

# **Feasibility study on the implementation of energy recovery tunnel segmental lining in the lot 3 tunnel on railway Line 16 of the Grand Paris Express**

**Fabrice Rognon<sup>1</sup>\*, Phidias Marco<sup>1</sup>, Bastien Chappuis<sup>1</sup>, Eloïse Moradpour<sup>1</sup>, Nicole Calame<sup>1</sup>**

<sup>1</sup> CSD INGENIEURS SA, Lausanne, Switzerland

\* f.rognon@csd.ch

## **Abstract**

This study analyses the opportunity of using energy recovery tunnel lining segments to produce heating and/or cooling. A 1D finite-element modelling demonstrated that it is possible to extract a specific vault power between 15 W/m<sup>2</sup> during summer and 35 W/m<sup>2</sup> during winter from the ambient air and adjoining geological formations, which corresponds to the capacity between 120 to 280 kW over a 300 m section situated before the entrance to an underground station. The heat extraction is modelled so as to avoid durable deviation of the ground temperature. The thermal fluxes direction reverses depending on the ground or tunnel air temperature, which allows to use the ground as a seasonal heat storage. Given the expected temperatures, cooling production is not envisioned. Based on the modelling results, such a system should allow for a greater heat extraction than one based on thermo-active moulded walls. Indeed, the tunnel lining segments are able to extract heat from the geological formations as well as recover heat from the tunnel ambient air.