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The High-Tech Strategy for Germany

# Research for Civil Security

## Protection of Supply Infrastructures



HIGH-TECH STRATEGY

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## Innovations for civil security: Protection of supply infrastructures

The heater remains cold, telephone and Internet connections are interrupted. Traffic lights are out of order, and fuel pumps at filling stations have stopped working. A prolonged power outage would lead to extensive social and economic disruptions in Germany. Electric power is also needed for conditioning drinking water. Like clean drinking water, the energy supply is among a modern industrial nation's most important resources. Although extremely rare in Germany, when they do occur, large-scale power failures or contaminants in drinking water affect a large part of the populace. Secure supply infrastructures are therefore of great importance.

Authorities and operators are also facing new challenges here, in view of the increasingly complex security risks. Hazards such as technological accidents and natural disasters, as well as new threats like terrorism and organized crime must be identified early for timely initiation of countermeasures and avoidance of cascade effects.

As part of its programme titled "Research for Civil Security", the Federal Ministry of Education and Research (BMBF) has allotted a total of over 245 million euros for civil security research to the end of 2011. The goal is to develop security solutions which can be embedded in comprehensive organizational concepts and plans of action.

However, civil security solutions which are innovative and suitable for society arise not only from technical innovations. Because every citizen comes into contact with security applications, social requirements must also be taken into account in the development of new technologies and organizational concepts. This is one of the security research programme's main guiding principles.

Solutions which are compatible in practical and social terms are therefore a central component of the civil security research projects presented in this collection of information, which deals with "protection against failure of supply infrastructure." The results of research on the security of supply infrastructure will contribute significantly toward improving security standards for the benefit of citizens.



# Scenario-based principles and innovative methods for the reduction of the risk of power supply failure (GRASB)

## Motivation

Prolonged power failure can be caused by natural disasters, accidents or intentional acts. Such situations can also contribute to the breakdown of public communications networks and other utilities like gas and water.

## Goals and strategies

The joint project's primary objective is therefore to reduce the risk of major power outages. In the course of this partnership, scientists and utility companies will jointly identify critical power supply infrastructures and classify them according to different risk levels. Considered here, in particular, are scenarios in which power failures adversely affect the population.

## Innovations and perspectives

The joint project GRASB will develop risk management and evaluation methods on the basis of investigated scenarios. This includes identifying responsibilities and infrastructures that require special protection, estimating resources and developing a communication concept. These measures are intended to enable power supply companies to recognize failure risks early, on the basis of specific criteria.



110-kV outdoor installation (source: RheinEnergie AG, Cologne)

## Announcement

Protection of Supply Infrastructures

## Project title

Scenario-based principles and innovative methods for reducing the risk of power supply failure, taking into account their impact on the populace (GRASB)

## Duration

09/2009 - 08/2012

## Project partners

- Federal Office of Civil Protection and Disaster Assistance (BBK), Bonn
- Cologne University of Applied Sciences, Institute of Rescue Engineering and Emergency Management, Cologne
- TÜV Rheinland Consulting GmbH (TRC), Cologne
- Wölfel Beratende Ingenieure GmbH + Co. KG (WBI), Höchberg

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# Learning information infrastructures for crisis management in case of medium to large electrical power breakdowns (InfoStrom)

## Motivation

Electric power is crucial to many supply systems, such as IT communication, transportation and healthcare. Though rare in Germany, when power failures do occur they often take the population by surprise and can accordingly cause significant damage. Decisive factors for good crisis management therefore include timely information and communication.

## Goals and strategies

The InfoStrom research project will develop a concept for fast response to power outages. Of equal priority here are rapid technical restoration of power supply, acceleration of organizational processes, and communication with affected actors. The project focus is on information management, especially acquisition, processing and dissemination of digital information to relevant user groups and the population.

## Innovations and perspectives

InfoStrom is currently preparing a decentralized, IT-based security platform. It will link all participants responsible for failure management, across organizational boundaries. Of decisive importance here is to prioritise and evaluate the acquired information in terms of relevance, credibility, etc., and present the outcome according to users' needs. This will create a framework for coordinating information flows for all those concerned. Furthermore, establishing such information flows in near real-time is encouraged, in order to improve situation analysis and communication for personnel deployed on-site, and to aid affected citizens.



Control centre in Berzdorf (source: RWE Rhein-Ruhr distribution network GmbH)

## Announcement

Protection of Supply Infrastructures

## Project title

Learning information infrastructures for crisis management in case of medium to large electrical power breakdowns (InfoStrom)

## Duration

03/2010 - 02/2013

## Project partners

- SAP AG, Walldorf
- University of Siegen
  - Institute for Business Information Technology
  - Institute for Media Research
- PSI AG, Berlin
- RWE Deutschland AG, Essen
- Fraunhofer Institute for Applied Information Technology (FIT), St. Augustin

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# Infrared laser-based fibre optic sensor system for drinking water monitoring (IRLSENS)

## Motivation

The supply of drinking water is an aspect of daily life in which particular importance is attached to maximum quality. Compliance with stringent regulations concerning drinking water is checked on the basis of maximum values for contaminants. Conventional measurement systems are already capable of detecting contamination of various kinds, and their origins, in a relatively short time, permitting operators to issue corresponding warnings to users of the affected drinking water network. One example here is the washout of fertilizer by heavy rain, which could result in regional crossing of specified parameters. Poisonous substances, especially fertilizers and pesticides, can be introduced into drinking water not just by accidents or natural disasters, but also by criminal or terrorist activities.

## Goals and strategies

The IRLSENS project is accordingly meant to develop an innovative measurement system capable of detecting, in particular, pesticides such as insecticides and chlorinated hydrocarbons like chloroform in a matter of seconds, so that operators of the affected supply network can be alerted more quickly. The new system blends innovations in the field of laser- and fibre-based infrared analysis to offer a powerful measurement technique.

## Innovations and perspectives

This new system's advantages lie in fast analysis, specialization in a particular group of substances, and automation. Because the measuring system will sometimes need to be installed in poorly accessible areas of the drinking water network, its automation is of particular importance. The project's technological elements will be accompanied by research into social-scientific aspects, especially effective risk communication, and analyses of legal frameworks.



Drinking water must meet the highest quality standards  
(source: ©iStockphoto.com/Chirkov)

## Announcement

Cooperation between Germany and Israel in civil security research

## Project title

Infrared laser-based fibre optic sensor system for drinking water monitoring (IRLSENS)

## Duration

05/2010 - 04/2013

## Project partners

- Fraunhofer Institute for Applied Solid State Physics (IAF), Freiburg
- Fraunhofer Institute for Physical Measurement Techniques (IPM), Freiburg
- Bruker Optics, Ettlingen
- DVGW Water Technology Centre (TZW), Karlsruhe
- Partner in Israel: Tel Aviv University (IL)

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# Intelligent emergency power supply concepts involving renewable energies (Smart Emergency Supply System SES<sup>2</sup>)

## Motivation

Malfunctions in power plants or power lines can quickly lead to widespread power outages. Prolonged, supra-regional disruptions in electricity supply hold great potential for destabilizing the economy and populace. Strategies for ensuring a minimum supply are therefore of crucial importance. Fail-safe automation of decentralized supply systems is a new approach of achieving a minimum electricity supply.

## Goals and strategies

Project SES<sup>2</sup> aims to create new emergency power supply structures incorporating decentralized conversion systems and renewable sources such as photovoltaics, wind turbines and fuel cells. An intelligent network management system, capable of optimising operations in a crisis, will be developed for renewable and other sources. To be considered here, above all, are the needs of households based on individual as well as regional factors. To register these factors accurately, the social-scientific element of the project will survey the minimum supply requirements of potentially affected households in the event of short-, medium- and long-term supply disruptions.

## Innovations and perspectives

Increasing integration of renewable and distributed power sources opens up new options for implementing fail-safe power supplies. Based on this, the SES<sup>2</sup> research project will make an important contribution toward ensuring continued supply for urbanized regions in the event of a prolonged, widespread power failure so as to reduce the risk of social instability.



SES<sup>2</sup> model of minimum emergency supply via renewable and distributed power sources (source: Egon Ortjohann)

## Announcement

Protection of Supply Infrastructures

## Project title

Intelligent emergency power supply concepts involving renewable energies (Smart Emergency Supply System SES<sup>2</sup>)

## Duration

08/2009 - 07/2012

## Project partners

- South Westphalia University of Applied Sciences – Soest division – Department of Electrical Engineering – Field of Energy Supply, Soest
- Leuphana University of Lüneburg, Faculty of Education, Culture and Social Sciences – Institute for Social Sciences
- devboards GmbH, Paderborn
- APtronic AG, Bad Sassendorf
- Geesthacht Public utilities GmbH, Geesthacht

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# Simulation of intersectorial cascade effects through breakdowns in supply infrastructures using a virtual 3D city model of Berlin (SIMKAS-3D)

## Motivation

Power supply systems, such as that for drinking water, depend increasingly on the functionality of other systems like the electricity supply. A disruption in one supply system can therefore quickly lead to a cascade of further disruptions.

## Goals and strategies

The joint project SIMKAS-3D will develop decision-making and coordination tools which will help avoid cascade effects following a failure of critical infrastructure. The aim of SIMKAS-3D is to analyse dependencies between supply systems using a virtual 3D city model of Berlin and by conducting exercises. Preventive measures, and strategies for action in the event of a disruption, will be prepared on the basis of simulations. Involved here, besides administrative bodies responsible for security, are, in particular, operators of infrastructures for gas, water, electricity and district heating.

## Innovations and perspectives

SIMKAS-3D will develop an IT-based platform suitable for all operators, which allows them to retain an overview, even in extreme emergency situations, and make the correct decisions quickly, in order to minimize the risks of failure associated with cascade effects in supply infrastructure. Within the framework of this IT-based platform, options for improved situation analysis will be combined with realistic simulations, in addition to the development of means of supporting communication and coordination between responsible participants.



Potsdam Square, Berlin (source: @iStockphoto.com/Nikada)

## Announcement

Protection of Supply Infrastructures

## Project title

Simulation of intersectorial cascade effects through breakdowns in supply infrastructures using a virtual 3D city model of Berlin (SIMKAS-3D)

## Duration

09/2009 - 08/2012

## Project partners

- Technical University of Berlin – Center for Technology and Society
- Technical University of Berlin – Department for Geodesy and Geoinformation Science
- DHI-WASY GmbH, Berlin
- Inter 3 GmbH Institute for Resource Management, Berlin
- Berliner Wasserbetriebe, Berlin
- NBB Netzgesellschaft Berlin-Brandenburg mbH & Co. KG
- Vattenfall Europe Distribution Berlin GmbH, Berlin
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## Protection of the supply of drinking water with regard to CBRN scenarios (STATuS) – Phase 2

### Motivation

The continuous supervision and guarantee of proper drinking water quality is an essential governmental mandate in a modern industrial nation. The central supply of drinking water needs to be protected against hazards: On one hand against accidents and natural disasters, on the other hand against crimes, such as terrorist attacks, in which biological, chemical or radioactive substances could be introduced into the drinking water system.

### Goals and strategies

The aim of the STATuS joint project is to conduct a comprehensive threat and risk analysis regarding the contamination of drinking water with biological, chemical or radioactive substances. This will serve as a basis for preparing specific security strategies, organizational concepts and technical innovations in order to safeguard drinking water. The results will be made available to users and authorities in the form of guidelines. All relevant phases of the drinking water supply chain, ranging from conditioning to consumption, will be covered.

### Innovations and perspectives

During the course of this joint project, particularly critical segments of the water supply system will be identified in cooperation with the companies involved. For these areas, the risks of contamination by different materials will be examined, and solutions developed. Sociological studies will shed light on the extent to which the necessary preventive measures and countermeasures are accepted by the populace.



Aerial view of a dam (source: KWL Water Supply Association, Kleine Kinzig)

### Announcement

Protection of Supply Infrastructures

### Project title

Protection of the supply of drinking water with regard to CBRN scenarios (STATuS) – Phase 2

### Duration

10/2009 - 02/2013

### Project partners

- 3S Consult GmbH, Garbsen
- Fraunhofer Institute for Optronics, System Technologies and Image Exploitation (IOSB), Karlsruhe
- Fraunhofer Institute for Systems and Innovation Research (ISI), Karlsruhe
- IWW Water Research Institute, non-profit, Mülheim an der Ruhr
- German Technical and Scientific Association for Gas and Water (DVGW) e.V., DVGW Water Technology Center (TZW), Karlsruhe
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## Energy and fuel supply for petrol stations and emergency generators during power outages (TankNotStrom)

### Motivation

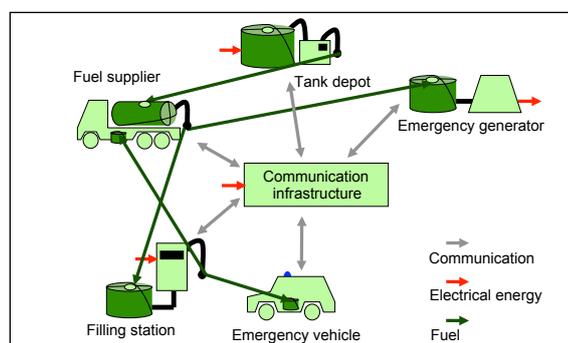
Almost all critical infrastructures, such as public transport and hospitals, rely on a functioning power supply, backed up by emergency generators in the event of a crisis. If the electricity supply failed for several weeks, there would no longer be enough fuel for emergency generators or vehicles deployed by rescue teams, because most filling stations have no emergency power supply. The joint project TankNotStrom will develop new ways of resolving the dependence of critical infrastructure on a continuous fuel supply.

### Goals and strategies

TankNotStrom aims to create an information, management and logistics system capable of maintaining a minimum fuel supply in the event of a power outage. To be inventoried here are emergency generators, deployable vehicles, the necessary quantities of fuel, as well as filling stations in Berlin-Brandenburg. In a test, emergency generators operated by the participants will be equipped with sensors enabling disaster control authorities to determine current fuel requirements through an independent communication system. The possibility to connect mobile emergency generators will be realized at selected filling stations.

### Innovations and perspectives

Because the existing communications infrastructure would not be usable in the event of a prolonged power failure, TankNotStrom will include an independent communications system powered by emergency generators. This system will, in turn, ensure a fuel supply for these generators. Filling stations can be integrated into the system by means of mobile emergency generators. Another focus of the project is on fuel logistics in the event of a crisis. Once complete, the project is to offer a functional demonstration system which can subsequently be developed and put into operation.



Dependence of infrastructure on fuel supply  
(source: TimeKontor AG)

### Announcement

Protection of Supply Infrastructures

### Project title

Energy and fuel supply for petrol stations and emergency generators during power outages (TankNotStrom)

### Duration

06/2009 - 05/2012

### Project partners

- TimeKontor AG, Berlin
- Brandenburg University of Applied Sciences, Department of Business and Management, Institute for Security and Safety
- Technische Universität Berlin, Innovation Centre Energy
- Charité - Universitätsmedizin, Berlin
- HiSolutions AG, Berlin
- Berlin Fire Department, Berlin
- Berlin School of Economics and Law, Security Management Programme, Berlin

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