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Program Manager for the GPU-accelerated commercial Lattice-Boltzmann solver ultraFluidX at Altair Engineering.



Thibaut De Lacroix p. 26
Consultant specialized in hydrogen and fuel cells at Hiniçio.



Vanessa Wabitsch p. 26
Marketing and Communication Manager at Hiniçio and REVOLVE.



Hadil J.S. Ayoub p. 60
Environmental scientist currently working as a communication assistant at REVOLVE.



Stuart Reigeluth p. 60
Founder of REVOLVE.



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Leader of the clean vehicles team at Transport & Environment.



Suzanne Hoadley p. 70
Senior Manager at the POLIS network of cities and regions for transport and innovation.

**Heather Allen** p. 12

Highly-regarded expert with 25 years of experience in sustainable transport, gender and climate change.

**Wouter Vanhoudt** p. 26

Director Europe at Hincio and project coordinator of the innovation Project CertifHy.

**Tudor Constantinescu** p. 32

Principal Adviser to the Director-General for Energy in the European Commission.

**Dino De Francesco** p. 26

Communications Manager at the Regions of Climate Action (R20).

**Alejandro Carbonell** p. 60

Architect with more than 15 years of experience and extensive training in entrepreneurship and leadership.

Photographers

Petr Malinak
Troels Heien
Martin Hesz
Bernhard Moritz
Scharfsinn
Tonkid
StockLeb
Lisa Schisanowski
Thussapon.28
Shooting@
Michel Petillo
Christian Tschürtz
Xujun

Graphic Designers

Émile Noël
Filipa Rosa

Project Managers

Patricia Carbonell
Vanessa Wabitsch
Danielle Kutka

Communication Assistants

Hadil J.S. Ayoub
Matthew Black

Marketing Director

Savina Cenuse

Founder

Stuart Reigeluth

COVER IMAGE: ERICA, THE FIRST DRIVERLESS BUS IN CATALONIA. THE BUS FITS 11 PASSENGERS AND IS BEING SHOWN AS A TEST RUN BEFORE EXPERTS HAVE TO IMPLEMENT IT IN 2020.

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▲ PASCAL SMET (AND HIS DOG EDGAR)

▲ BIKE LANE IN URBAN SPACE

Back to the future

In the 1950s and 1960s, urban planners designed cities around cars. Brussels is a sad example of this: a beautiful city, torn by motorways cutting through neighborhoods. Belgium's taxation policy over the last couple of decades has made the situation a whole lot worse. It is now more beneficial to live outside a city where taxes are lower, particularly if your employer provides a company car as a perk. Many employees are even issued with a fuel card, which makes the cost of travelling by car negligible. The result for Brussels is that of the 350,000 commuters coming into and leaving the city every day, half of them do so by car and often they are the sole occupant of that car.

The solutions are clear. Firstly, tax policy needs to promote living and working in the same location and it should ease people towards more sustainable modes of transport. Secondly, we need to invest in alternatives. Suburban rail infrastructure has to be brought into operation. We also need to extend the metro lines and connect them to Park & Rides on the outskirts. Thirdly, and perhaps most importantly, we need to create qualitative public space. International research shows that the more space you give to cars, the more cars you attract. Indeed, the most car-friendly cities are also the most congested. By giving back space to pedestrians and cyclists, cities can create places where people meet and connect. Child- and family-friendly cities, because it's the streets and squares where our children should be able to play and be safe. The idea is not to ban cars from the city, but to find a new balance. Back to the future.

Brussels is slowly but surely making that move from a city for cars to a city for people. In 2015, we created a large pedestrian zone in the city center – completely redesigned to incorporate art, trees, benches and meeting places. The same goes for the Schuman Roundabout, surrounded by the buildings of the EU institutions. The zone will be remodeled and transformed into a proper square that does justice to the location's status. As of this year, our second biggest shopping street will be pedestrianized as well. A project supported by local shopkeepers, because they were involved from the very beginning.

Finally, we should actively promote walking as the first option to move inside the city. Inspired by London we are putting up walking maps at bus stands around the city. There's a walking app which shows you the most scenic route and integrates secret passages that even Google Maps is not aware of. All in open data so that eventually, even Google can show the way. But most importantly, if qualitative space is given to pedestrians, they will use it happily.

Allow me to be optimistic. As a politician it is my moral duty. I am noticing change, something new is happening. There is a new generation of people who are fond of their city and want to make it a better place for residents and visitors alike. Cities around the world are making the same move. Together we should form a progressive coalition and show that we are cities where things can change. More space and more green. Let's change, let's go back to the future!

PASCAL SMET

MINISTER OF MOBILITY OF THE BRUSSELS CAPITAL REGION

An interview with Violeta Bulc

Achieving gender equality between women and men remains a major challenge across Europe, despite being a founding principle of the Union, says the European Commissioner for Transport.

▼ VIOLETA BULC, EUROPEAN COMMISSIONER FOR TRANSPORT



Why is it important to tackle the gender imbalance in the transport sector?

Only societies that know how to engage their entire capacity and potential can hope for a sustainable future – this is what drives my engagement in this topic. Despite progress and an increasing realization among all transport stakeholders that the sector can no longer be ‘exclusively for men’, currently only 22% of all transport workers are women. This is well below the figure for the overall economy at about 46%.

Besides employment, the gender pay gap remains a challenge. Across all sectors, women still earn on average 16% less than men in the EU. In addition, we continue to face fewer and slower promotions and difficulties in accessing board positions. For instance, in the aviation sector, less than 5% of pilots are women. In other words, there are still important challenges and barriers for women to access employment in the transport sector that need to be tackled. Equality between men and women is one of the European Union’s founding values and tackling the challenges faced by women in the sector has been at the heart of my mandate.

In the past year, we have seen fantastic initiatives and concrete measures taking place across Europe towards gender equality in transport.

What is it going to take for more women to join the transport sector?

There are some core aspects on which we need to concentrate our efforts to make the sector appealing to women. Improving working conditions could significantly contribute to encouraging women to start and to transfer their skills and continue their careers in the sector. It means putting in place measures to prevent violence, and to ensure adequate work-life balance; personal development and equal-pay. Ensuring an adequate working environment also starts with simple things: for instance, ensuring that all workplaces are equipped with separate toilets and dressing rooms, all the way to appropriate maternity leave arrangements.

However, putting in place legislative measures is not enough. Enhancing the attractiveness of the transport sector also requires a change of mentalities to remove some well-established stereotypes. Try to be vocal especially on fresh opportunities that new technologies bring, like automated and high-tech solutions.

They are a reality more and more. Raising awareness on the types of careers available, as well as on the reality of the workplace are important starting points. Nonetheless, changing mentalities also implies educational efforts and targeting children and young adults. Several of our partners have already developed projects that focus on educating young people (particularly girls) on technical, entrepreneurial and organizational professions. However, this will take some time and will only be possible if we witness joint efforts among all concerned actors in the sector and across society.

What projects is the Women in Transport—EU Platform for change involved with and what progress or achievements have been made?

The Women in Transport—EU Platform for change is a joint initiative between the European Commission and the European Economic and Social Committee. We launched it in November last year, with the objective of connecting all transport stakeholders eager to see changes in the sector. Platform members commit to undertake specific actions to strengthen women's employment in the sector. Our partners include all transport industries, trade unions, NGOs and media. A declaration to ensure equal opportunities to men and women in the sector has been signed by some key transport stakeholders – and remains available for further signatories online. The Platform is a fantastic tool to present the initiatives and projects of the signatories, share best practices, and encourage other stakeholders to take concrete measures to strengthen women's employment and equal opportunities. In the past year, we have seen fantastic initiatives and concrete measures taking place across



Europe towards gender equality in transport. Many of the signatories have focused their projects on education, developing toolkits for primary and secondary school teachers to fight gender stereotypes in transport. I invite all transport stakeholders to bring concrete actions in the EU Platform for change and to sign the Declaration.

and skills at a time when the transport sector is widening and evolving. As the sector becomes increasingly people-centered, digitalized and service-oriented, it is important that companies and service providers mirror shifts among the workforce. The growth of digital jobs presents excellent opportunities for women to enter and develop within the sector. Ensuring equal opportunities means also ensuring diversity and the development of solutions that meet the needs of all people.

**Across all sectors,
women still earn
on average 16% less
than men in the EU.**

**How will more women in the
workforce help transform
the transport sector?**

As more women start their careers or transfer to the transport sector from their existing careers, they bring with them experiences

**How can improving the
gender balance in the
transport sector be
beneficial to all?**

Studies show that organizations with inclusive cultures have greater innovation and higher creativity. The most successful societies are those that maximize their intellectual human potential. In turn, we need to use all talents to ensure the prosperous future of the sector and society as a whole. ●

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Missing the 'F' in sustainable mobility!

WRITER:
HEATHER ALLEN

We all agree that we need to shift transport away from fossil fuels to low-carbon, sustainable mobility, but as laudable as this may sound and be, the trends for more and better transport are not delivering increased prosperity for all...

One of the major challenges that policy-makers face today is reconciling the need for growth with environmental protection and social development. Transport is both an enabler and a barrier to this as each transport sub-sector or thematic area has different, and frequently conflicting priorities, especially within and between public and private institutions and departments. Transport is particularly complex with the many dependencies between mobility and access, the need for goods and people to travel and other key development areas such as education, health, economic growth and societal stability. In the past, high-quality transport system was seen as a prerequisite for development and a higher quality of life. However, now there are many signposts indicating not only that we need shift our transport away from fossil fuels to low carbon, sustainable mobility concepts, but how we should be doing this.

Sustainable mobility takes many forms, but its underlying premise is that carbon intensity

of transport and travel is reduced compared to today while accessibility and connectivity (both physical and virtual) are at least maintained, and in some cases, increased. A major reorganization of people's life-styles and business practises is needed, and a lot of attention is being given to electric mobility and other technical solutions. Politicians are anxiously putting programs in place to boost electric mobility as a major part of the solution. Attractive, shiny, all electric cars are becoming almost affordable and salesmen (and women) boast of "ranges of four to five hundred kilometers" with glints in their eyes as they 'steal your money' for these highly-priced vehicles.

In the past, speed and travel time savings were cornerstones of transport design, planning and investment. But we now realize that a trend of more and better transport does not deliver increased prosperity for all – in fact it creates divides between the 'have all, the have less and the have nots'. Yet it is still difficult to move policy away from tinkering at



the margins to make electric cars more affordable, promote car- and bike-sharing and building high-speed rail that take us further quicker. Although it is certainly true e-mobility will play a major role in the future, but this will come at a high cost and it seems that many lower-cost options are being neglected.

The majority of people dislike change – and looking more closely at what and who is going to have to change as well as the risks if we get it wrong shows there is much to fear. Those in positions of power and most decision-makers are more than comfortable with making a few small changes, rather than getting down to some of the central problems

with the sector. One of these is bringing in the 'F' word and bringing in the 'F' power into the sector. I am, of course, talking about feminizing the sector! Personally, I fear that without this the sector will neither become sustainable nor as low carbon as is needed within the time frame we have to make change.

Thankfully, there has been a seismic shift in thinking about diversity and equity. Indeed, this is reflected in the international agenda with gender-based targets set out the Sustainable Development Goals (SDGs) and the New Urban Agenda giving a clear framework for governments to follow. In addition, there is a growing consciousness that

There is real value in increasing the number of women in all sectors that are strongly male-dominated.

there is real value in increasing the number of women in all sectors that are strongly male-dominated.

The construction and transport industries are prime examples of where change needs to happen, as neither can boast about their gender balance especially at decision-making levels and the composition of the workforce. This may be not surprising as historically women were excluded from many of the technical degrees and many jobs were not

suitable for women as they typically required both 'brains and brawn', but this is no longer the case and it is time to open the doors and get more women involved.

Although, it is quite legitimate to ask why it is important to bring in more women into transport there are a number of very good reasons that are stacking up. Firstly, we need to get more women working in all sectors of the economy. This would be good for global growth. A report by the McKinsey Institute (2015) suggests that women account for 37% of measured global GDP, but that fully eradicating gender gaps could add up to 26% to global GDP relative to a 'business-as-usual scenario'. The OECD has similar projections stating that closing gaps between men and women could add 12% to OECD countries' GDP by 2030.

As women make up around 50% of the adult population, they present an untapped resource. Getting more of them earning would also help address poverty issues as currently, there are more women in precarious informal jobs, unemployed or simply unable to work outside the home for money.

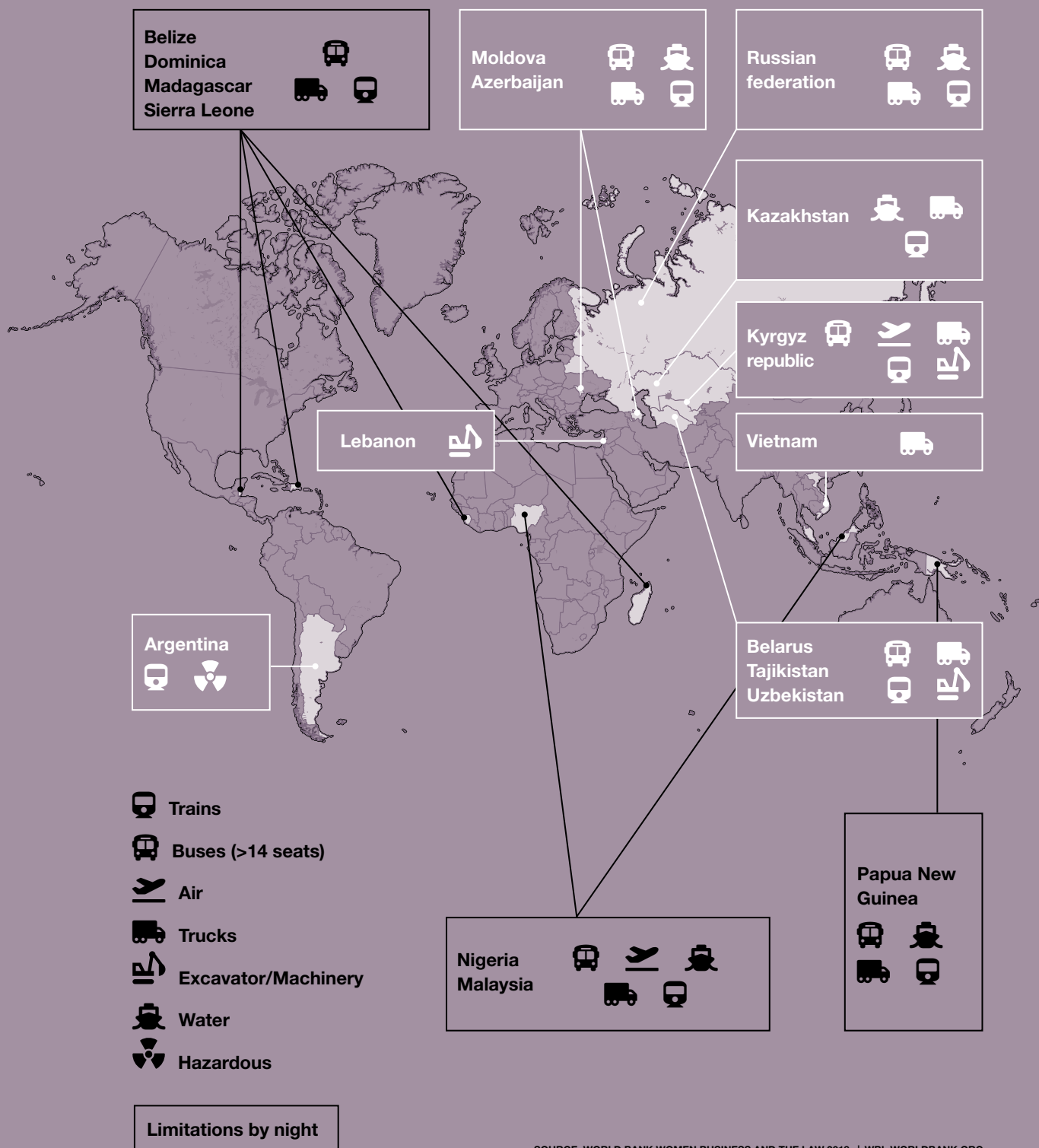
▼ HIGH SCHOOL GIRLS LEARNING AUTO MECHANICS, 1927



▼ FEMALE MECHANIC WITH HONDA MOTORCYCLE, 1975. SOURCE: MUSEUMS VICTORIA



Legal interdictions on women's employment in transport



Transport offers many opportunities for employment, but most jobs are still considered to be 'men only'. According to the 2018 Women, Business and the Law report, 19 economies impose restrictions on women's employment in transport. Overall, as many as 104 countries have at least one legal restriction on

women's employment in general (including transport). Examples include restrictions on night-time work, driving trains or heavy-duty vehicles.

Numerous barriers exist, most notably about issues around recruitment bias, where men are still preferred against taking on an equally qualified woman; and globally, there is a major gender pay gap. In most countries, women earn on average only 60-75% of men's wages.

On the other hand, there are numerous risks that we should be aware of if we do not change the current transport paradigm. Women are the majority of users of public transport in both developed and developing countries. This comes as no surprise when we consider the different mobility patterns between men and women. Women tend to make more frequent, shorter trips, while men typically make longer single destination trips. In the developed world this is beginning to change as roles become reversed and men more actively share family responsibilities. However, this is not yet the case in much of

Women are the majority of users of public transport in both developed and developing countries... because they *have to* not because they *chose to*.





NEPALESE PASSENGERS TRAVELING ON THE TOP OF THE YELLOW BUS. SOURCE: STOCKLEB ▲

the developing world, where women are still responsible for most of the caring duties associated with family life.

Despite being high public transport users, most urban networks are not designed with their needs in mind and the majority of improvements are based on travel time reductions, which in turn is linked to speed rather than connectivity. Women walk and take public transport more than men – but this is because they have to rather than they chose to. In research by the FIA Foundation and CAF, they found that even low income women would shift from these habits very quickly if they are given the opportunity. That opportunity will come as they become more empowered and financially secure. Indeed, this is already starting. Trends in the US and some European countries show that there are more women than men applying for driving licences, registering private cars and applying for car insurance.

Unfortunately, women are often targeted for harassment and hate crimes while using public transport or when they use public space to access it. Verbal or visual harassment is most common everywhere, but it sometimes leads to rape or death. The #MeToo Movement has one simple aim: Make the world safer for women by ensuring women are free from sexual harassment, abuse, assault, and rape. This goal relates as much to transport as other sectors. An 18-year-old black woman was killed while traveling late one evening on the San Francisco subway at the station where she got out. So, it is not surprising that the majority of women are concerned about their personal security based on their own experience or that of their close family or friends. Many learn from their mothers at an early age that public transport is unsafe, inconvenient and crowded. Indeed, safety and security concerns greatly affect women's mobility.

Transport plays a huge role in ordinary women's and girl's lives by getting them into work and giving them access to education that will in turn give them more choices when they are adult. The converse is also true – and if they

recently appointed its first female Transport Minister. If we can bring in more women as planners, engineers and project designers, it is more likely that women needs may be better planned into the systems we design and build, and that they may well remain as high users of public transport rather than shift to other modes.

Women account for 37% of measured global GDP

(McKinsey Institute, 2015)

perceive it not to be safe, secure and affordable, they will simply not take up the opportunities presented to them.

Women are becoming more vocal in expressing their transport needs. Women's voices shouted loud and clear in London when the international Ride Hail service Uber was mooted to be banned – these services were more attractive and useful to them than regular public transport and taxis. In a study in 6 cities by the World Bank, comparing such services in cities as far apart as New York and Jakarta, they found that women like to drive as it provides a flexible option for work, it provides affordable door-to-door services and it appears to be no more or less safe than other taxi-type services.

When we look at who are the decision-making roles for transport, it remains overwhelmingly male. There are a few outstanding examples, of course. One being the present European Commissioner for Transport, Violeta Bulc. Looking at around 60 OECD countries, a review of Ministers of Transport revealed that only 9 were female (July 2018) or around 15% of the total including Chile, Estonia, Finland, France, Korea, Netherlands, Serbia, Switzerland and USA. But only one from the Global South. A number of these have been in place for several years while Chile only

The stakes are high. If women shift from their current low carbon mobility habits to high carbon mobility, we risk making a lot of effort just to 'stand still' and technology cannot fill the gap. The sector will not be able to reduce its carbon intensity as an increasing number of women become motorized in their own right (even if they choose slightly smaller and less polluting cars than men do). The risks to sustainable mobility are therefore very real but there is still inertia in the sector to change.

What can cities and national governments do? Luckily there are many reports and policy papers that can provide guidance. GIZ's Transforming Urban Mobility Initiative (TUMI) have updated their SUTP report on Urban Transport and Gender; the FIA Foundation and CAF have been working on comparing and contrasting women's personal security in three Latin American cities and have developed the results into a summary and toolkit; and lastly the World Bank are including a gender chapter in their upcoming report for SUM4ALL (Sustainable Mobility for All) initiative. They have clearly identified the areas of 'women as users, decision-makers and workers' as thematic focal points and they will add this topic as a chapter in their update of the Global Mobility Report for the first time in early 2019. We can only hope that people are ready to listen and to change at the core of those who make the decisions about transport, and that this comes in time! ●

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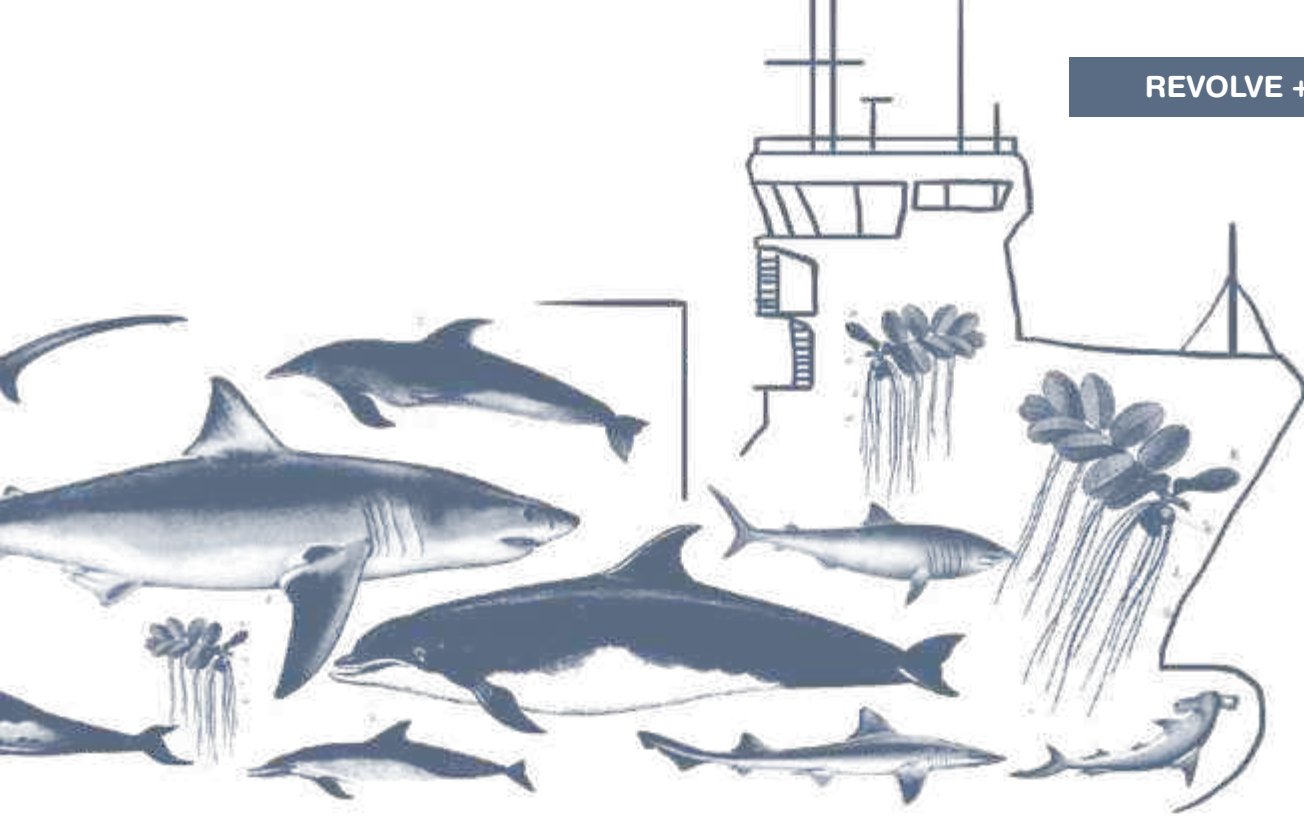
THE BIOMIMETIC HULL

An inspiration for friction reduction
from nature

WRITERS:

JOHANNES OEFFNER & CHRISTIAN F. JANSSEN

Inventors got their inspiration from nature to solve technical challenges for millennia. However, it is not as simple as it sounds, since highly complex biological structures cannot easily be copied technologically. Biomimetic solutions have enormous technical potential and collaborative projects continue to conduct research – also for shipping hulls.



Introduction

In the course of evolution, nature has developed a multitude of mature strategies to overcome all kinds of physical hurdles. Biomimetics tries to understand the underlying mechanisms of these biological phenomena and to transfer and translate them into technical concepts. Even though biomimetics is still quite young as a science, the basic idea has influenced technical inventions in the past as well.

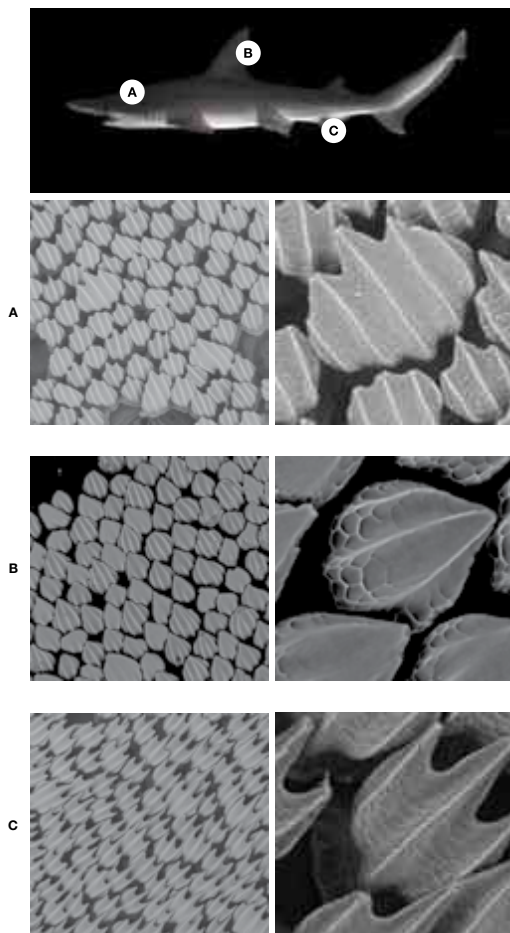
Leonardo da Vinci developed aircraft, helicopters and parachutes – the technical implementations of which were only prevented by the time in which he lived. The Swiss engineer George de Mestral got the idea for one of the first biomimetic products from his dog. After walks in the woods, he always had to take out burrs in his fur. When he looked at the holding mechanism more closely, he discovered the technical potential and patented the Velcro in 1951. Another biomimetic example is the lotus effect. The surface of the lotus plant can clean itself by combining microstructures and wax crystals. This effect was discovered in the 1970s. It has been used in paints, varnishes and sanitary facilities for about 20 years.

Even now in the 21st century, despite enormous scientific and technical progress and new possibilities in computer simulation and experimental technology, nature still forms the basis for numerous technical innovations. Bio-inspired technical innovations are developed with the most modern scientific tools and advanced, for example, in large international collaborative research projects such as the AIRCOAT project.

Biomimetics in fluid mechanics

Fluid mechanics – the science of the physical behavior of fluids and the flow around bodies – is ideal for biomimetic developments. Interactions between body surfaces and flowing media lead to forces that must be compensated by muscle power (in living beings) or drive power (in ships, cars, airplanes). Nature has developed many mechanisms to keep these forces (the flow resistance) and thus the energetic locomotion effort as small as possible.

In shipbuilding, innovative hull shapes lead to a steadily reduction of the so-called form drag. In return, however, the dominance of the remaining skin friction drag increased. This friction also increases with the steadily decreasing speed of ships ("slow steaming") and causes increasing fuel costs. Innovative biomimetic concepts are therefore of great ecological and economic interest for ship-building.



▲ FIG. 1 : BONNETHEAD SHARK (SPHYRNA TIBURO)
ENVIRONMENTAL SCANNING ELECTRON MICROSCOPE (ESEM).

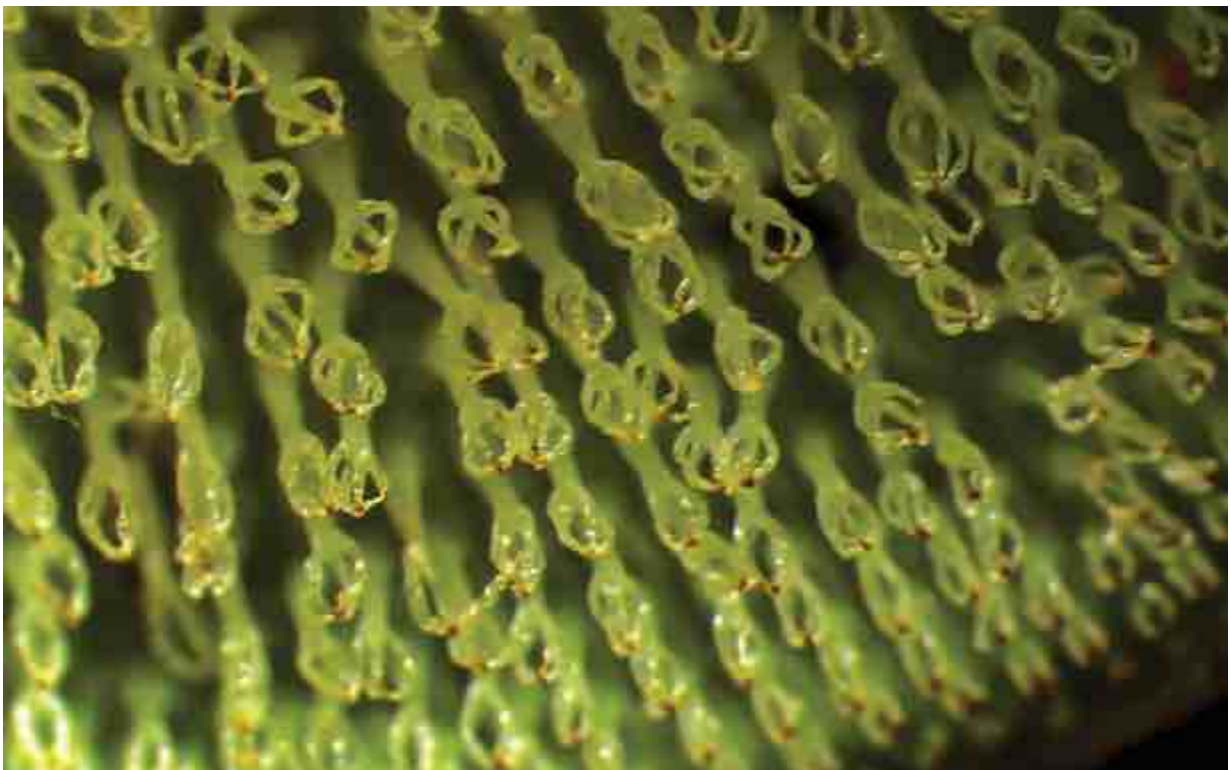
Sharks and dolphins

Shark skin is an established biomimetic approach to reduce frictional resistance. Its surface is covered with many tiny teeth, the so-called denticles, which have several grooves aligned in the direction of the flow (Fig. 1). Since a long time it is assumed that the denticles minimize hydrodynamic resistance. A valid method to check this was only found in 2012. Using a fin flapping robot, Oeffner & Lauder let the skin of two shark species oscillate elastically in the flow channel and demonstrated a 12% lower drag, compared to the same skin with removed denticles.

In the 1980s engineers invented Riblets (inspired from shark skin, which possess fine ribs structures with sharp tips). Experiments in flow channels showed a 7% drag reduction. However, the application of Riblet foils on aircraft and ship hulls proved to be uneconomical, as the relatively low minimization of resistance was exceeded by increased maintenance costs.

Oeffner & Lauder found that the dynamic change in skin shape caused by the shark's swimming movement is crucial for minimizing its drag. However, compared to the shark, a ship or airplane hull is rigid. Therefore, the functionality of the biological model can only be implemented to a certain degree. The technical effectiveness of biomimetic shark skin is thus limited.

Like the shark, the dolphin is also noticeable for fast movement with relatively low energy input. A closer look at its skin structure shows this is not due to the immediate surface texture, but to a deeper layer of dampening fat, which in addition to numerous other functions (such as thermal insulation and beneficial properties for wound healing) makes a decisive contribution to movement efficiency. The effect actually dampens interference waves occurring in the boundary layer and prevents the flow from a laminar to an energy-consuming turbulent state. Here, too, it is not primarily the dampening properties but the overall



▲ THE SURFACE OF THE FLOATING FERN SALVINIA ENABLES IT TO FORM A STABLE CONTINUOUS AIR LAYER WHEN SUBMERGED UNDER WATER.

deformation behavior of the dolphin skin that are decisive – This was recently being investigated in the international joint research project FLIPPER in which the Hamburg Shipmodel Basin (HSVA) and the Technical University of Hamburg (TUHH) were involved.

Thinking out of the box

In addition to direct adaptation, biological models in technology can also perform other tasks that go beyond their actual natural function. This has the advantage that the biological model can be selected specifically according to the technical requirements and possible technical limitations are circumvented by highly complex biological structures. A current example is the Salvinia effect and the EU project AIRCOAT.

The surface of the floating fern Salvinia is equipped with a special micro- and nano-structure and chemical composition, which enables it to form a stable continuous air layer once, submerge under water. This effect has massive technical potential. Equipping a ship hull with a continuous layer of air, the ship would literally glide over the water and thus reduce energy use and carbon emissions.

Already on the market are refit devices that use a similar concept by injecting air bubbles to the water under the ship hull. This micro-bubble technology is an active air lubrication solution. Inspired by the Salvinia effect, nanotechnologist Prof. Thomas Schimmel from the Karlsruhe Institute of Technology (KIT) has developed a passive air lubrication solution. They could show that this artificial surface maintains an air layer under water for several years and initial frictional resistance experiments were promising.

Biomimetics in shipbuilding

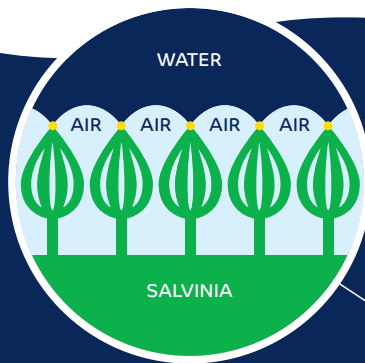
Fluid mechanic experiments and simulations of these biomimetic effects show significant drag reduction results. However, the examples also show that it is often only apparent at second glance which biomimetic mechanism is most opportune to use. This sometimes limits the technical transferability. In addition, surface coatings, especially in aircraft and shipbuilding, have to meet high durability requirements and there is a clear conflict of interests between aerodynamic and hydrodynamic resistance reduction and biological resistance. This is where the EU research projects eShark and AIRCOAT come in. The eShark project, which is due to finish 2018, targets to develop an environmentally-friendly, automatically-applied self-adhesive foil systems that have both anti-fouling properties and resistance-reducing effects. The 3-year AIRCOAT project, which started in 2018, combines this self-adhesive foil technology with the passive bio-inspired air lubrication technology to produce a game-changing hull-coating system. The project intends to validate its potential to reduce reducing frictional resistance, emission of pollutants and biofouling.

Some biomimetic effects contradict or complement each other in their effect and area of application – such as surfaces that are as smooth, rough or dampening as possible. While current research is more concerned with separate individual effects, a combination of techniques seems to be appropriate for technical applications, a task that must first be addressed in future research projects. Overall, a biomimetically-optimized hull could have a high potential to create a more sustainable water transport. ●



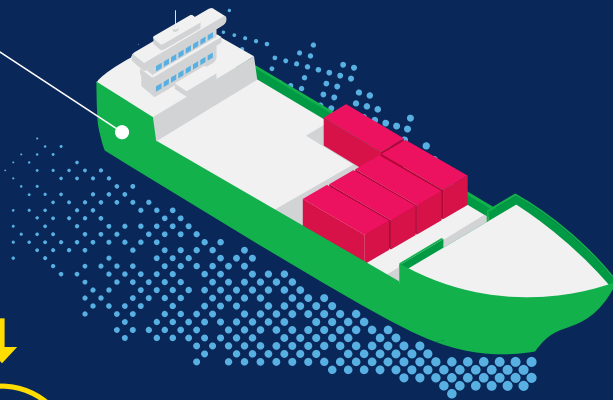
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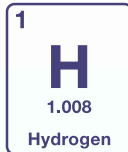
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CONSORTIUM PARTNERS



The AIRCOAT project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 764553.



The Hydrogen Revolution is Underway

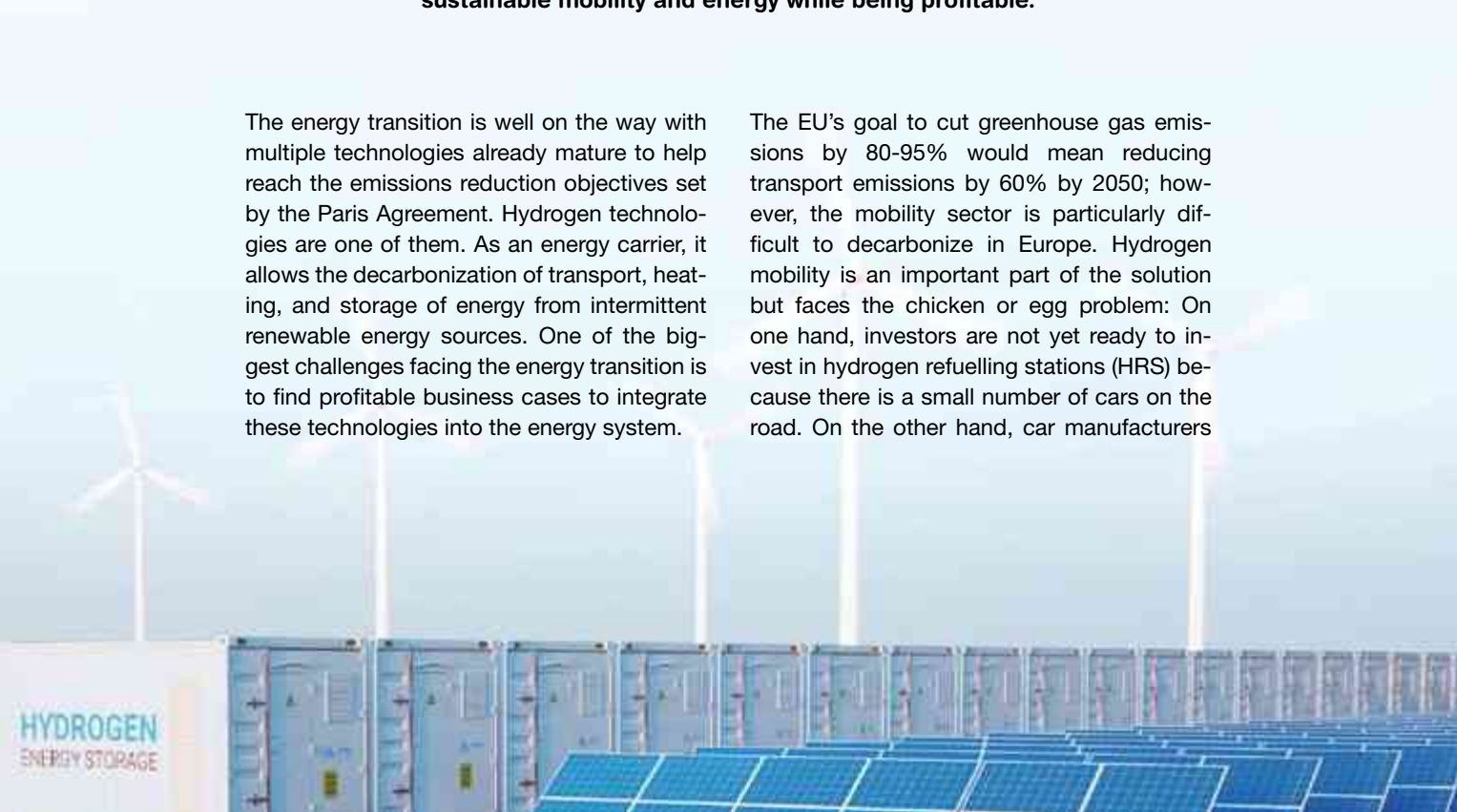
WRITERS:

WOUTER VANHOUDT, THIBAUT DE LACROIX, VANESSA VIVIAN WABITSCH

To realize the global climate and Sustainable Development Goals, decarbonizing the transport sector is key: hydrogen offers promising opportunities for driving forward sustainable mobility and energy while being profitable.

The energy transition is well on the way with multiple technologies already mature to help reach the emissions reduction objectives set by the Paris Agreement. Hydrogen technologies are one of them. As an energy carrier, it allows the decarbonization of transport, heating, and storage of energy from intermittent renewable energy sources. One of the biggest challenges facing the energy transition is to find profitable business cases to integrate these technologies into the energy system.

The EU's goal to cut greenhouse gas emissions by 80-95% would mean reducing transport emissions by 60% by 2050; however, the mobility sector is particularly difficult to decarbonize in Europe. Hydrogen mobility is an important part of the solution but faces the chicken or egg problem: On one hand, investors are not yet ready to invest in hydrogen refuelling stations (HRS) because there is a small number of cars on the road. On the other hand, car manufacturers



do not want to deploy vehicles in regions with a low-density HRS network. Currently, existing stations are financed mostly by Public-Private-Partnerships.

Hydrogen is profitable today

How can hydrogen innovations be lucrative today and in future? A study by Hinicio and Tractebel Engineering, financed by the Fuel Cell and Hydrogen Joint Undertaking, examines under which conditions Power-to-Gas can be viable economically today and in 2025. One of the key findings is that cost-effective business cases for hydrogen refuelling stations already exist. Therefore, the chicken-or-egg problem can be solved more easily than expected.

Hydrogen is not a primary energy source that is naturally available. One way to produce hydrogen is via water electrolysis—the decomposition of water into hydrogen and oxygen through electricity. To achieve low emissions from Well-to-Wheel, the life-cycle analysis of transportation fuels, electricity must come from renewable sources with low carbon emissions. As the cost of electricity is the most influential part in the overall cost of hydrogen, it needs to be as low as possible. Modelling allows to spot the most favorable places in Europe from an electricity point of view. Discount electricity can be received where a large amount of curtailed electricity is available, meaning electricity is produced but the grid cannot take it up, resulting in grid congestion.

Next to producing hydrogen for a mobility market, the electrolyzer could inject hydrogen into the natural gas grid, greening the heating network whilst providing balancing services to the electrical grid operator. The study shows that the business case of providing hydrogen to an HRS, combined with revenue streams from gas grid injection and flexibility services, allow to de-risk the investment of a hydrogen production plant.

Especially interesting for this business case is the semi-centralized hydrogen logistic model with regional hydrogen production hubs. These electrolyzer plants can be strategically located in areas with locally-curtailed electricity available at discounted prices, low grid costs and positioned close to the gas grid as to avoid expensive connectivity costs.

Germany, France, Denmark and Great Britain have planned to deploy hundreds of Hydrogen-Refuelling Stations over the next decade.

Transitioning to hydrogen mobility across Europe

Hinicio has been developing a unique competence center in the field of hydrogen energy within Europe since 2007. The region has ambitious plans for a future Hydrogen Economy. Many countries have demonstrated an ambitious hydrogen mobility roadmap: countries like Germany, France, Denmark and Great Britain have planned to deploy hundreds of HRS over the next decade. The Hinicio-Tractebel study shows that the electrolysis market with the described conditions of profitability in these four countries provided 1,300 MW in 2017, which is sufficient to produce the amount of hydrogen planned.

For creating more “sweet spots,” the study recommends developing a clear regulatory framework of access to curtailed electricity from renewables. Furthermore, grid charge exemption should be extended to other EU Member States. Also, hydrogen injection into gas grids should benefit from the same rules and tariffs as bio-methane injection and system services (especially Frequency Containment Reserves) also accessible for electrolyzer plants.

Hydrogen technologies demonstrate that they are an integral part in the great energy transformation of the 21st century and have great potential to be an important cornerstone of the future energy system. Now, the evolution of the regulatory environment is crucial for developing the niche market and to make this silent revolution louder in the near future. ●



▲ REFILLING THE HYDROGEN PASSENGER CAR TOYOTA MIRAI AT THE HYDROGEN REFUELING STATION ZAVENTEM, BELGIUM.

One way to produce hydrogen is via water electrolysis—the decomposition of water into hydrogen and oxygen through electricity.



Hinicio is a strategy consulting firm specialized in sustainable energy and mobility. Our areas of expertise include renewable energies, energy storage, energy efficiency, sustainable mobility and ocean energy. Since 11 years Hinicio has been developing a unique center of competence in the field of hydrogen energy and advises companies at every step of the value chain. Hinicio brings together a high level expert team to support large corporations, energy utilities, public authorities as well as start up companies based on a multidisciplinary approach bringing together technology, markets and policy. Find out more: www.hinicio.com



▲ IN JULY 2018, TOYOTA LAUNCHED THE FUEL CELL ELECTRIC CLASS 8 TRUCK WITH 300 MILES PER FILL.

REMOVING BARRIERS TO RENEWABLE TRANSPORT FUELS



PROJECT PARTNERS



Utrecht University

Imperial College
London



CHALMERS
UNIVERSITY OF TECHNOLOGY



CONTACT

Co-coordinator: Kristin Sternberg / k.sternberg@fnr.de

Communication: Simon Hunkin / simon.hunkin@greenovate.eu

Media: Vanessa Wabitsch / vanessa@revolve.media

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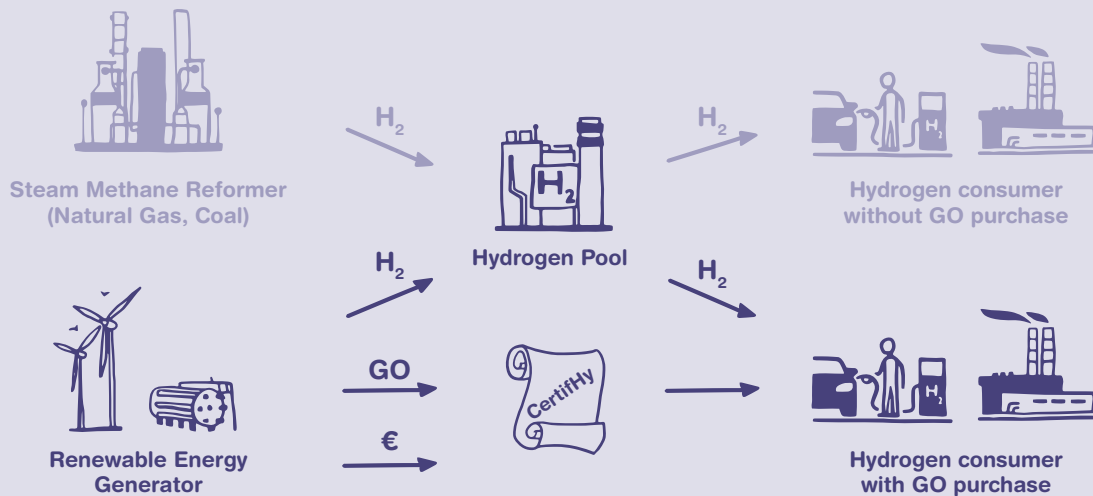
The ADVANCEFUEL project (Full Title: "Facilitating market roll-out of RESfuels in the transport sector to 2030 and beyond"), has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 764799.



CertifHy

DESIGNING THE FIRST EU-WIDE GREEN HYDROGEN GUARANTEE OF ORIGIN FOR A NEW HYDROGEN MARKET

Hydrogen is a key vector to reach climate change targets as it enables massive decarbonization in industry and transport when it is produced from renewables or low carbon energy sources. Global demand for hydrogen is foreseen to reach 50 million tons by 2025 and there is a potential that 50-60% of all hydrogen originates from renewable or low-carbon energy sources by 2030. A reliable scheme that tracks and certifies the origin of the produced hydrogen is essential to create a market for Green and Low-carbon hydrogen, as it is and has been for renewable electricity.



CertifHy is developing the first EU-wide Guarantee of Origin (GO) scheme for Green and Low-carbon hydrogen. Led by Hincio and in cooperation with Grexel, LBST, TNO and TÜV SÜD, the initiative is financed by FCH JU, the European public-private partnership for hydrogen and fuel cell technologies and is supported by the European Commission. CertifHy will provide information

about the source of the hydrogen with certificates being traded through an electronic registry separate from the physical flow. This allows EU-wide transferability and consumption of Green and Low carbon hydrogen and for profitable business cases to develop. A GO scheme offers transparency, empowers consumers and creates market pull for Green and Low-carbon hydrogen.



▲ THE CERTIFHY PILOT PLANT COLRUYT GROUP PRODUCES GREEN HYDROGEN ON SITE FOR FORKLIFT FLEETS, HEAVY DUTY VEHICLES AND PASSENGER CARS.

From concept to implementation

Based on the definitions of Green and Low-carbon hydrogen and a solid framework built during the first phase of the project, CertifHy is implementing the GO scheme currently. This includes defining the scheme's governance, as well as its processes and procedures over the entire GO life cycle: from auditing the hydrogen production plants, certification of hydrogen production batches, through the issuing and trading, all the way up to the sale of GOs.

Four pilot projects showcase different hydrogen production pathways and are testing CertifHy at their respective hydrogen production plants located throughout Europe. The industrial gas company Air Liquide demonstrates a hydrogen production plant using steam methane reforming with CCS/CCU unit in France. The chemical companies Air Products and Akzo Nobel present hydrogen production using a chlor-alkali process in the Netherlands. As a retailer Colruyt demonstrates on-site hydrogen production for its fleet in Belgium and the German energy storage company Uniper shows hydrogen production from water electrolysis. Their

production batches are audited during this pilot and the corresponding GOs will be up for trade in the second half of the project.

CertifHy's stakeholder platform (including four working groups) is a forum of discussion about how to structure the system and manage the pilot stage. It brings together 130+ European organizations across the whole supply chain contributing to shaping the GO scheme. "Whereas the first phase of CertifHy built a solid foundation with 14 companies and already more than 500 followers; I am greatly satisfied we are now rolling out the system with more than 800 stakeholders and creating a European harmonized system," states CertifHy's project coordinator Wouter Vanhoudt during CertifHy's stakeholder platform's first plenary session in November 2017.

By early 2019, CertifHy is creating the path forward for a concrete and actionable GO scheme. A reliable and efficient GO scheme will contribute to decarbonizing energy and transport, enhancing renewable energy use and moving ahead to a new energy market. ●

For more information please visit www.certifhy.eu and contact the CertifHy consortium via certifhy@hinicio.com

Interview with Tudor Constantinescu

PRINCIPAL ADVISER TO DIRECTOR GENERAL FOR ENERGY
OF THE EUROPEAN COMMISSION

What is the value of hydrogen for the energy transition in Europe?

The long-term objective of decarbonization implies that we look at a whole range of solutions that will facilitate reaching the EU energy and climate targets in the most cost-effective way. For achieving our targets in a competitive way, we need to focus more on energy efficiency and renewables. Renewables have to move to the centre stage of the energy mix. It is clear that renewables become even more important for the economy and the environment in future.

Currently, the share of renewables in electricity is about 30% and we expect it to be 55% by 2030 looking at the target in the renewables directive. However, in other important sectors such as transport and industry the share of renewables is not as high. In these sectors, hydrogen is a key enabler and playing an important role to facilitate the integration of renewables into the energy system. There are several energy storage technologies supporting the balancing of the electricity grid and integration of variable renewables. But green hydrogen may facilitate the most cost-effective integration from renewables in various sectors such as mobility, industry and also energy networks (electricity, heat, gas).

What are the most promising applications in the view of the European institutions?

In the last years, we have witnessed the versatile applications that hydrogen can offer – compared to a few years ago when the focus was on hydrogen for fuel cell vehicles only. Now we see hydrogen is not only used for road transport, but also for railway or maritime applications. Green and low carbon hydrogen offers a big potential to decarbonise carbon-intensive sectors that otherwise would be difficult to decarbonise. I would say the refining industry, the fertilizer industry and the steel industry are the most important carbon intensive industries where green hydrogen could have a major contribution to decarbonisation and in this way supporting also the integration of renewables into these sectors.

Hydrogen is a sector coupling enabler. Where do you see high potential for sector coupling and what is essential for realising it?

All the sectors I have mentioned offer this potential. Especially important is the mass scale

deployment of green hydrogen. For example, linking electricity and gas networks and the gas industry – to decarbonize gas infrastructure and to increase green hydrogen, but also synthetic methane and bio methane injected into the gas network. This would definitely offer big potential for the integration of renewables. The gas network has larger potential of gas storage with a lower cost compared with electricity. We see growing interest in this area across Europe – for example the Netherlands, Germany, France, Denmark, Austria and others, each driven by the particular opportunities they have to integrate renewable electricity and to make better use of the gas infrastructure.

Integrate hydrogen into the European policy framework

You see a lot of value of green hydrogen in the energy transition. What are the challenges for hydrogen to be part of the energy transition from a policy point of view?

It is important that we develop the regulatory framework in relation to the energy and electricity system. Hydrogen as an energy storage enabler is treated in a non-discriminatory way in the clean energy package. But it is also important to look at the other sectors. We need to develop an adequate regulatory framework also in relation to gas and to create the instruments allowing sectoral integration. We

should also invest in R&D to reduce costs and to make more innovative solutions also profitable.

What are the prospects to integrate hydrogen in policy and regulation?

To have hydrogen supporting sectoral integration, we need to adapt the policy and regulatory frameworks, for energy but also for transport and industry. The Alternative Fuels Directive created a first important basis for using hydrogen in transport. In the "Clean Energy for All Europeans" package we made major steps. First of all, in the recast of the renewables directive, we have put more focus on renewable fuels of non-biological origin. Green Hydrogen can be used to produce e-fuels which have the potential to decarbonise the transport sector by large on the road, but also railway and maritime. Upcoming is a directive and regulation for market design on electricity. We proposed a clear definition of energy storage that does not only refer to Power-to-Power but also Power-to-X (mainly Power-to-Heat and Power-to-Gas). This will be very important for the whole provisions about storage. We try to create a level playing field for a wide range of flexibility and storage technologies where each technology can contribute at the right place based on their main functions. There is growing interest from public authorities and industries (see also the Hydrogen Initiative signed in Linz in September by more than 20 Member States) to develop a regulatory framework with the aim to green the gas infrastructure ●

Read the full interview online:

www.revolve.media

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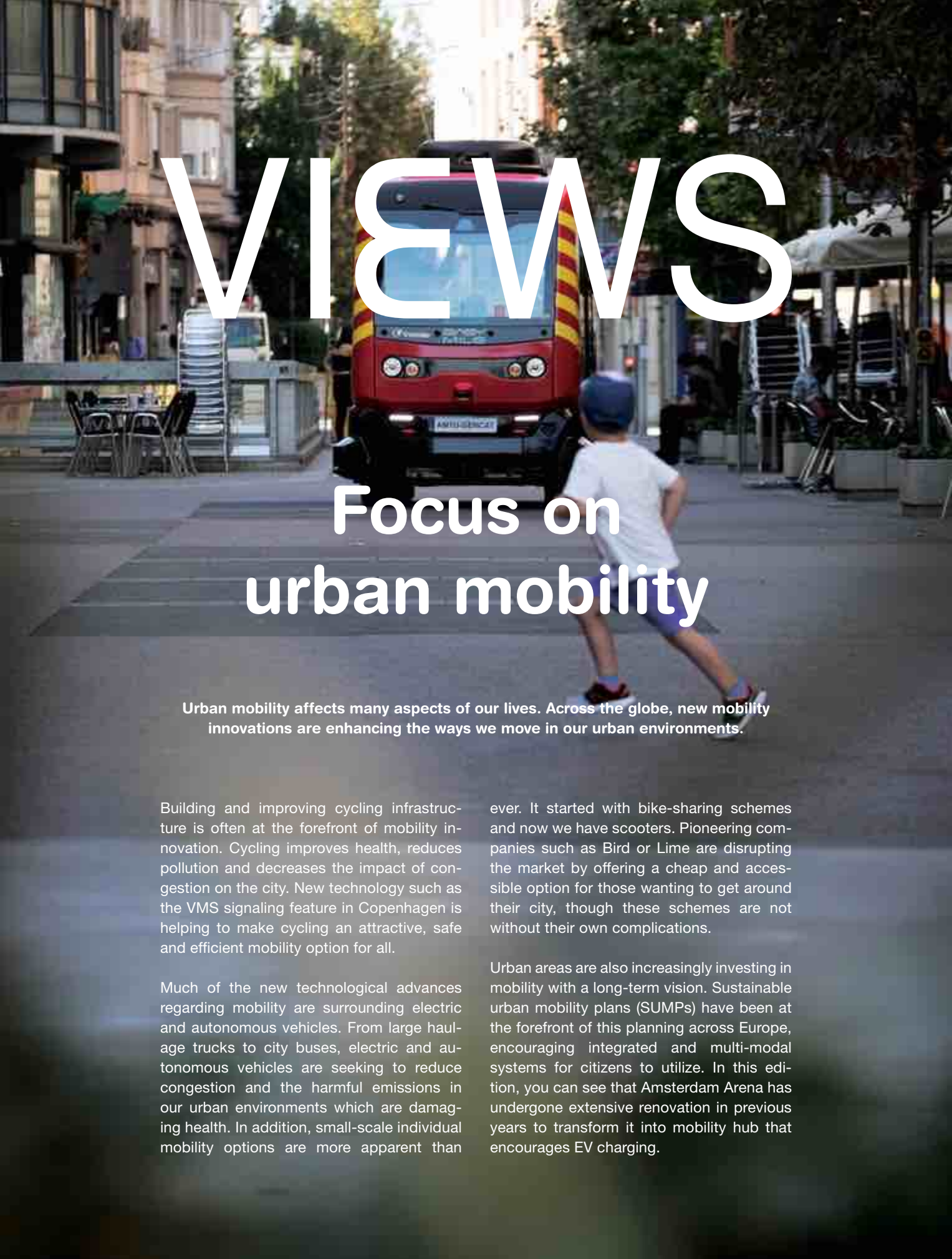
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Key Sectors

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A red and yellow striped bus is driving down a city street. In the foreground, a young child wearing a blue helmet and a white t-shirt is running towards the bus. The street is lined with trees and buildings, and there are outdoor seating areas on the sidewalks.

VIEWS

Focus on urban mobility

Urban mobility affects many aspects of our lives. Across the globe, new mobility innovations are enhancing the ways we move in our urban environments.

Building and improving cycling infrastructure is often at the forefront of mobility innovation. Cycling improves health, reduces pollution and decreases the impact of congestion on the city. New technology such as the VMS signaling feature in Copenhagen is helping to make cycling an attractive, safe and efficient mobility option for all.

Much of the new technological advances regarding mobility are surrounding electric and autonomous vehicles. From large haulage trucks to city buses, electric and autonomous vehicles are seeking to reduce congestion and the harmful emissions in our urban environments which are damaging health. In addition, small-scale individual mobility options are more apparent than

ever. It started with bike-sharing schemes and now we have scooters. Pioneering companies such as Bird or Lime are disrupting the market by offering a cheap and accessible option for those wanting to get around their city, though these schemes are not without their own complications.

Urban areas are also increasingly investing in mobility with a long-term vision. Sustainable urban mobility plans (SUMP) have been at the forefront of this planning across Europe, encouraging integrated and multi-modal systems for citizens to utilize. In this edition, you can see that Amsterdam Arena has undergone extensive renovation in previous years to transform it into mobility hub that encourages EV charging.

1. United States

AS DOCKLESS ELECTRIC SCOOTERS ENTER MORE U.S. CITIES, THIS NEW MODE OF URBAN TRANSIT SEEMS TO OUTPACE THE ABILITY OF CITIES TO REGULATE THEM. HOWEVER, A TEAM OF SCHOLARS AT THE SAN FRANCISCO-BASED TRANSPORTATION DATA AND ANALYTICS COMPANY POPULUS RELEASED A NEW REPORT ASSESSING USER ATTITUDES AROUND THE NEW SERVICES. A NATION-WIDE SURVEY FOUND WIDESPREAD SUPPORT FOR THE SCOOTERS WITH 70% OF RESPONDENTS LIKING THE NEW SERVICES—EVIDENCE THIS NEW FORM OF TRANSPORTATION CAN ADDRESS TRANSIT EQUITY ISSUES. SOURCE: CURBED

2. Sweden

THE EUROPEAN INVESTMENT BANK (EIB) APPROVES FINANCING FOR 'EUROPE'S LARGEST BATTERY FACTORY' WITH €52.5 MILLION IN FINANCING FOR SWEDISH BATTERY CELL MANUFACTURER NORTHVOLT AND IS PART OF THE EU'S PUSH TO COMPETE WITH ASIAN AND US MANUFACTURERS. THE NORTHVOLT PILOT FACILITY, WHOSE CEO PETER CARLSSON USED TO WORK FOR TESLA, IS THE MOST ADVANCED EUROPEAN INITIATIVE TO BREAK DEPENDENCE ON IMPORTED BATTERY CELLS. SOURCE: EURACTIV

6. United States

BIRD IS MAKING ITS FIRST MAJOR MOVE OUTSIDE THE U.S. THE SCOOTER-SHARING START-UP ANNOUNCED TODAY THAT ITS RIDEABLES WOULD BE HITTING THE STREETS OF PARIS AND TEL AVIV FOR A PAIR OF PILOTS THAT THE SANTA MONICA, CALIFORNIA-BASED COMPANY SAYS WILL BE ITS FIRST FORAY INTO FOREIGN MARKETS. BIRD IS ALSO EYEING OTHER CITIES AS IT SEEKS TO CAPITALIZE ON THE BUZZ SURROUNDING THE NEW BUSINESS OF ELECTRIC-POWERED, TWO-WHEELED MOBILITY. THE PILOTS WILL BE LIMITED AT FIRST, BIRD SAYS, STARTING WITH 50-100 SCOOTERS AND THEN SCALING UP FROM THERE. SOURCE: THE VERGE

8. South America

AIR POLLUTION KILLS NEARLY 7 MILLION PEOPLE ANNUALLY, WHICH COULD WORSEN IN REGIONS SUCH AS SOUTH AMERICA AND THE CARIBBEAN WHERE RAPIDLY GROWING TRANSPORT SECTORS ARE THE MAIN SOURCE OF GREENHOUSE GAS EMISSIONS. TO DETER THIS, UN ENVIRONMENT'S MOVE PLATFORM, ALONG WITH THE SUPPORT OF EUROCLIMA+ PROJECT, IS ASSISTING ARGENTINA, COLOMBIA AND PANAMA WITH NATIONAL ELECTRIC MOBILITY STRATEGIES AND IS ALSO HELPING CHILE AND COSTA RICA TO EXPAND THE USE OF ELECTRIC BUSES. SOURCE: UN ENVIRONMENT

7. Kenya

AFRICA CLEAN MOBILITY WEEK TOOK PLACE AT UN ENVIRONMENT HEADQUARTERS IN NAIROBI, BRINGING THE ISSUE OF INCLUSIVE TRANSPORT TO THE FOREFRONT USING A UNIQUE TEST TO SEE IF CITIES WERE ADDRESSING TRANSPORT SOLUTIONS FOR THE MOST VULNERABLE ROAD USERS—CHILDREN. A 'POPSICLE TEST' WAS PROPOSED TO SEE WHETHER A CHILD CAN SAFELY WALK TO A STORE, BUY A POPSICLE AND RETURN BEFORE IT MELTS. ALONG WITH PROMOTING BIKE-SHARING, THE POPSICLE TEST IS AN IMPORTANT AWARENESS CAMPAIGN AS AFRICA HAS THE HIGHEST ROAD FATALITY RATE IN THE WORLD—A CITY THAT IS SAFE FOR CHILDREN IS SAFE FOR EVERYONE. SOURCE: FIA FOUNDATION

On the move around the world



← 3. Asia & Europe

ASIAN AND EUROPEAN CITIES LEAD THE WAY TO SUSTAINABLE MOBILITY. HONG KONG IS THE GLOBAL LEADER FOR SUSTAINABLE TRANSPORT, FOLLOWED BY ZURICH AND PARIS IN THE 2017 SUSTAINABLE CITIES MOBILITY INDEX. EUROPEAN CITIES TAKE THE OVERALL LEAD ON SUSTAINABLE TRANSPORT, MAKING UP SEVEN OF THE TOP TEN. NORTH AMERICAN CITIES SHOW OPPORTUNITY FOR PROGRESS, HOWEVER DID NOT APPEAR IN THE TOP 20. SOURCE: ARCADIS

↙ 4. Thailand

AUTO RICKSHAWS, OR 'TUK-TUKS,' ARE A CLASSIC FEATURE OF BANGKOK THAT ARE ABOUT TO SEE A TRANSFORMATION AS ONE THAI COMPANY, TUK-TUK FACTORY, WILL BE MANUFACTURING 100% ELECTRIC TUK-TUKS. WITH THAILAND'S 20,000 TUK-TUKS EMITTING AROUND 100,000 TONS OF CO₂, THE ELECTRIFICATION OF THIS COMMON MODE OF TRANSPORT WOULD TRANSLATE INTO SIGNIFICANT ENVIRONMENTAL BENEFITS AND COULD PROVIDE GREATER MOBILITY TO PERSONS WITHOUT ACCESS TO SUCH, INCLUDING RURAL FARMERS, ALLOWING GREATER SOCIAL AND ECONOMIC OPPORTUNITIES. SOURCE: CNBC

← 5. Malaysia

MALAYSIA HAS THE HIGHEST OBESITY RATE IN SOUTHEAST ASIA AT 51.2%. THE CULPRIT? IT IS DUE IN PART TO DRIVING BEING THE ONLY FEASIBLE TRANSPORTATION OPTION. GIVEN THE TRAFFIC CONGESTION ON MALAYSIAN ROADS, THE ROAD TO THE FUTURE CANNOT BE PAVED BY SIMPLY BUILDING MORE OF THEM. DESIGNING CITIES FOR VEHICLES UNDERMINES THE MOBILITY OF PEDESTRIANS AND ACTIVE TRANSPORT, WHILE THOSE THAT CANNOT AFFORD CARS SUFFER EVEN LONGER TRAVEL TIMES. SUSTAINABLE CITIES OFFER PEDESTRIAN, CYCLING, AND PUBLIC TRANSIT OPTIONS—THE RIGHT APPROACH TO THE MOBILITY IF MALAYSIA IS TO TACKLE TRAFFIC CONGESTION AND OBESITY. SOURCE: MALAYSIAN INSIGHT

↑ 9. India

A REPORT BY THE NEW DELHI THINK TANK CENTRE FOR SCIENCE AND ENVIRONMENT (CSE) WARNS THE DUMPING OF OLD, POLLUTING CARS FROM THE US, JAPAN, AND EU TO AFRICAN AND SOUTH ASIAN COUNTRIES COULD CAUSE THESE COUNTRIES TO MISS NATIONAL TARGETS TO CUT GREENHOUSE GAS EMISSIONS. OF THE TWO BILLION VEHICLES IN THE WORLD, 40 MILLION ARE DEEMED UNFIT FOR ROAD USE IN DEVELOPED NATIONS. WITH MANY LOWER-INCOME COUNTRIES LACKING POLICIES TO KEEP SECOND-HAND CAR IMPORTS IN CHECK, MANY END UP IN COUNTRIES SUCH AS NIGERIA, WHERE 90% OF ITS 3.5 MILLION CARS ARE IMPORTED SECOND-HAND VEHICLES. SOURCE: REUTERS

↖ 10. Australia

AUSTRALIA'S NATIONAL TRANSPORT COMMISSION (NTC) HAS ANNOUNCED THE DRAFTING OF A NEW NATIONAL LAW THAT WILL ENABLE THE USE OF AUTONOMOUS VEHICLES ON AUSTRALIAN ROADS. THE LEGISLATION, TO BE IN PLACE BY 2020, IS EXPECTED TO HELP AUTOMATED VEHICLE MANUFACTURERS, AS WELL AS THE PUBLIC, UNDERSTAND THE LEGAL FRAMEWORK THEY ARE OPERATING IN AND ACCELERATE THE INTRODUCTION OF AUTONOMOUS VEHICLES (AV) IN AUSTRALIA. (SEE PAGES 70-74 FOR A REBUTTAL OF AV BY POLIS.)

















▲ THE JOHAN CRUIJFF ARENA SERVES AS A CARBON-NEUTRAL SUSTAINABLE MOBILITY HUB FOR THE SURROUNDING NEIGHBOURHOOD, ENCOURAGING EV CHARGING. SOURCE: HUGO NIESING, RESOURCEFULLY





PAS a PAS

Per Terrassa, a peu. Ràpid i saludable

HI SERÀS
EN UN PLIS



Distàncies i temps a peu per la ciutat:

A cada tram s'indiquen els minuts aproximats de recorregut a peu i la distància real en metres.
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Les línies no són proporcionals a la distància real.





▲ HYDROGEN BUS SERVING IN COLOGNE. SOURCE: VAN HOOL - RVL



▲ NEW CHARGING POINTS IN THE CITY OF AMSTERDAM HELP TO REDUCE EMISSIONS IN THE URBAN ENVIRONMENT. SOURCE: HUGO NIESING, RESOURCEFULLY



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Breaking Barriers: Financing the low-carbon transition

WRITER:
DINO DE FRANCESCO

Tackling climate change and building a global green economy is the opportunity of our time. The economic case for climate action is strong— investments in clean, resilient infrastructure contribute to the development priorities needed to achieve the United Nations Sustainable Development Goals (SDGs) by 2030 and the 2015 Paris Agreement. Finance flows for such projects should therefore be massive, but this is not yet the case. While project bankability and access to finance are major barriers to scaling-up project implementation, one question remains: What can be done to break these barriers?

Sustainable infrastructure investment: A cornerstone for the SDGs

Keeping pace with population growth, migration and urbanization trends demands an increase in infrastructure development especially in emerging economies and developing countries. Energy, water supply, sanitation and waste management, mobility services and communications systems are critical to ensuring effective economic and social development. According to the OECD, more than 80% of the SDGs rely on infrastructure

development. Successfully reaching the SDGs will require unprecedented investment across multiple sectors and given the long-term nature of infrastructure, the type we implement today will lock-in economic and climate benefits – or costs – for the decades to come. If we are to mitigate climate risks, improve living standards and deliver long-term sustainable growth, infrastructure projects need to be low-emission, energy-efficient and climate-resilient.

In the face of rapid urban expansion, the demand for such sustainable infrastructure projects is particularly high at the city, state

and regional levels. Projects designed and implemented to serve the needs of these expanding populations, typically of mid-size or between \$5-50 million in construction costs, offer the greatest potential. When appropriately prepared, projects that deliver both energy and public services can have significant impacts on local populations by reducing greenhouse gas emissions and air pollution, creating employment opportunities and improving overall health.

For R20, the problem of project bankability and access to appropriate finance are amongst the major barriers to scaling-up project implementation.

For John Tidmarsh, Chief Investment Officer at R20 Regions of Climate Action, a non-profit environmental organization, mid-size projects offer an unprecedented opportunity to maximize development impact while meeting the financial objectives of investors. “Mid-size, subnational and sustainable infrastructure can make a highly attractive investment proposition. They represent a potentially huge investment market in terms of number and of aggregate capital required for implementation. If such projects are designed to integrate the needs of a broad range of stakeholders, not only will social, economic and environmental impacts be achieved and scaled-up, but consequently, investment risks can be significantly reduced.”





Why investor interest isn't enough

There is growing interest amongst investors in what is a potentially huge investment market. Recent estimates suggest that between \$90-100 trillion worth of investments are needed over the next 15 years to fully implement the SDGs.¹ Of the investment needed, 60-70% will be required by emerging countries with the lion's share required for transport (43%) and energy (34%).²

Given the need, market size, and growing appetite amongst private investors, why are not more projects taking off? Some lay the blame at the door of policy-makers, others at that of investors and the private sector. However, the truth lies somewhere in-between. For R20, the problem of project bankability and access to appropriate finance are amongst the major barriers to scaling-up project implementation.

While project bankability can mean different things to people, it most often refers to the financial returns, factors of design, equipment used, availability of contracts and local capacities. However, the wider aspects of bankability that are associated with the social and environmental impacts of a project—the context in which it is developed, its compatibility with plans and policies and the vested interests of key stakeholders— is less often considered. To address these issues of “bankability” projects need to be designed and developed taking these factors into account, and all stakeholders must be coordinated to represent the community, public and private sectors, as well as investor interests.

As R20's Executive Director, Dr. Christophe Nuttall, explains, “One of the major bankability issues today comes from the limited degree of collaboration, understanding and interconnection between policy-makers, clean technology providers and public-private investors. These

¹ BETTER FINANCE, BETTER WORLD. CONSULTATION PAPER OF THE BLENDED FINANCE TASKFORCE.

² INVESTING IN CLIMATE, INVESTING IN GROWTH. OECD.

▲ R20 FOUNDING CHAIR AND FORMER GOV. OF CALIFORNIA, ARNOLD SCHWARZENEGGER, ADVOCATING FOR THE SUB-NATIONAL APPROACH IN THE FIGHT AGAINST CLIMATE CHANGE AT THE R20 AUSTRIAN WORLD SUMMIT. SOURCE: MARTIN HESZ.

If we are to mitigate climate risks, improve living standards and deliver long-term sustainable growth, infrastructure projects need to be low-emission, energy-efficient and climate-resilient.



REGIONS OF
CLIMATE ACTION



PROJECTS
IDENTIFICATION



PROJECTS
STRUCTURING



PROJECTS
BANKABILITY



PROJECTS
FINANCING



PROJECTS
IMPLEMENTATION



Special Purpose Vehicles
in PPP and PPA with clean
tech companies and local
authorities.



PROJECTS
MRV



◀ THE R20 VALUE CHAIN: THE R20 VALUE CHAIN: A TECHNICAL AND FINANCIAL ECOSYSTEM OF COMMITTED PARTNERS TO CONNECT THE DOTS BETWEEN POLICY-MAKERS, CLEAN TECHNOLOGY PROVIDERS AND PUBLIC-PRIVATE INVESTORS.

key stakeholders tend to work in silos and, almost invariably, do not understand each other's interests nor how their decisions can negatively impact each other and thus the bankability of projects.” Addressing this requires mobilization of and better collaboration between a broad range of stakeholders that are involved the length of the project development and financing value-chain. Bringing together expertise, resources and knowledge, coordinating efforts of the most important stakeholders, and building the capacity, understanding and trust that is necessary to deliver and replicate shared objectives is key to fostering project implementation.

This problem of bankability is also at the root of the second problem facing the scaling implementation of projects: access to finance. Because the project development value chain is not widely understood by those influencing project identification and development, projects do not meet the needs of investors. The earlier stage a project is at, the harder its “access to finance”.

Access to finance is often understood as a question of matching demand with supply, or projects with investors. The reality is far more complex. Generally, it is assumed that matching projects with investors regardless of the stage of maturity is sufficient to result in implementation. What is too often ignored is that projects have financing needs that are different depending on the stage of their development and that each stage has associated with it a different level of risk—or in the view of the investor—expected financial returns. For a project to have a chance at accessing finance, it must meet an investor interested in taking on the “risk-return” profile that is specific to the project's maturity and provide the investor with the information necessary to assess this profile.

But the challenge of accessing finance goes beyond matching the right opportunity with the capital that has an appetite for it. This matching must be available to finance each stage of project development and implementation, and must be coordinated to assure that projects successfully reach maturity in a timely manner, each successive financing stage following on from the other. This coordination is key to scaling-up the ready supply of projects that meet the needs of different sorts of capital, and thus to the scaling in deployment of the capital necessary to reach the SDGs and climate objectives.

So how do we go about this coordination? Both the challenge and the solution lie in creating innovative approaches and financing tools that allow different types of donors and investors to work together in a coordinated manner that industrializes and scales-up the matching process. In this way, the unique characteristics of each capital type can be leveraged towards the shared objective of scaling-up private investment to meet the SDG targets and climate action impacts. This coordinated approach is increasingly referred to as “blended finance.”

The World Bank, World Economic Forum, UN and many philanthropic foundations and private sector companies all agree that “blended finance”, such as the use of development capital from public or philanthropic sources to spur private sector investment, that could be the game-changer in delivering on the SDGs. By de-risking infrastructure investments and allowing the private sector to participate, blended finance can help capture over \$1 trillion in additional annual investment potential.³ Blended finance can play a major role in addressing the “access to finance” barrier, especially when it is deployed by funding vehicles that finance project

3 BETTER FINANCE, BETTER WORLD. CONSULTATION PAPER OF THE BLENDED FINANCE TASKFORCE.

identification, development and implementation and meet the expectations of public and private investors.

Climate funds for sub-nationals: Enormous potential to deliver on the SDGs.

A number of factors are required to deliver bankable projects to investors to accelerate the clean and climate-resilient infrastructure needed for achieving the SDGs: (1) involve sub-national governance from the start, as well as other local stakeholders, in full alignment with national plans and policies; (2) fast-track the development of projects the length of the project development and financing value-chain; and (3) “blend” donor, public and private capital.

R20 is applying these principles to set-up an integrated value chain approach. The “value chain” helps connect the dots between multiple stakeholders in policy, technology and finance sectors, providing a workable framework to identify, support development and secure the financing of high-impact, low-carbon and climate-resilient infrastructure. Among the key elements, the value chain deploys thematic, donor-funded, Pre-Investment Facilities and dedicated Sub-national Climate Funds (SnCFs).

Created in partnership with leading engineering firms, Pre-Investment Facilities finance and provide the expertise for the technical, legal and economic feasibility studies, as well as the social and environmental impact assessments required by investors. In so doing, they provide the necessary technical assistance to convert potential projects into bankable investment opportunities. Sub-national Climate Funds are created in partnership with leading impact fund managers to finance the selected projects coming from the value chain. The

first of such funds is the Sub-national Climate Fund for Africa (SnCF-Africa).

SnCF-Africa is a fund structured to invest in a portfolio of projects that will provide clean energy, waste valorization and energy efficient municipal lighting services to cities and regions in 15 African countries. It “blends finance” from philanthropists, foundations, governments, development finance institutions and private investors and targets projects conceived and developed at the sub-national level, of between \$5-50 million in capital expenditures. Considered too small for institutional investors or too large for sub-nationals and NGOs to finance, projects of this size are currently least-served by existing funding and investment-for-development vehicles.

The fund expects to invest in 30 projects and mobilize additional climate finance in the form of co-investment in projects. In so doing, the fund should significantly contribute to the SDGs by reducing 2 million tons of CO₂ per year (SDG13), creating up to 28,000 temporary and induced jobs (SDG8), and bringing better services (SDG7 & 11) to more than 17 million people. To back-up the environmental, social and economic claims for each project, R20 is working to make SnCF Africa the first fund to be fully certified by Gold Standard for the Global Goals, a next generation standard designed to accelerate progress toward the Paris Climate Agreement and the SDGs. ●



R20 – Regions of Climate Action is a not-for-profit international organization founded in 2011 by the former Governor of California, Arnold Schwarzenegger, in cooperation with a number of leading Regions, the United Nations, Development Banks, Clean-Tech companies, Academia and a number of NGO's, to support sub-national governments around the world to develop and finance green infrastructure projects.



9th Annual

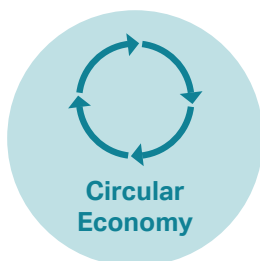


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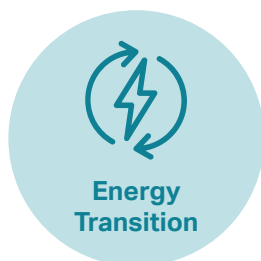
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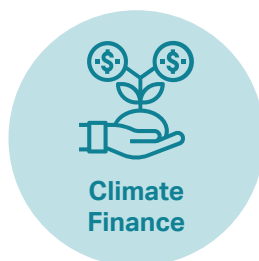
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**Energy
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**Climate
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Where policy-makers and climate technology innovators
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Imagine the TransArabian Xpress

WRITERS:

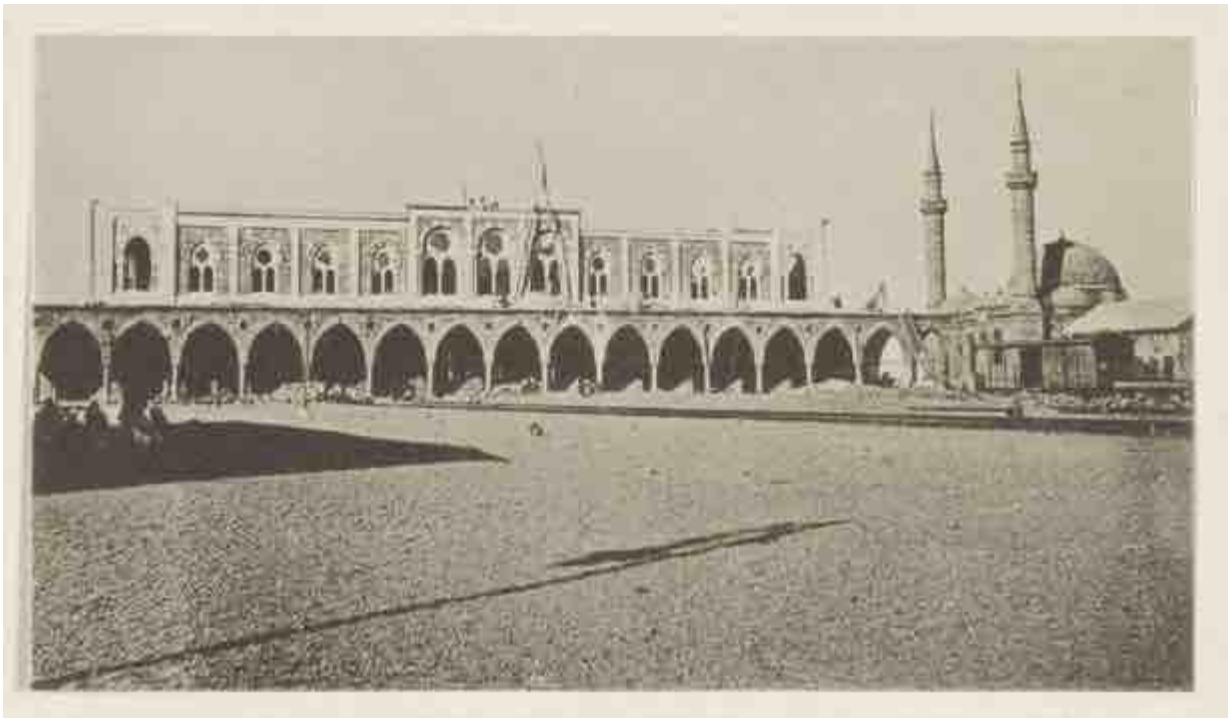
HADIL J.S. AYOUB & STUART REIGELUTH

Imagine connecting Morocco to Oman with a high-speed train going across North Africa and the Arabian Peninsula transporting people and goods for tourism, business and commerce.

Imagine a high-speed train that connects countries, cities and citizens across North Africa into the Middle East and the Arabian Gulf. Imagine a high-speed train that would transcend the wall between Morocco and Algeria, the refugee debacle between Tunisia and Libya, the political quagmire in Israel/Palestine, the wars in Syria and Iraq... Imagine a high-speed train powered by hydrogen and renewable energies that travel at 300-400 kilometers per hour from Casablanca to Algiers to Tunis to Tripoli to Alexandria-Cairo-Suez-Aqaba-Amman-Baghdad-Basra-Kuwait-Riyadh-Abu Dhabi-Dubai-Muscat... Imagine a high-speed train that makes stops at other cities, transporting goods and people, creating commerce and movement. Imagine that each station is an intermodal hub with options for public transport, bicycles, and car-sharing – all digitalized on your mobile. Imagine that each station is a historical building renovated in the local traditional architectural style: a blend of the Arabesque and the future mixed together by integrating nature with the digital world of tomorrow.

To contextualize this dream, the first Arab railway was opened in 1854 between Alexandria and Kafar Zayat in Egypt. Thereafter, railways were built in 11 Arab countries. Three major

As word spread that the pilgrimage had just become easier, business boomed, and by 1914 the annual load had soared to 300,000 passengers.



▲ MAIN RAILROAD STATION AT THE WESTERN GATE, MEDINA, SAUDI ARABIA, 1914. SOURCE: BERNHARD MORITZ



▲ PUTTING THE RAILS FOR THE CONSTRUCTION OF THE HICAZBAHN AT TEBUK, 1906. SOURCE: BERNHARD MORITZ

A HIGH-SPEED TRAIN CONNECTION

TRANSARABIA



AN INITIATIVE BY REVOLVE

14,000
ACROSS

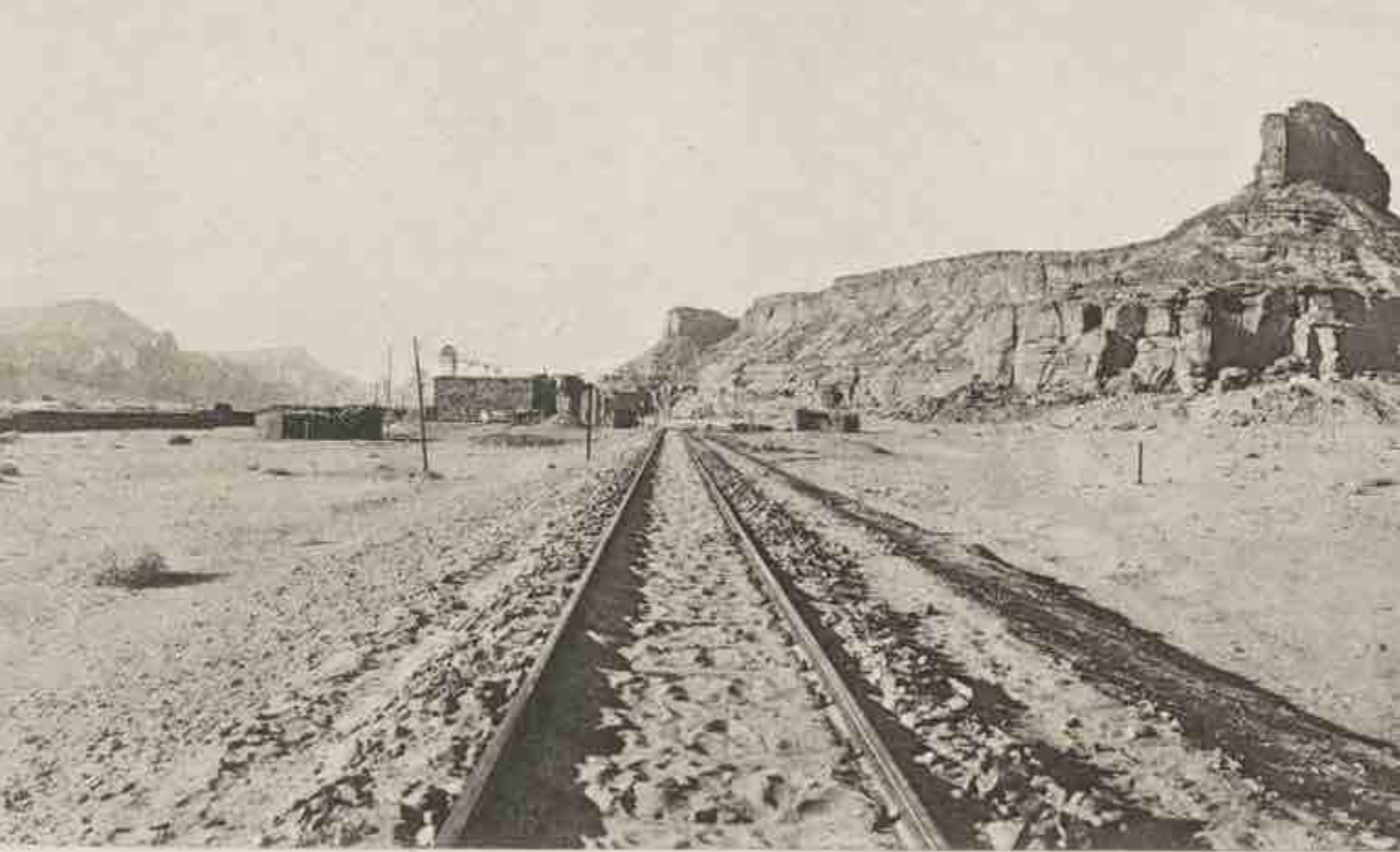
MAGHREB



ECTING INTERMODAL HUBS

AN XPRESS





▲ VALLEY OF EL 'AL 1KM SOUTH OF THE STATION. SOURCE: BERNHARD MORITZ

axes emerged in general geographical areas: (1) Maghreb (North Africa) linking from west to east: Mauritania, Morocco, Algeria, Tunisia, Libya; (2) the Nile Valley linking Egypt and Sudan; and (3) the Turkey-Red Sea connection linking from north to south Syria, Jordan, Lebanon, and Palestine to the west, and to the east Saudi Arabia and Yemen. Historically, and the focus of this first leg of the TransArabianXpress journey, we will look at perhaps the most important railway axis called the Hejaz Railway that was built in the early 1900s.

The Hejaz Railway was originally built to transport pilgrims from Istanbul via Damascus and Amman to Medina, where they would travel on to Mecca for the Muslim 'hajj' or pilgrimage. The idea was first put forward in 1864 during the height of the age of great railways around the world, but it was not until 40 years later (1908) that the Hejaz Railway came into being. Before the Hejaz Railway, Muslim pilgrims travelled to Medina by camel caravan. The journey between Damascus and Medina

usually took two months and was full of hardships. Since the Muslim calendar is a lunar calendar, the feast of Al-Adha, when Muslims travel to Medina to worship the Kaaba (Black Stone) changed from season to season. Sometimes it meant traveling through the winter, enduring freezing temperatures or torrential rains. At the height of summer, it meant crossing scorching hot deserts. Towns and settlements were sparse and there were hostile Muslim tribes along the way, as well as the inevitable bandits who preyed on pious pilgrims, as they made the 'once in a lifetime' pilgrimage.

The building of the Hejaz Railway presented a financial and engineering challenge. It required a budget of some \$16 million dollars, and this was at the turn of the century when dollars were worth a lot more than they are today. Contributions came from the Turkish Sultan Abdul Hammed, the Khedive of Egypt, and the Shah of Iran. Other contributions came from the Turkish Civil Service, Armed Forces, and other various fund-raising efforts

(which included the sale of titles such as Pasha or Bey to citizens who could afford the price of instant honour).

Construction, maintenance and guarding of the line all presented enormous difficulties. The task was mainly undertaken by 5,000 Turkish soldiers. Along the way there were hostile tribesmen, who before the railway, made a lucrative profit guiding, protecting and providing for pilgrims. They were very unhappy at losing part of their livelihood. Many of them were pastoralist whose main source of cash was their involvement in the pilgrimage each year. Along with this there were physical difficulties. Driving a railway across the Arabian deserts proved very difficult. The ground was very soft and sandy in places and solid rock in others. There were also major geographical obstacles to cross, such as the Naqab Escarpment in southern Jordan. While drinking water and water for the steam engines was a problem, winter rainstorms caused flash floods, washing away bridges and banks and causing the line to collapse in places.

The camel caravan owners were far from pleased by the construction of the railway line, as it posed a considerable threat to their livelihood. The railway journey was quicker and cheaper, and no one in their right mind would contemplate spending £40 on an arduous, two-month camel journey when they could travel in comfort in only four days for just £3.50. However, frequent attacks on the trains by the tribes and furious caravan operators, made the journey to Medina a perilous undertaking for pilgrims, whether by camel or by rail.

On 1 September 1908, the railway officially opened and by the year 1912 it was transporting 30,000 pilgrims a year. As word spread that the pilgrimage had just become easier, business boomed, and by 1914 the annual load had soared to 300,000 passengers. Not only were pilgrims transported to Medina, but the Ottoman Turkish Army began using the railway as its chief mode of transport for

troops and supplies. This was to be the railway's undoing, as it was severely damaged during the First World War (1914-1918) by Lawrence of Arabia and the Arab Revolt.

After the World War 1 and until as recently as 1971, several attempts were made to revive the railway, but the scheme proved too difficult and too expensive. Road transport was soon established and by the 1970s aviation had made rapid progress. The railway was abandoned and the huge old steam locomotives sat and rusted. Train stations ran into disrepair and dilapidation. No one travelled by train anymore except for a tourist line running from Damascus north to the Turkish-Syrian border, and that too is now closed due to civil strife. But the romance of the railway remains alive today with such projects as the TransArabian Xpress.

Interestingly, the railway never actually reached Mecca and during the Great Arab Revolt against the Ottomans during the First World War, parts of the railway were blown up by Lawrence of Arabia and the Arab allies. Some sections of the railway in Jordan are still in minor use today. Now, Jordan's railway network is composed of two main railway lines. The Jordan Hejaz Railway Corporation (HRC) uses a railway for touristic purposes as well as for limited passenger trains. The Aqaba Railway Corporation (ARC) was established in 1979 and uses a rail line to transport mainly phosphate to the Port of Aqaba. The total length of the network in operation is about 509 km and is composed of narrow gauge track (1050 mm gauge). Since 2010, the government has been developing a new national railway network: the feasibility study is completed and the estimated cost is around \$3.5 billion. It is unclear from where these funds will come. ●

An interview with Greg Archer

DIRECTOR, CLEAN VEHICLES, TRANSPORT & ENVIRONMENT

Europe needs to bring electric vehicle production home and replace diesel vehicles faster to regain a leading role in the energy transition in the transport sector.



▲ GREG ARCHER, DIRECTOR, CLEAN VEHICLES,
TRANSPORT & ENVIRONMENT

What is at stake in the current proposal to set future CO₂ limits for cars and vans?

If the battle to transform our cars is lost we will not be able to deliver on the 2015 Paris Climate Commitments. Transport is Europe's biggest climate problem representing over a quarter of all emissions and are still rising. Road transport is $\frac{3}{4}$ of all transport emissions and $\frac{3}{4}$ of these emissions are from cars and vans. Without meaningful CO₂ cuts from cars and vans, transport emissions will not be put in check, and many EU Member States will not be able to reach their 2030 CO₂ targets and the EU will default on its overall targets. If the EU, one of the leading advocates for the Paris Accord, cannot meet its goals it will have no credibility to push other countries to meet theirs, and to go further as will be needed to decarbonize by 2050. An unambitious car CO₂ proposal could have global consequences in our efforts to avoid dangerous climate change.

We need to make sure that the last combustion car is sold by 2035. To tackle rising transport carbon emissions, we need to set

an ambitious and binding CO₂ standards for 2025 and 2030. We need to both encourage companies producing zero emission vehicles while penalizing those declining to supply such vehicles, and ensure the emissions cuts are delivered on the road not just in distorted emissions tests. We urge member states to commit to a clean future and not perpetuate cars dirty diesel past.

Transport is Europe's biggest climate issue representing over 1/4 of all emissions and rising.

For trucks, CO₂ standards are on the table for the first time. Does this help?

Trucks represent 4% of vehicles but 25% of CO₂ emissions on our roads and CO₂ standards for heavy duty vehicles are overdue. The European Commission proposal is a good first step, and with more efficient trucks, long-haulers and logistics companies can make money saving fuel! But they would save even more money with more ambition and with a 35% emission cuts by 2030: €15,000 per vehicle per year would be saved.¹

What about electric buses? Are they ready to operate now?

Electric buses are ready today and bring substantial benefits to cities, with no pollutant emissions and very low noise levels. In China, there are over 400,000 electric buses on the roads; Europe is lagging miles behind. Some cities are making tentative commitments to procure zero emission buses, but more is needed to drive the market and supporting European electric bus manufacturers such as Solaris or Alstom.

The revision of the Clean Vehicles Directive proposed by the European Commission in November 2017 could accelerate electric bus uptake in European cities, thus significantly improving air quality and noise levels. The truck CO₂ proposal also sets incentives for zero emission trucks (and buses). We support this idea strongly but the Commission proposal (super-credits) creates hot air by double counting clean vehicle sales. A different system of credits and debits is needed to stimulate innovation and provide investment security for companies, also European ones.

Serious concerns have been raised regarding battery sustainability. Are electric vehicles really that clean?

There's no doubt that the overall environmental impact of electric vehicles depends partly on how the battery is produced. It is crucial batteries are manufactured with low carbon electricity, using materials extracted in a socially and environmentally responsible way. The emergence of an EU battery industry is a key step towards building more sustainable

1 - SAVINGS CALCULATED BASED ON TOTAL COSTS OF OWNERSHIP FOR THE VEHICLE'S FIRST USER OVER FIVE YEARS, EUROPEAN COMMISSION'S IMPACT ASSESSMENT.

batteries for electric vehicles. Today, CO₂ emissions from cars measured over their entire life-cycle are substantially better than the equivalent diesel model – even in Poland with its coal-dominated generation.

Electricity is getting cleaner each year and will be fully decarbonized by 2050 – oil for cars will be no longer so electric cars represent the low carbon and clean choice today and the only credible way to decarbonize light vehicles in the future. Oil production also causes environmental catastrophes such as the pollution of the Niger Delta, Deepwater Horizon and Exxon Valdez. All vehicle production causes some harm but going electric can minimize the damage.

In China, there are over 400,000 electric buses on the roads; Europe is lagging miles behind.

Is the lack of available charging points holding back EV uptake?

Contrary to mainstream belief, there are currently enough charging points in the EU for the number of electric vehicles on the road. This will be the case in 2020 too if Member States deliver on their plans to roll out EV charging infrastructure. We have tackled the chicken-and-egg dilemma by putting in place a minimal initial infrastructure. Now we need to tackle the lack of supply and choice of electric cars: European drivers can choose from nearly 400 different conventional cars, but they only have 30 different options when it comes to fuel cells and battery electric vehicles. Policy-makers should know this needs to change if we are serious about cleaning road transport. Once electric cars are selling at around 5% of new sales business will step in to make available the recharging infrastructure that is needed.

If Europe's automotive industry does not prepare for future, cleaner electric technologies, EVs will soon be imported from China. European car-makers invest 7 times more in EV production in China than in the EU! The shift to electric cars is as essential for the future of the automotive industry as it is for tackling climate change. ●



Transport & Environment's mission is to promote, at EU and global level, a transport policy based on the principles of sustainable development. Transport policy should minimise harmful impacts on the environment and health, maximise efficiency of resources, including energy and land, and guarantee safety and sufficient access for all.

FLEET OF ELECTRIC HYBRID BUSES IN CHONGQING, CHINA. ►
SOURCE: XUJUN





Automated Vehicles are NOT the answer

WRITER:
SUZANNE HOADLEY

Do you think automated vehicles are just going to come onto the market and solve our mobility problems? It's much more complex, POLIS explains:

Vehicle automation is possibly the most talked about development in the transport domain in recent decades. Headlines are not confined to the transport specialised press; they are widespread in the general media too. If you were to believe everything you read and heard about vehicle automation, you would be forgiven for thinking that driverless vehicles will be on our roads in the next 5-10 years and they will solve the main transport problems of congestion and safety. Is it so simple? POLIS does not believe so.

POLIS is concerned about the optimism bias in terms of what automated vehicles can deliver by way of benefits and when they will actually hit the roads. While automation may bring benefits, there is also the possibility that their widespread introduction in urban areas could lead to increased congestion, negative environmental impacts and negative health impacts, if walking and cycling are discouraged.

This was the backdrop for the discussions among POLIS members over the course of

2017, which culminated in a **POLIS discussion paper setting out the perspective of its member city and regional transport authorities on the theme of road vehicle automation**. Some 22 POLIS members contributed directly to this 12-page document, issued on 23 January 2018, which was endorsed by the full membership. In publishing this paper, POLIS hopes that research, technology development and policy-making will take into account some of the concerns, issues and questions raised.

The paper does not reflect a position but rather explores the potential impacts of driverless cars across a wide range of transportation domains and identifies some issues that city and regional transport authorities need to address and engage on as automated motoring advances. Given the uncertainties around when driverless cars will enter the market and in what form and the level of public acceptance, it is very difficult to predict the impacts. The paper therefore highlights potentially positive and negative outcomes across the domains that are relevant to city

and regional transport authorities, particularly their policies of promoting sustainable mobility. In conducting such an exercise, POLIS members are better equipped to think about the policies and measures they could adopt to achieve positive outcomes and to avert or mitigate negative ones.

POLIS = Cities and regions for transport innovation.

Visit: www.polisnetwork.eu

The impact of automated vehicles (AVs) on **travel behaviour** is one area that holds great unknowns: At one end of the spectrum where the car (private or shared ownership) remains an important mode of transport, there is growing consensus that there will be an increase in traffic and in km travelled. This would be to the detriment of public transport, walking and cycling. Indeed, such a scenario could lead to the end of high capacity public transport as we know it today. At the other end of the spectrum, where vehicle automation leads to a reduction in private car use/ownership in favor of a positive mix of active travel (walking and cycling), high-capacity modes (train, tram and bus) and shared mobility, the outcomes could be positive. While this latter scenario appears attractive, it relies on wider factors such as willingness to give up the convenience and comfort of a private car and car-sharing economics – a fleet owner will want a fleet of vehicles operating all the time, even when demand is low.

At a **spatial** level, self-driving vehicles are expected to free up road space and other

land as a big part of on-street and off-street parking becomes redundant. However, any freed-up road space would need to be put to other uses, otherwise it would no doubt be taken up by vehicles. This creates an opportunity to redesign streets and to use that space more efficiently, such as different usages depending on time of day and type of demand. A downside to vehicle automation could be longer commuting trips by car since this time could be spent doing other things such as reading, working or sleeping, even in congested conditions.

Vehicle automation holds potential to enhance transport **accessibility** among those population groups and areas that most need it, by reducing the cost of passenger transport provision in areas of low and dispersed demand (rural areas and suburbs) and for special transport services for the elderly and disabled. Current service provision may be fragmented and/or reliant on voluntary services. On the flip side of the social coin, it is not inconceivable that a future of market-led shared AV services could lead to different levels of service access depending on ability to pay: a premium subscriber could gain access to better and faster services, leading to increased **social division and inequality**.

Improving **road safety** is one of the key drivers for automating the driving task. Accidents due to driver distraction, a leading cause of accidents, should become a thing of the past in an automated future. Cities and regions see great benefit in vehicles programmed to comply with traffic rules, such as speed limits as they promise to be more cost-effective and efficient than current engineering measures (speed bumps, traffic calming, cameras, etc). However, since traffic rules and regulations can be specific to a given context and interpretation of those rules may differ from one city to another, a strong dialogue between industry and the public sector is required. With policies to promote active travel, cities and regions are particularly keen to know how automation can improve the safety of pedestrians and cyclists.



Given the complexity of the urban environment, with its short links, pedestrian crossings, on-street parking and range of road users – which is not the case for the ‘simpler’ motorway environment – there is concern that the safe operation of driverless vehicles on urban roads could in fact become an impediment to **traffic efficiency**. Will the sensors be so sensitive as to stop the vehicle regularly? What would be the impact on traffic flow of a mixed traffic environment involving vehicles of different levels of automation and active modes? The assumption today is that efficiency gains will only materialize once most (if not all) vehicles are highly automated – the long interim period could be painful. Further analysis and insights are needed.

With research and development mainly focusing on the vehicle environment, the requirements in terms of **infrastructure** are less clear. Ensuring a high level of service of the physical infrastructure, such as clear road markings and road signs, is difficult for a road authority today because of the cost involved and the fact that a utility company (telecoms operator, energy provider, water company) can dig up a road and may not leave it as they found it once their job is finished.

Building the required digital infrastructure may also be expensive. There are expectations that many of the tools, such as digital maps and communication networks, will be developed and funded by the private sector, who will then need to find applications for them. Where the public sector is needed to make an investment, the cost and benefit will need to be carefully analyzed. For instance, road authorities are unlikely to invest in C-ITS purely for the purpose of enabling automation in the future. However, they are considering where C-ITS can play a role in supporting the

What's C-ITS?

Cooperative ITS is a developing technology which will enable communication between vehicles and between vehicles and the infrastructure to deliver in-vehicle information (such as traffic light information or traffic information) and floating vehicle data to the traffic manager. Some vehicle manufacturers will start to make this communication technology a standard feature of new vehicles in the near future.

The safe operation proposed by driverless vehicles on urban roads could in fact become an impediment to traffic efficiency

traffic management task today, such as floating vehicle data and enhancing driver awareness of traffic rules.

A final domain of concern to city and regional transport authorities relates to legal aspects. While there are many discussions occurring at national and international levels, these are mainly focused on the vehicle and on creating the legal framework to allow automated vehicles to be piloted and even deployed on public roads. Such a discussion is missing at local/regional level, yet it is expected that new traffic rules will be needed for automated vehicles and new regulation may be required for the roll-out of automated car-sharing clubs. Specifically concerning the infrastructure, the liability issue needs to be clarified and EU rules may be needed regarding data sharing.

This is just a snapshot of some of the themes that need further attention as vehicle automation progresses. Building on these themes, POLIS members have identified a number of areas that they will give more attention to, namely:

- Build the right policy and planning framework to ensure they are prepared for and can steer the arrival of automated vehicles to ensure maximum benefit.
- Adopt a holistic framework, focusing on the services that automation can enable which lead to positive outcomes for city/regional transport goals and on most suitable road environment for such services.
- Anticipate the potential changes in travel behaviour that driverless vehicles may induce and introduce measures to ensure this is in line with sustainable mobility goals.
- Be prepared for changes to the role and responsibility of the road/transport authority that will arise on the path towards the increasing connectivity and automation of vehicles.
- Ensure personal security and safety of those using automated vehicles, in terms of trust, intimidation and hacking.

The POLIS paper represents the start of a reflection process on how to move forward on the topic of road vehicle automation in a constructive way that harnesses the opportunity that automation offers in a way that supports the liveability and inclusiveness of Europe's cities and regions. ●



POLIS is a network of European cities and regions working together to develop innovative technologies and policies for local transport. Since 1989, European local and regional authorities have been working together within Polis to promote sustainable mobility through the deployment of innovative transport solutions.

POLIS

CITIES AND REGIONS FOR TRANSPORT INNOVATION

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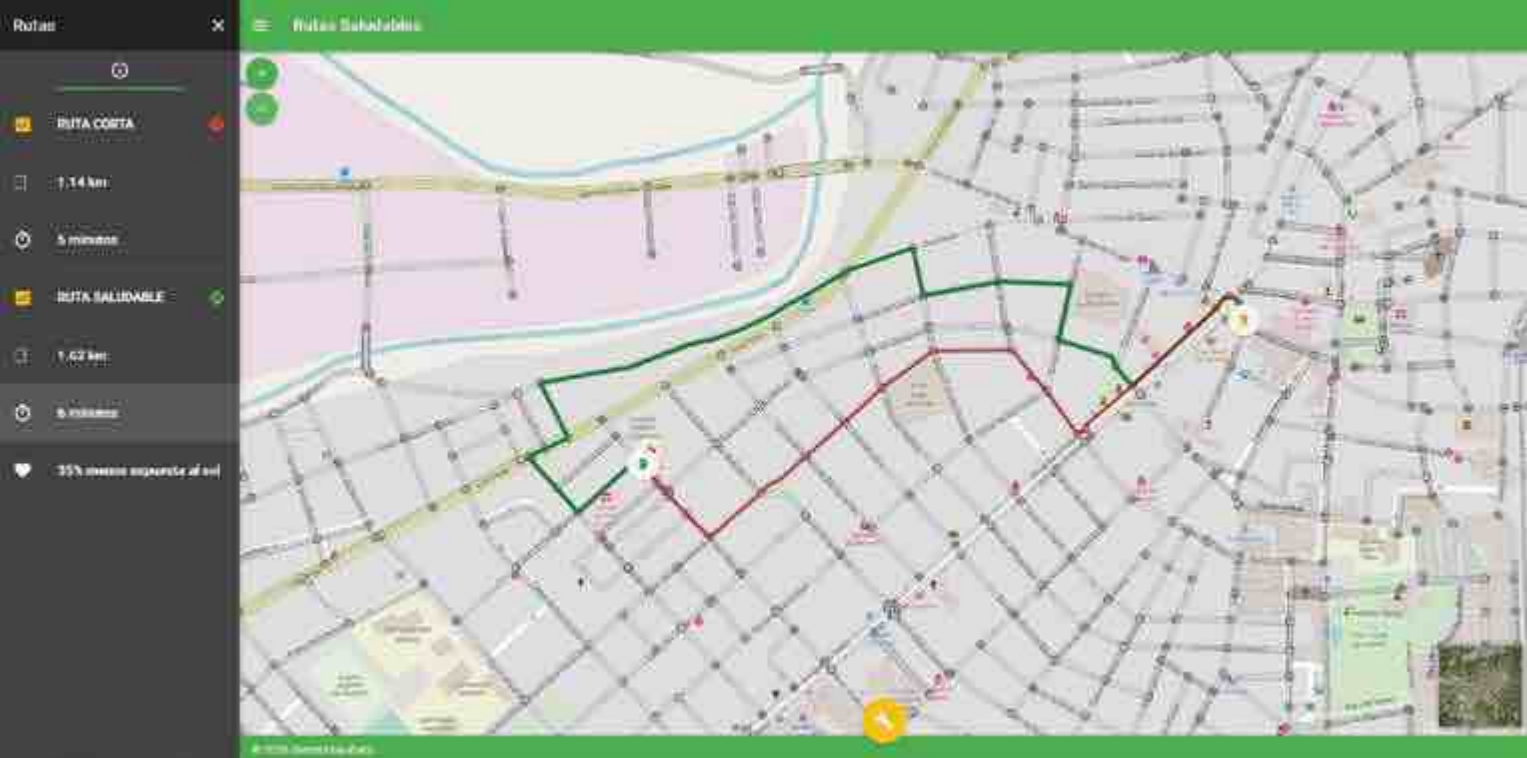
Download Healthy Routes

WRITER:
ALEJANDRO CARBONELL

When the potential of big data is channelled and used properly, the result can be really useful for cities and citizens, particularly for healthier mobility options.

According to the UN, by 2100 the average global temperature will increase 3 degrees generating greater climate instability. These extreme temperatures are affecting agriculture (crops around the world are devastated by hailstorm, droughts and floods), natural areas (forest fires and loss of biodiversity) and cities that, despite the fact that they occupy only 1% of the global surface, they consume 80% of the global energy and they are the main leading emitter of greenhouse gases.

Cities around the world are suffering floods, heat waves and other disasters that are a consequence of extreme temperatures because of climate change and citizens are developing more resilient diseases. According to the World Health Organisation, by 2050 there will be 250,000 additional deaths per year related to climate change problems. Moreover, in 30 years, 70% of the global population will live in urban areas, this means that cities must adapt to embrace all those people and to give them the best quality of life.



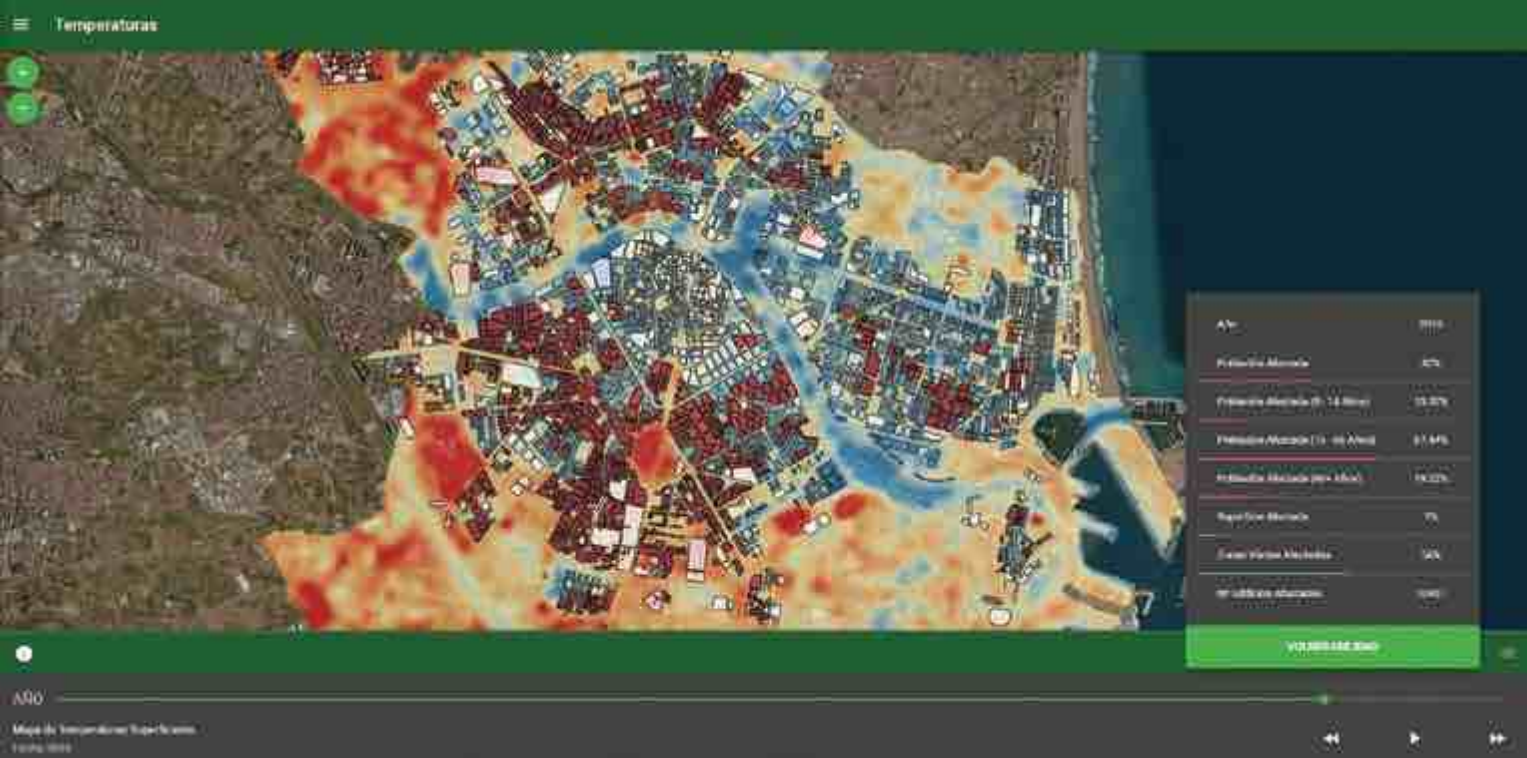
All those problems are costing cities more than €8 billion. As reported by experts from the Centre of Atmospheric Sciences of the National Autonomous University of Mexico by the end of this century the percentage of investments that cities would have to make will be equivalent to around 11% of their GDP for the prevention of climate change issues, mainly related to urban heat islands.

For that reason, cities are working to develop strategies to adapt their areas to new global demands: reduce CO₂ emissions, create and improve green urban areas, water resources management and waste management among other things. Faced with this situation, Green Urban Data emerged as an intelligent solution for the adaptation to climate change in urban areas focusing on the reduction of temperature effects.

Green Urban Data software monitors and measures environmental data in cities, locating the most vulnerable areas and elaborating recommendations for actions to facilitate the decision-making process of public administrations. The monitoring of a given city is made by mixing remote sensing technology, open source from the administration and analysis of Big Data. Green Urban Data

creates a map of the city that allows to visualize thermal information in a simple way to understand the data more easily. By locating vulnerable areas, the software can advise public administrations on where the priority action areas are and can offer recommendations about what would be the best actions to carry out. It also allows to quantify the benefits of the final application of those actions.

Green Urban Data is as an intelligent solution for cities to adapt to climate change.



The elephant in the room: mobility

The top 3 urban issues are: pollution, energy and mobility – all are interrelated as the increase of any one of them impacts directly on the others; moreover, an increase in any one of them results in higher urban temperatures, aggravating climate change and public health.

In terms of mobility, Hong Kong city is the global leader. They have developed an innovative underground system and most of its population use public transport daily. Hong Kong is not the only one: cities in Europe, like Zurich, Paris, Madrid and Barcelona are working to develop more sustainable ways to move into their respective city.

To address this concern, Green Urban Data has created “Healthy Routes” – an app that allows citizens to establish departure and arrival points of their journey, generating a map showing the most “healthy” itinerary compared to the shortest route. Some parameters that can be selected are, for example, a route with a higher percentage of shade, lower levels of allergens, greater accessibility or less noise.

Healthy Routes is a user-friendly app designed for all citizens. Elderly and children, who are more vulnerable to extreme temperatures, can use it to walk through shaded areas, where temperature differences are less dramatic. People suffering from allergies will find the path “cleaner” and, those with physical mobility challenges will find the most accessible route. Healthy Routes is also ideal for runners and sport lovers that look for healthier places for their walking or running routines.

Healthy Routes is a planning tool for public administration. Planning urban strategies can be difficult as there are many things to do and there is not always budget for everything, so it is necessary to prioritize and to carry out the best actions that improve the quality of life for all citizens in all possible ways.

Having a look at the healthiest routes, local governments can take into action for new urban strategies. Some examples include: creating and improving new bike lanes and in this way to promote the use of more sustainable ways of transport by citizens and reduce CO₂ emissions.

This mobile application can help to project pedestrianization schemes to reduce

temperatures in certain areas of the city and to create shaded paths to revitalize social life and the local economy in neighbourhoods. These actions are likewise an attractive claim for tourism, especially in cities with an historic fame of having hot weather, for example Mediterranean cities, like Athens or Valencia, but also others like Las Vegas, México or Bangkok.

Green Urban Data recommendations are framed in the context of advancing urban greenery and sustainable infrastructures. The main strategies are the recovery of parks and green areas with indigenous 'native' species, the improvement of irrigation systems and the soil permeability to reduce water consumption.

Healthy Routes
selects an itinerary
that takes on you on
roads with higher
percentage of
shade, lower levels
of allergens, greater
accessibility or
less noise.

Urban green areas boost the socialization process, thus helping to increase social and health equity. Greenery improves citizens' health as green areas reduce stress levels and because of its thermo-regulator impact influences people with heart diseases, chronic

illness and lung problems, thus enhancing their general quality of life.

The main goal of Green Urban Data is to help cities to adapt to climate change. Focusing on the effects of temperature this company is helping to improve the quality of life of citizens. ●



Green Urban Data creates software to facilitate the decision-making process and the prioritization of strategies against climate change. Environmental intelligence for healthy cities.

REVOLVE transmits inspiring messages and projects with its partners to communicate sustainability more visually and effectively. One of the ways we do this is by designing and curating large-scale outdoor exhibitions at strategic locations. And we do more! — In line with the values we share with our partners we minimize waste through:

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2. We recuperate the canvases and ship them to a small company in Germany that integrates physically-challenged people in the work force. The workers clean, cut and sew the canvases into new bags and folders.

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info@revolve.media

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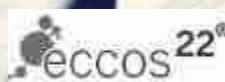


Dr. Markus Bürger
Chairman of the Executive Board

„Our major challenge is to understand and manage the increasing complexity of ecological and socio-economic reality.“



Dr. Christoph Müller
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