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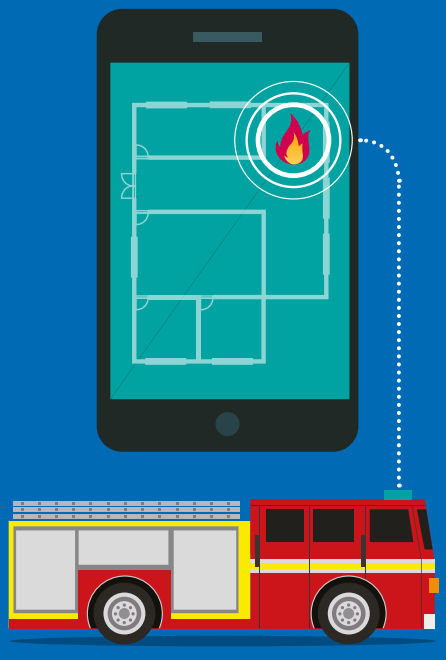
Smart Infrastructure: tackling chemical fires

How emerging technologies could revolutionise our response to public health emergencies



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The Smart Infrastructure series

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Infrastructure is all around us and ever-present in our lives: think of schools, roads, hospitals, power stations, telecommunications networks and sports facilities, to name but a few. Picture these in your mind and they are all quite, shall we say, solid. Made of bricks and concrete and steel and glass. Infrastructure is robust and long-lasting and inflexible. Until now.

In recent years, sectors such as communications and the media have been transformed by digital technologies; now infrastructure is in the foothills of its own technological revolution. And with that revolution comes a transformation in how infrastructure serves us, becoming more agile and responsive and clever.

By gathering, analysing and sharing new forms of data, we can improve and adapt decision-making in real time. By embracing the application of new technologies – such as driverless cars, smart electricity grids and adaptable buildings – we can drive up efficiency and realise new opportunities. And by building new data management systems and more flexible assets, we can improve collaboration and responsiveness – providing benefits for customers, managers and public agencies alike.

To help envision and promote that future, KPMG have conducted a series of thought leadership workshops – considering how we could use new technologies in infrastructure development, maintenance and operation to improve our lives, reduce costs, and create economic growth.

We imposed only a handful of rules on these workshops. All of our ideas had to be built around existing and emerging technologies; we've set our scenarios just a few years in the future. They had to have clear benefits for investors and managers as well as customers and public policy goals. And they had to be realistic and deliverable, addressing the potential concerns and challenges around matters such as privacy, security and governance.

Within those constraints, we've tried to step outside conventional thinking and test out new ideas. We want to stretch ourselves, applying new technologies and techniques to solve old problems. We want to think about how the world is changing, and how to stay ahead of that change. And then we want to bring that thinking back into today's world – mapping out the practical steps towards building a truly smart infrastructure.

Fire and chemical sensors | Real time locational info | Weather data | Personnel data | Emergency services = SMART Infrastructure.

Introduction

During emergencies, situation managers often have to make crucial decisions using the sketchiest of information. Smart infrastructure could dramatically improve both their access to reliable, real-time data, and their ability to collaborate with other public servants

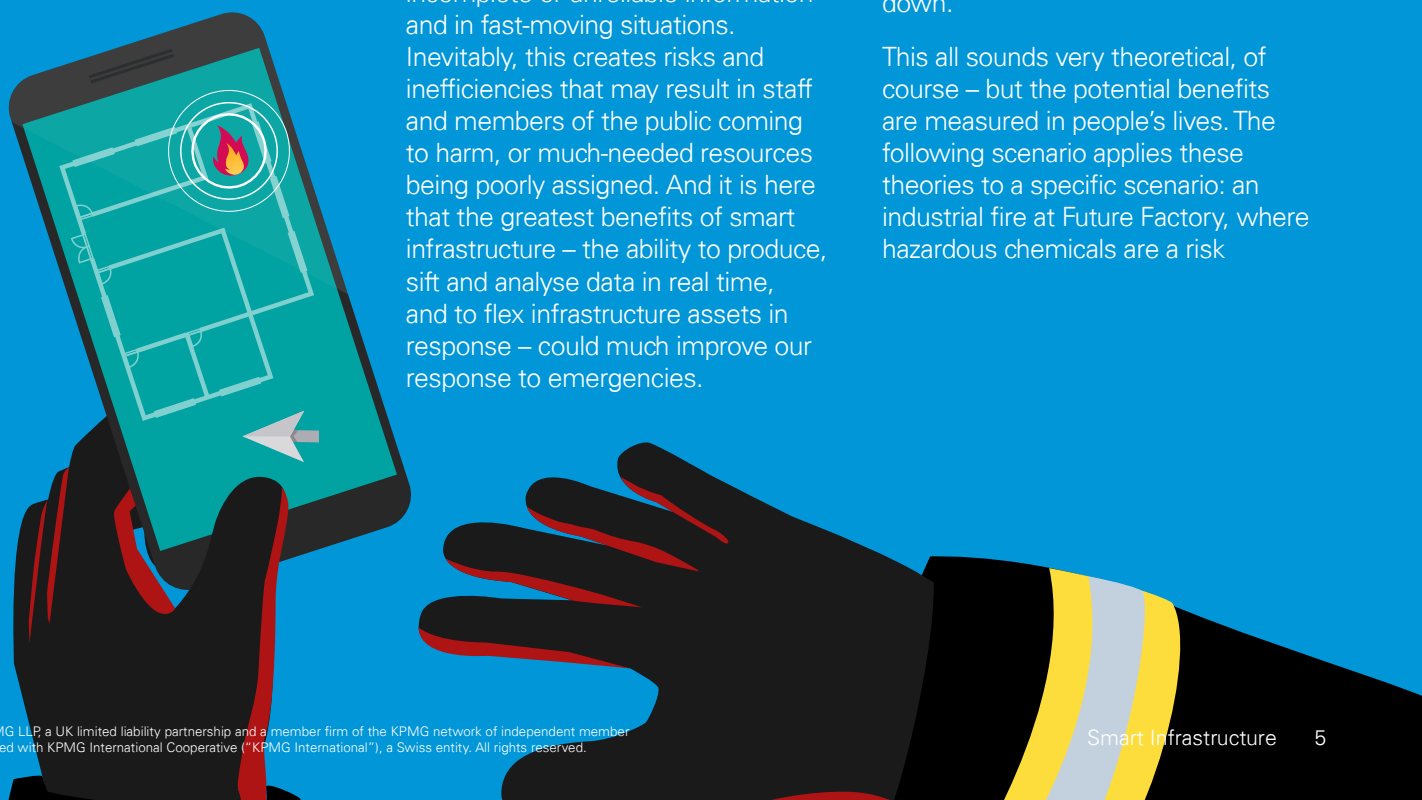
"Smart Infrastructure – the ability to produce, sift and analyse data in real-time and to flex infrastructure assets in response – could greatly improve our emergency services."

The UK's emergency services have long experience of dealing with all manner of major incidents, from riots to industrial accidents to terrorist attacks. They are highly professional, well-equipped, and trained to manage a huge range of threats and risks.

Yet by their very nature, each such event forces operational and team leaders to make complex, high-stake decisions about threats, deployments and priorities, often on the basis of incomplete or unreliable information and in fast-moving situations. Inevitably, this creates risks and inefficiencies that may result in staff and members of the public coming to harm, or much-needed resources being poorly assigned. And it is here that the greatest benefits of smart infrastructure – the ability to produce, sift and analyse data in real time, and to flex infrastructure assets in response – could much improve our response to emergencies.

By generating and sharing information on the nature, location and progression of specific threats, digital technologies promise to help emergency teams respond more quickly, effectively and safely – better protecting both the public and emergency staff, whilst deploying teams and equipment exactly where they're needed. And when infrastructure assets can change their operation to support the work of emergency crews, threats can be more effectively contained and closed down.

This all sounds very theoretical, of course – but the potential benefits are measured in people's lives. The following scenario applies these theories to a specific scenario: an industrial fire at Future Factory, where hazardous chemicals are a risk



Tackling a fire in a chemical factory: A Smart Infrastructure scenario

How digital technologies can support better decision-making and collaboration among our emergency services

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1 When a fire breaks out at Future Factory, the local fire control centre quickly receives an alert and a set of diagnostic data from the factory's advanced detection systems.

As well as regular smoke detectors, the factory is fitted with an array of sensors able to detect a range of different chemical gases. In fires involving chemicals, 'volatiles' are usually released before the generation of smoke particles. Future Factory's system is able to identify these gases, triggering the alarms before the fire is well-established and buying valuable extra response time.

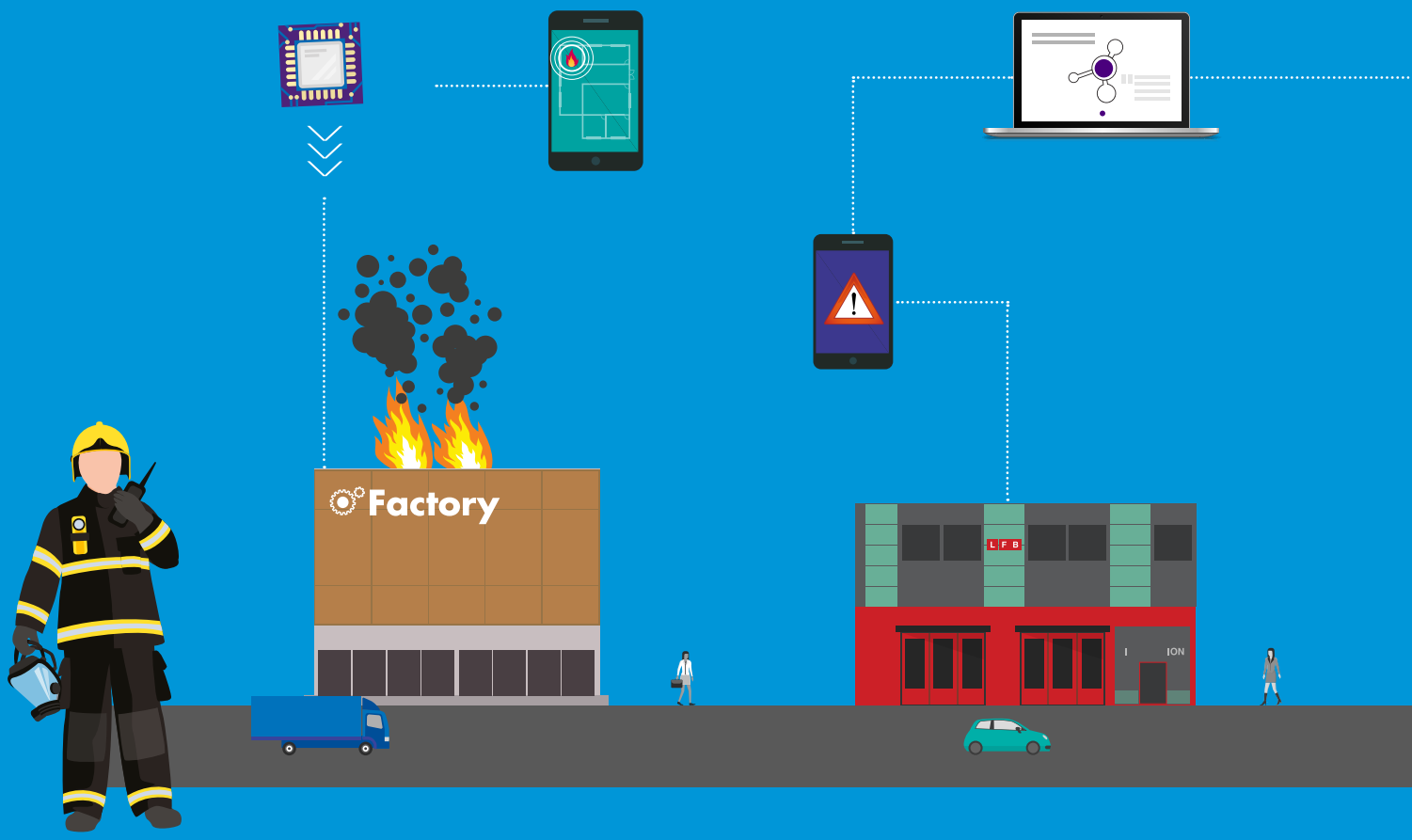
Along with the emergency alert, the fire control centre receives detailed information from the factory's chemical detector system – pinpointing the volatiles' location and composition, and ensuring that fire teams can head straight to the seat of the fire with the appropriate protective equipment. What's more, the suppliers of the factory's fire control system send over a briefing for firefighters – combining data gathered during previous conflagrations at sites around the world, fresh information transmitted by Future Factory's sensors, and weather reports pulled from Met Office feeds to create an automated projection of how this fire is likely to spread.

Meanwhile, Future Factory's smart meter automatically shuts off the gas supply to the building, cutting off the supply of a dangerous accelerant.

2 Having received the alert, the local fire service must now make a series of decisions on how to act. Its first, of course, concerns how to put out the fire. Data from the chemical detectors has already provided crucial information on the nature of the fire to be tackled.

This same information will help the fire service control room decide which other emergency services and partner agencies to involve. If the fire contains dangerous chemicals, the Environment Agency will need to be notified so it can execute its statutory advice and support duties in the event of chemical fires. Similarly, police and ambulance services will need to be informed in order to deploy the necessary personnel. And Highways England will need to be kept informed of the smoke fallout from the fire and its possible risks to motorists.

In our scenario, the control rooms of all these emergency services and key national bodies use the same software platform – ensuring that critical information on the incident can be shared immediately it comes through, informing all parties of the locations and activities of staff, and supporting the use of shared emergency response plans. With all the partners kept abreast of the latest developments and in constant contact, crucial decisions can be made rapidly and on the basis of the best available information.



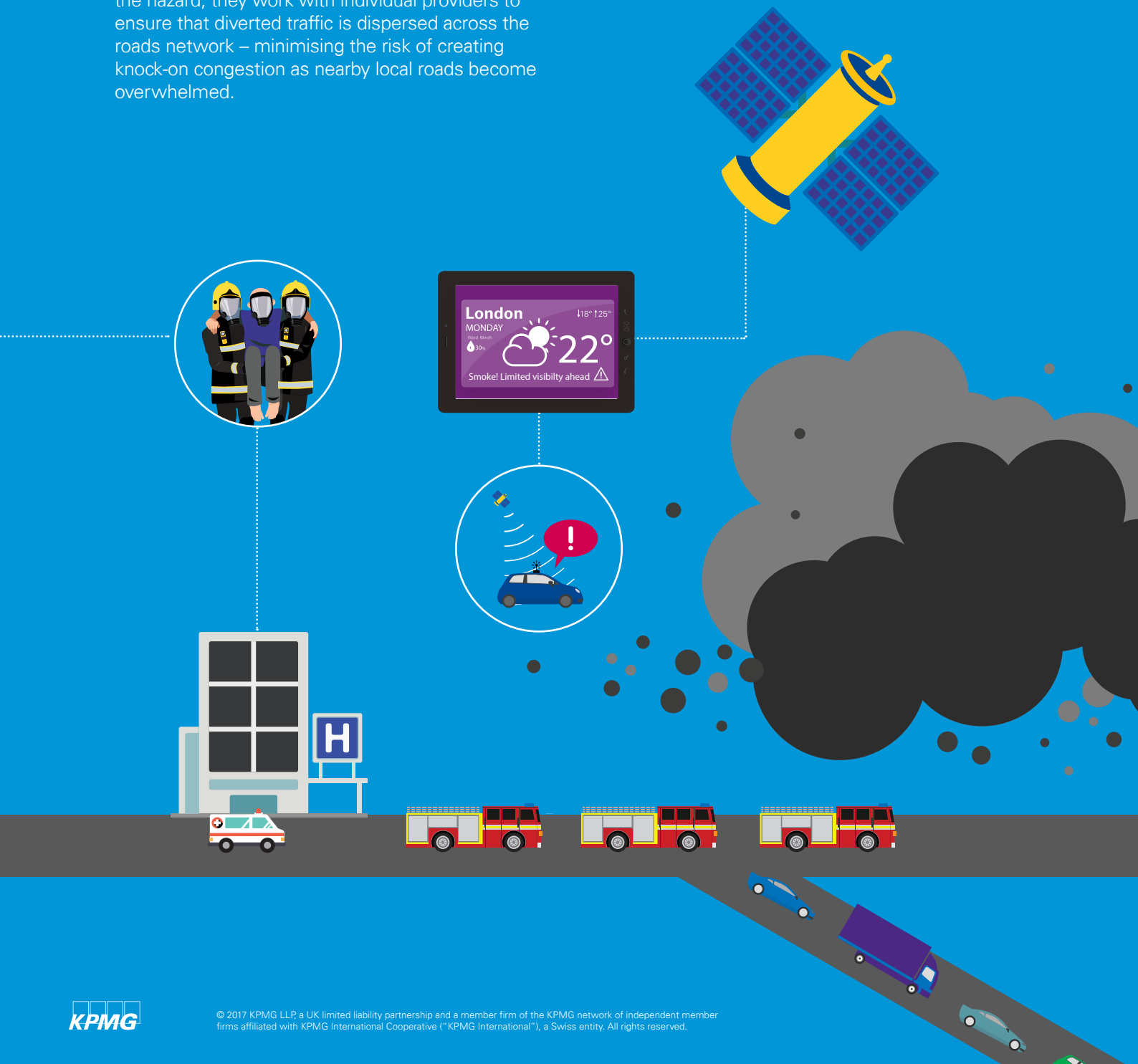
3 Whilst firefighters are still en route to Future Factory, a minor explosion sets alight a stock of raw materials – causing thick plumes of black smoke to drift towards a nearby motorway. This is quickly picked up by weather satellites and relayed, via the Met Office, to the emergency response partners.

Some of the driverless vehicles using the motorway belong to public bodies, or to businesses that have agreed data-sharing protocols with the emergency services; so control rooms are able to call up real-time video pictures from passing vehicles, confirming that smoke is beginning to reduce visibility on the motorway. Highways England immediately updates live traffic information signs, warning other drivers of the hazard and imposing temporary speed limits.

Keen to reduce the amount of traffic passing through the danger area, Highways England also communicates with the providers of satnav systems. Encouraging them to offer their users alternative routes bypassing the hazard, they work with individual providers to ensure that diverted traffic is dispersed across the roads network – minimising the risk of creating knock-on congestion as nearby local roads become overwhelmed.

Similarly, the providers of autonomous vehicles (AVs) are automatically informed of the drifting smoke and temporary speed limit. These organisations are likely to impose the speed limit on all their vehicles, and to advise their users to take a different route; where users agree, their vehicles are added to the dispersal system being overseen by Highways England.

Within a few minutes, a large proportion of oncoming traffic has been diverted off the motorway to reach their destinations via a range of new routes; this prevents the temporary speed limit from creating long hold-ups on the motorway. Highways England, the emergency services, satnav and AV providers will continue to manage traffic flows until the fire has been doused, whilst closely monitoring the smoke hazard in case the motorway must be closed completely.



4 Back at Future Factory, the fire crews have arrived and joined the designated staff in managing an emergency evacuation. The factory's managers operate a cloud-based access control system, under which sensors track the ID badges worn by staff and visitors – so emergency crews know exactly who was in the building when the fire started. Evacuated staff head for the assembly area, where a scanner identifies their ID cards and provides emergency crews with a list of anyone unaccounted for.

Where people cannot be found, fire marshals use the building's wifi system and the GPS tracking systems on people's work mobile phones to locate them; a clause within staff employment contracts permits the company to access corporate phone data for location purposes in the event of an emergency, satisfying the requirements of data protection laws. This data is then shared with fire teams, enabling them to mount carefully targeted searches for particular individuals.

5 The area immediately around the factory is becoming dark with drifting, noxious smoke – and emergency crews are concerned that the chemicals within it present an immediate health risk to local residents, particularly those with breathing difficulties. Response managers decide to evacuate a housing estate downwind of the plant.

Rather than working methodically through the estate, police commanders first access smart meter data to identify those homes most likely to be occupied: most residents have previously given their permission for data to be used in this way in the event of an emergency, with some also providing information that allows vulnerable people to be identified. All this data helps the police to prioritise their visits, enabling them to concentrate resources where they're needed and get people out of the area much more quickly.

Final thoughts

In this scenario, smart infrastructure contributes in many ways to saving lives and targeting resources. Useful data is gathered from alarm systems, weather satellites, smart meters, mobile phone networks and self-driving vehicles, and shared instantaneously between all the organisations involved. These different bodies are able to respond collectively to a fast-evolving situation, using a common communications platform to make and develop plans and to ensure that their staff operate as a single, well-coordinated team. And parts of the infrastructure are able to respond to changing needs – altering vehicles' routes to disperse them away from the affected area, for example.

The result is a fast and efficient response that minimises risk to the public and emergency staff, whilst ensuring that interventions are carefully-targeted and well-conceived. And all of the technologies explored in this text will be readily available within a few years; we already have the software and hardware to, for example, link together emergency response HQs or pinpoint homes with high energy use.

Nor are dedicated organisations or hardware required to realise most of these benefits, for the vast majority of this data is to be collected for quite different purposes; the challenge is instead one of brokering agreements between those producing and those using the data, putting the required data protection safeguards in place, and agreeing protocols to govern the sharing of data when required.

To reap these rewards, we'll need to think carefully about how we can get the best out of the digital systems being developed in every part of the public and private sectors – for as this scenario illustrates by drawing on technologies such as weather satellites, driverless cars, smart meters and phone GPS systems, the vast amounts of data generated within each sector can be hugely valuable to people in apparently unrelated fields. This will present a challenge as we move forward, but it is a good challenge to have. For as the quantities of data being produced spiral ever upwards, we'll have ever more opportunities to combine that data in innovative ways – producing benefits for all those involved.

Our infrastructure is increasingly clever, designed both to feed back data and to respond to changing requirements. But some of the greatest potential gains lie in linking together these different systems, creating a system of responsive networks, feedback loops and impact accelerators that are far greater than the sum of their parts.

We think the technology is ready; we think the benefits are huge; we think it's time to act. Let's create a smart infrastructure.

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The author of this whitepaper, Amy is a smart energy specialist with 15 years of experience gained in the communications technology and services, and utility consulting arenas. She has held a number of Director & Board level roles dedicated to smart energy.

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Wafa has extensive experience of the UK energy market in formulation of energy policy, development & execution of strategy flexible and smart capacity. At KPMG she has been advising investors in the energy sector on investment opportunities, offering regulatory and strategic advice on asset optimisation strategy.

Prior to joining KPMG she worked for Department of Energy and Climate Change providing advice to the Secretary of State for Energy, Ministers and Senior officials at HMG on energy policy and at RWE she worked in Corporate Strategy team for the generation business across UK, Germany and Netherlands.

Learn more about KPMG's Smart Infrastructure programme or join in the debate:

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