

INTERNATIONAL STANDARD



Smart cities – City service continuity against disasters – The role of the electrical supply

IECNORM.COM : Click to view the full PDF of IEC 63152:2020



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IECNORM.COM : Click to view this IEC 61152:2020

INTERNATIONAL STANDARD



Smart cities – City service continuity against disasters – The role of the electrical supply

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 03.100.70; 29.240.01

ISBN 978-2-8322-8552-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Concept of city service continuity (CSC) against disasters.....	7
5 Requirements and guideline for electricity continuity plan (ECP).....	9
5.1 General.....	9
5.2 Planning	9
5.2.1 General	9
5.2.2 Specific items to be considered	10
6 Requirements for electricity continuity system (ECS).....	10
6.1 General.....	10
6.2 Requirements for basic function.....	11
Annex A (informative) Consideration for ECP/ECS.....	12
A.1 Evaluation of necessary electricity capacity	12
A.2 Basic model of ECP/ECS	12
Annex B (informative) CSC type.....	14
B.1 CSC type1: Self-backup.....	14
B.2 CSC type2: Information cooperation.....	14
B.3 CSC type3: Power cooperation	15
Annex C (informative) CSC planning.....	16
C.1 Setting the level of services to be sustained for each area	16
C.2 How to improve cooperation.....	17
Annex D (informative) ECP/ECS planning using management timetable	18
Annex E (informative) Disaster related information	20
Annex F (informative) ECS status information.....	21
Bibliography.....	22
Figure 1 – Necessity of electricity continuity for CSC	8
Figure 2 – CSC concept image building up system of ECSs.....	9
Figure A.1 – Calculating total electricity to be needed.....	12
Figure A.2 – Basic model of ECP/ECS	13
Figure B.1 – Image of self-backup.....	14
Figure B.2 – Image of information cooperation.....	15
Figure B.3 – Image of power cooperation.....	15
Figure C.1 – Setting CSC type for each area in a city	16
Figure C.2 – Image of improving cooperation.....	17
Figure D.1 – Management timetable of layer-structured ECP/ECS	19
Table E.1 – Examples of alert information.....	20

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SMART CITIES –
CITY SERVICE CONTINUITY AGAINST DISASTERS –
THE ROLE OF THE ELECTRICAL SUPPLY**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 63152 has been prepared by IEC systems committee Smart Cities.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
SyCSmartCities/139/FDIS	SyCSmartCities/144/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

IECNORM.COM : Click to view the full PDF of IEC 63152:2020

INTRODUCTION

Cities are facing many kinds of potential threats which affect the continuity of city services. There exists, therefore, a great need to establish safe and secure societies in which negative impacts on city services to the citizens are minimized and city services are continuously available to them during a period of emergency. There is no doubt that, in modern cities, electricity plays a critical role in maintaining city services.

This document provides requirements and guidelines to ensure that city services can be sustained when the power supply from the grids is discontinued because of disasters.

The users of this document are assumed to be city developers, city operators, equipment manufacturers, essential service providers and disaster management personnel.

IECNORM.COM : Click to view the full PDF of IEC 63152:2020

SMART CITIES – CITY SERVICE CONTINUITY AGAINST DISASTERS – THE ROLE OF THE ELECTRICAL SUPPLY

1 Scope

This document establishes concepts and gives guidelines to help sustain a variety of city services on the occasion of a disaster from the perspective of providing electricity. It outlines the basic concepts on how multiple city services can cooperate and continue by electricity continuity plan(s) and electricity continuity system(s). It also specifies methods and means to establish these.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22301, *Societal security – Business continuity management systems – Requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

business continuity plan

BCP

documented procedures that guide organizations to respond, recover, resume, and restore to a pre-defined level of operation following disruption

[SOURCE: ISO 22301:2012, 3.6]

3.2

electricity continuity plan

ECP

documented procedures that guide organizations to ensure continuity of electricity supply to maintain city services in a business continuity plan that addresses disruption caused by a critical event

3.3

electricity continuity system

ECS

system required to ensure reliable and effective implementation of functions which are necessary for ECP

3.4

city service

service that is performed for the benefit of the public

Note 1 to entry: In this document, services depend on provision of electricity supply.

3.5

city service continuity

CSC

status in which, and capability with which, city services (i.e. public, medical, transportation communication services) that are provided to users in normal times, continue to be fully or partly provided, even in a state of emergency in which the normal functions of city infrastructures are interrupted

3.6

disaster

rapid or slow onset event that causes significant disruption to one or more city services for an extended period of time

Note 1 to entry: This can include natural disasters, failures of key components or systems whether in hardware or software, physical damage to systems, and cyber attacks.

3.7

organization

person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to, sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

Note 2 to entry: For organizations with more than one operating unit, a single operating unit can be defined as an organization.

[SOURCE: ISO 22301:2012, 3.33]

4 Concept of city service continuity (CSC) against disasters

Organizations that receive grid electricity supply need to secure back-up power sources in order to be able to continue providing their services when the grid electricity supply is discontinued due to disasters, up until the time when the electricity supply is back to normal.

Activities in a city are supported by the continuous supply of various services (water and sewage, gas, transport, hospitals, communications, logistics, etc.), and such services are supplied through facilities and devices, most of which, in general, need electricity from the grid to operate. Therefore, the loss of the grid electricity supply due to disasters results in the potential impact of a massive loss of such services.

For the city services to recover quickly so that the major loss of services can be minimized when a disaster strikes, organizations should prepare in advance to ensure that they can secure a minimum level of services until electricity supply returns to normal, making arrangements to facilitate full recovery of services at the earliest possible stage as shown in Figure 1. Each organization shall establish a business continuity plan (BCP) in order to address this need.

There are various approaches to develop an effective BCP. Some cities may conduct it in order of their specific priorities for critical and lifeline services while others may start trials in a part of the municipality. It might be implemented in an area where the private sector promotes urban development, or in a commercial zone or a residential area. It is important that the BCP takes into consideration the fact that the discontinuity of grid electricity supply due to disasters may occur in a limited area, not necessarily throughout a whole city, or may occur in a much wider area than the whole city.

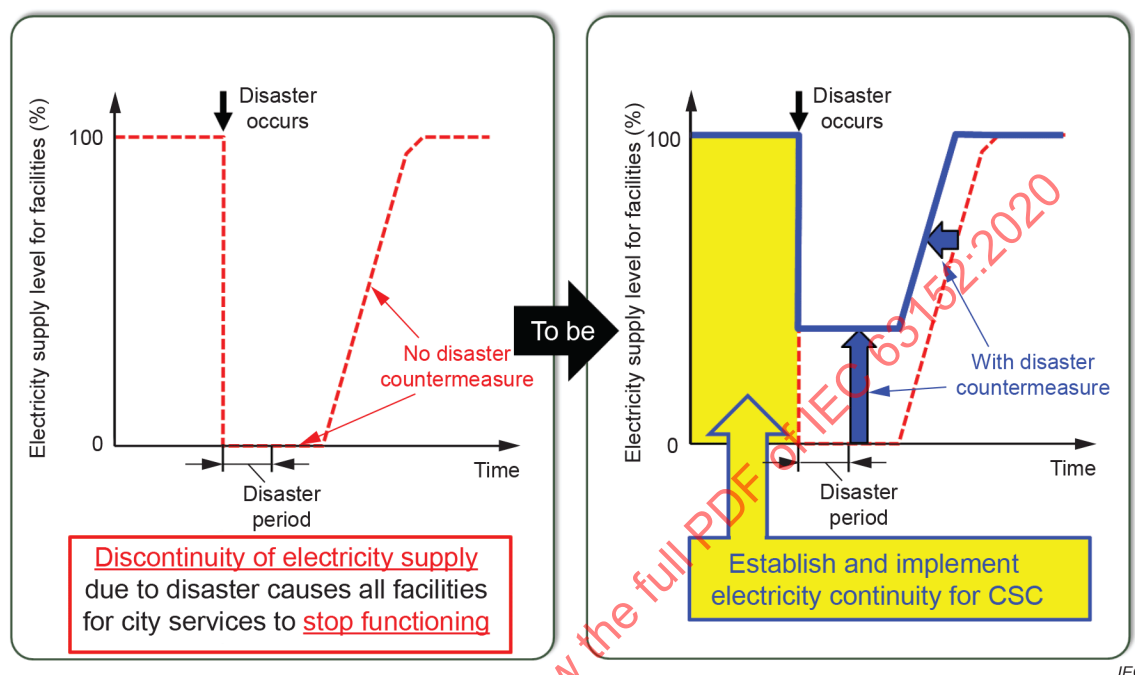


Figure 1 – Necessity of electricity continuity for CSC

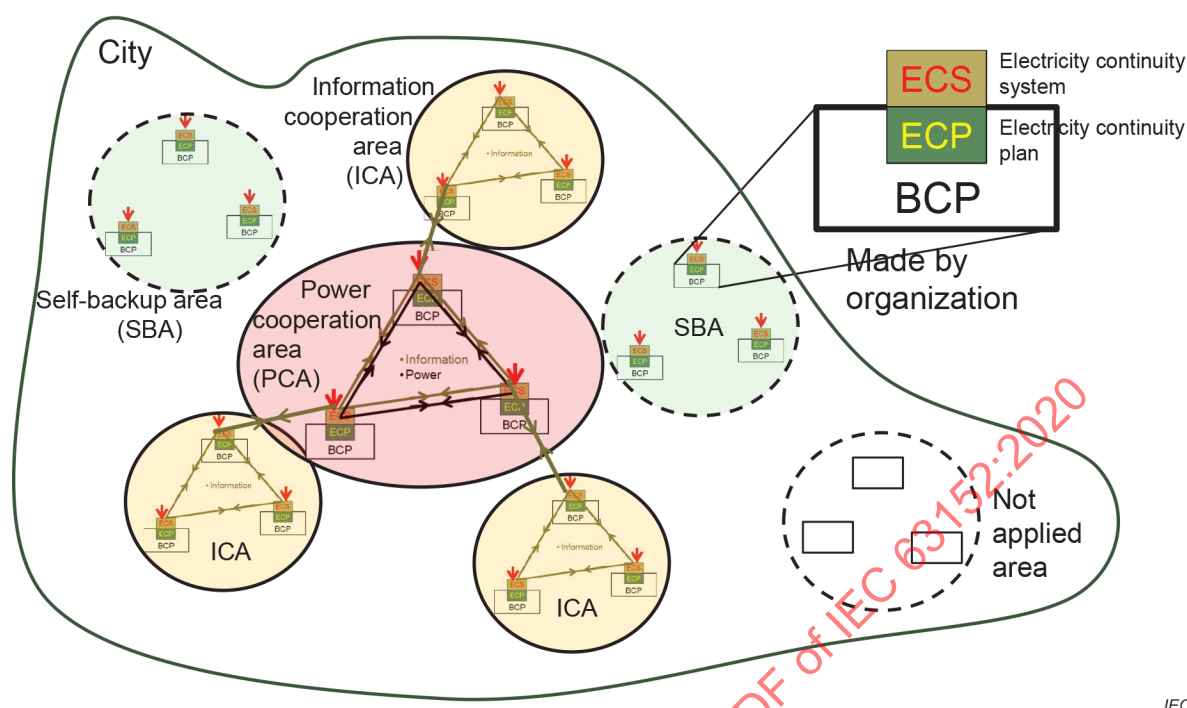
In order to secure services in a city at a minimum level during grid power loss due to disasters, each organization which provides services shall establish a BCP to secure its electricity supplies appropriately. In addition, plans for interactions between organizations should be prepared to support the continuity of services according to the requirements of each city, so that city administrators as well as citizens are able to obtain information on the availability of services, allowing them to make decisions and to take appropriate actions. This is the concept of city service continuity (CSC) as shown in Figure 2.

In order to realize this concept, each organization needs to develop an electricity continuity plan (ECP) focusing on electricity supply in its BCP, while installing an electricity continuity system (ECS) for implementing its ECP.

Uniform service continuity is not necessarily required for every area in the city as shown in Figure 2. Areas may include the following.

- Power cooperation area: In some areas, organizations should sustain prioritized services mainly in critical and lifeline fields by exchanging status information and stabilizing each other's electricity supply to the planned service levels.
- Information cooperation area: In some areas, organizations should exchange status information to provide support, for a situation in hand, such as by provisioning fuel for generators or sending electric vehicles (EVs) to the affected organizations when grid electricity supply is disrupted.
- Self-backup area: In some areas without adequate equipment to cooperate with other areas, organizations should implement backup power to sustain their own planned power level by themselves.

Electricity supply from the power grid is lost in this city



IEC

Figure 2 – CSC concept image building up system of ECSs

5 Requirements and guideline for electricity continuity plan (ECP)

5.1 General

The ECP is a plan to address critical events caused by disasters, and focuses on the continuity of electricity supply to maintain city services. The ECP is included in a BCP that ensures business continuity during disasters.

The ECP provides procedures and criteria to prepare, plan, introduce and operate readiness options to secure continuous supply on the electricity demand side, as well as identify elements to be reviewed in order to ensure continuity of city services, as a preparation against potential stoppage of electricity supply from the grid.

The ECP can be developed at related organizations in public and private sectors, including the entire city, the town, the neighbourhood, the block, the individual facility, etc. Stakeholders that develop the ECP include municipal governments, community associations, area developers and facility managers of buildings such as hospitals, factories and offices according to criticality.

The ECP includes an emergency plan that helps operators of city services continue to receive the required electricity supply during disasters, instructions on how to work with other ECPs in implementation of the emergency plan, and restoration measures to recover the electricity supply after disasters.

5.2 Planning

5.2.1 General

Organizations shall develop the ECP in reference to ISO 22301 and in the following order of content: "Context of the organization," "Leadership," "Planning," "Support," "Operation," "Performance evaluation" and "Improvement".

5.2.2 Specific items to be considered

Organizations shall consider the following matters in development of the ECP. Organizations need to carry out business impact analysis, risk assessment and strategy selection in the development of ECP and in addition, to consider the following matters.

- a) Evaluate necessary electricity capacity (refer to Clause A.1):
 - 1) assessing classification of type and magnitude of disaster;
 - 2) identifying priorities of facilities of the greatest need (e.g. hospitals, public buildings, transportation systems, communication systems, etc.);
 - 3) analysing the minimum level of services acceptable for the facilities identified and standing time required;
 - 4) estimating the potential impact caused by stoppage of individual city services due to grid power loss;
 - 5) estimating the required amount, quality, and cost of electricity.
- b) Consider CSC type of cooperation with other ECS (refer to Annex B):
 - 1) selecting ECSs for future cooperation in continuity of electricity supply (refer to Annex C);
 - 2) identifying and introducing facilities necessary to switch electricity mode when the grid power supply is halted and to secure safety when electricity supply is back to normal.
- c) Design ECS:
 - 1) developing a procedure to disconnect from the grid electricity;
 - 2) classifying and prioritizing the technologies, devices and equipment necessary to continue power supply;
 - 3) securing safety to avoid unintentional activation of electrotechnical equipment during recovery process, including to switch them off when the disaster occurs and on after the disaster;
 - 4) identifying ways to protect against cyber attack;
 - 5) developing a procedure to connect to the grid when electricity supply is back to normal.
- d) Assure measures to ensure implementation during disasters such as operation, maintenance, education and training sessions.
- e) Develop a procedure to check the soundness of electrotechnical equipment.
- f) Assure critical human resources, conduct periodical training, exercises and continual improvement of the ECP, including lessons learned from the BCP testing.

As a result, a set of ECP and ECS based on BCP shall be formulated as a series of actions along temporal phases including preparation for disaster, disaster strike, disaster response, recovery, and subsequent reviewing for preparation against future disaster (refer to Annex D as an example.)

6 Requirements for electricity continuity system (ECS)

6.1 General

The ECS indicates the elements required for an effective implementation of the ECP such as facilities, electrotechnical equipment and operational rules, and also covers the whole system as an aggregation of each such element, in order to enable continuous electricity supply during disasters.

6.2 Requirements for basic function

Organizations shall consider the following practices to establish the ECS:

- a) gathering disaster-related information;
- b) maintaining electricity at the required level;
- c) providing cyber security protection;
- d) sending/receiving status information regarding the operation of the ECS;
- e) disconnecting from/connecting to power grid;
- f) sharing surplus electricity;
- g) receiving needed electricity;
- h) controlling management systems of xEMS (Energy Management System), e.g. CEMS (Community Energy Management System), BEMS (Building Energy Management System), FEMS (Factory Energy Management System), HEMS (Home Energy Management System).

Interface of information and power is needed for the above functions, and the contents of information should be decided among areas/facilities to cooperate as shown in Clause A.2.

IECNORM.COM : Click to view the full PDF of IEC 63152:2020

Annex A (informative)

Consideration for ECP/ECS

A.1 Evaluation of necessary electricity capacity

To calculate the total electricity capacity required, when developing the ECP, it is necessary to decide services to be sustained. Their priority, required level and duration should also be decided by considering the required operation in the event of discontinuity of grid electricity supply. Finally, the level of electricity required for each service to operate on the agreed level is figured out, and these are summed up to the total electricity needed. The priorities and sustaining levels are decided in the BCP.

Figure A.1 indicates a sample case with four services (A, B, C, D).

Service	Priority	Sustaining level	Electricity	Duration	Total electricity
A	●	SL. A	aaa kWh	3 days all	} P_{total} kWh for 3 days
B	●	SL. B	bbb kWh		
C	~	~	~		
D	●	SL. D	ddd kWh		

Total required electricity capacity $P_{\text{total}} = \sum \text{critical load (kW)} \times \text{expected run time (h)}$

Priority : High ●, Middle ●, Low ~

Sustaining level: required operation(s) to sustain service

IEC

Figure A.1 – Calculating total electricity to be needed

Sustaining level is a level of planned services.

Examples of sustaining level include:

- lighting the emergency exit signs for lighting service,
- enabling hotline with emergency bureaus for emergency support service,
- keeping ICUs (intensive care unit) operational and maintaining ICUs' air conditioned for medical service,
- sustaining electricity to charge smart phones for communication service.

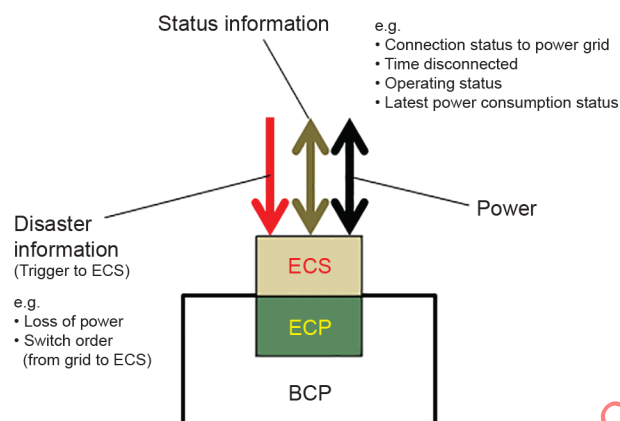
A.2 Basic model of ECP/ECS

ECP (electricity continuity plan) is included in BCP. ECS (electricity continuity system) is implemented based on ECP.

ECS should be able to receive disaster information in order to trigger the ECS and wake it up (regarding disaster related information, refer to Annex E).

ECS may need to have two connections – status information and power – to help with exchanging electricity among other ECSs (regarding status information, refer to Annex F).

Figure A.2 shows basic model of ECP/ECS.



IEC

Figure A.2 – Basic model of ECP/ECS

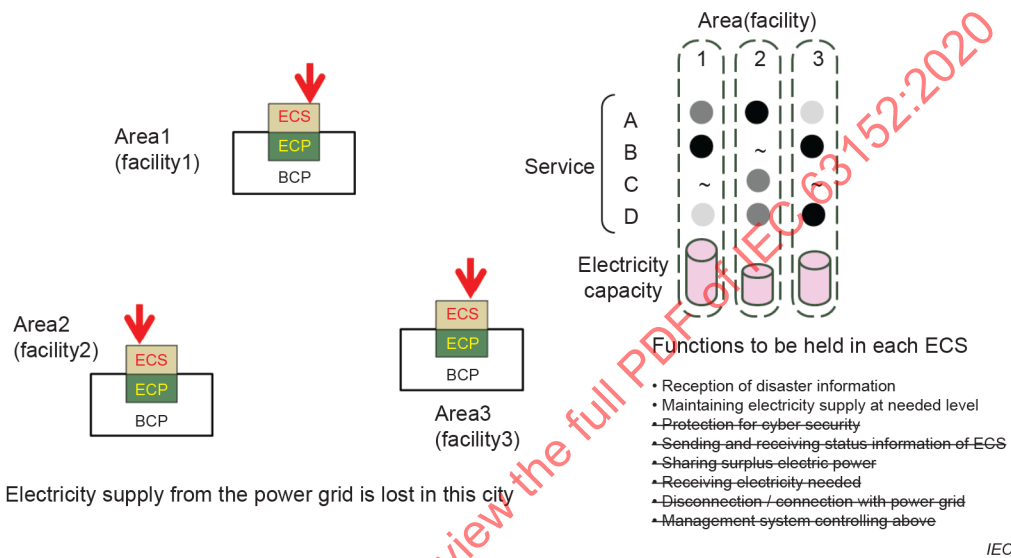
Annex B (informative)

CSC type

B.1 CSC type1: Self-backup

Each ECS independently maintains the required electricity level. Organizations may choose self-backup type in areas without adequate equipment to cooperate with other areas.

Figure B.1 shows an image of self-backup.



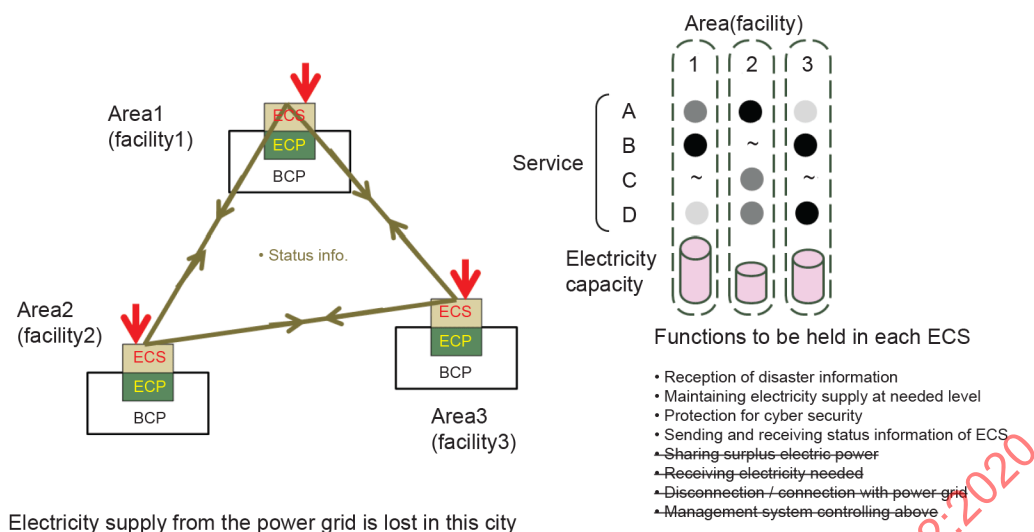
NOTE Strike-out lines indicate unnecessary items to be implemented.

Figure B.1 – Image of self-backup

B.2 CSC type2: Information cooperation

Each ECS exchanges its status information with others in order to coordinate, monitor and provide support for damaged areas.

Figure B.2 shows an image of information cooperation.



IEC

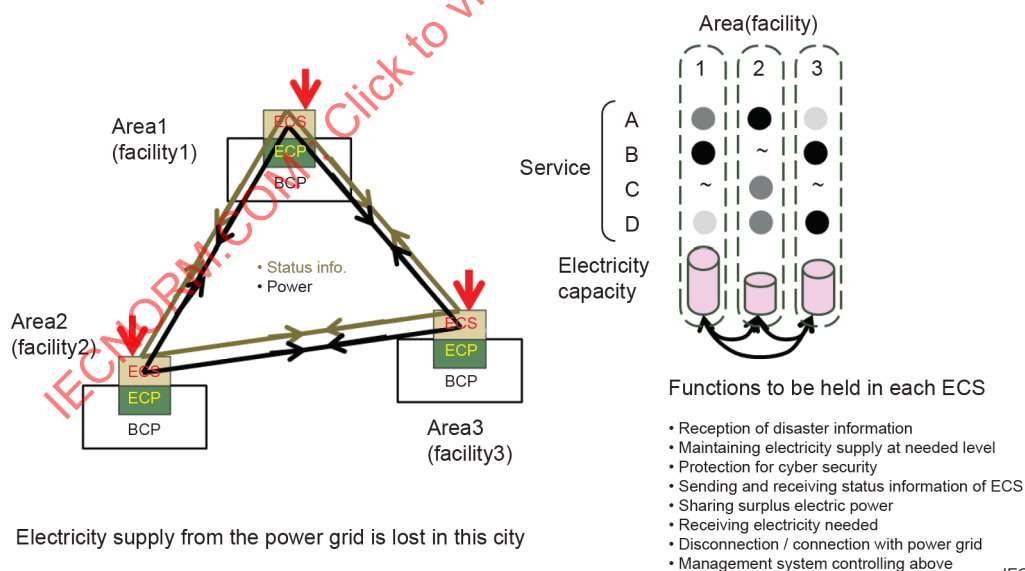
NOTE Strike-out lines indicate unnecessary items to be implemented.

Figure B.2 – Image of information cooperation

B.3 CSC type3: Power cooperation

Each ECS exchanges its status information with others and stabilizes electricity consumption to maintain planned service level.

Figure B.3 shows an image of power cooperation.



IEC

Figure B.3 – Image of power cooperation

Annex C (informative)

CSC planning

C.1 Setting the level of services to be sustained for each area

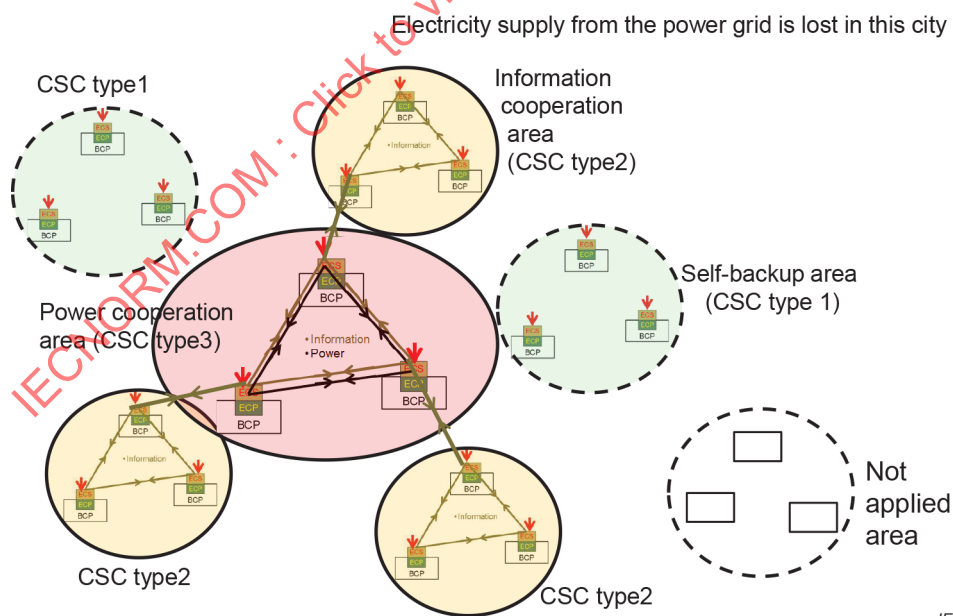
Here is an example of how city planners may decide on a configuration as shown in Figure C.1, to ensure the sustaining level of city services when the city loses some or all grid power as a result of a disaster.

- Extract services to be sustained when power loss occurs due to a disaster.
- Estimate sustaining level required for those services.
- Classify them into three types of area to achieve the sustaining level, and consider for each area how to implement required cooperation and conditions.
- Decide how to cooperate between areas to sustain services from an overall perspective.

The boundary and structure of areas may be decided in other ways. For example, areas may be based on the administrative district.

In any case, it is necessary to consider the sustaining level required in the area, taking into account the priority and needs of each service, the base of the service, and the capability of service. Furthermore, it is recommended to confirm that the sustaining level of service can be achieved from an overall perspective.

Services such as medical, water, sewage and communications are examples of prioritized city services.



IEC

Figure C.1 – Setting CSC type for each area in a city

C.2 How to improve cooperation

City planner may plan a step-by-step process to improve cooperation to increase service sustaining level in a city even once an ECP has been established.

Figure C.2 shows an image of improving cooperation.

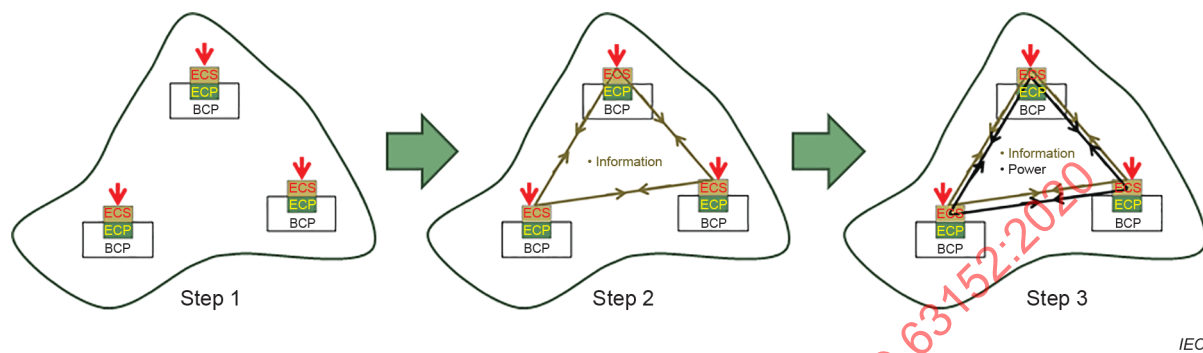


Figure C.2 – Image of improving cooperation

Annex D (informative)

ECP/ECS planning using management timetable

Management timetable is used to plan ECP/ECS. Management timetable describes whole configuration and temporal relationship of disaster alert, power securing and information sharing systems for city service continuity.

A sample of ECP/ECS is shown in Figure D.1. The horizontal axis indicates time-based phases regarding disaster occurrence and the vertical axis indicates interoperability layers. ECP/ECS are studied and designed along with the disaster phases on a stacked structure of the layers.

The disaster phases comprise: preparation for disaster, disaster strike, response, recovery and review for next preparation. Necessary elements and actions for disaster response and recovery should be listed and broken down for description in related phases.

The total set of ECP/ECS should be constructed in a stacked structure of layers so as to analyse and design the necessary elements and actions in each layer separately. The top layer would be the business layer corresponding to ECP. The other lower layers, corresponding to ECS, are function layer, information layer, communication layer and component layer.

The management timetable of layer-structured ECP/ECS is achieved by cascading each of the necessary elements and actions for disaster response and recovery through the phases and linking them in a phase among the layers.

IECNORM.COM : Click to view the full PDF of IEC 63152:2020