Create your **next move**

OCTOBER 16, 2017

PRESS KIT

EUROVIA INVENTS POWER ROAD®, THE POSITIVE ENERGY ROAD

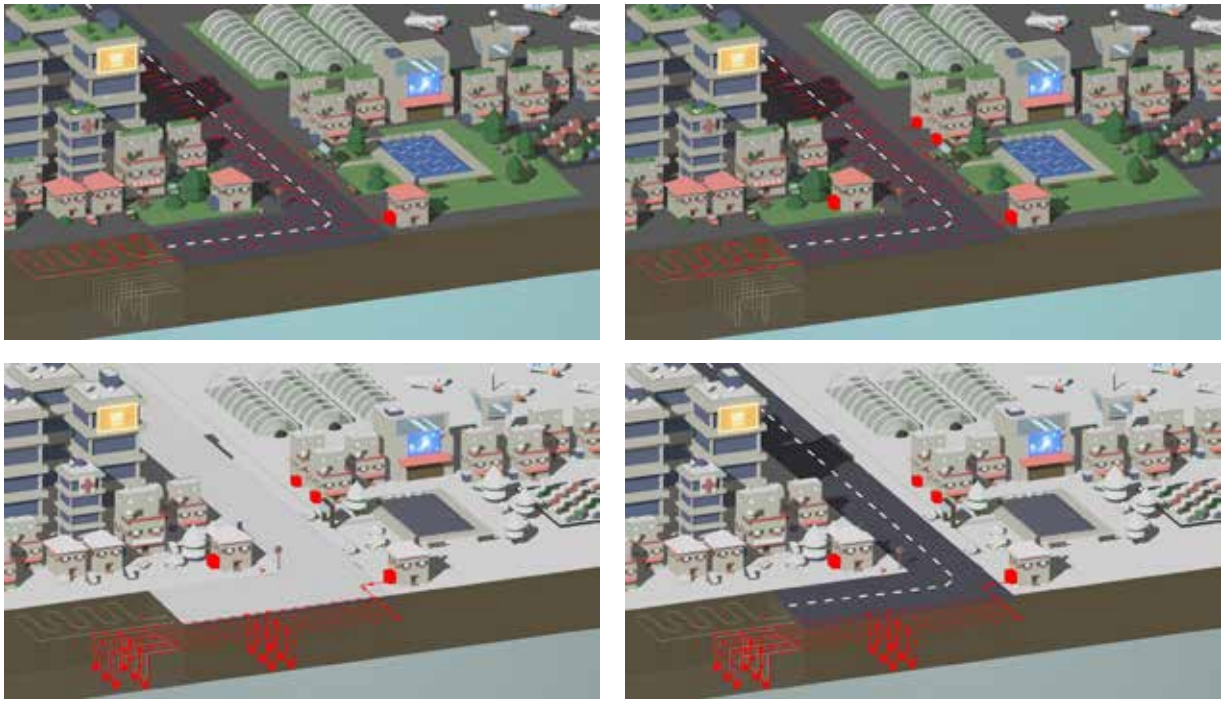
POWER ROAD®: HOW DOES IT WORK?

HEAT EXCHANGER INTEGRATED INTO THE ROAD

Power Road® is based on a simple concept: a road featuring all the regular safety, durability and recyclability characteristics of pavement with added heat energy production capacity obtained by capturing the sun's heat energy. This heat is stored and then used to heat surrounding infrastructure.
The application of this concept is based on the integration, in the upper layers of the road, of a heat exchanger consisting of tubes in which a heat transfer fluid circulates. Power Road® is reversible: it can operate either as a thermal energy collector that captures the sun's rays in the summer and converts them into heat or as a heat emitter, in particular to ensure the viability of the road in winter (snow and ice removal).

ENERGY EXCHANGES WITH SURROUNDING INFRASTRUCTURE AND BUILDINGS

Power Road® is integrated into the energy systems surrounding the road infrastructure in order to meet a local need. When operating as a solar thermal collector, i.e. in "summer mode," heat energy captured by Power Road® can be stored in the ground; this source of renewable energy can then power buildings and infrastructure located next to the road in order to heat them in the winter. There are many potential uses: heating of residential and tertiary buildings, industrial sites, pools, clean hot-water production, and more. In roadway thermal regulation mode, i.e. "winter mode," the heat available in the ground is used for snow and ice removal on the roadway, without the use of melting salts and thus reducing the environmental impact of road maintenance operations.



Depending on the application and use of Power Road®, the process may be associated with:

- **heat pump-assisted very-low geothermy** (horizontal heat collectors or vertical geothermal probes);
- **a solar heat pump** (combined "solar-assisted heat pump" solutions)
- **a source of low-carbon heat** (warm-temperature water loop, heat network, etc.)

The first tests of Power Road® conducted by Eurovia primarily concern applications related to snow removal.

This comprises:

- **an initial thermal screen**, positioned in the top ten centimetres of the roadway, when laying the surface layers of this roadway. It acts as a heat exchanger. It restores heat in order to melt snow and ice in winter.
- **a complementary geothermal collecting process;** geothermal energy can be collected, for example, by a set of horizontal tubes set up at a depth of approximately one metre or a field of vertical geothermal probes with heat exchange and/or storage capacity. The energy captured in the ground is used to heat up the road surface. This screen is integrated during the earthwork for the roadway.
- **a heat pump that recovers heat from the ground and restores it to the roadway.** In particular, it is activated during snowfall to heat up the road surface and eliminates the need for heavy winter maintenance operations.

AN INNOVATION WITH STRONG POTENTIAL IN LINE WITH ENERGY TRANSITION CHALLENGES

THE ROAD: AN UNTAPPED SOURCE OF ENERGY

The potential for developing Power Road® is commensurate with the very strong presence of road infrastructure. For the most part, these roads are surfaced with black bituminous pavement, the temperatures of which can reach 60°C at the surface and 40°C at 10 cm in depth, mainly under the effect of the sun. Scientific studies have shown that this hitherto untapped thermal solar energy can be captured. They evaluate the capturing potential at between 150 and 250 W/m² for sun radiation of 250 to 1000 W/m², depending on the geographical location and season.

CONTRIBUTING TO THE DEVELOPMENT OF RENEWABLE ENERGY

One of the main challenges of Power Road® is to develop the use of geothermics and thermal solar energy: the road thus becomes a producer and a vector of renewable heat, by limiting the use of fossil fuels, sources of greenhouse gas emissions. This challenge is completely in line with the goal set by the worldwide Energy Transition acts.
Power Road® is also contributing to the fight against climate change by helping reduce the effects of urban heat islands (UHI) by cooling pavements. This limits energy demands from air-conditioning systems.

PRODUCTION AND CONSUMPTION OF SHORT-CYCLE ENERGY

The road, in all its forms, is closely woven into the territory's social fabric, in particular when it comes to urban roads. With Power Road®, the road not only connects residents by allowing them to travel; it also connects them to renewable energy produced nearby using a short cycle that benefits from the close intertwining of transportation networks, activity areas and living spaces.

STORING ENERGY TO RESTORE IT LATER

A heat exchanger is naturally reversible. In summer, Power Road® captures thermal energy from the sun's radiation. Then, Power Road® transfers and stores this energy in the geothermal device. The energy stored can then be used in the winter to meet heating needs. The procedure is based on the inter-seasonal storage capacity of the geothermal device connected to the system, thus managing the phase shift between the availability of solar energy and heat requirements.
An induced effect of capturing solar energy is to cool the upper layers of the asphalt, which prevents the premature degradation caused by rutting. A consequence of this pavement "refreshment" is to mitigate the effects of urban heat islands (UHI); Power Road® prevents heat from accumulating in the roadway by capturing and storing it.

USES: FOUR EXAMPLES

ECO-NEIGHBOURHOOD

An eco-neighbourhood (residences, offices, businesses) uses a warm water loop for its heating, clean hot water, and air-conditioning needs. Different energy sources, including that constituted by Power Road®, are pooled to supply this warm water loop. During road infrastructure construction of the eco-neighbourhood (roadwork and car parks), the additional investment costs are limited to integrating the heat exchanger into the surface layers of the roadway.

POOL

A municipality wants to modify the water heating system for its municipal pool by integrating a source of renewable energy. The solution proposed by Eurovia: install the Power Road® system, consisting of the thermal collector integrated in the pavement and possibly connected to heat pumps, in the adjacent car park. A 120-space parking lot equipped with Power Road® can provide approximately 35% of the heating needs for a 25-m sports pool, a learners' pool and a wading pool.

LAND SUBDIVISION

When implemented during the creation of a subdivision, installation of the Power Road® heat exchanger in 1,000 m² of pavement can capture the equivalent needed to provide heat and hot water for 20 houses of 120 m² each, in accordance with Thermal Regulation RT2012. The complete device deployed by Eurovia combines a field of vertical geothermal probes for inter-seasonal storage of heat with the thermal solar collector in the pavement.

AIRPORT

When repairing taxiways and airplane parking areas in an airport with a surface area of 15 hectares, the Power Road® system is set up to ensure snow clearing from the runway while reducing winter maintenance operations, which typically require nearly 200 people and 40 pieces of heavy machinery. The solution includes the setting up of a probe field over a ground surface area of 3 to 4 hectares under the infrastructure or off-site.

TEST CASES

Power Road® can be used alone or in conjunction with existing storage and thermal systems. This technology is quite new and relevant from the standpoint of both overall energy system performance and economical value.

100% of the heating needs for a 70-m² housing unit.

REQUIREMENT: 2,100 kWh/year.
SOLUTION: — 1 heat pump-assisted probe installed 55 m deep.
— 25 m² of pavement (2 parking spaces or 5 m of 5-m-wide pavement).

100% of the heating and clean hot water needs for a 70-m² housing unit.

REQUIREMENT: 4,000 kWh/year.
SOLUTION: — 1 heat pump-assisted probe installed 75 m deep.
— 30 m² of pavement (1 parking space and 5 m of 5-m-wide pavement).

100% of the heating and clean hot water needs for a subdivision of twenty 120-m² houses.

REQUIREMENT: 6,900 kWh/year/house.
SOLUTION: — 20 heat pump-assisted probes installed 75 m deep.
— 1,000 m² of pavement:

- 500 m² of a parking lot, i.e. 2 parking spaces per house.
- 500 m² of pavement (100 m of 5-m-wide pavement).

100% of the heating needs for 1,000 m² of high-energetic-performance offices.

REQUIREMENT: 25 MWh/year.
SOLUTION: — 5 probes installed 75 m deep, assisted by a 25-kW heat pump.
— 300 m² of pavement, i.e. 25 parking spaces..

15% to 30% of the heating and clean hot water needs for an eco-neighbourhood of 55,000 m² (housing units, offices, hotel and businesses).

REQUIREMENT: 3 GWh/year.
SOLUTION: 500 m to 1 km of pavement. Power Road® contributes to powering a warm-temperature water loop.

100% of the heating and clean hot water needs for an eco-neighbourhood of 55,000 m² (housing units, offices, hotel and businesses).

REQUIREMENT: 3 GWh/year.
SOLUTION: 4 km of pavement.

Snow clearing of a 100-space parking lot (2,500 m² with traffic lanes).

REQUIREMENT: 200 W/m² for 25 days per year, i.e. 120 kWh/m²/year.
SOLUTION: 75 probes installed 100 m deep

Snow clearing of taxiways or a parking area of an airport (15 ha)

REQUIREMENT: 12 GWh/year.
SOLUTION: A field of probes over a ground surface area of 3 or 4 ha under the infrastructure or remotely..

30% of the heating needs of a municipal pool.

One 25-m sports pool, six lanes, 25 x 15 m, depth (> 1.80 m), one small learners' pool of medium depth (between 1.30 to 1.60 m) and one wading pool (25 m² with a max. depth of 0.40 m).
RECENT ENERGY REQUIREMENTS OF A POOL: 1,700 kWh/m² of basin area.
SOLUTION: 3,000-m² parking lot, i.e. 120 spaces.

100% of the heating needs for a 1,500 m² agricultural greenhouse

REQUIREMENT: 375 MWh/year.
SOLUTION: 500 m of 7-m-wide pavement.

TOWARD AN INDUSTRIALIZED PROCESS, WITH SPECIFIC AND PROVEN PERFORMANCE SPECIFICATIONS

INDUSTRIALIZATION AND COMPATIBILITY WITH "TRADITIONAL" ROADWORKS

The innovation approach launched by Eurovia along with its expert partners (see below) aims for a complete industrialization of the implementation of Power Road®, compatible with conventional roadwork machinery. Specifically, the industrial process will meet scheduling objectives: its implementation should not exceed the deadline for carrying out the work by more than 15% versus a "traditional" work site.
More generally, the current testing phase aims to define the conditions for its integration into the road production chain. Thus, Power Road® was designed to be compatible with the laying of warm and recycled mixes to reduce energy consumption and the quantity of aggregates used during pavement construction or renovation. As well, the tubes that make up the heat exchangers integrated into the roadway are 100% recyclable.

EXPECTED MECHANICAL AND ENERGY PERFORMANCE SPECIFICATIONS

The current tests aim to attain and scientifically validate specific performance specifications. Mechanically, pavement equipped with Power Road® will have the same performance specifications as "traditional" pavement: it will have the same durability, regardless of the type of traffic, including heavy trucks.
In terms of energy performance, the efficiency of solar capture is 10% greater than the sunlight received on the roadway. Collector performance qualification will allow this new renewable energy solution to be integrated into the dimensioning tools of thermal design firms.

ITINERARY OF AN INNOVATION

A FIRST SNOW REMOVAL DEMONSTRATOR

In 2013, a subsidiary of Eurovia (Vermot TP) in East of France tested the first version of Power Road® to apply geothermics to road engineering with help at the regional level from ADEME, the French Agency for Environment and Energy Management. Conducted on the company site in Gilley, this demonstrator made it possible to verify the overall design, functionality and efficiency of the snow removal process.
The test zone was equipped with a Smartvia® instrumentation system, developed by Eurovia, to compare Power Road® performance against other snow removal techniques.

WINNER OF THE "FUTURE ROAD" CALL FOR PROJECTS AND A NEW TEST PHASE

The positive lessons from these initial tests led Eurovia's Research Committee to do further work on this innovation. A file was submitted—and named winner—in 2016 during ADEME's "Future Road" call for projects as part of France's Programme Investissements d'Avenir (PIA, Future Investments Program). ADEME's support has resulted in a new testing phase, including the creation of two new demonstrators:

- ↳ One, currently under construction, on the access road to the heavy- truck parking lot at the Saint-Arnoult (A10) toll station, in the Cofiroute Network (VINCI Autoroutes); the area of this "industrial demonstrator" is 500 m².
- ↳ The other, on a 3,000-m² test site in an area currently being defined.

Contacts are being made within the public and private sectors to test Power Road® on other sites corresponding to the different areas of application for the process.

DEMONSTRATORS

As part of the deployment of Power Road®, two tests are being conducted in France. The objectives for these demonstrators: to test the technical and energy performances of the energy-positive roadway in real conditions and to specify installation methods.

SAINT ARNOULT D1 DEMONSTRATOR: BUILDING HEATING AND RESISTANCE TO MILLIONS OF POUNDS OF HEAVY VEHICLE TRAFFIC



Installed in July 2017, the D1 Demonstrator is located on the access road to the heavy-truck parking lot at the toll station of Autoroute A10 in Saint-Arnoult-en-Yvelines (South of Paris) in the Cofiroute Network (VINCI Autoroutes). It represents 500 m² of roadway. This car park has a building (Cofiroute "Customer Area") whose main floor will eventually be heated using the Power Road® process, associated with inter-seasonal storage (field of vertical geothermal probes).
These probes are located under a car park. Their number, spacing and depth have been optimized to meet the energy needs of the building. A heat pump produces the heat.
This facility will be equipped to retrieve and store all data from the energy exchanges between the various devices and geothermic production. A remote monitoring and maintenance device will be set up to interact with the regulation and different modes of facility operation.
In order to test the mechanical resistance of Power Road® to traffic loads, heavy-truck traffic will be simulated by setting up a pavement fatigue carrousel—operated by IFSTTAR (French Institute of Transportation Sciences and Technology)—which will analyze the mechanical behaviour of the pavement under simulated traffic. This carrousel will simulate the equivalent of 3 to 5 million heavy trucks on the test road in just a few months.

This project is supported by
ADEME's Programme Investissement d'Avenir (PIA).

EUROVIA'S EXPERT PARTNERS

Together with Eurovia's teams, specialized partners complement Eurovia's expertise in the three specific areas: mechanical behaviour of Power Road® under traffic load, energy performance, and design of thermal systems using Power Road®.

L'IFSTTAR (Institut français des sciences et technologies des transports, de l'aménagement et des réseaux), a public scientific and technological institution, is involved in the project for the analysis of the mechanical behaviour of Power Road®. The IFSTTAR has equipped one of the demonstrators with a pavement fatigue carousel, which tests the mechanical behaviour of Power Road® under simulated traffic. The Institute monitors the results and will participate in their analysis.

CEA Tech, the "technological research" cluster of the CEA (Commissariat à l'énergie atomique et aux énergies alternatives, the French Alternative Energies and Atomic Energy Commission), accompanies Eurovia in the energy aspect of the project, in order to model and optimize the performance of Power Road® in this area. Studies and tests were carried out on the platforms of the Institut national de l'énergie solaire (Ines, the National Solar Energy Institute), of which CEA is a partner.

BURGEAP, an engineering firm specialized in the environment, has partnered with Eurovia for the geothermal dimensioning of the project. BURGEAP is specifically in charge of studying the recoverable performances of the inter-seasonal storage process in the area of vertical geothermal probes, coupled with the Power Road® concept.

THE PONTARLIER PROJECT: SNOW REMOVAL FROM A SCHOOL PARKING LOT USING HEAT RECOVERED FROM HOUSEHOLD WASTE

As part of the overall renovation of the Place Becquerel in the City of Pontarlier (East of France), Vermot TP (a subsidiary of Eurovia) installed Power Road® in August 2017 to clear snow and ice from the parking lot of the Lycée Xavier Marmier (located on the site), the bus stop and certain sidewalks in winter. The energy source provided for its operation is the Pontarlier heat network whose energy is generated by the combustion of household waste using the waste energy recovery unit (Valopôle). Laying pavement that allows automatic snow clearing in the car park lot of the Lycée Xavier Marmier (4,400 m², of which 3,500 m² are equipped) provided an opportunity to extend the heat network and repair the aging car park.

This demonstrator will serve to define the protocols for connecting to the heat network and for measuring and optimizing the energy balance using this mode of operation, while enhancing the comfort and safety of users (reduced accident risk; safety of students, staff and visitors).

EUROVIA'S INNOVATION POLICY

Future mobility and green growth are two major pillars of Eurovia's innovation strategy, which includes six others: Industry 4.0, the connected work site, digital logistics, the client experience, the local experience, and the employee experience.

This strategy is applied in all areas and at all levels of the company, fostering the dissemination of an innovation culture that is closer to the reality of the Group's 500 business units in all its sectors of activity (works, industry, quarries, services) and in 15 countries.

INTERACTION BETWEEN INNOVATION IN THE FIELD, RESEARCH AND OPEN INNOVATION

Eurovia's approach to innovation is based on three complementary components:

- **Innovation in the Field,** in Eurovia's 500 companies, and with the support of a technical network of 650 engineers and technicians throughout France and abroad.
- **Research and Development.** For the past 13 years, Eurovia has had a research-dedicated laboratory not involved in daily technical emergencies: the International Research Centre located in Mérignac (Gironde). Its mission is to develop scientific and technical solutions that will be implemented on the worksites. It employs 35 researchers and is equipped with more than 100 test machines. Organizing their work by project and in accordance with the guidelines defined by Eurovia's Research Committee, researchers conduct studies and tests, analyze results, prepare and supervise the test phases in the field, and then participate in the technical development of new products and processes.
- **Participatory Innovation** by facilitating cooperation on projects with clients and/or partners: industries, universities, start-ups or through partnerships with incubators or institutions.

GREEN GROWTH

Sustainable development in general and the environment in particular are at the heart of Eurovia's innovation policy. More than 70% of the company's R&D budget is dedicated to the design of technologies and solutions to make infrastructure ever more environmentally efficient. Since its creation in 2004, Eurovia's International Research Centre has filed more than 130 patents and developed some 50 products and processes that reduce the carbon footprint of road activities, in particular in the area of warm mixes in situ. Upstream from the work sites, circular economy solutions developed by Eurovia's quarry and industrial site network favour local production and transport loops. They also contribute to preserving natural mineral resources by increasing the amount of recycled materials used.

To save resources, Eurovia already uses recycled materials from deconstruction to build new infrastructure. Resources from recycling account for 20% of its annual requirements. However, only half of these resources are used. This is why Eurovia is involved in the widespread valorization of excavated worksite materials in order to create real virtual quarries. Eurovia is also a forerunner in a research project for developing a 100% recycled pavement construction technique supported by ADEME.

FUTURE MOBILITY

Modes of movement are evolving and changing to become more collective, more connected, more secure, and more environmentally friendly. These new forms of mobility call for new solutions, which Eurovia is helping to develop.
Since the city of tomorrow will be denser, each of its spaces will have to perform several functions. The street will become more transparent in the urban fabric, its use will vary depending on the day of the week or time of day, and objects, buildings and infrastructure will be interconnected. Whether within its own research centres and laboratories or in partnership with start-ups, public and private institutions and universities, Eurovia is already working on these solutions.

EUROVIA'S INNOVATIVE PRODUCTS AND PROCESSES

ENERGY EFFICIENCY

↳ **Lumi+® :** a light-coloured, highly reflexive asphalt mix with high-efficiency LED lighting. Lumi+® is designed for urban settings and can reduce street-lighting expenditure by 40%. Lumi+® increases road albedo and thereby limits the effects of urban heat islands.

CONNECTED ROADS

↳ **Smartvia® :** road (and rail) instrumentation with sensors that provides real-time information on evolving conditions. Smartvia® was awarded the new digital technology trophy by Fédération nationale des travaux publics (France's national public works federation).

ASPHALT MIXES

↳ **Tempera® :** a second-generation warm mix. It helps reduce greenhouse gas emissions by up to 40% and generates energy savings of 30 to 40% by reducing asphalt-mix production temperatures (by up to 50°C).

- **Ecolvia® :** a cold asphaltic concrete deriving from a specific bitumen-emulsion formulation developed by Eurovia.
- **Aérovia® :** a special asphalt concrete with high mechanical resistance for airfields.
- **Kerovia® :** an asphalt concrete based on a kerosene-resistant binder.
- **Altivia® :** a robust asphalt mix highly resistant to the effects of water and frost.
- **Sequoia® :** a plant-based binder.

RECYCLING

- **Recycan® :** trench-backfill process that uses site-excavated materials, resulting in a 70% reduction in transport of materials to and from worksites.
- **Recyclovia® :** in-place roadway-recycling process used to refurbish surface courses. A single machine is used to recycle and re-install used pavement.

POLLUTION-REDUCING PROCESSES

- **NOxer® :** a process that neutralises nitrogen oxides (NOx) in exhaust gas. NOxer® is a coating that eliminates 10 to 40% of NOx involved in respiratory problems whenever critical thresholds are exceeded.

ROAD SAFETY

- **Viagrip® :** a highly skid-resistant surface dressing for accident-prone areas that reduces by two-thirds the incidence of accidents on wet roads.
- **Drainovia® :** the latest-generation porous asphalt that drains off rainwater, thereby limiting harmful road-surface effects (aquaplaning and splashing).
- **Viacolor® :** a coloured asphalt mix that provides high visibility at night and in rainy conditions.

SELF-DRIVING VEHICLES

In preparation for the advent of self-driving vehicles, Signature Group, a subsidiary of Eurovia, is taking part in the V2X collaborative innovation project in efforts to enhance self-driving vehicles' decision-making capacity. Its contribution involves placing road-side units, including radar and camera systems, at strategic locations as a means of providing useful information to vehicles.

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Contact presse :
Maxence Naouri
33(0) 1 47 16 48 36
maxence.naouri@eurovia.com

www.eurovia.com