

## Proposal 1

**Title:** Energy reduction in tunnels

**Theme:** Sustainable use of underground space

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**Abstract:**

The Dutch Ministry of Infrastructure and Environment, Rijkswaterstaat (RWS) is taking on a major challenge in order to achieve its policy objective: *20% energy reduction in 2020 compared to 2010 for all its objects (so also roads, bridges etc.)*. The energy demand of existing and new tunnels must be reduced by 48% to achieve this objective. In order to achieve this objective, different expert teams have been created for the Energy Reduction in Tunnels project with compositions that are based on their members' experience and skills. It has been concluded that with the smart combination of the current technical, contractual and process measurements described in this paper, an energy reduction of around 50% can be obtained. In addition, all these measures satisfy the national legislation and the tunnel guidelines (LTS). This can be seen as a positive start in creating a zero-energy tunnel and infrastructure, for which the COB will seek international coalitions to make those steps.

The Netherlands knowledge centre for underground space and construction (COB) presented a long-term vision on tunnels since, in past years, the emphasis was only placed on the availability, safety and reliability of tunnels. The new tunnel law, the National Tunnel Standard and the professionalization of both clients and contractors ensure that we are now in a transition phase and it is time to look beyond the problems of today. The large number of tunnels that need to be renovated in combination with the sustainability challenge, technical developments and continual high availability and reliability requirements demand a reformulated vision on tunnels. Adaptability is the key message of the vision and the roadmaps for research that follow this vision.

An adaptive tunnel works towards a zero-energy tunnel. Developments in the field of smart mobility and the transition from fossil fuels to renewable energy will play a major role in the feasibility of the zero-energy tunnel. The energy transition offers great opportunities to add additional features and local energy generation/storage to tunnels. There are also great opportunities in the framework of the objectives in the circular economy field. By designing modular tunnels and developing innovative forms of ownership and use, it is possible to stimulate suppliers and manufacturers to maximize durability. In addition, the adaptive tunnel will also work towards integrated energy solutions.

We have to work towards an adaptive tunnel that can adapt relatively easily to future developments and requirements, including in the field of energy. This adaptability applies not only to the materials used for the physical tunnel and its accompanying installations, but also includes the multifunctional use of the tunnel and its adaptability over time (day/night or seasonal cycles), depending on the user's needs. All these aspects have potential implications for space and energy consumption.