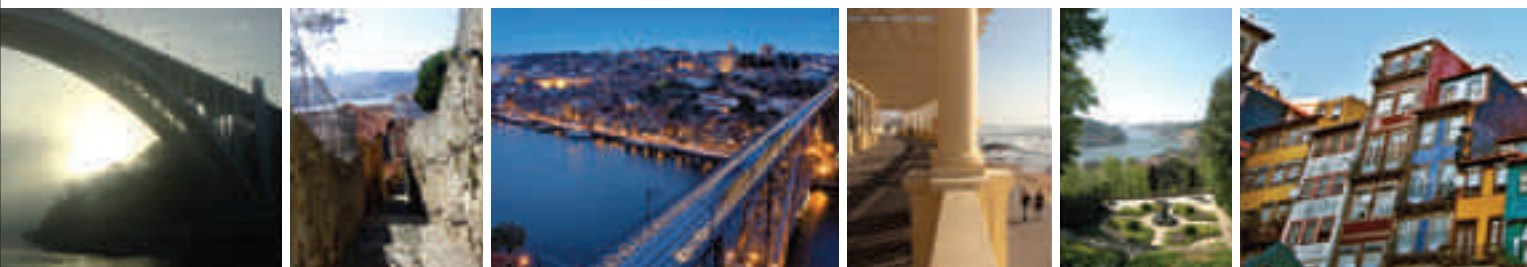
E-scooter sharing operators need to focus on scaling their fleet and delivering the best user experience. The technology powering their operating platform is essential as it can help avoid the pitfalls of operating large vehicle fleets and build a truly profitable business model. 



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Green and clean won't fix the climate!

A worrying aspect of sustainability is that environmental ambitions often overshadow the social aspects.

Writer: Heather Allen

There is widespread acceptance that we must make more efforts to decarbonize transport – and that the way we pump fossil fuels into vehicles to move around is simply not sustainable. But the reality is that we cannot make transport sustainable unless we do more than just make the vehicles cleaner and improve the infrastructure that they need better. Transport is more than mobility – and the two are actually rather different concepts. Transport is all about the function of how we get from point A to B, while mobility is the possibility to do so and how well and frequently we can access that possibility.

Transport is a key enabler to access to education, jobs, markets, and health services and allows people the opportunity for leisure and increased social contacts with friends and family. A better enabling policy environment, the reduction of perverse subsidies that encourage us to

travel without thinking are all desirable, but as we move from a world of 7.4 billion people and 1.1 billion vehicles,¹ we will also need to do something about *the way we travel* in terms of behavior and expectations and not only focus on technical improvements.

A worrying aspect of sustainability is that environmental ambitions often overshadow the social aspects. Women make up around 50% of the global population.² What is the connection with transport you may ask? Transport is a public good and a surely a road, bridge or bus service provides equal benefit to men and women?

1. Based on http://www.oica.net/wp-content/uploads//Total_in-use-All-Vehicles.pdf: <http://www.caradvice.com.au/133570/how-many-cars-are-there-in-the-world/>

2. In adulthood and this increases as populations age







POWER TO WOMEN

Access to safe, affordable transport plays a strong role in defining peoples' quality of life. The contrary is also true: a lack of safe and secure transport reduces economic opportunities, reinforcing poverty and increasing inequality and social exclusion. And this is where there is a major divide between men and women. The McKinsey Global Institute estimates that if women in every country were to play an identical role to men in markets, as much as US\$ 28 trillion would be added to the global economy by 2025.

Changes in demographic trends show a greater urban concentration of women-headed households, as the proportion of one-parent households. According to the United Nations, in most countries single

mothers with children have higher poverty rates than single fathers, and much higher rates than families with two parents. This may be partly due to increases in divorce, or as a result of separation or widowhood, or when children are born outside marriage.

Public transport is an essential public service, and it plays a significant role in ameliorating or exacerbating the life conditions of women, particularly those who are poor and therefore the increasing number of the urban poor who are women. It is well documented that men and women use transport differently. Typically, women make a larger number of shorter journeys at various times during the day, while men make fewer, longer

trips at more set times of the day. Women all over the world rely more on public transport than men do and in much of the developing world, this is their only choice of motorized transport. The Inter-American Development Bank Transport Week in 2015 states that the split of the use of public transport is 68% women to 45% of men in Latin America for the region. However, most transport planners and decision-makers still assume that males and female needs are the same and that both can be served with the same services, or by tweaking the scheduling a bit, rather than changing well established planning methods.

NO THANKS TO HARASSMENT

Research is now unveiling a number of 'inconvenient truths': concerns over personal security are more pronounced in women, especially girls, than in men; men are more concerned about theft, than harassment, yet a surprisingly large number of public transport users (men and women) have experienced harassment in public transport. According to the report *Safe and Sound*, this is a problem in many cities – from London and Paris to Delhi or Jakarta.

www.fiafoundation.org/connect/publications/safe-and-sound

Another study in three Latin American cities (Quito, Ecuador; Santiago, Chile; and

Buenos Aires, Argentina) entitled *Ella se mueve segura* looks into the more detailed aspects of the concerns women have over



their personal safety and security, while travelling on public transport. By using the same approach and methodology in all

three cities, the research teams were able to substantiate many observations from previous studies, but also bring in new aspects that hopefully will start to shift the current paradigm of thinking about transport provision in cities.

From this study 89% of women and 82% men in Santiago said they had either themselves experienced harassment or watched it happen to someone else. In Buenos Aires and Quito, the numbers were slightly lower. (Harassment here also includes petty crime.) Most harassment is verbal but 1 in 5 experienced physical harassment and 1 in 4 experienced what they considered 'severe harassment'. In all cities, the majority of cases were not

If women in every country were to play an identical role to men in markets, as much as US\$ 28 trillion would be added to the global economy by 2025



Public Transport Access & Harassment

reported, and there was little confidence that reporting such incidents would receive either effective or sympathetic responses from official security agencies.

The teams took both a quantitative and qualitative approach, collecting data from interviews at bus stops and stations by delving deeper into a number of aspects in focus group discussions

Women all over the world rely more on public transport than men do and in much of the developing world, this is their only choice of motorized transport.



and workshops (single sex and mixed groups) to identify what is working and why, and what is not... The outputs are being put together into a tool kit that will be available in both English and Spanish from the CAF (the development bank of Latin America) and FIA Foundation websites in October 2017 that endorse the project.

www.fiafoundation.org
www.caf.com/en

One of the interesting results of the study is that not only do women have different transport needs, but they also perceive many functionalities of the transport system differently to men. How people perceive service quality and security is particularly subjective. It is well known that a

woman travelling at night is risky but when does 'night' start? In Buenos Aires and Quito, in many women's minds it seems to start when it gets dark; but in Santiago travelling on the metro only becomes dangerous at 'night' (after 11pm) while not in the 'evening' (until that time). This and other aspects investigated, confirmed that there are many different perceptions about 'safe travel' and how this is interpreted,

and this varies between modes as well as at different times of the day. The lack of disaggregated data available or used at city or national level was stark and participatory workshops provided interesting results. It is clear that local women also had most of the solutions at hand – so including them in early planning stages is highly recommended.

feature on many statistical analyses and it is only when it reaches the extent of being a criminal offence such as theft, physical violence or rape does it become a statistic.

Secondly, harassment happens to everyone but women and girls are mainly harassed by men. The majority of cases cited occurred because the proponent

thought that they could get away with the act. Incidents occur at all stages of the trip not only in vehicles. Low income women were found to be particularly at risk as they had fewer choices, and often did not have the money to be able to choose a less risky option. But it is clear that women worry more about it even if they have not experienced it themselves, they will take action based on hearsay



Some conclusions really stood out as well from the initial results, notably that harassment on public transport happens on a daily basis and the majority of incidents are not reported. Most of the time neither the victim nor those that may see an incident are sure how to respond or who to report it to. Therefore, it does not

Harassment on public transport happens on a daily basis and the majority of incidents are not reported

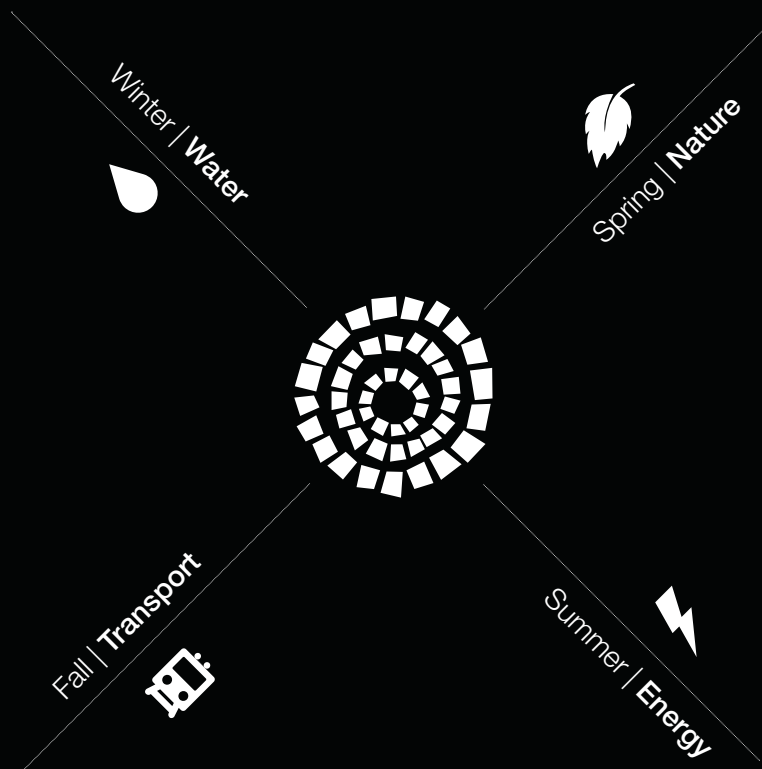
Public Transport Access & Harassment

about a service or route and avoid it, or in extreme cases not travel at all.

Lastly, the role women play in helping to change behavior, which is needed alongside technical improvements, is also underestimated. Women can act as strong agents of change but the risks of not considering their needs in how transport is developed are also high. A number of studies have shown that women are more likely than men to choose a transport mode, if they feel that it is more environmentally friendly. Expanding public transport is a transition strategy to move to less carbon intensive modes of mobility.

If women perceive public transport to be unsafe they will convey this fear to their children and close family members. This may hamper a broader shift in the next generation to sustainable modes, and also restricts more women entering the economy, impeding rather than enhancing economic growth. And as women become more empowered, there is a risk that they will shift away from being the majority user of public transport. By then it may be too late to get them back, even if we can get technology to deliver zero carbon vehicles and this will compromise how quickly we can decarbonize and shift to really safe and sustainable urban transport options. 🌐





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The distance remaining to low-carbon transport

The transport sector is undergoing a paradigm shift away from ‘conventional’ internal combustion engines towards electric and alternative energy source. The trend is positive but the question remains: how are we measuring the shift to low-carbon transport? Ghana shows by example.

Writers: Elah Matt

Particulate Matter (PM), Nitrogen Oxides (NOx) and a range of hazardous hydrocarbons and other pollutants contribute significantly to the global air pollution crisis, which kills millions of people prematurely each year. The transport sector emits nearly a quarter of all energy-related greenhouse gases (GHG) with significant impacts on the

global climate. With the Paris Agreement commitments and the 2 degrees “carbon budget” likely to be exceeded in the next 10 years (if it’s not already!) due to incorrect accounting and reporting methodologies, how can we clean up this mess?

Zero transport emissions are inevitable;

the only question is how to get there... quickly. Since 2011, Impact Global Emission Solutions (IGES) has been tackling the multiple challenges of today’s unsustainable mobility. Through analysis and review of global best practices, we identified some key pillars that we see as imperative to address and ensure truly sustainable mobility. These are:



Carbon Emissions Implementing MRV

- > Measure, report and verify (MRV) real-world vehicle emissions.
- > Reduce the emissions of vehicles already in use.
- > Transform new vehicles to truly zero carbon vehicles.
- > Empower a paradigm shift towards zero-carbon and zero air pollution mobility.

Measure ➡ Reduce ➡ Transform ➡ Empower

This article is not long enough to discuss all four pillars, we concentrate on the first and the last:

As seen in the 'dieselgate' scandal, real-world vehicle emissions are often far from those prescribed by regulations and claimed to be met by vehicle manufacturers. This is true for both old and new cars. There are multiple circumstances that affect real-world emissions, including:

- > Technical manipulations by manufacturers have led in some cases to new cars emitting over 10 times more than the permissible levels of emissions. This is true for Nitrogen Oxides (NOx) emissions, but also for emissions of Particulate Matter (PM) and other hazardous pollutants, both regulated and non-regulated.

- > Emission-abatement technologies, including catalysts may not work properly. Their effectiveness may be reduced due to operational temperatures, poor maintenance, unsuitable fuels, or because they are designed to reduce one type of pollutant, but may actually increase emissions of other pollutants (exchange effects of regulated and non-regulated pollutants).
- > Tampering with emission-abatement devices, such as Diesel Particulate Filters (DPFs). This is a common phenomenon in both developed and developing countries and may result in undetected high vehicle emissions.



In addition, emissions of smaller, ultrafine nano-particles (sub 23NM) remain largely unregulated. This is a huge concern, as these smaller particles are potentially the most harmful to human health. They can easily penetrate through the lungs, to the blood stream and settle in the brain and vital organs. They also contribute significantly to global climate change. Research shows disturbing evidence of catalyst materials transferring to central brain tissue, possibly exacerbating degenerative mental illnesses.

The solution? Real-time MRV of on-road vehicles. This enables identification of high-emitting vehicles that contribute disproportionately to overall emissions. Actions to reduce the emissions of those vehicles can then be taken in an effective, cost-efficient and equitable way. Real-world MRV also allows regulators to enforce meaningful regulations, emission standards and establish accurate emission inventories.

GHANA REAL-WORLD MRV PROJECT

In 2015, IGES carried out a groundbreaking real-world MRV project in Accra, Ghana. Ghana recognizes that a robust MRV system is the cornerstone for successful implementation of its international and national climate change mitigation and adaptation commitments and low emission, sustainable development.

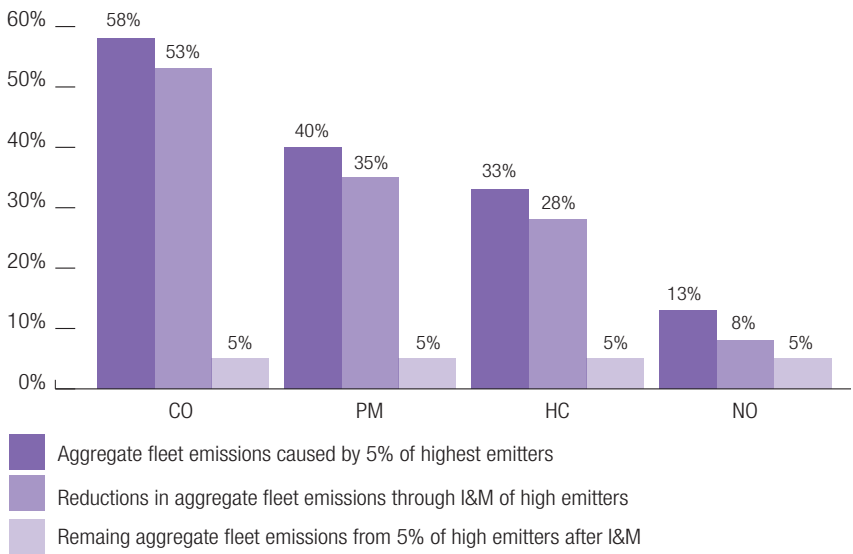
This is particularly important in the transport sector, where no emission base-lines, standards or compliance schemes were in place. The Government of Ghana needed appropriate tools to regulate and reduce the emissions of the vehicle fleet, which comprises predominantly second-hand imports. These vehicles emit high levels of CO₂, Short-Lived Climate Pollutants (SLCPs) and other harmful pollutants, posing serious threats to human health, climate change, the environment

and an obstacle to low-emission development.

To support Ghana's climate mitigation and sustainable development efforts, IGES implemented this first-of-its-kind real-world transport MRV project in Africa. The project collected and analysed real-time data on road-vehicle emissions, providing an example for future deployment of transport MRV technologies. The over-arching project goal was to build local capacity to measure and reduce the emissions of transport pollutants.

The project measured the roadside emissions of vehicles in the city of Accra, using advanced MRV technologies. Emissions of 14,500 buses, mini buses (Tro-Tros), Heavy Duty Vehicles, taxis and passenger cars were monitored over a two-week period. Data were collected and analysed to show fleet average emissions and distribution of pollution according to vehicle category and individual vehicles, verified to highest international standards.

Emissions Reductions: Inspection and Maintenance of High Emitters
(Based on IGES MRV Data for High Emitting Buses, Accra, Ghana)



Vehicle emissions were measured by strategically-placed devices able to monitor vehicle speed, climatic conditions and actual emissions. Results were recorded according to vehicle license plate numbers, allowing for identification of the most polluting vehicles (high emitters). The identification of high emitters allows regulators to develop policies and maintenance schemes, whereby the owners of these vehicles are obliged to bring them back into a road-worthy condition or retire them.

The project highlighted some significant challenges to reducing transport emissions in Ghana:

Carbon Emissions Implementing MRV

- > Emissions of all measured pollutants were significantly higher than those allowed under equivalent Euro Standards for vehicle emissions.
- > Across all vehicle categories, emissions were significantly higher than those measured in European cities.
- > 5% of the most polluting vehicles (high emitters) contributed up to 50% of overall emissions of measured pollutants; reducing the emissions of these would result in significant fleet-wide emission reductions (see graph: 'Emission Reductions of High Emitters').

These findings indicate that transport emissions and air quality issues in Accra are of an order of magnitude greater than expected. This problem is likely to prevail across cities in the developing world, where older vehicles predominate. On the bright side, these findings suggest that with localized real-world MRV data and appropriate policies, governments can be empowered to reduce transport emissions at source, in cost-effective, efficient and equitable ways.

The MRV methodology used in this project can be applied in various transport projects internationally. The support and collaboration of government stakehold-

ers, including the Ministries of Environment, Transport, Finance and the Environmental Protection Agency, as well as private stakeholders were key to enabling implementation and scaling up. Further MRV projects are being developed for verification under international climate change initiatives. As part of the development of the wider Ghana Eco-Transport Program, IGES is developing innovative business models, based on public-private partnerships, access to carbon markets, leverage of private investment and green bonds.



To support Ghana's climate mitigation and sustainable development efforts, IGES implemented this first-of-its-kind real-world transport MRV project in Africa.

EMPOWERING CHANGE

Our experience shows that policy-makers, NGOs and other stakeholders often do not have the necessary information and tools to bring about the change they want to see. For this reason, we have supported numerous capacity-building and training activities.

One of these is the **365 Campaign** which is an on-line database of transport and climate change actions and a knowledge product of the Paris Process on Mobility and Climate (PPMC). The database contains a maximum of 365 examples from around the world covering all modes of transport, collected under key words that allows the database to be searched according to region, area of activity (urban, rural, passenger, freight), UN mechanism (LPAA initiative, NAMA, INDC etc) and mode of transport (road, rail, waterborne etc).

PPMC is a major international partnership to support effective action on transport and climate change and strengthen the voice of the sustainable transport community in the United Nations Framework Convention on Climate Change (UNFCCC) process, especially at the Conference of Parties (COP23). COP23 to be held in November 2017 in Bonn, Germany, with Fiji presiding over the climate talks. It marks the start of how governments will concretely deliver on their pledges to climate action.

The 2015 Paris Agreement established a dedicated partnership mechanism to enable a long-term connection between the UN climate process, countries and the 77 voluntary and collaborative actions launched by public and private entities and partnerships since COP 21, as part of a Global Climate Action Partnership. COP 23 will see the start of the scaling-up of this partnership mechanism between 2017-2020, supported by High-Level Champions and bring like-minded initiatives and countries closer together. The 15 transport commitments launched under the Lima Paris Action Agenda (LPAA) are listed in the 365 database.

In another new and exciting initiative IGES, in conjunction with Global ISO Standards training Pro Captum and PECB, is implementing a global platform to enable key decision-makers to understand and prioritize emission mitigation techniques, methodologies and advanced sciences into bankable financial mechanisms including Green Bonds. This training is suitable for policy-makers, practitioners, researchers, NGOs and other stakeholders interested in taking effective action to mitigate the health and climate change impacts of transport-related emissions, in a way that creates co-benefits and maximizes the wellbeing of people, climate and the environment. 



Impact Global Emission Solutions (IGES) develop and implement pioneering methodologies, technologies and emission-reduction projects in the transport and energy sectors. The project pipeline is aligned with international, regional and national climate change, sustainable and low-emission development initiatives, financial instruments and markets.

www.impactglobalemissionsolutions.com

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