

# Executive summary Datamining with E-paint



## Introduction

MIS7 stands for Martin's Imagineering Studio. The founder has done a lot of inventions and several patents. He has won several awards and nominations like the innovation award of the American Society of Civil Engineering (ASCE) and was nominated some years ago as the innovator of the year by Accenture in The Netherlands. His background is biology and environmental science. During his work he is specialized in making civil, water and infra works smart. By working on this topic -making stuff more resilience- he worked on the subject to produce electric power by using temperature difference of objects to power up sensors so data can be mined. The idea is that the object like a road sent at the end a notification tot the asset owner to tell their might be a problem. During this work he came on the idea to make a piece of infra one big thermoelectric element. To make this possible, he designed and produced so called E-paint. A coating technique at which several inks are printed in such a grid, that a temperature difference causes an electric current. This creates a relatively low cost technology to produce electric power in infrastructure to make infrastructure more resilience.

## How does it work?

E-paint generates electric power based on a temperature difference. In an environment where heat transport is available, an electrical current can be generated. At this moment this can be done by traditional thermo-electric devises, called Peltier elements. Those Peltier elements are often 4,5x4,5cm. They consist of two several metals constructed in a special grid. They are covered with a ceramic plates. Normally they are used to cool objects by adding a DC current on the plates. It also works the other way: when one side is cooler than the other side, the plate will generate a DC current. In fact the electric current is being generated by the two metals caused by heat transport from one side to the other side. This is also the principle E-paint works. A good explanation is being done in the following YouTube movie: <https://www.youtube.com/watch?v=RC16MwzFq8A>

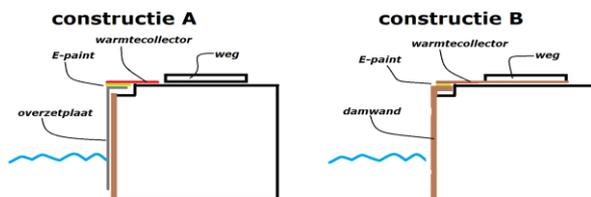


We were able to copy Peltier elements by using inkt. The great advantage is that large surfaces can be printed with the paint, so cost are being reduced. This makes the use of E-paint generating electric power in situations there is a low energy loss by heat transport. Think about pipes with cooling water. The water is hotter than the surrounding of the pipe, so E-paint on this pipe will generate electric power. We are also thinking about an application on a ship's hull. Here we have the cool sea around the ship, and the warmer interior of the ship. A ship is an interesting application, because it is hard to generate alternative power on a ship like the use of PV or a wind turbine. At this moment the paint generates several milliwatts per m<sup>2</sup>. We are now focusing to boost up this power like multi-layer of E-paint or developing a better grid of the two components of the paint. A demo movie of the paint on a pipe can be seen on You Tube: <https://www.youtube.com/watch?v=TdX-D5qFtKs&t=28s>

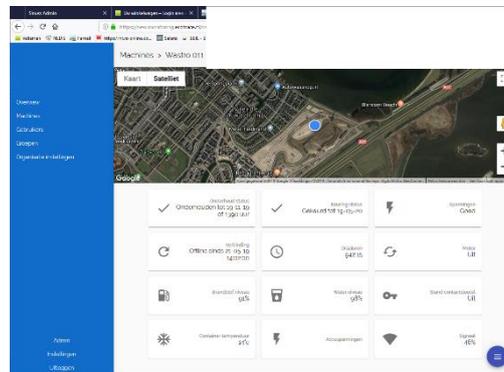


## Status development

At the end of 2018 we got an order of the Dutch government to do a feasibility study. This study involves an investigation in how E-paint can be used to generate electric power in waterways. Eventually we came with the following design (cross-section).



At this moment we have a project (funded project) for embedding the technology in a road. In this case we installed not E-paint, but just traditional thermo electric elements. The goal was to demonstrate that electric power can be generated in a road to power up sensors. In this case we use temperature, voltage and moist sensors. This was connected to the internet, so we can follow the data. In the future we want to enlarge this system and using E-paint. In below pictures some visuals of this pilot.



*P1: Installation of the system*

*P2: screenshot of data processing database*

In 2020 we won a challenge of the Bureau of Reclamation by using our technology to prevent corrosion of steel waterworks. We have made last year a proof of concept which shows that temperature differences of an object can produce electric power which can be used for cathodic shielding of steel. Simultaneously we developed the microprocessor in such a way that we can follow the data by internet. The system automatically measured the electrical guidance/potentials and delivers the right Voltage to protect the steel. As a matter of fact, we create a method in which the object produces its own power to protects its own integrity! At this moment the proof of concept is tested in Denver on lab. We are now busy making a prototype which can be tested in the field. We hope that I Q3 202 1 we have this test box operating near a dam in Arizona. In picture 3

the text box itself is shown. In picture 4 all electrical equipment including the power generator by using a temperature difference.

