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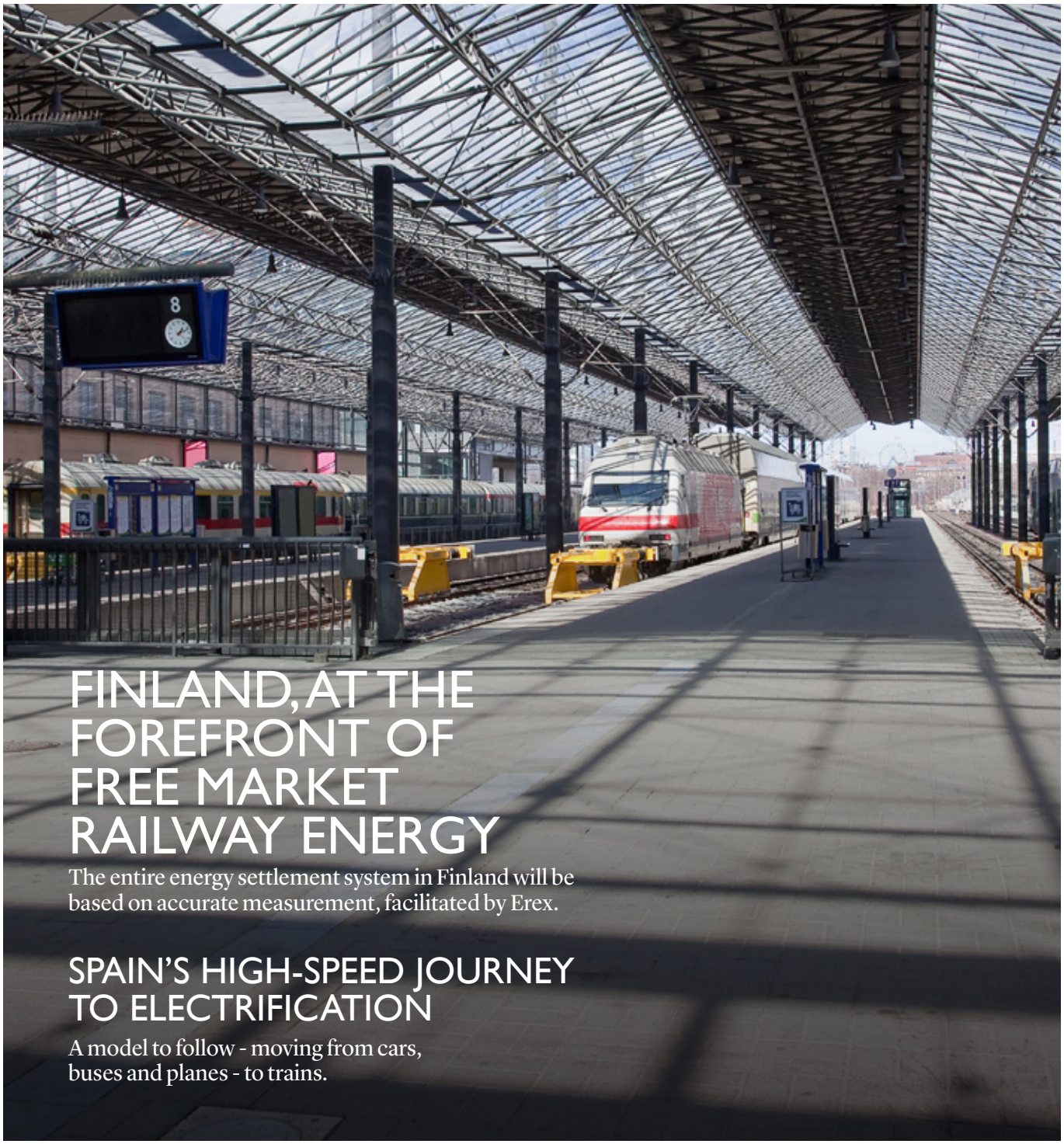
ANNUAL MAGAZINE 2016



FINLAND, AT THE FOREFRONT OF FREE MARKET RAILWAY ENERGY

The entire energy settlement system in Finland will be based on accurate measurement, facilitated by Erex.

SPAIN'S HIGH-SPEED JOURNEY TO ELECTRIFICATION

A model to follow - moving from cars, buses and planes - to trains.

This year's magazine is packed with a broad range of exciting topics, including an insight of Nord Pool, the pioneering free trading power exchange operating in the Nordic, Baltic region and UK; Finland's march towards an open energy market; and the vision and experiences from our chairman and director respectively.

Eress is currently working hand in hand with Finland, leading the way on how to liberalise the energy market while opening up its railways to competition to get the best options for the country.

Eress forum has also become more expansive. We have introduced a technical 'Erex User Camp' for our partners and operators, not to mention the creation of our first Eress Award for innovation in railway energy efficiency. The competition is designed to harness the most creative ideas in energy efficiency from Master and PHD level students from across Europe. You'll find a special update from one of our judges – and representative from The Netherlands, our latest partner – inside the magazine.

You can also visit our brand new mobile-friendly website at www.eress.eu to stay up to date with all the developments throughout the year.

As ever, we are happy to share our expertise and experience gained working across Europe over the past decade, making the implementation of metering and settlement processes more efficient in many diverse countries.

We would like to thank our outstanding partners for all support and hope you enjoy reading this year's magazine.

Sincerely,

Claudia van Diermen Jacobsen
Marketing and Partner Manager Eress

12 Spain's high-speed journey to electrification and what we can learn.

SOURCE: CAROLINE ROKA

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A YEAR OF CONSOLIDATION, IMPROVEMENTS, AND SUSTAINABLE GROWTH

With seven partners and counting, a decade of experience, and a vanguard system like Erex, Dyre Martin Gulbrandsen, Director of Eress, makes the business and environmental case for Erex as a facilitator of COP 21 goals within the context of the TSIs in the European railway industry.

Consolidation, improvements, and sustainable growth are perhaps the most important bywords at Eress, as over the past year we have been keenly focussed on bringing our entire organisation to a whole new level of professionalism.

After a decade of cross-border experience from north to south across the European market, at Eress we can now confidently say we are market-tested, market leaders, and the foremost standard-bearers in the area of accurate energy metering and settlement in the railway industry across Europe.

Additionally, Erex is backed by being fully in compliance with ISO 9001 quality standards. So while there are now competitors out there, they are just getting started, and their systems have not been fully tried and tested like Erex.

Our systems are highly functional, efficient, and simply work. Most importantly, we have proven we can handle crisis without data loss and are able to guarantee a very high uptime.

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TECHNICAL UPGRADES

Gulbrandsen says, "We have invested significantly to introduce smart technologies into the Erex software and have made considerable upgrades to the system making it more robust and resilient than ever".

With new upgrades and integrations into our IT system, processes are now fully automated, taking everything to a whole new level. We are now able to easily and efficiently share information with all our partners and apply best practice across the board with all of them.

Through a combination of internal and external expertise, continuous training, and a very dedicated team - most of whom have been with us for the past decade since our inception - we have had little to no knowledge loss - which on balance has allowed us to truly strengthen our technical skills, thus maintaining the bulk of our core competence inside the organisation.

CONSOLIDATION AND SUSTAINABLE GROWTH

Over the past year, we focused most of our energy on consolidation in preparation for future growth. Even so, to our delight the Netherlands came on board on 1 August 2015 as our seventh partner.

With the ambitious Dutch objective of powering 100% of their electric trains from wind energy by 2018, Erex became a natural partner of choice, capable of accurately

SOURCE: CAROLINE ROKA

Eress Partnership – Seven Countries and Counting

measuring energy usage across their rail network.

As we move forward in 2016, we turn our focus to sustainable growth. Our objective is to continue positioning ourselves as the natural partner of choice at a European level, as Europe's leading traction energy settlement system and a key player in the process of rolling out the Technical Specifications for Interoperability (TSIs).

Once fully implemented, the TSIs will guarantee that built and certified trains and rolling stock across the EU will have the technical requirements to run everywhere in Europe, thus enabling the realisation of a single railway market.

PREPARING FOR EXPONENTIAL GROWTH

These are exciting times for Eress and Erex. At present, we are experiencing 'luxury challenges' as more countries and operators are showing interest in Erex. This of course tells us we must prepare for exponential growth.

"We believe that the combination of seven partner-countries and counting, a decade of experience, and a system like Erex that allows for precision measurements in railway energy consumption, position us to help the railway industry contribute positively to Europe's COP21 commitment, which is to limit global temperature increase well below 2 degrees Celsius, while urging efforts to limit the increase to 1.5 degrees.

As the industry has come to understand we can only reduce what we can measure, we have proven the Erex system does just that. So for our partners, there is the double effect of being environmentally friendly as well as being able to pay only for the energy consumption that has been measured - and not payment based on estimates.

The return on investment is incredible as the Erex system is able to provide accurate data on all energy consumption and energy generated on a train-by-train basis within the network.

Eress Award: giving voice to the most innovative railway energy efficiency projects

FIRST ANNUAL ERESS AWARD FOR INNOVATION IN ENERGY EFFICIENCY

The First Annual Eress Award for Innovation in Energy Efficiency for the Railway Industry is now a reality, as Eress attempts to capture the innovative spirit and ideas of Master and PHD level students from across Europe. We spoke with one of the members of the jury, Mr Ralph Luijt, Manager of Energy & Environment at NS in the Netherlands, to learn about the new award and the selection process.

It was only last autumn, says Ralph Luijt, that Bart Van der Spiegel, the Infrabel Belgium representative on the Eress Steering Group, came up with the idea of creating a competition to encourage innovation in energy efficiency from among postgraduate students from across Europe.

Wheels were quickly set in motion, and it didn't take long before the members of the jury were actively tapping into their networks and contacts at the multiple universities across Europe and pointing them to the Eress website to promote the competition. Fortunately it worked - and before long the plan was on track. It quickly attracted twelve participants from five universities in four countries across Europe, who were then merely given seven weeks to come up with their projects.

Curiously enough, most of the participants came from universities in the United Kingdom, which is still outside of Eress, but which proves we all have our eyes on energy efficiency right across the continent.

The projects submitted from all participants were very original – and ranged from catenary improvements, to the optimisation of Driver Advisory Systems and the Time Table, to enhancements on the electricity supply systems.

With a wide variety of innovative ideas, Luijt feels the programme has been very successful for a first time event, and believes the number of submissions and the quality of the submissions were certainly a pleasant surprise to get the ball rolling. He remarks, "We had sufficient diversity to make us have to think long and hard in the selection process, but at the same time a manageable number to review and rank in a rather short space of time".

He goes on to explain why the competition and award are important to the railway industry. Luijt says, "We need to ensure that the next generation of technicians and energy managers are aware of, and are fully engaged in all the amazing potential applications in the area of energy efficiency on the rail – and it is important that Eress continues to help cultivate the sharing of ideas, concepts, and developments within the sector."

Now came the big task of selecting the two finalists. The process was interesting and the jury found itself with a good mix to choose from. The winner will be selected by the delegates attending the Eress Forum.

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As per the Award, the two finalists have been invited – all expenses paid - to the Eress Forum in Madrid, where they will have the opportunity to set up their stands to show their ideas. Both finalists will get an Eress Award Certificate. Additionally, the winner will get an Eress Award Prize and will be promoted on Eress' website.

Luijt goes on to say, "There is a real opportunity for some of these ideas to get put into practice, especially since they are so industry-specific. Most importantly, many of the influencers in the industry will be at the Eress Forum.

NORD POOL:

REGIONAL TRANSPARENCY AND EFFICIENCY IN ENERGY CONSUMPTION

Nord Pool is Europe's leading power market, offering trading, clearing, settlement and associated services in both day-ahead and intraday markets, whereas Erex offers the railway industry accurate data on energy consumption and settlement. We spoke with Stina Johansen, Director Communications at Nord Pool AS, to find out more and to connect the dots with the Erex system.

Ms Johansen started by explaining how the Nordic energy market works, the model on which the European energy markets are now based. Johansen says, "We have been developing and perfecting the delivery of robust, efficient and transparent power trading markets for over 20 years now. As a result, a dynamic energy market has evolved in which power can be easily bought or sold across borders, by calculating power prices in the markets where we operate, based on supply and demand".

She goes on to explain, "Nord Pool operates Europe's leading power markets, offering both day-ahead and intraday trading to its members across nine countries, with over 90% of all electricity traded on the open market within the Nordic countries. Nord Pool pioneered the first international power market, opened between Norway and Sweden in 1996. As a result, it became evident that integrated power markets were beneficial due to increased liquidity, transparency and efficiency.

"Many of Europe's power markets are now connected, and we use the same algorithms, at the same time everyday to calculate energy prices across Europe".

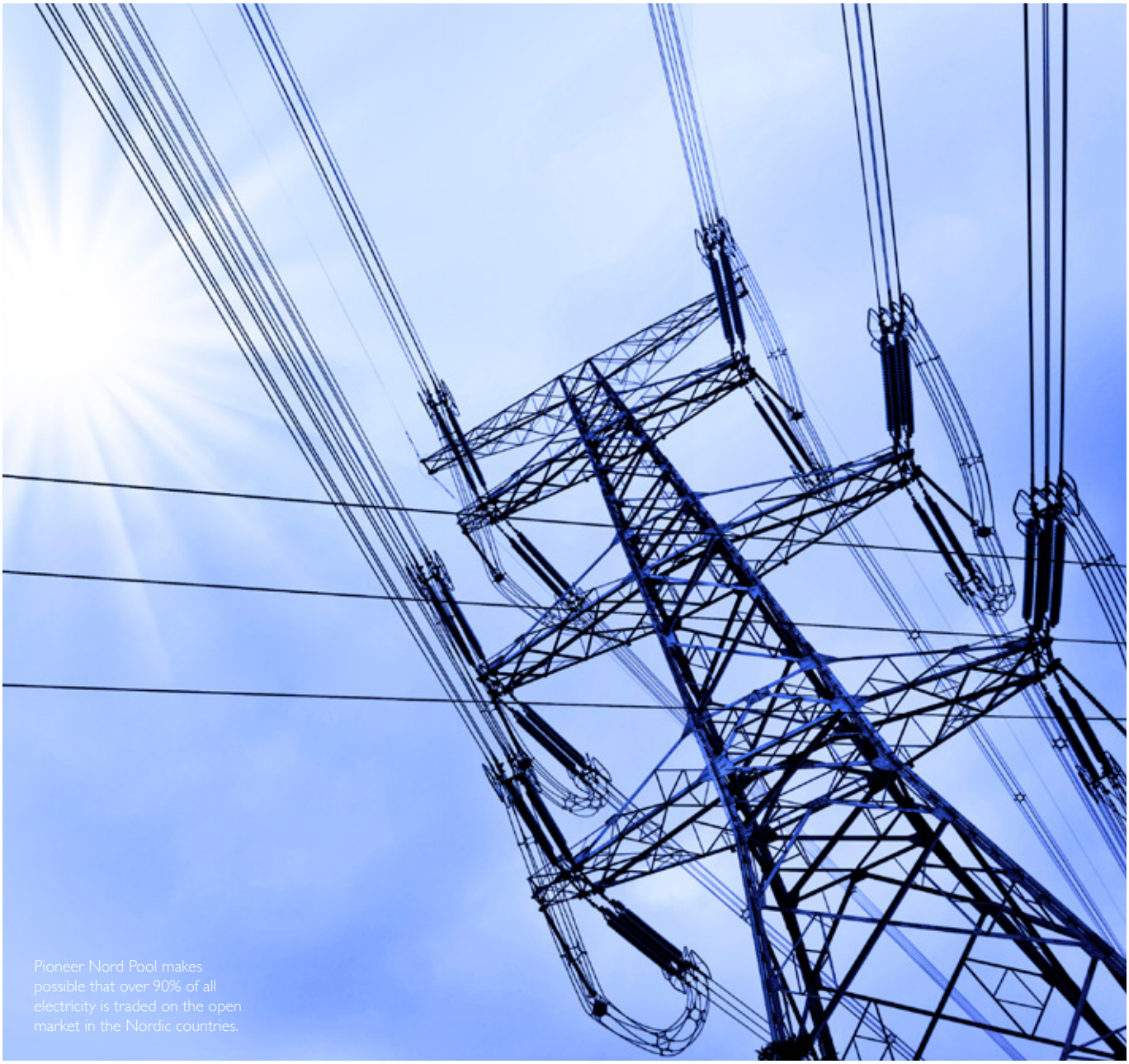
Ms Johansen explains that Nord Pool is open for both small and large market participants to trade within the markets they operate.

Johansen says, "We have a technical platform that gives market participants an easy way to buy and sell their power". The day-ahead market is the main arena for trading power. Here, contracts are made between seller and buyer for the delivery of power the following day, the price is set and the trade is agreed. Today there are around 360 buyers and sellers on Nord Pool's day-ahead market. Most of them trade every day, placing a total of around 2000 orders for power contracts on a daily basis.

Daily trading is driven by the participant's planning. A buyer, typically a utility company, needs to assess how much energy ('volume') it will need to meet demands the following day, and how much it is willing to pay for said volume on an hourly basis. The seller, for instance the owner of a hydroelectric power plant, needs to decide how much they can deliver and at what hourly rate. These needs are reflected through orders entered by buyers and sellers into the Nord Pool day-ahead trading system.

She explains, "Many of Europe's power markets are now connected, and we use the same algorithms, at the same time everyday to calculate energy prices across Europe".

Stina Johansen says, "Because we operate transparent markets, we facilitate



Pioneer Nord Pool makes possible that over 90% of all electricity is traded on the open market in the Nordic countries.

accurate market data to all parties, reflecting unforeseen circumstances such as weather, transmission capacity, and reductions, to mention a few. In essence, when climate conditions affect the Hydroelectric production of energy in Norway, the country may import energy from Denmark's wind farms, or from Sweden's nuclear energy reactors. The result is energy supply security for the region. It also means producers can invest in the grid and in the region based on where production costs may be lowest.

Having explained the entire process, she then connected it to the railway industry, which requires enormous amounts of electricity. What is vital is that the industry is able to purchase electricity transparently at market prices. And with a system like Erex, it allows for the train operators to know with precision exactly how much energy they need to buy based on the data provided by Erex.

DEVELOPING ENERGY EFFICIENCY POLICIES FOR RAIL SIMILAR TO AUTO INDUSTRY?

The IEA (International Energy Agency) is an autonomous organisation which works to safeguard reliable, affordable clean energy for its 29 member countries, and focuses on ways to improve the sustainability on transport systems. We spoke to Mr Pierpaolo Cazzola, Senior Energy and Transport Analyst, at the IEA, to learn what impact their work has on energy efficiency on the rail.

"IEA gives Policy advice to governments on implementing advanced technologies, improving fuel efficiency, and shifting to lower-carbon fuels and transport modes. And while there are no specific policies targeting the railway industry in terms of fuel economy standards like on cars as yet, world leaders are making historic commitments to target sustainable development through new Global Goals for Sustainable Development (SDGs), energy efficiency through the G20, and to tackle climate change through climate negotiations in Paris (COP21)," indicates Cazzola

We discussed the fact that transport is still heavily dependent on oil, and while most sectors have been reducing CO2 emissions, transport's share has been steadily increasing - and Pierpaolo indicated some of the reasons why the sector as a whole has been slower to shift to renewables. He says, "Key reasons are the tendency to shift towards cars with growing incomes, the cost of alternative technologies are still too expensive, and advanced biofuels are more expensive than fossil fuels".

In essence, to achieve Europe's targeted 80% CO2 reduction by 2050 compared to 1990, oil consumption in the transport sector must drop by around 70% from today, implying a revolution in transport fuels and the way we travel.

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"In 2013, when it came to railway and energy consumption in OECD Europe, fossil fuels accounted for 33% and electricity 67% of the total rail energy usage. Nevertheless, the renewable share of electricity covering all sectors was 30% renewables, whereas the share of rail energy usage was 20% renewables".

There are organisations like the PPMC (Paris Process on Mobility and Climate) that are working to help promote greater sustainability within the industry through initiatives that support effective action on transport and climate change with global targets for the rail sector:

- 50% reduction in CO2 emissions from train operations by 2030, and 75% reduction by 2050 (specific average CO2 relative to a 1990 base line – ie. reduction of emissions per passenger/km + tonne/km)
- 50% reduction in energy consumption from train operations by 2030, and 60% reduction by 2050 (specific final energy relative to 1990 baseline) 50% increase in rail's share of passenger transportation by 2030 and doubling by 2050 (2010 baseline)
- Rail freight activity equal to that of road freight by 2030, and exceeding road freight volumes by 50% by 2050. Plus, company level commitment signed by the CEO of the world's major railways the 'Railway climate responsibility pledge."

Piepaolo states, "Technologies like Erex, which provide precision data on energy consumption on the rail, integrate well into the broader plan to help the rail industry reach its goals on energy efficiency. The first step to be able to develop energy efficiency policies such as those already in place for cars is to have the possibility to effectively measure energy consumption."

The goal is 50% reduction in CO_2 emissions from train operations by 2030.

Spain has one of the best high-speed rail networks in the world.

SPAIN'S HIGH-SPEED JOURNEY TO ELECTRIFICATION

Within its mandate, The Spanish Railways Foundation conducts specialised research and provides technical training to the railway sector. Its focus on ensuring innovation, efficiency and industry best practice is always at the highest levels in Spanish rail. We spoke with Mr Alberto Garcia Alvarez, General Manager, to understand Spain's journey in railway electrification and how its efficiency standards are maintained.

Alberto Garcia Alvarez explains, "The Spanish Railways Foundation (La Fundación de los Ferrocarriles Españoles) was established in 1985 and is comprised of the major public sector stakeholders in Spanish rail. Within its remit, the foundation's focus is on providing highly technical research and training programmes for the industry in different areas, of which 'energy and emissions' are among the four main areas of research and scientific expertise".

The Foundation develops training programmes that promote the exchange of knowledge and experience. Importantly, they address technical developments that lower emissions and increase efficiency.

Growing concerns about energy usage and long term climate impacts on the transportation sector prompted policymakers in Spain to consider a variety of options to meet the future mobility and interconnectivity needs of the country, while simultaneously addressing the impact of these systems on the environment.

Garcia says, "The numbers speak volumes. Electrified high speed trains are more energy efficient than air transport or coaches. In terms of passenger comfort, costs and CO_2 emissions, Spain's move from cars, buses and planes - to trains - is a positive sign. Additionally, high speed rail has strategically interconnected the entire nation".

"The numbers speak volumes. Electrified high speed trains are more energy efficient than air transport or coaches. In terms of passenger comfort, costs, and CO_2 emissions, Spain's move from cars, buses and planes - to trains - is a positive sign. Additionally, high speed rail has strategically and culturally interconnected the entire nation".

By 2020, Spain will have Europe's largest high-speed network, with its 6,000 miles of track surpassing even France's TGV system. The number of passengers boarding long distance and high-speed trains has exceeded those taking domestic flights. This is partly due to highly affordable prices on rail and the fact that with high speed rail, the trip itself may be longer than a domestic flight, but the process is far more comfortable and productive for travellers, better on the environment, plus the trips are from city centre to city centre".

High-speed rail compares much more favourably to airplanes or automobiles. For example, while high speed rail emits 9.2 kg of CO_2 per passenger on a fully loaded train on the Madrid-Barcelona routes, a fully loaded plane or car emits 50.13 kg and 18.9 kg of CO_2 respectively on the same route.

Another advantage is that unlike other modes of transport, only electrified trains are able to both consume and generate energy, which is returned to the grid. This fact alone makes for a good argument in favour of electrification and accurate metering, the latter of which is provided by systems like Erex.

FINLAND, AT THE FOREFRONT OF FREE MARKET RAILWAY ENERGY

The liberalisation of the electricity and railway market in Europe has meant railway operators in Finland are going to be free to choose their own energy suppliers at will. We spoke with Mr Juha-Matti Vilppo, from Finnish Transport Agency (FTA), to discuss the vision behind FTA and its usage of Erex as a one stop solution for energy metering and settlement.

Unlike most other European railway markets, Mr Vilppo explained, "There are little to no cross-border train journeys between Finland and its neighbours. This is partly because Finnish tracks differ in size from standard European tracks and from those of its eastern neighbour Russia, among other factors".

What they do have in common though, is an energy union within the Nordic region. Having fully liberalised their electricity market, Finland leads the way in Europe and is willing to take the necessary steps to ensure its railway energy market is free, open, and competitive to the benefit of society, business, and the environment.

Liberalisation of the rail-energy market means even smaller-scale electricity consumers connected to distribution networks, including small enterprises and households, are able to purchase their electricity from their preferred supplier without being bound to a particular provider.

When it comes to the accurate measurement of consumption, this is where the Erex system comes in. The Erex system becomes a vital third party one stop solution that is capable of accurately managing both energy 'measurement principles' and 'invoicing principles' for electricity consumed on the rail.

In essence, the entire energy settlement system in Finland for rolling stock will be based on on-board meters and the accurate measurement of energy consumption, which is facilitated by Erex.

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The Finnish Transport Agency (FTA) became an Eress partner in 2013 to better comply with the objective of having a well regulated, efficient and transparent energy management system, wherein energy consumption and billing are based solely on exact measurements.

On another note, historically, Finland, Sweden and Norway used to operate their national imbalance settlement individually until they decided to join forces to create a harmonised system. eSett Oy is the company they formed, which is jointly owned by these three Nordic Transmission System Operators: (TSOs) Fingrid Oy (Finland), Statnett SF (Norway), and Svenska kraftnät (Sweden).

Juha-Matti Vilppo, explains, "There must always be a balance between supply and consumption of electricity. Imbalances arise from uncertainties in plans and failures in generation, consumption and grid. Imbalance settlement is therefore a necessary function in a commercial based electricity market for which highly accurate data is key to making this happen.

By joining forces, this means full and complete integration into the Nordic market, making Finland capable of using Nord Pool to purchase and sell energy; eSett for imbalance settlement; and Erex for metering and invoice settlement.

Eress is currently developing a Third Party Access (TPA) solution for the Finnish

By joining forces, Finland is getting prepared to open its market.

railway grid, which will allow train operators to choose their energy supplier freely.

This TPA is very important for Finnish Transport Agency, because FTA does not sell energy to railway undertakings (RU). Train operators must purchase their traction energy directly from the open market.

The entire settlement process is being done using the Erex IT system, primarily based on the extensive experience Eress already has with on-board meters, validation of metered data, and data exchange with other Infrastructure Managers (IMs).

Eress became the natural partner of choice to also develop third party access procedures. After this pilot project, the TPA procedures will be available to all Eress partners, which will mean Eress will have an extensive settlement system that is capable of covering all EU rules where the railway and energy markets converge.

Eress is currently developing a Third Party Access (TPA) solution for the Finnish railway grid, which will allow train operators to choose their energy supplier freely.

AROUND THE WORLD

INDIA

India's 64,000km rail system, the fourth largest in the world, transports more than ten billion passengers and 1,050 million tons of freight every year. But the network is perhaps best known for its capacity and safety issues, which makes it as one of the most dangerous globally. The Indian Government has been striving to tackle the problem and has injected billions of dollars into new projects and tracks. The Indian government has pledged to invest $147bn into major projects between 2012 - 2017, in an effort to finally catch up with its neighbouring nations.

Statistics

TRANSPORT IN EU:
responsible for 24% of EU greenhouse gas emissions and for 32% of all energy used in Europe.

24%
32%

ENERGY CONSUMPTION IN EU (28 members)

Agriculture	2 %
Industry	25 %
Transport	32 %
Households & services	41 %

EUS' ELECTRIFIED RAILWAY LINES

Netherlands:	99%
Luxembourg:	95%
Poland:	62%
Bulgaria:	7%
Cyprus:	no railway network

GREEN GAS EMISSIONS FROM TRANSPORT
(million tonnes CO_2 equivalent)

Year	1990	2012
EU – 28	963	1173
Germany	185	189
France	138	156

Most of EU countries have increased their CO_2 emissions. From 1990 to 2012, just Latvia, Lithuania and Finland have decreased their CO_2 emissions.

MELBOURNE AUSTRALIA

The $9 - $11-billion-dollar project will provide capacity to move an additional 39,000 passengers during each peak period. The project is the centrepiece of a suite of infrastructure projects designed to significantly increase capacity and to transform the rail network from a commuter-style suburban rail system to a metro-style rapid transport system. Construction is expected to commence in late 2018 and finish in 2026.

9-11 BILLION DOLLARS

39 THOUSAND ADDITIONAL PASSENGERS DURING EACH PEAK PERIOD

PANAMA METRO

Panama Metro is a rapid transit system that is under construction in Panama City, Panama. It is the first metro system in Central America. The metro system will address the increasing traffic congestion in the city and is expected to carry approximately 40,000 people an hour by 2035.

HS2 UNITED KINGDOM

High Speed 2 (HS2) is a planned high-speed railway in the United Kingdom linking London, Birmingham, the East Midlands, Leeds, Sheffield and Manchester. It would be the second high-speed rail line in Britain, the first being the High Speed 1 line connecting London to the Channel Tunnel. The line is proposed to be built in a "Y" configuration in two phases, with construction work on the first phase set to begin in 2017, reach Birmingham by 2026, Crewe by 2027 and be completed in 2033.

A CHAIRMAN'S VISION

Terje Stømer, longstanding Chairman of Eress, has successfully overseen the transformation of Eress from its infancy to what it has now become; a transnational European partnership with seven partner countries and counting. We asked Mr Stømer about the development process and about his future vision for Eress.

Terje Stømer says, "We have been extremely delighted as the development of Eress has been going to plan. Initially the objective was to cover the Nordic region. However, we quickly realised that the ground-breaking work we were doing was something necessary on a European level".

With the Netherlands joining Eress in 2015, Stømer is confident that they will be able to take their momentum to the other countries in Europe that are still outside of Eress. He also believes there are several factors that will influence its future growth.

Growth factors will be influenced by the rolling out of the TSIs; Climate change and the new COP21 targets; and the EU 20 20 20 goals, which are: 20% cut in greenhouse gas emissions (from 1990 levels); 20% of EU energy from renewable and 20% improvement in energy efficiency - the latter being where Erex simply gets the job done and done right!

As an early pioneer in energy efficiency on the rail in Europe, Eress is now the leading cross-border voice of experience when it comes to accurate energy metering and settlement systems on the railway.

Currently, there are over 4000 trains and 50 train operators connected to the Erex system, and by 2018, all the above growth factors are sure to bring about massive increases in the popularity and usage of Erex.

As an early pioneer in energy efficiency on the rail in Europe, Eress is now the leading cross-border voice of experience when it comes to accurate energy metering and settlement systems on the railway.

In addition to a settlement system, Eress provides standardisation and the necessary real time accurate information, which enables its partners to make informed decisions on energy efficiency and where to place their energy investments.

According to Stømer, part of Eress' corporate ethos is to help Infrastructure Managers make Railway Undertakings as successful as possible, by offering services to them all across Europe.

He says, "Eress selects the best suppliers with the best prices on behalf of its partners". He mentioned this came about as a result of the needs of its partners to have an experienced broker working on their behalf and the fact that as a group they are in a far better bargaining position.

Stømer believes COP 21 helps the debate for systems like Erex. He expects that "As countries across Europe continue to replace their diesel trains with electric trains, Eress will be well positioned to provide the necessary technical information to them, helping decision makers evaluate the environmental and economical viability of said projects more effectively."

Stømer says, "Whilst the vision for Eress remains Pan-European, Eress needs to become more connected to the EU, but not part of the EU, in order to remain as independent and as innovative as possible".

At a board level, says Stømer, "We are now developing and deploying our long-term sustainability plan and perhaps one day Eress could even be extended beyond European borders to become a global force. Terje Stømer ends by saying, "Perhaps the 'E' in Eress, which stands for European, will one day be replaced by a 'G' for Global," as Eress continues to grow from strength to strength.


Taking the Erex System
to Europe and Beyond

Eress, mai 2016 Design: REDINK. Content: TBG Media

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