IEC 63152

Edition 1.0 2020-07

INTERNATIONAL STANDARD

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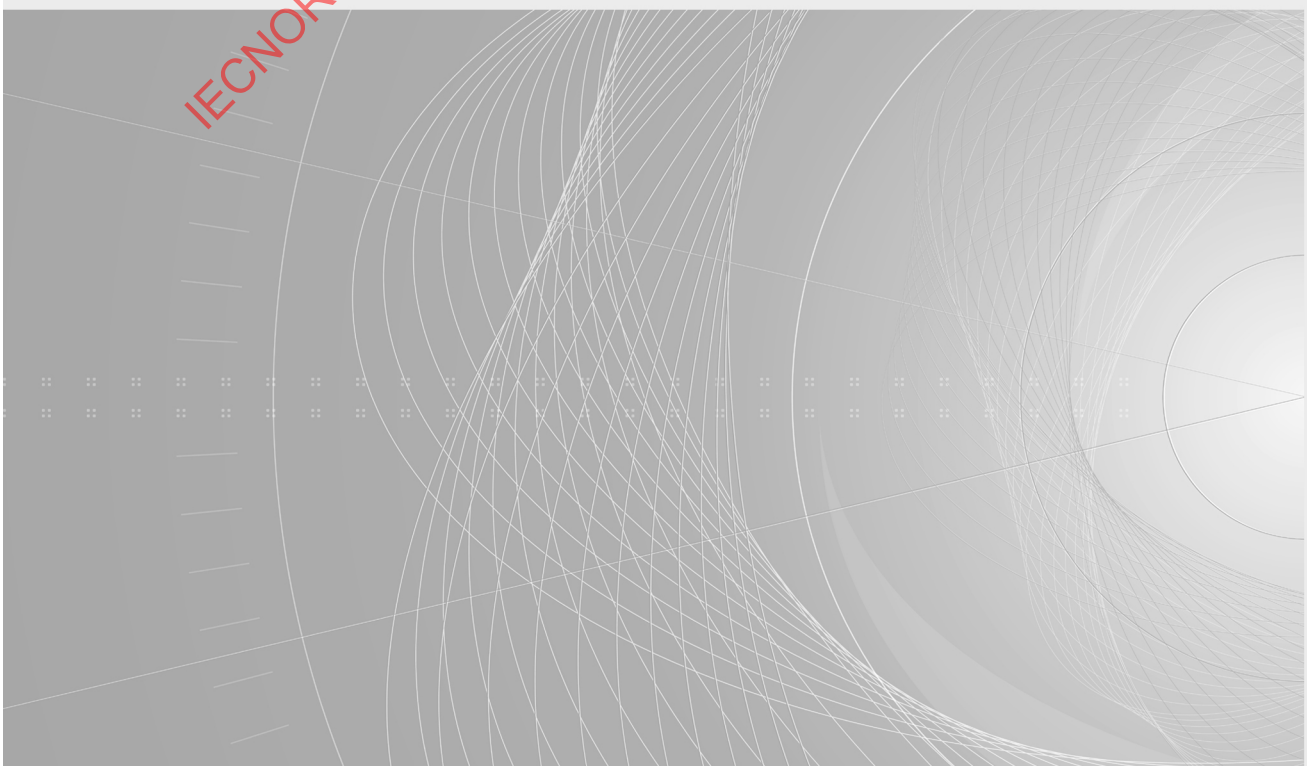
Smart cities – City service continuity against disasters – The role of the electrical supply



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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

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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

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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.

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.

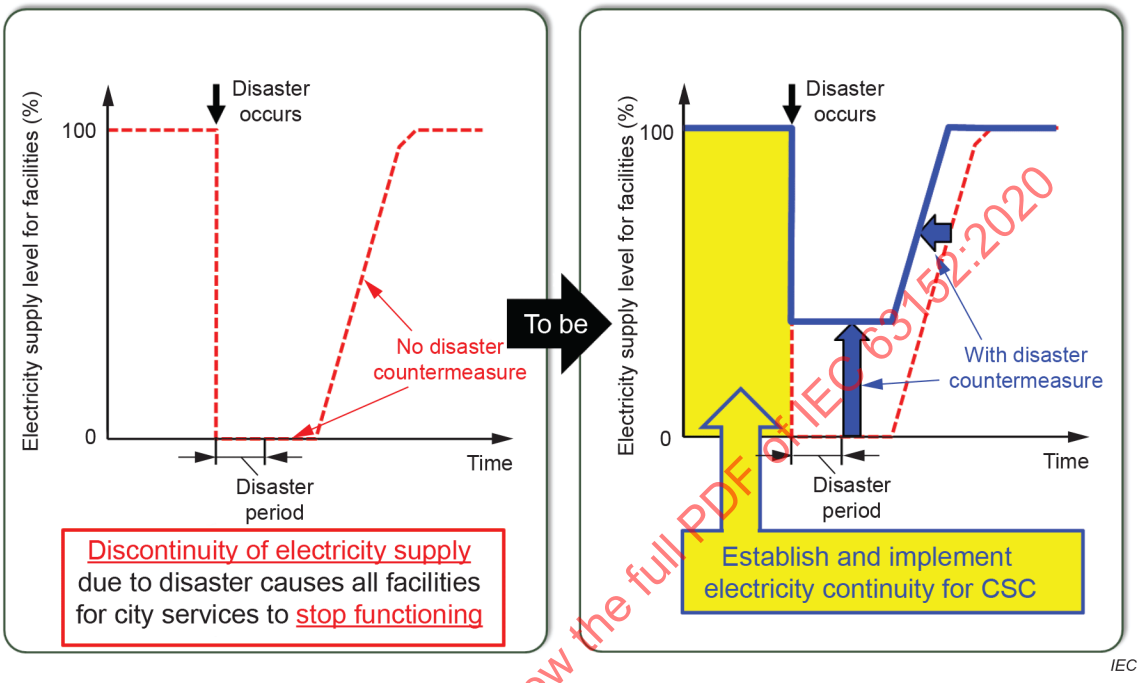


Figure 1 – Necessity of electricity continuity for CSC

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.

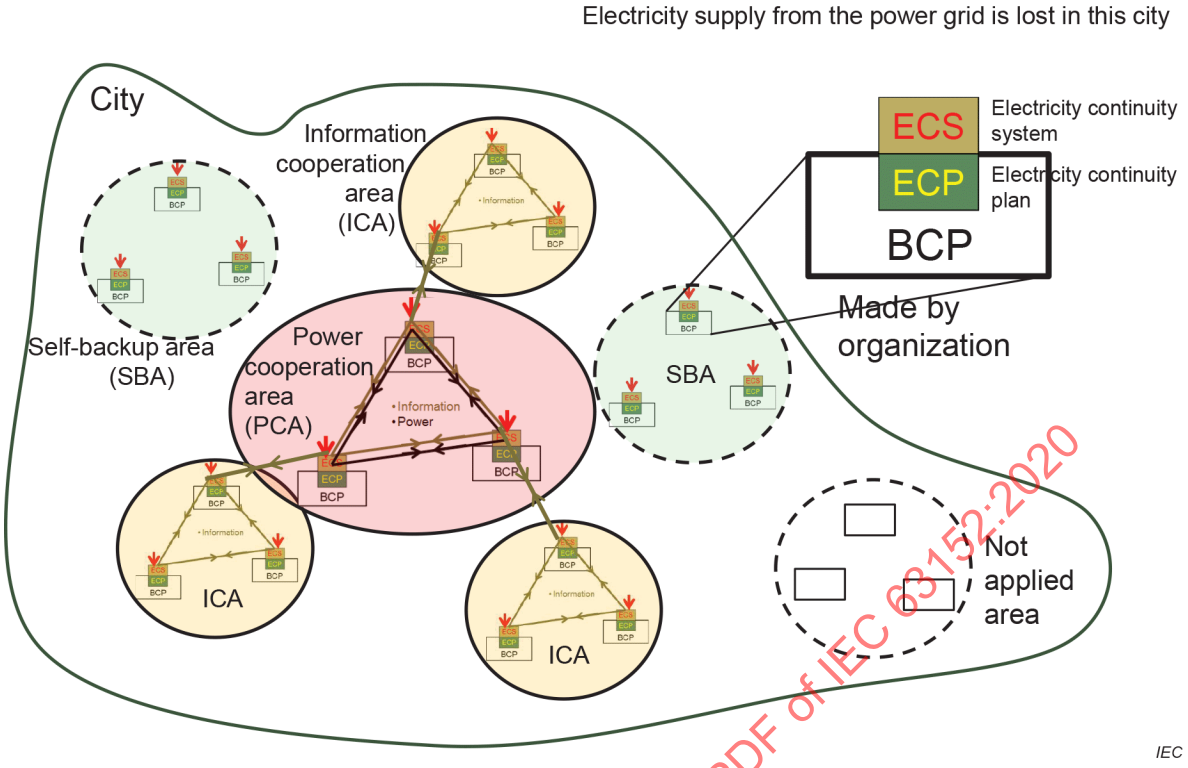


Figure 2 – CSC concept image building up system of ECSs

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.

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).

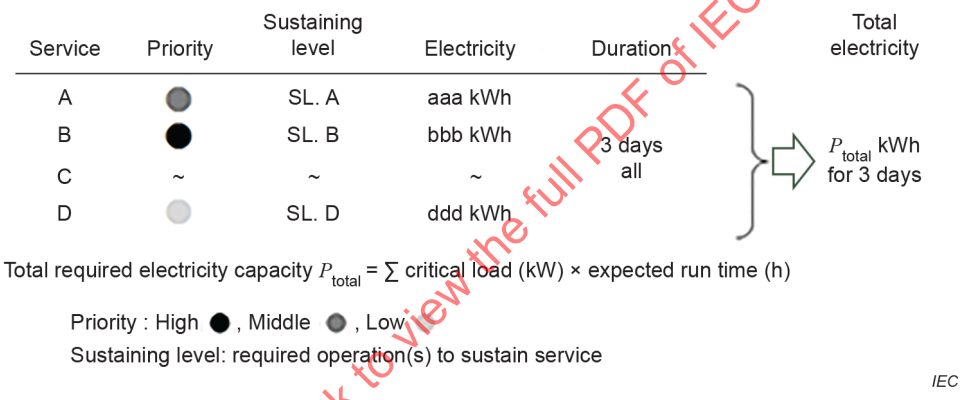


Figure A.1 – Calculating total electricity to be needed

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.

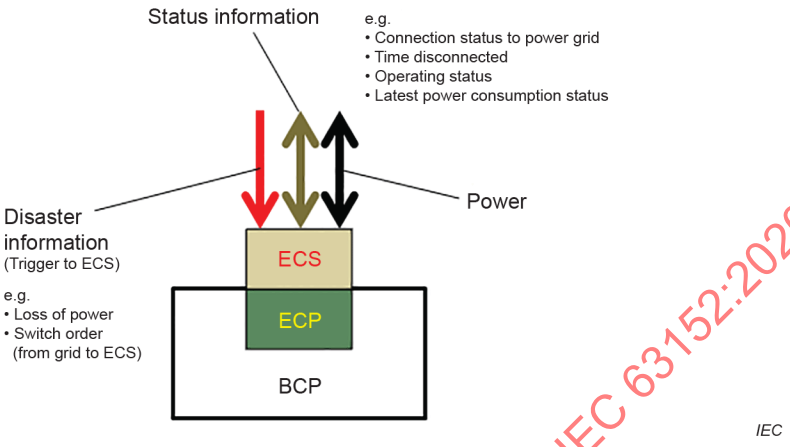


Figure A.2 – Basic model of ECP/ECS

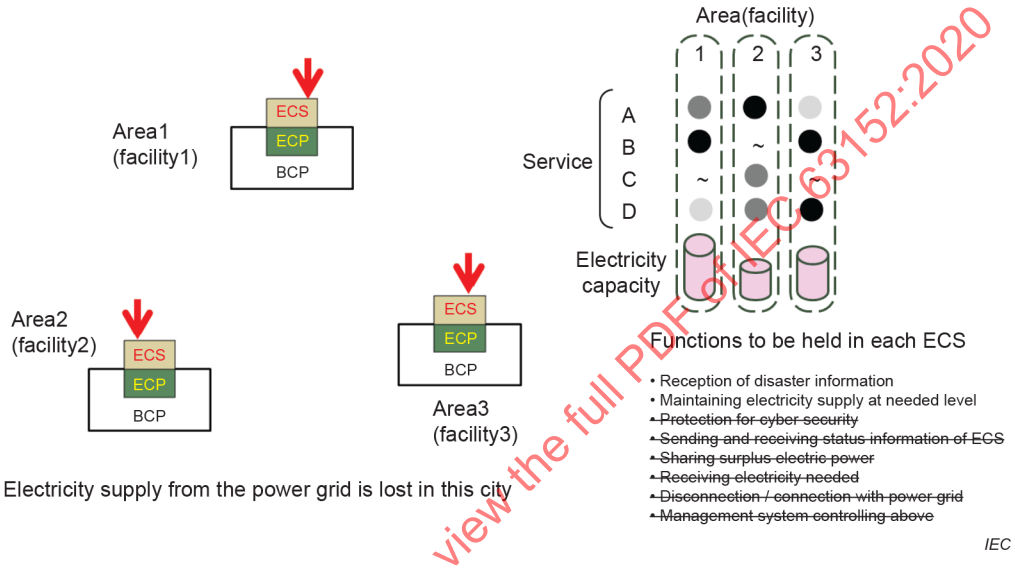
Annex B
(informative)

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.



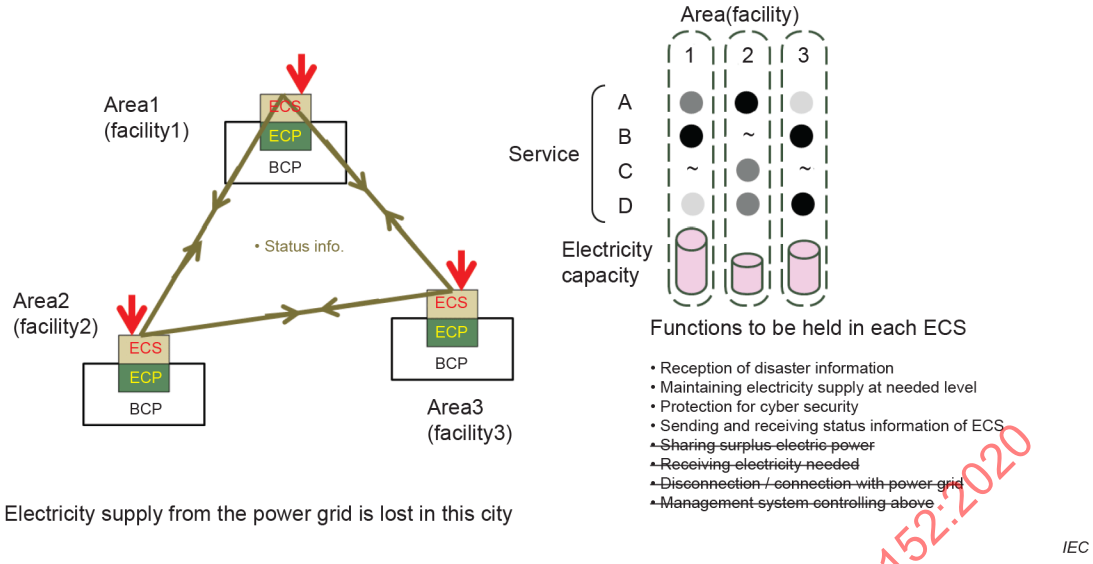
NOTE Strike-out lines indicate unnecessary items to be implemented.

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.



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.

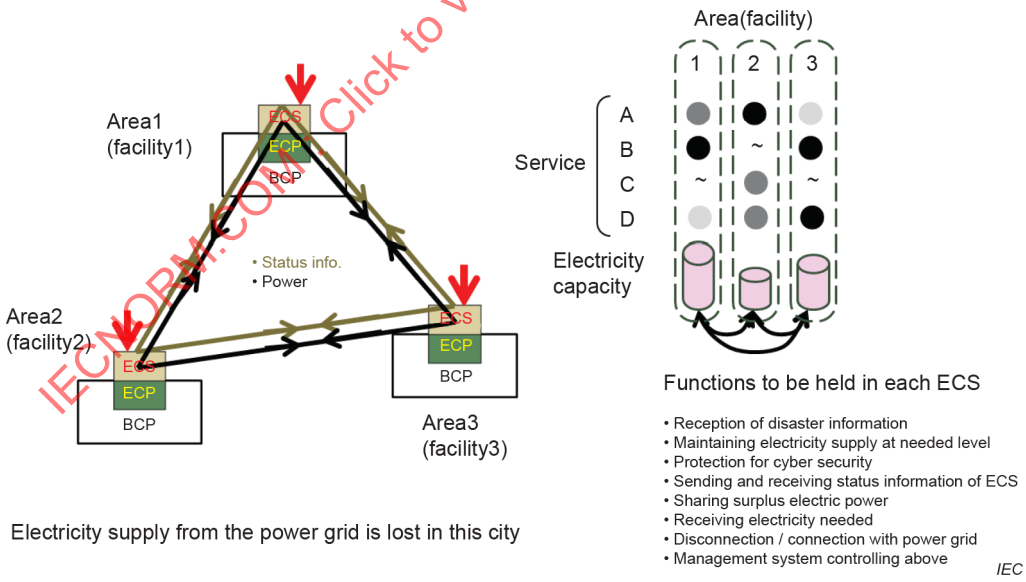


Figure B.3 – Image of power cooperation

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.

a) Extract services to be sustained when power loss occurs due to a disaster.

b) Estimate sustaining level required for those services.

c) Classify them into three types of area to achieve the sustaining level, and consider for each area how to implement required cooperation and conditions.

d) 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.

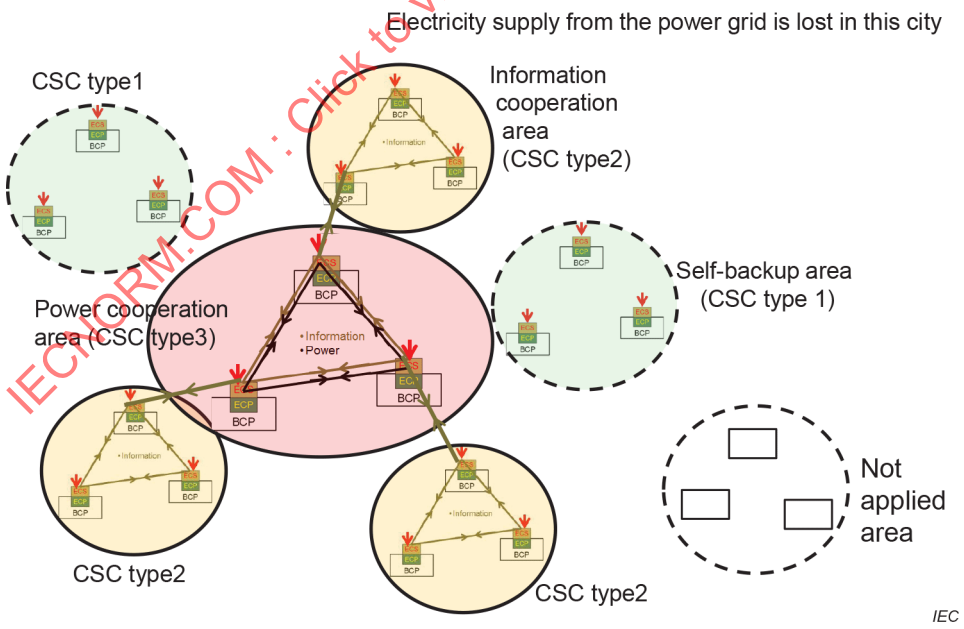


Figure C.1 – Setting CSC type for each area in a city

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.

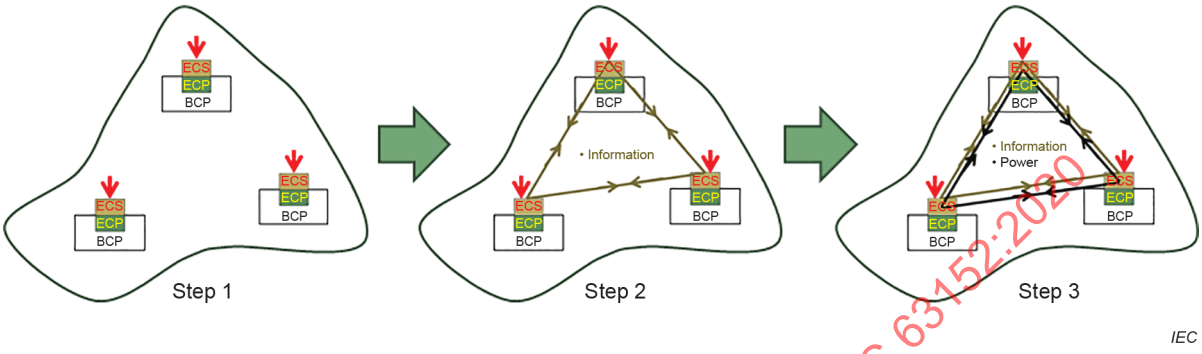


Figure C.2 – Image of improving cooperation

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 ECR. 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.