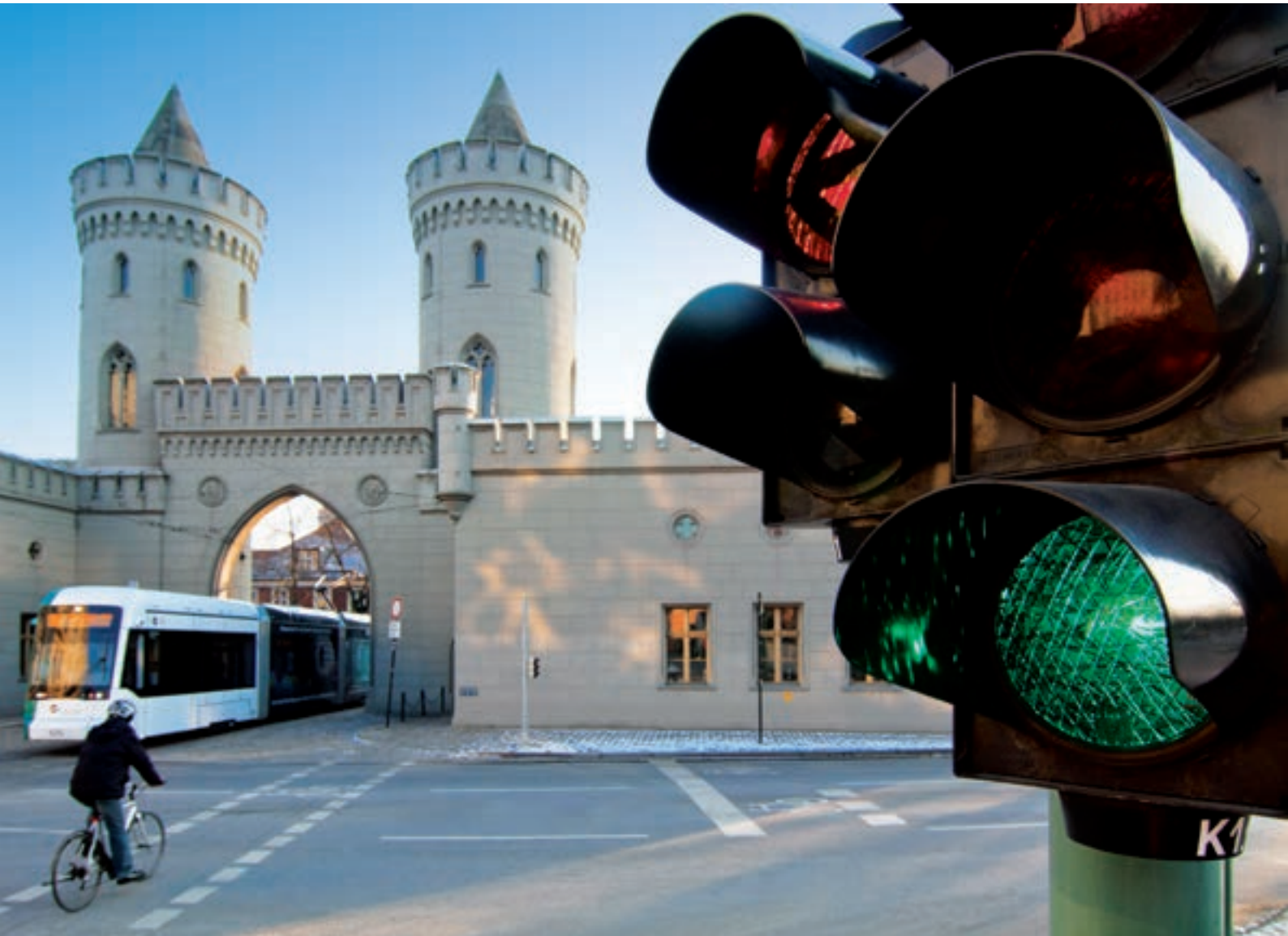
Green light for clean air

The residents of Potsdam, the Brandenburg state capital, can breathe easy: in spring 2012 the German city was equipped with an environmentally driven traffic control system. This innovative solution uses Siemens technology, and initial results show a noticeable improvement in air quality.



Particulates are no laughing matter. Scientists all over the world agreed long ago that these fine particles can trigger allergies and respiratory diseases. This led the Environmental Protection Agency (EPA) in the United States to set a concentration limit in micrograms per cubic meter (µg/m³) for so-called PM10 particles, which have a diameter of under 10 micrometers and are also known as particulate matter. Other regions followed suit: the current European Union regulation states that a PM10 average of 50 µg/m³ can only be exceeded a maximum of 35 times per calendar year. In many cities, however, adhering to this limit is a tough challenge.

In road transport the exhaust from diesel engines is the main source of particulate matter in the air, and this is evident in Brandenburg's capital Potsdam. In 2011, for instance, the PM10 concentration limit on the busy highway Zeppelinstraße, which runs from the southwest through the city center, was exceeded on 53 days – far more often than allowed. So the Potsdam transport planners took action: they hired Siemens to upgrade the existing traffic management into an environmentally driven traffic control system that sustainably cuts air pollution.

Small measures – big effect

It is clear that emission levels are particularly high when vehicles are stuck in traffic, as they constantly stop and go and engines are idle for long periods. The goal of a green traffic control system is therefore to enable traffic to flow more constantly. With this aim in mind, the traffic computer, which went into operation in spring 2012, not only evaluates traffic volume data from the installed traffic eye systems – it also receives measured values on the weather conditions and harmful emissions. It uses all this information as a basis for controlling a network of 30 light signal systems on frequently congested roads in the city.

This means the traffic light control can react directly to heavy traffic situations and critical environmental conditions. If pollution is approaching the permitted limit, the red-light phase of so-called ramp meters on the roads that access the highway are extended. As a result, the traffic density in the city center falls, traffic jams can largely be avoided and, thanks to the "green wave" of phased traffic lights on the highway, traffic flows swiftly toward the city center. What is more, journeys at peak traffic times only take a few minutes longer than at other times of the day.

Would a low-emission zone be more effective?

The strategy is not entirely new, and installing ramp meters is usually only one of several tools. The package of measures employed in Potsdam also includes separate bus lanes and priority at traffic lights for public transport, since ultimately the transport planners want to encourage more drivers to switch to buses and trams. They also intend to add more bike lanes, create park-and-ride systems, and have pedestrian crossings change to green more quickly.

Admittedly, in some places such measures are not sufficient to notably reduce emissions – as was for example the case in Düsseldorf, the state capital of North Rhine-Westphalia.

Environmentally oriented traffic control in Potsdam sinks emissions.

Here pollution only fell significantly once ramp meters and bus lanes were combined with speed limits and a low-emission zone. The Brandenburg Ministry of the Environment, Health and Consumer Protection also requested a study into the effects a low-emission zone would bring – with surprising results.

A Level 3 low-emission zone, whereby only vehicles with certified low emissions (indicated by a green sticker) could drive into Potsdam, would have cut PM10 emissions by just 1 µg/m³ or 5 percent in 2010, and in the reference year 2015 the yearly average PM10 values would have fallen by just 3.5 percent. The reason for this fairly weak impact could be the influence of the low-emission zone in the neighboring city Berlin; since 2010 only cars with a green sticker have been allowed to drive through Berlin's city center. For this reason, it is estimated that by 2015 only four in one hundred cars from Potsdam and the surrounding area would even be affected by the introduction of a low-emission zone.

Air is better, traffic is flowing

In Potsdam, however, the environmentally driven traffic control system is showing pleasing results even without additional measures. This was revealed by an initial evaluation shortly after the system went into operation. Air quality measurements by the Brandenburg Ministry of the Environment, Health and Consumer Protection verified that emission values in excess of the permitted limits were recorded far less frequently in the second half of 2012 than in the prior-year period.

In the center of Potsdam, for example, for the year 2012 as a whole the sensors only recorded excessive values on seven days. The measuring station on the busy and highly polluted Zeppelinstraße only recorded excessive values on 24 days, compared to 53 days the previous year. To quantify the impact: particle matter emissions caused by transport in the third quarter of 2012 were around 4.4 percent lower than in the prior-year period, while nitrogen oxide (NOx) emissions from transport fell by around 2.2 percent. The air quality has improved – and in contrast to the previous situation, only around one-tenth of vehicles get stuck in traffic jams at all.

Now it is a matter of fine-tuning. With the aid of ongoing measurement data, the threshold values and traffic light phases will be optimized and ramp metering locations assessed as the system continues to operate. In addition, on certain routes a Siemens camera system will record journey times in order to adjust the traffic light control to the current traffic situation even more precisely. Then Potsdam's residents will really be able to breathe easy. ■