Solar Powered Audio System

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INTRODUCTION

On music festivals such as Roskilde Festival, many of the guests bring their music systems. This can be anything from an old fashioned transistor radio to a car stereo system. In common for all of these systems are that they are powered by batteries, of which many are abandoned by the guests when they leave the festival.

Besides offering a solution to reduce the required battery mass, this project also offers a convenient and self-sufficient music system powered by photovoltaic panels, using state of the art, highly efficient audio amplification techniques.

THE SYSTEM

The festival guest requires their audio systems to be functionally many hours a day for periods exceeding a week. A traditional battery powered solutions this gives the festival guest 2 options:

- Bring enough pre-charged batteries to power the system for the entire period.
- Bring at least two batteries and find somewhere to charge the battery not in use during the festival.

Both of these solutions are inconvenient and requires a relatively large battery mass.

By using a combination of a photovoltaic panel and a battery, this project can not only eliminate emissions, but also drastically reduce the total battery mass, since the system at no time needs to store more energy than the amount required to power the amplifier during a single night. This is a much more convenient solution for the user. Not only is the mass of the overall system reduced, but the only thing the user has to do to maintain power on the system is to position the system out of the shadow. This can, of course, be done without having to turn off the music.

As an extra convenience for the user the system is also equipped with USB ports for charging mobile phones during the day.

The electronics in the system is designed with focus on high efficiency. The audio power amplifier is a highly efficient Class-D topology and care is taken to operate the solar panel around its optimum operating point. The USB charging system is powered by a highly efficient switch-mode buck converter.

Energy efficient and reliable operation of railway switches and crossings during winter - the fixed link across Great Belt as case

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INTRODUCTION

During winter times ice and compressed snow can cause problems with the operation of the switches, which can cause delays spread in the railway network. Removing ice or compressed snow is crucial to operation during winter times, but the current methods are inefficient and energy consuming. This project will have the fixed link across the Great Belt as case, but most of the solutions, can be applied to the national railway network, if not already existing there. On a yearly basis, A/S Storebælt uses 900.000 kWh on heating their 37 switches, meaning that there is a lot to be saved, if heating and removing the ice and snow can be made more effective.

THEORY

The chunks of ice will most frequently come from underneath the trains. When going through switches, the vibrations can cause chunks of ice, coming from underneath the trains to fall off and into the switch, preventing it from operating reliably. Today, the switches are heated by heating units placed on the foot of the rails, by clips. The fixed link across the Great Belt has 37 switches located in Nyborg, Korsør and on Sprogø, and the structure of the system entails that either all or none of the heating units at one station are switched on.

METHODS

There are several methods for avoiding ice and snow in the railway switches. In the project we investigated a few of these methods. The systems investigated are:

- System 80, currently in use on the fixed links across the Great Belt
- System 2000, currently in use on most of the national railway network
- A Swedish induction system that A/S Storebælt is currently considering

These systems are also considered in some combinations with surveillance of the switches in order to remove ice or snow, only when necessary.

RESULTS

The induction system on combination with increased surveillance will definitely make operation of the switches more efficient, as the heat will only be turned on, when necessary. Up to 70% of the switches are not used during daily operations, and since the induction system can heat just one side of the switch, up to 85% of the time a heating element is on, can be saved, if the heat is only turned on, when necessary.

CONCLUSION

There are definitely improvements to be made on the energy consumption used by A/S Storebælt for ensuring that the operation of switches is energy efficient and reliable. Our estimated energy conservation is approximately 500.000 kWh per year at the Great Belt.