



 <p>MEREPUV</p>	2017/PREV/783153
<p>"Methods and measures to enhance resilience against electric power outage in urban vital societal functions"</p>	

**MEREPUV**  
**Working Paper from**  
**Safety Region South Holland South**

D3.2 SRSHS

Approved by	
Date	



Funded by  
European Union  
Civil Protection

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# 1 Introduction

## Project MEREPUV

The Safety Region South-Holland South together with the city of Dordrecht has participated in the MEREPUV project, focusing on the effects of city-wide power outages on healthcare services. A wide range of professionals in both municipal and specialist healthcare services have been consulted, as well as professionals from several essential infrastructure providers for the healthcare services

## Overall goals of the project

The overall goals of the project were to increase the resilience of society during power outage by creating insights in the possibilities and recommendations to facilitate the community to increase the resilience of society and strengthen the capacities of the professionals in the vital infrastructure and crisismanagement.

## Scenarios

The selection of scenarios was made together with all projectpartners during the workshop in Bergen in May 2018 and after several consultations of the local coreteam, specialists and partners involved.

## Overall description of methods, process, data collection

The assessment conducted is done within the framework of the so-called bow tie model. The model is adapted and specified on basis of purpose, analytical object and main questions to be examined in the assessments. The following risk elements are assessed:

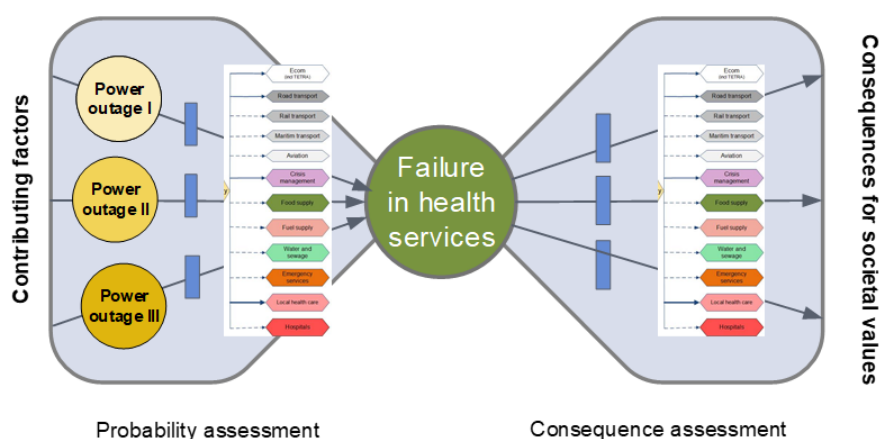
- Probability
- Vulnerability
- Consequences
- Uncertainty
- Steering ability: How manageable are the risks and vulnerabilities attached to the scenario? To what degree are there available measures which are likely to reduce risk and vulnerability? Vulnerability in health services is the analytical object in the model.

The probability assessment builds on results and insights from earlier risk and vulnerability assessments and other available existing knowledge and data material.

The probability intervals used are:

- Very low probability: 0-10 per cent likely in 50 years
- Low probability: 10-40 per cent likely in 50 years
- Moderate probability: 40-60 per cent likely in 50 years
- High probability: 60-90 per cent likely in 50 years
- Very high probability: 90-100 per cent likely in 50 years

Cascading effects of power outage and failure in health services in terms of influence on other critical functions in society



### The scenarios affecting other vital functions

In the assessments we examined whether and how the scenarios affect other critical input factors of which health services are dependent on in order to function.

### The scenarios affecting health services

In the assessment we described how the different scenarios affect health services, either directly or indirectly, due to failure or disruption in one or several other critical input factors for health services.

Furthermore, an overall assessment is made of how health services are affected in total. The assessment was based on a five-part scale from very low to very high degree.

### Insight in cascading effects and consequences for other vital societal functions

By examining other vital societal functions' dependency on health services, we perceived an impression of vulnerability in society related to failure in health services.

## 2 About power outages in the Netherlands

### Facts about reliability in deliverance of power in the Netherlands

The reliability of the deliverance of power is measured on EU-level. This is CAIDI, SAIFI and SAIDI. Customer Average Interruption Duration Index (CAIDI) is a reliability index commonly used by electric power utilities.

SAIDI is the System Average Interruption Duration Index and SAIFI is the System Average Interruption Frequency Index. The latter is commonly used as a reliability indicator by the electric power utilities. SAIFI is the average number of interruptions that a customer would experience.

Power distributor Stedin	CAIDI	SAIFI	SAIDI
2017	88	0.188	16
2018	76	0.223	17

The Saidi and Saifi numbers are within the accepted range of the EU, however the CAIDI (average interruption duration) is above the accepted range of the EU which is 65 minutes.

The Regional Risk Profile and the National Safety Profile consider the possibility of Power Outage very likely and with an high impact on society. The National Safety Profile also considers the chain effects in vital infrastructure very high. In the light of Energy transition the expectations are that the grid will be heavily strained due to higher impact and powerfluctuations which increases the chance of power outages. The investments made on the grid will take place and the grid will be have to be adjusted and when necessary renewed. However this will take time and also increases the number of power outages due to work on the grid.

### Facts about incidents of previous power outages

The Safety Region South Holland South and particularly the city of Dordrecht hasn't had experience yet with extensive and longterm power outage.

In other parts of the Netherlands we have had multiple incidents however these are all resolved within 24 hours, except in November 2005 due to extreme weatherconditions and in December 2007 when an Apache helicopter flew to the high voltage lines, which caused an power outage in a greater rural area with several municipalities. In the beginning, society didn't have severe problems, however after 24 hours the people got angry and they experienced more (financial) damage and nuisances. The institutions in the area took their responsibility and adjusted the health care services as much as possible, no fatalities were known which accured due to the power outage.

In the years following there were several severe and large power outages which lasted from 4 up to 12 hours. The latest large power outage which also occurred in an urban area was on the 17th of January 2017 in large parts of Amsterdam. The number of grid connections affected were 360.000 in the early morning at 4:19 hours. At 6:14 hours the majority of households and institutions regained power again, and the latest area reconnected was at 8:40 hours.

Although the power outage had a duration of 4 hours, unfortunately 2 persons deceased due to the effect the power outage had on the emergency call centre. There was a high increase in people who called the emergency call center. The lines were overloaded and the queues were full.

In 2015 there was a failure in a high voltage station, which caused a power outage in a large area of the northern part of Holland. In the end 6 Safety Regions were affected and there was a large upscaling of the crisismanagement organisations. This power outage had a duration of 5 hours, but had an enormous effect on society, businesscontinuity and health care services. Although no fatalities were reported, operations in hospitals had to be cancelled or postponed and traffic, metro, trains and flights experienced great disruptions. The airports couldn't handle the planned flights and bridges couldn't be operated. Failure of 75% of Telecom occurred within 1 hour. The distortions in society in fact took longer than the actual power outage.

## Expected societal development

Research by the National Institute for Public Health and the Environment shows the following<sup>1</sup>:

### Healthcare related expectations:

- Strong increase of people with elderly based illness. It will cause extreme pressure on the whole of the Healthcare system
- By increasing numbers of elderly people in the future more people with multiple disease will have to be treated. A considerable part of these people will also have social problems like loneliness and isolation. The number of people with complex transcending problems and demand for health care will increase.
- Patients will act more on themselves, it requires new skills as well as for the aid workers as for the patients. A number of people will not be able to do so and has to be taken care of.
- Mental pressure on younger groups is exceeding and brings new threats.
- Health care is shifting from institutions to home and requires adjustment in the health care system, the aid workers, adjustment in the skills of the professional care takes and patients.
- Explicit individual treatments or diagnoses will occur more often

### Society related expectations:

- More pollution and more stress on public health due to expanding of the larger cities
- Differences between neighbourhoods and areas caused by segregation, will cause a numerous accumulation of health related risk in areas and neighbourhoods
- New types of forms of living which will be expected to have a positive influence of well being
- New technologies will help in building resilience of civilians
- Air, water and soil quality improvement is expected, however new risk may occur
- Intensive livestock farming causes risks for healthcare and pandemics
- Noise pollution will extend and are a serious threat for health care and well being

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<sup>1</sup> Most relevant findings of the Research have been added to this summary. The complete research can be downloaded from the site of the National Institute for Public Health and the Environment website: [www.rivm.nl](http://www.rivm.nl)

- Digitalisation will require different skills from the working force. This will ask for lifetime learning. This will not be a possibility of lower educated people, elderly, people with health issues, thus could result in less job opportunities and poverty.

#### Considerations of probability of the chosen scenarios in MEREPUV

The chosen scenarios were discussed with the power distributor Stedin and within the local coreteam. In addition the National Safety Profile and the Regional Risk Profile also used a similar scenario, based upon duration. On top of this, the previous incidents show that the probability of the chosen scenarios certainly is feasible.



## 3 Responsibility of the municipality in case of power outages

### Overall responsibility for societal safety for municipalities vs. state / region / other stakeholders

Legal responsibility for crisis response in the Netherlands is mostly delegated to the local level and the safety region, with the mayor of the largest municipality within the region as the "commander". The mayor is considered to be the one who is ultimately responsible for the choices made.

There are multiple laws in place that indicate the legal responsibilities the different health organisations have. The general principle is that the healthcare organisations and individual professionals (like general practitioners), are responsible for ensuring quality healthcare to their patients, also during a power outage or other crisis. So they have to prepare for crisis situations, and make sure they can continue to function in a certain manner.

The health organisation has to report their preparation to the Safety Region. The GHOR as part of the crisis management network will advise, support and makes agreements with the health organisations has a coordinating role in this. The Safety Region always pays special attention to the health care section in their risk analyses and crisis management planning. As they have a coordinating role, the health sector is always an important factor and partner in their preparations and crisis response plans.

## 4 Cities assessments - main findings, possible measures and following up

### Summary cities assessments

#### Scenario 1 - 4 hour power outage

##### Impact on critical input factors for health services

The impact of a power outage of 4 hours on the critical infrastructure is relatively low. Organisations that manage what is considered critical infrastructure (Power supply, ICT, water supply, gas-network, Sewage system) are required by law to take precautionary measures to deal with the effect of power outage.

Those measures for the most part ensure that the effects of a 4 hour power outage are minimal. The electrical company will have to fix the problem and repair the network within 4 hours, or else they will have to pay for some of the damages. They are both technically and legally unable to restore the power to certain key locations first in case of a power outage (i.e. hospitals).

Both the gas network and water supply will continue to function, as the companies will be able to keep "pressure" on the infrastructure, ensuring the supply of gas and water. The city heating network and sewage system will stop to function, however impact is expected to be relatively

low. If there is a heavy rainfall event at the same time, the impact could be much bigger. Sewage could dump in open water if the system reaches capacity, and water will rise in the lower parts of Dordrecht. This could lead to blocking tunnels and causing damages due to waterlogging in houses, and sewage water coming up through the toilets in homes.

Transportation and the road network are expected to experience larger delays, and public transport will mostly stop functioning, with the exception of busses. Tunnels will be closed off and bridges will no longer be operable by a central system. This will cause large delays, and could be very harmful in case of delayed emergency vehicles.

The ICT and Telecom infrastructure will experience heavy impact in case of a 4 hours power outage. As all Wi-Fi connections will fail instantly, all phones, laptops and other internet devices will try to connect to the mobile network, overloading it and causing it to crash. Although some have a power back up for a couple of hours, they are still expected to fail. Emergency numbers will be able to function for a while, and people can call these using landline phones; however experiences show that these will be overloaded with callers.

#### Cascading effects and impact on other vital functions

During a power outage of 4 hours most health organisation will be able to (partly) continue to function. All organisations will face difficulties, especially the ones who do not have an emergency power system. It is however not expected to cause immediate loss of live.

The hospital will be able to continue to function, however they will only supply the necessary care, and will stop all non-critical appointments and treatments. Other health organisation indicates that they will improvise or fall back on regional organisations that will still have power. Because the impact will be manageable, the cascading effects are deemed to be minimal.

Although it is expected that the increased demand for communication will be very difficult, due to the problems expected in the ICT / telecom sector.

#### Consequences for societal values

The capacity of the healthcare organisation will diminish, however critical care will be able to continue to function. The only exception is the very vulnerable home care patients, who require machines to continue to live. This can be taken over by individual care, however if this is not supplied immediately by health care professionals or family members, there is a substantial risk for fatalities.

The ICT / Telecom as well as the public transport are expected to be not functioning, while there is an increased demand for these services. This is not expected to cause any societal unrest.

#### Identified vulnerabilities, existing barriers and proposals of measures

The dependence of the health organisation and society overall on ICT and telecom are a large vulnerability, especially considering these systems are expected to largely seize to function the moment there is a power outage.

Next to this the homecare health organisations are expected to not have the capacity to deal with the consequences of the power outage. Experiences show that they have a large degree of

flexibility and motivation to help in such situations; however the small scale of these organisations creates extra vulnerability. There is no overview and likely no possibility to contact the local people of those organisations, who have crucial information and skills. This is also a barrier, the problem of getting the information of home care patients, their location and healthcare needs, and the capabilities of the home care organisations.

Furthermore it is often unclear who in case of power outage will communicate about the consequences and the expected moment the power will be restored. There is no clear division of responsibilities to communicate between the home care organisation, power supply company and crisis organisations.

Possible measures are start communicating to raise the awareness about possible consequences due to a power outage, and to stimulate health organisations (especially homecare) and patients themselves to take more precautionary measures.

Preparations can be taken to ensure a quick transfer of critical information from homecare organisation to crisis organisation, in order to quickly dispense emergency healthcare to targeted location. Concerns due to privacy laws will have to be solved. This is considered as a measure that could solve one of the biggest possible impacts and problems that will occur.

#### Scenario 2 - 12 hour power outage

##### Impact on critical input factors for health services

The expected impact during a 4 hour power outage scenario is also expected to occur during a 12 hours power outage.

Furthermore it is expected that transportation and public transport will further diminish in capacity, although people by this time will have adapted to the new situation, so there is also a smaller demand. It could however still cause large problem for emergency services.

The possibility to communicate via ICT and TELECOM will further decrease, batteries of transceivers (walkie-talkie) will run-out, decreasing the already limited possibility for health organisations to communicate internally and externally even further. The water supply, sewage department, and gas network are not expected to experience any further impact.

##### Cascading effects and impact on other vital functions

During a power outage of 12 hours the impact on the health care sector will continue, however the strategy will remain the same. The organisation will still be able to ensure any critically needed healthcare. The impact on the other vital functions will therefore be relatively similar with the 4 hours scenario.

There will be an increased demand for assistance by crisis organisation, and patients who receive health care at home will also require more assistance. When this concerns patients who stay at special care institutions this could become problematic, as they could possibly cause harm to themselves or their environments. If these problems occur it will cause an increased demand for assistance from other health organisation to deal with these problems. How this will be organized and communicated is unclear.

### Consequences for societal values

The capacity of the health care system on the Island of Dordrecht will continue to decline, especially within the hospital.

The general practitioner also expects an increased volume of questions from patients, although they could possibly not be received due to the communication issues. No extra victims are expected, with again the exception of home care patients receiving critical care. As these patients are in need of constant care, and very vulnerable to any changes, the risk for fatalities will increase.

Furthermore some patients, who are housed in (semi-) closed housing, could cause unrest if they are no longer in the closed housing institutions. The expected chaos in traffic and public transport is expected to decrease, as people adapt to the new situation, as long as there is no extreme weather (cold / rainfall) the overall societal impact is considered to be low.

### Identified vulnerabilities, existing barriers and proposals of measures

Any home care systems that run on batteries will have run out during the 12 hours, in case of no spare batteries constant care will be needed. There is a demand for fuel to power emergency generators supplying health care locations.

Finally the increased use of electrical cars within health care organisations will decrease the mobility of health care professionals. Existing barriers are the increased demand for assistance that several health care organisations will have, however they will not be able to communicate this via any systems.

Furthermore the emergency hospital located in Utrecht will possibly be activated, however as they have only 100 beds, it could be that there is a further demand for capacity. The transport of the patients will also be a limiting factor, as there are only a limited number of emergency vehicles available.

Possible measures that can be taken are the organisation of extra assistance of material and people from outlying regions, as the distance is very short, extra capacity can be brought in very quickly. By supplying information to organisations and home care patients about the possibility and consequences of a longer power outage, further preventive measures could be stimulated, like the supply of back up batteries of vital medical apparatus people use at home.

### Scenario 3 - 24 hours power outage

#### Impact on critical input factors for health services

Again all the impact that is expected during a 4 and 12 power outage is also expected during a 24 power outage. A power outage of 24 hours is considered to be extremely harmful by most organisations, between the 12 and 24 hours changes occur in the critical infrastructure system, which will require a longer repair period. The strategy of most health organisations will change when they consider a 24 power outage situation.

Almost all organisations will start evacuating around this time; already there are deals in place with regional organisations to help each other during such an event. If there is a power outage of 24 hours the communication systems of the crisis organisations will be less reliable, and could partly stop to function.

Even without rainfall tunnels will fill up with water at this time, as the water is no longer pumped out. Localized flooding could occur from open water bodies, as the larger pump of the polder area will no longer function. Fuel shortages are expected to increase within Dordrecht. The city wide central heating system will have cooled down to a point, where heating the water used for heating homes will take a long time, giving an exact time estimate is not possible.

#### Cascading effects and impact on other vital functions

In case of a power outage of 24 hours, most healthcare organisations indicate they will start evacuating their patients to outlying regions. Evacuating the hospital will require a large number of emergency vehicles, this is most likely the limiting factor of the time needed to evacuate. The evacuation will be hindered by the closing of tunnels, but will still be possible.

Most organisations indicate that if there is a power outage of 24 hours, all patients will be evacuated, and the regional health care providers and organisations will help. Crisis organisation have a central role in coordinating this response, and although there will be many difficulties; they are expected to be able to cope with the situation.

#### Consequences for societal values

Between 12 and 24 hours general practitioners expect a large increase of questions from people and elderly in their neighbourhoods, that need medical attention or are worried given the situation.

This could cause unrest, as the capacity of the health care organisations will further decrease during this period. They also expect problems with staff and resources, which will be no longer sufficient to deal with the demand for healthcare.

That is why most organisations will have chosen to evacuate around this time. The evacuation will be risky for some patients, but staying within Dordrecht in such a situation is considered to be more harmful. The national government will have taken steps to assist with the crisis management, during such a situation.

#### Identified vulnerabilities, existing barriers and proposals of measures

There are various vulnerabilities that have been identified given a 24 power outage scenario. There will be an increased demand for healthcare, predominantly from people who receive healthcare at home, and elderly, at the same time the capacity for healthcare will drastically decrease.

Furthermore cooled medicines and food will no longer be usable / edible, and the capacity of the staff is expected to decrease. Existing barriers during this scenario are the capacity of emergency vehicles, which can be used in an evacuation. With previous large scale evacuation of patients, this proved to be the limiting factor.

Furthermore there is no central database with information about people who receive homecare that can be accessed by crisis organisations. Possible measures that could be implemented, is the realisation of local support points in the neighbourhoods, which can give information and supply to the people living there.

Also the evacuation of the island could be coordinated, to make sure several organisations don't decide to evacuate at the same time, resulting in long delays before evacuations are actually completed.

#### Scenario 4 - 72 hours/1 week power outage

##### Impact on critical input factors for health services

All previously mentioned impacts expected in the other scenarios are also expected to occur during the scenario of a power outage of 72 hours to 1 week. It has proven to be more difficult to assess what the expected impact is for this scenario, compared with the previous scenarios.

A real life example with similar circumstances as are in Dordrecht has not occurred, and most organisations don't see a week long power outage as a realistic scenario. The only situation which has been researched before in which there would be a power outage of a week, would be a large scale flooding of Dordrecht. However this would create a crisis on a different scale, and would include a complete evacuation of the island, and complete destruction of most critical infrastructure.

The only expected extra impacts on the critical infrastructure during a weeklong power outage, is that fuel available will further decrease, decreasing the mobility of people and healthcare organisations. If the water sanitation plant is not functioning for a week, it will need 3 weeks to start up again, as the biotope has to be recreated.

##### Cascading effects and impact on other vital functions

As all health care organisation indicated that they would be evacuated fully within three days, no further impact is expected on the critical infrastructure or other vital functions.

##### Consequences for societal values

Patients on intensive care will have to be moved to other hospitals in the region, and possibly the national emergency hospital in Utrecht. Moving patients on the intensive care will involve serious risk; however the hospital can no longer give the care needed to these patients.

Overall unrest will increase, not only within the health sector. No further consequences for the societal values were identified, as most organisations expect to be fully evacuated within 3 days.

##### Identified vulnerabilities, existing barriers and proposals of measures

It was difficult for organisations to imagine this scenario, reports also did not give a complete overview of the expected impacts. The chance of such a period of power outage in Dordrecht is extremely low, which may explain the very limited preparation for such an occurrence. This is vulnerability in the (extremely small) chance that it does occur.

Possible measures could be the support for the evacuation plans of the local health organisations, to complete this as fast as possible.

## Cities experience with the work process

### Involving of stakeholders

The approach of bringing all the stakeholders together in a single workshop, was a possibility for most organisations to compare with other similar organisations and gain immediate insight into their own possibilities. This made the larger workshops very beneficial, both for the overall project, as well as for the participating organisations.

However due to capacity issues it proved difficult to involve all the different organisations. In general it can be said that how smaller the organisation, and the more it was involved in decentralized home care, the more difficult they were to involve in the assessment. With the ultimate example of the home care organisations, which appeared to be not possible to directly involved them in this assessment, this was a big challenge in the assessment.

### Chosen analytical approach

The involvement of the vital infrastructure partners was fruitful and due to the use of the VITAP method of TNO it was possible to distinguish the critical issues by power outage. The Power distributor Stedin was involved in the local coreteam and attended both Vital infrastructure meetings as well as the local core team meetings. This provided actual and vital information for the expertmeetings and a good starting point for the discussions.

By using a matrix per scenario, divided by categories and interdependencies of other institutions and authorities was an exceleator. By reviewing this per participant knowledge and different perceptions were exchanged and discussed.

### Ensuring validity in results

After each session the results of the session were shared with the participants. In the final stages of this assessment all stakeholder will be invited for the last general workshop. All results and conclusions will be discussed, and possibly adopted giving the commentaries en feedback that are expected to be received. A written "summary brief" will be distributed to all the partners so that they can comment on the most salient points, without the need to go through the complete project report. All the time the coreteam meeting consisting of the municipality, the safety region, the GHOR and the electricity infrastructural organisation STEDIN was involved throughout the workshops and the writing process. And the concept conclusion have been discussed with them, and adopted according to their input and feedback

## 5 Following up on city reports from SRSHS

### Considerations of uncertainty and transferability in the results of the city assessment

#### Validity in results

For the first three scenarios there was both literature available, as the possibility to discuss possible impacts with the different health organisation, professionals and critical infrastructure organisations. The results from the work sessions reflected the same conclusions in the already available literature. Also the reports of power outages that actually occurred present the same overall picture.

Decisions that local organisations said that they would take at a certain moment, were mostly also executed by similar organisations that experienced a power outage. However small differences can have a large effect on the expected impact. If there is a large rainfall event during a power outage, the impact and consequences for critical infrastructure and healthcare organisations in Dordrecht would increase greatly.

Furthermore the final scenario of 72 hours to 1 week has proven to be difficult to analyse. Most organisation could not imagine such a situation, and there was only limited literature and previous experiences available. The degree of uncertainty increases with the duration of the power outage.

Finally although most organisation were included in the workshops, the home care organisation have proven to be a very difficult group to reach out to. Various methods were tried, and only very limited response was ever received. This does indicate the problems that will only grow during a power outage, the small organisation will have large difficulties to cope with changing situation, and especially crisis situation like power outages. Because there is currently not a properly functioning working relationship between these organisation and the crisis organisations, during an actual crisis the organisations will be slow to respond and organize help if they need it.

#### Are the findings seen as transferable also to other cities?

The situation in Dordrecht has comparable elements with other cities and countries, however it does have some unique characteristics. The increased use and reliance on ICT and telecom within the health sector is a shared characteristics between EU countries, although on different levels.

It is becoming more common for people to stay longer at home, or more quickly be discharged from hospital, and receive the care they need at home. The amount of people who are not able to be self-reliant without the home care is increasing, these people often rely on certain powered systems for their health.

Another shared characteristic is the change in the energy network used by cities. It used to be that power was created at several large power stations, and diverted via a network from large national infrastructure to a fine grid within cities.

Because of the energy transition most countries are going through at the moment, it is shifting to a much more complex and dynamic network. This comes with more vulnerability, and therefore a higher risk for power outages.



An unique characteristic for the Netherlands is the actual make-up of the large part of the country. Where most countries experience rapid growth of only the biggest cities, the western part of the Netherlands grows quickly, but in many different cities at the same time. Because of this the health care are not all located in a relatively small area, but dispersed over a larger region, within various mid-level cities. This creates a flexibility in the network, as organisations can support each other, when certain regions experience difficulties. This dispersed urbanized structure creates a level of resilience.

## Following up of findings by SRSHS

### Unexpected findings

There have been numerous unexpected findings. The expectations that the ICT and Telecom sector would fail quickly was expected, just as the fact that other critical infrastructure partners would most likely (partly) continue to function.

What was a surprise was that most of those organisation did not foresee that their own communications system that they use daily would also be unavailable, and did not prepare fully for this in their crisis plans.

Another unexpected finding was that originally there was an idea that a possible preventive measure was the selective repairing of the network, in order to restore the power to certain vital functions first (hospitals, elderly homes). This however turned out to be impossible, both legally as well as technically.

It was unexpected that most organisations would already start a large scale evacuation after 24 hours. Around this time it was deemed to be better for the patients to evacuate to surrounding regions, in comparison with staying with the area with no electricity. Because of this most organisations could not indicate possible impacts within the 72 hours to 1 week scenario, as they would have already left at that point.

The last unexpected finding was that it proved impossible to involve the homecare organisations within the project and the specific workshops. Even individual appointments were not possible, while we tried to contact multiple organisations, professionals and on several levels of the organisation. This will need further assessments, as there are indications of the impact, but not as clear as compared with the other organisations.

Furthermore large benefits in crisis response could be made if these organisations take or stimulate preventive measures, or are involved with the crisis response of the safety region. There is a need for further progress in the possibility of sharing information during a crisis situation, by the municipality or home care organisations. This currently has both legal as well as practical limitations, while the information is vital for a proper disaster response during a long power outage.

### Steering ability , availability of efficient and achievable risk reducing measures / clear responsibilities for who can make decisions regarding implementation?

There are several risk reducing measures available in different sectors. The recommendation on measures were validated by the participating institutions. The measures and recommendations as

stated are divided on the several sectors: Critical infrastructure, Crisismanagement organisation and Municipality and Health Care organisations.

#### Critical infrastructure

1. Increasing understanding of interdependencies between different critical infrastructure partners, and increase the business continuity of the critical infrastructure organisations
2. Create a clear plan and structure of communication message internally for the critical infrastructure organisation, and between the different organisations. Clarity is needed on who communicates what.
3. Work together with a national program on critical infrastructure and decreasing vulnerabilities.\*

#### Crisis management organisation and Municipality

1. Increased cooperation between crisis organisation and the Electricity power grid company (STEDIN) given the energy transition.
2. Create an interagency communication plan given several power outage scenarios, to clearly distinguish the responsibilities and actions between the crisis organisations, health organisations and other organisations.
3. Create prevention focussed action plan to create more awareness with home care organisation and patients, in order to increase self-reliance.
4. Crisis organisations have to organize a process in which data can be made available during crisis situations, on patients' needs and locations, in order to actively and directly offer the needed assistance. \*

#### Healthcare organisations

1. The GHOR (organisations that coordinates healthcare during crisis situations) organises a closer working relationship with the homecare organisations.
2. By increasing the awareness and showcasing of possible measures people can take themselves their resilience can be increased, to decrease the possible impact of a power outage.
3. Make the general tasks and responsibilities of the crisis organisations known to the large group of small homecare organisations, to make sure they know where to ask for help during a crisis situation. \*
4. Because the home care organisations have proven to be a difficult group to reach and to include within this research and the overall network. New methods have to be used to incorporate them within the standard crisis organisations network. The possible impact due to a power outage should be presented to them in an easy and attractive format, in order to create sufficient awareness and feeling of necessity within the organisations.

5. The health care organisation needs to be able to quickly supply needed information during a crisis situation. In order for this to be done data services need to be accessible during a crisis situation and people need to be trained to do this quickly.
- The recommended measures with the \* are the measures that should preferably be followed up by central level

#### The role of the SRSHS in following up

A workshop was organized in which all organisations that have participated in the assessment were invited, to discuss the current results and proposed measures. Through this discussion the conclusions were sharpened and broadly shared and accepted between the different organisations. The proposed measures were discussed and prioritized.

The findings were shared with the local Coreteam and will be integrated in the project of the SRSHS with the municipalities within the Safety Region. This project is about enhancing resilience especially in vulnerable parts of society like the elderly, and people who depend on home care services.

The report and recommendations are shared the resilience project initiated this April by the coordinating secretary of the municipalities and the Safety Region South Holland South. As this research contains vital information for this project the coreteammembers are included in this project as experts in this field.

The SRSHS also invited the housing corporations in Dordrecht to an especially for them designed introduction meeting. These introductions will also be presented to the housing corporations throughout the Safety Region in municipalities as Gorinchem, Hoeksche Waard and more. The municipalities will organize these meetings together with the Safety Region and focus will be on enhancing their knowledge on the network and the crisismanagement organisation as well as measures they can take in case of power outage. The necessity of preparation on emergencies and especially on communication and information efforts will be explained and best practises are shared.

#### Measures that will not be followed up

All measures which is in the influence of the Safety Region will be followed up. The measures which depend on action from third parties will be supported by the Safety Region.

#### Plan for following up by SR SHS

Based on the findings the Safety Region together with the cities Bergen, Stavanger and Valmiera the need for development of an inter-sectoral response plan was shared. Therefore a proposal is made for the DG Echo call of Prevention and Preparedness Projects for Civil Protection and Marine Pollution (UCPM-2019-PP-AG).

The response plan will be a direct result of this project and will include the proposed measures and recommendations gained by the MEREPUV project.

By including the national level in Latvia and the Netherlands, and in Norway the County level in the supervisory board, there will be national knowledge obtained and dissemination to other regions and cities.

## Following up on methodologies / work process

### Identified needs in terms of methodology? Need for new approaches? guidance material, more research and development?

The strength of the method is the structured approach towards the assessment. As a power outage would have large consequences, and many follow up impacts, it needs to be approached with a broad perspective.

The sequence of assessing the impacts first on the critical infrastructure network, secondly of the health organisation and thirdly back on the critical infrastructure was a logical sequence, and allowed for a complete mapping of the likely impacts.

It allowed us to properly assessing the impacts for the health organisation, by adding the most recent knowledge from the critical infrastructure partners on what the organisations can expect. However the assessment of impact from the health organisation back on the critical infrastructure was fairly minor, or at least did not result to many identified impacts. This could be due to the structure of the Netherlands, with a decentralized network of critical infrastructure and health organisations, creating over capacity and flexibility in the system, in case a certain area experiences problems.

### Identified topics regarding working with relevant stakeholders at local level – possibilities and limitations / challenges?

Plan for dissemination of the results to other cities/relevant stakeholders. A workshop was organized in which all organisations that have participated in the assessment were invited, to discuss the current results and proposed measures. Through this discussion the conclusions were sharpened and hopefully broadly shared and accepted between the different organisations.

The proposed measures were discussed and expanded or changed according to the expertise of the different organisations. This will also create partial ownership of the current results, in order to increase the likelihood of adoption of the possible measures.

## 6 Plan for dissemination to other cities / relevant stake holders

The report is direct input for the department of preparation on Disasters and Crises (Voorbereiding op rampen en crises VRC), particularly on the section Coordination on healthcare and the section Civil protection. The report will be used for the annual planning and policy planning and prioritization of actions and measures. Therefore the report will also be offered to the management board of the Safety Region.

- The following measures and recommendations will be integrated in the annual planning of the VRC:
  - Increasing understanding of interdependencies between different critical infrastructure partners, and increase the business continuity of the critical infrastructure organisations
  - A plan will be created in which structuring the communication message internally for the critical infrastructure organisation, and between the different organisations. This will bring clarity on who communicates what.
  - VRC will work together with a national program on critical infrastructure and decreasing vulnerabilities
- The department of Risk management at the Safety Region South Holland South has recently (April 2019) started the project Self-reliance together with the municipalities in the Safety Region. Again this report and its recommendations are direct input for this project.
- Furthermore the DG Echo proposal Care4Power is supported by the department of preparation on Disaster and Crises, and will be executed by this department which covers two of the main recommendations, an inter-sectoral response plan based on network building, communication and information procedures. As one of the outcomes an interagency communication plan given several power outage scenarios will be created, to clearly distinguish the responsibilities and actions between the crisis organisations, health organisations and other organisations.  
If granted the execution will take place in 2020-2021, together with Erasmus University and Medical Center and can be implemented in the three coordinating organisations for Healthcare during crises and disasters in the south west part of the Netherlands.
- The introduction meeting is executed throughout the Safety Region South-Holland South and will strengthen the network and encourage the preparations on power outage by the Housing Corporations.

## 7 Assessment of degree of achievement of project objectives

The following project objectives and results were achieved:

- Better ability among the partners to conduct vulnerability assessments addressing cascade effects due to interdependencies between vital societal functions and structures.  
*By working together and using the VITAP tool of TNO the Safety Region and city of Dordrecht gained more insight in the interdependencies and how to conduct these assessments. In addition to this the involved Stakeholder also gained more insight or realised that there was a need for doing some more internal research or different approach to their own business continuity.*
- Better understanding of the municipalities` role in preventing severe consequences of undesirable incidents hitting urban vital societal functions.  
*The measures recommend are of importance for the preventing role of the municipality, especially the recommendation to create an interagency communication plan and to create a prevention focussed action plan.. By using the research in the Self-reliance project in which this action plan should be formed, managed by the Safety Region and the municipalities of the Safety region the municipalities acknowledge their role.*
- Better knowledge of proper and efficient measures available at the local level for protecting citizens against severe consequences from power outage, with special emphasis on direct and indirect effects of disruptions on health services in Dordrecht.  
*Although the GHOR already put a lot of effort in the health services to prepare themselves for the direct and indirect effects of disruptions this research raised even more awareness by the local level and health services. The interaction between the stakeholders was of even more value and turned out to be a good initiative to emphasize the need of preparation. The need for a inter-sectoral plan is supported by the stakeholders and will provide the necessary preparations and measures on information, communication and so more when power outage occurs.*