

Recommendation

ITU-T Y.4498 (07/2024)

SERIES Y: Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

Internet of things and smart cities and communities –
Frameworks, architectures and protocols

Framework of city-level energy data sharing and analytics among buildings

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Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

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Recommendation ITU-T Y.4498

Framework of city-level energy data sharing and analytics among buildings

Summary

Recommendation ITU-T Y.4498 specifies requirements and architectural models for city-level energy management that facilitates data exchange, sharing and analytics among buildings in smart cities. Recommendation ITU-T Y.4498 also provides use cases to support energy planning, management and energy data sharing through city energy services for smart sustainable cities.

As the sector accounts for a significant portion of total energy consumption, efforts are being made to increase energy efficiency in the built environment through smart solutions in homes, office and commercial premises, and factories. To effectively support energy efficiency in smart cities, it is crucial to have city-level data sharing and analytics for services and intelligent applications. This allows information to be shared among buildings with different consumption patterns or renewable production to increase energy efficiency. To enable city-level data sharing and analytics, standardized specifications for energy data types and exchange methods are essential.

History*

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Data sharing and analytics, energy, energy management, smart building.

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In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Recommendation ITU-T Y.4498

Framework of city-level energy data sharing and analytics among buildings

1 Scope

This Recommendation establishes a framework for city-level data sharing and analytics for energy consumed and produced by services and intelligent applications among buildings to support smart sustainable cities.

This Recommendation includes:

- an overview of city-level energy data sharing and analytics among buildings;
- requirements for energy data sharing and analytics for city services and intelligent applications;
- architectural models, specification of functions and interfaces;
- energy data processing and operation for city services.

Appendix I provides use cases for city energy services to support energy planning, management and energy data sharing for smart sustainable cities.

NOTE 1 – This Recommendation considers buildings of three types, i.e., residential, office and commercial premises, and industrial.

NOTE 2 – Energy data related to personally identifiable information (PII) is limited to that which can be used publicly with the consent of each individual. Issues such as detailed data collection method and anonymization of PII may be related to regulation in some countries. Therefore, non-functional aspects related to regulation lie outside the scope of this Recommendation.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T Y.4200] Recommendation ITU-T Y.4200 (2018), *Requirements for the interoperability of smart city platforms*.
- [ITU-T Y.4201] Recommendation ITU-T Y.4201 (2017), *High-level requirements and reference framework of smart city platforms*.
- [ITU-T Y.4900] Recommendation ITU-T Y.4900/L.1600 (2016), *Overview of key performance indicators in smart sustainable cities*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 smart sustainable city [ITU-T Y.4900]: A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services and competitiveness, while ensuring that it meets the needs

of present and future generations with respect to economic, social, environmental, as well as cultural aspects.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 city-level energy management platform: A platform to facilitate the collection, sharing and analytics of energy consumption and production information necessary for city services and intelligent applications.

3.2.2 region-level energy management platform: A platform to support regional consumption and production entities such as buildings that provides a city-level energy management platform with the information necessary to achieve optimum performance.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AI	Artificial Intelligence
API	Application Programming Interface
CL-EMP	City-Level Energy Management Platform
DER	Distributed Energy Resource
DR	Demand Response
EI	Energy Interoperation
EMP	Energy Management Platform
ESP	Energy Service Provider
GIS	Geographic Information System
ICT	Information and Communication Technology
IDC	Internet Data Centre
PII	Personally Identifiable Information
P2P	Peer-to-Peer
RL-EMP	Region-Level Energy Management Platform
SCP	Smart City Platform
VPP	Virtual Power Plant

5 Conventions

In this Recommendation:

The phrase "is required" indicates a requirement that must be strictly followed and from which no deviation is permitted, if conformance to this Recommendation is to be claimed.

The phrase "is recommended" indicates a requirement that is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

6 Overview of city-level energy data sharing and analytics

6.1 Conceptual model

Buildings in a smart city are used for residential, office and commercial premises, or industrial purposes. In most countries, energy consumption in the building sector accounts for a significant portion of a city's total energy consumption. In order to increase the efficiency of energy consumption, efforts are being made in the building sector to implement smart solutions in such locations as the home, public buildings and factories. To effectively support these efforts, it is essential to establish for energy city-level data sharing and analytics for city services and intelligent applications. This enables buildings with different consumption patterns or renewable production of energy to share their consumption and production information for city usage efficiency. Standardized energy data types and exchange methods are essential to facilitate the city-level data sharing and analytics.

The city-level energy management platform (CL-EMP) aims to achieve optimum performance within the smart city energy sector. There is an increasing need for technologies that enable supply-side management, demand-side management, and integrated management of energy sources to effectively meet energy demand for smart sustainable cities [ITU-T Y.4900]. Furthermore, many studies are underway to improve operational efficiency by leveraging data sharing and analytics with energy management platforms (EMPs) for diverse purposes.

Figure 1 shows a conceptual model of city-level data sharing and analytics for energy among buildings for city services and intelligent applications. In this model, the region-level energy management platform (RL-EMP) of each building acts as the primary actor, while the energy service provider (ESP) and the city Internet data centre (IDC) serve as the secondary actors to provide convergence services. They are connected to the CL-EMP. The RL-EMP consists of residential building EMP, office and commercial building EMP, and industrial building EMP, depending on the specific purpose of each building. It supports a standardized energy interoperation (EI) interface for exchanging data with the CL-EMP. The CL-EMP receives energy data from each RL-EMP, as well as citywide demand and supply data from the ESP for each energy source. In addition, it exchanges publicly available data, such as geographic data and climate data, with the city IDC to facilitate city-level energy services. To support the development of intelligent applications, the CL-EMP acts as a data platform, collecting and analysing data, and sharing them with other city platforms and users through an open application programming interface (API).

With this conceptual model, it becomes feasible not only to save energy within a city, but also to develop city-level energy plans using a geographic information system (GIS) and enhance the utilization of the EMPs. Moreover, the model facilitates the emergence of new energy businesses, such as demand response (DR), virtual power plant (VPP), peer-to-peer (P2P) energy exchange, and CO₂ emissions management.