
Sustainable cities and communities — Indicators for resilient cities

*Villes et communautés territoriales durables — Indicateurs de
performance pour les villes résilientes*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 37123:2019](https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-9e83-8a5cbcf9010f/iso-37123-2019)

<https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-9e83-8a5cbcf9010f/iso-37123-2019>



iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 37123:2019

<https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-9e83-8a5cbcf9010f/iso-37123-2019>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	x
Introduction	xi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 City indicators	3
5 Economy	4
5.1 Historical disaster losses as a percentage of city product	4
5.1.1 General	4
5.1.2 Indicator requirements	4
5.1.3 Data sources	5
5.2 Average annual disaster loss as a percentage of city product	5
5.2.1 General	5
5.2.2 Indicator requirements	5
5.2.3 Data sources	5
5.2.4 Data interpretation	6
5.3 Percentage of properties with insurance coverage for high-risk hazards	6
5.3.1 General	6
5.3.2 Indicator requirements	6
5.3.3 Data sources	6
5.3.4 Data interpretation	6
5.4 Percentage of total insured value to total value at risk within the city	7
5.4.1 General	7
5.4.2 Indicator requirements	7
5.4.3 Data sources	7
5.4.4 Data interpretation	7
5.5 Employment concentration	8
5.5.1 General	8
5.5.2 Indicator requirements	8
5.5.3 Data sources	8
5.5.4 Data interpretation	8
5.6 Percentage of the workforce in informal employment	8
5.6.1 General	8
5.6.2 Indicator requirements	9
5.6.3 Data sources	9
5.6.4 Data interpretation	9
5.7 Average household disposable income	9
5.7.1 General	9
5.7.2 Indicator requirements	9
5.7.3 Data sources	10
6 Education	10
6.1 Percentage of schools that teach emergency preparedness and disaster risk reduction ..	10
6.1.1 General	10
6.1.2 Indicator requirements	10
6.1.3 Data sources	10
6.2 Percentage of population trained in emergency preparedness and disaster risk reduction	11
6.2.1 General	11
6.2.2 Indicator requirements	11
6.2.3 Data sources	11
6.3 Percentage of emergency preparedness publications provided in alternative languages ..	11
6.3.1 General	11

6.3.2	Indicator requirements.....	11
6.3.3	Data sources.....	12
6.4	Educational disruption.....	12
6.4.1	General.....	12
6.4.2	Indicator requirements.....	12
6.4.3	Data sources.....	12
7	Energy.....	13
7.1	Number of different electricity sources providing at least 5 % of total energy supply capacity.....	13
7.1.1	General.....	13
7.1.2	Indicator requirements.....	13
7.1.3	Data sources.....	13
7.1.4	Data interpretation.....	14
7.2	Electricity supply capacity as a percentage of peak electricity demand.....	14
7.2.1	General.....	14
7.2.2	Indicator requirements.....	14
7.2.3	Data sources.....	14
7.3	Percentage of critical facilities served by off-grid energy services.....	14
7.3.1	General.....	14
7.3.2	Indicator requirements.....	15
7.3.3	Data sources.....	15
8	Environment and climate change.....	16
8.1	Magnitude of urban heat island effects (atmospheric).....	16
8.1.1	General.....	16
8.1.2	Indicator requirements.....	16
8.1.3	Data sources.....	16
8.1.4	Data interpretation.....	16
8.2	Percentage of natural areas within the city that have undergone ecological evaluation for their protective services.....	17
8.2.1	General.....	17
8.2.2	Indicator requirements.....	17
8.2.3	Data sources.....	17
8.3	Territory undergoing ecosystem restoration as a percentage of total city area.....	18
8.3.1	General.....	18
8.3.2	Indicator requirements.....	18
8.3.3	Data sources.....	18
8.3.4	Data interpretation.....	18
8.4	Annual frequency of extreme rainfall events.....	19
8.4.1	General.....	19
8.4.2	Indicator requirements.....	19
8.4.3	Data sources.....	19
8.5	Annual frequency of extreme heat events.....	19
8.5.1	General.....	19
8.5.2	Indicator requirements.....	19
8.5.3	Data sources.....	20
8.6	Annual frequency of extreme cold events.....	20
8.6.1	General.....	20
8.6.2	Indicator requirements.....	20
8.6.3	Data sources.....	20
8.7	Annual frequency of flood events.....	20
8.7.1	General.....	20
8.7.2	Indicator requirements.....	20
8.7.3	Data sources.....	21
8.8	Percentage of city land area covered by tree canopy.....	21
8.8.1	General.....	21
8.8.2	Indicator requirements.....	21
8.8.3	Data sources.....	21

8.9	Percentage of city surface area covered with high-albedo materials contributing to the mitigation of urban heat islands	21
8.9.1	General	21
8.9.2	Indicator requirements	22
8.9.3	Data sources	22
9	Finance	22
9.1	Annual expenditure on upgrades and maintenance of city service assets as a percentage of total city budget	22
9.1.1	General	22
9.1.2	Indicator requirements	22
9.1.3	Data sources	23
9.2	Annual expenditure on upgrades and maintenance of storm water infrastructure as a percentage of total city budget	23
9.2.1	General	23
9.2.2	Indicator requirements	23
9.2.3	Data sources	23
9.3	Annual expenditure allocated to ecosystem restoration in the city's territory as a percentage of total city budget	23
9.3.1	General	23
9.3.2	Indicator requirements	24
9.3.3	Data sources	24
9.3.4	Data interpretation	24
9.4	Annual expenditure on green and blue infrastructure as a percentage of total city budget	24
9.4.1	General	24
9.4.2	Indicator requirements	24
9.4.3	Data sources	25
9.4.4	Data interpretation	25
9.5	Annual expenditure on emergency management planning as a percentage of total city budget	25
9.5.1	General	25
9.5.2	Indicator requirements	25
9.5.3	Data sources	25
9.6	Annual expenditure on social and community services as a percentage of total city budget	26
9.6.1	General	26
9.6.2	Indicator requirements	26
9.6.3	Data sources	26
9.6.4	Data interpretation	26
9.7	Total allocation of disaster reserve funds as a percentage of total city budget	26
9.7.1	General	26
9.7.2	Indicator requirements	27
9.7.3	Data sources	27
9.7.4	Data interpretation	27
10	Governance	27
10.1	Frequency with which disaster-management plans are updated	27
10.1.1	General	27
10.1.2	Indicator requirements	27
10.1.3	Data sources	27
10.2	Percentage of essential city services covered by a documented continuity plan	28
10.2.1	General	28
10.2.2	Indicator requirements	28
10.2.3	Data sources	28
10.2.4	Data interpretation	28
10.3	Percentage of city electronic data with secure and remote back-up storage	29
10.3.1	General	29
10.3.2	Indicator requirements	29

10.3.3	Data sources.....	29
10.4	Percentage of public meetings dedicated to resilience in the city.....	29
10.4.1	General.....	29
10.4.2	Indicator requirements.....	29
10.4.3	Data sources.....	30
10.5	Number of intergovernmental agreements dedicated to planning for shocks as percentage of total intergovernmental agreements.....	30
10.5.1	General.....	30
10.5.2	Indicator requirements.....	30
10.5.3	Data sources.....	30
10.6	Percentage of essential service providers that have a documented business continuity plan.....	31
10.6.1	General.....	31
10.6.2	Indicator requirements.....	31
10.6.3	Data sources.....	31
10.6.4	Data interpretation.....	31
11	Health.....	32
11.1	Percentage of hospitals equipped with back-up electricity supply.....	32
11.1.1	General.....	32
11.1.2	Indicator requirements.....	32
11.1.3	Data sources.....	32
11.2	Percentage of population with basic health insurance.....	32
11.2.1	General.....	32
11.2.2	Indicator requirements.....	32
11.2.3	Data sources.....	33
11.3	Percentage of population that is fully immunized.....	33
11.3.1	General.....	33
11.3.2	Indicator requirements.....	33
11.3.3	Data sources.....	33
11.4	Number of infectious disease outbreaks per year.....	33
11.4.1	General.....	33
11.4.2	Indicator requirements.....	33
11.4.3	Data sources.....	34
11.4.4	Data interpretation.....	34
12	Housing.....	34
12.1	Capacity of designated emergency shelters per 100 000 population.....	34
12.1.1	General.....	34
12.1.2	Indicator requirements.....	34
12.1.3	Data sources.....	34
12.2	Percentage of buildings structurally vulnerable to high-risk hazards.....	35
12.2.1	General.....	35
12.2.2	Indicator requirements.....	35
12.2.3	Data sources.....	35
12.3	Percentage of residential buildings not in conformity with building codes and standards.....	35
12.3.1	General.....	35
12.3.2	Indicator requirements.....	35
12.3.3	Data sources.....	36
12.4	Percentage of damaged infrastructure that was “built back better” after a disaster.....	36
12.4.1	General.....	36
12.4.2	Indicator requirements.....	36
12.4.3	Data sources.....	37
12.4.4	Data interpretation.....	37
12.5	Annual number of residential properties flooded as a percentage of total residential properties in the city.....	37
12.5.1	General.....	37
12.5.2	Indicator requirements.....	38

12.5.3	Data sources.....	38
12.6	Percentage of residential properties located in high-risk zones	38
12.6.1	General.....	38
12.6.2	Indicator requirements.....	38
12.6.3	Data sources.....	38
13	Population and social conditions.....	39
13.1	Vulnerable population as a percentage of city population.....	39
13.1.1	General.....	39
13.1.2	Indicator requirements.....	39
13.1.3	Data sources.....	39
13.1.4	Data interpretation.....	39
13.2	Percentage of population enrolled in social assistance programmes.....	40
13.2.1	General.....	40
13.2.2	Indicator requirements.....	40
13.2.3	Data sources.....	40
13.3	Percentage of population at high risk from natural hazards.....	40
13.3.1	General.....	40
13.3.2	Indicator requirements.....	40
13.3.3	Data sources.....	41
13.4	Percentage of neighbourhoods with regular and open neighbourhood association meetings.....	41
13.4.1	General.....	41
13.4.2	Indicator requirements.....	41
13.4.3	Data sources.....	41
13.5	Annual percentage of the city population directly affected by natural hazards.....	41
13.5.1	General.....	41
13.5.2	Indicator requirements.....	42
13.5.3	Data sources.....	42
14	Recreation.....	42
15	Safety.....	42
15.1	Percentage of city population covered by multi-hazard early warning system.....	42
15.1.1	General.....	42
15.1.2	Indicator requirements.....	42
15.1.3	Data sources.....	43
15.2	Percentage of emergency responders who have received disaster response training.....	43
15.2.1	General.....	43
15.2.2	Indicator requirements.....	43
15.2.3	Data sources.....	43
15.3	Percentage of local hazard warnings issued by national agencies annually that are received in a timely fashion by the city.....	43
15.3.1	General.....	43
15.3.2	Indicator requirements.....	44
15.3.3	Data sources.....	44
15.4	Number of hospital beds in the city destroyed or damaged by natural hazards per 100 000 population.....	44
15.4.1	General.....	44
15.4.2	Indicator requirements.....	44
15.4.3	Data sources.....	45
16	Solid waste.....	45
16.1	Number of active and temporary waste management sites available for debris and rubble per square kilometre.....	45
16.1.1	General.....	45
16.1.2	Indicator requirements.....	45
16.1.3	Data sources.....	45
17	Sport and culture.....	45

18	Telecommunication	46
18.1	Percentage of emergency responders in the city equipped with specialized communication technologies able to operate reliably during a disaster event	46
18.1.1	General	46
18.1.2	Indicator requirements	46
18.1.3	Data sources	46
19	Transportation	47
19.1	Number of evacuation routes available per 100 000 population	47
19.1.1	General	47
19.1.2	Indicator requirements	47
19.1.3	Data sources	47
20	Urban/local agriculture and food security	47
20.1	Percentage of city population that can be served by city food reserves for 72 hours in an emergency	47
20.1.1	General	47
20.1.2	Indicator requirements	47
20.1.3	Data sources	48
20.2	Percentage of the city's population living within one kilometre of a grocery store	48
20.2.1	General	48
20.2.2	Indicator requirements	48
20.2.3	Data sources	48
21	Urban planning	49
21.1	Percentage of city area covered by publicly available hazard maps	49
21.1.1	General	49
21.1.2	Indicator requirements	49
21.1.3	Data sources	49
21.2	Pervious land areas and public space and pavement built with porous, draining materials as a percentage of city land area	49
21.2.1	General	49
21.2.2	Indicator requirements	49
21.2.3	Data sources	50
21.2.4	Data interpretation	50
21.3	Percentage of city land area in high-risk zones where risk-reduction measures have been implemented	51
21.3.1	General	51
21.3.2	Indicator requirements	51
21.3.3	Data sources	51
21.4	Percentage of city departments and utility services that conduct risk assessment in their planning and investment	51
21.4.1	General	51
21.4.2	Indicator requirements	52
21.4.3	Data sources	52
21.5	Annual number of critical infrastructures flooded as a percentage of critical infrastructure in the city	52
21.5.1	General	52
21.5.2	Indicator requirements	52
21.5.3	Data sources	53
21.6	Annual expenditure on water retention measures as a percentage of city prevention measures budget	53
21.6.1	General	53
21.6.2	Indicator requirements	53
21.6.3	Data requirements	53
22	Wastewater	53
23	Water	53
23.1	Number of different sources providing at least 5 % of total water supply capacity	53
23.1.1	General	53

23.1.2	Indicator requirements.....	54
23.1.3	Data sources.....	54
23.1.4	Data interpretation.....	54
23.2	Percentage of city population that can be supplied with drinking water by alternative methods for 72 hours.....	54
23.2.1	General.....	54
23.2.2	Indicator requirements.....	54
23.2.3	Data sources.....	55
24	Reporting and record maintenance.....	55
Annex A	(informative) Typology of city hazards.....	56
Annex B	(informative) Mapping ISO 37123 indicators to the risk-management process.....	57
Annex C	(informative) Mapping ISO 37123 indicators to the disaster-management process.....	60
Annex D	(informative) UN Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction.....	62
Annex E	(informative) Mapping of ISO 37123 indicators to ISO 37101 issues and purposes.....	74
	Bibliography.....	82

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 37123:2019](https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-9e83-8a5cbcf9010f/iso-37123-2019)

<https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-9e83-8a5cbcf9010f/iso-37123-2019>

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 268, *Sustainable cities and communities*.
ISO 37123:2019

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Cities need indicators to establish their baseline, and measure and evaluate their performance. However, existing indicators are often not standardized, consistent or comparable over time or across cities. To address these challenges, a new series of International Standards is being developed to provide standardized indicators that enable a uniform approach to what is measured, and how that measurement is to be undertaken.

The first standard in this series, ISO 37120, has quickly become the international reference point for sustainable city indicators. While ISO 37120 contains a number of indicators of relevance to a city's resilience planning and assessment, the need for additional indicators for resilient cities has been identified, reflected in this document, as has the need for additional indicators for smart cities, developed in ISO 37122.

A resilient city is able to prepare for, recover from and adapt to shocks and stresses. Cities are increasingly confronted by shocks, including extreme natural or human-made events which result in loss of life and injury, material, economic, and/or environmental losses and impacts. These shocks can include but are not limited to floods, earthquakes, hurricanes, wildfires, volcanic eruptions, pandemics, chemical spills and explosions, terrorism, power outages, financial crises, cyber-attacks and conflicts. A resilient city is also able to manage and mitigate ongoing human and natural stresses in a city relating to environmental degradation (e.g. poor air and water quality), social inequality (e.g. chronic poverty and housing shortages) and economic instability (e.g. rapid inflation and persistent unemployment) that cause persistent negative impacts in a city.

A city's preparedness can be characterized by developing a detailed understanding of the risks to the city, by taking action to reduce vulnerability and exposure, and by enhancing the awareness and participation of individuals, households and businesses.

A resilient city is able to recover from shocks and stresses in a timely and efficient manner, with a focus on ensuring the continuity or rapid restoration of city services such as electricity, water, telecommunications, waste management, sanitation, food distribution, financial services and access to emergency services.

A resilient city is also a city that understands the necessity to adapt its systems and processes to ensure that they are as robust as possible in the face of shocks and stresses, building back better following extreme events, while focusing on the goal of restoring and ensuring long-term prosperity.

Resilience is both a core component and an essential enabler of sustainable development. This document is focused on resilience measurement as a major contribution to the sustainability of a city. The structure of the family of city indicators standards for sustainable cities and communities reflects this relationship between sustainable development, resilient development and smart development (see [Figure 1](#)).

Progress and transformation towards sustainable development through maintaining and improving city services and quality of life in the face of shocks and stresses is a core component of a resilient city. This document is therefore intended to be implemented in conjunction with ISO 37120.

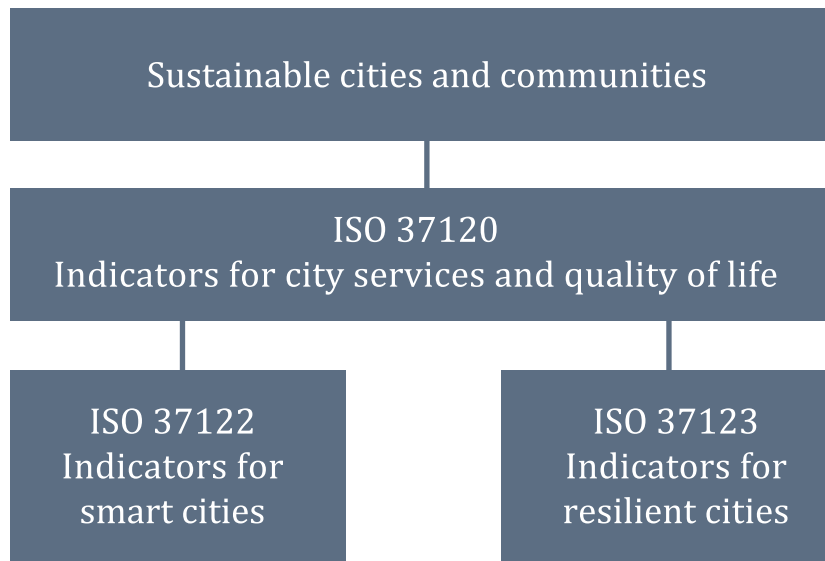


Figure 1 — Sustainable cities and communities — Relationships within the family of city indicators standards

The indicators in this document have been selected to make reporting as simple and inexpensive as possible, and therefore reflect an initial platform for reporting. The indicators have been developed to help cities:

- a) prepare for, recover from and adapt to shocks and stresses;
- b) learn from one another by allowing comparison across a wide range of performance measures, and by sharing good practices.

The indicators in this document can be used to track and monitor progress towards a resilient city, through the development of a city resilience strategy or when applying a city management system such as ISO 37101. While the indicators are structured around ISO themes that correspond to different sectors and services provided by cities, it is noted that the indicators can also be organized according to the risk management process ([Annex B](#)), the disaster management process ([Annex C](#)), the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction ([Annex D](#)) and the ISO 37101 issues and purposes ([Annex E](#)). Furthermore, the typologies of hazards ([Annex A](#)) can assist cities in identifying the potential hazards that they face, which is relevant to many of the indicators contained in this document. It is also provided as a guide for helping identify peer cities facing similar hazards.

This document will support any and all global agreements that support sustainability and resilience. Agreements currently in place include, but are not limited to: the Sendai Framework for Disaster Risk Reduction^[22], the New Urban Agenda, the 2030 Agenda (i.e. the United Nations Sustainable Development Goals^[27]) and the Paris Agreement.

A city which conforms to this document does so in regard to measurement of indicators for city resilience in conformity with the definitions and methodologies as set out in this document, and may only claim conformity to that effect. This document does not provide a value judgement, threshold or target numerical value for the indicators, therefore conformity with this document does not confer a status in this regard.

It is acknowledged that cities may not have direct influence or control over factors governing some of these indicators, but the reporting is important for meaningful comparison and provides a general indication of resilience.

In this document, the following verbal forms are used:

- “shall” indicates a requirement;

- “should” indicates a recommendation;
- “may” indicates a permission;
- “can” indicates a possibility or a capability.

The terminology used within this document is outlined in the United Nations General Assembly (UNGA) Terminology Document, available at https://www.preventionweb.net/files/50683_oiewgreportenglish.pdf

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 37123:2019

<https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-9e83-8a5cbcf9010f/iso-37123-2019>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 37123:2019

<https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-9e83-8a5cbcf9010f/iso-37123-2019>

Sustainable cities and communities — Indicators for resilient cities

1 Scope

This document defines and establishes definitions and methodologies for a set of indicators on resilience in cities.

This document is applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size or location. Maintaining, enhancing and accelerating progress towards improved city services and quality of life is fundamental to the definition of a resilient city, so this document is intended to be implemented in conjunction with ISO 37120.

This document follows the principles set out in ISO 37101, and can be used in conjunction with this and other strategic frameworks.

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 37101, *Sustainable development in communities — Management system for sustainable development — Requirements with guidance for use* [ISO 37123:2019](https://standards.iteh.ai/catalog/standards/sist/d9640929-4bd5-47b5-)

ISO 37120, *Sustainable cities and communities — Indicators for city services and quality of life*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 37101 and ISO 37120 and the following apply.

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

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

3.1 critical infrastructure

physical structures, facilities, networks and other assets which provide services that are essential to the social and economic functioning of a community or society

Note 1 to entry: Examples of critical infrastructure can include, but are not limited to, power generation, transmission and distribution, water treatment, distribution and drainage, wastewater and storm water infrastructure, transportation, gas supply and distribution, telecommunications infrastructure, educational facilities, hospitals and other health facilities.