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N°17 | FALL 2015

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– *If Mayors Ruled the World, Dysfunctional Nations, Rising Cities*, Benjamin Barber, Yale University Press, 2013

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**Revolve Media** is a limited liability partnership (LLP) registered in Belgium (BE 0463.843.607) at Rue d'Arlon 63-67, 1040 Brussels.

**Revolve Magazine** (ISSN 2033-2912) is registered in Belgium (BE 0828.676.740) as a subsidiary fully-owned by Revolve Media.

Printed with vegetable-based ink on chlorine-free paper, **REVOLVE** uses FSC approved paper (for more on how **REVOLVE** is a sustainable magazine see p.82).

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Cover image: Sipping on a latte while zipping along the Quai of the Seine in Paris on a unicycle.  
Source: Solowheel



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## SPECIAL DOSSIER: SUSTAINABLE MOBILITY

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## Tomorrow's Mobility Solutions Are Here

**Jean-Luc de Wilde** dedicated 10 years to directing and developing bike usage in Belgium ([www.provelo.be](http://www.provelo.be)), then 8 years on modernizing the public transport system in Brussels including the management of two European projects ([www.tickettokyoto.eu](http://www.tickettokyoto.eu) and [www.tramstore21.eu](http://www.tramstore21.eu)). He was chief editor of the first edition of the UITP "Public Transport Trends 2015".

On the eve of the climate summit in Paris, mobility worries decision-makers because – contrary to other sectors – pollution emanating from modes of transport continues to climb around the world, representing today more than a quarter of total emissions. Automobile congestion and noxious pollutants are pervasive. And yet, solutions are now coming to market that were unimaginable a few years ago.

At the end of 2014, Mrs. Hidalgo, the Mayor of Paris, surprised the world by banning diesel vehicles in the center of France's capital by 2020. Of the 4,500 buses in circulation around Paris, around 3,600 will be replaced by electric buses and the other 900 will be powered by biofuels. In London, Mayor Boris Johnson decided to create a perimeter of Ultra Low Emission Zones around the capital in which only hybrid and electric vehicles will be able to circulate. 3,000 hybrid buses are on their way.

After a century of hegemony in heavy transport on wheels, diesel and its fine particles will exit

exponential urban areas. The overall bus system is being carried away in this direction, moving towards using rechargeable electric batteries, alternative fuels and new designs that constructors are competing to find solutions to the challenges of sustainable mobility.

A second remarkable development: the number of bike users is becoming truly significant in many cities. Even if Paris is at a modest 2% of the total mobility done by bicycle, Berlin has reached 13% while the numbers in Amsterdam (22%) and Copenhagen (27%) clearly show that when public cycling plans and coherent policies converge then citizens choose this more environmentally-friendly mode of moving. (Source: [www.epomm.eu](http://www.epomm.eu))

By extension, the electric bike is now revolutionizing personal transport for the elderly and people in less good shape who can now go up hills and cover longer distances previously too steep and too much of an effort. The electric bike only weighs 25 kg and can take a person up to 25 km/h on average without exuding strenuous efforts. In comparison, the electric car is a 1,000-2,000 kg vehicle that can carry 2-5 passengers at the speed of traffic. The energy required, the batteries needed, the electricity spent, are



much more significant. In China, with more than 20 million units per year, the sale of electric bikes has surpassed generic bikes and motorbikes since a few years and is on par with car sales.

A third development: hybridization of transport modes.

What's the difference between the metro and the train, when new lines around cities are being based on driverless technologies? What's the difference between a tram on wheels and a trolley bus? Between a suspended metro and an urban cable car? Thanks to the development of new concepts, a continuity of possible solutions is emerging to transport people differently but each time more efficiently and in more inter-modal ways.

In parallel, the borders between private and public transport are becoming blurred: traditionally exploited by public operators, public transport is more and more becoming privatized within a public-private partnership

context of concessions and trade-offs usually to everyone's advantage. Considered too sovereign and inefficient, the national or regional monopolies continue to cede ground to international operators or smaller enterprises more specialized and with greater flexibility. Will Belgium soon be the last European country to have not introduced any form of competition in its public transport?

Fourth development: smartphones, big data and the shared economy

With Internet and smartphones, the borders between personal and collective transport are dissolving: bikes and cars are becoming shared modes of urban mobility. Taxis are also becoming shared in some cases (Collecto), as well as individual cars that are shared more and more (peer-to-peer). Uber and Blablacar, and hundreds of smaller initiatives (Caramigo, Wibee...), rely on the use of billions of pieces of data accessible in real time to match supply with demand

for cars and parking. This has tremendous implications for actually using less cars and even no longer needing to own one.

Faced with the evolution of electric mobility, hybridization of modes of transport and advent of car-sharing, two important questions arise:

1. Where will the supply of energy come from as we move from fossil fuels to cleaner technologies? Between the delayed phasing out of nuclear and the reappearance of coal mining, isn't it time to prioritize decentralized forms of production and of storage with renewable energies?

2. Public action: how to make predictions in times of turmoil? Is politics and public administration not also about setting agendas and deadlines to create results (such as curbing emissions), to offer more research funds to develop the goals and offer infrastructures on which multiple actors will develop the best possible services. ☺



Volvo hybrid electric-biodiesel bus being tested in Curitiba, Brazil. Source: Milton Jung

# Jacqueline Galant

Belgian Federal Minister of Mobility

### As federal minister of mobility, what is your vision of mobility?

My vision of mobility is pragmatic because, if nothing changes, the situation on our roads will continue to worsen while the negative impact of traffic on the economy and on our collective well-being will only increase.

Within ten years, it is essential to have succeeded in rationalizing our infrastructure uses with, as guiding principles, strong emphases placed on the fluidity and security of movement as well on the reduction of the transport sector's environmental impacts. Mobility must be sustainable and intermodal.

We must succeed in providing an efficient public transportation system, with the railway network as its backbone, as well as maximizing the uses of our road infrastructures while promoting more decarbonized means of transport.

How? By stimulating progress. Technological progress that opens up new perspectives for better traffic management, for bringing the user/client closer to transportation supplies (namely thanks to real-time geo-localized information sharing), and for reducing the risks of accidents and their consequences. Progress is also necessary in the management of public companies, such as the SNCB and Infrabel. As Minister,



I must have the means of providing positive change in these companies' cultures, so as to obtain greater productivity and offer better client services.

Obviously, as a corollary, my role is to raise awareness, inform and convince citizens that intermodality is not only necessary but desirable for everyone, namely for rush hour movements to and from work. Everybody must be an agent of change

### What progress seem most likely to consolidate while you are in office?

The re-organization of the railway network is a priority and I want to succeed in modernizing its two companies within 5 years so as to ensure their viability, but also their competitiveness in view of opening the market to competition by 2019-2021.

Mobility is a fragmented prerogative in Belgium, which does not facilitate the adoption of a coordinated public policy on the question. Nonetheless, I wish to reform the Driving Code as well as giving Belgium a supply framework for welcoming connected and autonomous vehicles.

It is perhaps not as visible for the citizens, but I have inherited of prerogatives that were highly impacted by the sixth reform of the State: agreeing on the distribution of com-

progress must contribute  
to a sustainable, fluid  
and safer mobility.

petencies (often very technical), transferring all federal data towards the regions, training regional personnel for its new missions while guaranteeing a continuity in the service provided, is a demanding job, one that I would like to see accomplished as fast as possible in the interest of the citizens and professionals. I am also currently consolidating an important legislative undertaking to reform the procedure related to driving fines.

### Is the driving force of change more at the technological or the human (behavior change) level?

I have faith in the progress we can accomplish in the field of technology and science. Without humans, no progress! This goes beyond the competency of mobility though, it's a matter of the role of government: how far can we go in order to change behaviors? Should we impinge on freedoms to force an evolution in mentalities on questions of mobility? Our role is to give general directions on what constitutes progress in terms of mobility, then to oversee the optimal conditions for inciting its development, so as to, at last, have the greatest number of people benefit from it. On this subject my position is clear: progress must contribute to a sustainable, fluid and safer mobility.

### Intermodality of transport (trains, metros, car sharing, biking...) is being

### advanced as the solution. How can this intermodality be accelerated?

As a first phase, I will soon set up a strategic platform reuniting the SNCB, Infrabel and regional transport companies in view of increasing cooperation between public transportation services. Secondly, I will create an investment task force with the railway companies (and tomorrow any other operator) while ensuring the regions' participation. These two spaces must be places of dialogue and decision-making that will allow for the desired intermodality to take hold between the different actors of the mobility sector.

### On an individual level, in your private life, how to you get around?

I am always ready to experiment new means of transport! For the moment, I am working on passing my motorcycle license, mostly out of passion and for pleasure. I also recently bought an electric bicycle. It is surely one of the modes of transport of the future. 🚲



Images: (opposite) Minister Jacqueline Galant. Source: Benjamin Brolet (above) Trains at rest in Louvain Station, Belgium. Source: Federal Ministry of Mobility.

# Sustainable Mobility



This special dossier on **Sustainable Mobility** by **Lesley Brown** from *Mobility* magazine comprises five features about the different forms of transport coming to market and the technological innovations behind them that are **driving positive change towards cleaner mobility**. Coordinated by **Revolve Media Mobility Advisor, Jean-Luc de Wilde**, this dossier goes hand-in-hand with our **photo exhibition** showing the solutions that exist today that are making mobility more sustainable from car-sharing to urban cable cars to driverless metros to electric vehicles are more.

**We invite you to visit the exhibition on the Esplanade of the European Parliament from 17-23 September during the European Mobility Week and thereafter at Gare du Nord from 23 September until the end of October.**





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**Writer:** Based in Paris, **Lesley Brown** is a B2B journalist specialised in rail and public transport. She reports on the news, innovations, and events in both sectors – in print, digital, and across social media – with a special focus on the European marketplace.

**Mobility**  
THE EUROPEAN COLLECTIVE TRANSPORT MAGAZINE

# Driverless Metros

Metro systems without drivers on board, referred to as unattended train operation (UTO), driverless, or automatic, are expanding. Today, over 40 lines across the globe function this way, and in the coming years this particular *modus operandi* is forecast to grow five times faster than in the last decade.

Taking the driver out of the equation, and putting technology in his or her place, opens up potential benefits for all – industry, transport operators, funding authorities, and passengers. All, that is to say, except the ousted drivers, of course!

Having no drivers reduces payroll costs. Energy bills are lower since acceleration and deceleration patterns can be adjusted to reduce consumption, and maximize energy recovery. And while maintenance costs are marginally higher, due to the introduction of platform and track protection systems, these are expected to be offset by the aforementioned staff and energy savings.

In terms of operational flexibility, the systems are capable of tailoring service coverage to best meet the needs of the moment, for example by optimizing the running time of trains, adjusting the speeds of the system, squeezing headways, and reducing dwell times in stations. A further, non-negligible advantage lies in the perceived quality of the driverless service – since it is generally more reliable, with shorter dwell times, passengers spend less time waiting at platforms. Understandably, they view this improvement in a favorable light.

There are currently over 600 kilometers of automatic metro lines in operation worldwide, with the first such systems – Lille in Europe; Vancouver, Detroit, and Miami in North America; and Kobe, Yokahoma, and Osaka in Japan – dating from 1980 to 1990. And between 2014 to 2025, growth is expected to be exponential and reach 1,888km, predicts the UITP's Observatory for Automated Metros.<sup>[1]</sup> A flourishing sector of activity indeed, yet one that comes with its fair share of challenges...

[1] see [www.metroautomation.org](http://www.metroautomation.org)



Images: (this page) Model of the metro cars to come. Source: Alstom.  
(next page) Le VAL, Lille. Source: Mobility (p.14) Istria station on driverless metro Line 5, Milan. Source: Stefano Stabile

## → Lille Line 1

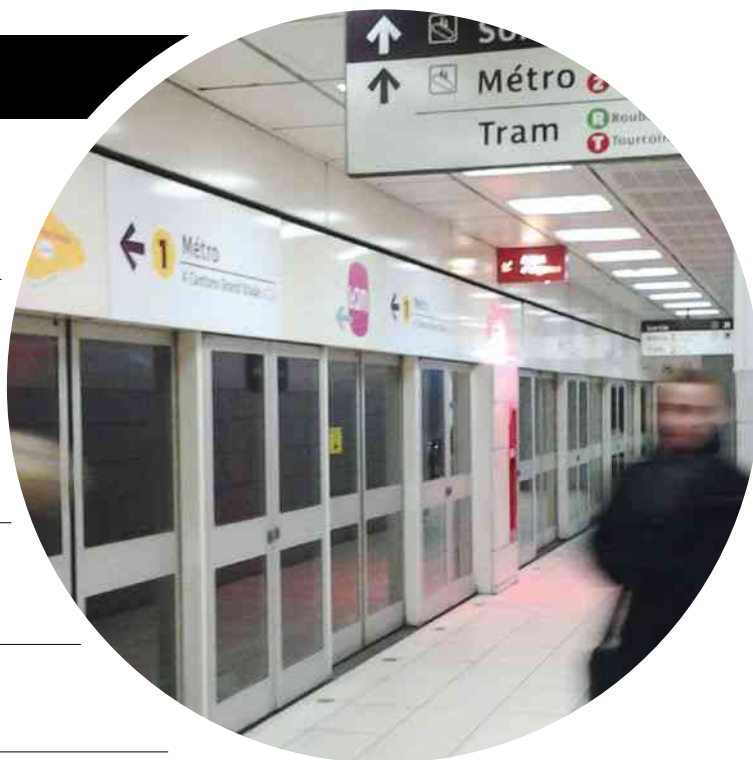
**18 stations** over **13.5 km of line**,  
of which **8.5 km in tunnels**

**Headway of 66 seconds** at peak times

**53 x 26-meter long** trains

**Two connections** with **Line 2**

Average speed of **32 km/h**



## Lille Gives Driverless More

Thirty three years old, the *grande dame* of metro automation is being given a facelift. A pioneer in the field, Le VAL<sup>[2]</sup> or Métro de Lille Métropole (northern France), comprises two lines covering 45km and serving 60 stations.

Over the past decade, use of collective transport in Lille Métropole has risen by 40%, compared to 12% for the car. And while this trend is good news for modal shift, it is putting increasing pressure on the systems serving the city and its suburbs. Introduced into operation in 1983, metro Line 1 has a total of 18 stations and connects up with the tram, V'Lille bike sharing, bus, and commuter rail services. It currently clocks up around 165,000 journeys every day; i.e. 60 million per year, and these figures are growing. Given the key position it occupies in keeping the city on the move, the metro *lillois* simply cannot afford to be outpaced by capacity demand.

With a headway of 66 seconds at peak times, the minimum technically possible with the current system, there is no further scope for increasing service frequency on Line 1. The only solution is to introduce longer trains – from the current 26 to 52 meters – a move that subsequently entails doubling the length of the platforms.

The program – rolling stock and ATO (Automatic Train Operation) system; high voltage currents; ventilation and smoke extraction; tracks; modification of stations and the installation of platform screen doors – debuted in January 2013, with completion scheduled for October 2017.

As the first automatic metro in the world to be renovated, the undertaking is being closely followed by industry professionals worldwide. For a good reason. There are a number of significant challenges to be faced, including the need to perform all the tasks during five years without inter-

rupting commercial services. This explains why they are being carried out at night, when the metro is closed between 1.00 to 5.00am. However, considering the time it takes to install and remove their equipment, in reality the teams have just three hours per night to perform their magic. Furthermore, certain operations, such as installing the new platform screen doors, call for particular vigilance. Extremely robust and consequently very heavy to handle, these doors must be perfectly installed, accurate to the nearest millimeter, prior to restoring traffic – the trains pass by at a distance of just 5cm!

The total cost of modernizing Line 1 amounts to €629 million, of which €300 million has been pledged by the European Investment Bank (EIB). The project forms part of Lille Métropole's vision to drive up the use of collective transport by 50% by 2020 and to develop a transport network capable of handling 265 million journeys annually, compared to the current 160 million.

[2] Véhicule Automatique Léger, on tyres

## State-of-the-Art for Vienna

In June 2015, Vienna's public transport operator Wiener Linien, together with the City of Vienna and the Austrian Transport Ministry announced that its new U5 metro line is to become the first to be fully automated in the network. Due to open in 2023, the driver-

“We need new concepts for the increasing number of passengers on public transport and ways to further increase service frequency”

– Executive City Councillor Renate Brauner

less U5 service will improve overall customer service, allow better management of service disruptions, boost punctuality, and heighten safety through the presence of platform

screen doors. On a wider level, it will also play a part in helping the city cope with its growing passenger volumes.

“We need new concepts for the increasing number of passengers on public transport and ways to further increase service frequency,” says Executive City Councillor Renate Brauner. “All this is possible with automated underground trains. The U5 will

be a smart underground line for our smart city, whose technology lives up to today's state-of-the-art and provides new safety features.”

CCTV, passenger alarms with direct

voice connections on board the trains, and an underground line supervisor located in the control centre will be additional features of the system.

## Extending Driverless in Milan

The third section of Milan's automated metro Line 5 opened on 29 April 2015, two days before the inauguration of Expo 2015, providing for the first time a direct convenient access to the famous San Siro football stadium. The five new stations of the 7.1 km western extension are served by trains running every three minutes during peak times, from four to six minutes off peak.

The first fully driverless metro line in the city, Line 5 has been in operation since 2013: the first 4.1 km long stretch opened in February 2013, followed by a 1.4 km long extension in March 2014. With the opening of this latest prolongation, Milan's metro network has increased from 103 to 108 stations and from 94 to 101 km.



# FLEXITY 2



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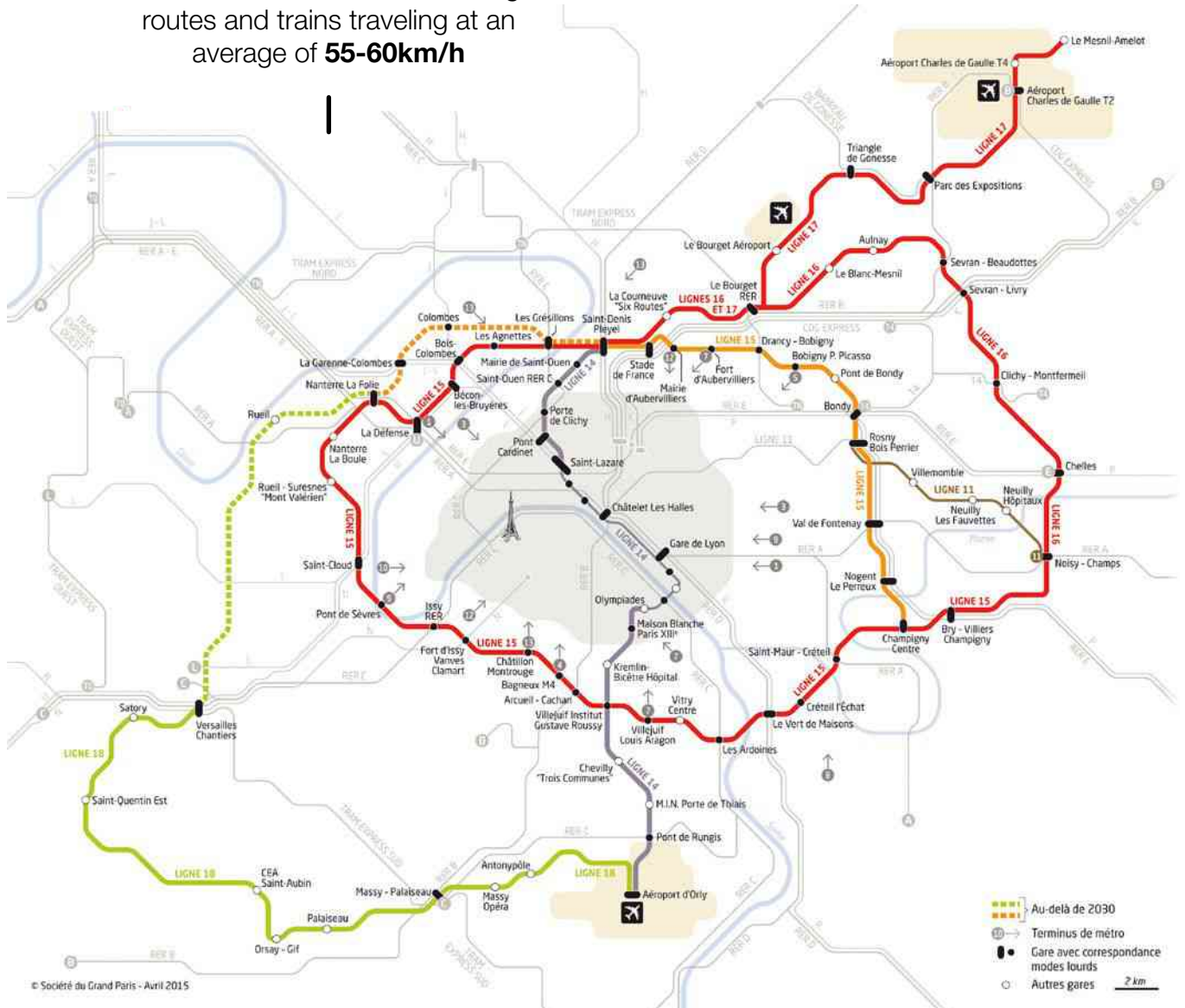
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**BOMBARDIER**  
the evolution of mobility

# → Le Grand Paris by 2030

**205 km**  
of **automatic metro lines**

**Journey times** will be **significantly reduced**, especially from suburb to suburb, with ring routes and trains traveling at an average of **55-60km/h**



**68 new stations** connecting Grand Paris clusters with **three airports** plus **TGV (high-speed rail) stations**

**2 million passengers** will travel on the network **every day**

## Paris Converts Another Line

By 2022, the metro system in Paris, which comprises 14 lines, will boast 3 UTO routes. While Lines 1 and 14 are already in service, Line 4 is currently being converted to driverless operation in order to “increase the capacity, regularity, quality of service, responsiveness and safety of the line,” says operator RATP. Currently the second busiest service in the network, Line 4, which is 12.1km long with 27 stations, averages 740,000 passengers a day.

Making Line 1 automatic, a complex undertaking (regular passenger services remained open) completed in December 2012, has since boosted the efficiency of this route for both RATP and passengers alike, namely by enabling more trains to be provided during peak hours and improving service regularity.

Ongoing since 2014, renovation and conversion works on the 100-year old Line 4 are being carried out to avoid any major traffic disruption – as was the case with Line 1. “RATP’s priority is to improve the quality of service and the automation of Line 4 is an important step in achieving this goal,” comments Pierre Mongin, CEO, RATP.

## Le Grand Paris – Automatic From Day One

To further improve the public transport services and quality of life for inhabitants of the City of Light and its suburbs, much is riding on the project baptized “Le Grand Paris”, a development program for the entire metropolitan area due to be completed in 2030. Key to this ambitious plan is its automatic metro system – the Grand Paris Express – that will comprise

four new-build lines (15-18) and two extensions (11 and 14) designed to serve suburb-city centre and suburb-suburb journeys. Line 15 will create a ring route around the city, while the others will serve developing neighborhoods – housing, economic activities, university centers, and cultural facilities. The new system will also involve extending existing Paris metro lines.

improved control of train movements, hence more efficient energy recovery and energy consumption

Preparatory works for Line 15 – deviating underground gas, electricity, and telecommunications networks – began in 2015. If all goes to plan, civil engineering works for the metro infrastructure of this line should start in 2016.

“RATP’s priority is to improve the quality of service and the automation of Line 4 is an important step in achieving this goal”

– Pierre Mongin, CEO, RATP <sup>[4]</sup>

Image (this page): Close attention has been paid to the design of stations along automatic metro Line 1, Paris. Source: David Moraldo



## Win-Win For All?

As the above examples demonstrate, all important current and future projects in metro are UTO. Representing state-of-the-art in metro technology, automation provides a glimpse of the future for this particular transport mode. Driverless metro systems are more energy-efficient and punctual, and additional trains can roll out of depots at short notice.

What more could operators, and passengers, want?

The UTO network is expected to deliver the following benefits:

- the frequencies of trains can be adjusted at any moment, a benefit of particular importance given the constantly changing nature of city life (week, weekend, special events, Bank Holidays, etc.)
- operating uncertainties lessened since automation means better management of journey times and commercial speeds of trains
- operating costs optimized through

Making these services more appealing to the travelling public falls in line with a bigger goal – to double the market share of public transport worldwide by 2025.<sup>[3]</sup> Launched in June 2009 by the UITP (international organization for public transport authorities and operators), this ambition, which goes by the name of PTx2, is aimed at governments, local authorities, investors and stakeholders, as well as public transport actors themselves, be they organizing authorities, operators or industry suppliers.

[3] to find out more, go to [www.UITP.org/strategy-public-transport](http://www UITP.org/strategy-public-transport) [4] in May 2015, Mr Mongin was succeeded in this post by Elizabeth Borne

# Europe 2030 Cleaner Buses

A reduction in greenhouse gas (GHG) emissions by 40% below the 1990 level. A target for renewable energy of at least 27% of the energy mix. These goals represent two pillars of the new European Union (EU) framework on climate and energy for 2030, presented by the European Commission (EC) in January 2014.<sup>[1]</sup> In this context, how is the bus sector performing?

Buses have long suffered from a poor public image, often perceived as noisy, unreliable, slow, uncomfortable and polluting. Certainly, efforts to address these shortcomings have been made over the years, particularly with

regards to technology. In the last decade, a genuine “propulsion supermarket” of alternative fuels and drivetrains has emerged, offering a number of clean fuel options to improve air quality, overcome noise pollu-

tion, and meet additional EU policy targets. Hybrid and electric buses are now part of a range of available vehicle options, with the latter opening up inviting prospects for the electrification of diesel bus lines.

[1] [http://ec.europa.eu/clima/policies/2030/index\\_en.htm](http://ec.europa.eu/clima/policies/2030/index_en.htm)



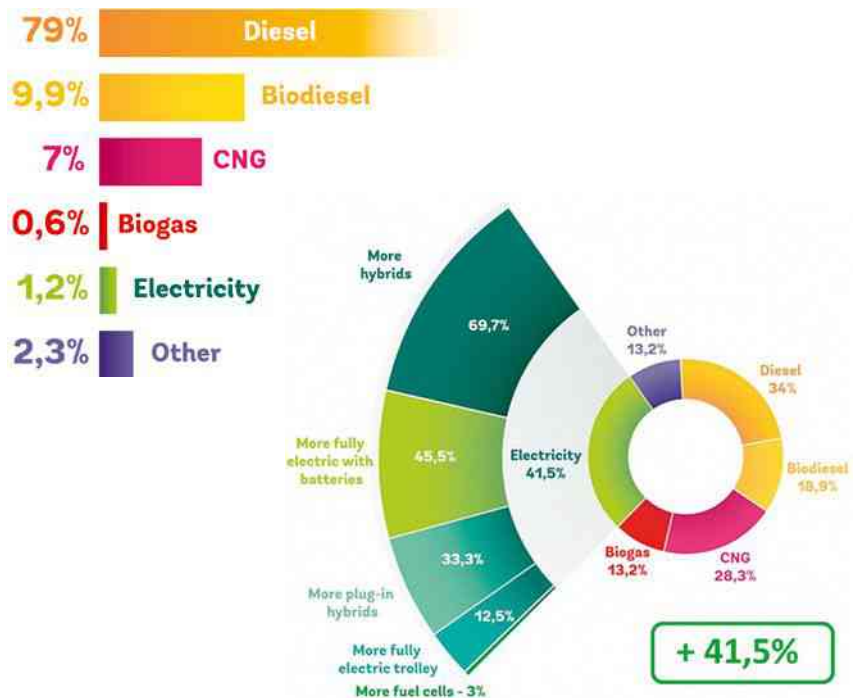
# Zero Emission Urban Bus System (ZeEUS)

A survey conducted by UITP – the international organization for public transport authorities and operators<sup>[2]</sup> – reveals that electric buses represent about 1% of the 70,000 urban buses currently serving a population of over 100 million inhabitants in 24 European countries. More than 40% of the surveyed cities and operators declared their willingness to change their fleets towards more electric solutions, mainly hybrids and fully electric with batteries.

This strong trend confirms a dynamic scenario for the future of European bus systems. E-buses represent a big operational challenge and an important change for passengers. Strongly contributing to a cleaner environment, smoother driving and lower noise levels, they provide a completely different feeling and help reinforce the attractiveness of public transport. Today, those that have been introduced in our cities are predominately mini- (8 and 30 seats) and midi- (generally larger than a traditional minibus but smaller than a full-size single decker) buses.

The current challenge is to implement the electric technology on high capacity buses in European cities with important historical structures, complex topography, and limited space. E-buses can only become a relevant alternative to their diesel counterparts if they can carry a high number of passengers with greater energy autonomy while fulfilling a daily service.

With 40 partners representing the entire value chain of standard electric buses (cities, operators, industries, researchers, and energy providers), the ZeEUS project<sup>[3]</sup> fully embraces the challenge to extend the 100% electric solution to the core part of the bus network. Under UITP's leadership, and with the co-funding support of the EC, live operational tests in 10 European cities are demonstrating that several electric bus solutions can be implemented on high capacity buses under normal service conditions.



Charts: Future trends: respondents distribution according to future plans to change propulsion system ratio (percentage totals up > 100%). Source: 3iBS survey, [www.3ibs.eu](http://www.3ibs.eu)

Image (left): ZeEUS electric bus test, 2015, Stockholm. Source: Volvo Bus Corporation (next page) MAN Lion's City Hybrid on the roads. Source: Lothar Reichel / MAN Truck & Bus AG

The ZeEUS demonstrations taking place in Barcelona, Bonn, Cagliari, London, Muenster, Plzen, Randstad, Paris, Stockholm and Warsaw are implementing e-buses in different geographical and climatic environments. Local and horizontal evaluations are being carried out to provide decision-makers with

discussions on the progress and deployment strategies of high capacity bus electrification in urban contexts.

## Going Electric in London

In March 2015, Transport for London (TfL) announced that a south London bus route is to become the first in the capital to be operated entirely by electric buses. Following initial tests with two vehicles – Optare MetroCity single deckers – a further seven are to be added (manufacturers to be confirmed) by the end of 2015. Passengers are likely to notice that these pure electric buses offer lower noise and vibration levels compared to diesel. Meanwhile, bus operating company Arriva is looking forward to lower maintenance and running costs. Last but not least, the environment will benefit too since the vehicles have zero tail-pipe emissions, which means lower carbon emissions and better air quality.



the necessary tools to assess the economic, environmental, operational and social feasibility of electric urban bus systems. The ongoing collection of valuable information is an opportunity to share experiences of high capacity e-buses with cities outside the project. Cities leading these experiences are invited to join the ZeEUS Observatory, which enables knowledge-sharing and in-depth

[2] [www.uitp.org](http://www.uitp.org) [3] for more information visit [www.zeeus.eu](http://www.zeeus.eu), or contact Pauline Bruge at [pauline.bruge@uitp.org](mailto:pauline.bruge@uitp.org)

"This is an exciting new milestone for our bus fleet, which is already one of the cleanest in Europe," commented Mike Weston, TfL's director of buses. "We currently have eight electric buses in our fleet and as this number grows we are learning more about this new technology, which alongside other measures like retrofitting older vehicles with enhanced exhaust systems and continuing the expansion of our hybrid fleet, continues to contribute towards our strategy to further reduce harmful emissions from the capital's bus fleet."

By 2020 there will be 300 electric buses in passenger service in London, plus, by 2016, over 1,700 hybrids.

## Sweden 'Greens' its Fleet

As a forerunner in the field of alternative fuels for both private and public transport, let's take a look at bus-related developments in Sweden. In March 2014, Keolis Sverige, which runs buses in Stockholm,

Gothenburg and other major cities, inked a large deal with constructor MAN Truck & Bus. Out of the total contract for 181 city buses, the delivery of which began in the summer of 2014, 52 are hybrid models combining a diesel engine with an electric drive. Low fuel consumption and emissions are *de rigueur*. The hybrids are designed to save up to 30% on diesel costs, and "to reduce CO2 emissions in the same proportions." An additional benefit is their noise reduction capability, when pulling away from a stop, for example, the vehicle is driven in a full-electric mode, with the diesel engine engaging

only after the first few hundred meters.

This large addition of buses, which is being deployed for service in Stockholm and its surroundings, will serve to considerably expand the 'green' credentials of the 1,900-vehicle fleet already operated by Keolis Sverige. To date, an impressive 80% of the latter runs on renewables – ethanol, biogas, biodiesel, and B30 diesel (with 30% non-fossil components). Furthermore, by training its drivers in eco-driving techniques, the company says it can cut fuel consumption by 10 to 15%.

## Electric Drivetrain Buses

According to a report by Pike Research<sup>[4]</sup> by 2018, more than 75,000 electric drivetrain buses will be in service around the world.

Electric drivetrains – whether for hybrid systems, battery electric, or fuel cell – hold appeal for the bus market for many of the same reasons they do for light duty vehicles: the promise of moving away from oil, efficiency gains, limiting greenhouse gas emissions, and, in many cases, lower operating costs.

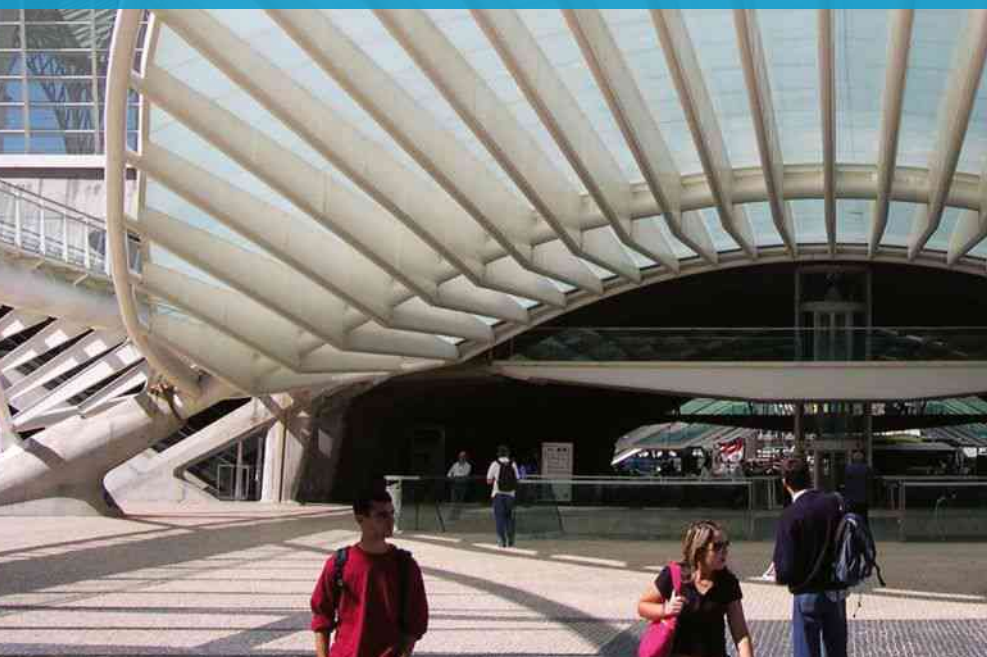


## Creating the next generation of interchanges

NODES (New tOols for Design and OpEratioN of Urban Transport InterchangeS) is building a Toolbox to support European cities, transport authorities and operators in the design and operation of new or upgraded public transport interchanges.

The Toolbox allows practitioners to assess and benchmark their interchange and to improve its performance.

These tools are identified under five topics (which correspond to transport interchanges' key functions): land use and infrastructure, design, intermodality and ICT, management and business models, energy and environment. Their efficiency was tested in nine European cities who are engaged in substantial development or upgrading activities, which provides a feedback loop for their improvement.



### NODES in brief

**Duration:** October 2012 - September 2015

**Coordinator:** UITP, the International Association of Public Transport, [www.uitp.org](http://www.uitp.org)

**17 partners:** local government administrations, public transport operators, research centres, European associations

For more information:

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- Website : [www.nodes-interchanges.eu](http://www.nodes-interchanges.eu)
- Like us on : [www.facebook.com/Nodestransport](https://www.facebook.com/Nodestransport)
- Follow us on Twitter @transportnodes



[www.zeeus.eu](http://www.zeeus.eu)

Bringing electrification to the heart of the urban bus network

## Zero Emission Urban Bus System

**10** European cities are currently demonstrating the feasibility of electrification for high capacity buses in real service.

After a meaningful evaluation, 40 partners led by UITP will develop the support tools for policymakers to decide "if", "how" and "when" to introduce electric buses in their city. An Observatory closely follows and discusses the progress of urban bus system electrification around the globe and contributes to its deployment strategies. Selected observed and monitored demonstrations will join the ZeEUS network.

Cities experiencing high capacity e-buses are invited to join the Observatory by contacting Pauline Bruge: [pauline.bruge@uitp.org](mailto:pauline.bruge@uitp.org).



### ZeEUS in brief

**Scope:** Testing electrification solutions at the heart of the urban bus system network through live urban demonstrations and facilitating the market uptake of electric buses in Europe

**Duration:** November 2013 – April 2017

**Budget:** 22,5m€ (13,5m€ EU Funding)

**Coordinator:** UITP, the International Association of Public Transport, [www.uitp.org](http://www.uitp.org)

# Improving Urban Life

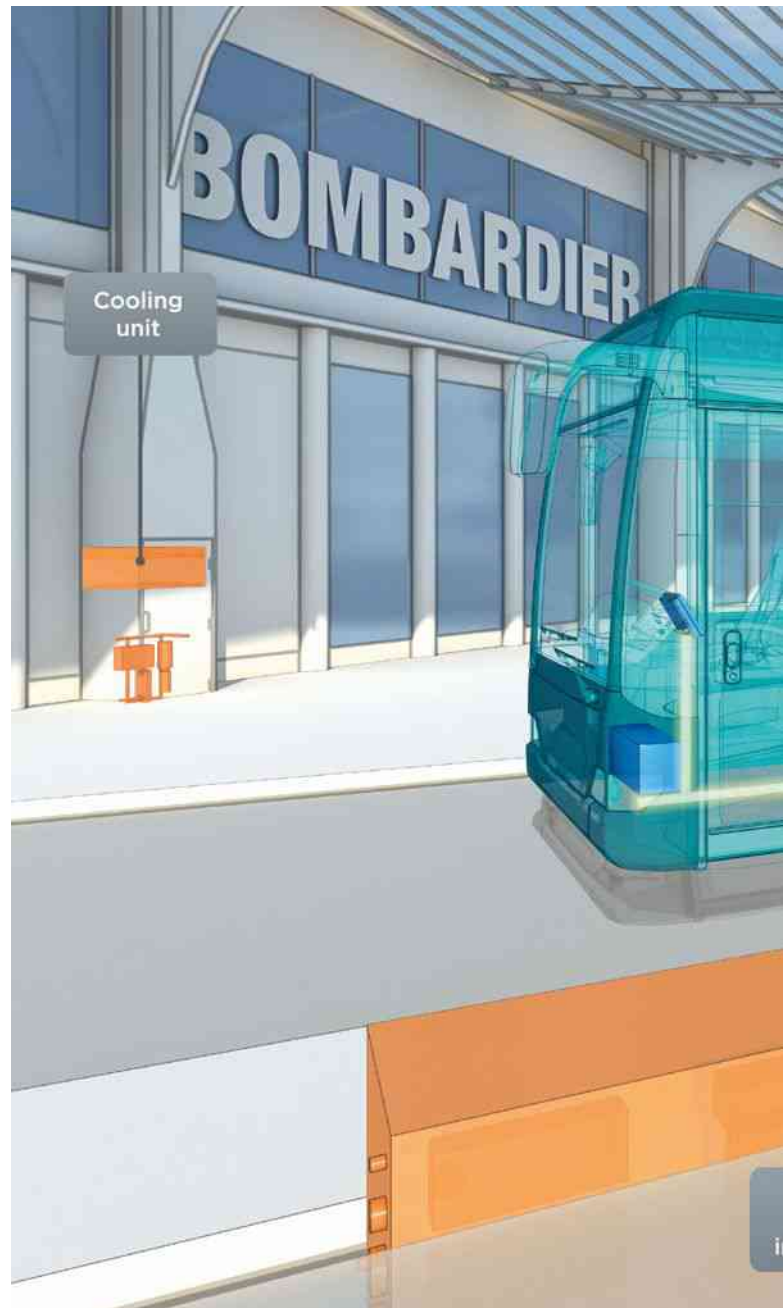
In June 2015, UITP released a position paper on bus systems in Europe<sup>[5]</sup>. Its recommendations encourage all actors – the EU, Member States, and local transport authorities – to consider that a “clean fleet” can be composed of hybrid, electric, and alternatively fuelled, as well as modern Euro 6 (latest fuel emission standard) buses: “It is the task of local authorities to determine the right mix, taking into account the feasibility in the local context.”

While research into alternative drive systems was originally motivated by the high price of oil, pollution, emissions, and noise have

“While a regular percentage (ca. 8%) of the bus fleet is renewed every year, the renewal of an entire fleet is achieved over a full bus lifecycle, i.e. ca. 12 years, sometimes longer.”

– UITP

Image (right): The invisible and efficient *BOMBARDIER PRIMOVE* wireless charging system for electric buses allows seamless integration, thereby enhancing historic urban environments like Bruges. Source: Bombardier



since gained prominence on the political and legislative agenda. Buses are a prime target for action because many vehicles with old, polluting engines continue to work all day in city centers. Indeed, while propulsion technologies used in the bus sector have greatly diversified, diesel and biodiesel buses still constitute the lion's share of Europe's bus fleet (around 90%). And diesel generates pollutants such as unburned hydrocarbons (HC), CO<sub>2</sub>, carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), and particulate matter (PM), which can have adverse health and/or environmental effects.

To assess the full environmental and climate impact of vehicles, UITP recommends assessing them “from well to wheel”. This

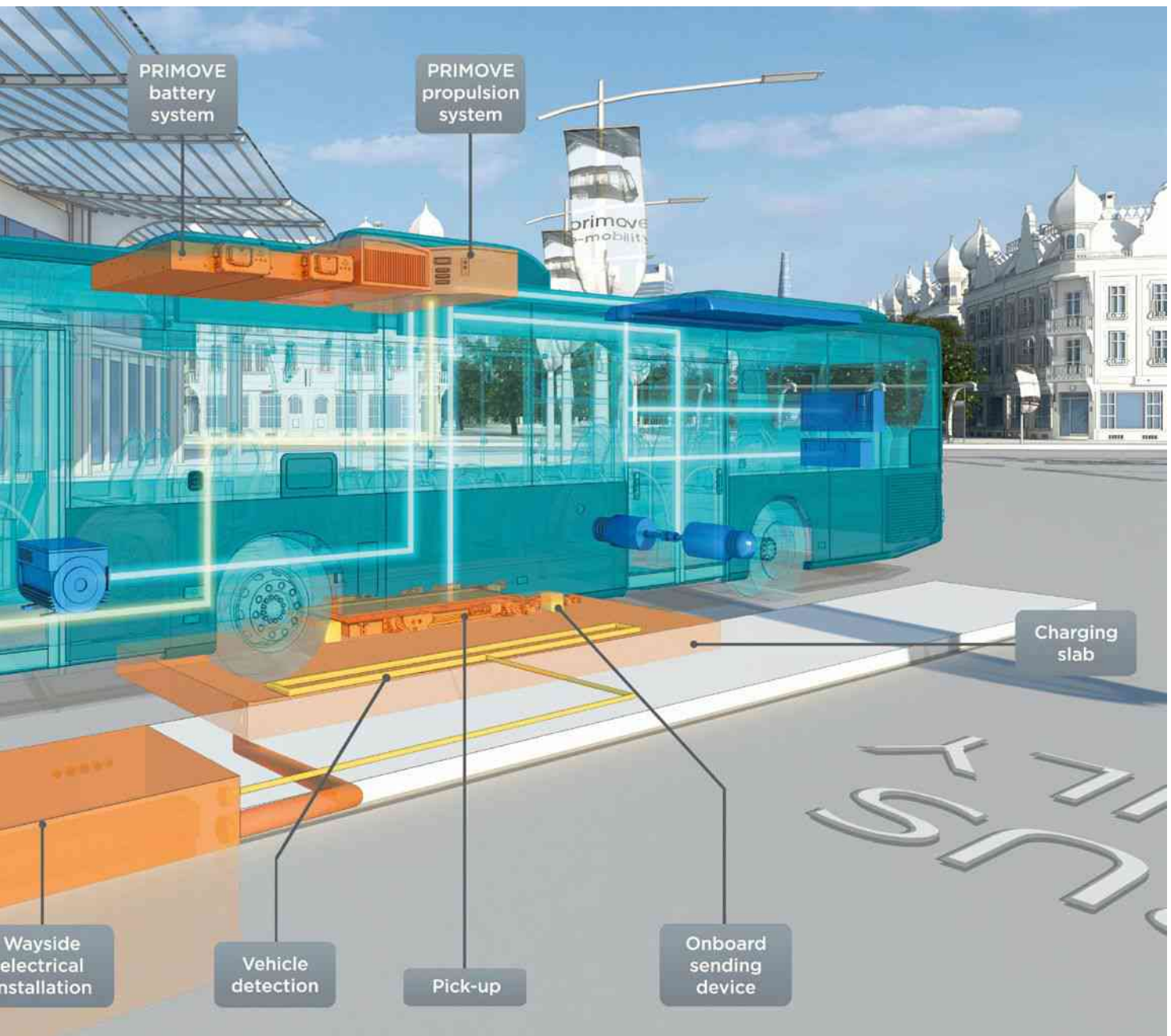
approach includes considering how the fuel in question is generated and delivered, plus exploring the origin, production, and disposal of components, for example with the batteries of electric buses. Other UITP recommendations to the EU include the following:

- expand public transport systems by investing into more priority and dedicated bus lanes
- promote public transport as part of any European CO<sub>2</sub> reduction strategy, and as a

strategy for clean air

- encourage cities to set ambitious quantitative modal share targets to attain balanced sustainable mobility
- continue to provide research and investment funding for public transport
- together with the European Investment Bank (EIB), provide funding for an accelerated renewal of the oldest parts of bus fleets, leading to an immediate improvement in CO<sub>2</sub> emissions and pollutants.

[5] [www.uitp.org/positionpaper-bus-systems](http://www.uitp.org/positionpaper-bus-systems)



## From Alternative to Mainstream

There are a number of forces driving efforts to bring 'alternative' fuel technologies such as electric and hybrid to the fore. Namely the desire of operators to cut operating costs and boost their brand image; initiatives spearheaded by public transport bodies; legislation from Brussels aimed at tackling pollution and

congestion; and, of course, business interests from the bus industry.

In an ideal world, actions to reduce emissions from urban mobility should be achieved through a combination of measures, notably by shifting to sustainable transport modes and cleaner fuels, and by adopting vehicle standards. These should be further strengthened by better managing transport demand to increase its efficient use. Congestion pricing, low

emissions zones, clean air funds, green zones, parking management and vehicle quota systems... all are examples of the measures that some cities are taking in this area.

A win-win for all? Perhaps one day, one year...

# Urban Cable The Missing Link?

From the USA to Europe, from North Africa to Asia, the urban cable car is bringing the mountains to the city. The ability of this transit mode to span metropolitan sprawl to provide short and cost-appealing travel links is gaining credibility, traction, and proving an increasingly attractive complement to the metro, tram, and bus staples of collective transport.

“Since 2012, there has been real momentum around the urban cable car, with 30 new and ‘serious’ well-advanced projects worldwide,” says Jacques-Jo Brac de la Perrière, from the association Ville et Transports Ile-de-France. The driving forces? The

ability of cable to cross natural (hills and rivers) or man-made (roads or railway lines) features; to create interconnections; and to alleviate road congestion. Ecological reasons are cited too – thanks to their energy efficiency, the systems have an appealingly

neat footprint. Since they generate less rolling resistance than land-bound transport, less electrical power is required to drive the cables. Furthermore, stop-and-go operations are energy sparing too. As an added extra, introducing this mode can help boost the





appeal of a city (to both tourists and potential inhabitants), and its outlying districts.

The cost factor is a draw, too, with cable requiring less investment to build than its bigger sister modes: a one kilometer route costs around €40-50 million for a metro; between €15-25 million for a tramway; and €8-15 million for cable. And who can afford

to ignore the conundrum currently faced by local and municipal authorities – the pressing need to expand their saturated transport networks on significantly reduced budgets.

Nevertheless, together with the benefits come a number of technology- and infrastructure-related challenges. The route must be strategically planned – not only

to provide the desired link per se – but also to link up as seamlessly as possible with other, existing modes. Will there be intermediary stations, and if so, how many and where? Getting the capacity and design of the cabins (or pods) right is equally important. Bearing in mind that city cable is not expected to carry the same volumes of passengers as the metro. Its urban role being to supplement existing modes, not replace them. Also station access for all, from street level to platform, must obviously be taken into consideration: if rapid and easy it will encourage riders; if not, they will travel other ways.

Last but far from least, let's not overlook the safety and security aspects of the system, during boarding, alighting, and the journey itself. Can the doors be forced open? Is there an emergency stop button? Will stations be staffed or not? Is CCTV in operation?

### 3 Major Players

The supplier market for cable systems is dominated by three major players – the Italian Leitner; the Austro-Swiss Doppelmayr Garaventa; and the French POMA. For these firms, the market segment of urban cable represents a welcome business segment, enabling them to diversify from their core business for winter sports.

Images: (left) POMA cable cars over the river Isère in Grenoble, France. Source: POMA (above) Leitner cable car, Bolzano, Italy. Source: Leitner

# Over the River Thames

Over- and underground, buses, Tramlink, Docklands Light Railway, taxis & minicabs, river, cycling, walking... and cable... London has brought another transit mode into its fold. The Emirates Air Line<sup>[1]</sup> service – so called because it is sponsored by said airline – the first of its kind in the U.K., made its maiden ‘flight’ prior to the start of the Summer Olympic Games in 2012. Gliding 90 meters above the Thames River, the 1.1km line connects the O2 arena on Greenwich Peninsula with the ExCel Exhibition Center at Royal Victoria Docks. A complex construction project, it involved stretching 50-millimeter steel cables between steel towers 90-meters high.

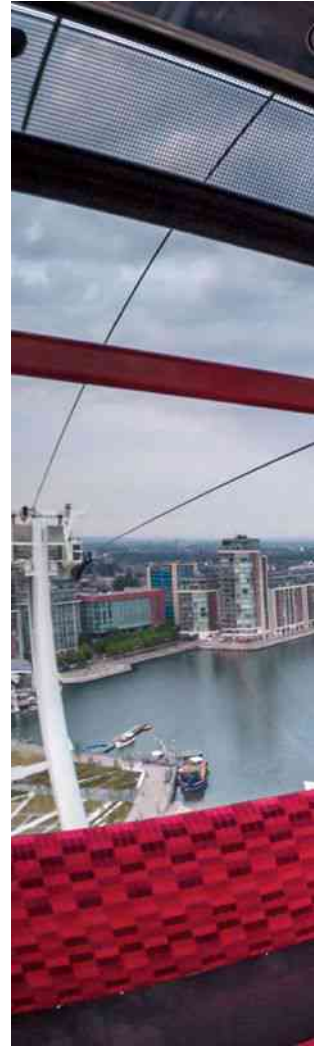
[1] www.emiratesairline.co.uk

Each cabin (34 in total) can carry 10 passengers, plus bicycles, and travels at a maximum speed of 6 meters per second (20 km/hr). Up to 2,500 passengers can be carried per hour, per direction, with the one way trip lasting 5 minutes at peak hours, and 10 minutes at other times (service speed is reduced).

Ironically, in beautiful mountain settings, over the years ugly pylons have been inserted for cable cars but nobody seems to have protested; yet in the urban context there is public outcry

Images: (below) Opened in 2012 to link Greenwich Peninsula and the Royal Docks in London, the Emirates Air Line cable cars cross the Thames River in as little as five minutes. Source: Ian Patterson (right) Capsule, Thames Cable Car. Source: James Petts (p.28) Source: Avant Première

The system forms part of the Mayor of London’s vision to regenerate the east of the city. Boris Johnson is keen to transform this area into a new metropolitan quarter boasting new businesses, tourist attractions, homes and employment opportunities. By providing the river crossing and introducing a landmark architectural addition to the cityscape, much more than passengers is riding on this cable service.



## Changing Faces & Attitudes

In France, the Téléal cable project<sup>[2]</sup> in Val-de-Marne (a department southeast of Paris) has been garnering attention among the national media. After languishing on the drawing board for the past five years, in September 2013 it was finally validated, although the necessary funding still appears to be outstanding. The area to be covered by this new transport system is cut up by rail tracks, a marshalling yard, roads, warehouses, and high-voltage lines. All of which leave little if any room to manoeuvre. Several options were explored when deliberating over how to supplement the existing, saturated, public transport offer.

One possibility was obviously to focus on

[2] www.valdemarne.fr



the surface, for instance by restructuring and improving the existing bus network. Another option was to build a metro line underground, but this would have proved too costly and taken too long to complete. Finally, cable came up trumps by meeting all the key criteria, namely mobility needs, costs, and time to implement. The subsequent plan is to build a 4.5km long cable system, served by four to five stations. Designed to link up with one metro line and a number of bus routes, the estimated time gain for users will be 30 minutes of travel time less per day.

## Not Over My Back Yard

Despite having gained acceptance in terms of function, there is still some way to go on Téléal's form factor, particularly with regards to the urban insertion of pylons and stations. The irony is that in beauti-

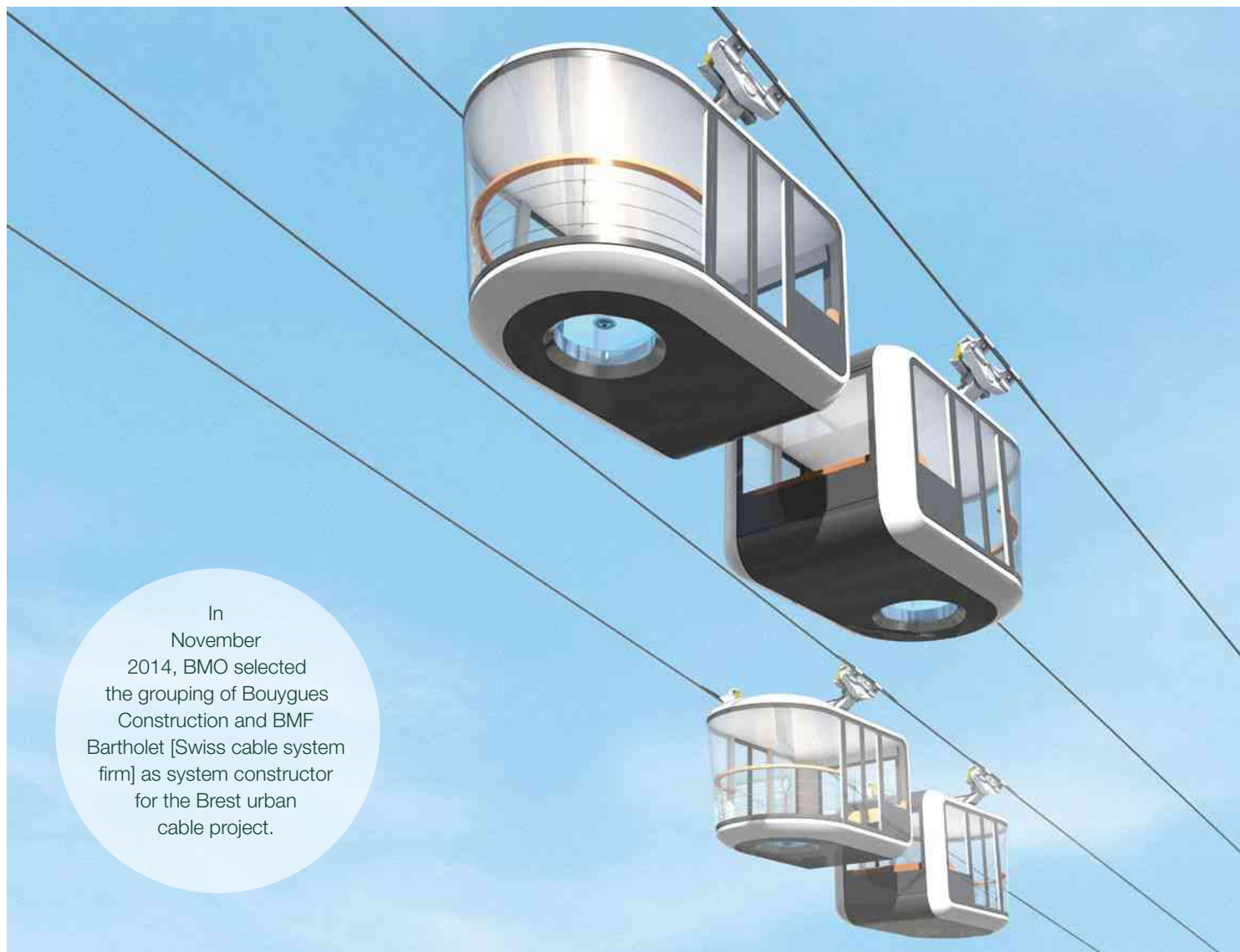
ful mountain settings, over the years ugly pylons have been inserted for cable cars but nobody seems to have protested; yet in the urban context there is public outcry. Always lurking at the back of minds is resistance to invasion of our 'back yards'. The saying 'a man's home is his castle' still holds true today – take the heated debate over the planned construction of a second, high-speed rail route (HS2) in Britain, for instance, and the French are no exception: "Today in France we are seeing strong resistance to the urban cable car," reports Pierre Serne, vp, STIF & administrator, GART (French transport authorities), "just as we did in the early days of the tramway revival."

The answer, Mr. Serne reckons, is for the system to be innovative, for sure, but equally to prove truly pertinent as a solution to the mobility problems experienced by the city district in question. "And here the Téléal proj-

ect, with its plan for an efficient service and reduced journey times, is a case in point," he adds. "If we can deliver these two elements, cable will be accepted by the public."

## Eyesight, Not Eyesore

Design undoubtedly has a part to play in gaining public acceptance. Not least by rethinking cable for its urban surroundings, rather than simply imposing the solid, functional mountain model on the city. And herein lies opportunities such as new kinds of pylons, and why not incorporate solar panels, too? The pods and cabins can become attractions in themselves, moving urban sculptures, with carefully chosen lighting and materials transforming them into a landmark and attraction. This has been the case with the Emirates Air Line in London, and is



In November 2014, BMO selected the grouping of Bouygues Construction and BMF Bartholet [Swiss cable system firm] as system constructor for the Brest urban cable project.

In January 2015, French public transport group RATP and POMA signed a cooperation agreement for urban cable. According to the three-year understanding, the two partners will:

- share information on cable transport ventures – existing or planned – worldwide
- study opportunities for developing new projects together
- respond to consultations of interest to both parties in this particular field

“ We are convinced that cable transport is a mode for the future that will carve out its niche in the mobility chain; one that will meet the demand of local authorities wishing to develop their urban transport network,” stated Pierre Mongin, CEO, RATP. “Although we already have experience in cable transport, thanks to the Montmartre funicular [in Paris] and Salève cable system [Geneva, Switzerland], we wish to strengthen our our position and go further through this partnership.”



long line, with terminal stations only, will cross the river Penfeld to link up its Right and Left Banks. “As is the case for many other cities with a large river running through them, Brest suffers from being effectively sliced in two,” points out project director Victor Antonio. Over the years, while the city center and economic activities developed on the Left Bank, the Right, formerly the naval, industrial district, was dedicated to ship-building. And although two bridges already span the Penfeld, they have long since reached saturation – a problem that is particularly irksome at peak travel times. “Currently, it takes 15 to 20 minutes to travel between the sides of the river, by car or tram,” explains Mr. Antonio. “But by cable it will take just three!”

- reliability: cable is considered one of the most reliable modes of public transport

“If the system appeals to tourists by offering a vantage point over the city, we will consider this an added benefit,” points out Alain Masson, 1st vice president, Brest métropole océane (BMO), who nevertheless insists the link is designed first and foremost to cater for everyday journeys, such as going to work. Consequently, the ticketing system will be integrated into the city’s public transport network, and accept travel passes.

Open 358 days of the year until 1:00 am (opening times to be confirmed), the system will operate 19 hours a day, with a frequency of one cabin every five minutes, and a journey time of three. With a maximum capacity of 1,200 passengers per hour/per direction, 650 passengers are expected, estimates Brest Métropole.

“Introducing the cable car into the urban public transport chain is not a trend, not a gadget, and not a panacea either”

– Joël Carreiras, city councillor, Toulouse

## Sky's the Limit

Given interest from all sides – decision-makers, authorities, constructors (naturally!), city planners... urban cable may well prove its staying power in Europe's city mobil-

ity chains. Obviously, the success of good projects will prove exemplary, paving the way for further developments. “Introducing the cable car into the urban public transport chain is not a trend, not a gadget, and not a panacea either,” says Joël Carreiras, city councillor, Toulouse, “but a question of the right mode for particular needs; needs such as efficiency, passenger numbers, modal switch, and social benefits.”

Making comparisons between the diverse urban cable links now dotting the globe is not necessarily a fruitful exercise. “It's important too not to compare city to city – where each project has its unique characteristics and operating conditions,” advises Mr. Carreiras, “but rather assess how well the system would fit into a given modal mix.”

planned for the French coastal city of Brest. As Anna Katharina Rudolph from cable system supplier Doppelmayr points out: “It [the system] doesn't have to look like a ski lift.”

## Cable Knit for Brest

Apart from Paris, elsewhere in France, Toulouse, Grenoble, Marseille and Brest also have cable plans, some even more advanced. From this fold, the cable project in Brest, Brittany, which forms part of an ambitious urban development enterprise called “Capucins Brest”,<sup>[3]</sup> is scheduled to enter into service during the second half of 2016. The 460-meter-

## Weighing the Options

Like Conseil Général du Val-de-Marne, the municipal authorities of Brest opted for the aerial mode after taking all the other alternatives – transporter bridge, a road or pedestrian lift bridge – into consideration. Cable won the day for the following reasons:

- investment: at around €18 million, it worked out cheapest (the cost of each of the other options was estimated at between €20-60 million)
- environment: cable emits just 10 grams of CO<sub>2</sub> per person kilometer, compared to 17g for a tramway, 23g for a metro, and 76g for a bus

[3] [www.capucinsbrest.com](http://www.capucinsbrest.com)

# Catching a Ride

As sharing gains momentum in the field of transport, there is no lack of bright ideas aimed at encouraging the public to reassess their travel habits and adopt different approaches.

'Sharing' is an open-ended concept whose iterations include collectively owned property used by a network or community, private property put at the disposition of friends and strangers, different groups using pieces of public space according to their particular needs, and so on. When it comes to travel and transport, ride sharing – a safer and more sophisticated form of hitchhiking – is one approach that is

certainly gaining appeal across Europe. Indeed, the number of online services that put private car drivers and riders in contact has grown considerably over recent years. Factors encouraging their popularity are wide and varied – fuel prices, traffic congestion, the prohibitive costs of owning and running a car, of finding and paying for parking spaces, plus the rise of the internet, mobile applications and social media.

## Pooling Resources

In operation for 17 years, Liftshare.com might well qualify as one of the oldest ride sharing schemes around. Its managing director, Ali Clabburn, was so inspired by a trip he took to Germany as an 18-year-old – where ride sharing was his bread and butter for traveling around the country – that he posted a sign on the notice board



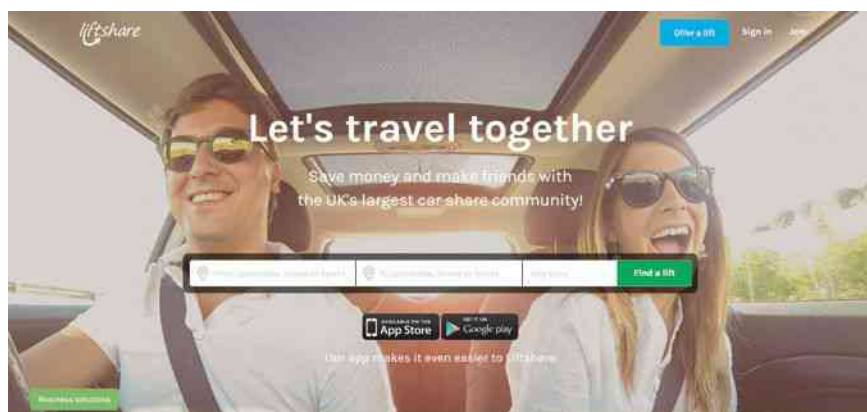
at his student union upon his return to England, trying to see if there were others like him interested in pooling their resources. Mr. Clabburn reports that his teenage self was “amazed” by what he saw in Germany – drivers willing to offer rides to strangers – and shocked that there was nothing like it in the U.K. at the time. One year later, in 1998, the first Liftshare website went live. “That makes us two weeks older than Google,” he points out.

## Ratings & Savings

The online testimonials posted by smiling sharers (reviews and ratings are common ground and a fundamental part of sharing economy platforms of any kind these days), highlight the social aspect of Liftshare. Nevertheless, Mr. Clabburn recognizes that “individuals are primarily interested because they think they can save money” – adding that, in fact, they do!

tion,” declares Mr. Clabburn; “we were set up to solve a problem.” And, as the founder learned, once the hunt for profits is cast aside, the service becomes that much more attractive to potential users. In the early days, users were charged a £10 (€12.43)/year fee; five people signed up. When the fee was reduced to £5 (€6.21) annually, membership doubled. And when the founders decided that membership would be free, more than 50 people joined.

In reality, the free individual memberships are supported by corporate membership fees. “We have to work harder than a non-profit or a regular business, because we are playing to both sides.” In essence, the outreach to individuals involves, first and foremost, making people aware that sharing exists as an option. “Ride-sharing isn’t sexy,” admits Mr. Clabburn. “People don’t come into the office wearing Lycra, like cyclists.” On the business side, the challenge is even more present, since big decision-makers are not often car-sharers: “It’s not the same profile,” as Mr. Clabburn puts it. However, Liftshare has



The present-day Liftshare, which has gone international in Australia and the USA), targets two types of users: individuals and companies. After creating a user profile, the former are then free to advertise their willingness to share a ride, or their desire to ride along. Anyone can register: having a car is not required, with the website remarking simply that it is the rider’s duty to share costs. Beyond cars, users can also search for people with whom to share taxis, bike rides, even walks. As for businesses, they can create a restricted network just for their employees, or open up to the full Liftshare network. “Companies are trying to make it possible for their staff to travel more affordably,” explains Mr. Clabburn, “and to reduce the need for parking.”

Playing to both sides – engaging the ‘common man’ and the corporation – is likely what has made Liftshare a success.

Image: (left) Source: David Lefevre / BlaBlaCar

“The cost of fuel makes the case for car-sharing overwhelming,” says a testimonial posted by U.K. Liftsharer Norman. “I estimate my carpool keeps about £150 (€213) a month in my pocket that would otherwise plug down my filter cap. At typical levels of taxation, that’s the equivalent to a salary rise of £2,500 (€3,550).”

## Playing to Both Sides

Liftshare is officially a non-profit organization. “We’re primarily about social innova-

succeeded in attracting some of the biggest corporates in the U.K. to their cause – like Heathrow Airport, BSkyB, or Scottish Power, for example, which makes it easier for others to follow suit.

## BlaBlaCar – Biggest in the Business

Present in 19 countries across Europe and Asia, and with 20 million members, BlaBlaCar is the biggest player on the European ride sharing scene today. And its origins, born out of a need unfulfilled, are not dissimilar to those of Liftshare. One Christmas, founder Frédéric Mazzella, a student at the time, wanted to get home to his family in the French countryside. He had no car. The trains were full. The roads, too, were full of people driving home, alone in their car. It occurred to him that he should try and find one of the drivers going his way and offer to share petrol costs in exchange for use of an empty

seat. He thought he could do it online, but no such site existed... And so, in 2006 the (ad)venture began!

To find a ride, or for drivers offering empty seats, users go to the website, sign up,

plan a car share where both drivers and all passengers are women.

To secure its spot as Europe's leading city-to-city car-sharing service, in April 2015, the company bought one of its big-

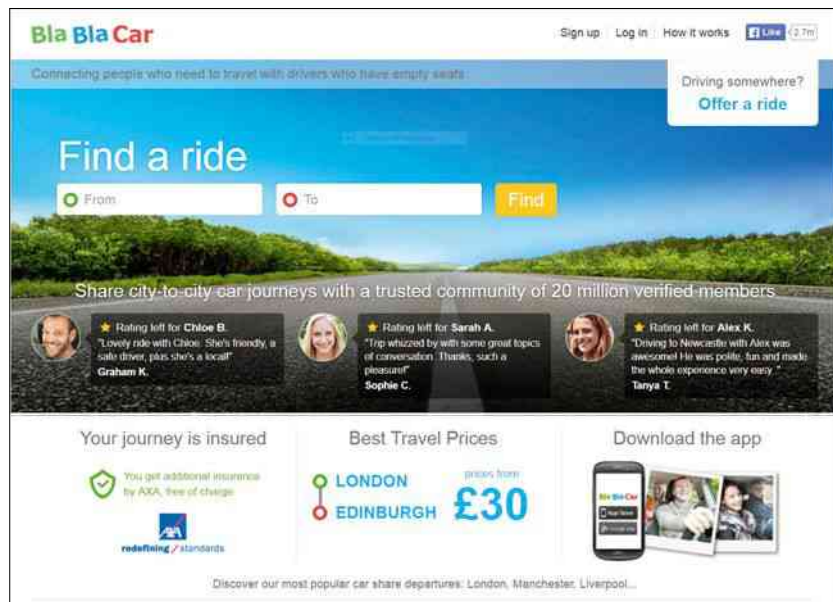
its *modus operandi* is a real sign of the times – new technologies disrupting traditional business models. However, while the authorities in countries across Europe have yet to decide how to handle this controversial start-up, the traveling and paying public appear to be in favor: following the violent anti-Uber demonstrations in France this June 2015, comments posted by the public on the web, Facebook and Twitter showed little sympathy for the furious taxi industry! Given that their drivers, in France, have a reputation for being unfriendly and for overcharging, how can customers be expected not to welcome the arrival of an alternative?

## Sharing... Caring?

For those without cars – nearly 58% of Europe's population, according to statistics by Eurostat – ride-sharing can indeed be a solution when more established travel modes simply don't fit into the practical, social, or financial plan. And long distance services like Liftshare and BlaBlaCar have definitely encroached on traditional transport modes such as rail. How do we know? Because a number of train operators have come up with offers, notably group travel discounts, to encourage the public to stick to the tracks for these journeys. French Railways (SNCF) in particular, appears very anxious to protect its business. In 2013, by purchasing ride sharing site [www.123envoiture.com](http://www.123envoiture.com) the company gained a foothold in what it obviously sees as both a developing and rival market.

Flexibility, seamless mobility, saving money and time... the factors driving the uptake of ride sharing are numerous. And meanwhile, there is a growing awareness that our reliance on single-occupancy vehicles is no longer valid in a world where urban space is at a premium, fuel and time are precious, and where the environmental impacts of our transport activities are becoming increasingly obvious. As transport become more sharing-oriented, does this herald the dawn of a more caring society? Only time will tell...

The **Sustainable Mobility**  
special dossier continues on p.52 >>



then enter their departure/arrival points plus travel date. Seats are reserved via secure credit/debit card payment, with the rider receiving a booking code as confirmation. Phone numbers are exchanged to

gest rivals in Germany, Carpooling.com, as well as Hungary-based Autohop.

## Uber – Sign of the Times

Uber, the San Francisco-based, ride sharing company launched in 2009 and now present in 59 countries worldwide, is not having an easy ride in Europe. Firstly, it's important to point out that unlike Liftshare and BlablaCar, Uber is designed for travel within cities, with its mobile app enabling people to 'hail a ride' with the driver of a private car instead of an official cab. But in a number of cities, of which Berlin, Paris, London, Madrid and Milan, taxi drivers are not taking this head-on challenge to their established business lightly. Their complaint being that these 'freelancer' Uber drivers are not properly regulated, don't pay the same amount of taxes, and are basically 'enticing' customers away.

Given that Uber is not a transport company but a technology start-up, the furore over



arrange the final details. Trust and safety are guaranteed by means of a system whereby drivers and riders alike are given ratings online after the trip. An added safety feature is the 'Ladies Only' service, which allows members, if they prefer, to



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VIEWS

# Sustainable Mobility



Urban cable car traversing the Queensboro Bridge to Roosevelt Island in New York City. Source: POMA



The Grenoble-Bastille cable cars, known locally as "les bulles" ("the bubbles") links the city center with the former fortress across and above the Isère River. Source: POMA



BOMBARDIER PRIMOVE: a wireless and contactless charging system for clean, quiet and convenient e-buses in the historic city centre of Bruges, Belgium. Source: Bombardier





The electric BMW i3 is now available at DriveNow car sharing in Copenhagen and interconnected with public transport (August 2015). Source: BMW



Intermodality: connecting public transport in Strasbourg, France for citizens and visitors to go from electric trams to buses, 2002. Source: POLIS / UITP



The colorful Röda linjen (Red Line) T14 of Stockholm's metro open since 1964 is 41,6 kilometers long. Source: Ingolf



The colorful Röda linjen (Red Line) T14 of Stockholm's metro open since 1964 is 41,6 kilometers long. Source: Ingolf



Place Luxembourg is a highly vibrant neighborhood that deserves a better public space for seamless mobility and enhanced community life. This 3D rendition of the square projects what the near future could look like. Source: Espaces-Mobilités / ZOOO





Intermodality: reducing carbon emissions and the use of motorized vehicles, an urban cable car station connects passengers with the local train system in Medellin, Colombia. Source: POMA



Intermodality: nearly 230,000 visitors travel from bus to train per year at the Historic Grand Canyon Depot. Source: Grand Canyon National Park



Personal Rapid Transits (PRT) move irregular flows of people, going in different directions, and allows point-to-point travel, bypassing intermediate stations. Source: Vectus



The Personal Rapid Transit (PRT) – also known as podcars – is an automated guideway transit (AGT) system that operate digitally on specifically designed magnetic paths. Since 2010, a 10-unit PRT system has been operating in Masdar City, UAE. Source: 2getthere



When there is no more room on the ground, then go to the sky. These two-person pods are coming to market in India and Israel this year transporting passengers on suspended lines above city traffic. Source: SkyTran





Exponential electric vehicles are coming to market, reducing pollution and noise in cities, but not incremental car traffic. Source: Sopotnicki / Shutterstock



The Faraday Electric Bike has a simple classy design with batteries in the downtube and a front hub motor. Source: Richard Masoner



Urban mobility is mainly about travelling short distances, done by different modes. On the market in France and Belgium since 2015, these self-balancing unicycles are powered electrically. This new 10 kg compact vehicle is easy to carry and can cover up to 10 km at about 10-15 km/h. Source: Solowheel

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# Batteries Driving the Future of Electric Vehicles

Greening road transport is necessary to achieve European Union (EU) and world targets for reducing emissions since the sector contributes about one-fifth of the EU's total emissions of carbon dioxide (CO<sub>2</sub>), the main greenhouse gas. While these emissions fell by 3.3% in 2012, they are still 20.5% higher than in 1990.

Following up on the 2007 European Commission strategy, the EU has put in place a comprehensive legal framework to reduce CO<sub>2</sub> emissions from new, light duty vehicles (LDV) – cars and vans – as part of efforts to ensure it meets its greenhouse gas emission reduction targets under the Kyoto Protocol and beyond. The legislation sets binding emission targets for new car and van fleets. In parallel, to help drivers choose new cars with low fuel consumption, EU Member States are required to ensure that relevant information is provided to consumers, including a label showing the fuel efficiency and CO<sub>2</sub> performance of cars.

## European Green Vehicles Initiative

[1] [www.egvi.eu](http://www.egvi.eu)  
A contractual public-private partnership (PPP), the European Green Vehicles Initiative (EGVI)<sup>[1]</sup> is dedicated to deliver-

ing green vehicles and mobility system solutions. Established as a continuation of a previous such program, it aims to accelerate research, development, and the demonstration of technologies for the efficient use of clean energies in road transport.

The EGVI is one of three PPPs included in the European Commission's recovery package ("a comprehensive action plan for a coordinated response to the economic crisis"). Its envelope of €5 billion is expected to help boost the automotive industry in a time of economic hardship, and support the development of new, sustainable forms of road transport. To do this, three streams of action are being followed:

- R&D, mainly through FP7 and Horizon 2020 grants for research on greening road transport. Budget: €1 billion, of which



€500 million from the EC, matched by €500m from industry and Member States

- support for industrial innovation through European Investment Bank (EIB) loans. Budget: €4 billion (in addition to existing loans)
- demand side measures & public procurement, such as the reduction of registration taxes for low CO2 cars.

The wide range of EGVI research top-

ics encompasses cars, trucks, greening internal combustion engines, bio methane use, logistics, transport system optimization, and electric and hybrid vehicles, with a particular emphasis on electric engines and smart electricity.

An example of a project ongoing under the EGVI umbrella is COSIVU – Compact Smart and Reliable Drive Unit for Commercial Electric Vehicles.<sup>[2]</sup> The partners

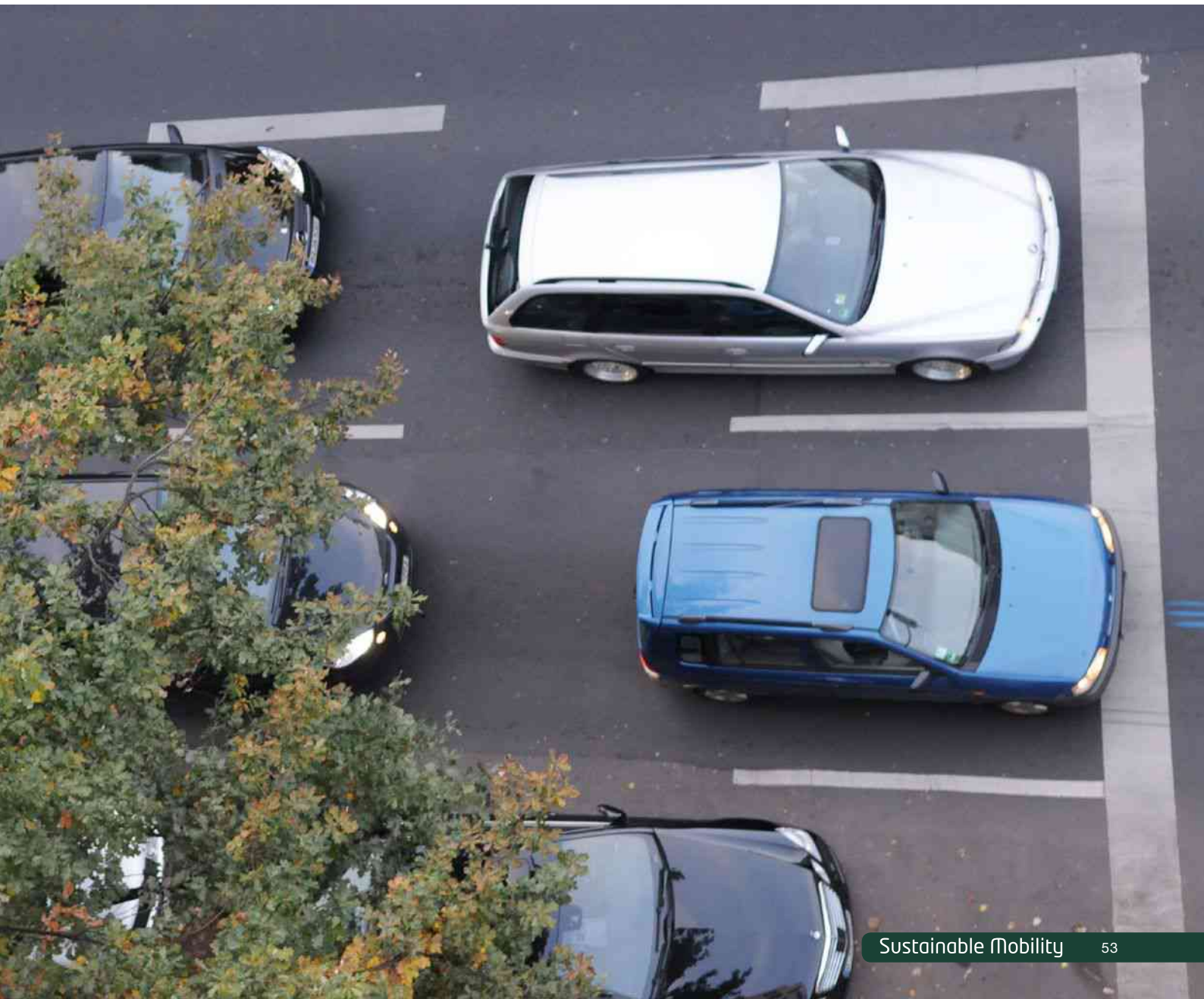
behind this three-year initiative, funded to the sum of €5.2 million and due to end in September 2015, have developed a novel system architecture for drive-trains consisting of a smart, compact, and durable single-wheel drive unit, including the following features:

- integrated electric motor
- inverter with SiC-based power electronics
- novel control and health-monitoring system with wireless communication
- advanced ultra-compact cooling solution

The benefits to be gained from this innovation are significant weight reduction, less switching losses, increased energy

[2] [www.cosivue.eu](http://www.cosivue.eu)

All in all, the electric vehicle (EV) is 'greener' than its internal combustion counterparts; and at its heart lies the battery.



efficiency, and an extended driving range for commercial vehicles. During the final six months of the project, this unique drive unit has been finalized for use in both a commercial vehicle and passenger car.

## Boosting the Battery

Part of the strategy to 'clean up' the EU's transport sector depends on the rise of the electric vehicle (EV). Because although the latter is responsible for a certain amount of CO<sub>2</sub> emissions – generated when taking electrical energy from a fossil fuel powered grid – when in operation, it produces none. All in all, the EV is 'greener' than its internal combustion counterparts.

At the heart of the EV lie its batteries. In the coming years, Lithium-ion (Li-Ion), the reference technology for plug-in and full

## EU legislation sets binding emissions targets for new car and van fleets

Images: (previous page and pp.56-57) Berlin traffic and intersection.  
Source: David Moraldo (this page) Electric charging point.  
Source: Tom Lee / Transport for London (TfL)

EVs (PHEVs & BEVs), is expected to dominate the market by 2017. Compared with other battery types on the market (lead-acid and nickel metal hydride, NiMH), Li-Ions have the highest energy density and a shorter charge time. However, the lion's share of their production is currently coming out of North America and Asia; leaving Europe's manufacturing industry, with its lower capacity, lagging behind.



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The only way Europe can become competitive with these countries in battery production is by developing new chemistry/technologies based on innovative materials and processes in the manufacturing value chain in order to deliver the following benefits:

- a more environmentally friendly production method for battery components
- a swifter battery assembly procedure, and
- easier and more effective disassembly and end-of-life recycling

## Eco-Designed Processes

In response to the above, the EU is backing a large-scale collaborative project called GREENLION<sup>[3]</sup> – running from 2012-2015 – that is focusing on the industrial development of eco-designed processes at electrode, cell and battery module levels.

Its 16 partners (industry, research, and universities) from 7 Member States are establishing a process for manufacturing greener and cheaper Li-Ion batteries for EV applications – via the use of high thermally stable binders that are both water soluble and fluorine-free. Such an approach would eliminate the use of volatile organic compounds (VOC, some of which are dangerous to human health or harm the environment), reduce the costs of cell assembly, and render the disassembly and end-of-life recycling of the batteries easier and more effective. To achieve these end goals, the tasks are divided into the following six work packages.

- new materials: development of new active and inactive battery materials viable for water processing (green chemistry)
- innovative electrode processes (coating from aqueous slurries): leading to reduced electrode production cost and environmental pollution

[3] [www.greenlionproject.eu](http://www.greenlionproject.eu)



- elaboration of new assembly procedures (including laser cutting and high temperature pre-treatment) capable of substantially decreasing the time and costs of cell fabrication

- lighter battery modules with air cooling and easier disassembly through eco-designed bonding techniques

- development of an automated module and battery pack assembly line for increased production output and reduced costs

- waste reduction: making use of the

GREENLION is targeting the industrial processes at electrode, cell and battery module levels



water solubility of the binder allows extensive recovery of the active and inactive battery materials

In June 2015, the team presented results so far on the upscaling of active materials manufacturing (graphite anodes), the integration of the electronics in the battery module, and the design of production lay-outs for automated assembly of battery modules. In addition, the recycling logos designed for eco-labelling were presented. "Altogether, these improvements will allow higher energy efficiency and substantial cost reductions, thus ensuring real competitiveness for Li-Ion batteries based on

new technologies," commented project coordinator Iosu Cendoya of Spain's Fundacion CIDETEC.

Before the project end in October 2015, partners Volkswagen and SEAT will assess the final assembled battery module to see whether it meets the specifications required for EVs.

## Steering in the Right Direction

In April 2015, provisional figures published by the European Environment Agency show CO<sub>2</sub> emissions from new

cars sold in 2014 fell 2.6% to an average of 123.4 grams per kilometer (g/km), compared to 127 in 2013 and 132.2 in 2012. This means the legal target of 130g/km set for 2015 has been met two years early. "The 2015 CO<sub>2</sub> target has already been achieved – this is good news," responded former Climate Action Commissioner Connie Hedegaard. "This clearly demonstrates the efficiency of the EU's legislation in driving change. It also shows that European car-makers are already steering towards the 2021 target of 95g, and therefore proving us right when we said that the 2015 target was both achievable and cost effective." 

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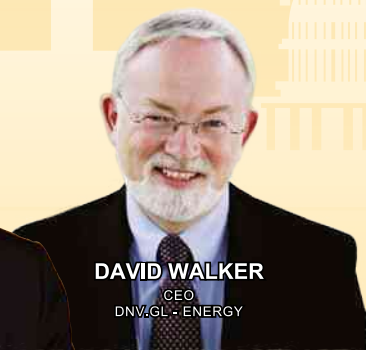
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# UNDER CONTRACT

## The Hidden Risks for Chicken Farmers

Industrialized poultry production means 19.5 trillion chickens produce over 86 million pounds of meat every year, which means billions in profits. But as corporate multinationals increase their global power, the farmers are increasingly exploited, facing severe risks including bankruptcy. *Revolve* investigates why experts call the modern-day poultry contract a form of serfdom.

Writer: Sally Lee



The role of the farmers in a contract model is not what most people would recognize as farming; it's closer to modern-day serfdom.



Image: Modern poultry houses are packed with 30-40 thousand chickens. The birds do not have much space and are kept indoors with limited access to light.  
Source: Marcello Cappellazzi

A global surge in poultry production is changing the way we produce food. Lauded by economists and industry officials, the vertically-integrated industry has become a model for processing hogs, cattle, even seeds – because it appears to return high profits to shareholders under the guise of economic efficiency. A flood of foreign investment is replicating this model with the growth of transnational corporations and a flurry of international mergers. A closer look at the real effects of poultry production where it all started – the “chicken-belt” in the United States – reveals the systematic exploitation of farmers.



## Insight into India

According to the UN Food and Agriculture Organization (FAO), per capita meat consumption doubled between 1980 and 2005 in developing countries, and consumption of eggs more than tripled. A perfect example of this burgeoning market trend is the sudden growth of chicken consumption in India. Associate Professor of poultry science at the University of Agricultural Sciences in Bangalore, Dr. Chidananda explains that the surge is part of a broader transition in India's food economy. “Income is increasing, and the young generation wants to eat more meat,” he said. “The cold chains are also increasing. We have Metro, we have Food World... we even have Walmart com-

ing to India. The potential in the Indian food industry is huge.”

Dr. Chidananda's research has focused on the emergence and impact of contract farming in the poultry industry in India. He notes that traditionally, poultry was a luxury item in India that was more expensive than other meats such as mutton. Most chicken is sold through what is called a “wet-market,” where shop keepers slaughter and dress the chicken at the moment of purchase. However in the past decade, brand-name shops owned by poultry integrators such as “Star Chicken” have opened in major cities, selling pre-cut and frozen chicken sourced

through contract production at lower-than-market prices.

Dr. Chidananda claims that “this strategy, at least in part, reflects an effort by the integrators to increase profits by turning poultry into a low-margin, high-volume business.” In other words, the integrator benefits from a competitive advantage of the sheer volume of their production, compared to independent producers, and can afford to sell it cheaper. By changing the nature of the market, they push independent growers and wholesalers out of business overtime, creating a sort of domino effect of concentration.



**Image:** Poultry farmers in India are being recruited by integrators to sign production contracts modelled after the system developed in the United States which has left many family farmers facing bankruptcy. Source: Marcello Cappellazzi

Tyson Foods is the U.S.-based multinational corporation at the top of the global chicken chain. According to Watt Poultry Magazine, Tyson slaughters almost two billion chickens annually and leads in production of “ready to cook” poultry products. Technically India does not allow for the import of chicken (although the WTO may soon force India to import U.S. poultry). But through a joint venture with Godrej Agrovet, Tyson has gained access to the growing Indian market, by opening two plants in the Bangalore area to process chickens raised by farmers who hold contracts with Godrej.

The entrance of big players, such as Tyson,

means big changes — for farmers in particular. Raising poultry under contract with a national integrator for 7 years before being cut-off, an anonymous farmer described the type of business relationship farmers can expect: “We do not get a copy of the contract,” he said. When asked if he could negotiate or discuss his costs with the company, he said: “We are scared to negotiate because they would stop bringing birds.”

He described a process of going to an office in town and signing 50-60 pages of agreements without being able to read or understand the details. He also explained that in order to build his two poultry houses,

he took out a significant loan. Ten years later, he has only paid a small portion of the loan and is still struggling under the debt. Where he used to house 20,000 chickens, he now rents his houses as empty sheds to a sculptor of Ganesh statues and a dog-care facility.

“In reality the farmers are not happy,” says Dr. Chidananda. “If I raised a loan and started production, I would never be able to pay off the loan. Rather I would continue doing a job, slave to pay the interest on the banks side, and grow the chickens for the companies, and I remain stuck in the middle.”

# THE **DEBT** TREADMILL FOR POULTRY GROWERS

**X UNDER CONTRACT**  
Farmers in the fine print

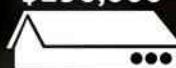
Farmers sign contracts because they hear claims from the industry such as this one:

*"Contract with a broiler company allows new farmers to begin farming and current farmers to grow"*

(National Chicken Council, 2009)

in 2004 **\$49,037\*** /grower  
was required to upgrade  
\*(USDA)

Chicken Houses =

|                                                                                     |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| \$250,000                                                                           | \$250,000                                                                           |
|  |  |
| \$250,000                                                                           | \$250,000                                                                           |
|  |  |

The **equity** built up during the activity as a grower is used to **renew their debt**

An average farm has 4 chicken houses = **\$1 MILLION**

## IV.

### Unexpected costs

The farmers are obliged by the integrator to make large investments to upgrade their houses according to the industry's needs.



## III.

### Paycheck variability

Farmers are clustered in pools and compete for a fixed amount of money that the company predetermines.



## I.

### False promises

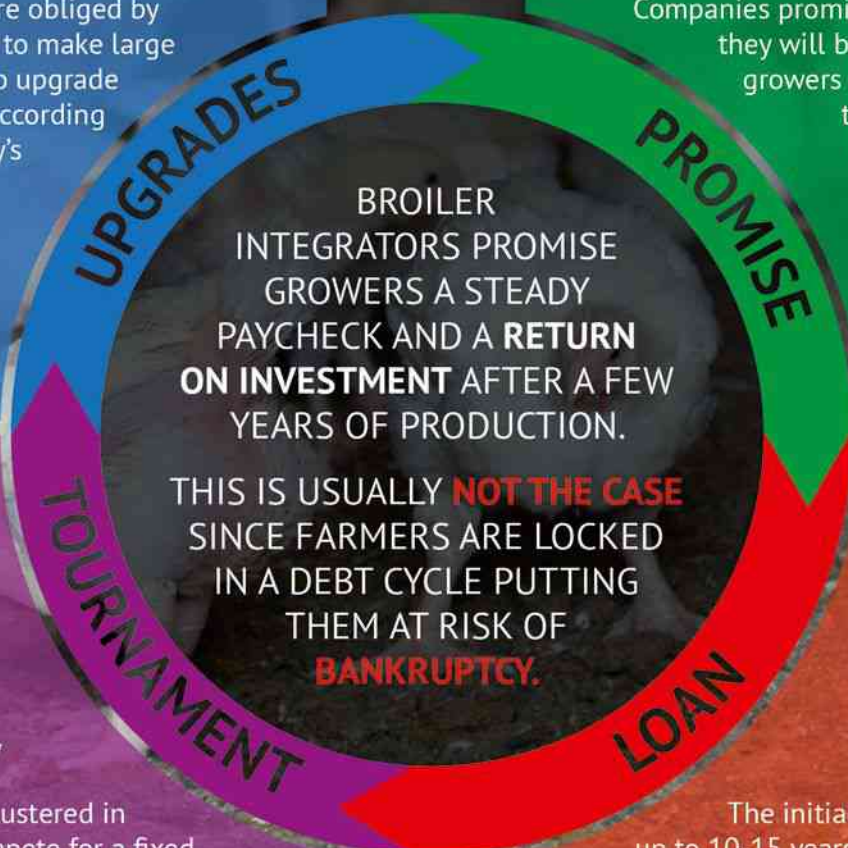
Companies promise the farmers they will be independent growers able to pay off the investment in a few years.



## II.

### Risk & insecurity

The initial loan may last up to 10-15 years, but contracts can be flock to flock and unreliable. Farmers often use their house and other properties as collateral.



# What Really Came First: The Contract

The use of contracts with poultry growers started in the United States in the 1940s and became overwhelmingly popular, coinciding with dramatic growth in the industry – a remarkably similar trajectory to India’s current transformation. Until the 1940s, U.S. chicken production was still largely decentralized, and the majority of chicken farms were backyard or independent operations (PEW 2011). Then, over a 10-year period until 1950, the U.S. marketplace saw a decrease in the number of chicken farms by 98%, and a simultaneous increase in the sales of poultry by 1,400% (USDA 2007).

The sudden changes were a result of two trends – increasing production thanks to technological development, and the beginnings of vertical integration and consolidation in the industry.

The introduction of the Confined Animal Feeding Operation – known now as the CAFO, led to exponential growth in production capacity for broilers. The CAFO is an indoor “house” that is designed to be also a feeding system, and today can manage 30,000-40,000 birds in a single structure (PEW 2011).

Capitalizing on this potential, feed mills and processors merged to form what would eventually become known as “integrators,” or large livestock firms, such as Tyson, Pilgrim’s Pride, Perdue, and other major firms in the meat market today. As they bought up portions of the supply chain, they could control the inputs, and adjust output levels to reign in overproduction, essentially fine-tuning the industry to maximize profit.

Today, integrators typically own all aspects of the supply chain except the farm. They own the breeding process (several even own their chicken genetic lines), they own

the hatchery where the chicks are born, they own the feed mill that produces their own blend of feed, and they have a staff of veterinarians and “field techs” that supervise farmer activity in raising their birds. Indeed the farmers they contract with never own the birds they raise, they remain the integrator’s property from the point they are dropped off as chicks, until the company picks them up five weeks later and drives them to their slaughter and processing facility.

The role of the farmers in a contract model is not what most people would recognize as “farming.” In his book *The Meat Racket* author Christopher Leonard charts the transition of Tyson’s farmers from independent business partners in cooperation with their integrator to what he calls “serfdom.” “The

**“The company owns everything except the farm. Why would this one piece remain off the balance sheet?”**

– Christopher Leonard, author of *The Meat Racket*

company owns everything except the farm,” he said. “Why would this one piece remain off the balance sheet? A Tyson foods top attorney said that “with a contract model they could get the benefit of controlling the farm... but they would not have to sink their capital into what is really a crummy investment of these chicken houses.”

And thus evolves the modern poultry production contract. Interestingly, in terms of overall investment in the poultry industry, the integrators typically invest about 50% (processing facilities, transportation and logistics, inputs, etc) and the farmers invest another 50% of the capital, which is generally represented in large loans in the ballpark of \$500,000 to over \$1,000,000 each. Despite the balance of capital investment, the power dynamic is extremely one-sided. The decision-making powers and ownership over the final product remains solely with the integrator. Land and labor investments remain with the farmers, along with a disproportionate experience of production risk.



# Risky Business on the Farm

To understand what the transformation in India and other developing poultry industries might bring, one just has to listen to the stories of the veteran producers in the South of the United States.

Mitchel and Karen Crutchfield were growers for Tyson for 25 years in Arkansas. “This is my grandfather’s land,” Karen explained. “This was sold as a long-term investment,” she said of the four poultry houses she and her husband built, a total investment of around \$600,000. “They said you get out of debt and then you’ll see real money. That was basically false advertisement.”

In 2012, the Crutchfields, in their late 60s, were well on their way to paying off their houses. They had taken out a 15-year loan, and had only three years left to go when Tyson decided to upgrade the houses of its growers in their area. To pay for the upgrade, the Crutchfields would have had to refinance their loan all together. “We would have been 80 years old in the chicken houses in our wheel chairs,” said Karen.

They were still able to raise healthy birds without the upgrade. They refused to reinvest their loan, and told Tyson they would go without the upgrade. As a result, they and several other growers were cut-off from their contract. All they received was a letter in the mail. Today the Crutchfields are facing bankruptcy and fighting against the loss of their farm, house, and even their cattle business.

Meanwhile in North Carolina, Craig Watts is still growing chickens for Perdue as he has done for more than 20 years. “You figure contract, you figure security, you think this will pay out in 10 years,” he said. “But I had to start a separate

“They said you get out of debt and then you’ll see real money. That was basically false advertisement.”

– Karen Crutchfield, poultry grower in Arkansas

business to support my chicken habit. You’ve got two options: stay in it or lose your farm.” Watts’ name is recognized by many in the business today, as he recently has become an outspoken whistleblower on the green-washing

of false animal welfare claims in the industry, and the exploitation of growers.

In Mississippi, Paul Brown sat in his living room next to his wife and daughter in the house he built by hand just two years before. “Who is stupid enough to take everything you have ever worked for, and get in bed with a company that says they are going to pay you . . . but they are going to pay you by their scales,” he said. “If you are comfortable with that, you’d be as big a fool as I was. That cost me 27 years.” Brown and his wife quit their Tyson contract three weeks before, after realizing they were at a point of bankruptcy with no other options. The poultry investment they made in 10 houses had ruined their cattle business, and destroyed their savings.

Across the U.S. south-east, thousands of family farmers could tell similar stories. The problems farmers face in squeezing a livelihood out of contract poultry production are complex. The integrators have a powerful lobby, regulation is scant and poorly enforced, and retaliation is a common practice in the industry. As a result, farmers rarely – if ever – speak out about their situation. But the most poignant example of the exploitation of farmers in the poultry industry is a mechanism built into the contracts themselves called “tournament payment.”

# Culture of Misinformation

In 2010, the United States Department of Justice, charged with investigating and enforcing anti-trust regulations, held joint hearings with the U.S. Department of Agriculture to collect testimonies and evidence regarding corporate concentration in poultry production. In footage from the hearings, a representative of the National Chicken Council asks: “With all due respect . . . why knowing what you know, at least from your comments, would you get into a business that you feel is not a good business?”

A farmer from the Contract Poultry Growers Association of the Virginias stood up to

respond: “I bought the largest poultry farm in West Virginia and Virginia five years ago. And I can tell you the reason why I got into it is that the company lied.”

Despite the decades of struggle that have put thousands of family farmers out of business, the poultry industry is still signing up hundreds of new farmers, with new and bigger loans than ever before. Fear has a silencing effect in the farming community, and intimidation and retaliation from companies for speaking out has prevented many farmers from sharing their stories.

At the same time, academic institutions, extension offices and industry representatives alike continue to market the poultry contract as a reliable, stable means of making a living. The brochures and websites do not mention things like tournament payment or forced upgrades.

It is precisely this culture of misinformation that Dr. Chidananda is hoping will be prevented in the developing market in India. “We have diversity in the marketplace in India still,” he said. “If we can keep it, keep the rights of farmers, we can prevent what has happened in the United States.” 🌱



# X UNDER CONTRACT

Farmers in the fine print

**BREAKING  
THE SILENCE  
ON THE  
HUMAN COST  
OF CHEAP  
CHICKEN**



REVOLVE



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# Fueling Indian Agriculture

## Water, Subsidies and a Lot of Debt

The link between food production and water use is direct and controversial: many say that agriculture, responsible for 87% of all freshwater withdrawals, should be more efficient in using this resource to meet the increasing demand for food, while others point to the fact that irrigation will have to grow in the future if we want to feed the planet.

Writer and photographer: Marcello Cappellazzi





When assessing the challenges of the future, it is important to keep an eye on our history. The world population is expected to grow exponentially, reaching a peak of 8-10 billion people by 2050. The population growth rate in 1963 reached a peak of 2.19%, at a time when biological immunization drastically reduced mortality. In India, the population grew from 360 million in 1950 to 1 billion in 2000. The main challenge for policy-makers at that time was to provide enough food to the Indian population, at any costs.

The main reason behind government support for the “Green Revolution” throughout half century was the idea that technological progress could lead to an increase in agricultural output. Three main problems

were targeted: a reform in the distribution of land, the mechanization of the sector, and the introduction of high yielding varieties of crops. Those farmers who could afford the machineries and the seeds saw an increase of 300% in their production, but, even after the initial investment, the costs for running this agricultural model would multiply. Machines need fuel to run and often need repairing, and high yields requires constant purchases of inputs, such as seeds, fertilizers and pesticides. Farmers that could make a profit while meeting the extra costs imposed by modernization had the capital to invest in more land, more machines and better inputs, to the detriment of poorer farmers left without adequate access to resources.

The overuse of nitrogen for agricultural purposes created an unprecedented nutrient imbalance in Indian soils, creating the conditions for environmental degradation and reduced crop productivity.



## Enter Nitrogen

The introduction of high yielding varieties in fact required an increased use of chemical fertilizers and irrigation, which are not equally available across India. The government's attempts to boost the availability of water and nitrogen fertilizers all across the country did not solve this problem, but rather exacerbated it and created new ones. Through the use of subsidies and extension services, the Indian government opened the market for fertilizer producers, and granted them a return of 12% on their investment since 1977. The scheme in place favors the production of nitrogen, making India the

largest producer of urea (which is used as a nitrogen based fertilizer) on the planet. The boost to the fertilizer Industry enhanced the increase in soil productivity needed to provide enough food for the growing population. However, the overuse of nitrogen for agricultural purposes created an unprecedented nutrient imbalance in Indian soils. Before the introduction of chemical fertilizers, India used to have nitrogen poor soil, while today the average nitrogen surplus is of 54 Kg/ha. This figure is remarkably high compared to EU countries where the average is 31 Kg/ha, and the over-use of

Images: (pp.68-69) Ragi harvest, a crop that can be grown under rainwater conditions in semi arid areas of Karnataka. (top) Village in Ragihalli where farmers experiment water saving technologies to grow rice. (p.72) Farm in Kanakapura using rainwater as the only source of irrigation.



## Groundwater Resources

fertilizers constitutes a hazard for several ecological and biogeochemical processes. The regional inventory of soil nitrogen balance conducted in 2000-2001 found that the quantity of nitrogen fertilizer applied in India raised from 0.065 in the 1950s to 11.31 million tons. Over-application of nitrogen is critical in many parts of India, where soil acidification and soil hummus depletion are accelerated by synthetic nitrogen. Fertilizer subsidies are endangering the health of Indian soils, and they constitute the biggest expenditure in the federal budget after the subsidies for food.

However, the biggest threat comes from the policies promoting irrigation and groundwater extraction. The Green Revolution can be seen as a 'success story' in regions sharing one common characteristic: assured water supplies and control over them. States like Punjab, Haryana and western Uttar Pradesh became the agricultural basket of India, and it was thanks to the construction of dams collecting surface and rain water that farmers had access to this precious resource. On the other hand, arid and semi-arid regions could not benefit from a reliable source of water, other than groundwater resources. In order

to promote the Green Revolution model, it was necessary for the government to make groundwater resources accessible to the farmers, otherwise left with underperforming seeds and the debts contracted to afford the investments. For this reason, states like Andhra Pradesh started implementing support policies for pumping groundwater for agricultural purposes, by granting free electricity (or at a flat rate) to run the tube wells operated by the farms. This scheme is now present all across India, even if it creates a distortion in the agricultural sector with terrible consequences. Over the years,

India has become the largest consumer of groundwater resources, extracting 250 km<sup>3</sup> of water per year, of which 90% is used for agriculture. In most of the country, extraction rate exceeded the recharge capacity of underground reservoirs, making India the country hit the worst by groundwater depletion as found by NASA.

Over-extraction of groundwater is a plague in all the regions that cannot rely on surface or rain water for agricultural purposes. This is due to domestic consumption, industry

needs, but particularly because of the inefficient use of water for irrigation purposes. Through subsidies, farmers are incentivized to grow high yielding crops that can only perform well under a high use of inputs. Being the losers of the Green Revolution, small-scale farmers, living at the margin of society and unable to compete with the successful agribusiness, are left with no choice but to use the land and water available to grow crops, mostly for their own consumption. Farms now grow rice or sugarcane in areas far from water bodies

and continue to pump water just to keep their paddy fields at their optimal with about 7 cm of standing water. The result is that in the south, west and central India the water table has been decreasing uncontrolled, lowering the level of water by 60 meters in 30% of the regions of southern India and 10% in central and western states. The farmers in these regions not only have to dig deeper, hoping to find water, but in many cases have to depend on unreliable supply of electricity to run their farm and feed their families.

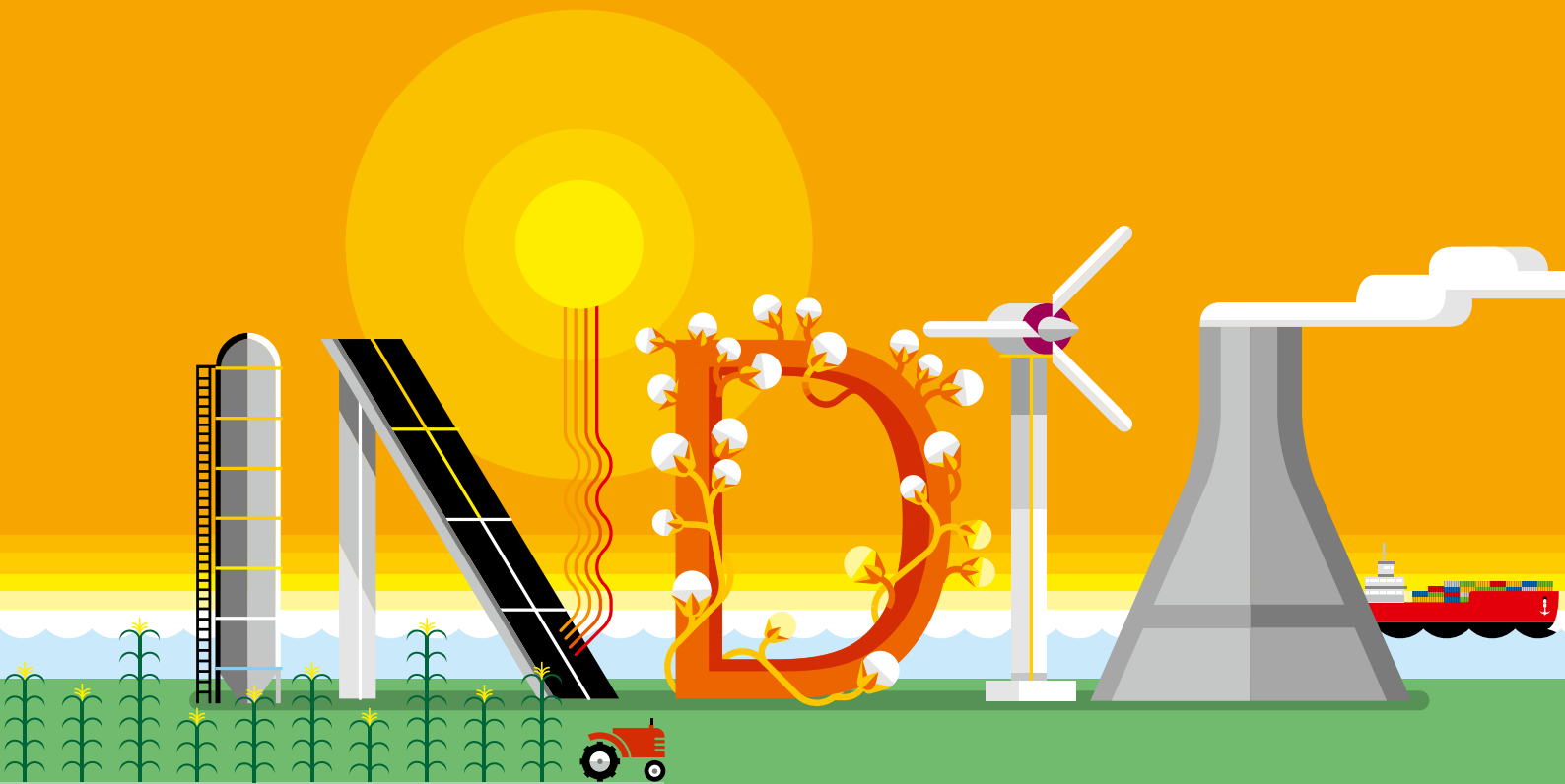


COMING THIS WINTER

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# Digging Deeper Debt

In the villages surrounding Bangalore, Karnataka, the farmers suffer from the hazard of groundwater depletion. Many of them are left with dry wells due to the decrease in the water table and are left with no choice but to purchase the water they need to run their farm from neighbors that have the capital to invest in deeper bore wells. Having access to water creates a great opportunity for farmers to earn money, but they often have to face incredible costs to reach the precious aquifers hundreds of meters below their farmland. One

farmer interviewed by Revolve had to dig 12 wells before finding a spot over his farm from which he could pump an adequate amount for his crops. Each bore well cost him INR 100,000 (about € 1,500), when the revenues from his agricultural activities are as low as INR 160,000 per year. Modern agriculture in many parts of India means debt for the farmers. Farmers have to bet their savings and livelihood, hoping to find more water to extract; sometimes they even ask the help from priests and diviners to point to the next



Images: (top/left) A farmer uses groundwater to irrigate his fields in Tumkur. (bottom/left) A farmer selects the tomatoes to bring to the local market in Bannikuppe. (top) Groundwater is used for irrigation purposes all year round in Tumkur.



favorable spot for digging a new well. But even religious guides fail to find the water simply because there is no more, meaning the farm is left with a destiny of drought and debt.

Over the past 20 years, around 300,000 farmers committed suicide because of the inability to repay their debts. Every day, 41 farmers commit suicide, especially in water scarce regions of Karnataka, Andhra Pradesh, Maharashtra and Madhya Pradesh. In 2010, the Central Government attempted to gather information on the suicide rates of farmers in the country and found that over the 15,963 farmers that committed suicide, 76% were in these states. Debt relief is among the many measures the central and state governments are trying to enact to reduce the burden

on farmers' weak finances. In 2013, the Government of India launched a "Special Livestock and Fisheries" package in order to help farmers diversify their sources of income and decrease their dependency from crops which they cannot irrigate.

The shift to livestock production, and especially poultry production, is promoted as

the solution to bring farmers out of poverty by government, international agencies and transnational companies alike. In a village close to Bangalore, we met a farmer who started producing chickens for Godrej Agrovet. He provides chicken to the processing plant opened in Bangalore by the company which is owned with a 51% share by the US-based Tyson, a major poultry

Over the past 20 years,  
around 300,000 farmers committed  
suicide due to lack of water and  
impossible debts.

processor globally (See “Under Contract: Corporate Concentration Breeds Hidden Risks for Chicken Farmers Worldwide” on pages ...). In order to build the chicken house the farmer had to go further in debt, but with the promise of building equity in the long run.

Having only shifted his financial exposure from debts contracted to grow crops, to debt contracted to raise chickens, the farmer is now dependent on the variable paycheck from the private company rather than from inaccessible water resources.

The Indian agricultural sector  
is far from being a sustainable  
production system.

## Government Responses

The role of the government in addressing the crisis of small scale farmers in water scarce regions of India has been ineffective and even detrimental to farmers and the environment. The focus on debt relief only postponed the consequences of falling water levels in the region, and the indirect support to the poultry industry further increased the risks of bankruptcy for the farmers. The Green Revolution assured an adequate production of food to secure the food supply in India, and current policies and practices promoted by the government are still geared towards achieving this goal in the future. But modernization of the agricultural sector cannot achieve this goal automatically. Nutritional security, especially for the rural population, is now ensured through a large use of subsidies: subsidies to purchase inputs to grow crops, to diversify the sources of income, to purchase food grains or to repay the debt contracted by the farmers. The Indian agricultural sector thus is far from being a sustainable production system.

The policy framework created to support food production in India throughout the years made India a food sovereign country, but it also had negative effects on the environment and on the livelihoods of farmers. The subsidies naturally benefit large-scale farms that, by nature, use more water and fertilizers. Subsistence farmers are pushed without

any choice to buy seeds they cannot afford, spread chemicals that poison their land and waste precious water that is less and less available. If we look at our past, it is clear that to sustain human populations in the future we have to move beyond the solutions proposed by the Green Revolution. The goal of increasing agricultural productivity must in fact also consider ways reduce the negative impact of over-extraction of groundwater and over-use of nitrogen. Reducing the input dependency of farmers could lead to a more sustainable agricultural sector in India, even though many benefit from an intensive and commercial model of agriculture. The investments in high yielding seeds and improved technologies generated in 2009 revenues of almost €35 billion in rice production and €10 billion for wheat, creating a huge wealth to be distributed among Indian farmers. However, the ones reaping the benefits are the farmers that have capital investments, large farms and adequate access to water, leaving the majority of the rural population in radical poverty. But farmers, either rich or poor, are by far not the biggest winners of the Green Revolution in India. The real money is in fact in the growing market for agricultural inputs, with an estimated seed market of €150 million where only 350 companies operate, and almost €3 billion in subsidies to be distributed among the 121 plants producing fertilizers in India.

The Green Revolution may have served the purpose of increasing the agricultural output in India, but it surely also increased the profits of private companies operating in this sector.



The future prospects for the Indian agricultural sector do not envision a more equitable and fairer system to the farmers. On the contrary, private interests still prevail over the goal of lifting the rural population out of poverty. The current political support to livestock production contracts and genetically engineered crops clearly shows that also in the future, Indian agriculture will generate profits for the private corporations that own the agricultural inputs. Farmers are left at the margin of this system, limiting their production options and ability to change. If the world of tomorrow will have to grow enough food to sustain an 8-10 billion population, we must understand that the solution should not be imposed by the industries interested in this expanding market. For our agricultural system to be sustainable, the attention should not only be focused on increasing the productivity of fewer and fewer farms, but it should also recognize the importance of a prosperous rural population capable of managing our precious natural resources. 🌱



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# REPURPOSING

## Brands + Sustainability

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Innovative start-ups from around the world are recycling and reusing waste to make new products. By incorporating sustainability into their brands, they can provide eco-friendly products that consumers can buy with a clear conscience. *Revolve* looks at three brands that repurpose the old to create something new.



### Bio-Bean

[www.bio-bean.com](http://www.bio-bean.com)

Each year in the UK, 1.8 million tons of CO2 emissions are generated by 500,000 tons of coffee waste with disposal costing as much as £50 million. Currently, most waste coffee grounds are sent to landfill, incinerated or sent to anaerobic digestion.

Bio-bean's process offers commercial and environmental advantages at every stage. Integrating with existing supply chains and recycling waste into resources, bio-bean transforms the challenges of urbanization into huge opportunities.

Bio-bean is an award-winning green energy company that industrializes recycling waste coffee grounds into advanced biofuels to reduce greenhouse gas emissions and create carbon-neutral biofuels.

Bio-bean was created to solve the challenge of coffee waste disposal, now our solution is part of a wider social trend. Where others see waste, bio-bean sees resources, demonstrating that urban structures are open to sustainable redesign.

# Nudie Jeans

www.nudiejeans.com

Founded in 2001 in **Gothenburg, Sweden**, Nudie Jeans has grown to be a leader in sustainable and **organic denim** production, providing unrivaled collections showcasing the best of understated Swedish design.

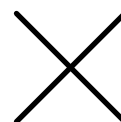
**The Nudie Jeans Recycle Project** seeks to find **new use for old, worn-out Nudie jeans**. The goal is to be able to recycle every fiber and piece of the jean. **90% of every pair of denim was recycled** into two projects that are sure to tie any room together:



1

## In-And-Out Camper Seat

The inspiration for the camper seats originated from one of Sweden's favorite pastimes – camping. This foldable camper seat is available in two options: Light Blue and Dark Blue. Each seat is beautifully braided by hand with a simple construction, using the inseam and out seam of nine pairs of rigid Nudie jeans, one belt and one leather patch.



2

## Lill-Matts / Stor-Matts

The Swedish tansmatta – also known as rag rug – is made from shredded pieces of the Nudie Jeans denim used for the In-and-Out Seam Camper Seats.



**STOR-MATS**  
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**LILL-MATS**  
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# Loloi

www.loloirugs.com

More than half a million women around the world wear saris, but when the life of dress comes to an end, companies around the world, including Loloi, **are finding ways to re-purpose the disposed material** and give it a **second life.**



"We saw the opportunity to re-purpose the materials and scraps found in unwanted saris **into beautiful rugs and pillows** as a way to support the environment," says Cyrus Loloi. "By breathing new life into the saris, we have found a way to minimize the amount of waste that goes into landfills every year and **create a product that consumers find both beautiful and appealing.**"



Loloi has created an entire line of pillows made from **Sari Silks** that comes in a variety of colors and dimensions. The radiant Giselle Collection by Loloi is hand knotted entirely of refurbished sari silks from India. Each design reverberates in **stunning colors** like **ruby red and sapphire blue** that make for an incredibly **vibrant collection, ideal for contemporary to transitional interiors.**

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STUNNING COLORS

# Nickel

www.bruce Taylorsculpture.blogspot.com

"Many of my public works use recycled/reclaimed materials, transforming them into new contemporary forms connecting the past and future sustainably: recycle, re-use, reclaim, refurbish, restore, repurpose and revitalize. My goal is to use as much recycled materials as is possible within the limits of time and budget. I feel good using such materials and enjoy the search to find new and different ways to incorporate reclaimed elements into my art"

– Bruce Taylor, artist

## RECYCLE, RE-USE, RECLAIM, REFURBISH, RESTORE, REPURPOSE AND REVITALIZE



Images of "Art Fencing" in El Paso, Texas, USA.

This project was part of the City of El Paso, Bataan Bridge Project, using 100 feet of 6'-9' high "Art Fencing" over a railroad bridge crossing. Many of the stainless steel elements were reclaimed from scrap yards and cut, arranged, welded and polished into a new work that conceptually conveys the surrounding land, rivers, cities, and means of transportation.





REVOLVE

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1



2



3

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