



ASSOCIATION MONDIALE DE LA ROUTE
WORLD ROAD ASSOCIATION
ASOCIACIÓN MUNDIAL DE LA CARRETERA

LA GRANDE ARCHE
Paroi Sud - 5e étage
92055 La Défense Cedex - France

T +33 1 47 96 81 21
@ info@piarc.org
w www.piarc.org

Positive Energy Roads

CALL FOR PROPOSALS

Deadline for submission of proposals: February 15th, 2019

1 PURPOSE AND STRATEGIC SIGNIFICANCE

1.1 Introduction

The World Road Association (PIARC) has established a Special Projects fund to enable it to respond outside the usual four years Technical Committee cycle to emerging issues and priorities identified by its members. This paper is a Call for Proposals to conduct the “Positive Energy Roads (PER)” Special Project.

1.2 Preliminary definition of Positive Energy Road (PER)

The study should propose a definition for PER. As a starting point for the call for proposals, the PER definition would be: A PER is a road infrastructure that produces more energy from renewable sources or traffic lost of energy than it consumes during operation phase or during construction and operational phases.

1.3 Purpose

The purpose of this proposed project is to assess feasibility and future development of Positive Energy Roads through the analysis of a business model from Road Authorities perspective, including which technologies bring higher advantages to achieve an affordable business model for road administrations depending on local context.

In recent years various studies have attempted to leverage large road surfaces and road structures as potential sources of energy. Similar to positive energy buildings, positive energy roads aim to produce more energy (electricity, heat, etc.) than consumed during their lifecycle including construction and operational phases. If the time needed to become energy-positive is relatively short, then such roads can be considered autonomous in terms of their energy needs. This approach is directly related to the impact of climate change on road construction and road infrastructure lifecycles, without forgetting the increasing costs of road construction and maintenance.

Following a theoretical and exploratory phase, demonstrations and experimental projects have been built in numerous countries, including the United States, France, the Netherlands and Germany, among others. This multidisciplinary research unites several elements with an interest for PIARC and its members, including technological and engineering innovations in domains including the environment and the economy. It crosses several of PIARC themes of expertise: road infrastructure management and finance, road infrastructure design and maintenance, climate change adaptation and mitigation and environment considerations.

In a global context in which all countries are currently seeking renewable energy sources, energy positive roads become particularly interesting. In addition, the winter specifics of such projects will be of special interest to member countries with long and severe winter conditions.

2 METHODOLOGY AND APPROACH

2.1 Description of Positive Energy Roads with regard to their TRL (Technology Readiness Level), their benefits and their challenges and their potential business model

1. The study should propose a clear definition of Positive Energy Road (PER) including different levels of PER for instance PER over operational phase, and PER including construction and operational phase.
2. Assessment of different technologies (using different sources of energy production: photovoltaic, photothermal, geothermal, kinetic energy, wind power...), their association to different road elements (pavements, sound barriers, etc.) and the use purpose of the produced energy (road lighting, electrical vehicles recharging, tunnels ventilation, de-icing, powering road ITS equipment, powering the general energy network, other road operational tasks...) regarding their TRL and description of the players involved in the development including the energy storage aspects.

Different technologies of energy production are developing in universities, research institutes, industries and companies (both SMEs and large companies). There are different statements and reports of their functionality and how close they are to market introduction. Assessment of their TRL give a lead to in what timeframe we can expect Positive Energy Roads to be a part of the road transport system. The task is to describe different Positive Energy Roads regarding to their TRL.

3. Each technology has its benefits and challenges. The task is to describe the benefits and challenges (including costs) of each of the technologies, and provide potential use depending on aspects such as climate, geography, local energy demand, road traffic, road infrastructure characteristics...
4. The different technologies are developing in different parts of the world and are fostered by different players. The task is to describe players around the world with regard to their involvement, incentives and their ambition in Positive Energy Roads development.
5. The business model of Positive Energy Roads is still to be assessed, above all to cover the huge investments on infrastructures, in energy storage and in connection to energy networks, but also the operation. Different players may be involved, not only the road owners and operators but also power supplier companies. The task is to describe the different scenarios and business models that are under discussions among the actors.

2.2 Comparison of different Positive Energy Roads technologies with regard to their pros and cons and the compatibilities among them

The task is to describe Positive Energy Roads technologies with regard to their pros and cons in the following fields taking into account their efficiency and power capacity for each energy purpose:

- Their possibilities to be used in different scenarios, climates and locations.
- Their potential to reduce use of energy and emission of greenhouse gases over the lifetime of the road infrastructure.
- Their potential to contribute to some energy needs on the road infrastructure such as lightning, charging of electric vehicles (static charging or dynamic charging on the road, cf. PIARC Special Project on Electric Roads <https://www.piarc.org/en/order-library/29690-en-Electric%20road%20systems:%20a%20solution%20for%20the%20future.htm>), de-icing operations, operational tasks such as ITS, tunnels ventilation... or to provide energy back to the general energy network.
- The safety and security issues of each system.
- The reliability, failure scenarios and life expectancy
- Environmental impact such as visual impacts.
- Land requirements.
- Operations and maintenance (e.g. winter operations with deicing issues, additional cost in pavement, bridges and tunnels maintenance due to energy mechanism, difficulties/limitations to the normal routine maintenance and major repairing).
- Intellectual Property Rights (IPR) connected to each Positive Energy Roads technology.
- The prerequisites for each Positive Energy Roads operability such as regulations, road infrastructure and payment systems.
- Their potential to be combined with other technologies to achieve PER.
- Their potential conflict with other technologies foreseen to be implemented on roads (such as dynamic charging, infrastructure sensors or monitoring, V2I and X2I communications, etc.)
- All the requirements that could be drivers or impediments to the actual deployment of these Positive Energy Roads. This includes cost elements on the infrastructure, technology development, safety of users, safety of pedestrians, compatibility with existing infrastructure such as bridges, tunnels, etc.
- Brief comparison with other energy sources around the world and particularly in the countries where PER have been implemented.

It is essential that the study focuses on the needs of PIARC members, especially national road administrations and road operators. This study should provide high-level guidance that will help them make decisions such as investments on infrastructure, support to innovation, test beds, partnerships, etc.

2.3 Business model from Road Administration perspective

- The report should conclude on feasibility and future development of Positive Energy Roads through the analysis of a business model from Road Authorities perspective, including which technologies bring higher advantages to achieve an affordable business model for road administrations depending on local context.

2.4 Approach

Proposals in response to this Call should use the template “Answer to the Call for Proposals for the Positive Energy Roads PIARC Special Project”. The answer should include a description of the approach to be taken to collect and compile the information being requested. The proposal should answer the following questions about the tenderer’s approach:

1. How will the study collect international information regarding development, production and use of different technologies for PER?
2. How will the study collect PER examples and case studies?
3. How will the study identify PER successes or areas for improvement?
4. How the study will analyze the impact to PER of other energy sources in each country?
5. How the study will analyze the capability of PER to contribute to energy need on the infrastructure: lightning, charging of electric vehicles, etc. and beyond such as house heating, public lighting, general power network?
6. How the study will analyze a business model from Road Administration perspective?
7. What will be the study milestones in terms of deliverables? What will be the approach for monitoring the progress of the study and to include the inputs from the Project Oversight Team (POT)? It is recommended to organize monthly videoconference, and to share with the POT regularly intermediate deliverables asking for feedback.

2.5 Key areas

Please describe the key areas for consideration in the framework:

1. What will be the study’s means of collecting information from different areas of road administration, academia and relevant industry (i.e. planning, financing, asset management, design, construction, operations, and maintenance) from international road sector including successful and unsuccessful case studies?
2. Low and middle income countries (LMIC) represent an important share of PIARC membership and it is crucial that their needs are addressed within PIARC activities. How will case studies from LMIC be gathered and how their needs will be taken into account?

3 FINAL DELIVERABLES

The final deliverables will comprise:

1. A **report** presenting the different technologies to achieve Positive Energy Roads and its contribution to decarbonization of road infrastructure. What kind of road infrastructures are targeted? What measures are used or suggested? Thoughts about changes in the road environment. Which players are primarily involved? Thoughts about ownership and changes in roles.

The general structure of the report should be as follows (adjustments with the agreement of the POT are acceptable):

1. Introduction: project background, objectives and scope.
2. Methodology and approach.
3. Description of PER technologies with regard the energy source, road elements involved, produced energy use, their TRL and the players involved, taking into account local characteristics.
4. Comparison of different PER technologies.
5. Business models for road administrations.
6. Conclusions of the study, including the future of PER.
7. Recommendations, for road administrations, LMIC and PIARC.
8. References
9. Appendices

- Taking into consideration the LMIC in the study: LMIC are key membership of PIARC and their needs, opportunities and challenges should be addressed. Each chapter of the report should make reference to LMIC when relevant. A chapter inside the report's conclusions with possible **specific recommendations for LMIC** should also be considered.

- The specific recommendations for road administrations and road operators are a key element of the report, they should be relevant for high decision makers and operators.

- The specific recommendations for PIARC could include recommendations to liaise with specific industries, take part in existing conferences and/or create a new technical committee / task force on the subject.

2. Presentation material to present the results of the Special Project at PIARC Council meeting on October 4th, 2019 in Abu Dhabi.
3. Contribution to the Session on the Special Projects inside the World Road Congress in Abu Dhabi 6-10 October 2019.

The final products will be submitted in electronic form in English. The report will be owned by PIARC and it will acknowledge the contribution of the external consultant. The report will use the Word template provided by PIARC. The World Road Association will ensure translation into French and Spanish. In addition, they will make it available for free in the World Road Association's Virtual Library to ensure a large world outreach for the report.

4 KEY DATES

The proposal should also include a proposed draft of a work schedule. The schedule should identify dates or time frames for accomplishing major milestones in the project. The work schedule will include monthly videoconference meetings and dates or time frame for an interim product or products that allows adequate time for review and feedback prior to the final deliverable. The schedule must be completed, and final report should be delivered by September 1st, 2019, so PIARC can proceed to translation and dissemination of document in advance to participants to PIARC Council meeting and the World Road Congress.

These are some of the milestone to be included in the offer:

1st half of March: Kick-off videoconference meeting.

Intermediate milestones to be proposed by the tender.

2nd of September 2019: Finalization of the report in English

16th of September 2019: Finalization of Council presentation and Congress presentation.

4th of October 2019, Presentation at PIARC Council meeting

6-10th of October 2019, Presentation at the World Road Congress

5 PROPOSED BUDGET

Please provide a general budget for the project. The funding requested from PIARC should not exceed 30,000 Euros all taxes included (according to the French legislation PIARC is exempted of VAT). The budget should include a general itemization of the costs of the major work elements of the project.

Since a timing delivery of the outputs is at the essence of the Special Projects mechanism, late penalties could be applied if the external consultant fails to deliver the outputs in the proposed milestones. The framework to apply these penalties will be agreed with the tender before signing the purchase order based on the milestones scheduled included in the tender's proposal.

6 PROPOSED EXPERTS AND INTERNATIONAL NETWORK

The proposal should also include a description of the relevant expertise that qualifies the tenderer to undertake the project. Specifically:

1. Please describe any past or current work projects that relate to the subject of this proposal.
2. Please also identify the person or persons who will be working on this project, describing their roles and estimated contribution to the project, and providing information on their backgrounds, experience and expertise.
3. Please provide information about any other international network, other than the World Road Association, from which tender could be leveraged from.

7 PROJECT OVERSIGHT AND PROPOSALS EVALUATION

The project will be overseen by a project evaluation and steering committee called “Project Oversight Team” (POT) to select the preferred tender and assist in the development of the project. These experts will be drawn from PIARC membership and will include representatives from Technical Committees D1 Asset Management and E.2. Environment Considerations in Road projects and Operations and the PIARC Strategic Planning Commission and some member countries.

The POT will assess proposals and select the preferred tender on the basis of its assessment of:

- a) Technical approach and methodology (up to 35 points): how well tenders address the project objectives and deliverables and how effective and resilient is the proposed approach and methodology including collecting case studies internationally and addressing the needs of different PIARC member countries, such as LMIC;
- b) Proposed work plan including intermediate milestones (up to 15 points).
- c) Value for money offered by the tenderer (up to 20 points): including additional contributions leveraged by the proposal; and the time offered by different contributors of the tender’s team.
- d) Experience of the proposed team on the holistic vision of the road sector (up to 10 points)
- e) Experience of the proposed team on the PER sector (up to 10 points)
- f) International experience and network of the proposed team (up to 10 points)

The POT will oversee progress of the Project, including participating in periodic calls, reviewing interim and final products. The POT will also provide any relevant information from the PIARC work to the selected tenderer (e.g., information obtained from surveys) for use in the project. In addition to review and oversight by the POT, input may also be sought from the other members of Technical Committees and the PIARC Executive Committee and Strategic Planning Commission.

8 PROPOSAL SUBMISSION

Proposals should include the elements identified in this Call for Proposals.

Answers should use the Word template “Answer to the Call for Proposals for the Positive Energy Roads PIARC Special Project”.

Proposals should be submitted electronically in English to the World Road Association General Secretariat at:

info@piarc.org

no later than:

February 15th, 2019.

For any questions, please send E-mail to info@piarc.org