**TC3.5 Survey – March 2025**

**Who we are**

This survey is organized by Technical Committee 3.5 of PIARC (World Road Association).

PIARC was founded in 1909 as a non-profit, non-political association. Our goal is to organize the exchange of knowledge on all matters related to roads and road transport. We count 125 governments as members, as well as regions, groups/companies, and individuals. The Association mobilizes the experience and knowledge of 1,200 experts from more than 80 countries in 20+ Technical Committees and Task Forces.

Our knowledge products include reports, online manuals, international seminars and Congresses, etc. [www.piarc.org](http://www.piarc.org)

**Technical Committee 3.5 “Road infrastructure for road transport decarbonization”**

This committee shares information from road agencies to accelerate deployment of best practices and avoid missteps by sharing lessons learned. The purpose of this TC includes sharing knowledge on modern technologies and policy consideration to introduce electric roads. There is also the need to produce more green energy among the nations, and the road sector has the possibility to contribute to energy production by deploying smart energy solutions on and along the roads. It is important to learn more about these possibilities.

Knowledge of the irreversible damaging consequences of climate change has resulted in global acceptance of the need to reduce carbon emissions in all sectors of human activity, including the road sector, which is one of the largest contributors to carbon emissions. However, as efficient transport is vital to national economic growth, actions to reduce carbon emissions must not negatively impact the development and maintenance of high-quality road infrastructure, particularly for LMICs.

**Aim of the survey**

The survey is intended to obtain some initial data on road administration plans to achieve carbon neutrality. In addition, we would also like to identify relevant stakeholders who would be happy to collaborate further in providing information on this issue.

The outputs from the survey will serve to produce a technical report including recommendations to achieve carbon neutrality. The final report will be available free of charge once the study is concluded.

We expect the input from road authorities and transport authorities, road operators, and experts from within consultancies and universities.

**Notes**

Please contribute your answers by filling in this word document and send it by email to james.grenfell@ntro.org.au. We estimate that it takes 45-60 minutes to answer the whole survey.

**Deadline**

Your answers are expected before Monday 7th July.

**Definitions**

* Net zero carbon***:******reduces carbon emissions to as close to zero as possibl*e**. Any small amount of remaining emissions is then offset by absorption in natural carbon sinks such as forests or the use of new technologies such as carbon capture.
* Carbon neutrality*:* ***Balancing carbon emissions by ‘offsetting’,*** i.e., separately removing carbon in the atmosphere from emissions
* **Electric Road Systems (ERS)**: transportation solutions that **enable the transfer of electric power to electric vehicles (EVs)** while in motion through conductive or inductive charging technologies integrated into roadways. ERS can deliver sufficient power to propel the vehicles and, depending on each vehicle’s power demand, charge the battery with any surplus energy.
* **Near-road infrastructure:** any off-road infrastructure or asset in the roadside corridor owned or controlled by the transport agency or authority (e.g. safety barriers, noise walls, embankments and earthworks)
* **On-road infrastructure:** any infrastructure which is part of pavement structure (e.g. structural pavement layers, traffic lights and culverts).
* **Overhead conduction:** ERS charging technology based on catenary cables.
* **In-road conduction**: ERS charging technology based on conductive rails integrated in the road structure at its surface.
* **Greenhouse gases (GHGs)** are gases in the atmosphere that trap heat and contribute to global warming. The main GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and water vapor (H2O).
* **Life cycle assessment (LCA)**, also known as life cycle analysis, is a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.
* **Low and middle-income countries (LMICs)** are classified by the World Bank based on their gross national income (GNI) per capita, with low-income countries having a GNI per capita of $1,035 or less, and lower-middle-income countries between $1,036 and $4,085.
* **Private or public utility**: organization that provides essential services like electricity.
* Technology Readiness Level (TRL): ***is a measurement system that assesses how mature a technology is***. Definitions of TRLs are proposed below:

TRL 1: Basic principles observed and reported
TRL 2: Technology concept formulated
TRL 3: Analytical and experimental proof of concept
TRL 4: Technology validated in a lab
TRL 5: Technology validated in a relevant environment
TRL 6: System/subsystem model validation in a relevant environment
TRL 7: System prototype demonstration in an operational environment
TRL 8: Actual system completed and service qualified
TRL 9: Actual system proven in operational environment

**Contact**

If you need more information about this survey, please contact: james.grenfell@ntro.org.au
Thank you for your input.

Technical Committee 3.5 of PIARC

# Demographic Questions

## Question 0.1

Please select your Organisation type:

|  |
| --- |
|[ ]  Ministry of transport |
|[ ]  Government (other) |
|[ ]  National agency with road and transport expertise, government advisor |
|[ ]  Research institute / University |
|[ ]  Technology Manufacturer (other) |
|[ ]  Electricity supplier (Electricity Production) |
|[ ]  Power grid company (Electricity Distribution) |
|[ ]  Road owner |
|[ ]  Road operator |
|[ ]  Electric vehicle charging/Alternative fueling technology provider |
|[ ]  Electric vehicle charging/Alternative fueling operator |
|[ ]  Freight Operator |
|[ ]  Other (please specify) |

## Question 0.2

What Country is your Organisation based in?

## Question 0.3

Are you/Is your organisation a member of PIARC?

[ ] Yes

[ ] No

## Question 0.4

Do you agree to be contacted by PIARC?

[ ] Yes

[ ] No

If you replied “yes”, could you please enter your email address?

# Policy

## Question 1.1

Does your country/state/province have a target date for achieving Net Carbon Zero?

[ ] Yes

[ ] No

If yes, what date is set?

If possible, please provide a link to any published strategy or supporting literature

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.2

Does your country/state/province have a target date for achieving net carbon zero in the road sector?

[ ] Yes

[ ] No

If yes, what date is set?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.3

Are target dates for achieving net carbon zero specified for heavy vehicles/commercial transport (including light commercial vehicles)?

[ ] Yes

[ ] No

If yes, what date is set?

and light/private vehicles?

[ ] Yes

[ ] No

If yes, what date is set?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.4

Does your country/state/province have a target date for achieving carbon neutrality?

[ ] Yes

[ ] No

If yes, what date is set?

If possible, please provide a link to any published strategy or supporting literature

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.5

Does your country/state/province have a target date for achieving carbon neutrality in the road sector?

[ ] Yes

[ ] No

If yes, what date is set?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.6

If applicable, does your strategy address any of the following?

[ ] Street Lighting

[ ] Fleet vehicles (e.g. cars, vans, trucks, used by road administration to undertake general operations tasks. To include vehicles such as snowploughs and gritter vehicles, but excluding plant for construction and maintenance and emergency service vehicles)

[ ] Road Maintenance

[ ] Road Construction

[ ] Vehicles using network

[ ] Offsetting emissions

[ ] Mineral extraction for (low emission) vehicle production (e.g. production of battery (lithium) and motor components (rare earths))

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.7

Do you ask your contractors (e.g. construction contractors, road maintenance contractors, toll-road operators) / supply chain to measure / manage carbon?

[ ] Yes

[ ] No

If yes, which types of contractors/ supply chain partners?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.8

If applicable, please tell us about any innovative approaches to reduce carbon that you would like to highlight from your country / state / province:

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.9

In your country / state / province, please tell us about activities specifically related to decarbonizing in the road sector for the next 2-5 years. Could you summarize the core aspects of this policy, in terms of programs, financing, etc.? Please consider general transport policy including restrictions on vehicles based on emissions, private cars, commercial vehicles, intermodal hubs, urban transport, and road pricing

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.10

What actions does your country/state/province aim to take to ensure that the targets are achieved? Examples are:

- economic incentives to adopt electric vehicles,

- economic incentives for the construction of public/private charging infrastructure,

- reduced speed limits on roads,

- blending biofuels in fossil fuels at the point of sale,

- regulating resource extraction/use of raw materials for electric vehicle production,

- carbon pricing.

Please add any information you feel is relevant or any additional comments you might have here:

## Question 1.11

Would you be willing to have a follow up discussion about your answers to these policy questions?

[ ] Yes

[ ] No

Please provide contact information for the person we may contact and the topics they could be interviewed on:

# Electric Road Systems (ERS)

In alignment with PIARC’s TC 3.5 goal of sharing information about best practices for decarbonizing the road transportation industry, this survey aims to gather insights on current deployment activities, perceptions, and policy considerations regarding electric roads.

## Question 2.1

How familiar are you with current Electric Road Systems technologies and their applications?

[ ] Very familiar: I know what ERS are and very aware of the advantages and challenges of the different technologies. I am also knowledgeable in one or more use cases or studies made on ERS in my country or region.

[ ] Somewhat familiar: I know what ERS are and aware of some applications.

[ ] Not familiar at all, this is all new to me.

## Question 2.2

Which ERS technology (inductive, overhead conduction, in-road conduction) are you most familiar with? Please answer the following questions with this charging technology in mind (if you have expertise in multiple ERS types, you may wish to answer Question 2.4 and 2.6 for each ERS type considered).

If you are equally familiar or unfamiliar with all three charging technologies, please choose “ERS in general” and refer to the concept of ERS when answering this questionnaire.

|  |  |
| --- | --- |
| **Charging technology** | **Choice** |
| Inductive (dynamic) | [ ]  |
| Conductive overhead (dynamic) | [ ]  |
| Conductive in-road (dynamic) | [ ]  |
| ERS in general | [ ]  |

## Question 2.3

To the best of your knowledge, please rate the potential impact of Electric Road Systems on the current road transport system if they were to be deployed to their full potential and capacity in your region.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Large scale deployment of ERS impact on... | SignificantAdverseImpact | AdverseImpact | NoImpact | MinimalBenefit | SignificantBenefit |
| Greenhouse Gas Emissions (Lifecycle Analyses)  | [ ]  | [ ]  | [ ]  | [ ]  | [ ]  |
| Local Air Quality | [ ]  | [ ]  | [ ]  | [ ]  | [ ]  |
| Operation Costs for RoadAdministrators (e.g. source of income or additional costs) | [ ]  | [ ]  | [ ]  | [ ]  | [ ]  |
| Vehicle Operating Costs (fuel costs, maintenance, etc.) | [ ]  | [ ]  | [ ]  | [ ]  | [ ]  |
| Vehicle Capital Costs (sales price) | [ ]  | [ ]  | [ ]  | [ ]  | [ ]  |
| Noise | [ ]  | [ ]  | [ ]  | [ ]  | [ ]  |

## Question 2.4

What are the top challenges you foresee in full-scale deployment of Electric Road Systems?

(Please assign a level of challenge to the following from 1-9, with **1 being the most significant challenges** and 9 the least significant ones in your country or region. Please assign the same level of challenge to a maximum of 3 items on the list).

|  |  |
| --- | --- |
| **Challenge** | **Rating** |
| Vehicle Costs | Choose an item. |
| Installation Costs (road infrastructure, new road infrastructure or integration in existing one) | Choose an item. |
| Maintenance Costs (road infrastructure) | Choose an item. |
| Installation Costs (vehicles, retrofit or modifying the fabrication chain) | Choose an item. |
| Maintenance Costs (vehicles) | Choose an item. |
| Interoperability of the technologies proposed by different providers (ex. Between two different fabricants of inductive or conductive solutions) | Choose an item. |
| Impact on Road Infrastructure | Choose an item. |
| User Acceptance and Public Opinion | Choose an item. |
| Competition with other concepts, such as fast charging and hydrogen-powered vehicles | Choose an item. |
| Technical Feasibility | Choose an item. |
| Electricity Production  | Choose an item. |
| Electricity Distribution | Choose an item. |
| Safety and Security | Choose an item. |
| Regulations | Choose an item. |
| Business Models | Choose an item. |
| Reliability and Availability of the Network | Choose an item. |
| Ownership  | Choose an item. |
| Political Influence | Choose an item. |
| Other | Choose an item. |

## Question 2.5

How developed are the ERS in your organization/country? Please choose only one option.

[ ] Debate about ERS has not started / Not aware of any projects or discussions on ERS in my country or region.

[ ] Feasibility studies are being carried out at research centers/universities, by policy makers or by private road owners.

[ ] Policy makers are considering ERS.

[ ] Full-scale ERS projects are in the design process.

[ ] Full-scale ERS projects are being trialed or in short-term deployment.

[ ] Full-scale ERS projects have been deployed.

## Question 2.6

What incentives or policies would encourage full scale ERS deployment in your country or region?

(Please assign a level of impact to the following from 1-9, with **1 being the most significant impact** and 9 the least significant ones in your country or region. Please assign the same level of impact to a maximum of 3 items on the list).

|  |  |
| --- | --- |
| **Incentive** | **Rating** |
| Tax incentives and credits for investors for infrastructure deployment | Choose an item. |
| Government grants and funding programs for infrastructure deployment | Choose an item. |
| Subsidies for electric vehicles for electric vehicles deployment (both HGV and LV) | Choose an item. |
| Regulatory support and streamlined permitting processes | Choose an item. |
| Infrastructure development funding from international organizations | Choose an item. |
| Legislation aimed at banning the sale or circulation of Internal Combustion Engine (ICE) vehicles, or imposing heavy taxes on ICE operations | Choose an item. |
| Public tenders for public-private partnerships for infrastructure deployment (concessions) | Choose an item. |
| Public tenders for the electrification of public vehicle fleets | Choose an item. |
| Educational campaigns to raise public awareness and acceptance | Choose an item. |
| Research and development funding for ERS technology improvement | Choose an item. |
| Other (please specify) |  |
| a) |  |
| b) |  |

## Question 2.7

**Please specify** what do you think the role of your local and national governments should be at the different stages for the full-scale deployment of ERS in your region/country:

Open answer

Please add any information you feel is relevant or any additional comments you might have here:

## Question 2.8

In your country or region, what business models do you believe are most viable for the development and operation of ERS?

[ ] Government and Utility-led investment models (free use of the road, private or public utility charges the use of the ERS, pay-per-use system)

[ ] Private pay-per-use models (free roads, access to ERS services through a ERS service provider, pay-per-use system)

[ ] Subscription-based models (free roads, fix rate for accessing ERS services through a ERS service provider)

[ ] Public-private partnerships (toll-roads, private concessions that provide both road and ERS paying-services)

[ ] Other? please develop:

|  |
| --- |
| Please add any information you feel is relevant or any additional comments you might have here: |

## Question 2.9

Would you be willing to further discuss your experiences with full-scale ERS deployment with the project team?

[ ] Yes

[ ] No

Please provide contact information for the person we may contact and the topics they could be interviewed on:

# Positive Energy Roadways

## Question 3.1

What kind of technologies are you using to generate energy from the road infrastructure (either **on-road** or **near-road**)? (choose as many as are applicable)

|  |
| --- |
|[ ]  * 1. Wind
 |
|[ ]  * 1. Solar
 |
|[ ]  * 1. Geothermal
 |
|[ ]  * 1. Piezoelectric
 |
|[ ]  * 1. Other
 |
|[ ]  * 1. None
 |

## Question 3.2

What kind of energy are they producing?

|  |
| --- |
|[ ]  1. Electricity
 |
|[ ]  1. Heat (or cooling)
 |
|[ ]  1. Other
 |

## Question 3.3

Are these systems

|  |
| --- |
|[ ]  1. Business as usual?
 |
|[ ]  1. In trial?
 |
|[ ]  1. In development?
 |

## Question 3.4

What is the TRL (Technology Readiness Level)?

## Question 3.5

What do you see as the barriers to more widespread implementation?

|  |
| --- |
|[ ]  1. Upfront costs
 |
|[ ]  1. Safety implications
 |
|[ ]  1. Environmental implications
 |
|[ ]  1. Policy
 |
|[ ]  1. Lack of knowledge
 |
|[ ]  1. Market readiness
 |
|[ ]  1. Unclear organizational responsibilities
 |
|[ ]  1. Other (please provide more details)
 |

## Question 3.6

How are you measuring their sustainability/decarbonization potential? Can you elaborate on the technique or share a link to this method?

|  |
| --- |
|[ ]  1. Economic impacts
 |
|[ ]  1. LCA/GHG emissions savings
 |
|[ ]  1. Social impacts
 |
|[ ]  1. Multifactorial
 |
|[ ]  1. Other
 |

## Question 3.7

Are systems given ratings based on energy efficiency or sustainability? Or do you have a way to assess the relative benefits of different products or technologies?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 3.8

Are there policies in place to encourage uptake of such technologies? If so, can you share a link to those policies?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 3.9

Are there (government) incentives in place to encourage research and development into such systems? If so, what are they and were they successful initiatives?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 3.10

Is there funding in place to encourage their implementation? If so, has it been used and did it lead to implementation?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 3.11

What happens at end of life to decommission or rehabilitate such systems? Is end-of-life considered in the LCA of the project?

Please add any information you feel is relevant or any additional comments you might have here:

## Question 3.12

Do you have any case studies that you can share on the topic of such technologies that have been trialled in your country/jurisdiction?

**Question 3.13**

Please add any information you feel is relevant or any additional comments you might have here:

Would you be willing to have a follow up discussion about your answers to these Positive Energy Roadway questions?

[ ] Yes

[ ] No

Please provide contact information for the person we may contact and the topics they could be interviewed on: