



The hybrid solar road

When road produces electricity and calories ...

What if a road became a source of renewable energy? Aren't pavements already there under our wheels, ready to recover the sun's energy? Why not dream? If the 1 million linear kilometres of pavement we have in France were totally outfitted with photovoltaic panels or with a coating material able to capture and use solar heat, and even if the yield were only at 10%, the power thus produced would potentially equate all of the electric power consumed in France!

Yes, but... There must be sustained friction between the road surface and tyres in order to guaranty road safety for travelling cars and lorries, whilst at the same time, reducing noise pollution. The pavement must withstand the constant passing of axles. A road and its features must be sustainable in spite of occasional severe weather episodes: rain, snow, drought, etc.

The market already offers a number of solutions for photovoltaic roads. To name but a few: *the Wattway*® process by Colas in France, *the Solar Road*® cycling path in the Netherlands, *the Solar Roadway*® prototype in the USA...

IFSTTAR's on-going research builds on this concept, seeking optimisation of recovered power through combining electricity and calories. The system must mimic in convenience the exact equivalent of a traditional road surface. And this must be done for an acceptable cost compared with the traditional non energy-producing solutions.

The bearing surface is made of a translucent coating with an excellent tyre-to-road contact. Made of glass aggregates and a translucent resin binder, plant binder and bitumen, it covers an array of flexible photovoltaic cells. These cells are spread on a layer of porous coating material, with a liquid coolant running through.

Indeed, photovoltaic cells heat up and their performance diminishes (photovoltaic solar farms know all about it). The liquid coolant cools down the cells and recovers the unused portion of solar flow as thermal energy. Since the translucent road-bearing layer acts as a greenhouse, the hybrid system suitably increases the operation's yield in energy (similarly to a solar water heater). Then the fluid is cooled down via an exchange with the heating network before returning to the cycle.

The technical feasibility of Ifsttar's Hybrid Solar Road has now been established. A full-scale demonstrator is on exhibit at the French Pavilion at COP21 in Le Bourget.

Other functions are already piggybacking off this initial concept. What if the produced electric power and thermal energy were used in a «limited circuit»? To keep road surfaces from freezing; to power traveling electric cars; for dynamic light signage; for lighting up vulnerable zones; for road-side communication systems; etc. Ifsttar's research teams are actively studying these avenues which, with a number of other topics, fall under the scope of the Fifth Generation Road Programme, i.e. *Route de Cinquième Génération*®.





Solar road demonstrator - hybrid, thermal and photovoltaic

This demonstrator is made by stacking materials and various components, each fulfilling a specific function.

Solar rays are captured via the road-bearing surface covered with a semi-transparent coating made with glass aggregates; its road grip is compatible with road traffic.

Solar receivers positioned under the bearing surface then produce the electric power to run a pump balancing the upstream and downstream chambers. A layer of porous coating, placed under these solar receivers and through which a fluid flows, makes it possible to collect thermal energy from the unused portion of the light output shining from a lamp installed on the equipment described above.



Photos : Arnaud Bouissou, MEDDE

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