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Triplesign Solar VMS, ITS tool for sustainable traffic management of smart cities.

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Abstract

The Triplesign prismatic VMS is reliable and based on low investment technology. It has limited or almost no maintenance requirements and except for communication it consumes almost no power. The power consumption for the communication has, due to a recent break-through in our product development, been drastically reduced and in the most effective systems we find the average power consumption for a Triplesign VMS to be at 1.5W.
The sign can therefore be operated with full communication 24/7 with a battery of 20-70Ah and a solar panel of 20-60W. As no external power supply is needed the carbon footprint is minimized.
The time, cost and the carbon footprint of the actual installation are also significantly reduced as no heavy machinery as excavators and haulers are needed for running cables to connect the Tirplesign to the electric power grid.
Triplesign prismatic VMS supports the driver with relevant traffic information for safety and efficiency in an utterly cost-effective and environmentally friendly way. In that sense Triplesign is taking an active part of the development of the sustainable city of the future.

SUSTAINABLE VMS, SOLAR VMS, LOW POWER CONSUMPTION VMS

Rapid increase of vehicle count and growth of cities contradicts the desirable development for global warming and UN targets for a sustainable earth.

The world economy is growing, and the cities of the world grows even faster. By 2050 it is estimated that 70% of the world population will live in cities. In the same time the number of vehicles is expected to be increasing drastically from around 1 billion 2010 to estimated 2 billion 2035. All these vehicles on the roads create already today congestions, logistic sub optimization and environmental pollution.

In October 2018 the new climate report from IPCC, Intergovernmental panel on Climate change was released:

"Limiting global warming to 1.5ºC would require rapid, far-reaching and unprecedented changes in all aspects of society, the Intergovernmental Panel on Climate Change (IPCC) said in a new assessment. With clear benefits to people and natural ecosystems, limiting global warming to 1.5ºC compared to 2ºC could go hand in hand with ensuring a more sustainable and equitable society".

It is also stated that global emissions of carbon dioxide (CO2) have increased by almost 50 per cent since 1990. Carbon dioxide is reported to be the greenhouse gas affecting the climate change the most. Almost all Vehicles create emissions with CO2 pollution when it is used.
For United Nation (UN) is the limitation of the climate change one of their main targets for a sustainable world.

There is a tough challenge for the world society to manage the growth in number of vehicles and the growth of the cities on one hand and the environmental problems and UN target for a sustainable earth on the other.

It is therefore very important that the vehicles are used as effective as possible in order to decrease the driving time for the decrease of the CO2 emissions.

VMS as a sustainable ITS tool

An important tool to ensure a safe and efficient traffic flow is traffic management. Today we can see a massive development of different and more cost effective road data-collection technologies than ever before. With this information the road users can be warned about hazards, such as unexpected ice or snow, wind speed on bridges, accidents and road works or congestions ahead, for the drivers to make decisions about their journey based on current and up to date information.

To secure that this information is supplied to all drivers in a given position, especially in case of a hazard, a variable message sign (VMS) is an ideal tool to be used by the traffic management.

From an environmental perspective this is also of great importance as a more efficient traffic flow decreases the actual driving time from point A to point B, which effectively reduces the fuel consumption and therefore plays an active role in reducing the carbon dioxide footprint generated from the traffic.

Triplesign Prismatic VMS

In many countries VMS's installed are built with LED technology.
Triplesign produces Prismatic VMS. Leading markets for that technology are Germany, Netherlands, Poland and Norway but the technology is more or less represented in most European countries. The prismatic VMS technology is electro-mechanical, and the message is exposed by the same traffic reflective vinyl as any static traffic sign, but instead the vinyl is laminated onto triangular prims, rotating to the face requested by the traffic management system.
There are 3 alternatives/sides/faces on one prism but it is possible to combine several prismatic VMS's into one sign-frame to increase the available number of alternatives/combinations.
Triplesign builds all VMS's in customer required sizes and a lot of installations are supplemented by LED VMS and/or static signs.
Solar panels in combination with UPS and a wide variety of different sensors are standardized add-ons and options.
The prismatic technology is a superior cost and environmental effective alternative to LED VMS when the prescribed messages to be showed are pre-decided and less than four.
It is off course not an alternative if real time messages are required.
However, the majority of VMS installations are used with less than three predefined messages so prismatic VMS's should in most cases be fully complying with the requirements.
The prismatic VMS production and use are regulated under the same EN-standard 12966-1 2005+A1:2009 as LED VMS.

Triplesign Primatic VMS a sustainable VMS

The Triplesign prismatic VMS does not consume any power for displaying the message unlike a LED VMS, which require constant power supply to display any message.
An add-on to our controller PLC, also used as remote communication system, has recently been developed to drastically reduce the average power consumption of a Triplesign VMS to as low as only 1,5W.
Equipped with a solar panel of between 20-60W and a UPS/battery of 20-70Ah the sign is fit to operate 24/7 in all major populated areas of the world without any need of access to the local main power grid. The benefits with not needing the connection to main power are many: A unit can be installed into existing traffic situations/sites in a matter of hours and does not need any external power supply. The time and costs for road authorities wishing to deploy a unit are greatly reduced due to taking out the excavation need and permit handling for the access to main power grid. This keeps the time, risks and costs of road work to a minimum and from an environmental view reduces the carbon footprint of the complete installation, leaving heavy and fuel consuming machinery out of the equation.

Triplesign prismatic VMS supports the driver with relevant traffic information for safety and efficiency in an utterly cost-effective and environmentally friendly way. In that sense Triplesign is taking an active part of the development of the sustainable city of the future.

A standard LED based VMS consumes power all the time when the information is displayed. As information to be supplied is increasing, due to all data being collected, we can see a trend towards full matrix/picture LED VMS. The power consumption of a full matrix LED can be up to 600-700watt/SQM. It is not possible to indicate any exact figures for average consumption as there are so many parameters but as a rule is the power consumption around 300watt/sqm for active full matrix units. As the power consumption is so high it is either extremely costly or not realistic to have the units supplied by solar panels/batteries for any longer periods. Instead is external power the important source of supply. Due to this are the installation time, risks, costs and the carbon footprint increased as the installation need heavy machinery as excavators for the connections to the main power grid.

So even though the LED VMS through a more efficient traffic flow reduces the fuel consumption of vehicles and therefore reducing the carbon dioxide footprint generated from the traffic the LED VMS itself makes the opposite. The high power consumption of LED VMS contradicts the UN targets for a sustainable earth as the extra electric power needed normally comes from power production based on either coal or oil. Both are the main sources of the carbon dioxide increase and in according to IPCC the real reason of the problem with global warning.

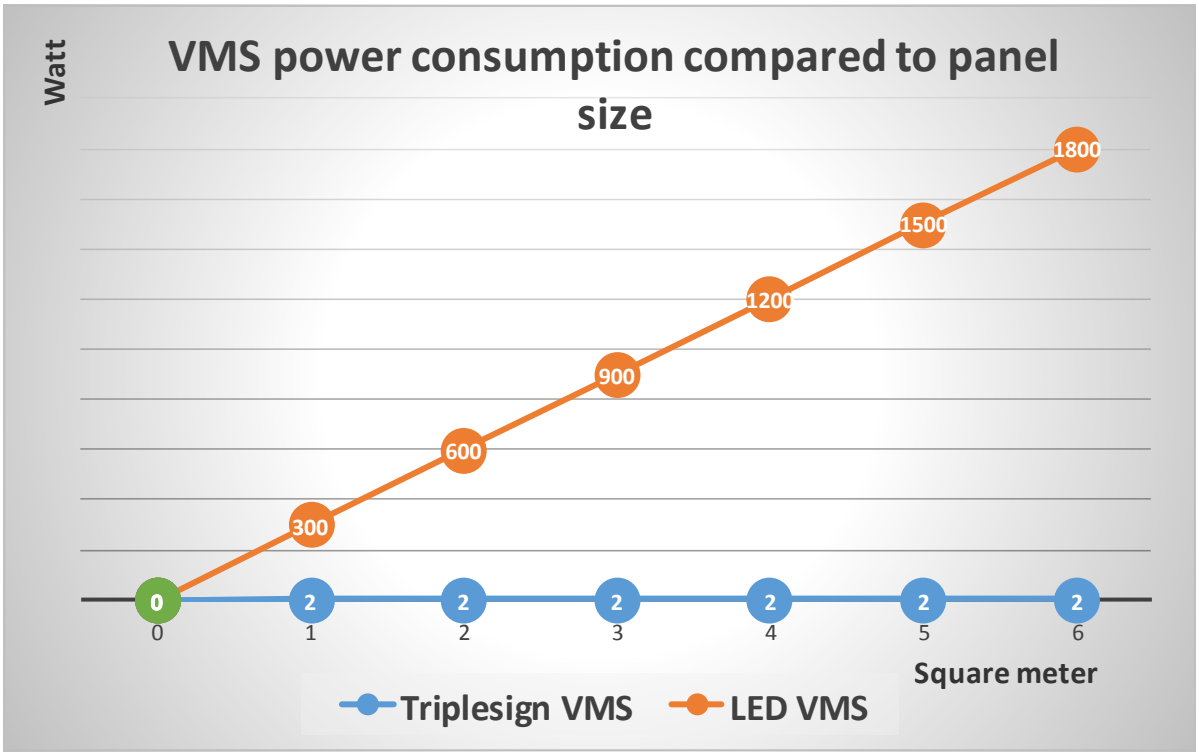

Diagram: comparison power consumption for VMS technologies

In the above case we are comparing the power consumption for Triplesign Prismatic VMS and LED VMS when a message is exposed. The LED VMS is full matrix and based on an average power consumption of 300W. The top consumption for strongest exposure suitable at day time is normally double or 600-700W. It is noted from the diagram that the power consumption of LED VMS increases linearly for to reach 1800Watt for a 6 SQM unit. The Triplesign Prismatic VMS on the opposite does not increase the power consumption at all with the size. Instead it remains very low independently of the size of the sign.

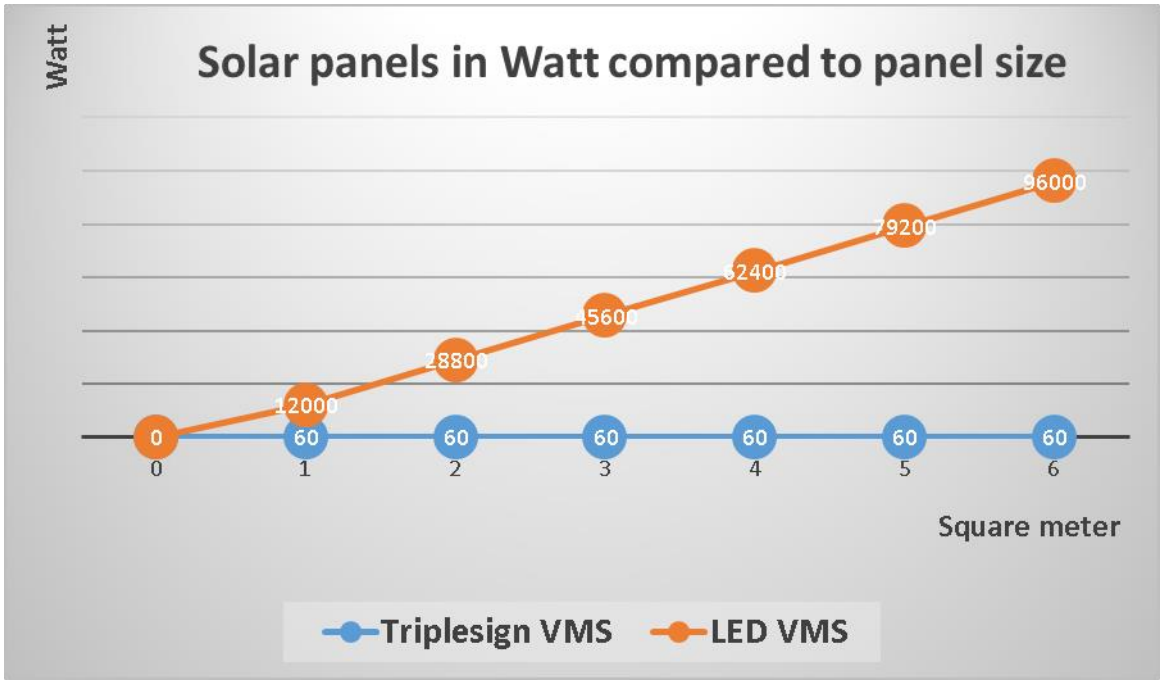

Diagram: comparison solar panels requirement for VMS technologies

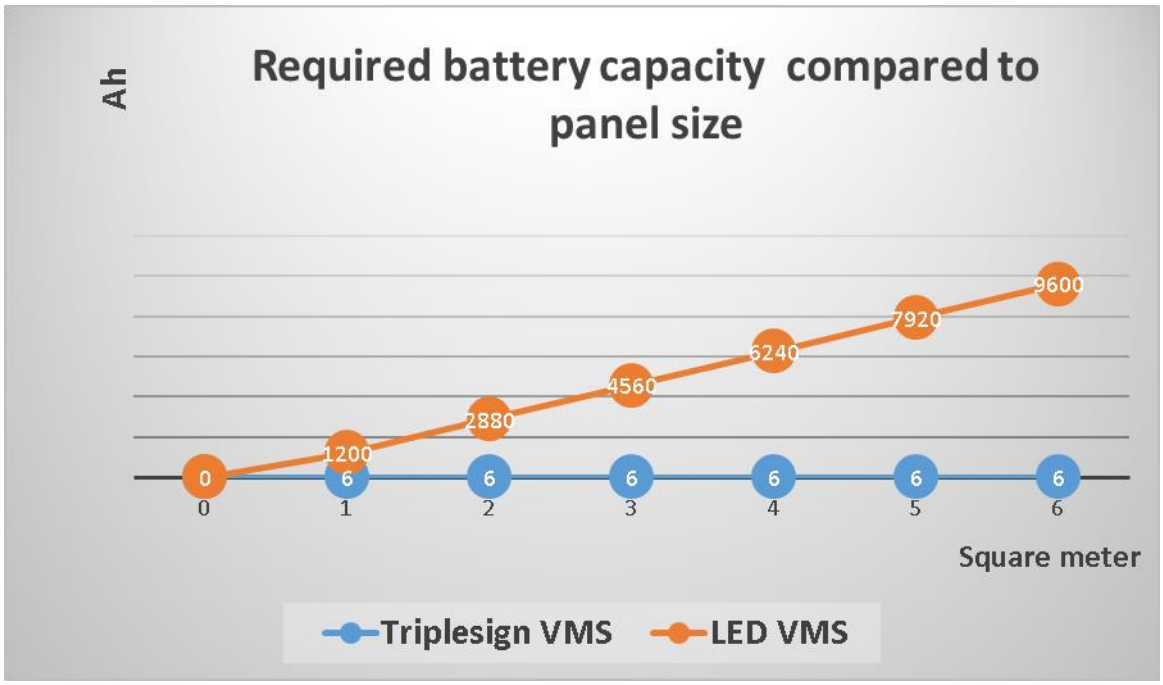

Diagram: comparison battery capacity requirement for VMS technologies

For the above 2 diagrams. The solar Irradiation for solar panel in optimal angel in Dec for major European capitals is between 0.7 and 1.3 W/m^2/day, Copenhagen, 0.73, Stockholm 0.75, Berlin 0.83, Amsterdam & Brussel 1.0, London 1.26 and Paris 1.3 all noted from database PVGIS-CMSAF. This is the reality a VMS with solar and battery must manage. In the below diagram we have based the diagram on 0,8 W/m^2/day, 75 % efficiency of the panels placed in optimal angle, in no shadow position and a power consumption of a full matrix LED VMS with 30% under maximum power consumption. The battery capacity needed is based on the power consumption/day times two.
From the diagrams we can read that solar panel and battery capacity required for a 2SQM LED VMS to manage the conditions in the midwinter of North Europe is 28800W of solar panels and 4560Ah of batteries. As for the power consumption is the required capacity of solar panels and battery capacity increased linearly with the size of the LED sign. For Triplesign prismatic VMS on the other hand remains the required capacity for solar panels and battery on the same very low level independently of the sign size.

Conclusions for choosing an efficient VMS for the sustainable smart City.

The conclusion from the diagrams is that the installation of full matrix LED VMS based on environmental friendly Solar supply is not economic realistic for mayor parts of the populated world. It is also not environmental friendly to use such much resources for a VMS installation. Especially in consideration of the high requirements for battery capacity. On the market there is alternative as limited LED VMS, Prismatic VMS and a sign combination of both. And for high costs there is also fuel cell solutions on the market.

For areas with better solar circumstances it is also worth to consider other alternatives then full matrix LED VMS as the difference in investment and environmental impact are so high.

In this calculations it is important to see all the costs and to have a complete picture of the environmental impact. For instance must the installation costs and the complete system needed for the VMS be included in the cost calculations. For example can a standalone of grid Triplesign installation of 2x2M with Solar be installed for a total cost of 3000-4000 Euro. Same LED full matrix including installation/ excavation can easily reach above 20 000 Euro. And on that severe costs for managing traffic and time consuming traffic jams during installation. Such un-necessary high costs installations are done on large scale today costing the societies enormous in extra costs.

On the environmental side must the carbon footprint generated from installation and the complete VMS system be calculated. We can today see a huge difference in-between countries concerning the use of VMS technologies. The explanation of this differences is more connected to traditions and the product assortment of the active actors of the specific market then professional calculations based on comparison. Hopefully we can start to share the experience we have for to secure that we make VMS

to an environmentally friendly traffic management tool for the sustainable city.

Keywords:

VMS, Prismatic VMS, Triplesign, Sustainable, Smart cities, low power consumption, Solar. Traffic management tool, environmentally friendly

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