



INTERNATIONAL UNION
OF RAILWAYS

**AFRICAN
RAILWAY
THURSDAYS**

"THE CHALLENGES OF SUSTAINABLE DEVELOPMENT,
WHICH RAILWAYS FOR TOMORROW ?"



Collaboration for Sustainable Mobility



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BARBER



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HOPPER



Charlie
YOON



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Sydney Trains Sustainability and Emissions Reduction Strategy

Sydney Trains Sustainability & Emissions Reduction Strategy



Commercial in Confidence

- **Strategic Direction**
- **Emissions Profile**
- **Energy Efficiency**
- **Renewable Energy**
- **Biodiversity**
- **Waste & Recycling**



Future Transport Strategy 2056



Future Transport 2056 provides us with an overarching vision.

Our mandate is to support the economic development of the State, working to deliver the NSW Government's vision of **integrated, connected and liveable cities**.

10 Year Blueprint

Connecting to the future outlines the strategic direction of Transport. It sets out where we need to focus our efforts in the

near term to move us towards our long term vision outlined in Future Transport 2056.

- Transport for NSW Future Transport Strategy 2056, which outlines the NSW Government's vision of integrated, connected and liveable cities.
- Transport for NSW Future Energy Strategy – Headline Actions include:
 - Net Zero Emissions from heavy rail, light rail and metro electricity consumption by 2025
 - Sydney Trains target for a 10% reduction in the rate of energy consumption (kWh/train km) over five years.



Connecting our customers' whole lives



Successful places



Strong economy and quality of life



Thriving people doing meaningful work

NSW Climate Change Policy Framework and Net Zero Plan

Net zero emissions by 2050.

Net Zero Plan forecast to deliver **35% reduction by 2030** including **transport related initiatives:**

- Transition public bus fleet to zero emission buses
- Corporate fleet EV program
- Charging stations
- 30% of new NSW Gov passenger fleet electric or hybrid by 2023, at least 10% fully electric
- Yearly fuel costs and fuel economy star rating at point of sale and registration.
- Option to offset carbon emissions at registration.

Future Transport

A resilient transport system that contributes to the NSW Government's objective of **net zero emissions by 2050.**

Future directions to investigate that form the basis of Future Energy.

Future Energy

Scope

- Direct emissions from on-road transport, rail transport and ferries
- Indirect emissions from electricity used for on-road transport, rail transport and ferries

Objectives

- Implement financially sustainable actions to maximise value and position the sector to take advantage of rapidly developing technology
- Secure our transport energy needs and manage energy supply climate risk
- Support the transition of the transport sector to **net zero emissions by 2050**

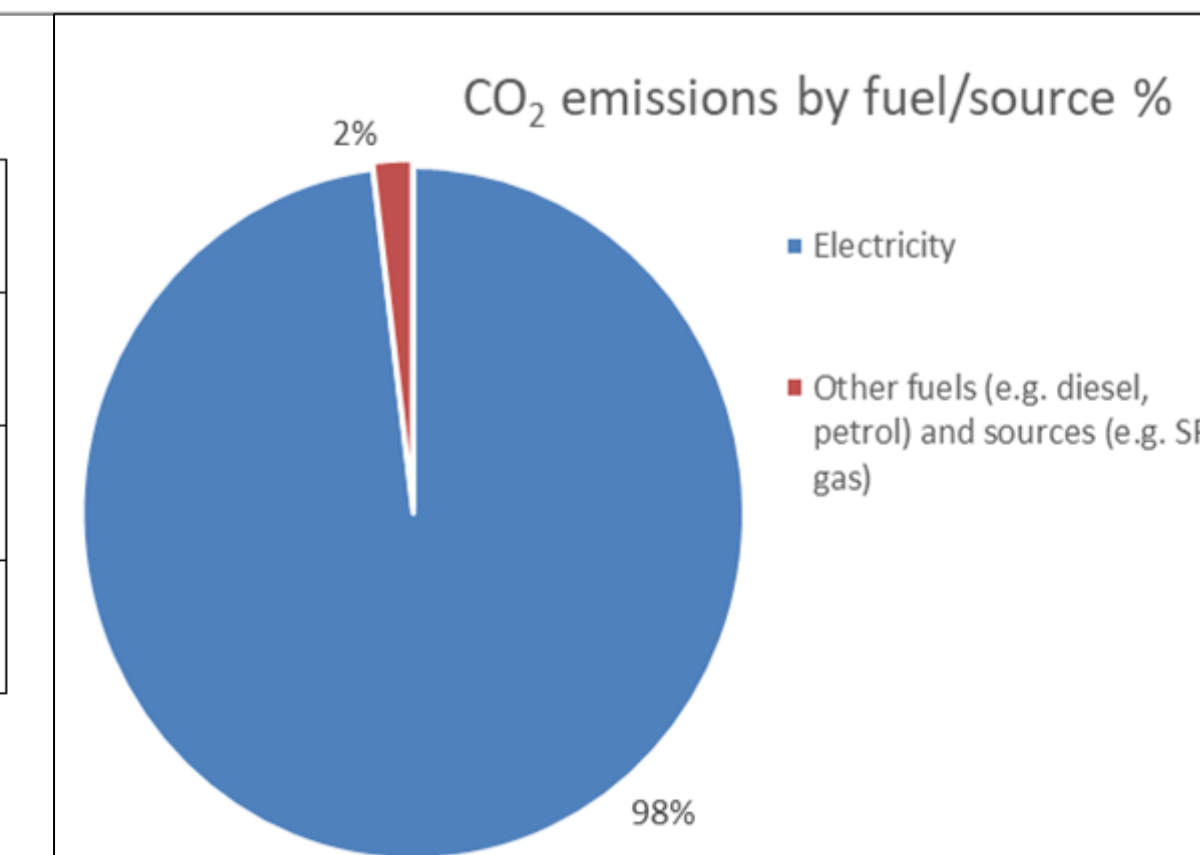
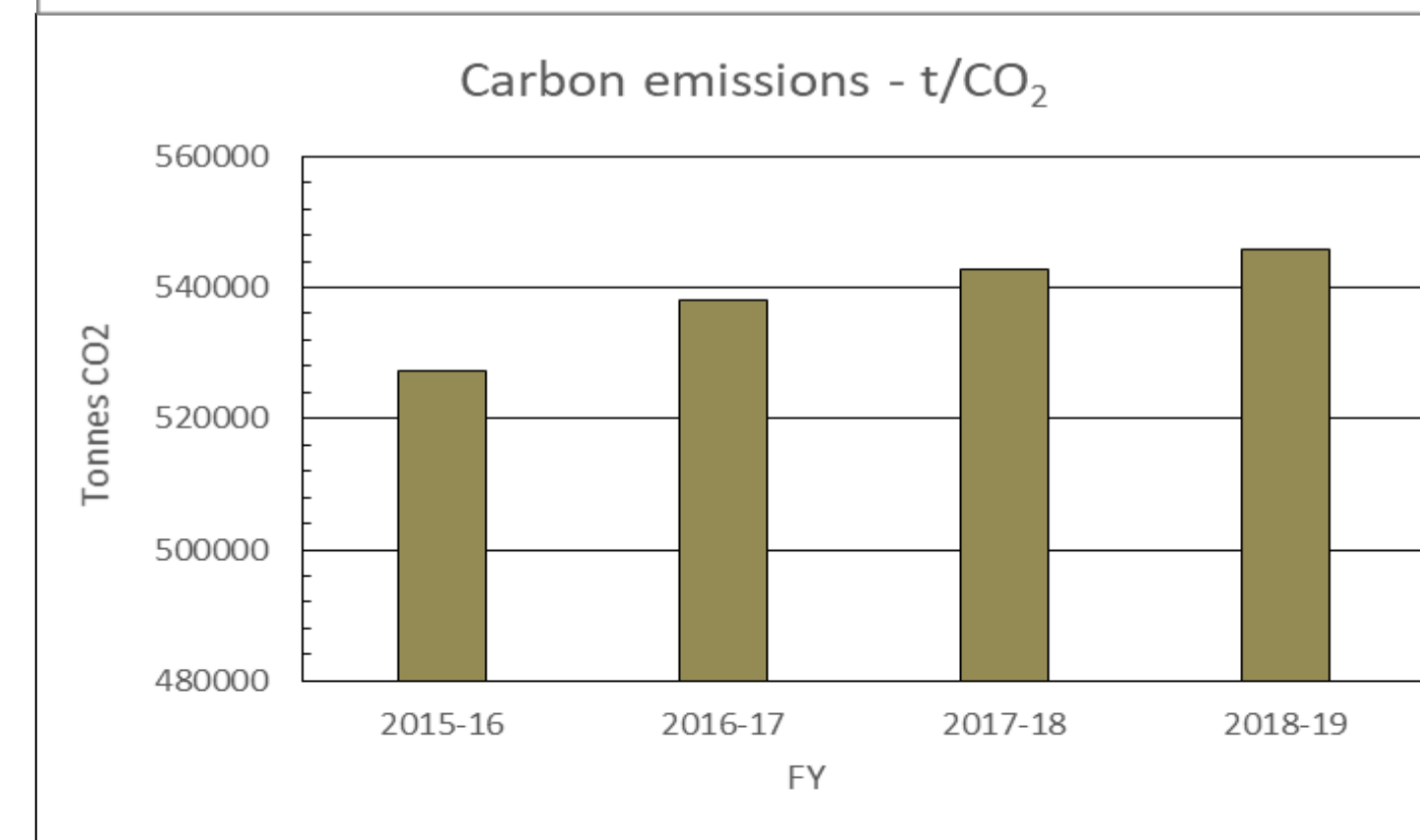
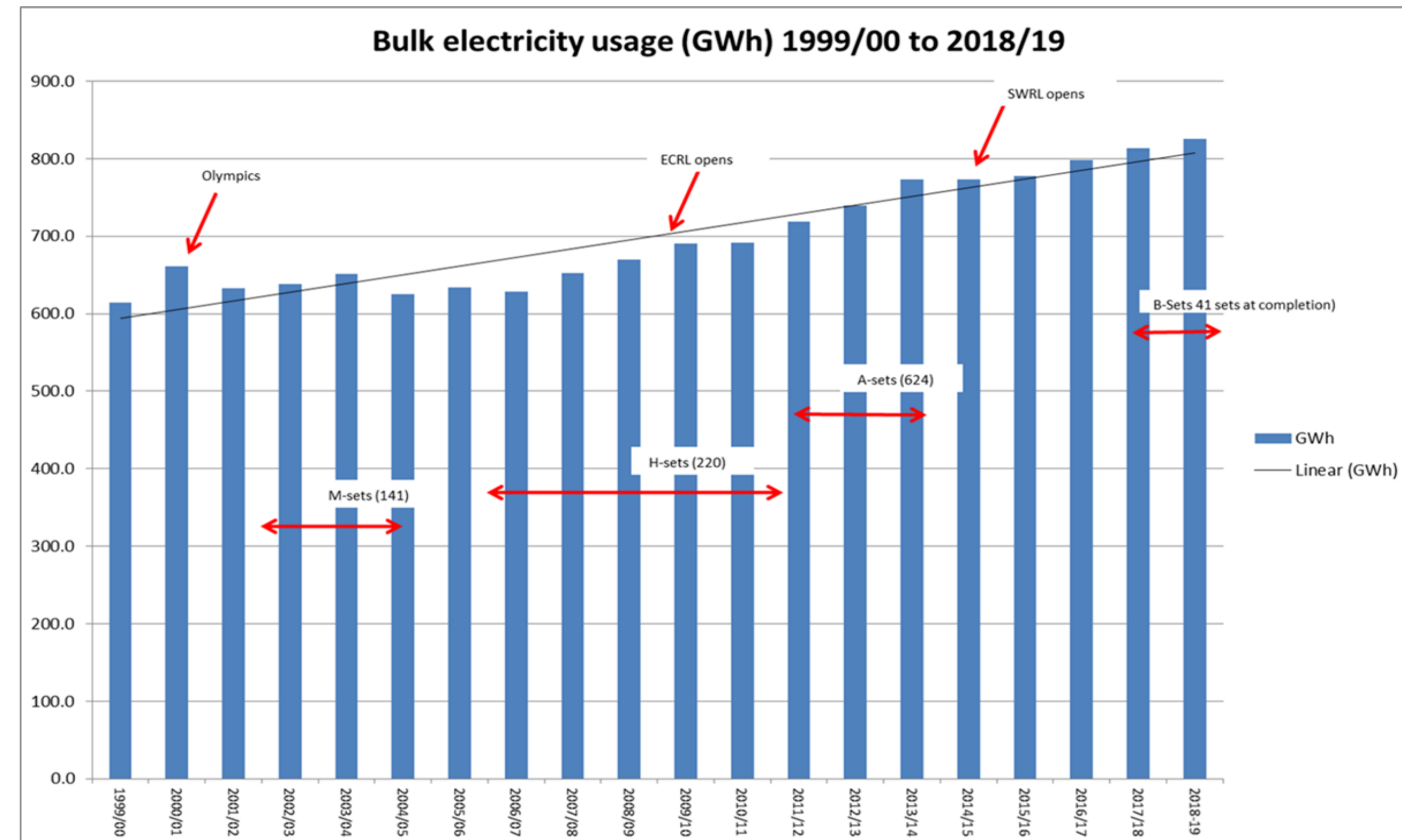
Focus Areas

- Improve operational energy efficiency
- Increased uptake of zero and low emission vehicles.
- Identify and promote opportunities to shift to more efficient transport modes.
- Transition to a secure, cost-effective, low emission energy supply
- Embed low carbon considerations as part of decision making across the cluster

Bulk Consumption and Emissions Profile

Sydney Trains makes up 1.3% of the total use of electricity in NSW

- Our bulk electricity consumption is measured in GWh (FY19 - 869GWh), primarily driven by rolling stock and its associated movements (77%) followed by Stations (8%) and Rail Infrastructure (4%)
- Our bulk consumption is demand driven and has increased year on year due to the introduction of;
 - new rolling stock (traction, HVAC)
 - additional running lines
 - additional services (timetable updates)
- Our emissions profile for FY19 was 545,750 t/CO₂-e
- 98% of our emissions are Scope 2 - *indirect emissions from the creation of electricity*
- 2% of our emissions are Scope 1 due to *direct emissions from diesel powered plant and equipment*



Energy Efficiency - Initiatives

In Progress

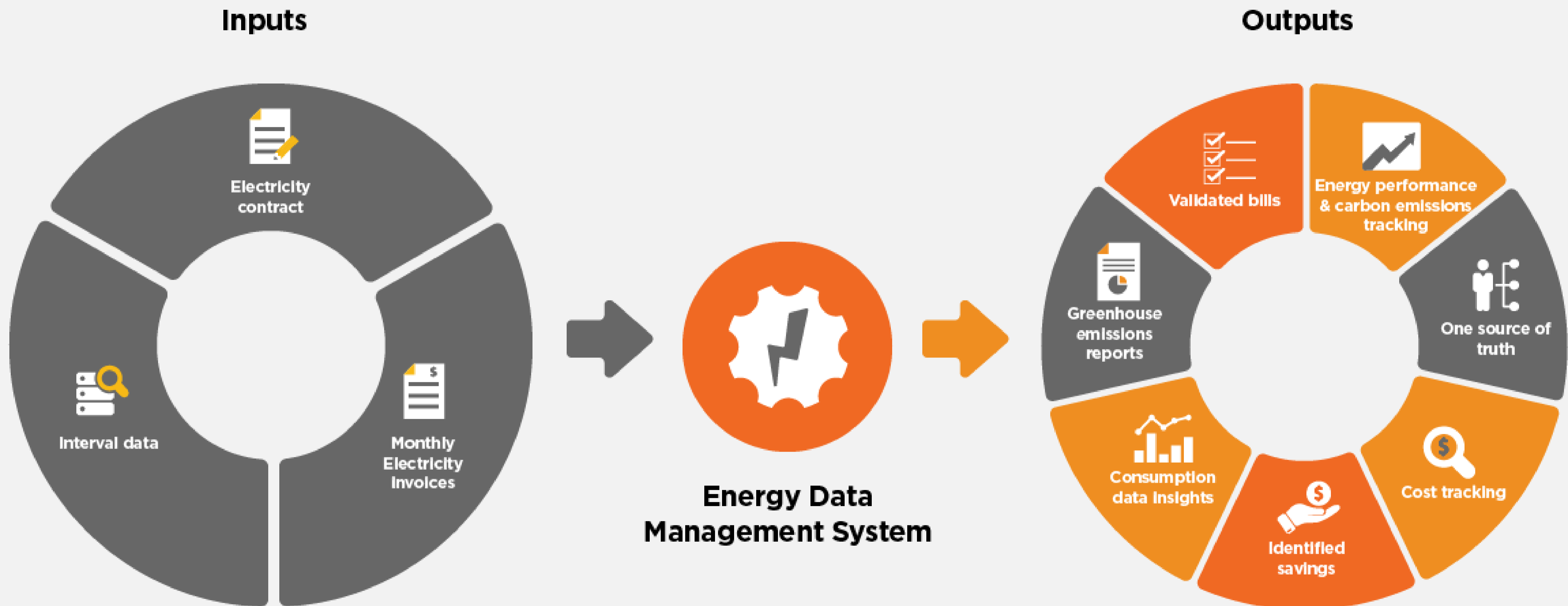
- i. HVAC software enhancements for A and B sets:
 - Optimising duct heater set points
 - Introducing new efficiency mode (HVAC setback) when sets are stabled
- ii. HVAC hardware upgrades for A sets – reducing condenser coil size and converting fans to EC motors
- iii. LED lighting upgrades – over 120 stations complete, LED trials in tunnels (e.g. City Underground), and continually exploring for more opportunities for LED deployment.
- iv. Energy Data Management System EDMS – see following slide for overview

Under Investigation

- i. Using inverter technology to replace energy dissipating resistors at select substations and recover braking energy



Energy Data Management System – Envizi



Renewable Energy – Behind the meter PV systems

- Sydney Trains now has 860kW of PV installed across 27 locations
- Business case development is underway for the installation of large PV systems at :
 - Mortdale Train Maintenance Centre – 1MW
 - Clyde Warehouse and Clyde Hub Office – 451kW
- TfNSW and Sydney Trains have been working collaboratively to assess and deliver PV systems across TAP and car-park projects.
- A recent example is the new PV system with battery storage installed at Rooty Hill station commuter car park.



Biodiversity – Grey Headed Flying Fox

- Grey-Headed Flying-Fox (GHFF) are listed threatened species both in NSW and Nationally.
- Two Camps occur on land adjacent to the rail corridor, the camps support up to 10,000 GHFF at Clyde and 20,000 Wollie Creek (which is a nationally significant camp).
- Flying fox camps are becoming more common in populated areas due to habitat loss and this regularly results in conflicts with residents, Wollie Creek and Clyde do not suffer with this issue making them important camps to maintain.
- Regular vegetation management is required to maintain these camps to prevent habitat loss and the subsequent shift of GHFF closer to residents.
- Vegetation management must be undertaken sensitively to avoid disrupting the bats breeding cycle.



Top right: Location of Clyde GHFF Camp (green outline)
Bottom Right: Location of Wollie Creek GHFF Camp
Bottom Left: GHFF roost by day at camps
Centre: Modern environmental condition require weed management to be undertaken at Camps

Chullora Ballast Recycling Centre

- The BRC's core function is the cost effective management of spoil and spent ballast that has been generated by Sydney Trains' trackwork programme.
- This is achieved this through recycling to meet the requirements of EPA Resource Recovery Orders and Exemptions into reusable products for rail-related infrastructure projects.
- The BRC processes approximately 100,000 tonnes per annum, with a rate diversion from landfill of over 90%.



Overview: Emissions Reductions & Energy Procurement Strategy

Category Management

Ongoing Management

Continuous management of electricity category to ensure a never ending cycle of continuous improvement and taking opportunities as the market presents them. Moving away from contract end date driving procurement.

Electricity Hedging Program

Providing the ability to hedge in the market up to 3 years out when the physical electricity contract is in its latter stages

Develop internal capability

Develop internal capability in terms of analysis, reporting, strategy implementation and governance to allow the ongoing management of more complex models to be effective and deliver best overall value for money.

Ongoing Strategies

Electricity data

Implement the EDMS system to create a platform where all electricity related data is stored, validated, analysed and utilised by all stakeholders. Creating a single source of truth.

Electricity Embedded Customer Network

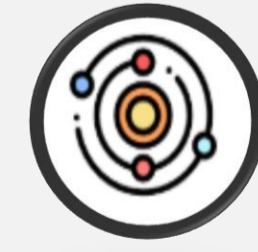
Efficient embedded network, operating on a fully outsourced basis with a program to upgrade metering to automated meter reading.

Reduce Consumption

Ongoing initiatives to reduce energy consumption across the network, heavily focussed on train traction operations (HVAC, lighting, stabling mode)

Best Overall value for money

Providing energy solutions that provide the optimum mix that balances risk versus reward.



Carbon offsets

A strategy to assist the business with ascertaining the to understand the costs and the best pathway associated with achieving the offsetting of 100% of electricity related carbon emissions

React to changing market and internal drivers

Providing a framework both contractually and from a governance and capability perspective to allow ST to react to an ever changing market and internal drivers to manage energy price risk.

Flexibility In Procurement models

Ability to change the mix of commercial models throughout contract term to suit market conditions, Including optional extensions and increasing renewables percentages if required.

Procurement



Heidi

HOPPER

Sustainability Initiatives in Irish Rail

Sustainability Initiatives



Heidi Hopper Duffy
*Railway Undertaking
Environmental Officer*

Agenda

- IE Sustainability Policy & Strategy
- Fleet Modifications – Electrification and Hybridization
- Train Maintenance – Hazardous Waste Minimisation
- Packaging Waste Upcycling – Wood Waste Upcycling Projects
- Centralised Contracts - Single Use Plastics Project
- Health & Wellbeing & Environment Initiatives
- Swap Shops – Reuse within Industry
- Track Infrastructure – Reuse within Industry
- Sustainability Integration – Challenges for Initiatives

IÉ Sustainability Strategy

Strategy Document issued by IÉ Board in 2020

Economic: Provide a high-quality transport service that stimulates economic activity, tackles congestion and connects communities, businesses and organisations.

Social: Foster a diverse and inclusive society by ensuring access and opportunity for all.

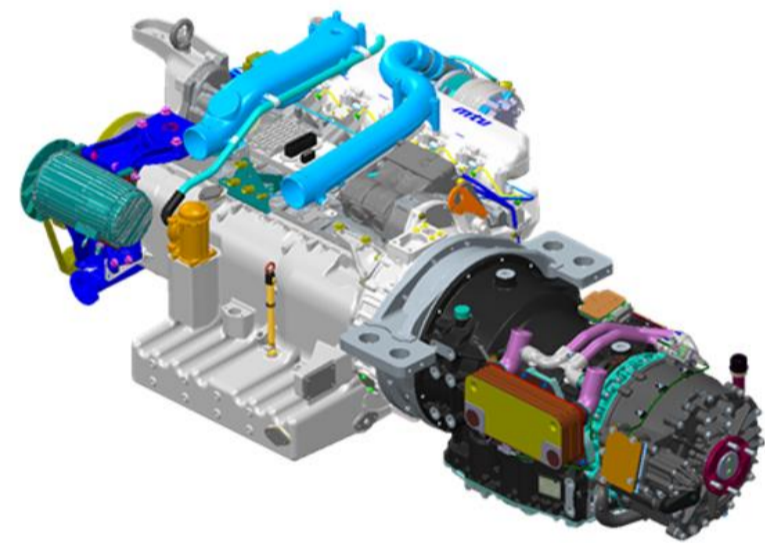
Environment: Work with partners to lead the transition to a low emissions transport network; ensure the protection of natural capital and infrastructure at risk of climate-related disruption; and minimise our impact to the environment through circular economy initiatives.

Iarnród Éireann: Delivering Sustainability for 21st Century Ireland

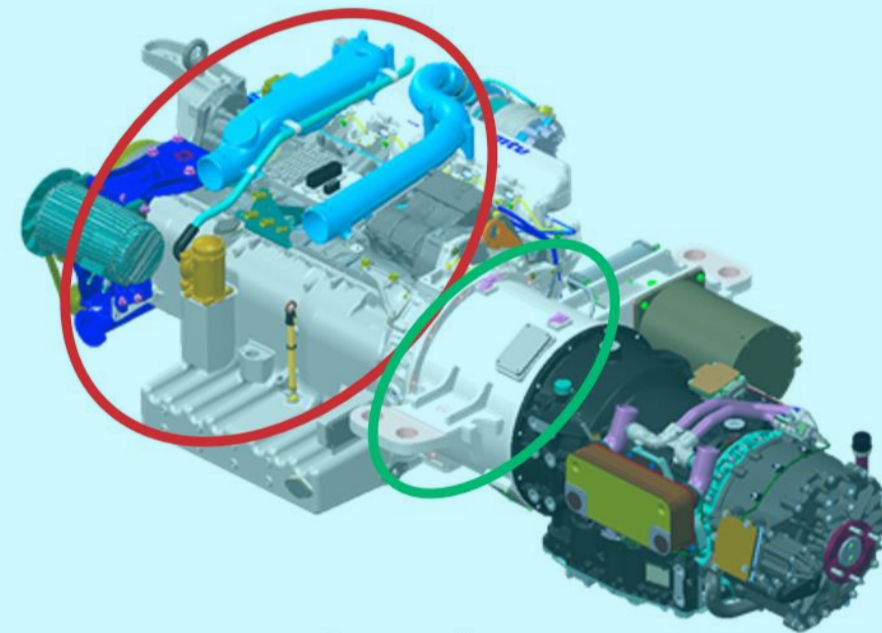


October 2020

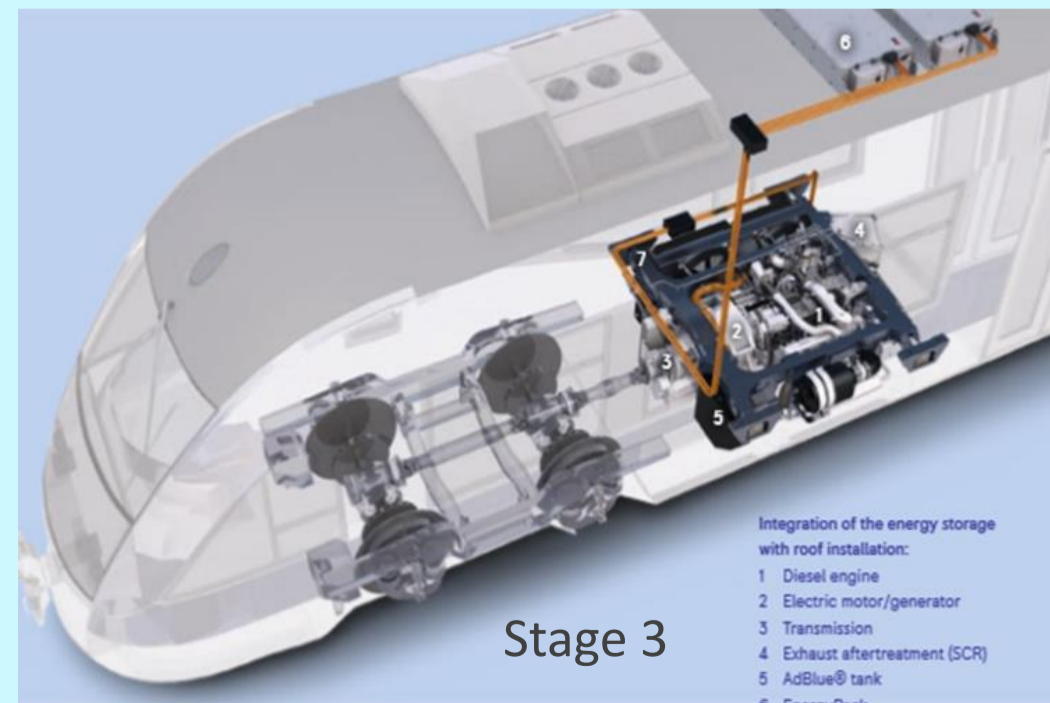
Hybridization



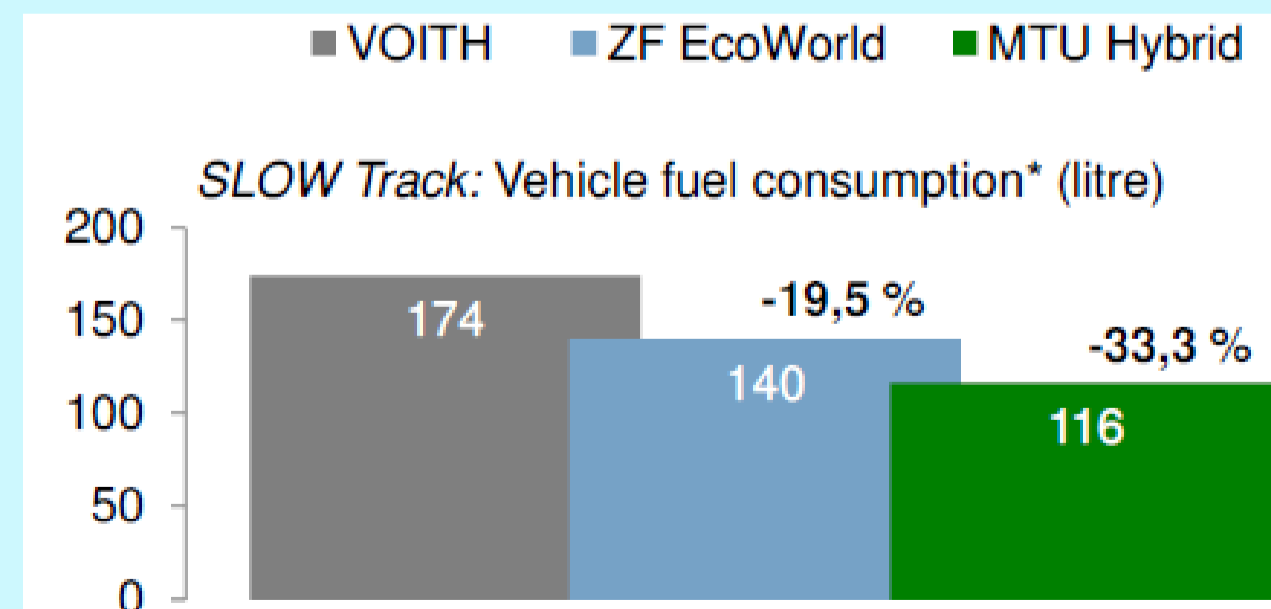
ZF Transmission – Stage 1



Engine & E-Machine – Stage 2



Stage 3



- Bridging the gap - hybrid power packs
 - Stage 1 – ZF transmission on trial now
 - Stage 2 – Engine & E-machine trial to start in Aug 2021
 - Stage 3 – Hybrid drive trial (battery pack)– Aug 2022
 - Fleet Roll Out – commencing Jan 2025
 - 60 cars per year
 - 4-5 year programme
- Savings per year:
 - **33% reduction** in fuel consumption (7.6 million litres)
 - 20,000 tonnes of CO₂
 - 860 tonnes of NO_x
 - 45 tonnes of PM
 - 21 dB noise reduction

Train Maintenance Hazardous Waste Minimisation

■ Coolant Recycling

- Waste coolant shipped overseas for disposal (large carbon footprint).
- 90% of the time, coolant is ok for reuse, might need water top-up
- **Initiative:** collect coolant into mobile units, test and put back into engine.



23 Tonnes of waste coolant saved annually



Significant reduction in life cycle impact.



€26,000 saved annually

■ Used Oil Filters

- Filters shipped overseas for disposal (large carbon footprint).
- **Initiative:** crush filters, collect oil for reuse as heating oil, recycle metal, dispose of residual paper as hazardous waste (far less weight)



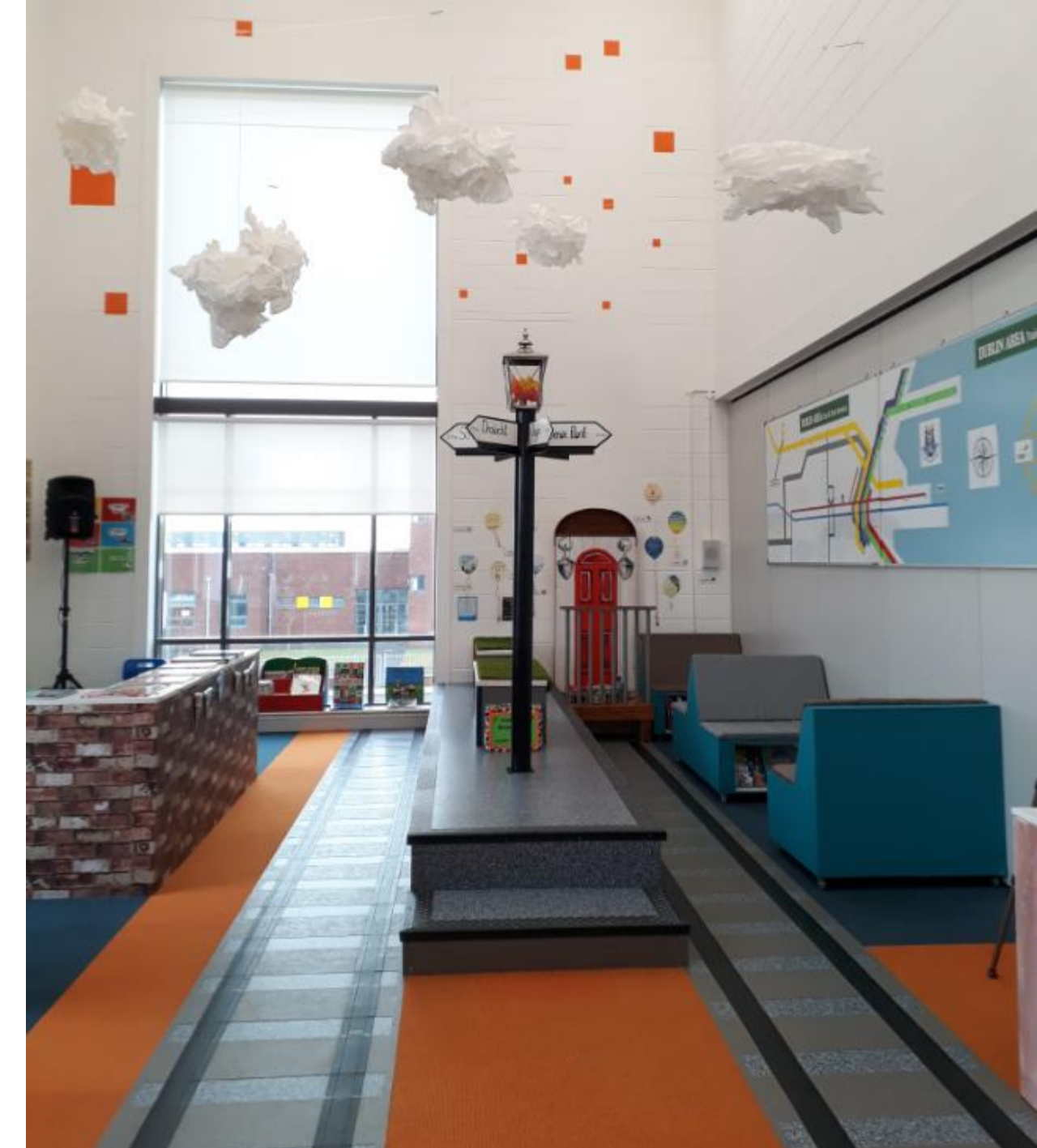
13 tonnes of waste filters saved annually



Significant reduction in life cycle impact.



€9,000 saved annually



Wood Waste Upcycling Projects Local Community Network

Swords Educate Together Sensory Garden for
Autism

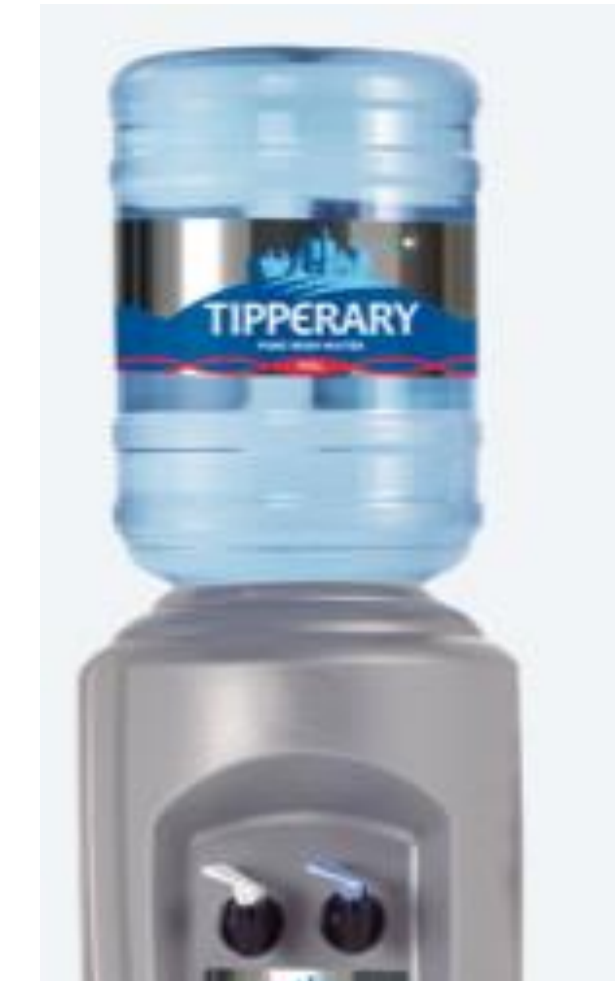
New Train-themed Library in Hansfield National
School

Centralised Contracts: Single Use Plastics Project

- Single Use Plastics Ban implemented in March 2019
- Contacted all central vendors – positive responses
- Big wins:
 - Cleaning products sachets – **91% reduction in plastic**, 204kg CO₂e saved annually, **better cleaning**
 - Paper only tickets – **54% reduction in cost**, **430kg** of plastic, **5,315 CO₂e** saved annually, no validation issues (eventual move toward mobile devices)



**Bin Liners →
Biodegradable option**



**Water Dispensers →
switch to mains fed**



**Non reusable cleaning product containers →
Sachet system with reusable bottles**



**Trilaminated Tickets →
Paper only**

Health & Wellbeing & Environment Initiatives



- **Cycling /Walking Promotions**

- Cycle to Work Scheme – deduction from gross pay cheque (before tax) approx. 50% savings
- Reviewing the provision of support facilities provisions (lockers, showers, etc.)

- **Promoting Gardening**

- Promotion of healthy eating, and lower carbon footprint
- Station vegetable gardens – partnering with local support groups, pride in stations
- Gardening Webinar – home gardens

- **Men's Sheds**

- Materials provided (wood, metal) - upcycling
- Mental health of retirees



CME Continuous Improvement Website

Submit your Employee Suggestion Forms [Here](#)

Continuous Improvement A3 Reports

Continuous Improvement Training Matrix

Continuous Improvement Projects

Business Systems 

Continuous Improvement Team Use Only

Green Belt Application Form

Swap your Items [here](#)

Swap List

Attachments	Item Name	Title	Please Choose
Category : Ink Cartridges (1)			
Category : Office Equipment (3)			
	HP Color Laserjet 5550n	network printer	Swap
	Lever Arch Folders	60 Lever Arch Folders	Swap
	WhiteBoards	2 x 1800*1200 Whiteboards	Swap
Category : Office Furniture (1)			
	Office Desk	Office Desk	Swap
Category : Other (4)			
	Storage cabinet x 2	Bunded and shelved. Some damage to the...	Swap
	IBC Bund	IBC Bund	Swap
	2 Barrell Bund for indoor use	This bund holds 2 barrells for use indoors/...	Swap
	Pallet Racking	Pallet Racking required to fit into modified ...	Wanted
Category : Plant Equipment (9)			
	Decrapper Reels	1 new + 1 old but functional.	Swap
	Lathe	Lathe	Swap
	Engine Lifting Table	Engine Lifting Table	Swap
	Jib Crane	2 500kg jib cranes, substantial foundations...	Swap

Swap Shops – Reuse within Industry

Reuse within Industry – Track Infrastructure

- Approximately 20% of redundant concrete sleepers are reused on branch lines
- 18,000 sleepers reused as access roads in 2020
- 7,000 Tonnes of Metal Waste recovered for recycling in 2020

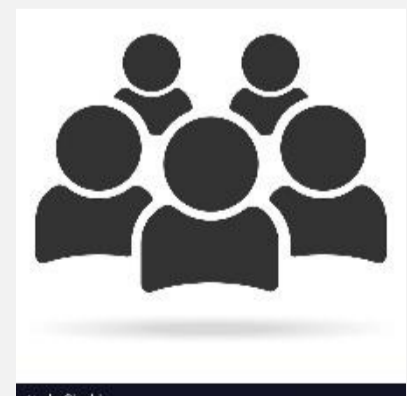




Pushing an open door - if the cost savings justify the change!



Reluctant to change if payback is long-term – hybrids and electrification just around the corner...but still a decade to go!



Environmental Management Team limited (2 people for 5,000 staff nationwide) – still seen as secondary support. An integrated management system with a focus on sustainability is needed.

Challenges for Initiatives



Thank you!



Charlie
YOON

Korail's Sustainability management to connect People, World, Future

Connecting the People, World, and the Future
Railroad of the Republic of Korea



KORAIL OVERVIEW



Facilities and Transportation Performance (As of December 31, 2019)

Trains

16,180 cars



- > KTX 1,530 cars
- > Passenger car 821 cars
- > Diesel train 2,913 cars
- > Generator car 113 cars
- > Locomotive 429 cars
- > Diesel crane 15 cars
- > Freight car 10,359 cars

Length of Railway Lines



- > Railway length **4,087.1km** (99 lines in total)
- > Double-track railway **2,573.7km** (63.1%)
- > Electrified track length **2,990.1km** (72.1%)

Average Transported Volume per Day



- > Passengers **3.604** million
- > Freight **80,000** tons





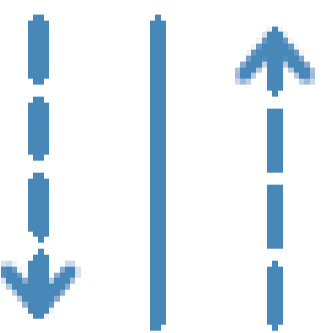
Stations

698 stations



- > 346 local stations
- > 306 whistle stop stations
- > 2 yards
- > 44 signal stations and signal stations

How to fight against COVID19

Establishing thorough quarantine system				
Disinfecting railway stations	Quarantine Train	Thermal Imaging Camera	Placing Hand sanitizers, Antibacterial film	Separating traffic lines for passengers boarding and arriving
Two or more times daily	4.5 times per day			
				

K-Quarantine Thanks to YOU



KORAIL's Sustainability Management



Sustainable development GOALS



Poverty Eradication

- Rail House(Improving living space for the underprivileged)
- Public concessionary fare



Fighting against Poverty and Food Security

- Operating a Love-Fund
- Happy Train



Healthy Life and Welfare

- Promoting flexible work system
- Creating a culture of work-family balance
- Operating a reasonable welfare system



Quality Education

- Education and training of employees
- Designating Day of company safety day



Promotion of Gender Equality and Women's Rights

- Recruitment and HR without discrimination
- Implementing gender equality system
- Expansion to female man...



Clean water and sanitation

- Managing water pollutant
- Reusing wastewater treatment facility water



Provision of Sustainable Energy

- Introducing new and renewable energy
- Reducing greenhouse gases
- Energy saving activities
- Responding to the carbon emission trading system



Sustainable Economic Growth and Decent Jobs

- Open recruitment
- Advanced labor-management culture
- Creating jobs in the private sector
- Creating and distributing economic value



Establishment of Infrastructure, Sustainable Industrialization

- Safety first management



Resolution of Inequality

- Recruitment and HR without discrimination
- Enforcing socially equitable employment



Creation of Sustainable Cities and Residential Areas

- Social contribution activities in local communities
- Promoting local economy



Sustainable Consumption

- Purchasing SME products
- Purchasing eco-friendly products



Prevention of the Impact of Climate Change

- Establishing greenhouse gas inventory
- Operating Greenhouse Gas Energy Committee
- Acquiring 'low carbon certification' for the carbon footprint of the environmental label



Protection of the Terrestrial Ecosystem

- Managing sewage and wastewater
- Protecting the ecosystem



Realization of Peace and Justice

- Ethical management system
- Anti-corruption system and education
- Personal information protection and information security



Global Partnership

- Joining and supporting UNGC
- UIC (International Railway Federation) regular member country activities
- OSJD (International Railway Convention regular member country activities
- Japan-Korea railroad exchange cooperation (Ministry of Land, Infrastructure and Transport, JR Kyushu, JR East Japan)





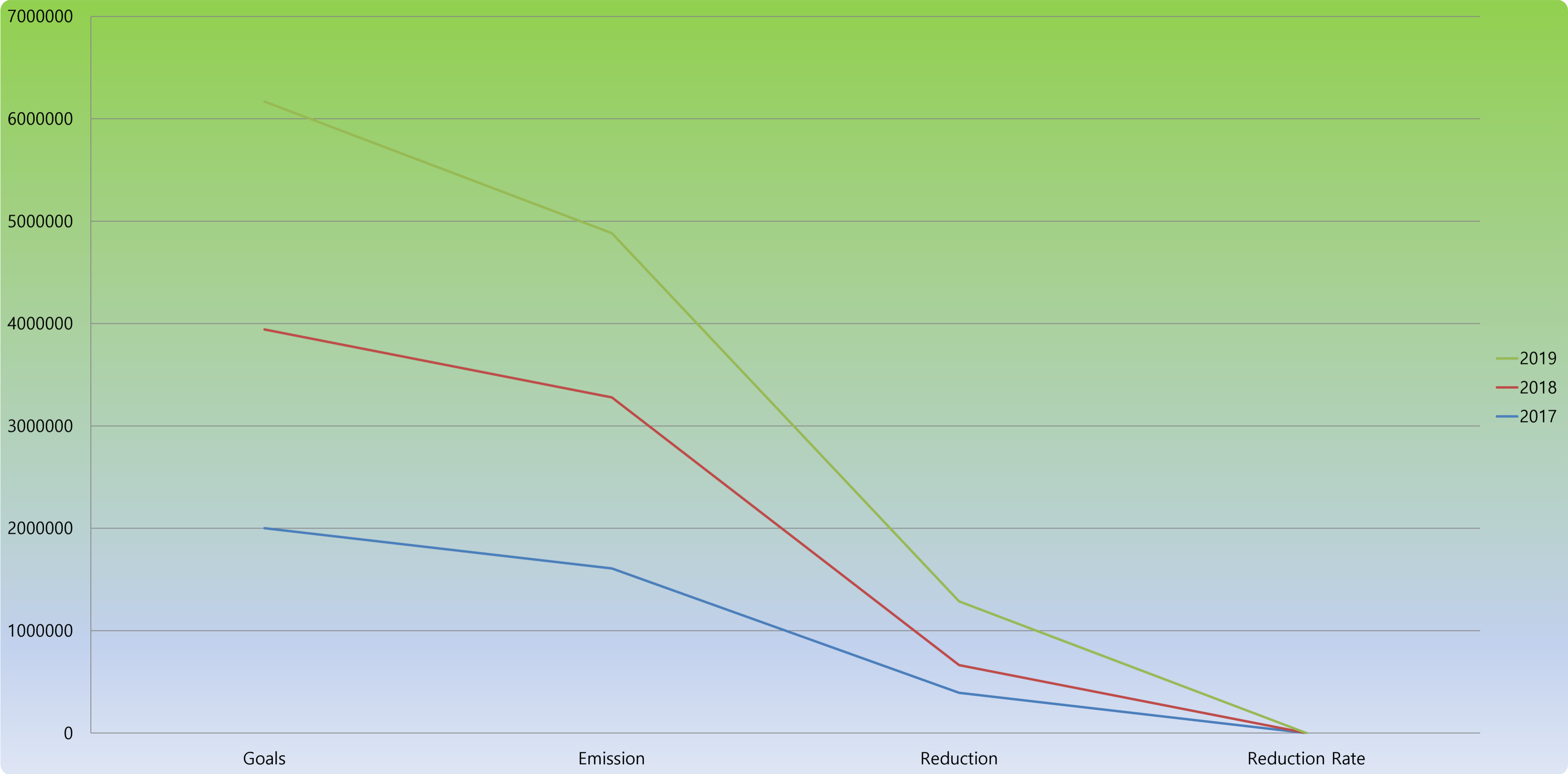
WE SUPPORT

Environment Management



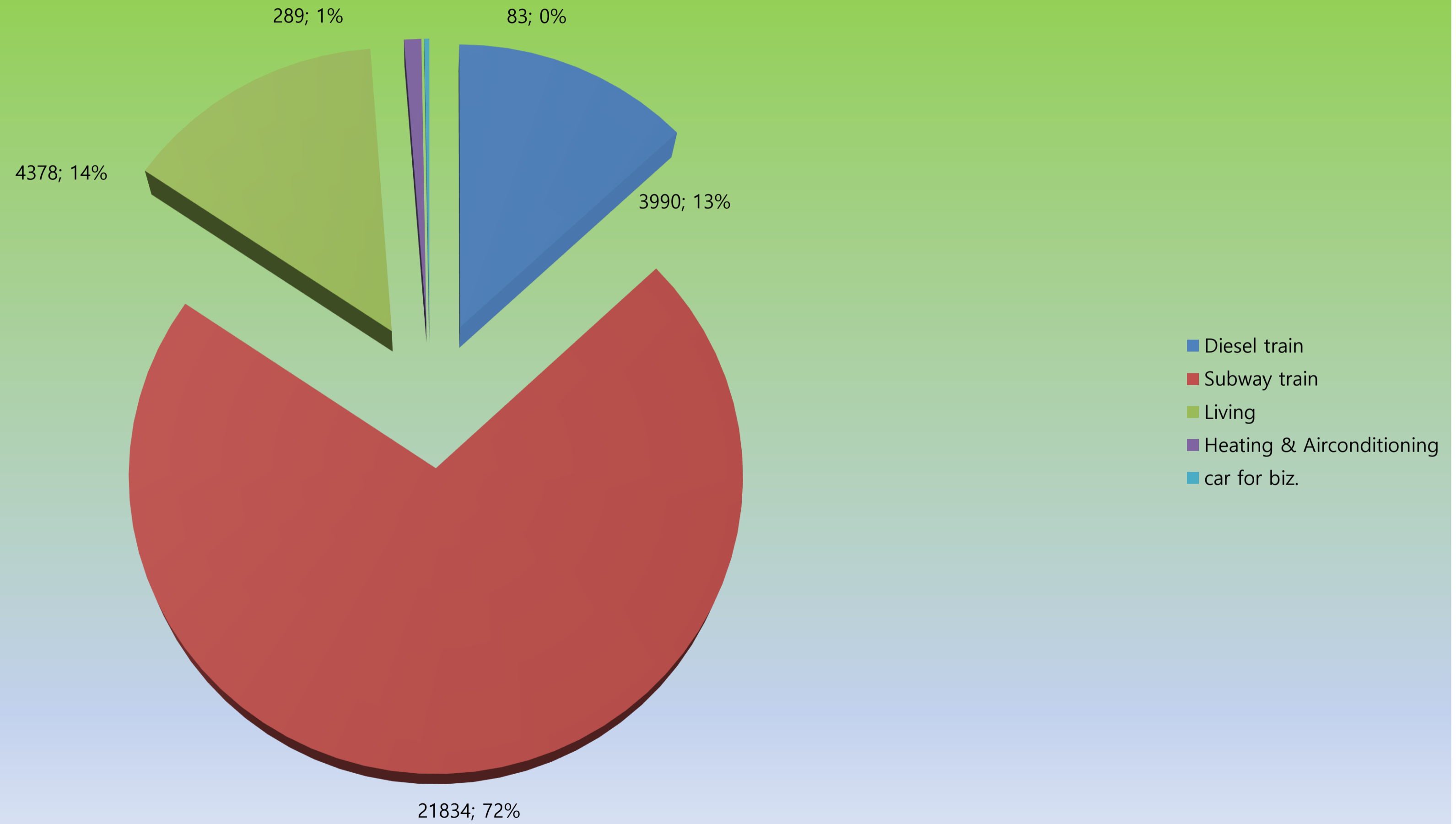
Green-house Gas Reduction

(tCO2-eq, %)



Energy Usage Results

(tCO2-eq)



Air Quality

Stations		2017		2018		2019	
		Under	Ground	Under	Ground	Under	Ground
Fine dust	150mg/m2	69	61	78	69	73	65
CO2	1000ppm	523	488	526	571	509	579
CO	10ppm	1	1	1	1	1	1
Formaldehyde	100mg/m2	9	12	24	18	18	13

Trains			2017	2018	2019
Fine dust	Subway	200mg/m2	66	87	105
	train	150mg/m2	55	59	61
CO2	Subway	2000ppm	1048	1231	1062
	train	2000ppm	1225	1170	1309

Noise and Vibration

dB(A) average

Noise			2017	2018	2019
Residential Area	Day	70	56	57	56
	Night	60			
Manufacturing Area	Day	75	54	54	56
	Night	65			

Investment for Environment

(Million KRW)

Investment amount	2017	2018	2019
Water	278	270	177
Air	23	114	82
Soil	330	966	1265
Waste disposal	180	412	13
Sum	811	1762	1537

For more Information

- KORAIL Sustainability Management Annual Report
- http://info.korail.com/mbs/english/subview.jsp?id=english_040700000000
- KORAIL Environment Management Annual Report
- http://info.korail.com/mbs/www/subview.jsp?id=www_030612000000
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Carole

ESCOLAN

Sustainable energy policy at SNCF Voyageurs

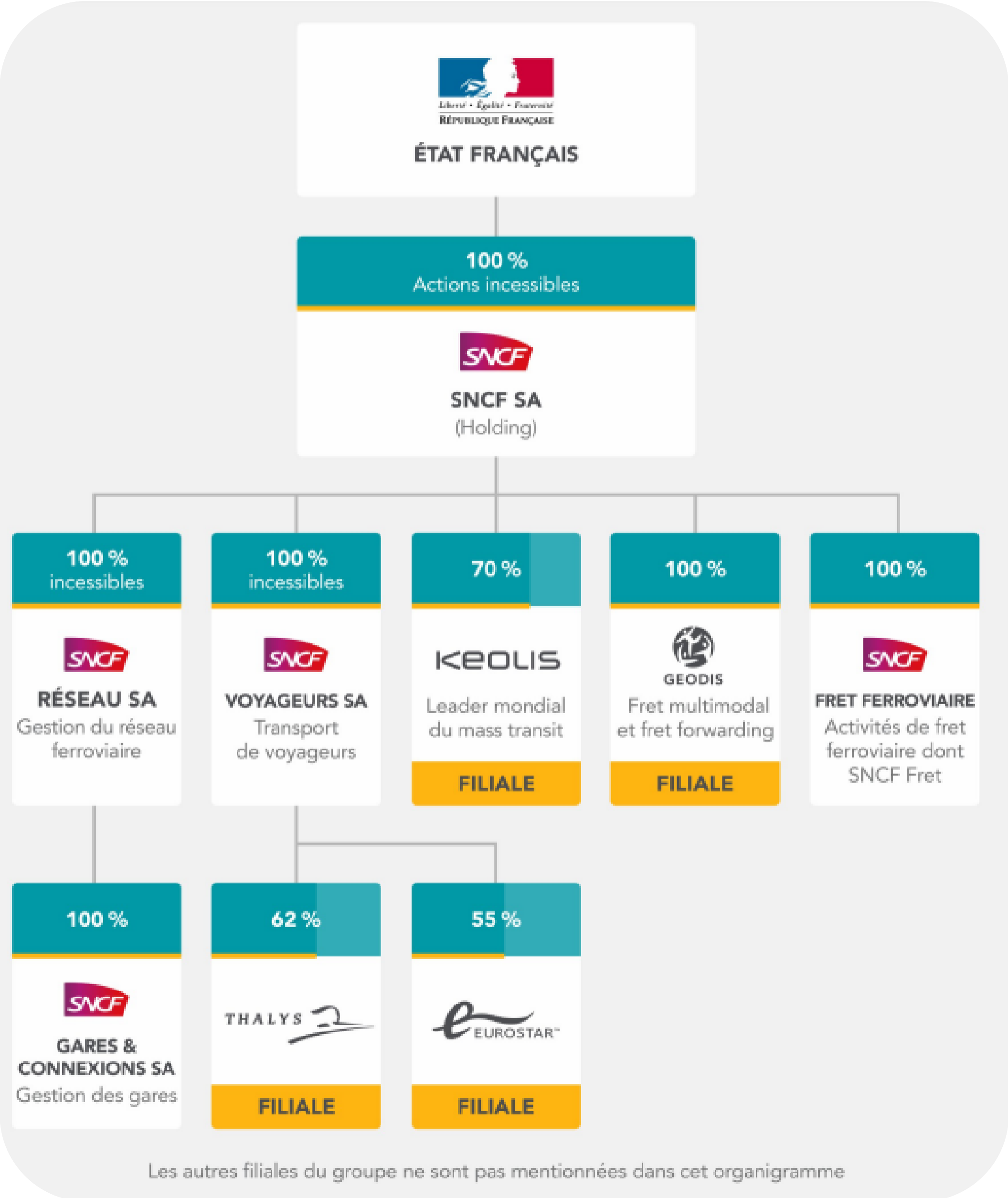


SUSTAINABLE ENERGY & CARBON POLICY AT SNCF VOYAGEURS

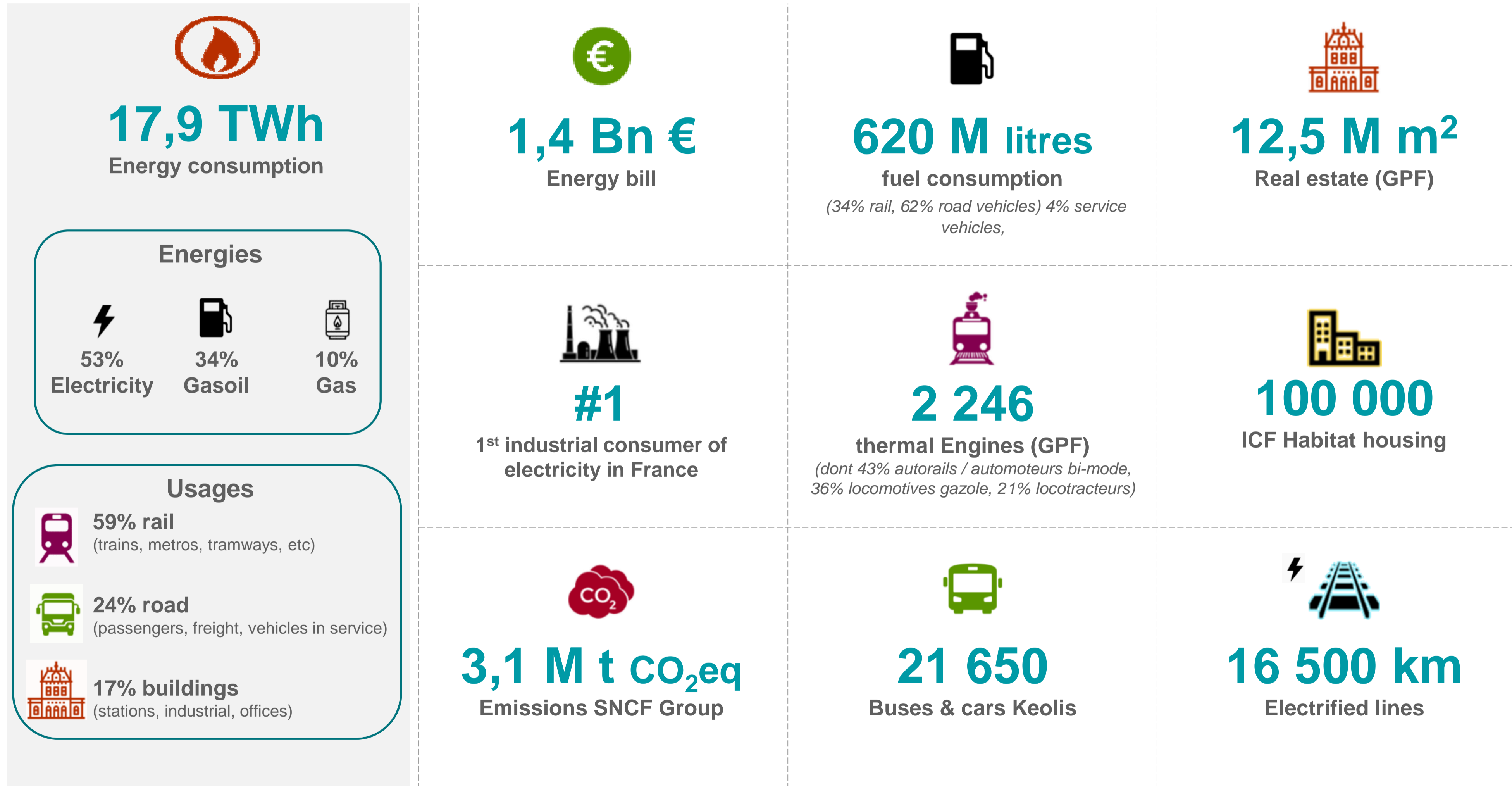
« The first leverage for environmental impact is to gain market share on the most polluting modes »

»

SNCF ORGANISATIONAL CHART



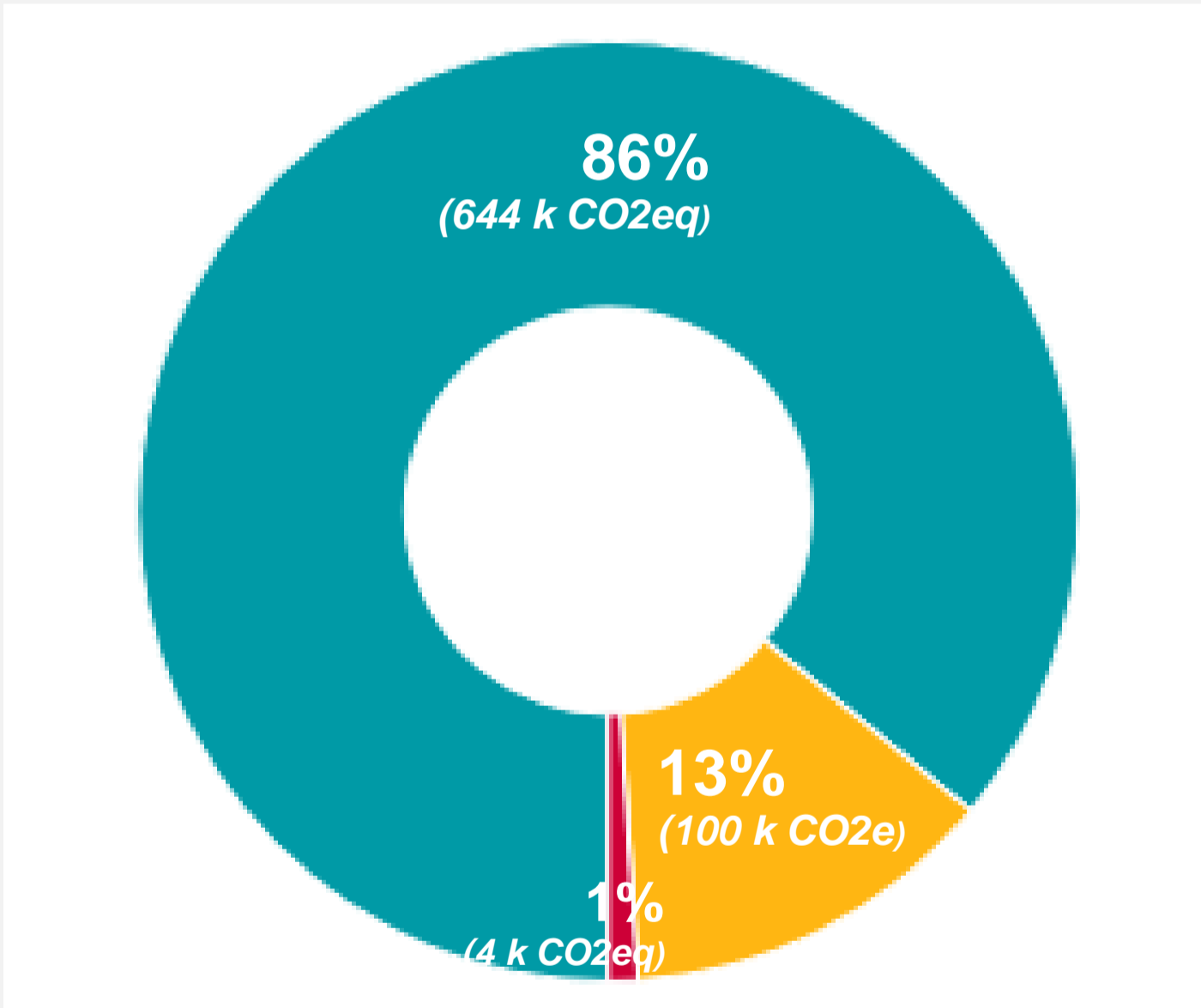
ENERGY IS A MAJOR ISSUE FOR SNCF GROUP



SNCF VOYAGEURS : EMISSIONS MAINLY COMING FROM DIESEL TRACTION, THOUGH ACCOUNTING FOR A MODERATE SHARE OF COSTS AND TRAFFIC

Diesel accounts for 16% of trains.km, 22% of expenditures but 55% of Co2eq emissions

CO2eq Emissions SNCF Voyageurs



■ Traction ■ Bâtiments ■ Véhicules de service

*Scopes 1 & 2

Répartition des trains.km 368 M train.km



Répartition des coûts énergétiques 425 M€



Répartition des émissions de tCO2eq 646 tCO2eq



Figures : 2019



DIFFERENT SITUATIONS BETWEEN ACTIVITIES



ENERGYM IX

- Mix 100% electricity based
- High passenger traffic
- Excellent environmental performance

- Energy mix including diesel :
 - TER (~50%)
 - IC (~14%)
- Rather low average occupation rate
- Rather good environmental performance compared to other means of transport but less excellent

CO2

1,7
grCO2/p.km

4,1
grCO2/p.km

24,8
grCO2/p.km

5,3
grCO2/p.km

TARGETS FOR 2030

Modal share

- ❖ Between 13 and 15% of modal share for passenger transport;
- ❖ 18% of modal share for freight transport;

CO2eq emissions

- ❖ Carbon neutrality by 2050
- ❖ 30% reduction on transport activities by 2030 (vs. 2015 – scopes 1 & 2);
- ❖ 50% reduction on buildings emissions by 2030 (vs. 2015 – scopes 1 & 2);
- ❖ 3,7 million tons of CO2eq avoided per billion€ of investment;

Energy targets

- ❖ Renewable Energies : increased share of renewables in the energy mix from 3% in 2022 to 20% in 2026;
- ❖ Phasing out of Fossil fuels by 2035 (TER)



STRATEGY & ACTION PLAN 2021-2025

MERCREDI 5 MAI 2021



AN ENERGY-CARBON STRATEGY LAUNCHED IN 2016 AT SNCF VOYAGEURS

Our Responsible Energy strategy, reflects SNCF VOYAGEURS 'desire to be **proactive** and **exemplary** on the sustainable mobility market, in a logic of **economic performance and differentiation** from its competitors.

3 AXES

Axe 1 - Controlling our energy bill
(purchasing, counting, energy savings)

Axe 2 - Decarbonising our assets
Get out of fossil fuels

Axe 3 - Greening our electricity
Through the development of electricity based on renewables

3 TARGETS FOR 2015-2025

Energy efficiency and frugality : decrease by 20% of our energy intensity per passenger.km

Innovation in favour of decarbonation by reducing the use of fossil fuels

Greening half of the electricity used for traction

ECO-DRIVING



Economic / ecological driving assistance on the drivers' iPad

- *Major challenge : average gain of 10% in consumption when circulating + improvement of trains' regularity*
- *Target : 100% drivers equipped in 2022*

ELECTRICITY METERING SYSTEMS

Generalization of on-board electricity meters by the end of 2025 as well as dedicated information systems

- *27% of the electric fleet to date*

ECO-PARKING



Energy consumption reduction during commercial stops

- *Stationary trains can consume from 5 to 30% of their global energy consumption*
- *A change of habits is necessary*
- *1st goal of « PLANETER » or TRANSILIEN program: reduction by 1/3rd of stationary trains' consumption*

ROLLING STOCK



Less energy consuming rolling stock

- Energy saving actions on:
 - *resistance to movement,*
 - *traction / comfort auxiliaries (air conditioning / heating management, LED lighting, etc.)*
- Opportunities:
 - *TGV-M,*
 - *Chambord Project (AGC mid-life operation, etc.),*
 - *RER NG,*
 - *AML D*

FOCUS ON TGV M



Maximise the circularity of our rolling stock

CIRCULAR TGV

Recycling rate of TGV M*

97%

ECO
CONCEPTION
IN FRANCE

MID- LIFE
RENOVATION
AFTER 15/20
YEARS

DISMANTLING
& END OF
LIFE
RECYCLING
IN FRANCE



Commissioned
in 2024



- Energy consumption reduced by 20%, by integrating ultra-capacity trainsets : 740 people transported vs 556
- Energy from braking is stored on board and returned to other trains which use this energy to run => ~ 10% of a train's energy is returned.
- CO₂ sensors in coaches in order to deduce the number of passengers on board, therefore to regulate the air conditioning or the heating accordingly.
- Mid-life renovation planned to be carried out after 15/20 years of operation, to extend rolling stock's lifetime and therefore avoid the use of new resources.



PLANÈTE
VOYAGES

*Recycling rate of current TGVs : 92%

AXE 2 – DECARBONATION – PHASING OUT OF FOSSIL FUELS

IN THE SHORT-TERM: BIOFUEL



- 100 000 tons of CO₂/year by 2025

< 01

02

- 1/3rd passengers carbon footprint

Avoid 500 000 tons of CO₂ in France through modal shift from cars to trains

< 03

26% des rames TER sont 100% gazole



2035 sortie du gazole



B100 : made of 100% biofuel from the rapeseed sector :

- French production covers 1.1 M hectares cultivated in 2020.
- It provides simultaneously proteins for breeding (oil cakes), edible oil and biofuel



- Experiments in commercial service Paris / Granville (Normandy) and Paris / Laon (Hauts de France) from April 2021
- Discussion underway with other Regions showing interest



60% reduction in CO₂ emissions and in all air pollutants (Regiolis)



- Compatibility with existing thermal equipment without costly modification of the engines
- Some limitations remain:
 - ✓ adaptations necessary within service stations;
 - ✓ partnerships to be built with biofuel producers,
 - ✓ financing of additional costs



AXE 2 – DECARBONATION – PHASING OUT OF FOSSIL FUELS

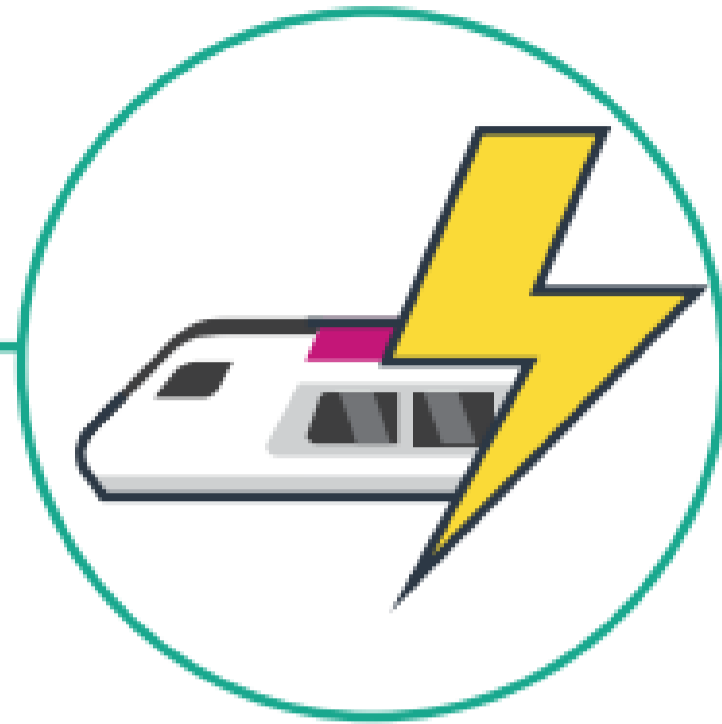
DEVELOPMENT OF NEW TECHNOLOGIES : HYDROGEN



- For the 4 regions, hydrogen seen as part of a **global ecosystem** that could supply not only trains, but also buses, trucks, boats, etc.
- The total project amounts to **231 million €**.
- The 1st **test runs** are scheduled for late **2023 - early 2024**, with a first **commercial run** planned for **late 2025**.

- First order to Alstom of **12 dual-mode trainsets** (+ 2 optional), using electricity from overhead lines or electricity produced from hydrogen.
- Order placed on behalf of **Bourgogne-Franche-Comté, Auvergne Rhône-Alpes, Grand Est** and **Occitanie** regions, where these trains will run on partially electrified tracks. Composed of 4 coaches, they will replace some trains running on electricity and diesel currently in use.
- Regiolis have fuel cells powered by hydrogen, stored on the roof, as well as batteries placed under the train.
- Regiolis will go up to **600km**, carry **220 passengers** at **160 km/h**.

AXE 2 – DECARBONATION – PHASING OUT OF FOSSIL FUELS



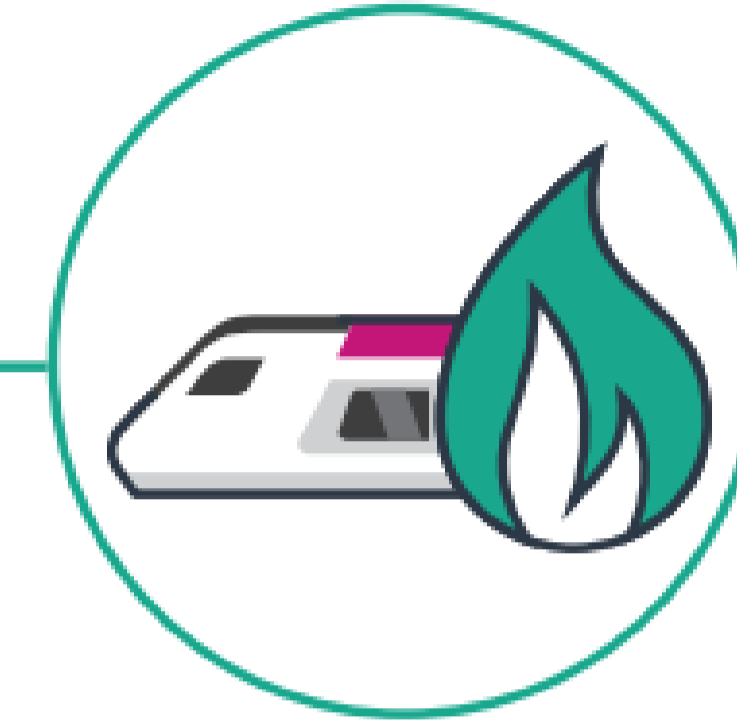
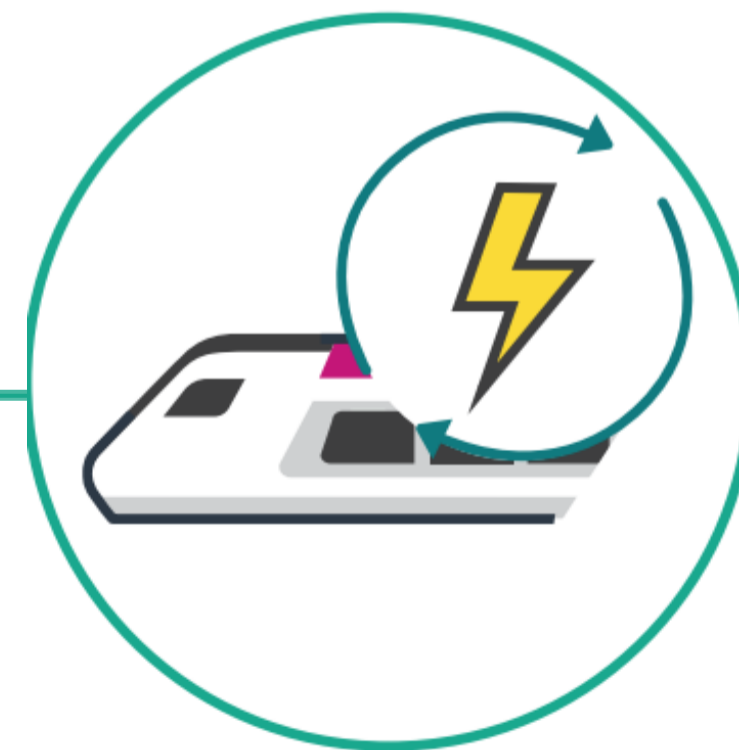
BATTERY TRAINS

- Project with Bombardier and 5 regions to transform a diesel AGC train into a battery train.
- Diesel engines are replaced by lithium batteries which recover braking energy (previously lost as heat), for the traction of the train.
- Few transformations needed : rail infrastructure remains unchanged, trains already in circulation can be modified during their mid-life operation
- 1 TER will be transformed into hybrid in 2021 and in service in 2022/2023.
- Total investment of 38M€



HYBRID TRAINS

- Project with Alstom and 4 regions to develop a hybrid train.
- Half of diesel engines are replaced by lithium batteries which recover braking energy (previously lost as heat), for the traction of the train.
- Enables 20% reduction in the energy consumed and in greenhouse gas emissions, reduction in use and maintenance costs.



BIOGAS TRAINS

- SNCF Voyageurs is studying Biogas, trains, which combines territorial and greening issues.
- A renewable gas alternative to fossil fuel resulting from anaerobic digestion, could be a new opportunity complementing TER B100, Hybrid, Batteries and hydrogen.
- Could enable at least 80% reduction in greenhouse gas emissions.



AXE 3 – GREENING OUR ELECTRICITY

Purchase of renewable electricity via PPAs

- 3 Renewable Energy Power Purchase Agreements (PPA) with Voltalia and EDF renewables
- 20 years 'contracts.
- **Target:** 20% of renewable energy PPA in the traction electricity mix in 2025 - 6% contracted to date.
- Taking into account the greening of electricity purchases on the French market, the electricity consumed by SNCF Voyageurs should be 40-50% of renewable origin in 5 years.





THANK YOU FOR YOUR ATTENTION

29 APRIL 2021





Q&A

Finance innovative modes and mechanisms at the low-carbone mobility service in Africa



Martha B.
LAWRENCE

AFRICAN BANK OF
DEVELOPMENT

The image features a solid green background. In the top-left and bottom-right corners, there are decorative elements consisting of several overlapping, slanted rectangular shapes in various shades of green, black, and grey. The text 'African Bank of Development' is centered in the middle of the page in a white, bold, sans-serif font.

African Bank of Development



Martha B.
LAWRENCE

Rail Financing for Green Transport

Rail Financing for Green Transport

UIC: African Railway Thursdays Sustainable Development Challenges: Railways of Tomorrow

Panel on Financing Innovative Modes and Mechanisms of Low-carbon Mobility Service
in Africa

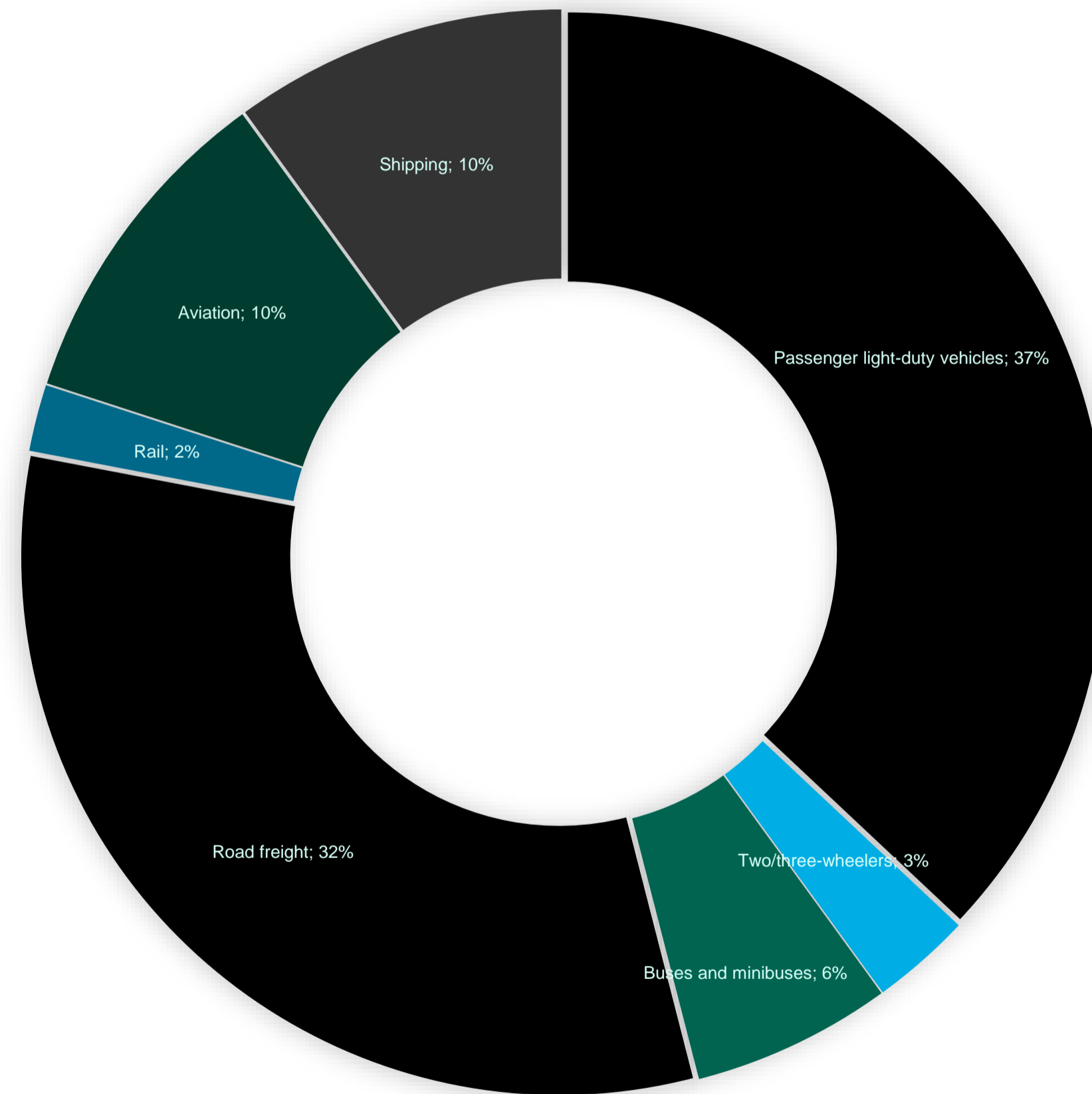
Martha Lawrence, Leader, Railway Solutions, Infrastructure Vice Presidency, World
Bank

29 April 2021

Opportunities to decarbonize transport through RAIL

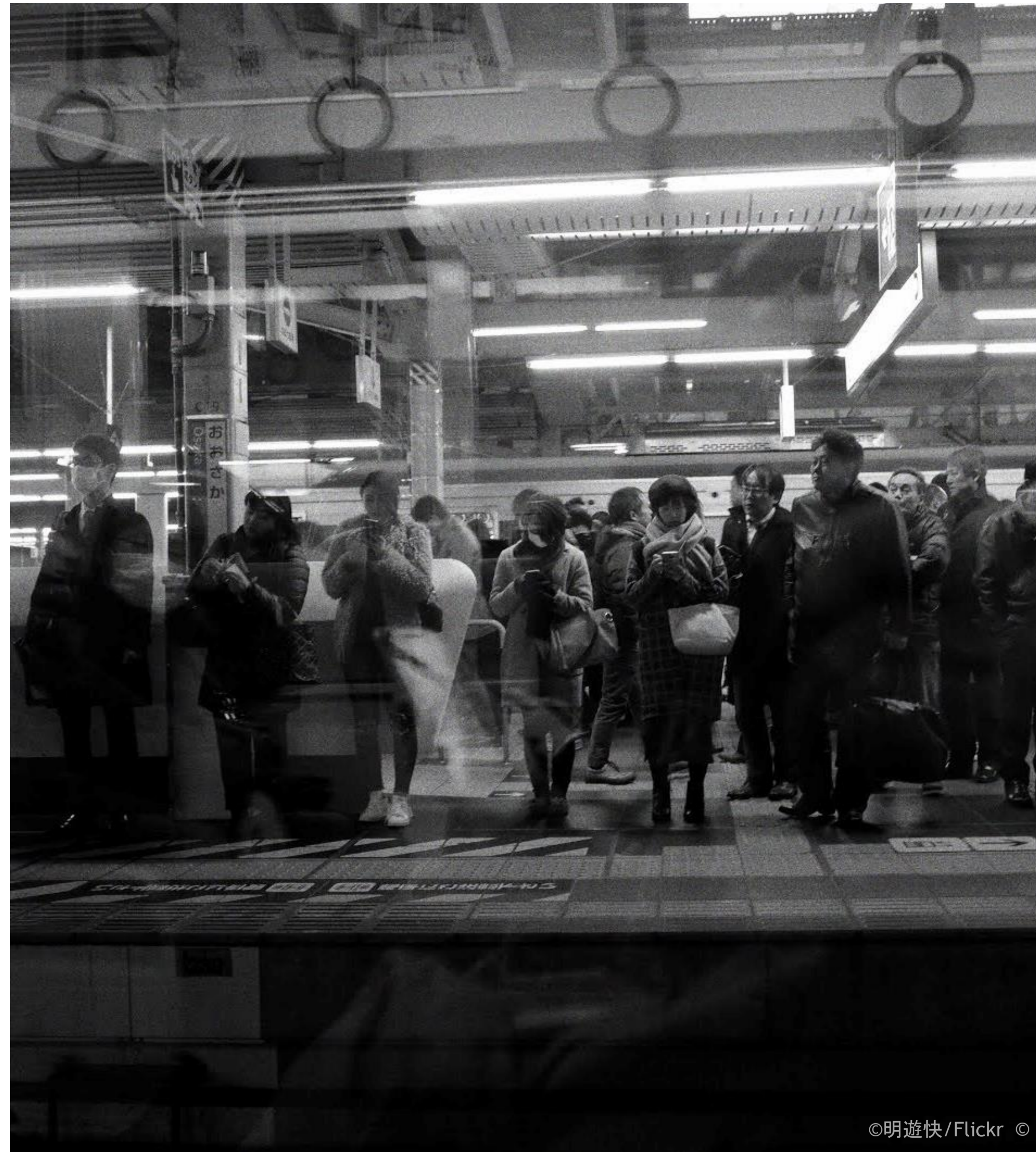


Rail's Contribution to Decarbonizing Transport



Source: IEA, 2018, the Future of Rail, p. 80

Shift to Rail: Urban & Commuter



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Shift to Rail: Semi-High-Speed Rail



Shift to Rail: High Speed



Shift to Rail: Bulk & Multimodal Freight



Improve Rail: Clean Energy

- Energy from a **clean** source
- **Reliable** energy supply
- Traffic **density** makes the investment economically viable

Electric
Power Supply



- Produced in a **clean** way

Hydrogen
Power Supply



Rail Financing



Railway Funding Sources



Passenger tickets



Freight services



Government



Ancillary services

Railway Financing Types

Sovereign

➤ Government

Corporate

➤ Company

Project

➤ Project

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Green Bonds in Railways: Global Examples



Company	USD in M	tranches	USD in M/tranch
Russian Railways	560	1	560
Thailand BTS Group	408	5	82
Japan JRRT	500	1	500
NY MTA	6,359	10	636
Paris SGP	5,675	8	709

World Bank Green Bonds

How the World Bank defines “green” projects:

- Support transition to low-carbon and climate resilient growth in client countries
- Climate change mitigation, *i.e., greater efficiency in transport, incl. fuel switching and mass transport*, and adaptation
- Selected by WB environment specialists
- Six steps following the same stages as other WB financed projects, incl. due diligence and monitoring process throughout the project cycle
- Comply to WB safeguards policies
- Eligible criteria underwent an independent review by the Center for International Climate and Environmental Research at the University of Oslo (CICERO)

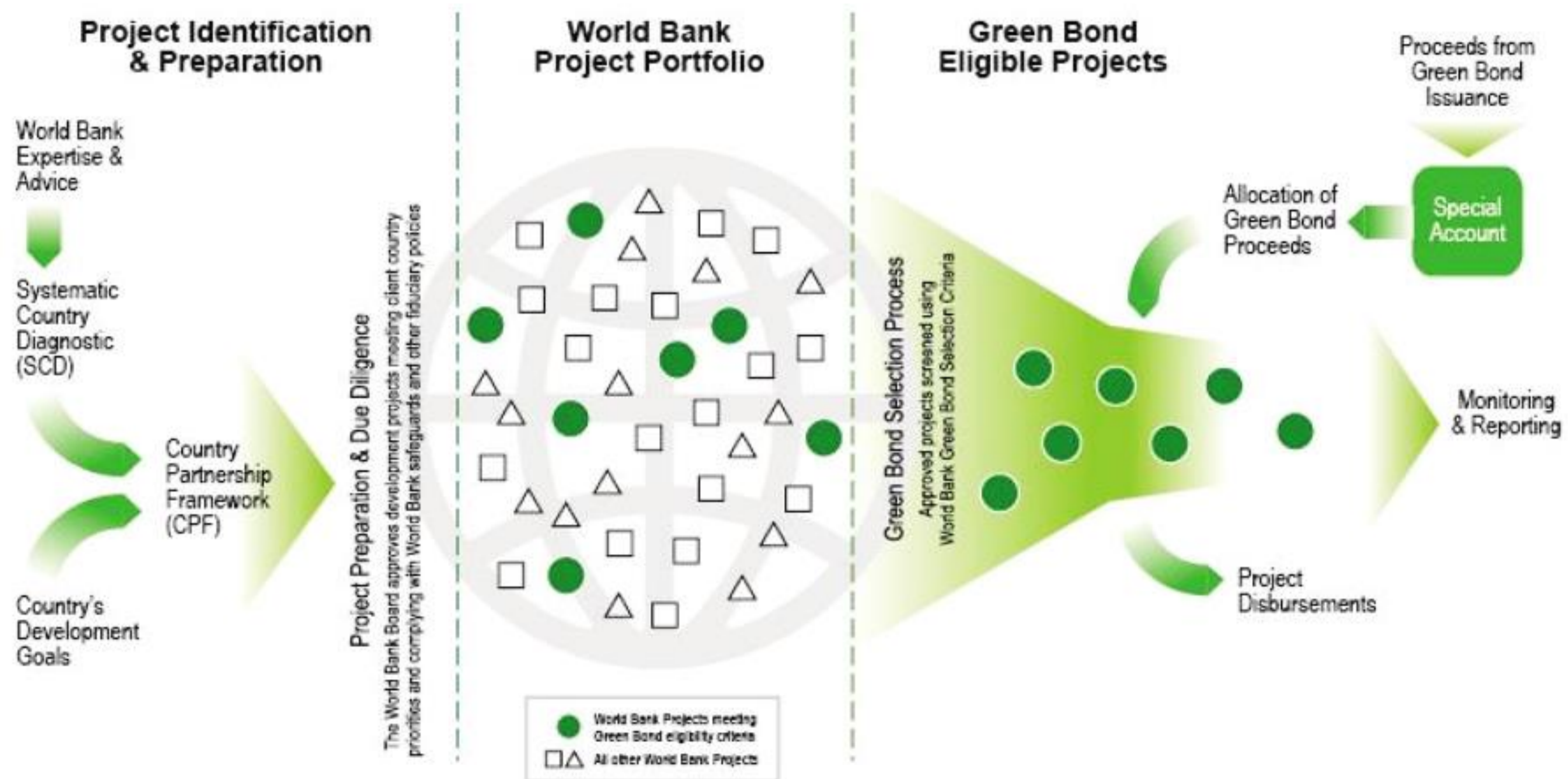


© World Bank Treasury, Capital Markets Department

Source: <https://treasury.worldbank.org/en/about/unit/treasury/ibrd/ibrd-green-bonds#3>

World Bank Green Bonds Financing Process

Earmarking and allocating Green Bond proceeds



World Bank railway projects using green bonds proceeds

Brazil Greening Rio de Janeiro Urban Rail Transit: The system is expected to especially serve the poor populations who rely on public transportation by reducing travel time, in particular when switching from inefficient bus services.

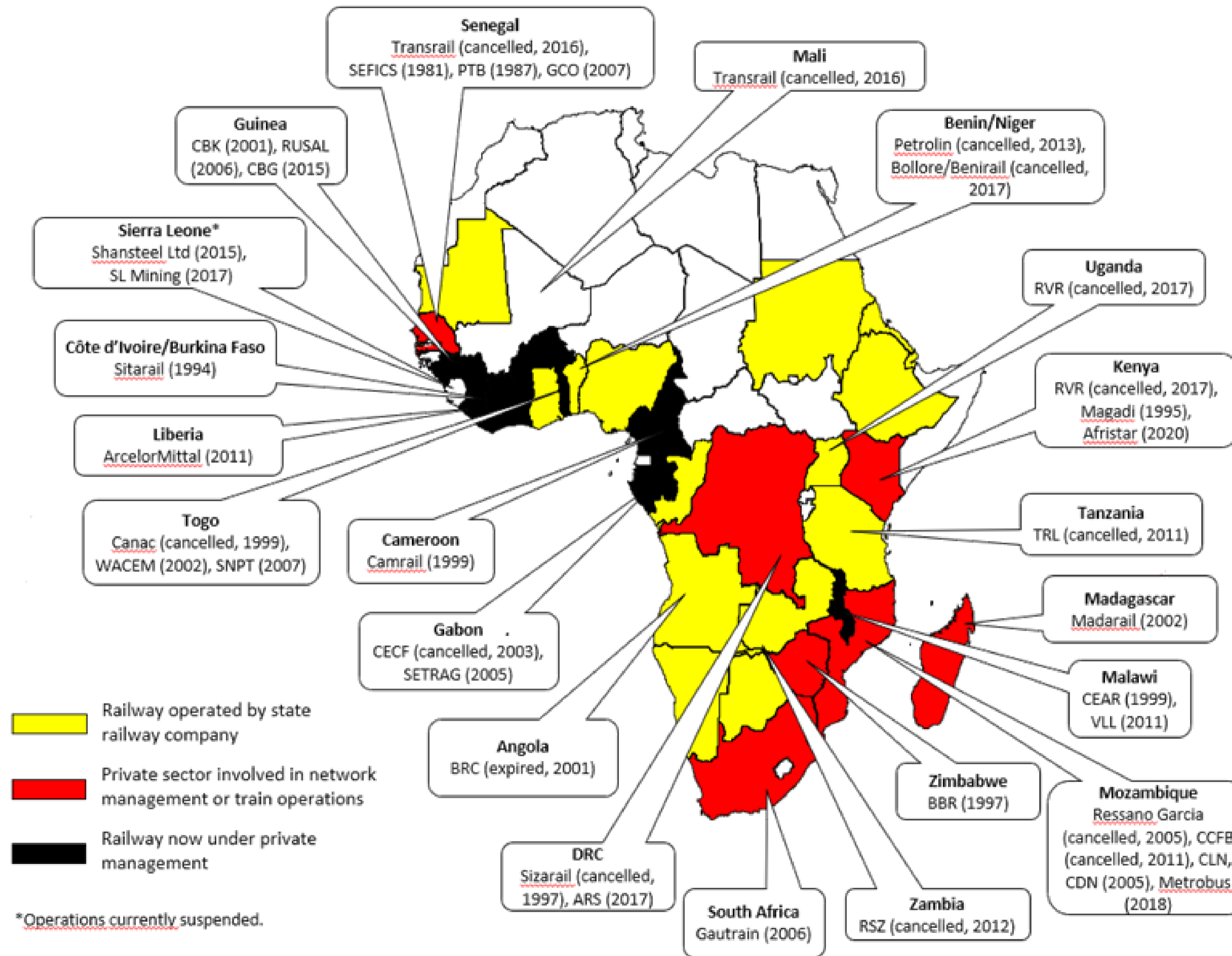
China Hajia Railway: The project supported the construction of a 343 km-long, electrified, mixed-use (passenger and freight) rail line between Harbin and Jiamusi.

China Nanchang Urban Rail: The project finances construction and equipment for urban rail Line 2 (24 km and 21 stations), as well as technical assistance to improve ridership levels, increase land value around stations.



Source: <https://treasury.worldbank.org/en/about/unit/treasury/ibrd/ibrd-green-bonds#3>

Rail Concessions in Africa

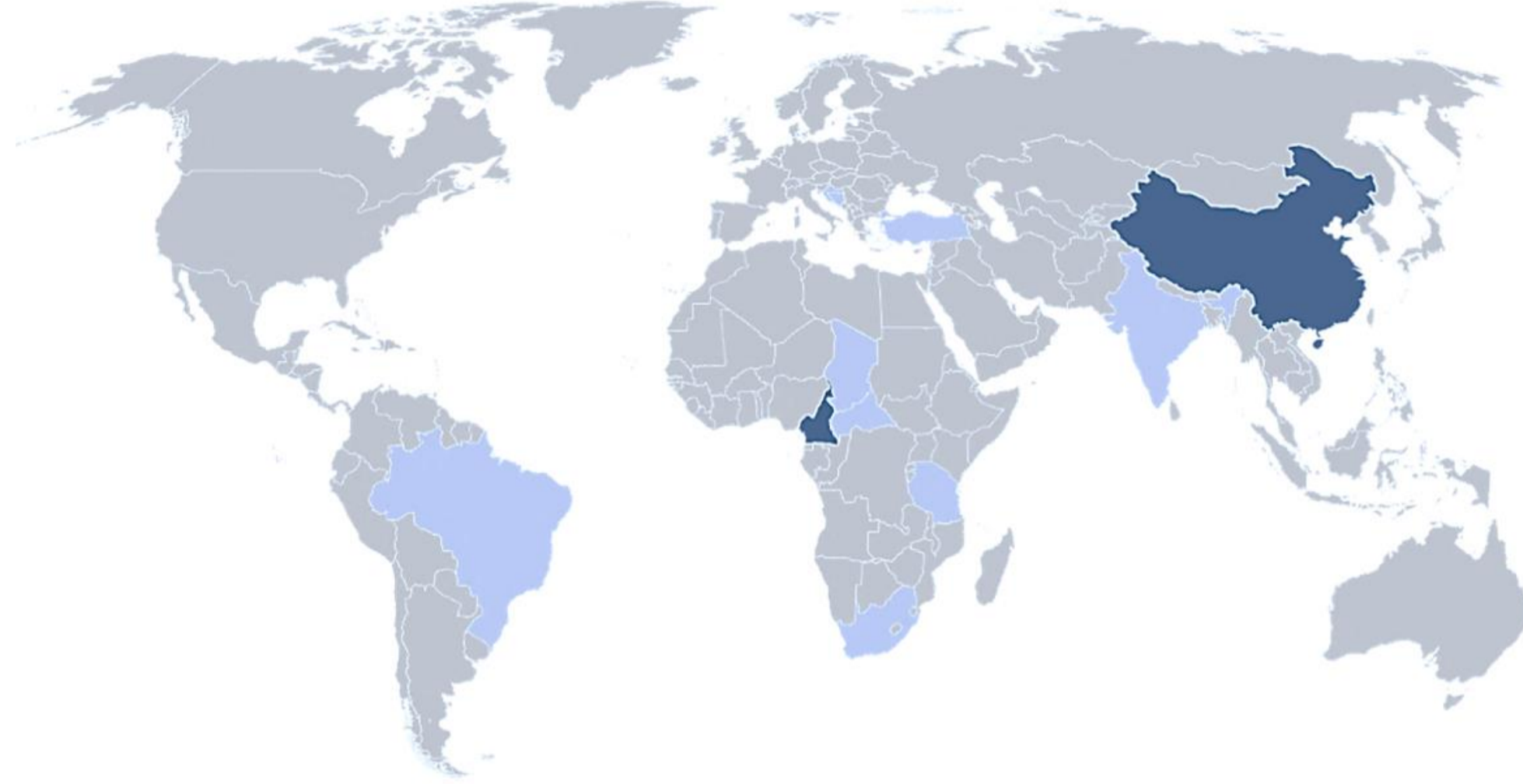


World Bank support for Rail

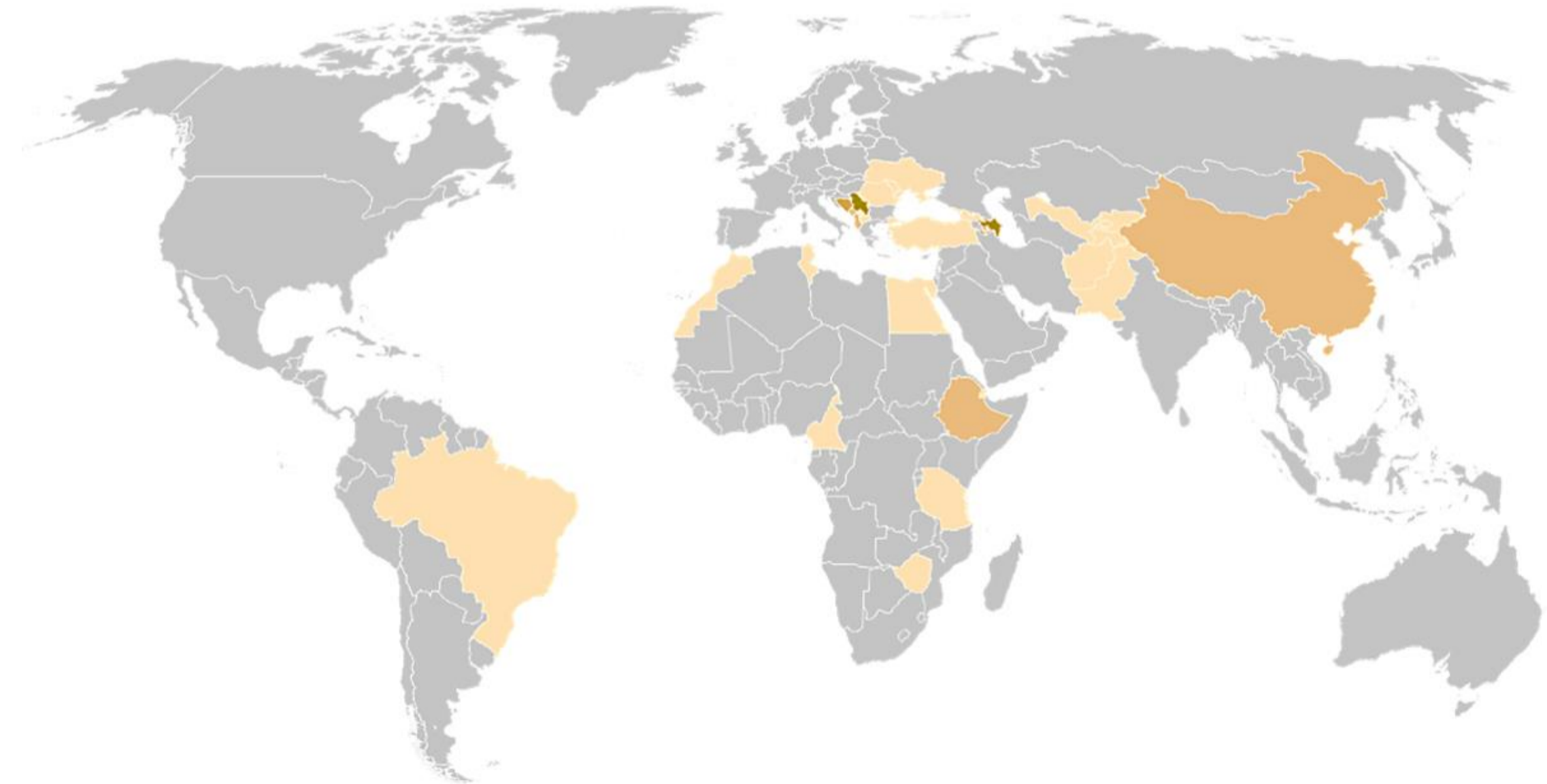


Current Railway Sector Lending

Active Railway IPFs: 11 Projects; ~\$2.4 bn



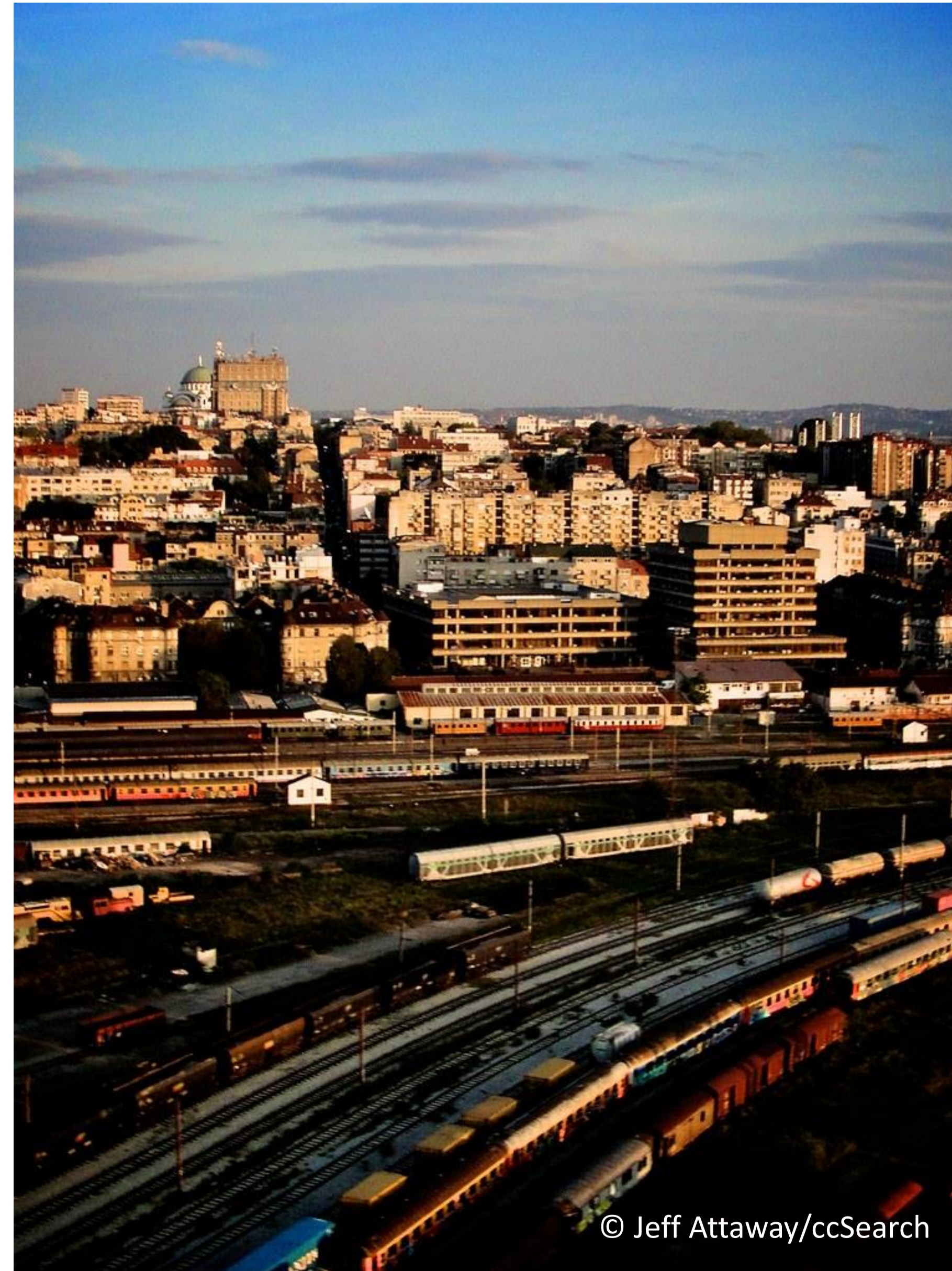
Active Railway ASAs: 22 activities; ~\$6.7 M



World Bank focus:
increase **Climate Co-
Benefits**

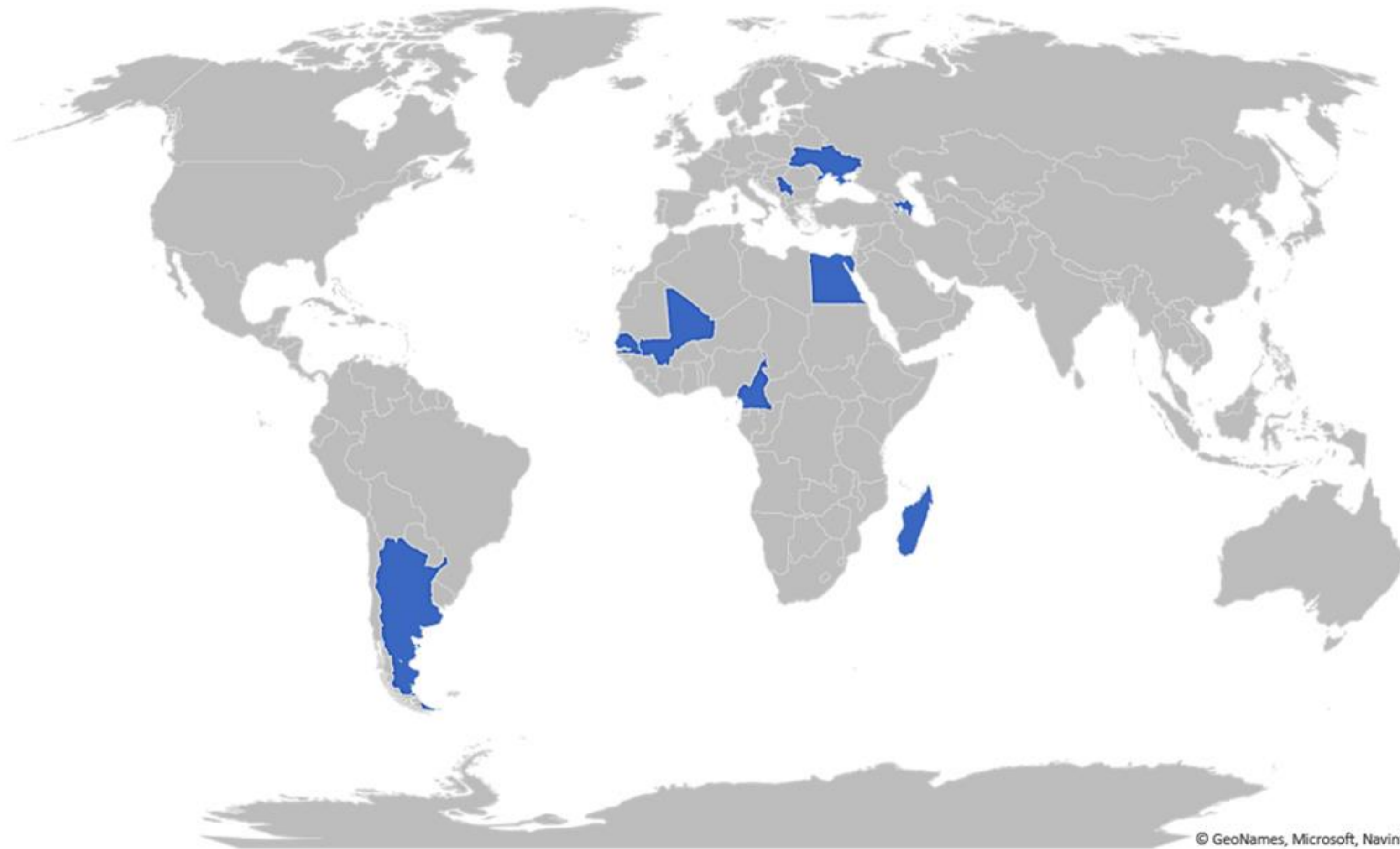
- ▶ Increased emphasis
on **Railways** as low-
emission mode

Example:
**Serbia Railway
Modernization Project**



Railway Lending Pipeline

Pipeline Railway IPFs: 8 Projects; ~\$2.1 bn



Railway Resources

[Railway Reform Toolkit](#)

[Urban Rail Handbook](#)

[China High Speed Rail Development](#)

[Railway Financing e-learning](#)

[The Rail Freight Challenge for Emerging Economies: How to Regain Modal Share](#)

[Modern Railway Services in Africa: Building Traffic – Building Value](#)

An aerial photograph showing a long train crossing a bridge over a river. The surrounding landscape is densely forested with green trees. The text "Thank you!" is overlaid in the center of the image.

Thank you!



Q&A



Said
Chandid

CONCLUSION