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中華民國國家標準

C N S

電力公用事業應用整合 - 配電管理之 系統介面 -

第 5 部：分散式能源最佳化

Application integration at electric utilities - System
interfaces for distribution management - Part 5:
Distributed energy optimization

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前言

本標準係依據 2020 年版 ISO/IEC 61968-5，不變更技術內容，制定成為中華民國國家標準者。

本標準係依標準法之規定，經國家標準審查委員會審定，由主管機關公布之中華民國國家標準。

依標準法第 4 條之規定，國家標準採自願性方式實施。但經各該目的事業主管機關引用全部或部分內容為法規者，從其規定。

本標準並未建議所有安全事項，使用本標準前應適當建立相關維護安全及健康作業，並且遵守相關法規之規定。

本標準之部分內容，可能涉及專利權、商標權及著作權，主管機關及標準專責機關不負責任何或所有此類專利權、商標權及著作權之鑑別。

簡介

Introduction

各種型式之分散式能源(distributed energy resource, DER)的技術進步，已驅動公用事業、耗用者及第三方評估及部署之增加。此等 DER 通常係於配電層及連接至電網，若設計、整合及管理不當，則其大規模或大量存在可能造成破壞。

Technology advancements in various types of distributed energy resources (DER), have driven increases in their evaluation and employment by utilities, consumers, and third parties. These DER are often connected to the grid at the distribution level where their presence in large scale or volume could be disruptive if not designed, integrated, and managed properly.

變流器(inverter)係將 DER 整合至電網之功率轉換器電路，具快速功率控制且無固有慣性的高性能裝置，因此能快速回應命令及本地條件。即使小型變流器亦往往具處理及記憶資源，且能支援各種通訊協定及先進功能。過去幾年，業界努力定義變流器可提供之各種標準電網支援功能並容許遠端監視且管理此等功能的標準通訊協定。

Inverters, the power converter circuits that integrate DER to the grid, are highly-capable devices with fast power controls and no inherent inertia such that they can respond quickly to commands and local conditions. Even small-scale inverters tend to have processing and memory resources and can support a variety of communication protocols and advanced functions. Over the last few years, industry efforts have defined a wide range of standard grid-supportive functions that inverters may provide and standard communication protocols that allow these functions to be

remotely monitored and managed.

若此等變流器能力能正確暴露並整合至傳統公用事業系統營運中，則高滲透 DER 能自有問題之不確定性轉變為用於配電管理的有益工具。為達成此等潛在利益，其可能不僅需使用標準協定與個別 DER 裝置通訊，亦需用於管理 DER 之系統(於此稱為 DER 管理系統或“DERMS”), 有效地將有關可用資源的資訊通知其他軟體應用，並交換資訊以有效管理 DER。此外，由於某些裝置之規模，為最佳化 DER 的管理，其係於聚合中管理，以下簡稱“DER 群組管理”。

If these inverter capabilities can be properly exposed and integrated into traditional utility system operations, high penetration DER can be transformed from problematic uncertainties to beneficial tools for distribution management. To achieve these potential benefits, it needs to be possible not just to communicate to individual DER devices using standard protocols, but also for the systems that manage DER, referred to herein as DER Management System or "DERMS", to effectively inform other software applications regarding the resources available and to exchange information that allows the DER to be managed effectively. Additionally, due to scale of some devices, to optimize the management of DER they are managed in aggregate, referred hereafter as "DER group management".

傳統上，配電系統之營運並未廣泛控制或集中管理。較先進系統可於變電所、線路調整器及/或電容器組上配備有載分接頭切換變壓器(on-load tap changing transformer, LTC)，以有助於最佳化配電電壓及無效功率流。於許多情況下，此等裝置可能為固定式或組態設定為自主運作。然而，於不斷增加之情況下，較集中化配電管理系統(distribution management system, DMS)係用以協調其行為，用以較最佳化整體效果。DMS 功能可駐留於公用事業營運中心，其中單一大型軟體管理許多電路，或其可以較受限制之式樣駐留於變電所或其他層級，其中較小規模的系統負責管理個別饋線或電路。

Traditionally, distribution systems have been operated without extensive controls or centralized management. More advanced systems may have On-Load Tap Changing transformers (LTCs) at substations, line regulators, and/or capacitor banks that operate to help optimize distribution voltage and reactive power flow. In many cases, these devices may be fixed or configured to operate autonomously. In a growing number of cases, however, a more central Distribution Management System (DMS) has been used to coordinate their behaviour for a more optimized overall effect. DMS functionality may reside at the utility operations centre, where single, large-scale software manages many circuits, or it may reside in a more limited fashion at the substation or other level, where smaller-scale systems act to manage individual feeders or circuits.

無論何種情境，目前世代之 DMS 系統未設計為利用 DER 可供應的容量。於大多數情況下，DMS 內之 DER 支援係受限制為監視“公用事業規模”DER (> 1 百萬瓦特)的輸出。此外，既存產業標準僅於個別裝置層級定義 DER 之先進功能，缺乏對企業整合有用的較聚合之饋線等級表示。

本標準針對分散式能源資源之整合，開發適當的企業層級功能。此等功能係旨在與先前已定義之智慧型變流器的共同功能結合使用。

Regardless of the scenario, the present generation of DMS systems is not designed to take advantage of the capabilities that DER may offer. In most cases, DER support within a DMS is limited to monitoring the output of "utility scale" DERs (> one megawatt). In addition, existing industry standards define advanced functions for DER only at the individual device level and lack the more aggregated, feeder-level representations that are useful for enterprise integration. This document develops appropriate enterprise-level functions for the integration of distributed energy resources. These functions are intended to work in conjunction with the common functions for smart inverters that have previously been defined.

所涵蓋之高層級使用案例包括 DER 群組成員資格(membership)管理、DER 群組狀態監視、DER 群組預測、有效功率及無效功率的調度，以及將 DER 作為聚合群組管理之其他能力。

本系列標準作為整體，針對配電管理系統(DMS)定義用於介面架構之主要元件的介面。本系

列標準第 1 部基於介面參考模型(IRM)識別並建立用於標準介面之要求事項(requirements)。

本標準第 3-9 部定義與介面參考模型所描述之各主要營運功能的相關介面。

The high-level use cases that are covered include management of DER group membership, DER group status monitoring, DER group forecasting, and dispatching of real and reactive power and other capabilities of managing DER as aggregated groups.

The IEC 61968 standard, taken as a whole, defines interfaces for the major elements of interface architecture for Distribution Management Systems (DMS). *Part 1: Interface Architecture and General Recommendations*, identifies and establishes requirements for standard interfaces based on an Interface Reference Model (IRM). Parts 3-9 of this standard define interfaces relevant to each of the major business functions described by the Interface Reference Model.

依本系列標準中所使用，DMS 由用於公用事業之各種分散式應用組件組成，用以管理配電網。此等能力包括監視及控制用於電力配送之設備、確保系統可靠性的管理過程、電壓管理、需求面管理、停電管理、工作管理、自動對映及設施管理。

此組標準僅係受限制為介面之定義且係獨立於實作。其提供不同電腦系統、平台與語言間之互運性。用以實作符合此等介面之功能性的方法及技術，係視為超出此等標準之適用範圍；此等標準中僅規定介面本身。

As used in IEC 61968, a DMS consists of various distributed application components for the utility to manage electrical distribution networks. These capabilities include monitoring and control of equipment for power delivery, management processes to ensure system reliability, voltage management, demand-side management, outage management, work management, automated mapping and facilities management.

This set of standards is limited to the definition of interfaces and is implementation independent. They provide for interoperability among different computer systems, platforms, and languages. Methods and technologies used to implement functionality conforming to these interfaces are considered outside of the scope of these standards; only the interface itself is specified in these standards.

1. 適用範圍

1 Scope

本標準之適用範圍係針對 DERMS 功能的企業聚合所需之一組功能的說明。此等交換很可能發生於 DERMS 與 DMS 之間。然而，由於此係企業整合標準，針對應用整合(使用 Web 服務或 JMS)或其他鬆散耦合之實作，其可利用 IEC 61968-100:2013，因此針對 DERMS 可與其交換資訊的系統並無技術限制。此外，宜該注意，DERMS 可使用各種標準及協定與個別 DER 通訊，諸如 CNS 61850 系列標準、IEEE 2030.5 配電網路協定(distribution network protocol, DNP)、Sunspec Modbus 或開放場域訊息匯流排(open field message bus, OpenFMB)。DERMS 的角色之一係代表系統運作者管理通訊的此差異及複雜性。然而，對個別 DER 之通訊超出本標準適用範圍。讀者需查閱此等標準，以瞭解對個別 DER 智慧變流器(smart inverter)之通訊。

The scope of this part of IEC 61968 is the description of a set of functions that are needed for enterprise integration of DERMS functions. These exchanges are most likely between a DERMS and a DMS. However, since this is an enterprise integration standard which may leverage IEC 61968-100:2013 for application integration (using web services or JMS) or other loosely-coupled implementations, there are no technical limitations for systems with which a DERMS might exchange information. Also, it should be noted that a DERMS might communicate with individual DER using a variety of standards and protocols such as IEC 61850, IEEE 2030.5, Distribution Network Protocol (DNP), Sunspec Modbus, or perhaps Open Field Message Bus (OpenFMB). One role of the DERMS is to manage this disparity and complexity of communications on the behalf of the system operator. However, the communication to individual DER is out of scope of this standard. Readers are invited to look to those standards to understand communication to individual DERs' smart inverter.

適用範圍將限於下列使用案例種類：

- DER 群組建立 - 管理聚合中之 DER 的機制。
- DER 群組維護 - 新增、刪除或修改所給定 DER 群組之成員及/或聚合容量的機制。
- DER 群組刪除 - 移除整個群組。
- DER 群體狀態監視 - 用以量化或查明 DER 群體目前容量及/或狀態之機制。

The scope will be limited to the following use case categories:

- DER group creation - a mechanism to manage DER in aggregate
- DER group maintenance - a mechanism to add, remove, or modify the members and/or aggregated capabilities of a given group of DER

- DER group deletion - removing an entire group
- DER group status monitoring - a mechanism for quantifying or ascertaining the current capabilities and/or status of a group of DER

• DER 群組預測 - 針對給定之未來時段，用以預測一群 DER 的所規定容量及/或狀態之機制。

• DER 群組調度 - 用以請求將一群 DER 之所規定容量調度至電網的機制。

• DER 群組電壓升載率(ramp rate)控制 - 用以請求 DER 群組依循升載率曲線之機制。

• DER 群組連接/解連 - 請求 DER 自我隔離或依需重新連接至電網之機制。

為支援上述種類之使用案例，本標準規定下列資料要求事項(剖繪)，依表 1 中所示：

- DER group forecast - a mechanism for predicting the capabilities and/or status of a group of DER for a given time period in the future
- DER group dispatch - a mechanism for requesting that specified capabilities of a group of DER be dispatched to the grid
- DER group voltage ramp rate control - a mechanism for requesting that a DER group following a ramp rate curve
- DER group connect/disconnect - a mechanism to request that DER either isolate themselves, or reconnect to the grid as needed

To support use cases in the preceding categories, this document specifies the following data requirements (profiles) as shown in Table 1:

表 1 本標準剖繪

Table 1 - IEC 61968-5 Profiles

DERGroups	DERGroupQueries
DERGroupStatuses	DERGroupStatusQuer
DERGroupForecast	DERGroupForecastQ
DERGroupDispatch	DERGroupQueries

表 1 左欄中之剖繪係“基礎”DER 剖繪，出現於 IEC 61968-100 遵循訊息的酬載部分。表 1 右欄中之剖繪係出現於 IEC 61968-100 遵循訊息的請求部分中之“查詢”剖繪，用以於使用“get”CIM 動詞時規定查詢參數。

此外，本標準使用既存之 IEC 61968-9:2013，依表 2 中所示，其係用以傳遞事件資訊，且用於 DER 群組連接/解連使用案例。此等並未延伸，僅傳遞特定於此等使用案例之資料。

The profiles in the left column of Table 1 are the "base" DER profiles and appear in the Payload section of IEC 61968-100 compliant messages. Those in the right column of Table 1 are the "query" profiles that appear in the Request section of IEC 61968-100 compliant messages and

are used to specify the query parameters when using the "get" CIM verb.

Additionally, this specification uses existing IEC 61968-9 :2013, *Application integration at electric utilities - System interfaces for distribution management - Part 9: Interfaces for meter reading and control profiles*, as shown in Table 2, which are used for passing event information and for the DER group connect/disconnect use cases. There are no extensions made to these profiles, only the data specific to these use cases is passed.

表 2 IEC 61968-9 剖繪

Table 2 - IEC 61968-9 Profiles

EndDeviceControls
EndDeviceEvents

不同於先前之本系列標準，本標準支援各“基礎”剖繪的“受限制”及“不受限制”版本之規格。“受限制”版本具較多數量之非選項資料元件，旨在與“create”及“created” CIM 動詞一起使用。“不受限制”版本將所有或幾乎所有 CIM 元件定義為選項，此係支援涉及“change”、“changed”、“delete”、“deleted”及“get” CIM 動詞之運作所須。

本標準包含表 3 中所列出之節次。

In a departure from prior IEC 61968 standards, this document supports specification of both a "constrained" and an "unconstrained" version of each of the "base" profiles. The "constrained" versions have a greater number of non-optional data elements and are intended for use with the "create" and "created" CIM verbs. The "unconstrained" versions have all or almost all of the CIM elements defined as option, which is required to support operations involving the "change", "changed", "delete", "deleted" and "get" CIM verbs.

This part of IEC 61968 contains the clauses listed in Table 3.

表 3 本標準之文件概觀

Table 3 - Document overview for IEC 61968-5

節次 Clause	標題 Title	目的 Purpose
	適用範圍 Scope	描述本標準之適用範圍及目的。 The scope and purpose of the document are described.
2	引用標準 References (Normative and Informative)	包含透過此文字中之引用而構成本標準條款之條款的文件。 Documents that contain provisions which, through reference in this text, constitute provisions of this International Standard.
3	用語、定義及縮寫 Terms, definitions, and	建立本標準中所使用之共同用語。 Establish the common terms used in this specification.

	abbreviations	
4	文件規約 Document Conventions	與用以維護及建構相關文件之資訊交換相關的訊息型式。 Message types related to the exchange of information for documents related to maintenance and construction.
5	DER 企業整合使用案例 DER Enterprise Integration Use Cases	基於使用案例之訊息交換的特定要求事項及細節。描述 DER 企業整合訊息型式用語及靜態資訊之一般作法。 The specific requirements for and details of the message exchanges based on the use cases. Description of general approach to the DER enterprise integration message type terms and the static information.

2. 引用標準

2. Normative references

下列標準因本標準所引用，成為本標準之一部分。有加註年分者，適用該年分之版次，不適用於其後之修訂版(包括補充增修)。無加註年分者，適用該最新版(包括補充增修)。

~~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.~~

IEC 60050-300, *International Electrotechnical Vocabulary (IEV) - Part 300: Electrical and electronic measurements and measuring instruments - Part 311: General terms relating to measurements - Part 312: General terms relating to electrical measurements - Part 313: Types of electrical measuring instruments - Part 314: Specific terms according to the type of instrument*

IEC TS 61968-2, *Application integration at electric utilities – System interfaces for distribution management - Part 2: Glossary*

IEC 61968-9:2013, *Application integration at electric utilities - System interfaces for distribution management - Part 9: Interfaces for meter reading and control*

IEC 61968-1, *Application integration at electric utilities - System interfaces for distribution management - Part 11: Common information model (CIM) extensions for distribution*

IEC 61968-100:2013, *Application integration at electric utilities - System interfaces for distribution management - Part 100: Implementation profiles*

IEC TR 62051, *Electricity metering - Glossary of terms*

IEC 62055-31, *Electricity metering - Payment systems - Part 31: Particular requirements - Static payment meters for active energy (classes 1 and 2)*

IEC TR 62357-1:2016, *Power systems management and associated information exchange - Part 1: Reference architecture*

IEEE 1547-2018, *IEEE Standard for Interconnection and Interoperability of Distributed Energy*

3. 用語、定義及縮寫

3 Terms, definitions and abbreviated terms

IEC 60050-300、IEC TS 61968-2、IEC TR 62051 及 IEC 62055-31 之用語及定義，以及下列用語及定義適用於本標準。

For the purposes of this document, the terms and definitions given in IEC 60050-300, IEC TS 61968-2, IEC TR 62051 and IEC 62055-31, and the following 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>~~

~~Where there is a difference between the definitions in this document and those contained in other referenced IEC standards, then those defined in IEC TS 61968-2 shall take precedence over the others listed, and those defined in this document shall take precedence over those defined in IEC TS 61968-2.~~

3.1 用語及定義

3.1 Terms and definitions

3.1.1 分散式能源管理系統(distributed energy resource management system, DERMS)

該系統代表其他受關注之系統，管理個別分散式能源(DER)的通訊及控制(且可以各種場域訊息協定完成此)，並聚合此資訊且與其他公用事業系統通訊，諸如作為 DMS。

3.1.1 Distributed Energy Resource Management System (DERMS)

The system which, on the behalf of other interested systems, manages the communications and control of individual Distributed Energy Resource (DER (and may do this with a variety of field message protocols), and aggregates this information and communicates with other utility systems, such as a DMS.

3.2 縮寫

3.2 Abbreviated terms

AMI	先進讀表基礎設施(advanced metering infrastructure)
CIM	共同資訊模型(common information model)
DER	分散式能源(distributed energy resource)
DERMS	分散式能源管理系統(distributed energy resources management system)
DMS	配電管理系統(distribution management system)
EMS	電能管理系統(energy management system)
IEC	國際電工技術委員會(International electrotechnical commission)

UML	統一建模語言(unified modelling language)
UUID	通用唯一識別符(universally unique identifier)
XSD	XML 綱要定義(XML schema definition)

4. 規約

4.1 UML 圖表

4 Conventions

4.1 UML diagrams

本標準使用標準 UML 行為圖表，尤其以循序圖說明 DERMS 與所欲 DERMS 間交換資訊之其他企業或駐存系統間的整合，或自企業系統至所駐存 DERMS 或分散式 DERMS。

This document uses standard UML behavioural diagrams, specifically, sequence diagrams to illustrate the integration between the DERMS and other enterprise or hosted systems that desire to exchange information with the DERMS, or from enterprise systems to hosted or distributed DERMS.

4.2 DER 企業整合剖繪設中之單元

4.2 Units of measure in DER enterprise integration profiles

本標準剖繪包含規定有效功率、無效功率、視在功率及電壓之元件。針對此等量之測量的單位分別為 kW、kVAr、kVA 及 V

The IEC 61968-5 profiles contain elements specifying active, reactive, apparent power, and voltage. The units of measure for these quantities are kW, kVAr, kVA, and V respectively

DERMS 特性化：

於高層級處，DERMS 具 4 個特性：

- 聚合 - DERMS 促進將個別 DER 分群放入聚合資源。
- 簡化 - DERMS 處置 DER 設定值(settings)之細節，並對系統運作者提供簡單服務。

DERMS characteristics

At a high level a DERMS has four characteristics:

- Aggregation - The DERMS facilitates the grouping of individual DER, into an aggregated resource.
- Simplification - The DERMS handles the granular details of DER settings and presents simple services to the system operator
- 最佳化 - DERMS 宜最佳化各種群組內 DER 之使用，以最低成本及最高電能品質取得所欲結果。此外，若於群體內管理異質性 DER，DERMS 宜知悉如何最佳地利用個別

DER 以獲取所規定結果。此可涉及於群組中所有個別 DER 間均攤請求，或具判定如何最好地服務請求之演算法。

- 轉譯 - 個別 DER 可說不同語言，取決於其型式及規模。DERMS 宜處置此等不同語言，且以一致之方式呈現予上游主呼叫個體。
- Optimization - The DERMS should optimize the use of DER within various groups to get the desired outcome at minimal cost and maximum power quality. Additionally, if managing heterogenous types of DER within a group, the DERMS should know how to best leverage the individual DER to get a specified outcome. This may involve equally spreading a request across all the individual DER in a group, or having an algorithm that determines how to best serve a request
- Translation - Individual DER may speak different languages, depending on their type and scale. DERMS should handle these diverse languages, and present to the upstream calling entity in a cohesive way.

然而，讀者宜記住，本標準適用範圍並非針對 DERMS 之行為如何，或其如何管理對個別 DER 的通訊，而是特定地以運作之企業對企業(B2B)模式，進行 DERMS 與其他企業系統或第三方間通訊。此外，讀者不宜於此等訊息中輸入任何營運邏輯。本標準未對任何給定實現之堅固性提出建議。例：未對任何所給定 DER，以及基於位置或容量之其他型式的 DER 歸為群組之價值提出建議。此種營運邏輯宜包含於 DERMS 中，而非於相關聯之訊息中禁止。

However, the reader should remember that the scope of this specification is not for how the DERMS behaves, or how it manages communication to individual DER, but is specifically the communication between a DERMS and other enterprise systems or third-parties in a business-to-business (B2B) mode of operation. Further, the reader should not impute any business logic within these messages. This specification makes no recommendation as to the soundness of any given implementation. For example, no recommendation is made as to the worthiness of any given DER to be in group with other types of DER based-on location or capability. This sort of business logic should be contained within a DERMS, and not proscribed in the associated messages.

5. DER 企業整合使用案例

5.1 一般

5 DER enterprise integration use cases

5.1 General

DERMS 與 DER 群組一起工作，以便能處置聚合中之 DERMS 針對電力系統行為的請求。

此聚合使系統運作者無需管理各 DER 個體，隨著電力系統中 DER 滲透率不斷增加，情況變得更成為問題。為此，此等使用案例著重於 DER 群組之建立及維護、容量探索、DER 連接/解連、此等群組的狀態監視及預測，以及電力及電壓調度。

The DERMS works with groups of DER so that requests made of the DERMS for behaviour in the power system can be handled in aggregate. This aggregation relieves the system operator from having to manage each DER individual, a situation that becomes more problematic as DER penetration in the power system continues to increase. To that end these use cases focus on the creation and maintenance of groups of DER, capability discovery, DER connect/disconnect, status monitoring and forecasting of these groups, and dispatching of power and voltage.

名義上，於傳統公用事業中，DERMS 可能類似於 AMI 頭端之邊緣系統(edge system)。有如 AMI 頭端其自表計(meter)取得狀態、事件及測量資料，且可將控制訊息發送予表計一般，DERMS 自智慧型變流器取得狀態並可將控制訊息(調度請求)發送予智慧變流器。雖然此係標稱組態，但本標準並未規定架構。DERMS 可為傳統邊緣系統，其可納入 DMS，其可由雲端中之聚合器所駐存，或依圖 1 其可為變電所中的“盒中 DERMS”。

Nominal, in a traditional utility, the DERMS may be an edge system similar to an AMI Head-End. Like the AMI Head-End which gets status, events, and measurement data from meters and may send control messages to the meters, a DERMS gets status from a smart inverter and may send control messages (dispatch requests) to the smart inverter. While this is the nominal configuration, this specification is not prescriptive as to architecture. The DERMS could be a traditional edge system, it could be subsumed into a DMS, it could be hosted by an aggregator in the cloud, or it could be a "DERMS in a box" in a substation per Figure 1.

此架構假設有可與其通訊之智慧變流器。於某些情況下，DER 係位於配電網路中，但處於“無聲”狀態，無法與其通訊。此等型式之 DER 超出本標準的適用範圍。

This architecture assumes that there is a smart inverter that can be communicated with. There are instances where DER is in the distribution network but is "dumb", with no ability to be communicated with. Those types of DER are outside of the scope of this specification.

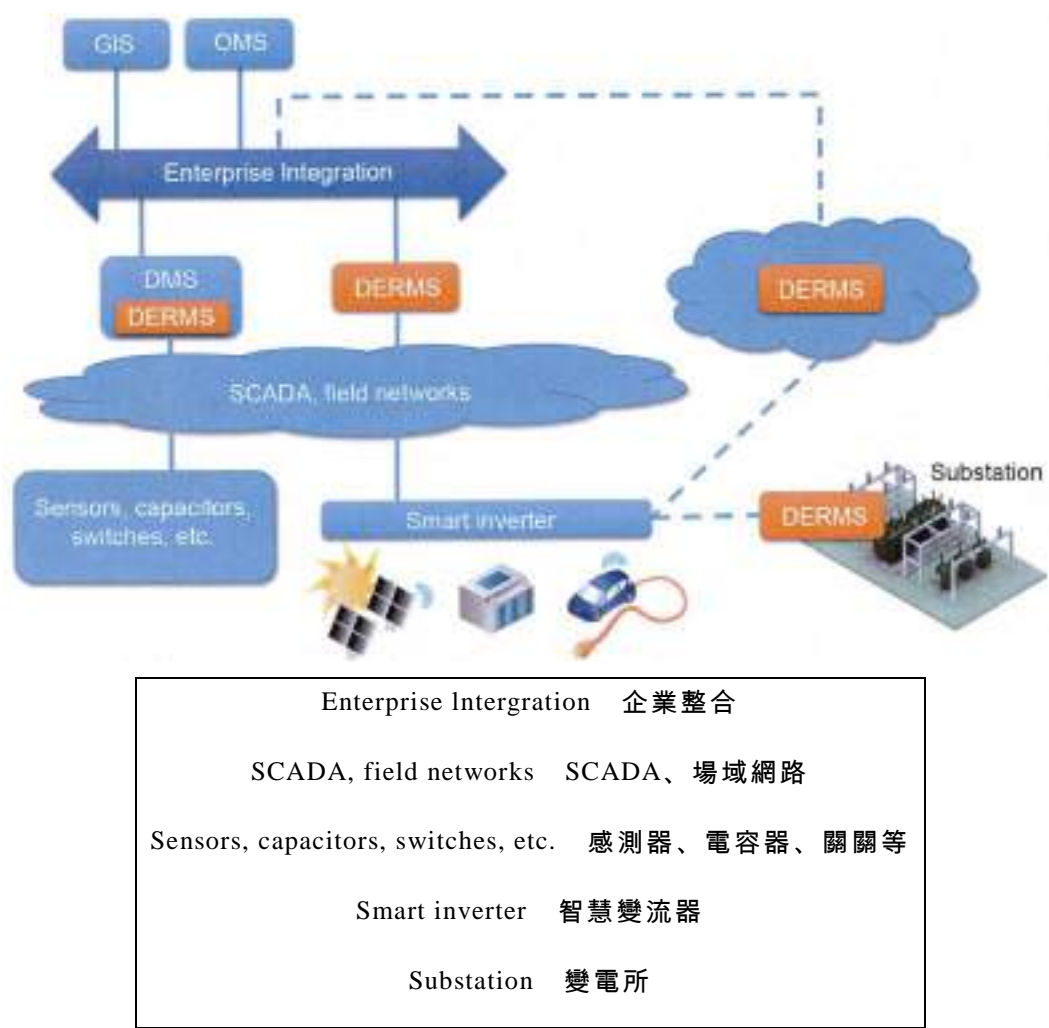
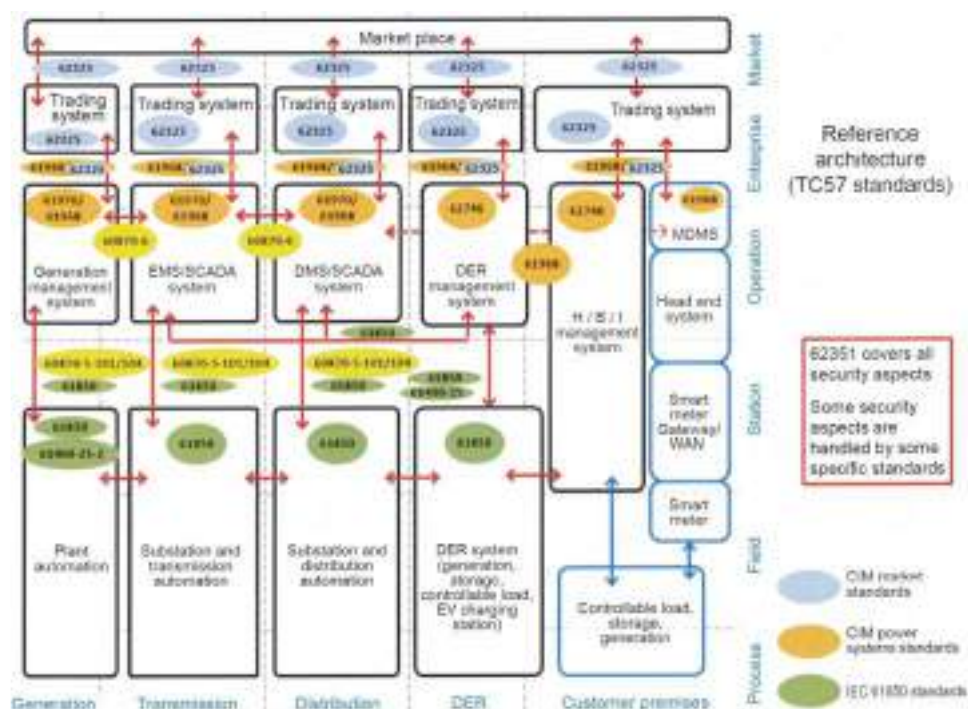


圖 1 DERMS 部署之架構選項

Figure 1 - Architectural options for DERMS deployments

亦宜強調，針對企業整合之規格係逐參考架構的適當領域。參照圖 2。

It should also be emphasized that this specification for enterprise integration is the appropriate domain per the reference architecture. See Figure 2.



Market place 市場

Trading system 交易系統

Generation management system 發電管理系統

EMS/SCADA system EMS/SCADA 系統

DER management system DER 管理系統

H/B/I management system H/B/I 管理系統

Head end system 頭端系統

Smart meter gateway/WAN 智慧表計閘道器/WAN

Smart meter 智慧表計

Plant automation 工廠自動化

Substation and transmission automation 變電所及輸電自動化

Substation and distribution automation 變電所及配電自動化

DER system (generation, storage, controllable load, EV charging station) DER 系統(發電、
儲能、可控制負載、EV 充電站)

Controllable load, storage, generation 可控制負載、儲能、發電

Market 市場

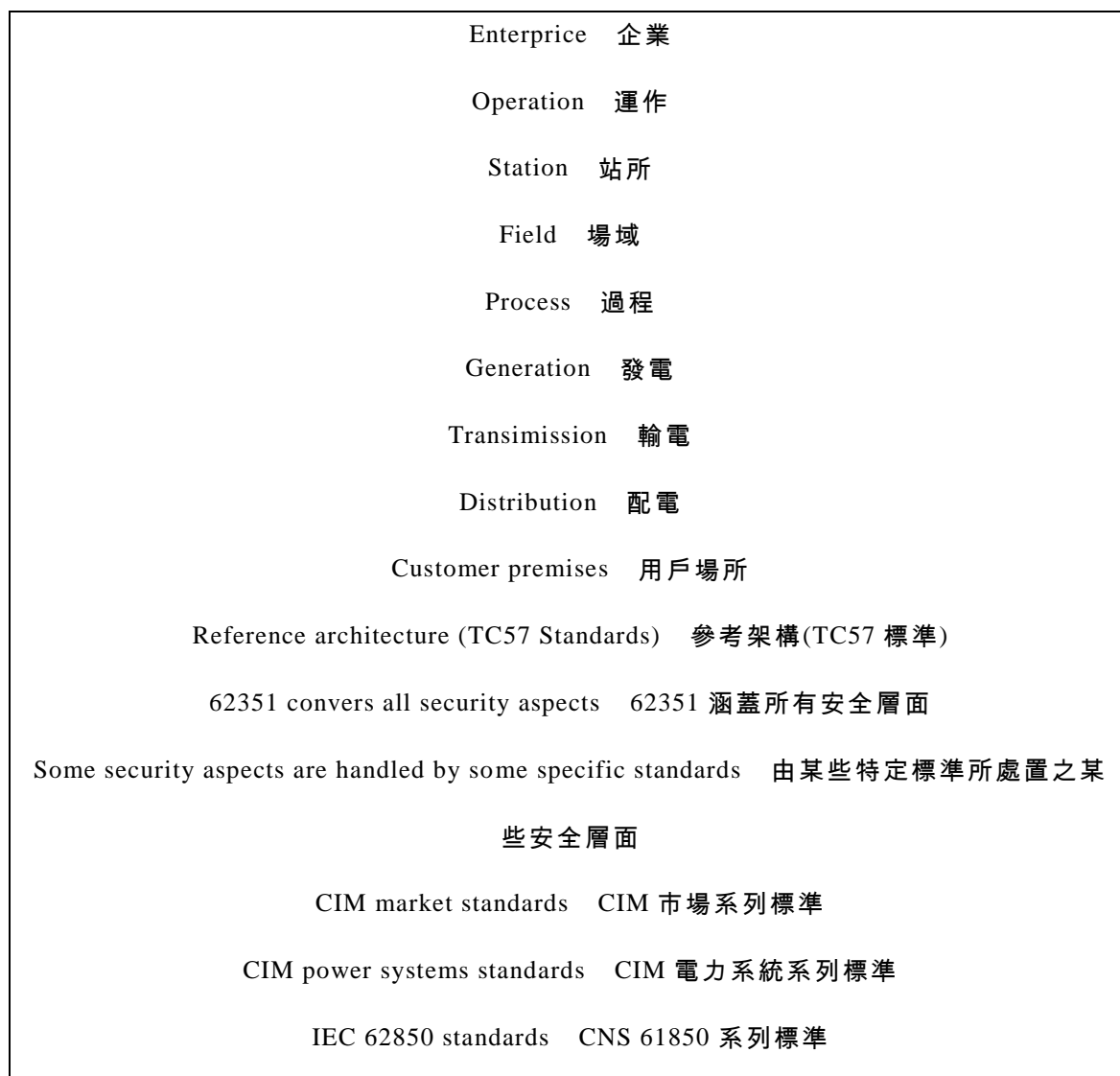


圖 2 參考架構，IEC TR 62357-1:2016

Figure 2 - Reference architecture, IEC TR 62357-1:2016

此外，本標準適用範圍係受限制為聚合中之 DER 控制功能，而非可能導致此種控制的基於市場之動機或事件。

Additionally, the scope of this standard is limited to the control functions of DER in aggregate, and not the market-based motivations or event that might lead to such control.

依 IEC TR 62357-1:2016 之圖 2 說明，DERMS 與其他企業系統間的企業通訊屬於本系列標準領域，而 DERMS 與實際 DER (或特定地)連接至 DER 之智慧變流器間的通訊，儘管亦使用其他標準及協定(諸如 IEEE 1815 (DNP)、IEEE 2030.5、Sunspec Modbus 及 OpenFMB)，但於 IEC 內部則屬於 CNS 61850 之範圍。CIM 式整合亦可以依 IEC 62325-301 及 IEC 62361-100 中所登載而達成。

As Figure 2 of IEC TR 62357-1:2016 illustrates, the enterprise communication between a DERMS and other enterprise systems falls into the IEC 61968 domain while communication between a DERMS and the actual DER (or specifically) the smart inverters attached to the DER, within the IEC, is the realm of IEC 61850, although other standards and protocols are also used such as IEEE 1815 (DNP), IEEE 2030.5, Sunspec Modbus, and OpenFMB. CIM-based integration could also be accomplished as documented in IEC 62325-301 and IEC 62361-100.

依導致結束 IEC 61850-90-7 制定之工作，一群產業利害相關者受召集以確定配電業者的需要。可確定隨著 DER 於配電網中滲透率提高，運作者不想要管理與個別 DER 通訊，而是與管理系統通訊，以管理聚合中之 DER；管理聚合中的 DER 要求企業整合，以促進與其他企業系統(例：DMS 或 GIS)的“對話”。

As the work that led to the creation of IEC 61850-90-7 concluded, a group of industry stakeholders was convened to determine the needs of distribution operators. It was determined that operators, as DER penetration in the distribution grid increased, did not want to manage the communication with individual DER, but rather, communicate with a management system to manage DER in aggregate; that managing the DER in aggregate would require enterprise integration to facilitate "conversations" with other enterprise systems such as a DMS or GIS.

本標準涵蓋之使用案例為：

- DER 群組建立。
- DER 群組維護。
- DER 群組狀態及監視。
- DER 群組預測。

The use cases covered in this document are:

- DER group creation
- DER group maintenance
- DER group status and monitoring
- DER group forecasting
- DER 群組調度。
- DER 群組電壓升載率控制。
- DER 群組連接/解連。
- DER 群組容量探索。
- DER group dispatch

- DER group voltage ramp rate control
- DER group connect/disconnect
- DER group capability discovery

5.2 DER 群組建立

5.2.1 一般

5.2 DER Group creation

5.2.1 General

此用以識別所預期之 DER 群組的過程，係其他 DER 群組功能之必要前提。此分群之維護亦屬必要，以便於較高層級上監視並管理 DER，重點聚焦於配電系統上而非個別 DER 工廠或裝置相關的屬性、影響及機會。

The process for identifying the intended set of DER is a necessary precursor to the other DER group functions. Maintenance of this grouping is also necessary so that it becomes possible to monitor and manage DER at a higher level with a focus on the attributes, impacts, and opportunities as they relate to the distribution system rather than individual DER plants or devices

5.2.2 分群要求事項

5.2.2 Grouping requirements

企業整合關注群組(interest group)識別表 4 中所顯示用以判定 DER 集合之要求事項及限制事項(constraints)。

The enterprise integration interest group identified the requirements and constraints shown in Table 4 for the identification of sets of DER.

表 4 DER 分群功能性要求事項

Table 4 - DER Grouping functional requirements

要求 Requirement	說明 Description
GR : 1 群組大小 GR:1 Group Size	1 或多個“群組”須為可能。 "Groups" of one or of many must be possible
GR : 2 由電力系統 等級分群	於各種情況及使用案例下，可能需於電力系統之不同層級上監視並管理 DER 的容量，包括： • 由變電所。

<p>GR:2</p> <p>Grouping by power system level</p>	<ul style="list-style-type: none"> • 由電路/匯流排。 • 由饋線。 <p>Under various circumstances and use cases, the ability to monitor and manage DER at varying levels of the power system may be needed, including:</p> <ul style="list-style-type: none"> • By Substation. • By Circuit/Bus. • By Feeder. • 由饋線區段(開關間之饋導體)。 • 由孤島或微型電網(校園、產業設施)。 • 由個別裝置。 • 由緯度/經度矩形。 • By Feeder Segment (contiguous conductor between switches). • By Island or micro-grid (campus, industrial facility). • By Individual Device. • By Lat/Lon Rectangle.
<p>GR : 3</p> <p>依其他屬性分群</p> <p>GR:3</p> <p>Grouping according to other attributes</p>	<p>於各種情況及使用案例下，可能需於電力系統之不同層級上監視並管理 DER 的容量，包括：</p> <ul style="list-style-type: none"> • 由電路相 - 例：針對連接至 A、B 及 C 相之單相 DER，DMS 可定義分離的群組，且可個別地請求該等狀態。 <p>Under various circumstances and use cases, the ability to monitor and manage DER at varying levels of the power system may be needed, including:</p> <ul style="list-style-type: none"> • By Circuit Phase - For example, a DMS could define separate groups for single phase DER that are connected to A, B, and C phases, and could request the status of these individually. • 由 DER 型式 - 例：針對 PV 系統、電池儲能系統、EV 或任何其他 DER 型式，DMS 可建立分離之群組。 • 由 DER 擁有者 - 例：可全體地檢視並管理公用事業或特定用戶所擁有之所有 DER。 • 由方案登錄或契約安排。 • 聚合層級或額外屬性之任意組合。 • By DER Type - For example a DMS could create separate groups for PV systems, battery storage systems, EVs, or any other DER type.

- | |
|---|
| <ul style="list-style-type: none"> • By DER Owner - For example, all the DER owned by the utility, or a particular customer, could be viewed and managed collectively. • By program enrolment or contractual arrangement. • Any combination of aggregation level or additional attributes. |
|---|

5.2.3 動態配電系統組態所引起之挑戰

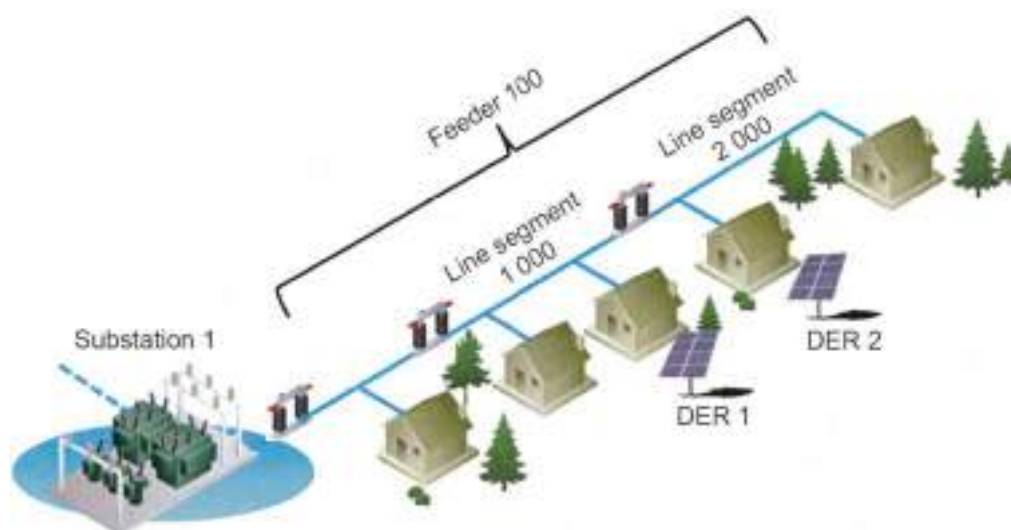
5.2.3 Challenges posed by dynamic distribution system configurations

最初，考量於各監視請求或管理命令內，可傳遞識別電力系統聚合層級之資訊，諸如變電所、饋線等，依表 4 中所識別。此考量係基於個 DER 可與某個變電站、饋線、區段等相關聯之概念。然而，由於配電電路組態之潛在動態本質，發現此作法於許多情況下不切實際。該問題係說明於下圖中。

Initial, it was considered that within each monitoring request or management command, one could pass information identifying the power system level-of-aggregation, such as substation, feeder, etc, as identified in Table 4. This consideration was based on the notion that each DER could be associated with a certain substation, feeder, segment, etc. However, this approach was found to be impractical in many circumstances due to the potentially dynamic nature of distribution circuit configurations. The problem is illustrated in the following figures.

圖 3 說明簡單徑向饋線，其散發自單一變電所，且透過一系列開關持續至線路末端。於此種情況下，有可能將 DER2 與變電所 1、饋線 100 及線路區段 2000 相關聯。

Figure 3 illustrates a simple radial feeder that emanates from a single substation and continues, through a series of switches, to an end-of-line. In such a case, it would be possible to associate, for example, DER2 with Substation 1, Feeder 100, and Line Segment 2000.



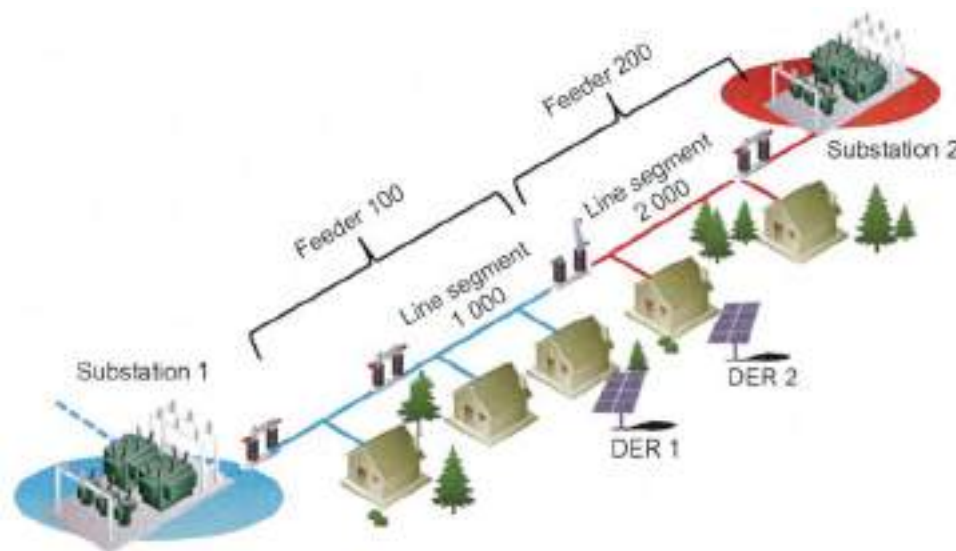
Substation 1	變電所 1
Feeder 100	饋線 100
Line segment 1 000	線路區段 1,000
Line segment 2 000	線路區段 2,000

圖 3 簡單徑向饋線

Figure 3 Example of simple radial feeder

圖 4 說明較複雜之安排，其中涉及 2 個變電所。依所示，斷開之開關將系統分離為 2 個部分，與各變電所相關聯。於此型式之安排中，能斷開或閉合不同開關，將線路區段(負載及 DER)自 1 個變電所轉移至另一變電所。於此種情境中，DER 無法與所給定之變電所靜態地相關聯，且“饋線”的概念係由開關位置所動態地定義。

Figure 4 illustrates a more complex arrangement in which two substations are involved. As shown, an open switch is separating the system into two sections, one associated with each substation. In arrangements of this type, different switches can be opened or closed, shifting segments of line (load and DER) from one substation to another. In scenarios such as this, DER cannot be statically associated with a given substation, and the concept of a "feeder" is dynamically defined by the switch positions.



Substation 1	變電所 1
Feeder 100	饋線 100
Feeder 200	饋線 200
Line segment 1 000	線路區段 1,000

Line segment 2 000	線路區段 2,000
Substation 2	變電所 2

圖 4 具替代變電所之饋線示例

Figure 4 - Example of feeder with alternate substation

圖 5 呈現進一步之複雜度；涉及多個變電所的配電網，且涉及由任 1 甚至多個變電所饋電予配電網。此型式之安排尚不常見，但確實存在，並進一步說明嘗試將 DER 與特定變電所、饋線或線路區段相關聯所面臨的困難。

Figure 5 presents a further degree of complexity; a distribution network in which multiple substations are involved and the distribution grid may be fed by any one or even multiple substations. Arrangements of this type are not yet common but do exist and further illustrate the difficulty faced in attempting to associate DER with a particular substation, feeder, or line segment.

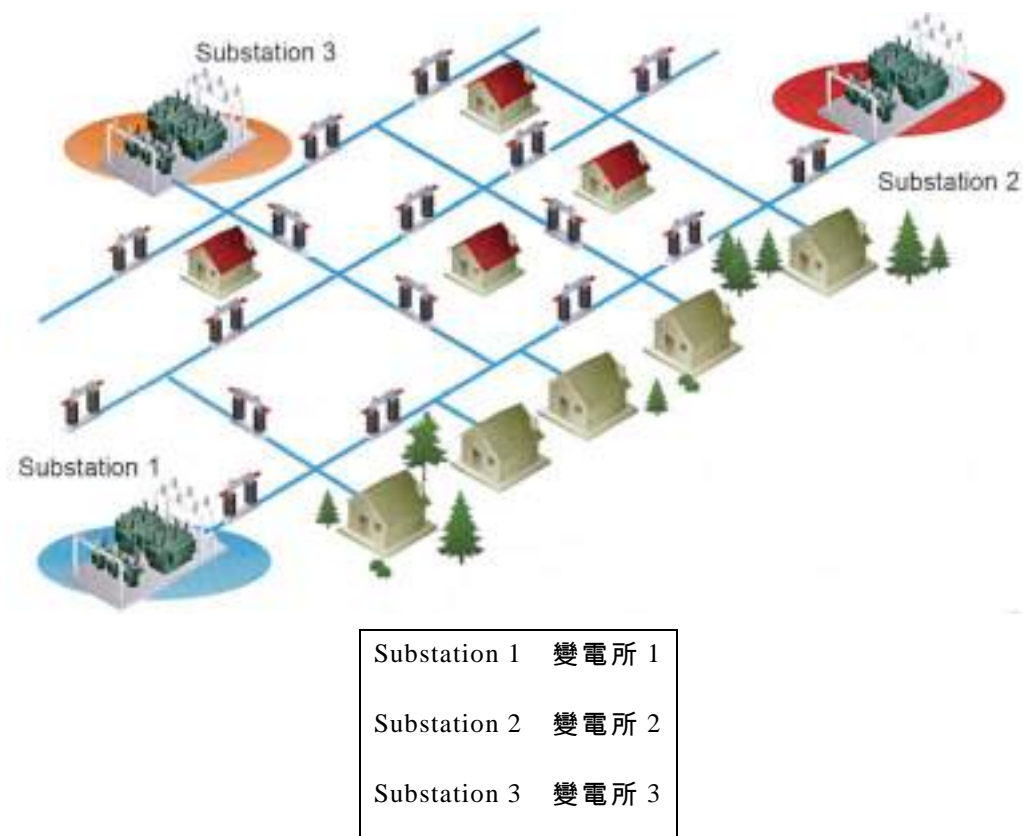


圖 5 互連之配電網示例

Figure 5 - Example of an interconnected distribution network

希望監視或管理 DER 之個體將傳遞能由提供的實體使用之資訊，以判定哪個 DER 宜受影響或於回應中表示。狀態回應將針對由請求所指示 DER 之範圍，提供所聚合的資訊。

Entities wishing to monitor or manage DER will pass information that can be used by the providing entity to determine which DER should be impacted or represented in the response. Status responses will provide information aggregated for the range of DER indicated by the request.

5.2.4 企業資訊模型所引起之挑戰

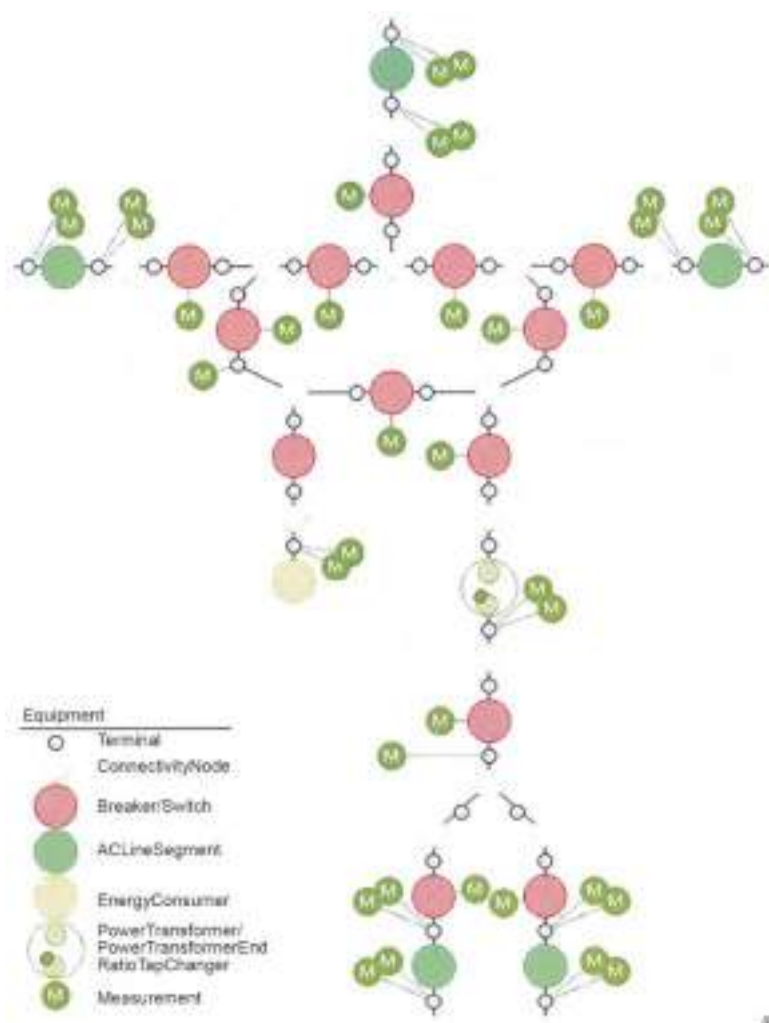
5.2.4 Challenges posed by enterprise information models

IEC 共同資訊模型(common information model, CIM)之檢驗指示，配電電路組態的動態本質先前已辨識，且裝置(無論 DER 或其他)通常僅以其所連接之直接終端所識別。

圖 6 說明某些模型概念。

An inspection of the IEC Common Information Model (CIM) indicated that the dynamic nature of distribution circuit configurations has been recognized previously and that devices, whether DER or other, are normally identified only with the immediate terminal to which they connect.

Figure 6 illustrates some of the model concepts.



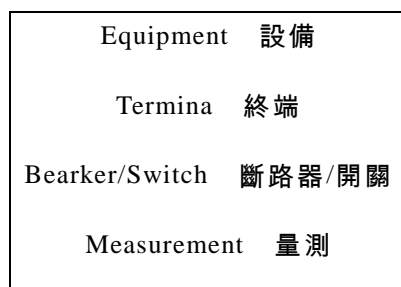


圖 6 共同資訊模型說明

Figure 6 - Common Information Model illustration

儘管 DER 並未顯示於此圖中，但其可能認為類似於表示能源耗用者之黃色圓圈。依圖例中所示，模型之元件的電氣連接稱為“終端”，終端係藉由“連接節點”連接在一起。

Although DER are not shown in this diagram, they may be thought of similarly to the yellow circle which represents an Energy Consumer. As shown in the diagram legend, the electrical connections to an element of the model are called "Terminals" and terminals are connected together by "Connectivity Nodes".

CIM 定義“AC 線路區段”，但此不同於圖 3 至圖 5 中所討論之線路區段。於 CIM 中，“AC 線路區段”係於遍及其長度載送相同電流之導體，沿途無負載或發電。換言之，於連接負載或發電裝置的各點處，模型中存在“連接節點”，節點前後具分離之 AC 線路區段。此詳細程度容許模型包括阻抗並用於潮流分析。

以此方式，個別元件之終端係常數屬性，且藉由處理自 1 個連接節點至另一連接節點的模型，僅動態地計算作為“饋線”或“變電所”一部分之意義。

The CIM defines an "AC line segment", but this is not the same as what was discussed as line segments in Figures 3 through 5. In the CIM, an "AC Line Segment" is a length of conductor carrying the same current throughout its length, with no load or generation along the way. In other words, at each point where a load or generation device is connected, a "Connectivity Node" exists in the model, with separate AC Line Segments before and after the node. This level of detail allows the model to include impedances and to be used for power flow analysis.

In this way, the terminals of individual elements are constant attributes, and the sense of being part of a "feeder" or "substation" is computed only dynamical, by processing the model from one connectivity node to another.

5.2.5 針對 DER 聚合使用任意定義之群組

5.2.5 Using arbitrarily-defined groups for DER aggregation

鑑於上節中所識別之挑戰，開發使用任意可定義群組的做法。基本想法係於 DER 監視

或管理訊息前定義 DER 分群之過程。此將使任何應用可依該應用關注之任何基本原理定義 DER 分群。其亦使得提供 DER 服務之個體(例：DERMS)無需讀入並處理即時連接模型。

In view of the challenges identified in the previous section, an approach using arbitrarily-definable groups was developed. The basic idea is to precede DER monitoring or management messages with a process to define a grouping of DER. This will make it possible for any application to define groupings of DER according to whatever rationale is of interest to that application. It also makes it possible for the entity providing the DER service (e.g. a DERMS) to not be required to read-in and process the real-time connectivity model.

圖 7 中所圖示之作法涉及請求/回覆互動，其中 DERGroup 係由 1 個個體(例：諸如 DMS 的群組形成個體)所定義，並提供予 1 或多個群組確認個體(例：1 或多個 DERMS)。

The approach illustrated in Figure 7 involves a request/reply interaction in which a DERGroup is defined by one entity (e.g. the Group Forming entity such as a DMS) and provided to one or more Group Acknowledging entities (e.g. one or more DERMS).

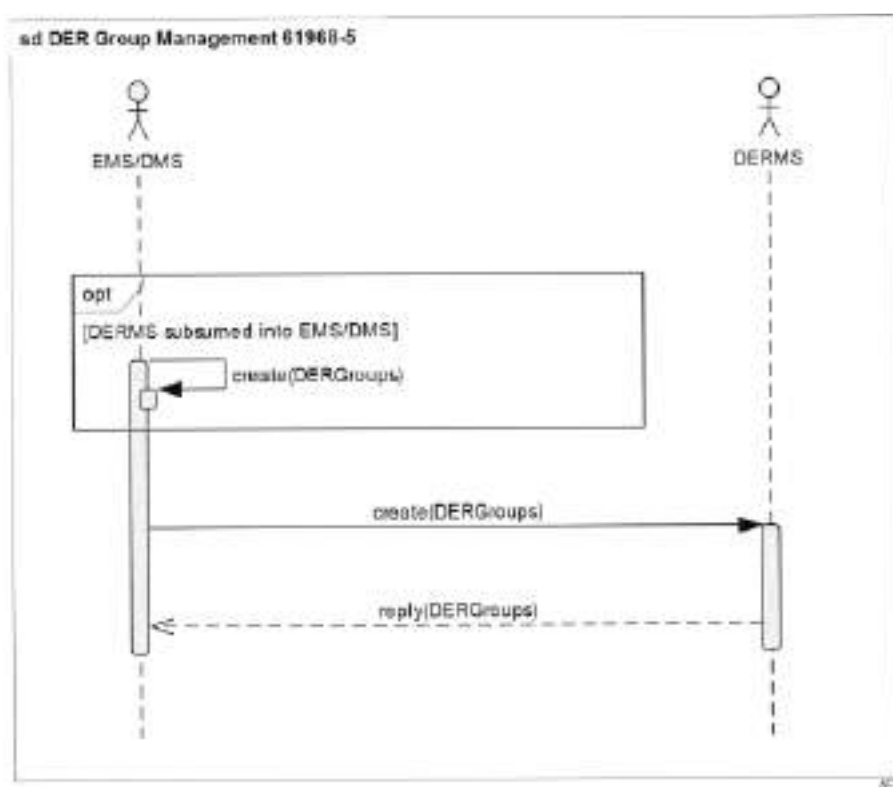


圖 7 用於建立 DERGroup 之請求/回覆訊息交換模型樣

Figure 7 - Request/Reply message exchange pattern for the creation of a DERGroup

此互動係使用 A.2 中之 DERGroups 剖繪的“受限制”版本所達成，可於另一交易(諸如 DER 狀態請求及回覆)之前或前的任何時間立即發生。

圖 8 描繪相同情境之替代傳訊作法。此示例使用通知訊息(於 IEC 61968-100 中稱為事件延伸模板訊息)而非請求/回覆訊息互動。

This interaction, which is accomplished using the "constrained" version of the DERGroups profile found in Clause A.2 could occur immediately before another transaction, such as a DER Status request and reply, or any time prior.

Figure 8 depicts an alternate messaging approach for the same scenario. This example uses a notification message (referred to in IEC 61968-100 as an Event Stereotype message) rather than a request/reply message interaction.

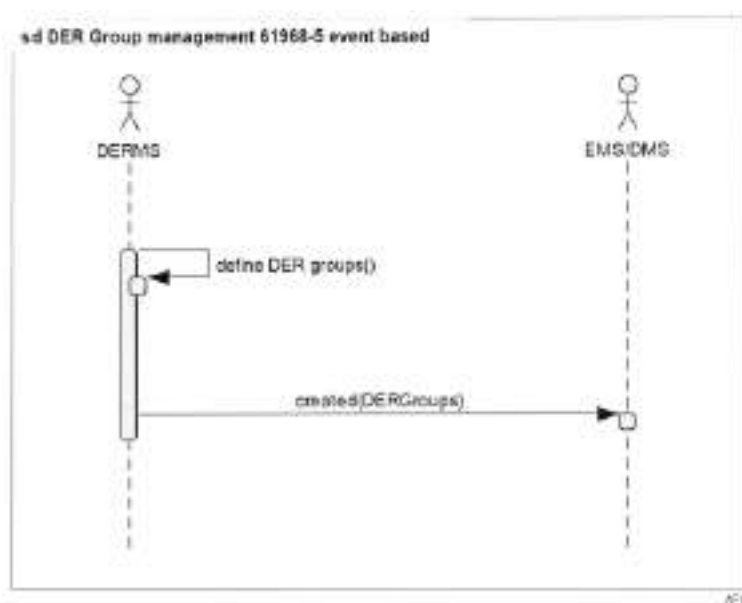


圖 8 用以建立 DERGroup 之通知訊息交換型樣

Figure 8 - Notification message exchange pattern for the creation of a DERGroup

再次，此交易係使用 A.2 中之 DERGroups 剖繪的“受限制”版本所達成。注意，CIM 動詞已自“create”變更為“created”。據推測，群組確認個體(於此案例中為 EMS 或 DMS)將於接收通知訊息後實例化 DER 群組；然而，於此互動型樣中，群組形成個體未接收群組確認個體成功實例化群組之確認。

Once again, this transaction is accomplished using the "constrained" version of the DERGroups profile found in Clause A.2. Note that the CIM verb has changed from "create" to "created". Presumably, the Group Acknowledging Entity (in this case an EMS or DMS) would instantiate the DER Group following receipt of the notification message; however, in this interaction pattern the Group Forming Entity does not receive confirmation that the Group Acknowledging Entity successfully instantiated the group.

所說明傳訊型樣中之任一者支援建立與所欲任何聚合層級相關的群組，包括變電所、饋

線、線路區段或其他，依表 4 所請求。此作法並未規定特定之整合作法，例如容許：

- DERMS 可處理系統模型並定義自有分群，但未要求其如此。

Either of the illustrated messaging patterns supports the creation of groups that relate to any level of aggregation desired, including by substation, feeder, line segment, or other, as required in Table 4. This approach is not prescriptive of a specific integration approach, allowing, for example:

- A DERMS could process the system model and define its own groupings but does not require it to do so.

- DMS 可定義其過程關注之特定群組。此可包括與各種電力系統組態相關聯之不同分群。例：於圖 4 中所圖示之電路安排中，DMS 可針對連接至變電所 1 (沿藍色線路) 的所有 DER 定義 1 個群組，針對連接至變電所 2 (沿紅色線路) 之所有 DER 定義另一群組。若沿此線路之斷開的開關然後閉合且不同之開關斷開，則可定義 2 個不同群組以表示該替代電路組態。

- A DMS could define the specific groups that are of interest to its processes. This could include different groupings that would be associated with various power system configurations. For example, in the circuit arrangement illustrated in Figure 4, a DMS could define one group for all DER connected to Substation 1 (along the blue line) and another for all DER connected to Substation 2 (along the red line). If the open switch along this line is then closed and a different switch opened, then two different groups could be defined to represent that alternative circuit configuration.

注意，於 CIM 及本標準剖繪中，DERGroup 係 CIM EndDeviceGroup 物件之實例。而且個別 DER (群組之成員) 係 CIM EndDevice 物件的實例。EndDevice 類別係場域裝置之通用表示，EndDeviceGroup 類別提供將其分群的機制。此等類別最初係定義於 IEC 61968-9 中，並用以利用 DER 群組管理。

Please note that in the CIM and in IEC 61968-5 profiles, DERGroups are instances of the CIM EndDeviceGroup object. Likewise, individual DER (the members of a group) are instances of the CIM EndDevice object. The EndDevice class is a generic representation of field devices, and the EndDeviceGroup class provides a mechanism to group them. These classes were originally defined in IEC 61968-9 and leveraged for DER group management.

關於於 XML “片段” 中使用 mRID、時戳或其他標頭元件之備考：此等標頭屬性係用以識別於傳送與接收系統間所交換的資料剖繪。有關形式明確之訊息整合型樣的定義、使

用及元件，參照 IEC 61968-100:2013。

A note on the use of mRID, timestamp, or other header elements in the XML "snippets": These header attributes are used for identification of the data profile that is exchanged between sending and receiving systems. For the definition, use, and components of well-formed message integration patterns, the reader is referred to IEC 61968-100:2013.

5.3 DERGroup 之維護

5.3.1 一般

5.3 Maintenance of DERGroups

5.3.1 General

建立群組後，任何系統可藉由新增、刪除或更新有關 1 或多個成員或容量之資訊，啟動更新 DER 群組的運作。此係使用 A.3 中之 DERGroups 剖繪的“不受限制”版本所達成。

使用不受限制版本，以便僅新增、修改或刪除之 DERGroup 元件需納入訊息。

使用 CIM “change” 動詞及 DERGroups 剖繪新增及/或修改成員及/或容量係屬簡單過程，依圖 9 中 2 個互動中第 1 者所說明。

Once a group is created then any system could initiate an action to update the DER Group by adding, removing, or updating information about one or more members or capabilities. This is accomplished using the "unconstrained" version of the DERGroups profile found in Clause A.3. The unconstrained version is used so that only the elements of the DERGroup that are added, modified or deleted need be included in the message.

Adding and or modifying members and/or capabilities is a straightforward process using the CIM "change" verb and the DERGroups profile, as illustrated in the first of the two interactions in Figure 9.

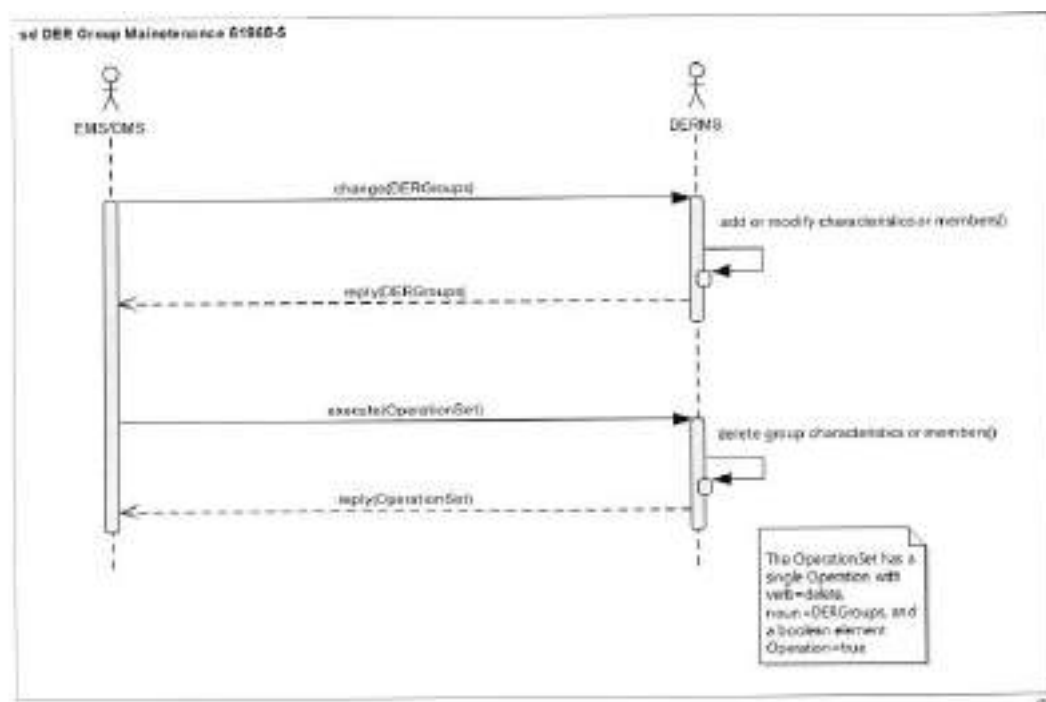


圖 9 支援新增或修改 DERGroup 成員資格或容量或刪除群組成員之訊息交換型樣

Figure 9 - Message exchange patterns to support adding or modifying DERGroup membership or capabilities, or deleting a group member

自 DER 群組中刪除個別 DER 或容量，要求使用 “execute” CIM 動詞及 OperationSet，依圖 9 中 2 個互動中第 2 者所說明。

刪除整個 DER 群組係另一簡單過程，此次使用 CIM “delete” 動詞及 DERGroups 剖繪，依圖 10 中所圖示。

Removing an individual DER or a capability from a DER group requires the use of the “execute” CIM verb and the OperationSet, as illustrated in the second of the two interactions in Figure 9. Additional information concerning the use of Operation Sets can be found in Annex C.

Deleting an entire DER group is another straightforward process, this time using the CIM “delete” verb and the DERGroups profile, as illustrated in Figure 10.

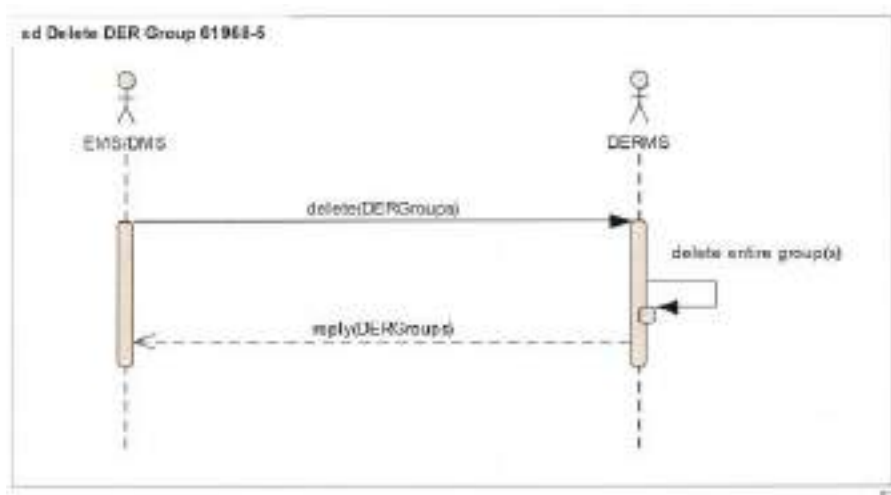


圖 10 反映刪除整個 DER 群組之訊息交換型樣(刪除)

Figure 10 - Message exchange pattern reflecting deleting an entire DER group (delete)

注意，雖未說明，但 DER 群組維護功能亦可利用事件延伸模板型訊息(event stereotype message)，如 5.1 中之示例。

Please note that although not illustrated, the DER group maintenance functions can also utilize event stereotype messages, like the example in 5.1.

5.3.2 DER 群組維護示例

5.3.2 DER Group maintenance example

假設存在 DER 群組，具 Names.name 值為 "Group A"。就此示例而言，此群組具 3 個成員；其 mRID 及有效功率容量依表 5 中所顯示。因此，群組 A 之總有效功率容量將為 19.5 kW。

Assume that a DER group exists with a Names.name value of "Group A". This group has three members, for the purposes of this example; they have the mRIDs and active power capabilities as shown in Table 5. The total active power capability of Group A would therefore be 19,5 kW.

表 5 更新前 DER 群組 A 成員資格示例

Table 5 - Example DER Group A membership before update

DER 成員 mRID DER member mRID	最大容量 Maximum Capability
cabb102d-4ab6-42ffb30b-b2a70922a929	2.5 kW
2cb43245-ed67-4751-b09c-028a0e65e004	5 kW
94928710-2ad2-4a0f-8f12-c6304c1e5b19	12 kW

此群組及各自成員之紀錄係儲存於 DERMS 中。DMS 之系統運作者判定配電網路中已安裝新 DER，並決定將此 DER 新增至群組 A。此新 DER 之 mRID 為 "3092d3ae-c57e-4079-a4d4-543d024eea8c"，最大額定有效功率容量為 5 kW。DMS 將使用 "change" 動詞及 DERGroups 名詞發送訊息，依圖 9 中第 1 個互動所說明。

若使用 XML 作為資料序列化格式，則下列為此變更請求訊息之示例 XML 片段：

The record of this group and respective members is stored in the DERMS. A system operator of a DMS determines that a new DER has been installed in the distribution network and decides to add this DER to Group A. This new DER has an mRID of "3092d3ae-c57e-4079-a4d4-543d024eea8c" and a maximum active power capability rated as 5 kW. The DMS would send a message using the change verb and the DERGroups noun, as illustrated in the first interaction in Figure 9.

If XML is being used as the data serialization format, the following is an example XML snippet for this change request message is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<!--XMLSpy v2015 rel. 4 sp1 (x64) (http://www.altova.com)所產生之示例 XML 檔案 -->
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com) -->
<RequestMessage xmlns="http://iec.ch/ITC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-namespace"
xsi:schemaLocation="http://iec.ch/ITC57/2011/schema/message Message.xsd">
  <Header>
    <Verb>change</Verb>
    <Noun>DERGroups</Noun>
    <Timestamp>2016-07-21T12:31:01-06:00</Timestamp>
    <MessageID>9f5e5644-7b5f-491a-b69a-077b6807b8c8</MessageID>
    <CorrelationID>a9aca27b-1bc1-4749-a729-c7cf40c86c4b</CorrelationID>
  </Header>
  <Payload>
    <DERGroups xmlns="http://iec.ch/ITC57/2016/DERGroups#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/ITC57/2016/DERGroups# DERGroups.xsd">
      <EndDeviceGroup>
        <DispatchablePowerCapability>
          <maxActivePower>24.5</maxActivePower>
        </DispatchablePowerCapability>
      </EndDeviceGroup>
    </DERGroups>
  </Payload>
</RequestMessage>
```

```

<mRID>3092d3ae-c57e-4079-a4d4-543d024eea8c</mRID>
</EndDevices>
<Names>
<name>Group A</name>
</Names>
</EndDeviceGroup>
</DERGroups>
</Payload>
</RequestMessage>

```

使用 “Group A” 之 Names.name 識別符，以便 DERMS 知悉哪個 DER 群組正更新中。

接收訊息後，DERMS 將檢查內容，發現正新增成員(憑藉目前群組中不存在之新 DER 識別符)，並使用擷取識別符的新成員更新群組，並將該成員之容量新增至群組容量。

DER 群組 A 現有 4 個成員，總最大有效功率容量為 24.5 kW，說明於表 6 中。

The Names.name identifier of "Group A" is used so that the DERMS will know which DER group is being updated. Upon receipt of the message the DERMS would examine the contents, see that a new member was being added (by virtue of a new DER identifier that does not exist in the current group) and update the group with this new member capturing the identifier and adding this member's capability to the group's capability. DER Group A would now have four members and a total maximum active power capability of 24,5 kW, illustrated in Table 6.

表 6 新增第 4 個成員後之 DER 群組 A 示例

Table 6 - Example DER Group A after adding a fourth member

DER 成員 mRID	容量
DER member mRID	Capability
cabb102d-4ab6-42ff-b30b-b2a70922a929	2.5 kW
2cb43245-ed67-4751-b09c-028a0e65e004	5 kW
94928710-2ad2-4a0f-8f12-c6304c1e5b19	12 kW
3092d3ae-c57e-4079-a4d4-543d024eea8c	5 kW

作為進一步之示例，假設 DMS 運作者已接收具 mRID “cabb102d-4ab6-42ff-b30b-b2a70922a929” 之 DER 已停止服務的通知。DMS 將對 DERMS 發送訊息以通知其此運作。如前所描述，移除成員要求使用運作集(若使用符合 IEC 61968-100:2013 之 SOAP 訊息)。

若使用 XML 作為資料序列化格式，則下列為此變更請求訊息之示例 XML 片段：

As a further example suppose that the DMS operator has received notice that DER with mRID cabb102d-4ab6-42ff-b30b-b2a70922a929, has been taken out of service. The DMS would send a message to the DERMS to notify it of this action. As previously described, removing a member requires the use of an OperationSet (if using IEC 61968-100:2013 compliant SOAP messages).

If XML is being used as the data serialization format, the following is an example XML snippet for this change request message:

```
<?xml version="1.0" encoding="UTF-8"?>
<!--XMLSpy v2015 rel. 4 sp1 (x64) (http://www.altova.com)所產生之示例 XML 檔案 -->
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64)
(http://www.altova.com)-->
<RequestMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-
namespace" xsi:schemaLocation="http://iec.ch/TC57/2011/schema/message Message.xsd">
  <Header>
    <Verb>execute</Verb>
    <Noun>OperationSet</Noun>
    <Timestamp>2016-07-21T12:48:33-06:00</Timestamp>
    <MessageID>63154f89-9fed-47f1-9a22-f3394e2aac8a</MessageID>
    <CorrelationID>88a34023-22a5-4c5c-85cc-518a4644e1d3</CorrelationID>
  </Header>
  <Payload>
    <OperationSet>
      <Operation>
        <operationId>1</operationId>
        <noun>delete</noun>
        <verb>DERGroups</verb>
        <elementOperation>>false</elementOperation>
        <DERGroups xmlns="http://iec.ch/TC57/2016/DERGroups#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2016/DERGroups# DERGroups.xsd">
          <EndDeviceGroup>
            <EndDevices>
              <mRID>cabb102d-4ab6-42-b30b-b2a70922a929</mRID>
            </EndDevices>
            <Names>
              <name>Group A</name>
            </Names>
```

```

</EndDeviceGroup>
</DERGroups>
<Operation>
<OperationSet>
</Payload>
</RequestMessage>

```

請求訊息中包含所刪除 DER 之 mRID 及所修改的群組(群組 A)之 Names.name 識別符。

於 OperationSet 酬載中，使用 delete 動詞並將 elementOperation 布林值設定為 true。

The request message contains the mRID of the DER being deleted and the Names.name identifier of the group (Group A) being modified. Within the OperationSet payload the delete verb is used and the elementOperation Boolean is set to true.

注意，運作集中之單一運作未提供於刪除 DER 成員時更新 maxActivePower 容量(於示例中現為 22.0 kW)的機制。更新容量可以運作集中之第 2 個運作，或使用類似先前示例中所示的第 2 個獨立“變更 DERGroups”交易所達成。

執行 OperationsSet 交易後，群組 A 之成員資格將依表 7 中所顯示。

Please note that the single Operation within the OperationSet does not provide a mechanism for updating the maxActivePower capability (which in the example would now be 22, 0 kW) when the DER member is deleted. Updating the capability could be accomplished with a second Operation within the OperationSet or with a second standalone "change DERGroups" transaction similar to that shown in the previous example.

Following execution of the OperationSet transaction, the membership of Group A would be as shown in Table 7.

表 7 刪除後 DER 群組 A 成員資格示例

Table 7 - Example DER Group A membership after delete

DER 成員 mRID DER member mRID	容量 Capability
2cb43245-ed67-4751-b09c-028aOe65e004	5 kW
94928710-2ad2-4aOf-8f12 c6304c1e5b19	12 kW
3092d3ae-c57e-4079-a4d4-543d024eea8c	5 kW

5.4 DER 群組查詢

5.4 DER Group queries

一旦建立群組，任何系統可查詢以取得有關群組之資訊，包括其成員資格及容量。此係

使用 “get DERGroups” 交易所達成，依圖 11 中所圖示。

Once a group is created then any system may query to get information about group, including its membership and capabilities. This is accomplished using a "get DERGroups" transaction, as illustrated in Figure 11.

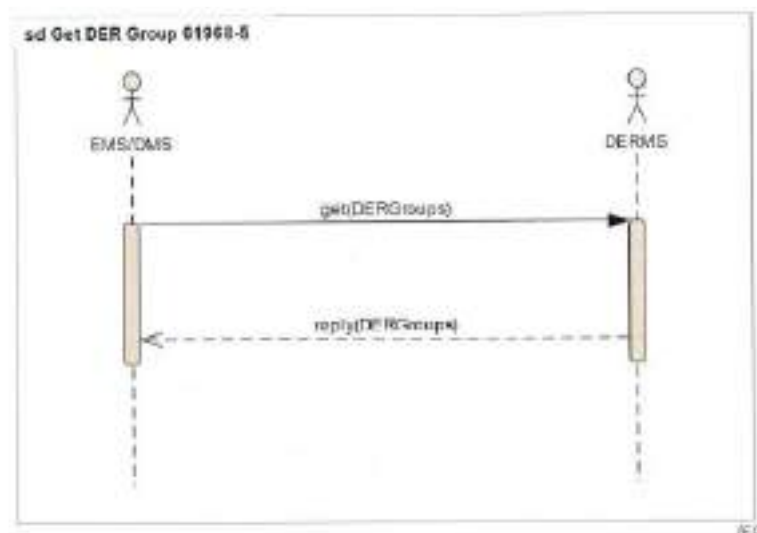


圖 11 支援查詢 DER 群組之訊息交換型樣

Figure 11 - Message exchange pattern to support querying a DER group

當使用 CIM “get” 動詞時，查詢參數係於特殊 “查詢剖繪” 中提供，其係置放於 IEC61968-100 訊息之請求而非酬載部分中。DERGroupQueries 剖繪參照附錄 A。

若使用 XML 作為資料序列化格式，則下列為此查詢訊息之示例 XML 片段：

When using the CIM "get" verb, the query parameters are provided in a special "query profile" that is placed in the Request rather than the Payload section of the IEC61968-100 message. The DERGroupQueries profile can be found in Annex A.

If XML is being used as the data serialization format, the following is an example XML snippet for this query message:

```

<?xml version= "encoding="UTF-8"?>
<!--XMLSpy v2015 rel. 4 sp1 (x64) (http://www.altova.com)所產生之示例 XML 檔案 -->
<!--Sample XML file generated by XMLSpy v2015 rel. 4 sp1 (x64) (http://www.altova.com)->
<RequestMessage xmlns="http://iec.ch/TC57/2011/schema/message"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:n1="http://www.altova.com/samplexml/other-
namespace" xsi:schemaLocation="http://iec.ch/TC57/2011/schema/message Message.xsd">
<Header>
<Verb>get<Nerb>

```

```

<Noun>DERGoups</Noun>
<Timestamp>2016-07-21T13:22:54-06:00</Timestamp>
<MessageID>94df9ce0-74c3-47ac-b8be-a5f3b0c68447</MessageID>
<CorrelationID>debc642-562b-417b-8cge-4b7c30d3e0c8</CorrelationID>
</Header>
<Request>
<DERGroupQueries xmlns="http://iec.ch C57/2016/DERGroupQueries#"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://iec.ch/TC57/2016/DERGroupQueries# DERGroupQueries.xsd">
<EndDeviceGroup>
<Names>
<name>Group A</name>
</Names>
</EndDeviceGroup>
</DERGroupQueries>
</Request>
</RequestMessage>

```

回應訊息使用先前所描述建立 DERGroup 示例中所使用之相同 DERGroups 剖繪回傳 DER 群組的細節。

The response message returns the details of the DER Group(s) using the same DERGroups profile used in the create DERGroups examples previously described.

5.5 DER 群組狀態監視

5.5 DER Group status monitoring

DER 群組狀態係使用 DERMonitorableParameter 類別報告。此等參數中之 1 或多個可能於訊息中傳遞，各具特定的 DERParameter，且選項地，具對應 DERParameter 之一組各自 DERCurveData。

圖 12 說明用以請求 DER 群組狀態之訊息互動。

DER group status is reported using the DERMonitorableParameter class. One or more of these parameters may be passed in a message, each with a specific DERParameter, and optionally, a set of corresponding DERCurveData for the respective DERParameter.

Figure 12 illustrates the messaging interaction for requesting the status of a DER group.

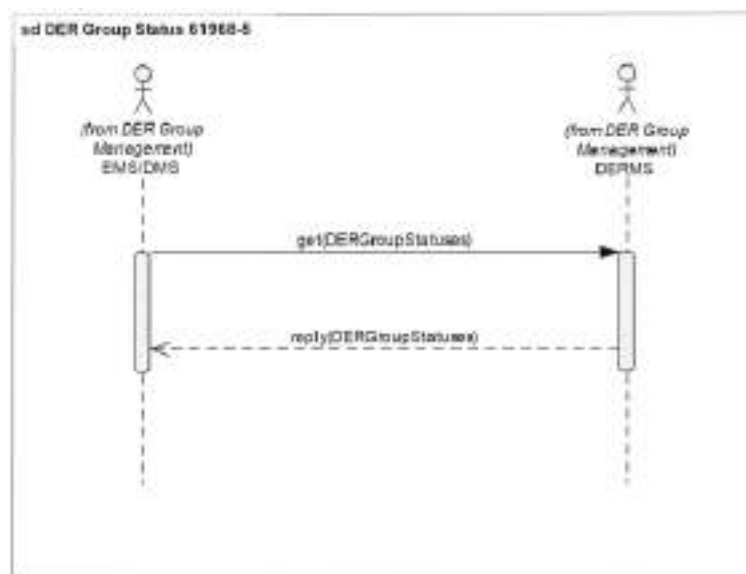


圖 12 DER 群組狀態監視之訊息交換型態(PULL)

Figure 12 - Message exchange pattern for DER Group status monitoring (PULL)

此作法中之目標為請求個體(例：DMS)可請求狀態(針對 DER 群組)，以及針對該群組各容量之值。此交易之此請求部分係使用 A.7 中的 DERGroupStatusQueries profi 所達成。使用 A.6 中所提供之 DERGroupStatuses 剖繪的不受限制版本回傳回應。

或者，DERMS 可選擇對所關注系統廣播狀態變更，依圖 13 中所圖示。

The objective in this approach is that a requesting entity (a DMS for example) could request the status (for a group of DER), and the values for each of the group's capabilities. This request portion of this transaction is accomplished using the DERGroupStatusQueries profi, found in Clause A.7. The response is returned using the unconstrained version of the DERGroupStatuses profile found in Clause A.6.

Alternative, the DERMS may choose to broadcast status changes to interested systems, as illustrated in Figure 13.

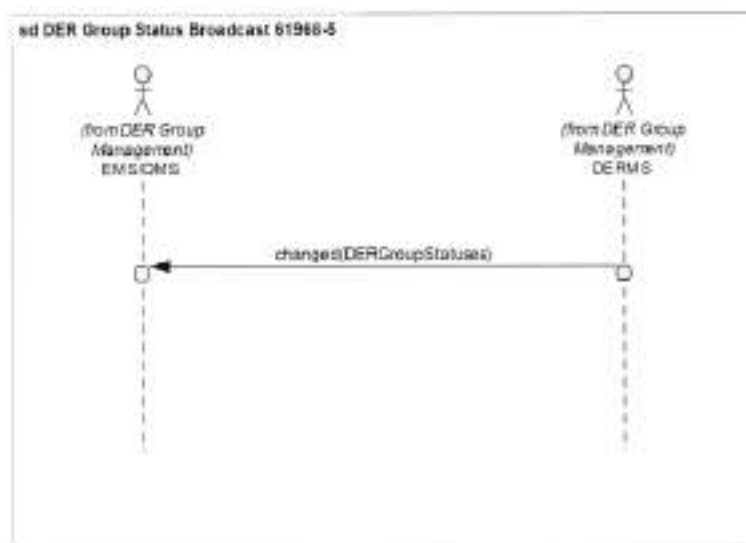


圖 13 DER 群組狀態監視之訊息交換型態(PUSH)

Figure 13 - Message exchange pattern for DER Group status monitoring (PUSH)

此交易亦利用 A.6 中之 DERGroupStatuses 剖繪的不受限制版本。

This transaction also utilizes the unconstrained version of the DERGroupStatuses profile found in Clause A.6.

5.6 DER 群組預測

5.6 DER Group forecast

本節描述可能藉以於軟體應用間交換 DER 可用性預測之方法。能針對 DER 群組之任何或全部可調度功率容量提供預測。

This subclause describes a method by which forecasts of DER availability may be exchanged between software applications. Forecasts can be provided for any or all of a DER group's dispatchable power capabilities.

此功能僅定義如何交換 DER 預測資料，並未規定如何判定預測。例：某些提供 DER 預測之個體可存取詳細的天氣預測資訊，包括衛星或天空觀測能力，以預測太陽變化。其他人可監視 DER 之運作狀況或分析過往資料，以便更準確地判定預測。無論可使用哪種預測方法，此功能僅解決 DER 可用性(例：有效功率、無效功率及視在功率)之預測交換，而非解決天氣或其他相關資料的交換。

This function only defines how DER forecast data is exchanged and does not specify how forecasts are determined. Some DER forecast-providing entities could, for example, have access to detailed weather forecast information, including satellite or sky-viewing capabilities to enable prediction of solar variability. Others could monitor DER health or analyses

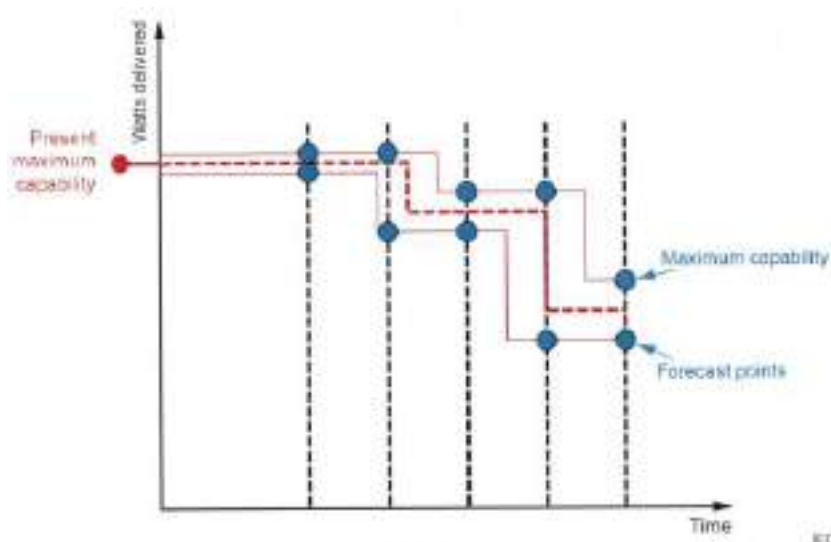
historical data in order to determine forecasts with greater accuracy. Regardless of the forecasting methods that may be used, this function only addresses the exchange of the forecast of the DER availability (e.g., real, reactive and apparent power) and does not address the exchange of weather or other related data.

依先前節次所描述，有效功率、無效功率及視在功率，以及其他容量之目前狀態可包括 3 個部分：目前值、最大及最小可調節範圍。預測係與最大值及最小值相關。預測與目前值無關，因其係可調度且僅受最大值及最小值所限制。

As described in a previous section, the present status for real, reactive and apparent power and other capabilities may include three parts: a present value, a maximum, and a minimum range of adjustability. Forecasting is relevant for the maximum and minimum values. Forecasting is not relevant for the present value because it is dispatchable and bounded only by the maximum and minimum.

預測可涉及不同程度之不確定性。為表示此，針對所給定參數之預測可描述為包絡線，即一系列不確定性，隨著預測變得不太確定，可能進一步擴展至未來。概念係圖示於圖 14。

Forecasts may involve varying degrees of uncertainty. To represent this, the forecast for a given parameter can be described as an envelope, a range of uncertainty, possibly widening further into the future as the forecast becomes less certain. The concept is illustrated in Figure 14.



Watts delivered	所配送之瓦特數
Present maximum capability	目前最大容量
maximum capability	最大容量

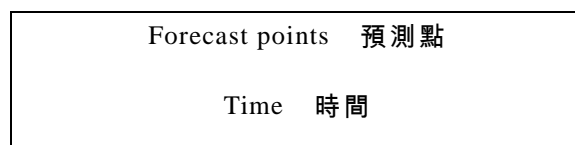


圖 14 表示電池儲能群組預測之點示例

Figure 14 - Example of points to represent battery storage group forecast

目前最大值及最小值係於左側處加標籤。因為其反映目前狀態，故其係特定、已知之值。

但展望未來，針對此等量之預測可能透過不斷擴大的範圍表示，依紅色陰影區域所圖示。

The present maximum and minimum values are labelled at the left-hand side. Because they reflect the present state, they are specific, known values. But looking into the future, the forecasts for these quantities may be represented through a widening envelope, as illustrated by the red shaded areas.

儲能系統之預測考量：

針對電池儲能 DER 群組之可用性的預測亦可藉由上述做法表示。然而，此等群組之預測可用性可能具不同外觀，且本質地取決於調度等級。

Forecast consideration of storage systems:

Forecasts for the availability of groups of battery storage DER may also be represented by the approach described above. The forecasted availability of these groups, however, may have a different appearance and would naturally be dependent on the level of dispatch.

例：考量由 3 個電池儲能裝置組成之群組：

- DER1 10 kW 70 kWh
- DER2 5 kW 20 kWh
- DER3 15 kW 65 kWh

As an example, consider a group comprised of three battery storage devices:

- DER1 10 kW 70 kWh
- DER2 5 kW 20 kWh
- DER3 15 kW 65 kWh

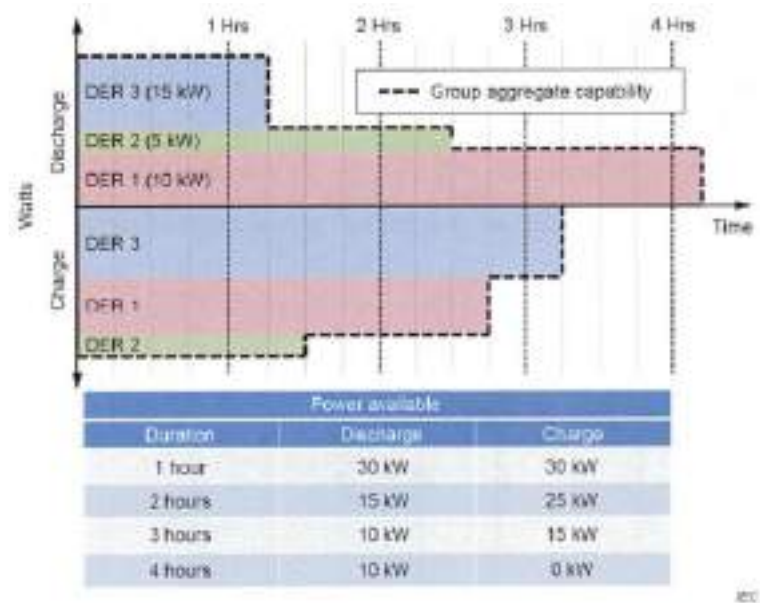
為簡化起見，此示例假設各裝置能以相同於其放電之速率充電。

圖 15 說明此等 3 個裝置視為群組之個別充電可用性與放電可用性將如何。隨著各裝置之儲能容量被充滿或耗盡，該群組充電或放電的聚合容量將逐步下降。

For simplification, this example assumes that each device can charge at the same rate at which it discharges.

Figure 15 illustrates how the individual charge availability and discharge availability of these

three devices might appear when viewed as a group. The aggregate capability of the group to either charge or discharge is shown to drop in steps as each device's storage capacity is filled or depleted.



1 Hrs	1 小時
2 Hrs	2 小時
3 Hrs	3 小時
4 Hrs	4 小時
Group aggregate capability	群組聚合容量
Watts	瓦特數
Charge	充電
Discharge	放電
Time	時間
Power available	可用電力
Duration	持續時間

圖 15 電池 DER 群組可用性示例

Figure 15 - Battery DER Group availability example

針對電池儲能群組，預測本質上係屬調度層級之功能。有鑑於此，提出 DER 預測請求之個體將能基於請求中所傳遞的假設調度等級執行此運作。

圖 16 說明針對請求 DER 群組之預測的訊息傳遞互動。

For battery storage groups, the forecast is inherently a function of the level of dispatch. In view of this, the entity making the request for a DER forecast will be able to do SO, based on a hypothetical level of dispatch that is passed in the request.

Figure 16 illustrates the messaging interaction for requesting a forecast for a DER group.

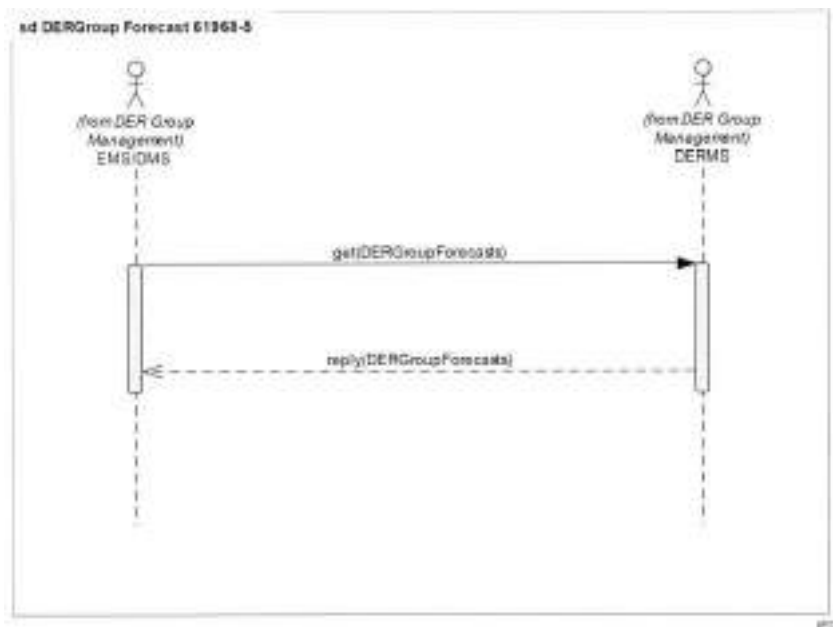


圖 16 DER 群組預測之訊息交換型樣(PULL)

Figure 16 - Message exchange pattern for DER Group forecasting (PULL)

此作法中之目標為請求個體(例：DMS)可請求預測(針對一組 DER)，並取得未來一段時間內該群組各容量的預測最小值及最大值。此交易之請求部分係使用 A.10 中的 DERGroupForecastQueries 剖繪所達成。使用 A.8 中所提供之 DERGroupForecasts 剖繪的受限制版本回傳回應。

或者，DERMS 可選擇對所關注系統廣播狀態變更，依圖 17 中所圖示。

The objective in this approach is that a requesting entity (DMS for example) could request the forecast (for a group of DER) and get predicted minimum and maximum values for each of the group's capabilities for a time period in the future. This request portion of this transaction is accomplished using the DERGroupForecastQueries profile, found in Clause A.10. The response is returned using the constrained version of the DERGroupForecasts profile found in Clause A.8.

Alternative, the DERMS may choose to broadcast status changes to interested systems, as illustrated in Figure 17.

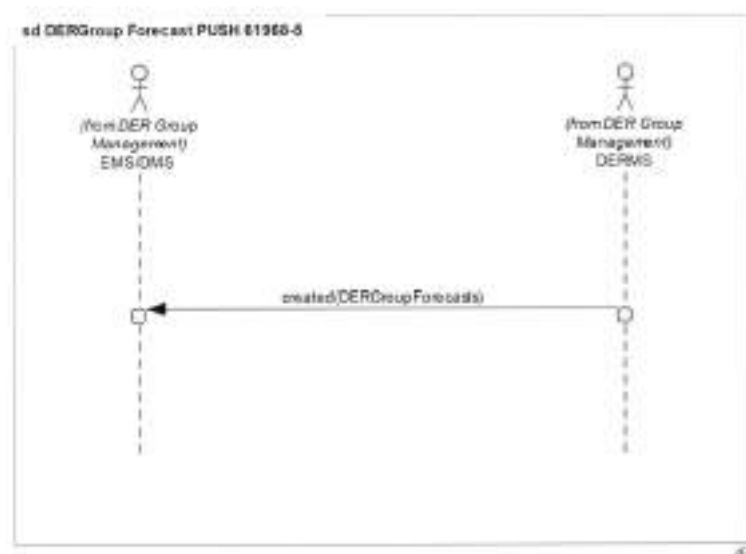


圖 17 DER 群組預測之訊息交換型樣(PUSH)

Figure 17 - Message exchange pattern for DER Group forecasting (PUSH)

該交易亦利用 A.8 中之 DERGroupForecasts 剖繪的受限制版本。

預測將識別已預測之 DER 群組，並將 DERMonitorableParameter、DispatchSchedule 及 DERCurveData 結合使用，預測區間的最小/最大值，以及相關聯的信任度(預測落在預測最小值/最大值範圍內之可能性有多大)。

有關預測的更多資訊，參照 IEC 62325-451-5:2015，能源市場通訊之框架。

This transaction also utilizes the constrained version of the DERGroupForecasts profile found in Clause A.8.

A forecast will identify the DER group for which the forecast has been made and using the DERMonitorableParameter in conjunction with the DispatchSchedule and DERCurveData, min/max values of the interval for the forecast, as well as the associated confidence (how likely the forecast will fall within the predicted min/max values).

For more information on forecasts, please see IEC 62325-451-5:2015, Framework for energy market communications.

5.7 DER 群組調度

5.7 DER Group dispatch

此段落描述藉以管理 DER 群組之電力等級的方法。此方法係以請求之形式，將群組的電力設定為所規定等級並將其調度至電網。

This paragraph describes a method by which the power level of a DER group may be managed. This method is in the form of a request that the power for the group be set to a specified level and dispatched to the grid.

此功能係旨在適用於企業整合環境中之軟體應用間。因此，其未直接影響群組內個別 DER 之管理方式。例：若該功能要求將一組 10 個 DER 之功率輸出減少至較目前值小 100 kW 的位準，則各 DER 減少 10 kW、1 個 DER 減少總共 100 kW，或跨群組之任何其他分散能源可滿足此。藉以管理個別 DER 之演算法及方法超出本標準適用範圍，且視為直接管理 DER 的個體(諸如 DERMS)之責任。

This function is intended to apply between software applications in an enterprise integration environment. As such, it does not have direct bearing on how individual DERs within the group are managed. For example, if this function requests that the power output from a group of 10 DER be reduced to a level that is 100 kW less than the present value, it may be satisfied by each DER being reduced by 10 kW, one DER being reduced by the whole 100 kW, or any other distribution across the group. The algorithms and methods by which individual DER are managed is out of scope of this standard and is viewed as the responsibility of the entity directly managing the DER, such as a DERMS.

先前定義之使用任意定義群組的方法亦用於此功能。其要求電力請求個體及供電個體瞭解並同意所參引之 DER 群組定義(亦即組成該群組的 DER 清單)。依先前所描述，群組之組成可由請求者、提供者或任何其他個體所定義，且其建立可為手動或自動過程。

The previously-defined method of using arbitrarily-defined groups is also used for this function. It requires that the referenced DER group definition (i.e. the list of which DER make up the group) is known and agreed-to by both the power-requesting and power-providing entities. As described previous, the makeup of the group could have been defined by the requestor, the provider, or any other entity, and its creation could have been a manual or automated process.

圖 18 說明電力調度序列。此外，此示例顯示狀態監視請求亦可跟隨於調度請求之後(顯示為參引狀態監視使用案例之 UML “矩形”)；或先於預測，以便請求個體可知悉目前可能的可調整範圍，且狀態監視追蹤對調度之回應。群組建立(要求)及狀態監視(選項)可於電力調度(請求及回應)之前或前的任何時間立即發生。此外，儘管超出本系列標準適用範圍，但此示例顯示 DERMS 如何使用個別 DER 之智慧變流器所使用的任何協定與特定 DER 通訊。

Figure 18 illustrates a power dispatch sequence. In addition, this example shows that a status monitoring request may also follow the dispatch request (shown as the UML “rectangle” referencing the status monitoring use case); or preceded by a forecast, so that the requesting entity may know what range of adjustability is presently possible, and status monitoring tracks

the response to the dispatch. Group creation (required) and status monitoring (optional) could occur immediately before the power dispatch (request and reply) or any time prior. Additionally, although out of scope of IEC 61968, this example shows how the DERMS communicates with individual DER using whatever protocol the smart inverter for the particular DER uses.

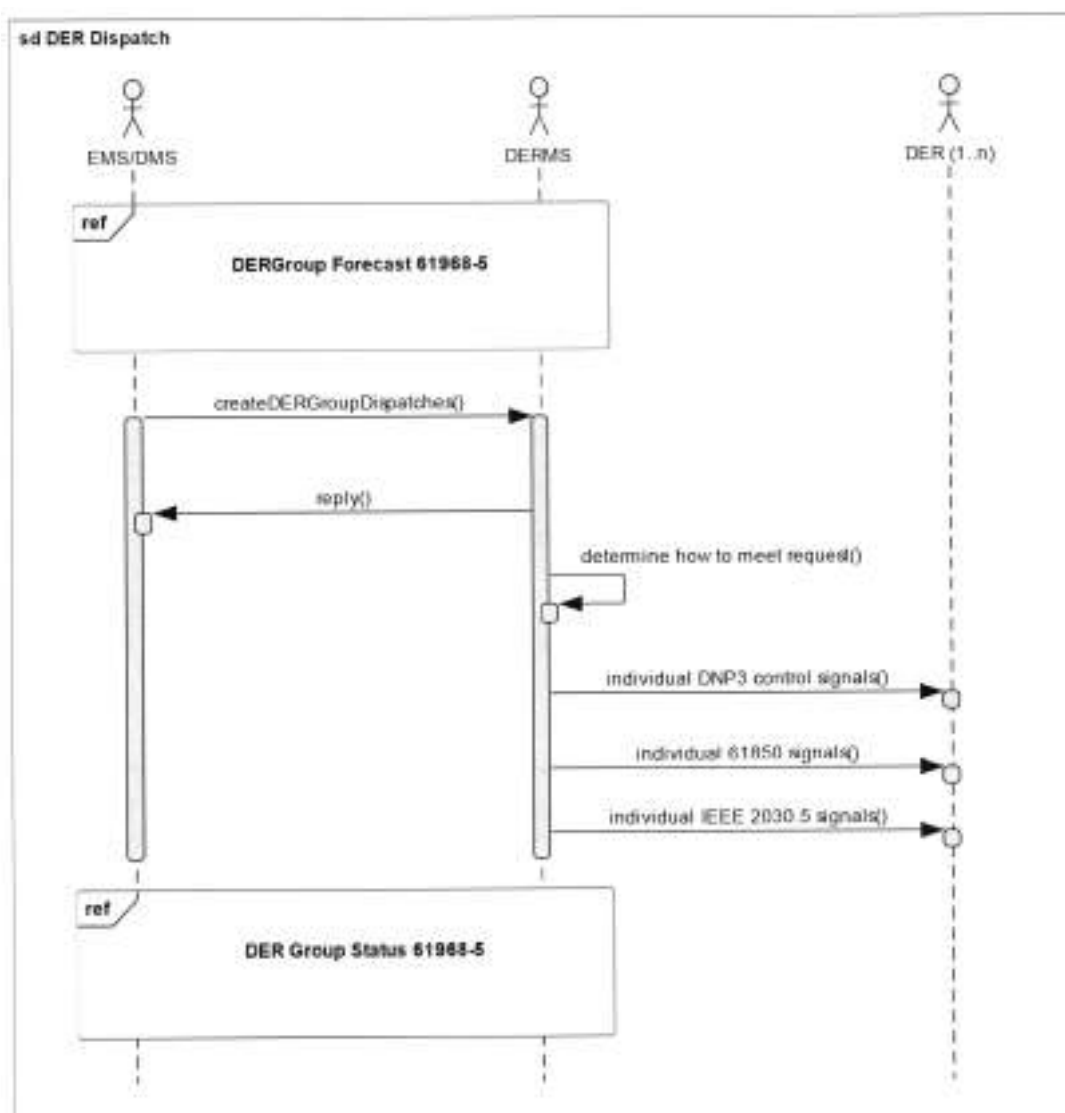


圖 18 DER 群組調度之示例訊息交換型樣

Figure 18 - Example Message exchange pattern for DER Group dispatch

此作法中之目標為請求個體(例：DMS)可請求 DER 群組調度電力。此交易之請求部分係使用 A.10 中之 DERGroupDispatches 剖繪的受限制版本所達成。注意，各調度係針對單一容量。

The objective in this approach is that a requesting entity (DMS for example) could request the dispatch of power from a DER group. This request portion of this transaction is accomplished using the constrained version of the DERGroupDispatches profile, found in Clause A.10. Note

that each dispatch is for a single capability.

為發出調度請求，系統傳遞針對 DER 群組之有效識別符，以及所欲的容量及量。例：若所欲為 100 kW 有效功率，請求系統對 DERMS 發送請求(建立 DERGroupDispatches)，則該請求具 DER 群組(例如“群組 A”)之 mRID 或 Names.name，以及具 Capability 型式為“activePower”，值為 100。

就追蹤目的，通常亦為 DERGroupDispatch.mRID 或 DERGroupDispatch.Names.name，以識別此請求。回應僅為成功或不成功之指示。

To make the dispatch request the system passes a valid identifier for the DER Group, and the capability and quantity that is desired. For example, if 100 kW of active power was desired, the requesting system would send the DERMS a request (create DERGroupDispatches) that had the mRID or Names.name of the DER group (e.g. "Group A"), and a RequestedCapability with a capabilityKind of "activePower" and a value of 100.

There would normally also be a DERGroupDispatch.mRID or a DERGroupDispatch.Names.name to identify this request for tracking purposes. The response is simply an indication of success or failure.

5.8 DER 群組連接/解連

5.8 DER Group Connect/Disconnect

此係控制功能，藉以將給定群組中之所有 DER 與電網解連或重新連接。理論上，DERMS 或提供此服務之其他個體可藉由利用標準“連接/解連”功能為之，已針對 IEC 標準(尤其 EndDeviceControl；IEC 61968-9 讀表及控制)中各個 DER 識別此功能。

This is a control function by which all DER in a given group may be disconnected-from or reconnected-to the grid. Notionally, a DERMS or other entity providing this service could do so by leveraging the standard "Connect/disconnect" function that has been identified for individual DER in the IEC standards (specifically EndDeviceControl; IEC 61968-9 Meter Reading and Control).

此功能之使用案例可包括針對電網維護鎖定、軟關機或圍繞計畫性停電的重新啟動。

技術作法：

連接/解連請求應包括簡單布林指示符，指示要求哪個狀態。

Use cases for this function could include lockout for grid maintenance, soft shutdown or restart around planned outages.

Technical approach:

The Connect/disconnect request shall include a simple Boolean indicator of which state is

required.

連接/解連請求應包括下列時序參數：

- 運作之開始日期/時間，或 “now” 指示符。
- 延遲時間，於開始連接/解連連接運作前將隨機延遲一段時間。
- DER 群組成員斷開或連接(於給定 DER 大小之情況下盡可能線性)的時間視窗 DER 群組功能探索。

The connect/disconnect request shall include the following timing parameters:

- A start date/time for the action, or a "now" indicator.
- A delay time over which a random delay is to be placed prior to starting the connect/disconnect action.
- A time-window over which the DER group members are to be disconnected or connected (as linearly as possible given DER sizes) DER Group function discovery.

5.9 DER 群組容量探索

5.9 DER group capability discovery

此系統具有關個別 DER 之已安裝容量的資訊，以及將其轉譯為該群組所支援功能的智慧。於某些時間點，分離之應用(諸如配電管理系統)試圖瞭解特定 DER 群組所支援的功能，並利用此訊息。

This system has information regarding the installed capabilities of individual DER, and the intelligence to translate this into the functions supported by the group. At some point in time, a separate application, such as a Distribution Management System seeks to understand the supported functions of a particular group of DER, and this message is utilized.

基於針對所支援功能之請求，DERMS 將針對下列功能傳遞一組布林值：

- 連接/解連。
- frequencyWattCurveFunction。
- maxRealPowerLimiting。
- rampRateContro。

Based on a request for supported functions, a DERMS would pass a set of Boolean values for the following functions:

- Connect/disconnect
- frequencyWattCurveFunction
- maxRealPowerLimiting
- rampRateControl

- reactivePowerDispatch。
- realPowerDispatchvoltageRegulation。
- voltVarCurveFunction。
- voltWattCurveFunction。
- reactivePowerDispatch
- realPowerDispatchvoltageRegulation
- voltVarCurveFunction
- voltWattCurveFunction

此外，亦新增 DERNamePlate 類別以支援與 IEEE 1547 之一致性，其中指示 DER 容量、諸如最小/最大有效功率、無效功率、電壓及其他運作特性。有關細節，參照附錄 B 之 DERNameplate 類別表格。

Additional, the DERNamePlate class has been added to support consistency with IEEE 1547, wherein DER capabilities such as min/max Active Power, Reactive Power, Voltage, and other operational characteristics are indicated. See Appendix B, DERNameplate class table for more details

5.10 DER 群組電壓調節功能

5.10 DER group voltage regulation function

此係控制功能，DER 藉以支援針對各種電壓需要之可能請求。請求個體可規定標的電壓或增加/減少調整請求，可於任何群組層級提出；諸如整個電路、個別饋線(或其區段)或微型電網。

This is a control function by which DER support for various voltage needs may be requested. Requesting entities could specify a target voltage or an increase/decrease adjustment. Requests could be made at any group-level; such as an entire circuit, an individual feeder (or segment thereof), or a microgrid.

提供此服務之個體(例：DERMS)可使用個別 DER 的各種設定值以提供該服務。此包括例：調整各種 DER 之標的電壓(例如 IEC 61850-90-7 中的 V_{nom})，以及開啟/關閉或調整無效功率功能。針對此功能之使用案例包括饋線層級保護電壓降低，其以可調度方式開啟/關閉以減少尖峰負載。

The entity providing this service, for example, a DERMS, could use a variety of settings of individual DER in order to provide this service. This includes, for example, adjustments to

the target voltage of various DER, for example, V_{nom} in IEC 61850-90-7), and turning on/off or adjusting reactive power functions. Use cases for this function include feeder-level conservation voltage reduction which might be turned on/off in a dispatchable way to reduce peak loading.

“電壓調節”功能僅規定預期結果，而未規定藉以獲得結果之控制方法。

類似於其他調度功能，DERMS 能於斜坡速率曲線中規定一系列 X 值及 Y 值，此將容許於一段時間內變更值，或表示恆定狀態之單一值。

The "Voltage Regulation" function specifies only the intended result, and not the control method by which the result is obtained.

Similar to the other dispatch functions, the DERMS can specify a series of X and Y values in a ramp rate curve, which would allow for changing values over a period of time, or a single value that would represent a constant state.

附錄 A

(規定)

針對 DERMS 剖繪之資料要求事項

Annex A

(normative)

Data requirements for DERMS profiles

A.1 一般

A.1 General

表 A.1 至表 A.11 係針對 DERGroup 相關剖繪之規範性資料要求事項。

有關完整資料之定義，參照 CNS 61968-11。有關資料模型之圖形表示，參照 “CIM version iec61970cim17v22_iec61968cim13v11_iec62325cim03v14”。

Table A.1 to Table A.11 are the normative data requirements for the DERGroup related profiles. Complete data definitions can be found in *IEC 61968-11, Application integration at electric utilities—System interfaces for distribution management—Part 11: Common information model (CIM) extensions for distribution*. For a graphical representation of the data model, see *CIM version iec61970cim17v22_iec61968cim13v11_iec62325cim03v14*.

下列剖繪可具多種型式之序列化，諸如 XSD、RDF、XML、JSON 或 protobuf。基於 SOAP 或 JMS 之整合指引，參照 IEC 61968-100:2013。

所有類別係繼承自 identifiedObject。mRID 屬性係定義為字串，但首要實務為 mRID 宜限制為全域唯一 ID (GUID)。

The following profiles may have many types of serialization such as XSD, RDF, XML, JSON, or protobuf. For SOAP or JMS based integration guidance the reader is referred to IEC 61968-100:2013.

All classes inherit from identifiedObject. The mRID attribute is defined as a string, but leading practice is that mRID should be constrained to a globally unique ID (GUID).

於表 A.1 至表 A.11 中，某些將加標籤為“受限制”，某些將加標籤為“不受限制”。此不同於過去之剖繪開發，過去嘗試建立“一體適用”的剖繪。然而，認知更嚴格之限制改善互運性的機會，於某些情況下，將要求具較少選項元件的受限制剖繪。通常，於對請求之回應中使用不受限制的剖繪，且因可能未填充所有資料元件，故具更多選項元件容許適當程度之靈活性。

In Tables A.1 to A. 11, some will be labelled as "constrained" and some will be labelled as

"unconstrained". This differs from profile development in the past where attempts were made to create "one size fits all" profiles. Recognizing however, that tighter constraints improves the chance for interoperability, in some instances constrained profile, which have fewer optional element, will be required. Typically unconstrained profiles are used in the response to a request and since all data elements might not be populated, having more optional elements allows for an appropriate level of flexibility.

表 A.1 IdentifiedObject

Table A.1 - IdentifiedObject

核心：IdentifiedObject			
Core: IdentifiedObject			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
aliasName	string	[0..1]	
description	string	[0..1]	
mRID	string	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
name	string	[0..1]	

於表 A.2 至表 A.11 中，剖繪係以屬性及超類別之組合進行詳述。超類別係屬屬性，其本身即為類別，例：狀態。

In Tables A.2 to A.11, profiles are detailed with a combination of attributes and super classes. A super class is an attribute which is itself, a class, e.g. Status.

A.2 DERGroups 剖繪(受限制版本)

A.2 DERGroups profile (constrained version)

DERGroups 剖繪包含一對多 DERGroup。DERGroup 係 EndDeviceGroup 類別之特殊化。

於此剖繪之受限制版本中，元件 DERFunction 係屬必備。

The DERGroups profile contains one-to-many DERGroup. DERGroup is a specialization of the EndDeviceGroup class. In the constrained version of this profile, the element DERFunction is mandatory.

表 A.2 DERGroups 剖繪

Table A.2 - DERGroups profile

DERGroups			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments

DERGroups	EndDeviceGroup	[1..*]	
剖繪屬性 Profile Altributes			
mRID	string	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID.
description	strlng	[0..1]	
DERFunction	DERFunction	[1..1]	參照附錄 B。 See Annex B
EndDevice	EndDevice	[0..*]	參照附錄 B。 See Annex B
Names	Names	[0..*]	參照附錄 B。 See Annex B
version	Version	[0..1]	

A.3 DERGroups 剖繪(不受限制版本)

A.3 DERGroups profile (unconstrained version)

於此剖繪之不受限制版本中，DERFunction 係屬選項。

In the unconstrained version of this profile, DERFunction is optional.

表 A.3 DERGroups (不受限制之)剖繪

Table A.3 - DERGroups (Unconstrained) Profile

DERGroups			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
DERGroups	EndDeviceGroup	[1..]	
剖繪屬性 Profile Altributes			
mRID	string	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
description	string	[0..1]	
DERFunction	DERFunction	[0..1]	參照附錄 B。 See Annex B

EndDevices	EndDevices	[0..*]	參照附錄 B。 See Annex B
Names	Names	[0..*]	參照附錄 B。 See Annex B
version	Version	[0..1]	參照附錄 B。 See Annex B

A.4 DERGroupDispatches 剖繪(受限制版本)

A.4 DERGroupDispatches profile (constrained version)

於此剖繪之受限制版本中，EndDeviceGroup 屬性係屬必備，DERMonitorableParameter 亦係屬必備。(有關調度，參照附錄 B 之 EndDeviceGroup)。

In the constrained version of this profile, the attribute EndDeviceGroup is mandatory DERMonitorableParameter is also mandatory. (See Annex B, EndDeviceGroup for dispatches).

表 A.4 DERGroupDispatches (受限制之)剖繪

Table A.4 - DERGroupDispatches (constrained) Profile

DERGroupDispatches 包含 1 對多 DERGroupDispatch			
DERGroupDispatches contains 1-to-many DERGroupDispatch			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
DERGroupDispatches	DERGroupDispatch	[1..*]	
剖繪屬性 Profile Attributes			
DERGroupDispatch 包含下列元件：			
DERGroupDispatch contains the following elements			
mRID	string	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
EndDeviceGroup	EndDeviceGroup	[1..1]	有關調度，參照附錄 B 之 EndDeviceGroup。 See Annex B, EndDeviceGroup for Dispatches
Names	Names	[0..*]	參照附錄 B。 See Annex B

A.5 DERGroupDispatches 剖繪(不受限制版本)**A.5 DERGroupDispatches profile (unconstrained version)**

於此剖繪的不受限制版本中，EndDeviceGroup 係屬選項。DERMonitorableParameter 亦屬選項(關於調度，參照附錄 B 之 EndDeviceGroup)。

In the unconstrained version of this profile, EndDeviceGroup is optional. DERMonitorableParameter is also option (See Annex B, EndDeviceGroup for Dispatches).

表 A.5 DERGroupDispatches (不受限制之)剖繪

Table A.5 - DERGroupDispatches (unconstrained) profile

DERGroupDispatches 包含 1 對多 DERGroupDispatch			
DERGroupDispatches contains 1-to-many DERGroupDispatch			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
DERGroupDispatches	DERGroupDispatch	[1..*]	
剖繪屬性 Profile Attributes			
DERGroupDispatch 包含下列元件： DERGroupDispatch contains the following elements			
mRID	String	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
EndDeviceGroup	EndDeviceGroup	[0..1]	有關調度，參照附錄 B 之 EndDeviceGroup。 See Annex B, EndDeviceGroup for Dispatches
Names	Names	[0..*]	參照附錄 B。 See Annex B

A.6 DERGroupForecasts (受限制)**A.6 DERGroupForecasts (constrained)**

用以對 DERMS 詢問 DERGroup 預測。於此剖繪之受限制版本中，predictionCreationDate 及 EndDeviceGroup 係屬必備。

Used to ask a DERMS for DERGroup forecasts. In the constrained version of this profile,

predictionCreationDate and EndDeviceGroup are mandatory.

表 A.6 DERGroupForecast (受限制之)剖繪

Table A.6 - DERGroupForecast (constrained) profile

DERGroupForecasts 包含 1 對多 DERGroupForecast			
DERGroupForecasts contains 1-to-many DERGroupForecast			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
DERGroupForecast	DERGroupForecast	[1..*]	
剖繪屬性 Profile Attributes			
DERGroupForecast 包含下列元件：			
DERGroupForecast contains the following elements			
mRID	String	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
predictionCreationDate	dateTime	[1..1]	
EndDeviceGroup	EndDeviceGroup	[1..1]	參照附錄 B 之 EndDeviceGroup。 See Annex B, EndDeviceGroup
Names	Name	[0..1]	

A.7 DERGroupForecasts (不受限制)

A.7 DERGroupForecasts (unconstrained)

於此剖繪之不受限制版本中，predictionCreationDate 及 EndDeviceGroup 係屬選項。

In the unconstrained version of this profile, predictionCreationDate and EndDeviceGroup are optional.

表 A.7 DERGroupForecast (不受限制之)剖繪

Table A.7 - DERGroupForecast (unconstrained) profile

DERGroupForecasts 包含 1 對多 DERGroupForecast			
DERGroupForecasts contains 1-to-many DERGroupForecast			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
DERGroupForecast	DERGroupForecast	[1..*]	
剖繪屬性			

Profile Attributes			
DERGroupForecast 包含下列元件：			
DERGroupForecast contains the following elements			
mRID	String	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
predictionCreationDate	dateTime	[0..1]	
EndDeviceGroup	EndDeviceGroup	[0..1]	參照附錄 B 之 EndDeviceGroup。 See Annex B, EndDeviceGroup
Names	Name	[0..1]	

A.8 DERGroupStatuses 剖繪

A.8 DERGroupStatuses profile

表 A.8 DERGroupStatuses 剖繪

Table A.8 - DERGroupStatuses profile

DERGroupStatuses 包含 1 對多 DERGroupStatus			
DERGroupStatuses contains 1-to-many DERGroupStatus			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
DERGroupStatuses	EndDeviceGroup	[1..*]	
剖繪屬性			
Profile Attributes			
mRID	stnng	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
DERMonitorableParameter	DERMonitorableParameter	[1..*]	參照附錄 B 之 DERMonitorableParameter。 See Annex B, DERMonitorableParameter
Names	Name	[0..*]	參照附錄 B 之名稱。 See Annex B, Names
status	Status	[0..1]	

A.9 EndDeviceControls

EndDeviceControls 係用於控制功能，諸如指示整組 DER 連線或解連。此剖繪係相同於 IEC 61968-9:2013 讀表及控制中之來源剖繪。

The EndDeviceControls is used for control functions such as indicating to an entire group of DER to connect or disconnect. This profile is the same as the source profile in IEC 61968-9:2013, Meter Reading and Control.

A.10 DERGroupQueries

此剖繪係用以請求有關 DERGroup 之資訊。請求系統簡單地通過識別符(mRID 或名稱)，回應系統即針對該 DERGroup 回傳所有資料。若未傳遞識別符，則回應系統將使用所有 DERGroup 之資料回應。此係特殊之“引導”情況，可用於以 DERGroup 資料填充系統，以便用於進一步交易的基礎。

This profile is used to request information about a DERGroup. The requesting system simply passes along the identifier (mRID, or Names) and the responding systems returns all data for that DERGroup. If no identifier is passed, then the responding system is to respond with the data for ALL DERGroups. This is the special "bootstrap" case that can be used to populate a system with DERGroup data so that a basis for further transaction may occur.

表 A.9 DERGroupQueries

Table A.9 - DERGroupQueries

DERGroupQueries 包含 1 對多 EndDeviceGroup			
DERGroupQueries contains 1-to-many EndDeviceGroup			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
剖繪屬性 Profile Attributes			
EndDeviceGroup	EndDeviceGroup	[1..*]	參照附錄 B 之 EndDeviceGroup。 See Annex B, EndDeviceGroup

A.11 DERGroupStatusQueries

此剖繪係用以請求有關 DERGroup 之狀態(電源相關)的資料。雖查詢具相同於 DERGroupQueries 剖繪之結構，但回應係使用 DERGroupStatuses 剖繪。

This profile is used to request data about the status (power related) of a DERGroup. While the query has the same structure of a DERGroupQueries profile, the response is with the

DERGroupStatuses profile.

表 A.10 DERGroupStatusQueries

Table A.10 - DERGroupStatusQueries

DERGroupQueries 包含 1 對多 EndDeviceGroup			
DERGroupQueries contains 1-to-many EndDeviceGroup			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
剖繪屬性 Profile Attributes			
EndDeviceGroup	EndDeviceGroup	[1..*]	參照附錄 B 之 EndDeviceGroup。 See Annex B, EndDeviceGroup

A.12 DERGroupForecastqueries

針對預測相關之資料，此剖繪係用以查詢諸如 DERMS 的系統。

This profile is used to query a system such as a DERMS, for data related to forecasts.

表 A.11 DERGroupForecastQueries

Table A.11 - DERGroupForecastQueries

DERGroupForecastQueries 包含 1 對多 DERMonitorableParameter、1 對多 DispatchSchdu，以 及 1 對多 EndDeviceGroup			
DERGroupForecastQueries contains 1-to-many DERMonitorableParameter, 1-to-many DispatchSchdu, and 1-to-many EndDeviceGroup			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
剖繪屬性 Profile Attributes			
DERMonitorablePar ameter	DERMoni!orablePara meter	[1..*]	參 照 附 錄 B 之 DERMonitorableParameter。 See Annex B, DERMonitorableParameter
DispatchSchedule	DispatchSchedule	[1..*]	參照附錄 B 之 DispatchSchedule。 See Annex B, DispatchSchedule
EndDeviceGroup	EndDeviceGroup	[1..*]	參照附錄 B 之 EndDeviceGroup。

			See Annex B, EndDeviceGroup
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附錄 B

(規定)

超類別

Annex B

(normative)

Super classes

B.1 一般

B.1 General

此等類別(依表 B.1 至表 B.15 中所顯示)係於其他類別中用作屬性用以建構剖繪。

These are classes (shown in Table B.1 to Table B.15) that are used as attributes in other classes for constructing a profile.

B.2 CurveStyle 類別

B.2 CurveStyle class

表 B.1 CurveStyle 類別

Table B.1 - CurveStyle class

核心：CurveStyle Core: CurveStyle	
屬性 Attribute	資料型式 Data Type
constantYValue	string = "constantYValue"
straightLineYValues	string = "straightLineYValues"

B.3 DERCurveData 類別

B.3 DERCurveData class

表 B.2 DERCurveData 類別

Table B.2 - DERCurveData class

DERCurveData		
屬性 Attribute	資料型式 Data Type	基數 Cardinality
intervalNumber	Integer	[0..1]
maxYValue	float	[0..1]
minYValue	float	[0..1]
nominalYValue	float	[0..1]

timestamp	dateTime	[0..1]
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B.4 DERFunction 類別

B.4 DERFunction class

DERFunction 類別係用以與請求系統共用有關回應系統能支援哪些 DER 功能的資訊。

The DERFunction class is used to share information with a requesting system about which DER functions the responding system can support.

表 B.3 DERFunction 類別

Table B.3 - DERFunction class

DERFunction			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
connectDisconnect	boolean	[0..1]	
frequencyWattCurve	boolean	[0..1]	
maxRealPowerLimiting	boolean	[0..1]	
rampRateControl	boolean	[0..1]	
reactivePowerDispatch	boolean	[0..1]	
realPowerDispatch	boolean	[0..1]	
voltageRegulation	boolean	[0..1]	
voltageVarCurve	boolean	[0..1]	
voltageWattCurve	boolean	[0..1]	
DERNamePlate	DERNamePlate	[1..1]	參照附錄 B 之 DERNamePlate 表格。 See Appendix B, DERNamePlate table

B.5 DERMonitorableParameter 類別

B.5 DERMonitorableParameter class

此類別係用以判定將調度哪些能力以及哪些區間。

This class is used to determine which capability is going to be dispatched and what interval.

表 B.4 – DERMonitorableParameter 類別

Table B.4 - DERMonitorableParameter class

DERNamePlate		
屬性 Attribute	資料型式 Data Type	基數 Cardinality
DERParameter	DERParameterKind	[1..1]

flowDirection	flowDirecilonKind	[0..1]
yMultiplier	UnitMultiplier	[1..1]
yUnit	DERUnitSymbol	[1..1]
yUnitInstalledMax	float	[0..1]
yUnitInstalledMin	float	[0..1]
DispatchSchedule	DispalchSchedule	[1..*]

B.6 DERNamePlate 類別

B.6 DERNamePlate class

此類別係用以指示源自 IEEE 1547 能力之清單支援哪些屬性。

This class is used to indicate which attributes are supported from the list of IEEE 1547 capabilities.

表 B.5 DERNamePlate

Table B.5 – DERNamePlate

DERMonitorableParameter			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
activePowerRating	ActivePower	[1..1]	單位功率因數處之有效額定功率(依 IEEE 1547)。 Active power rating at unity power factor (per IEEE 1547)
overexcitedActivePowerRating	ActivePower	[1..1]	規定過勵磁功率因數處之有效功率額定值(依 IEEE 1547)。 Active power rating at specified over-excited power factor (per IEEE 1547)
overexcitedPowerFactor	PerCent	[1..1]	規定過勵磁功率因數(依 IEEE 1547)。 Specified over-excited power factor (per IEEE 1547)
underexcitedActivePowerRating	ActivePower	[1..1]	規定欠勵磁功率因數處之有效額定功率(依 IEEE 1547)。 Active power rating at specified under-excited power factor (per IEEE 1547)
maxApparentPower	ApparentPower	[1..1]	視在功率最大額定值(依 IEEE 1547)。 Apparent power maximum rating (per

			IEEE 1547)
normalOperatingPerformanceCategory	normalOperatingPerformanceCategory	[1..1]	參照列舉。 See Enumerations
abnormalOperatingPerformanceCategory	abnormalOperatingPerformanceCategory	[1..1]	參照列舉。 See Enumerations
internationalIslandCategory	internationalIslandCategory	[0..1]	字串。 String
maxInjectedReactivePower	ReactivePower	[1..1]	無效功率注入最大額定值(依 IEEE 1547)。 Reactive power injected maximum rating (per IEEE 1547)
maxAbsorbedReactivePower	ReactivePower	[1..1]	無效功率吸收最大額定值(依 IEEE 1547)。 Reactive power absorbed maximum rating (per IEEE 1547)
maxActivePowerCharge	ActivePower	[1..1]	最大有效充電額定值，以瓦特為單位(依 IEEE 1547)。 Maximum active power charge rating in watts (per IEEE 1547)
maxApparentPowerCharge	ApparentPower	[1..1]	最大有效充電額定值，以瓦特為單位(依 IEEE 1547)。 Maximum active power charge rating in watts (per IEEE 1547)
nominalACVoltage	Voltage	[1..1]	標稱交流電壓額定值，以 RMS 伏特為單位(依 IEEE 1547)。 Nominal AC voltage rating in RMS volts (per IEEE 1547)
maxACVoltage	Voltage	[1..1]	最大 AC 電壓額定值，以 RMS 伏特為單位(依 IEEE 1547)。 Maximum AC voltage rating in RMS volts (per IEEE 1547)
minACVoltage	Voltage	[1..1]	最小 AC 電壓額定值，以 RMS 伏特為

			單位(依 IEEE 1547)。 Minimum AC voltage rating in RMS volts (per IEEE 1547)
supportedControlModeFunction	string	[1..1]	所支援控制模式功能(依 IEEE 1547)。 Supported Control Mode Functions (per IEEE 1547)
manufacturerName	string	[0..1]	製造者名稱(依 IEEE 1547)。 Manufacturer Name (per IEEE 1547)
modelName	string	[0..1]	型號(依 IEEE 1547)。 Model Number (per IEEE 1547)
serialNumber	string	[0..1]	序號(依 IEEE 1547)。 Serial Number (per IEEE 1547)
firmwareVersion	String	[0..1]	韌體版本(依 IEEE 1547)。 Firmware Version (per IEEE 1547)

B.7 DispatchSchedule 類別

B.7 DispatchSchedule class

此類別指示針對所給定 DERGroup 調度之曲線樣式及區間型式。

This class indicates the curve style and interval types for a given DERGroup dispatch.

表 B.6 DispatchSchedule

Table B.6 – DispatchSchedule

DispatchSchedule			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
curveStyleKind	CurveStyle	[1..1]	
startTime	dateTime	[1..1]	
timeIntervalDuration	integer	[1..1]	
timeIntervalUnit	TimeIntervalKind	[1..1]	參照附錄 B 之列舉。 See enumerations, Annex B
DERCurveData	DERCurveData	[1..*]	

B.8 EndOevice 類別

B.8 EndOevice class

該類別係用以識別個別 DER。

The class is used to identify an individual DER.

表 B.7 EndDevice

Table B.7 – EndDevice

EndDevice			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
mrlD	string	[0..1]	當為字串時，該字串宜限制為 10 個 GUID。 While a string, the string should be restricted 10 a GUID
Names	Names	[0..1]	參照路 B 中之 Names 類別。 See Names class in Annex B

B.9 EndDeviceGroup 類別

B.9 EndDeviceGroup class

使用源自 CIM 之計量套件(metering package)，EndDeviceGroup 促進 EndDevice 群組的管理。DER 全景中之智慧變流器係屬終端裝置的型式，因此此類別係利用以管理 DER 群組。

Used from the metering package in the CIM, EndDeviceGroup facilitates the management of groups of EndDevices. Smart Inverters in the DER context, are types of EndDevices, so this class is leveraged to manage groups of DER.

表 B.8 EndDeviceGroup 類別

Table B.8 - EndDeviceGroup class

計量：EndDeviceGroup Metering: EndDeviceGroup		
屬性 Attribute	資料型式 Data Type	基數 Cardinality
status	Status	[0..1]
type	string	[0..1]
version	Version	[0..1]

B.10 用以調度及預測之 EndDeviceGroup (受限制)

B.10 EndDeviceGroup (constrained) for dispatches and forecasts

類似於 A.12 中之 EndDeviceGroup 類別，此係用以識別 DERGroup。然而，此使用之 EndDeviceGroup 具額外元件：DERMonitorableParameter。於受限制版本中，要求

DERMonitorableParameter。

Like the EndDeviceGroup class in A.12, this is used to identify the DERGroup. However, the EndDeviceGroup in this use has an additional element: DERMonitorableParameter. In the constrained version DERMonitorableParameter is required.

表 B.9 EndDeviceGroup (受限制之)調度類別

Table B.9 - EndDeviceGroup (constrained) dispatches class

Metering: EndDeviceGroup			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
mRID	string	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
DERMonitorableParameter	DERMonitorableParameler	[1..1]	
Names	Name	[0..*]	

B.11 用以調度及預測之 EndDeviceGroup (不受限制)

B.11 EndDeviceGroup (unconstrained) for dispatches and forecasts

表 B.10 用以調度及預測之 EndDeviceGroup (不受限制)

Table B.10 - EndDeviceGroup (unconstrained) for dispatches and forecasts

計量：EndDeviceGroup Metering: EndDeviceGroup			
屬性 Attribute	資料型式 Data Type	基數 Cardinality	備註 Comments
mRID	string	[0..1]	當為字串時，該字串宜限制為 GUID。 While a string, the string should be restricted to a GUID
DERMonitorableParameter	DERMonilorableParameler	[0..1]	
Names	Name	[0..*]	

B.12 名稱

B.12 Names

對 mRID 之替代識別符。

Alternative identifier to mRID.

表 B.11 名稱

Table B.11 – Names

核心：Names Core: Names		
屬性 Attribute	資料型式 Data Type	基數 Cardinality
name	string	[1..1]
nameType	NameType	[0..1]

B.13 NameType

此係用以指示 Name 類別中之 Name 係屬哪種名稱。

This is used to indicate what kind of name is the Name in the Name class.

表 B.12 NameType

Table B.12 – NameType

Core: NameType		
屬性 Attribute	資料型式 Data Type	基數 Cardinality
description	string	[0..1]
name	string	[1..1]
nameTypeAuthority	string	[0.. 1]

B.14 NameTypeAuthority

負責管理(此型式之)名稱的機構。

Authority responsible for managing names (of this type).

表 B.13 NameTypeAuthority

Table B.13 – NameTypeAuthority

核心：NameTypeAuthority Core: NameTypeAuthority		
屬性 Attribute	資料型式 Data Type	基數 Cardinality
description	string	[0..1]

name	string	[1..1]
------	--------	--------

B.15 Status 類別**B.15 Status class**

表 B.14 Status 類別

Table B.14 - Status class

Status		
屬性 Attribute	資料型式 Data Type	基數 Cardinality
dateTime	dateTime	[0..1]
reason	String	[0..1]
Remark	String	[0..1]
Value	String	[0..1]

B.16 Version 類別**B.16 Version class**

於 DERGroup 之全景中，可能用以追蹤將個別 DER 新增至 DERGroup 或自 DERGroup 中移除時的變更。

In the context of DERGroups, may be used to track changes when an individual DER has been added to or removed from a DERGroup.

表 B.15 Version 類別

Table B.15 - Version class

屬性 Attribute	資料型式 Data Type	基數 Cardinality
date	dateTime	[0..1]
major	Integer	[0..1]
minor	Integer	[0..1]
revision	Integer	[0..1]

附錄 C
(規定)
列舉類別

Annex C
(normative)
Enumerated classes

C.1 一般

C.1 General

列舉類別(依表 C.1 至表 C.7 中所顯示)係屬選項受限制清單。基礎類別通常為字串資料型式，但非容許之任何字串，而是將字串限制為特定值。

Enumerated classes, as shown in Table C. 1 to Table C.7, are restricted lists of options. The base class is often a string data type, but instead of allowing any string, restricts the string to a specific value.

C.2 abnormalOperatingPerformanceCategory 列舉類別

C.2 abnormalOperatingPerformanceCategory enumeration class

此列舉係用於指示 DER 可能屬於哪個異常運作效能種類。

This enumeration is used to indicate which abnormal operating performance category a DER may be in.

表 C.1 abnormalOperatingPerformanceCategory

Table C.1 – abnormalOperatingPerformanceCategory

abnormalOperatingPerformanceCategory (列舉) abnormalOperatingPerformanceCategory (enumeration)	
屬性 Attribute	資料型式 Data Type
CAT I	String = "CAT I"
CAT II	String = "CAT II"
CAT III	String = "CAT III"

C.3 DERParameterKind 列舉類別

C.3 DERParameterKind enumeration class

表 C.2 DERParameterKind

Table C.2 – DERParameterKind

DERParameterKind	
屬性 Attribute	資料型式 Data Type
apparentPower	String = "apparentPower"
activePower	String = "activePower"
reactivePower	String = "reactivePower"
highFilterBiDirectionalRegulation	String = "highFilterBiDirectionalRegulation"
lowFilterBiDirectionalRegulation	String = "lowFilterBiDirectionalRegulation"
highFilterUpRegulation	String = "highFilterUpRegulation"
lowFilterUpRegulation	String = "lowFilterUpRegulation"
highFilterDownRegulation	String = "highFilterDownRegulation"
lowFilterDownRegulation	String = "lowFilterDownRegulation"
increasingRampRate	String = "increasingRampRate"
decreasingRampRate	String = "decreasingRampRate"
voltage	String = "voltage"

C.4 DERUnitSymbol

表 C.3 DERUnitSymbol

Table C.3 – DERUnitSymbol

DERUnitSymbol		
屬性 Attribute	資料型式 Data Type	備註 Comment
A	string = "A"	以安培為單位之電流。 Current in Ampere.
Ah	string = "Ah"	安培小時。 Ampere-hours, Ampere-hours.
As	string = "As"	安培秒(A·s)。 Ampere seconds (A·s).
Btu	string = "Btu"	能量，英國熱能單位。 Energy, British Thermal Unit.

Hz	string = "Hz"	以赫茲(1/s)為單位之頻率。 Frequency in Hertz (1/s).
V	string = "V"	以伏特(W/A)為單位之電位。 Electric potential in Volt (W/A).
VA	String = "VA"	以伏特安培為單位之視在功率(亦參照有效功率及無效功率)。 Apparent power in Volt Ampere (See also real power and reactive power.)
VAh	String = "VAh"	以伏特安培小時為單位之視在能量。 Apparent energy in Volt Ampere hours.
VAr	String = "VAr"	以無效伏特安培為單位之無效功率。電力之“無效”或“虛數”分量($V \sin(\phi)$) (亦參照有效功率及視在功率)。 Reactive power in Volt Ampere reactive. The "reactive" or "imaginary" component of electrical power ($V \sin(\phi)$). (See also real power and apparent power).
VArh	String = "VArh"	以伏特安培無效小時為單位之無效電能。 Reactive energy in Volt Ampere reactive hours.
VPerVA	String = "VPerVA"	功率因數(PF)，有效功率與視在功率之比值。 備考：IEC 表計與 EEI (ANSI)表計間用於功率因數之正負號規約(sign convention)有所不同。假設資料耗用者瞭解所使用之表計型式並同意任何給定公用事業所使用的正負號規約。 Power factor, PF, the ratio of the active power to the apparent power. Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
VperVAr	String = "VperVAr"	功率因數(PF)，有效功率與視在功率之比值。 備考：IEC 表計與 EEI (ANSI)表計間用於功率因數之正負號規約有所不同。假設資料耗用者瞭解所使用之表計

		<p>型式並同意任何給定公用事業所使用的正負號規約。</p> <p>Power factor, PF, the ratio of the active power to the apparent power.</p> <p>Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.</p>
Vh	String = "Vh"	<p>伏特小時。</p> <p>Volt-hour. Volt hours</p>
Vs	Strig = "Vs"	<p>伏特秒(Ws/A)。</p> <p>Volt second (Ws/A).</p>
W	String = "W"	<p>以瓦特為單位之實際功率(J/s)。電力可具實際分量及無效分量。電功率之實部(I^2R 或 $VI\cos(\phi)$)係以瓦特表示。</p> <p>(亦參照視在功率及無效功率。)</p> <p>Real power in Watt (J/s). Electrical power may have real and reactive components. The real portion of electrical power (I^2R or $VI\cos(\phi)$), is expressed in Watts. (See also apparent power and reactive power.)</p>
WPerA	String = "WPerA"	<p>每電流之有效功率，瓦特/安培。</p> <p>Active power per current flow, watt per Ampere</p>
WPers	String = "WPers"	<p>升載率(瓦特/秒)。</p> <p>Ramp rate in Watt per second.</p>
Wh	String = "Wh"	<p>實際能量(瓦特小時)。</p> <p>Real energy in Watt hours</p>
deg	String = "deg"	<p>以度為單位之平面角。</p> <p>Plane angle in degrees.</p>
degC	String = "degC"	<p>以攝氏度為單位之相對溫度。</p> <p>Relative temperature in degrees Celsius.</p>
h	String = "h"	<p>時間，小時=60 分鐘=3,600 秒。</p> <p>Time, hour = 60 min = 3600 s</p>
min	String = "min"	<p>時間，分鐘=60 秒。</p> <p>Time, minute = 60 s.</p>

ohm	String = "ohm"	以歐姆為單位之電阻(V/A)。 Electric resistance in ohm (V/A)
ohmPerm	String = "ohmPerm"	每米長度之電阻，以歐姆/公尺((V/A)/m)為單位。 Electric resistance per length in ohm per metre ((V/A)/m)
ohmm	String = "ohmm"	電阻率、歐姆米、(rho)。 Resistivity, Ohm metre, (rho).
onePerHz	String = "onePerHz"	頻率之倒數(1/Hz)。 Reciprocal of frequency (1/Hz)
therm	String = "therm"	能量、熱能。 Energy, Therm

C.5 FlowDirectionKind 列舉類別

C.5 FlowDirectionKind enumeration class

表 C.4 FlowDirectionKind

Table C.4 – FlowDirectionKind

計量：FlowDirectionKind (列舉) Metering: FlowDirectionKind (enumeration)	
屬性 Attribute	資料型式 Data Type
none	string = "0"
forward	string = "1"
lagging	string = "2"
leading	string = "3"
net	string = "4"
q1plusQ2	string = "q1plusQ2"
q1plusQ3	string = "q1plusQ3"
q1plusQ4	string = "q1plusQ4"
q1minusQ4	string = "q1minusQ4"
q2plusQ3	string = "q2plusQ3"
q3plusQ4	string = "q3plusQ4"

q3minusQ2	string = "q3minusQ2"
quadrant1	string = "quadrant1"
quadrant2	string = "quadrant2"
quadrant3	string = "quadrant3"
quadrant4	string = "quadrant4"
reverse	string = "reverse"
total	string = "total"
totalByPhase	string = "totalByPhase"
q5	string = "inductive"
q6	string = "capacitive"

C.6 normalOperatingPerformanceCategory 列舉類別

C.6 normalOperatingPerformanceCategory enumeration class

於 DERNamePlate 類別中使用，指示 DER 將使用哪個正常運作類別。

Used within the DERNamePlate class to indicate which normal operating category the DER will utilize.

表 C.5 normalOperatingPerformanceCategory

Table C.5 – normalOperatingPerformanceCategory

normalOperatingPerformanceCategory (列舉) normalOperatingPerformanceCategory (enumeration)	
屬性 Attribute	資料型式 Data Type
CAT A	String = "CAT A"
CAT B	String = "CAT B"

C.7 TimeIntervalKind 列舉類別

C.7 TimeIntervalKind enumeration class

於 DERGroup 預測剖繪中用以設定預測之時間全景。

Used in DERGroup forecasts profile to set the time context of a forecast.

表 C.6 TimeIntervalKind

Table C.6 – TimeIntervalKind

TimeIntervalKind (列舉)	
TimeIntervalKind (enumeration)	
屬性 Attribute	資料型式 Data Type
Y (年)	String = "Y"
M (月)	String = "M"
D (日)	String = "D"
H (小時)	String = "h"
m (分鐘)	String = "m"
s (秒)	String = "s"

C.8 UnitMultiplier 列舉類別

C.8 UnitMultiplier enumeration class

針對 CIM 所定義之單位乘數。當適用於已包含乘數之單位符號時，將使用 2 個乘數。例：

為使用單位符號 kg 交換公斤，使用“無”乘數；為交換公噸(Mg)，使用“k”乘數。

The unit multipliers defined for the CIM. When applied to unit symbols that already contain a multiplier, both multipliers are used. For example, to exchange kilograms using unit symbol of kg, one uses the "none" multiplier, to exchange metric ton (Mg), one uses the "k" multiplier.

表 C.7 UnitMultiplier

Table C.7 – UnitMultiplier

UnitMultiplier		
屬性 Attribute	資料型式 Data Type	備註 Comment
E	string = "E"	艾(Exa , 10 ¹⁸)
G	string = "G"	吉(Giga , 10 ⁹)
M	string = "M"	百萬(Mega , 10 ⁶)
P	string = "P"	拍(Peta , 10 ¹⁵)
T	string = "T"	兆(Tera , 10 ¹²)

Y	string = "Y"	佑(Yotta , 10^{24})
Z	string = "Z"	皆(Zetta , 10^{21})
a	string = "a"	阿(Atto , 10^{-18})
c	string = "c"	厘(Centi , 10^{-2})
d	string = "d"	分(Deci , 10^{-1})
da	string = "da"	十(Deca , 10^1)
f	string = "f"	飛(Femto , 10^{-15})
h	string = "h"	百(Hecto , 10^2)
k	string = "k"	千(Kilo , 10^3)
m	string = "m"	毫(Milli , 10^{-3})
micro	string = "micro"	微(Micro , 10^{-6})
n	string = "n"	奈(Nano , 10^{-9})
none	string = "none"	無(無乘數) None (No multiplier)
p	string = "p"	皮(Pico , 10^{-12})
y	string = "y"	攸(Yocto , 10^{-24})
z	string = "z"	介(Zepto , 10^{-21})

相對應國際標準

IEC 61968-5:2020, Application integration at electric utilities - System interfaces for distribution management - Part 5: Distributed energy optimization

名詞對照

C

capability	容量；能力
common information model, CIM	共同資訊模型
constraints	限制事項

D

distributed energy resource, DER	分散式能源
distribution management system, DMS	配電管理系統
distribution network protocol, DNP	配電網路協定

E

edge system	邊緣系統
event stereotype message	事件延伸模板型訊息

I

interest group	關注群組
inverter	變流器

M

membership	成員資格
meter	表計
metering package	計量套件

O

on-load tap changing transformer, LTC	有載分接頭切換變壓器
open field message bus, OpenFMB	開放場域訊息匯流排
operator	運作者；營運者

R

ramp rate	升載率
requirements	要求事項
S	
settings	設定值
sign convention	正負號規約
smart inverter	智慧變流器