IMPETUS:
A research and innovation project addressing urban safety

IMPETUS

Intelligent Management of Processes,
Ethics and Technology for Urban Safety

A Horizon 2020
Research and Innovation Project

This project receives funding from the European Union's Horizon 2020
research and innovation programme under grant agreement No 883286.

This file provides an overview of H2020 project IMPETUS.

It is based on a presentation made by the project coordinator, Joe Gorman, at the 2020 TIEMS Conference in December 2020:

Citizens and cities
facing new hazards
and threats

30th November to 4th December 2020

Session 8: Smart resilient cities

Joe Gorman

WHAT is IMPETUS: Key facts

- A research and innovation project in "Horizon 2020" programme of the European Union

- Carried out by a multi-national consortium across Europe and beyond

- **Overall goal:** *Improve the security of public spaces in smart cities*

- Total budget 9.3 M€, EC funding 7.9M€

- Led by SINTEF, independent research institute, Norway

- Duration 24 months

WHEN will IMPETUS happen?

Challenging: 24-months duration

Sep 2020 - Dec 2020	Jan 2021 - Apr 2021	May 2021 - Aug 2021	Sep 2021 - Dec 2021	Jan 2022 - Apr 2022	May 2022 - Aug 2022

2020   **2021**   **2022**

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The project lasts only 24 months: about a year shorter than is typical for collaborative projects of this kind. This reflects the perceived urgency of the topic addressed by the project.

This short timescale means that the project is a challenging one for the consortium.

WHEN will IMPETUS happen?

Challenging: 24-months duration

Today

Sep 2020 - Dec 2020	Jan 2021 - Apr 2021	May 2021 - Aug 2021	Sep 2021 - Dec 2021	Jan 2022 - Apr 2022	May 2022 - Aug 2022

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As of today [the day the presentation was made at the TIEMS conference, December 2020], the project is in its very initial phases. Thus: the presentation is about the goals and structure of the project. It is too early to present *results* from the project.

Our collaborative project will be carried out by a consortium of 17 organizations from 10 different countries   - mostly EU countries, but a few outside the EU.

There are different types of partners (as shown) – these complement each other in terms of skills and roles.

The role of the two city partners is to act as "trial sites" for experimenting with the solutions to be developed in the project.
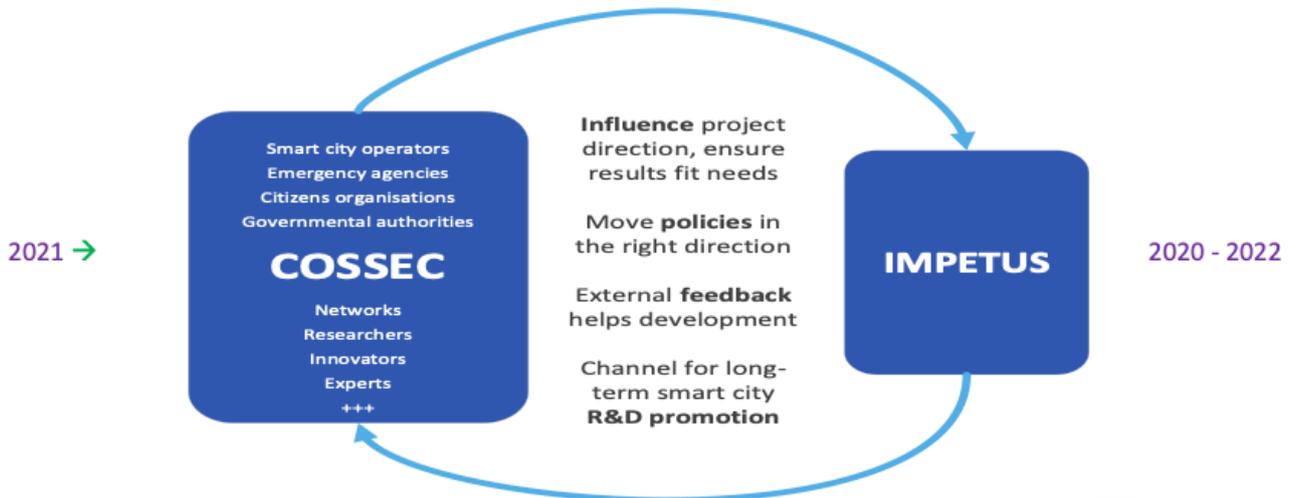
We are in the process of establishing COSSEC - a group of
stakeholders with an interest in the topics covered by IMPETUS but
who are not formal members of the consortium.
COSSEC will start in January 2021.

COSSEC membership is based on invitations from the consortium.
But it is possible to ask to be invited; if interested, refer to contact
information at the end of this presentation.

The long-term plan is that COSSEC will persist after the project
itself has ended – as a community of organizations interested in
using the results of the project and fostering further progress and
cooperation.

This main objective of IMPETUS sets the scene for what the project is all about.

The three "intersecting circles" show the three main areas of interest in the project. The <u>intersection</u> is important: all three parts of the project overlap, and they are integrated to form a coherent whole.

WHY IMPETUS: Main objective

Improve the security of public spaces in smart cities

Processes

Ethics
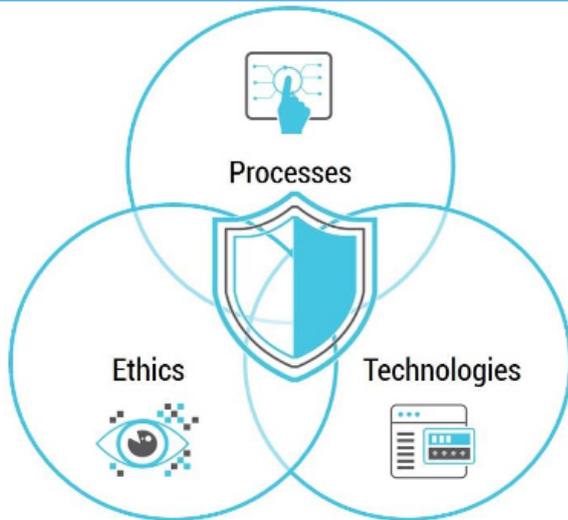
Technologies

The IMPETUS intersection: **integrating interdependent solutions and concerns**

- Can advanced **technologies** improve the detection and management of security events?
- How will this affect **processes** used in day-to-day operations?
- Are there **ethical** and legal issues?

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Technologies is about using devices and smart software to help predict, detect and deal with emergencies.

Processes is about supporting how first responders and others work together in preparing for or responding to an emergency – and the role of technologies in supporting this.

Ethics is complementary to the above two: it is about making sure that ethical, legal and data privacy concerns are properly taken into account and addressed in project work and in the solutions developed.

WHY do Smart Cities need IMPETUS?

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Remember the overall goal of IMPETUS: Improving the safety of public spaces in *smart cities*.

The "smart city" concept is often presented almost like some kind of science fiction dream – as in the attractive picture shown.

But what do we actually mean by "smart city"?

The four bullets shown here list some of the key technological characteristics that we would normally associate with the "smart city" concept.

WHY do Smart Cities need IMPETUS?

Smart Cities

- High-tech grid of sensors (cameras, environmental sensors, traffic sensors, …)
- IoT ("Internet of Things") – internet is everywhere – not least in everyone's pockets
- IT systems controlling critical infrastructure
- Advanced algorithms and AI (Artificial Intelligence) to help people make decisions

Efficient city administration

Enhanced situational awareness, especially in emergencies

Help authorities make sound decisions, fast

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13

Using these technologies effectively, can give substantial benefits in terms of how a city can be run, especially in emergency situations [green boxes].......

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Efficient city administration

Enhanced situational awareness, especially in emergencies

Help authorities make sound decisions, fast

Increased "attack surface"- more vulnerabilities e.g. cyber attacks

Increased risk of unethical use of personal data

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… but the technologies also bring challenges [red boxes].

The increased "attack surface" refers to the fact that use of advanced systems generates a *dependence* on these systems, so there can be serious negative consequences for the city if these are attacked: increased vulnerability.

Advanced systems in many cases make extensive use of large amounts of data, some of it potentially sensitive personal data. So there is a risk that this might be mis-used.

And this is where IMPETUS comes in:

The project will develop solutions that facilitate and promote the good things in smart cities ….

….. while at the same time putting in place procedures and technologies to guard against potential negative aspects.

The project approach to achieving its objective is based on four key elements.

The first is to understand in detail the situation in smart cities.

This means we have to know what kind of *threats* to safety in public spaces they are concerned about. We will do that through close dialogue with the cities that are partners in the project, and also through contact with our COSSEC members.

It also means that we need to make cities aware of what kind of *opportunities* can be offered by emerging technologies and approaches to organizing preparedness and response.

Most of this work will take place during the first 6 months of the project, and will result in a set of formalized requirements that will guide future work in the project.

HOW will IMPETUS achieve its vision?

What do we need?
- Identify *risks* and *opportunities* in smart cities
- Formalize *requirements*

What tools can help us?
- *Refine* technologies from partners
- Refine and integrate to provide an *integrated platform*

IMPETUS will build on existing technologies, brought to the project by partners. We will *not* start from scratch: that would be unrealistic given the timeframe of the project.

These existing technologies will be refined in the course of the project, in response to the requirements identified.

HOW will IMPETUS achieve its vision?
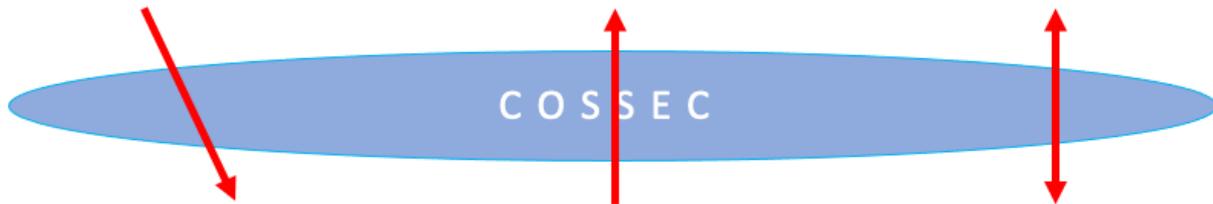
What do we need?
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What tools can help us?
- *Refine* technologies from partners
- Refine and integrate to provide an *integrated platform*

Does it work?
- Validation in *large scale trials*
- Involve *stakeholders* from inside and *outside consortium*

Project results will be developed and tested in close cooperation with the two trial cities in the project [details later].

Feedback from outside the consortium will be obtained through COSSEC.

ALL work done by the project will be carried out with ethical, legal and privacy concerns governing:
- The way the project work itself is carried out;
- How the solutions and approaches being developed would operate in deployment after the project.

By "governing" we mean that ethical, legal or privacy concerns will very closely guide the work, in such a way that concerns are addressed in a satisfactory way.

The project organisation includes dedicated resources specifically dealing with these issues, supplemented by an independent ethics board.

Co-operation with external organisation through COSSEC will apply to <u>all</u> aspects of our work, including ethical, legal and privacy work.

Platform: Provides the *support* you need

A key result of the project is the IMPETUS "platform".

By "platform" we mean something that provides cities with the support that they need.

Platform: Provides the *support* you need

Integrated: for use separately or together, as part of an overall solution

The platform consists of a collection of different technologies, gathered together as a package.

The different technologies can be used separately, by different actors in different situations.

But they can also be used together, as part of an overall approach.

Platform: Provides the *support* you need

Integrated: for use separately or together, as part of an overall solution

In different phases

For different kinds of threats

We classify components of the platform in two different dimensions.

The first classification dimension is about when the technologies would be used.

By *Before* we mean potentially a long time before any kind of "incident": things that we do for overall preparedness.

By *Imminent* we mean when there are indications of a possible incident. At this stage we might not necessarily even know the exact nature of a threat – just that there are indications that something is not as it should be.

By *During* we mean that some incident is on-going. In this phase we urgently need clarity about specific details of the incident. And we need to use that information to plan and carry out our response.

The second classification dimension is about the type of threat we are dealing with.

In some cases, we will know that we are dealing with a very specific threat [the purple boxes just give some examples]........

Platform: Provides the *support* you need

Integrated: for use separately or together, as part of an overall solution

In different phases

For different kinds of threats

Before — Simulation

Imminent — Detection

During — Classify – monitor - analyze | Optimize response

Specific — Chemical/biological attack | Cyber attack | Physical attack (gun, vehicle, bomb, ..)

Evolving — Forewarning of unusual activity

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… but in other cases we will have indications that something "unusual" is going on that merits further analysis to understand what it might indicate and possibly prevent it becoming an actual, specific threat.

Tools primarily aimed at threat detection and analysis

The following slides provide examples of some of the tools that will from parts of the platform. In this presentation, they are provided simply to give a "taste" of the types of tools, and where they fit in the two classification dimensions. Thus, there are no detailed annotations for the slides presenting the tools. Future presentations will provide information on all tools, with more details.

Social media detection tool

Forewarning of unusual activity – based on internet activity observations

Methods & Tools to automatically monitor public online content

- **Automatic text classifiers**
  - Machine Learning and Deep Learning models to classify the messages in domains

- **Data collection technologies**
  - Methods to extract information from web and social networks
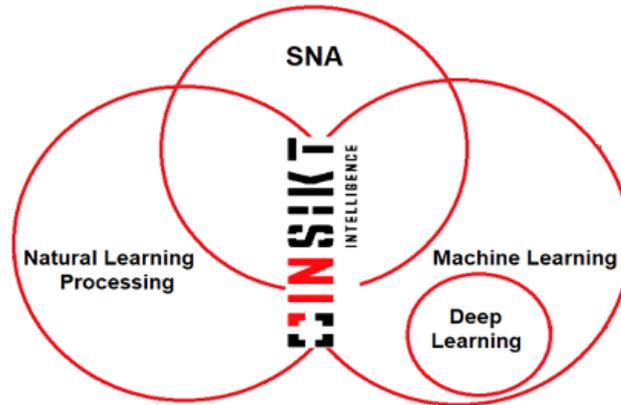
- **NLP**
  - Methods to discover insights into the content of the messages

- **Social Network Analysis**
  - Methods to discover relationships between users

SNA

Natural Learning Processing

Machine Learning

Deep Learning

INSIKT INTELLIGENCE

Joe Gorman

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Physical threat intelligence tool

Forewarning of unusual activity – based on sensor data

Anomalies of different time series detected (in green)
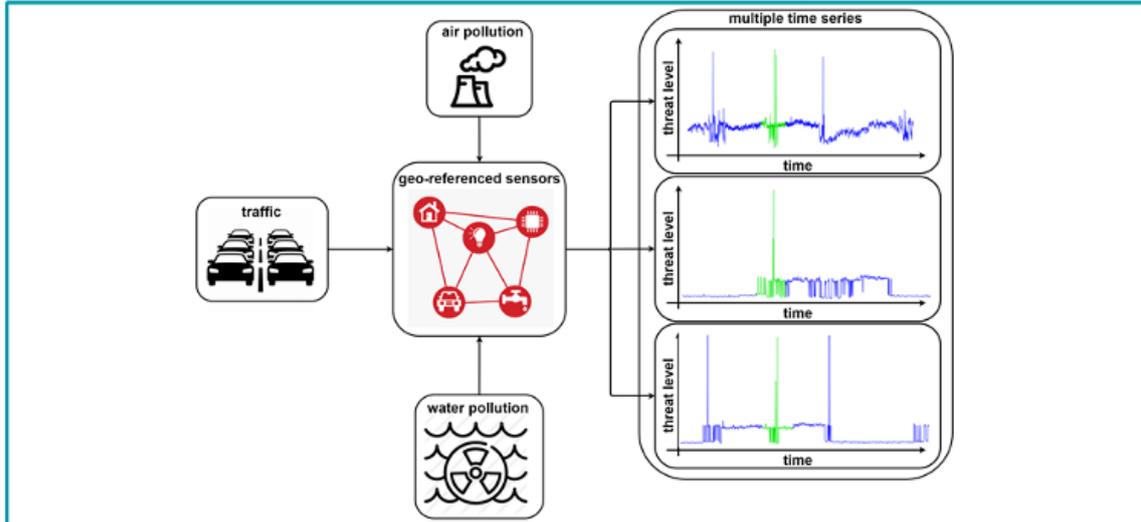
Biochemical risk detection tool

Chemical/biological attack – collect data, smart assessment of risk level
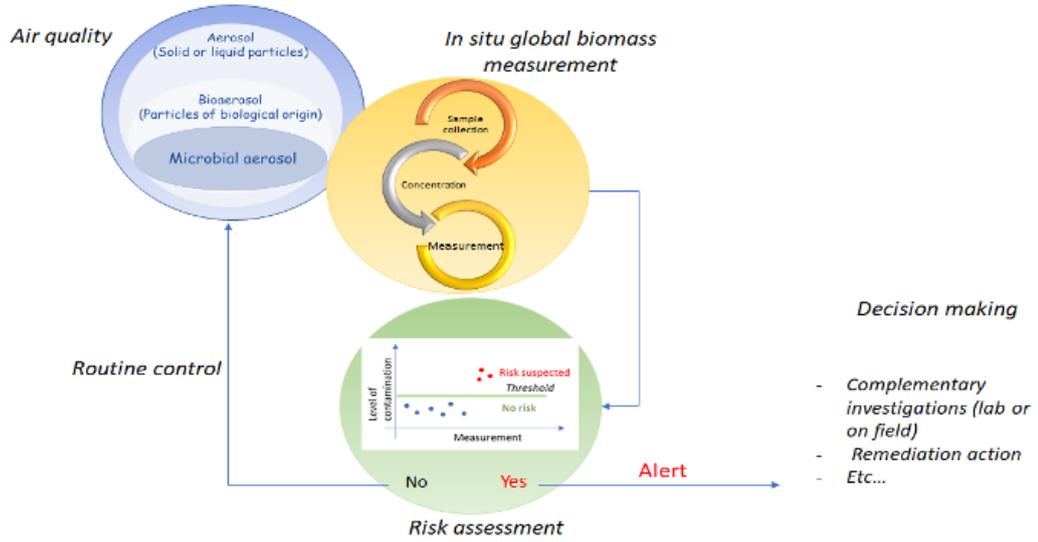
Weapon and face detection tool

Physical attack (gun, vehicle, bomb, ..) - based on AI-based analysis of CCTV images
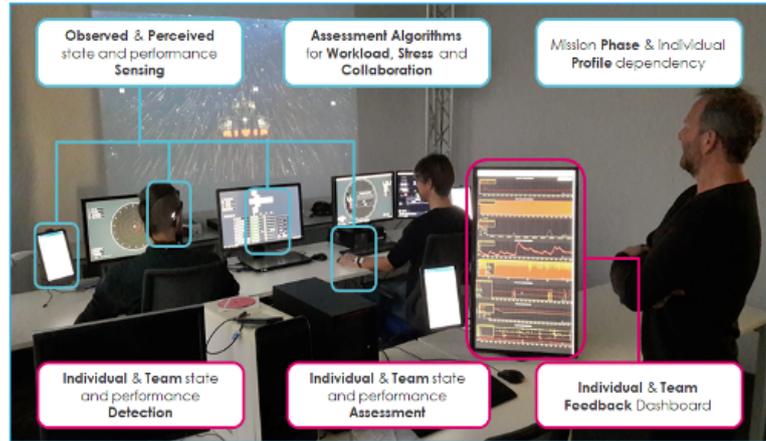

Instant

Weapon Detection

Via AI

Through CCTV

With Real-Time Alerts

Tools primarily aimed at optimizing threat response

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Human computer interaction tool

Optimize response – helping IT system users work well under stress
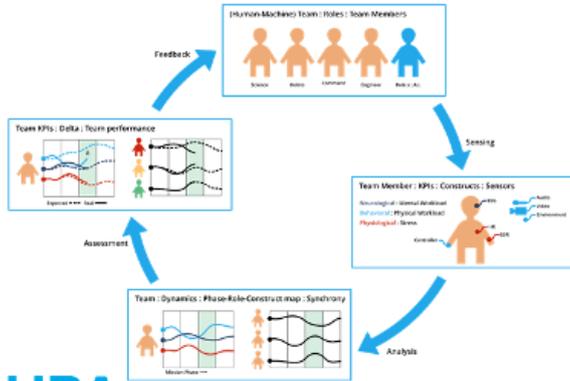
Using (neuro)physiological sensors, machine learning for real-time workload assessment and user feedback

32

Physical Threat Response (Padova)

Optimize response –direct & prioritize traffic
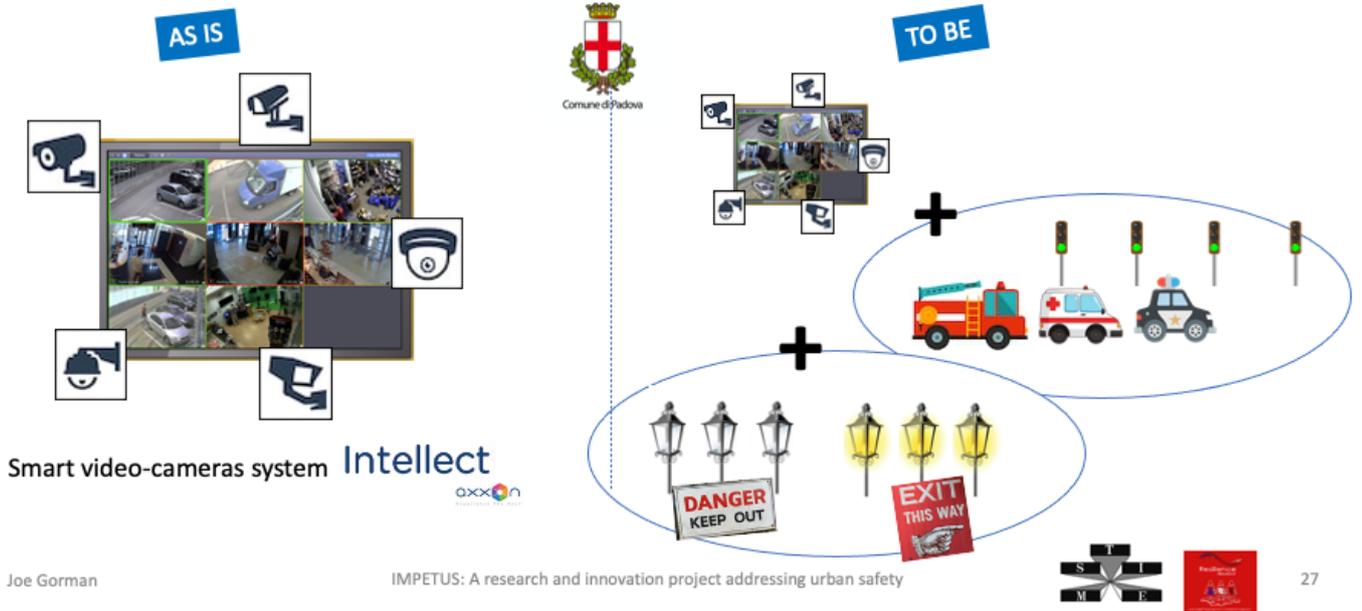
AS IS

TO BE

Comune di Padova

Smart video-cameras system Intellect

DANGER KEEP OUT

EXIT THIS WAY

The two cities chosen as trial sites in the project are medium sized cities. We wanted to have cities that were large enough to offer realistic scenarios, but small enough for it to be feasible to:

- Have detailed dialogue with first responders, authorities and other stakeholders;
- Organize testing, including "on street" operations.

Testing and validation will be carried out in three phases as shown.

The nature of the testing/scenarios will have some commonality between the two cities, but also aspects unique to each city, to widen scope.

The "Next steps" shown here are as of the date that this presentation was made [December 2020].

The point about "face to face meetings" refers to meetings within the consortium – as of this date not possible due to the Covid crisis, but considered important to arrange as soon as possible to improve communication and common understanding in the consortium.

These are the "next steps" for after completion of the project.

It is essential to keep these in mind throughout the project itself – as they have a major impact on how we organize our work and make strategic plans for the long-term.
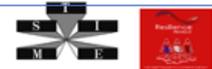
We thank you for your time in viewing this presentation.

You will find further information on the website, but do contact us directly if you have specific questions.