

Taiwan Power Research Institute



IEC 61850標準之推廣應用

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於電腦公會B102會議室

2015.11.18



台灣電力公司

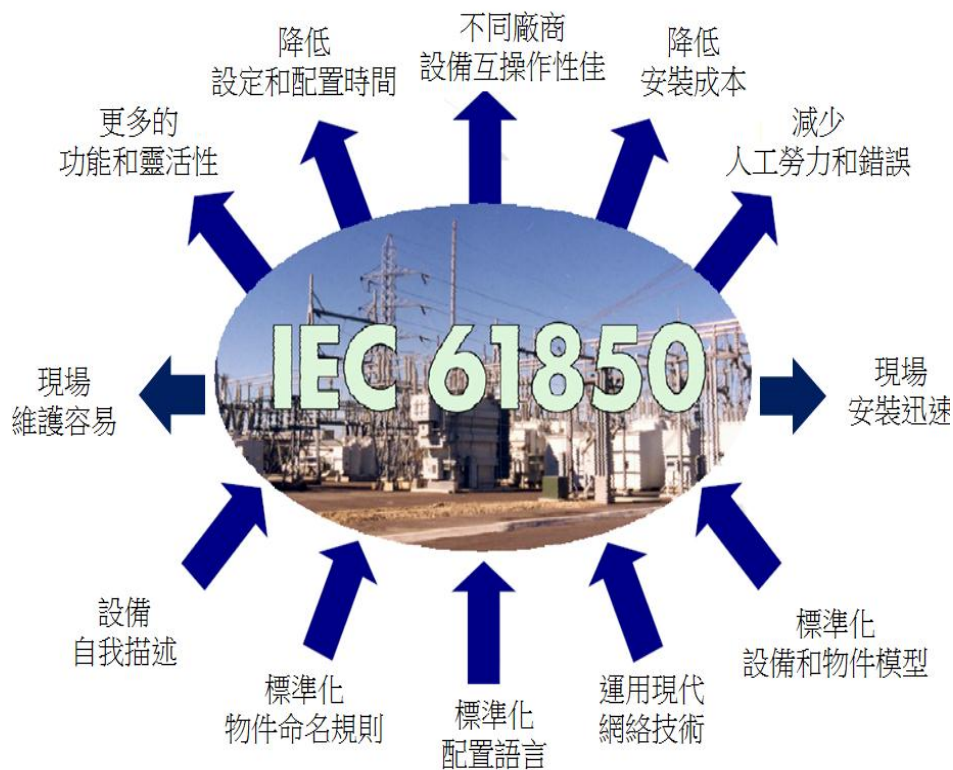
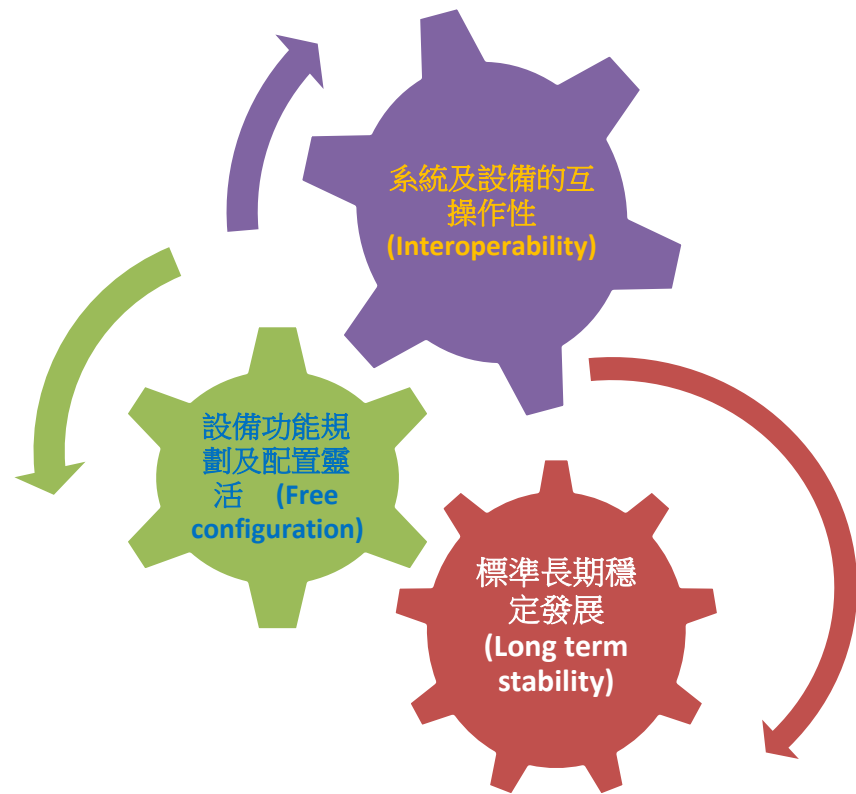


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1. 前言
2. IEC 61850標準最新發展
3. 推廣需要標準產品及系統
4. 推廣應用看法及作法

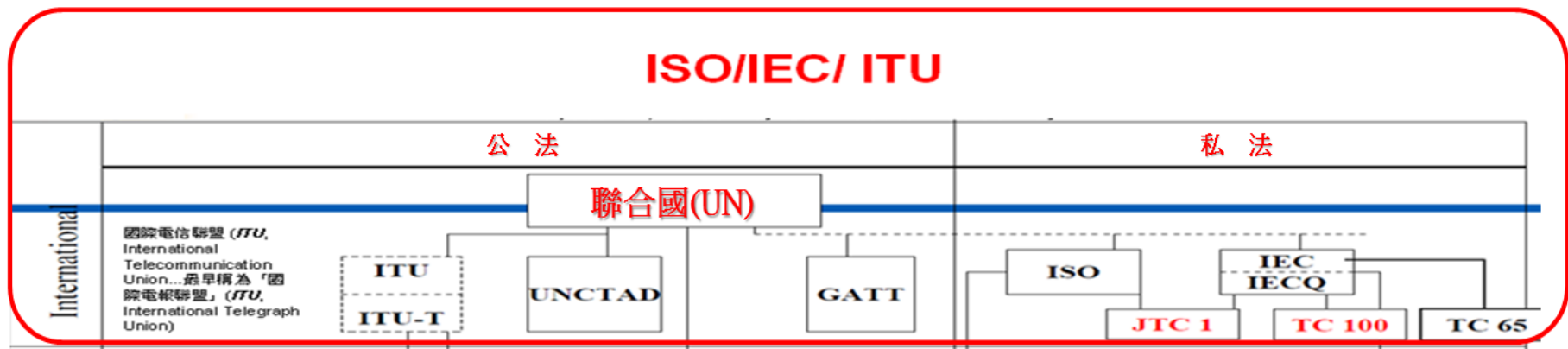
1.(1) 為何推廣IEC 61850標準

具有許多具體的優點及效益



1.(1) 為何推廣IEC 61850標準

由IEC制定具公正性、長久性、互通性



由最高位階標準訂定單位IEC所訂定

GATT (General Agreement on Tariffs and Trade - 關稅暨貿易總協定)

UNCTAD (United Nations Conference on Trade and Development-聯合國貿易和發展會議)

International Standards (ISO, IEC, ITU)

Regional Standards (CEN, CENELEC)

National Standards (ANSI, IEEE, CNS, JIS)

Industry Standards - formalized practice

Industry Practice - informal practice(準則)

Proprietary Systems - vendor specific

1.(1) 為何推廣IEC 61850標準

公認的智慧型電網重要核心標準之一

The screenshot shows the IEC website's 'Core IEC Standards' page for Smart Grid. The page features a navigation menu at the top with links like 'myIEC', 'Subscribe', 'Sitemap', 'FAQs', and 'Contact us'. Below the menu, there are navigation tabs for 'You & the IEC', 'About the IEC', 'News & views', 'Standards development', 'Conformity assessment', 'Members & experts', 'Developing countries', 'Webstore', and a search bar. The main content area is titled 'Core IEC Standards' and includes a 'Download' button for a 424 kB file. A list of standards is provided, with 'IEC 61850: Power Utility Automation' highlighted by a red dashed box. Other standards listed include IEC/TR 62357: Service Oriented Architecture (SAO), IEC 61970: Common Information Model (CIM) / Energy Management, IEC 61968: Common Information Model (CIM) / Distribution Management, IEC 62351: Security, IEC 62056: Data exchange for meter reading, tariff and load control, and IEC 61508: Functional safety of electrical/electronic/programmable electronic safety-related systems.

International Electrotechnical Commission
International Standards and Conformity Assessment for all electrical, electronic and related technologies

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You & the IEC | About the IEC | News & views | Standards development | Conformity assessment | Members & experts | Developing countries | Webstore | Search... | Advanced search

About the IEC > What we do > Technology sectors > **Smart Grid**

Smart Grid

Optimal electricity delivery

Smart Grid Standards Map

World Smart Grid Forum

Roadmap

Insights

IEC Standards

Background

Challenges

Development

Core IEC Standards

Over 100 IEC Standards have been identified as relevant to the Smart Grid. Below is a list of the core standards. The complete list of IEC Standards (by importance and relevant application) is available for download.

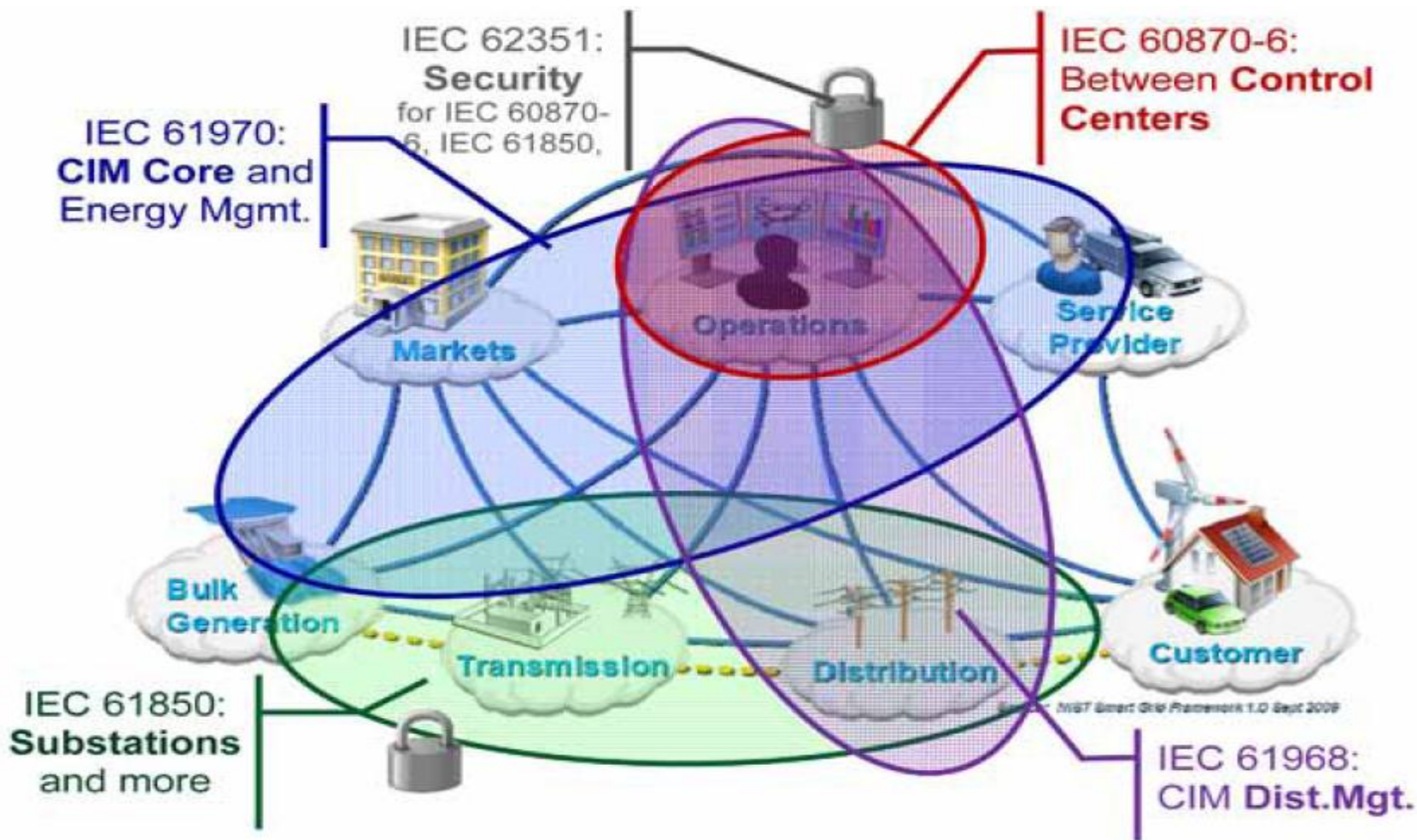
Download 424 kB

- IEC/TR 62357: Service Oriented Architecture (SAO)
- IEC 61970: Common Information Model (CIM) / Energy Management
- IEC 61850: Power Utility Automation**
- IEC 61968: Common Information Model (CIM) / Distribution Management
- IEC 62351: Security
- IEC 62056: Data exchange for meter reading, tariff and load control
- IEC 61508: Functional safety of electrical/electronic/programmable electronic safety-related systems

1.(1) 為何推廣IEC 61850標準

智慧變電所唯一選擇

Standards that Have Been Recommended to FERC by NIST



1.(2)推廣緣起

- 配合行政院核定智慧電網總體規劃(國家分工)
- 台電智慧電網規劃-引進IEC 61850標準
- 先從先導型變電所建置，再逐步推廣應用



1.(3)IEC 61850智慧變電所

智慧變電所

通訊標準統一適合未來智慧電網整合
維護簡單及建置容易
...許多優點



傳統變電所

通訊協定太多不易整合到未來智慧電網
監控線路繁雜維護及建置高
...許多缺點



2.(1)已公布(出版)之最新IEC 61850

- IEC/TR 61850-1 ed2.0
- IEC/TS 61850-2 ed1.0
- IEC 61850-3 ed2.0
- IEC 61850-4 ed2.0
- IEC 61850-5 ed2.0

IEC 61850-8-1 ed2.0
IEC 61850-9-2 ed2.0
IEC/PAS 61850-9-3 ed1.0
IEC 61850-10 ed2.0

IEC/IS IEC/TS,
IEC/TR,IEC/PAS

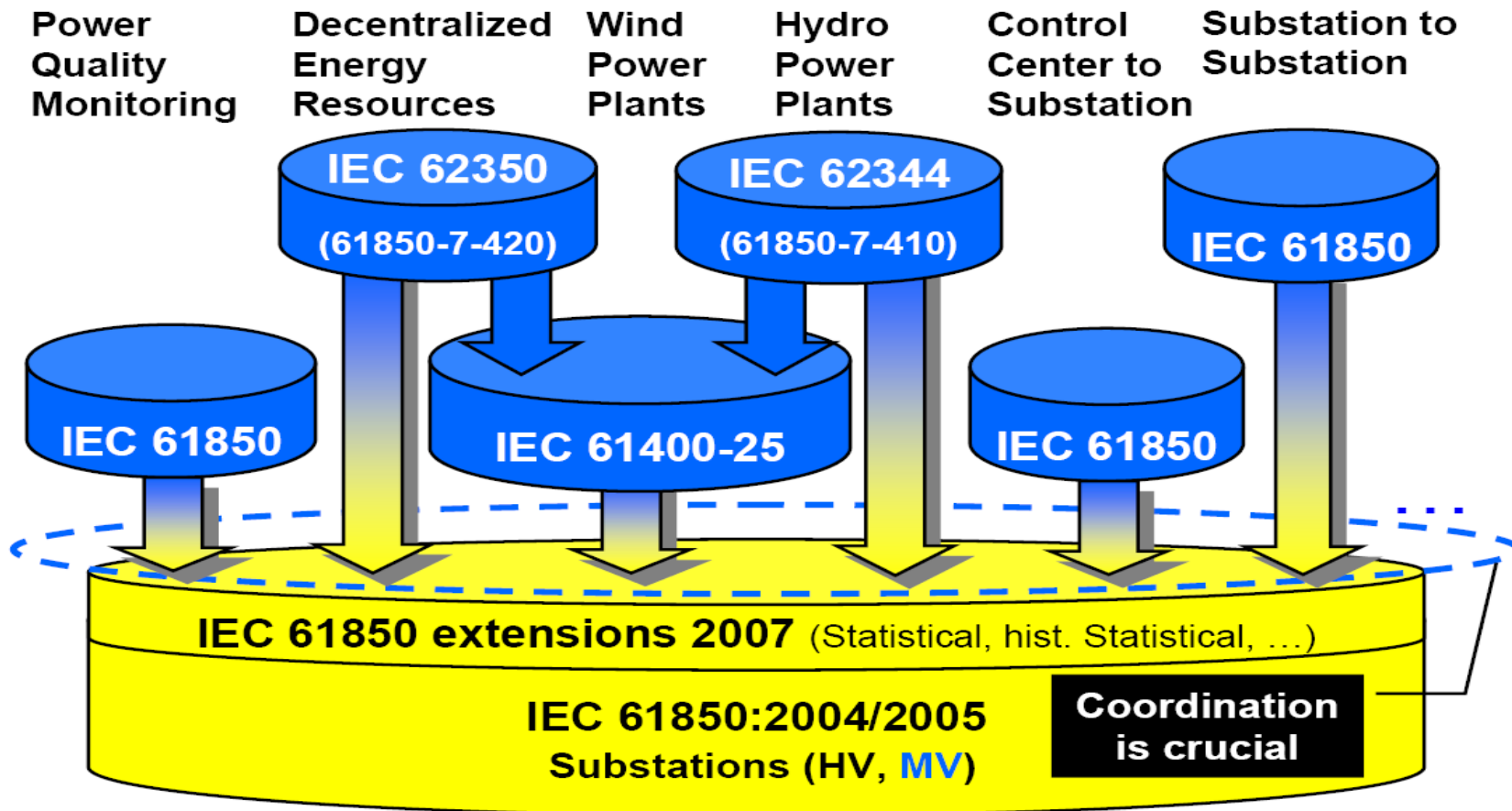
IEC 61850-6 ed2.0
IEC 61850-7-1 ed2.0
IEC 61850-7-2 ed2.0
IEC 61850-7-3 ed2.0
IEC 61850-7-4 ed2.0
IEC 61850-7-410 ed2.0
IEC 61850-7-420 ed1.0
IEC/TR 61850-7-510 ed1.0

IEC/TS 61850-80-1 ed1.0
IEC/TR 61850-80-3 ed1.0
IEC/TR 61850-90-1 ed1.0
IEC/TR 61850-90-4 ed1.0
IEC/TR 61850-90-5 ed1.0
IEC/TR 61850-90-7 ed1.0
IEC/TR 61850-90-12 ed1.0

2.(1)現有標準年份及Part名稱

- [IEC TR 61850-1:2013](#) Introduction and overview
- [IEC TS 61850-2:2003](#) Communication networks and systems in substations - Part 2: Glossary
- [IEC 61850-3:2013](#) General requirements
- [IEC 61850-4:2011](#) System and project management
- [IEC 61850-5:2013](#) Communication requirements for functions and device models
- [IEC 61850-6:2009](#) Configuration description language for communication in electrical substations related to IEDs
- [IEC 61850-7-1:2011](#) Basic communication structure - Principles and models
- [IEC 61850-7-2:2010](#) Basic information and communication structure - Abstract communication service interface (ACSI)
- [IEC 61850-7-3:2010](#) Basic communication structure - Common data classes
- [IEC 61850-7-4:2010](#) Basic communication structure - Compatible logical node classes and data object classes
- [IEC 61850-7-410:2012](#) Basic communication structure - Hydroelectric power plants - Communication for monitoring and control
- [IEC 61850-7-420:2009](#) Basic communication structure - Distributed energy resources logical nodes
- [IEC TR 61850-7-510:2012](#) Basic communication structure - Hydroelectric power plants - Modelling concepts and guidelines
- [IEC 61850-8-1:2011](#) Specific communication service mapping (SCSM) - Mappings to MMS (ISO 9506-1 and ISO 9506-2) and to ISO/IEC 8802-3
- [IEC 61850-9-2:2011](#) Specific communication service mapping (SCSM) - Sampled values over ISO/IEC 8802-3
- [IEC PAS 61850-9-3:2015](#) Precision time protocol profile for power utility automation
- [IEC 61850-10:2012](#) Conformance testing
- [IEC TS 61850-80-1:2008](#) Guideline to exchanging information from a CDC-based data model using IEC 60870-5-101 or IEC 60870-5-104
- [IEC TS 61850-80-3:2015](#) Mapping to web protocols – Requirements and technical choices
- [IEC TR 61850-90-1:2010](#) Use of IEC 61850 for the communication between substations
- [IEC TR 61850-90-4:2013](#) Network engineering guidelines
- [IEC TR 61850-90-5:2012](#) Use of IEC 61850 to transmit synchrophasor information according to IEEE C37.118
- [IEC TR 61850-90-7:2013](#) Object models for power converters in distributed energy resources (DER) systems
- [IEC TR 61850-90-12:2015](#) Part 90-12: Wide area network engineering guidelines

2.(2) 涵蓋再生能源資訊通訊標準



- IEC 61860標準可擴充及重複使用
- 涵蓋水、風力及太陽能等分散式再生能源資訊通訊標準

2.(2) IEC 61400-25標準最新發展

標準	名稱 Wind turbines - Part 25-x: Communications for monitoring and control of wind power plants -	目前 狀態	出版或 預計出 版日期
IEC61400-25-1 Ed. 1.0	Overall description of principles and models	IS	2006-12
IEC61400-25-1 Ed. 2.0	Overall description of principles and models	AMW	2016-11
IEC61400-25-2 Ed. 1.0	Information models-	IS	2006-12
IEC61400-25-2 Ed. 2.0	Information models	IS	2015-06
IEC61400-25-3 Ed. 1.0	Information exchange models-	IS	2006-12
IEC61400-25-3 Ed. 2.0(RLV)	Information exchange models	IS	2015-06
IEC61400-25-4 Ed. 1.0	Mapping to communication profile	IS	2008-09
IEC61400-25-4 Ed. 2.0	Mapping to communication profile	CCDV	2016-06
IEC61400-25-5 Ed. 1.0	Conformance testing	IS	2006-12
IEC61400-25-5 Ed. 2.0	Conformance testing	AMW	2016-11
IEC61400-25-6 Ed. 1.0	Logical node classes and data classes for condition monitoring	IS	2010-11
IEC61400-25-6 Ed. 2.0	Logical node classes and data classes for condition monitoring	AMW	2015-11

IEC/TS 61400-25-41: Mapping to communication profile based on IEC 62541 (OPC UA) Rejected (proposed on 2015-5)
2015-10-09: The NP was finally accepted due to a late appointment of two additional experts from two additional countries.

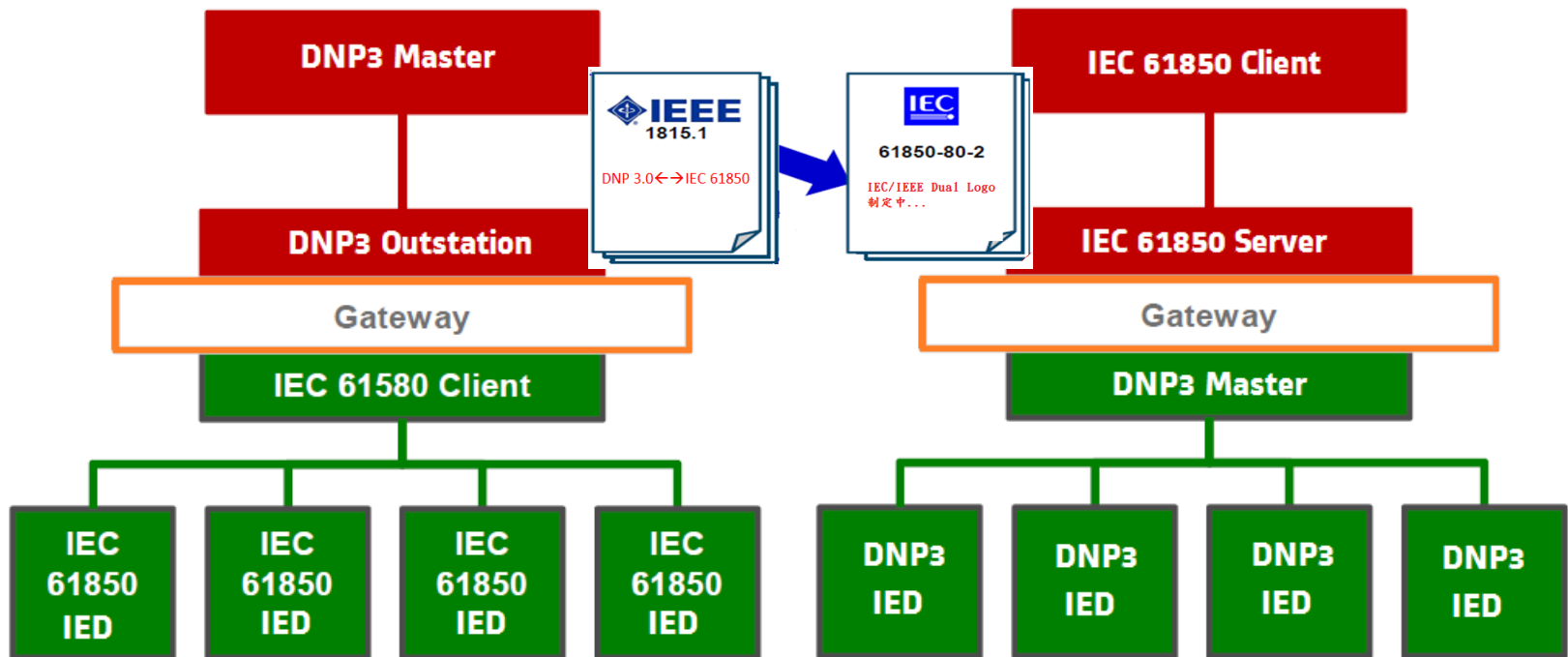
2.(3)IEC 61850標準擴充延伸說明

IEC 61850與電業各單位息息相關
涵蓋發輸配用戶再生處調度處修護處...

IEC 61850 電業 自動 化 標準 延伸 至 公司 許多 相關 單位 業務	...			
	7	410	水力	發
		420	分散式能源 DER	再生處
	8	2	Web Service	
	9	3	電力系統 PTP Profile	系統穩定
	80	2	與 DNP 3.0 間之 Mapping	新舊變電所
		4	轉換 COSEM(IEC 62056)	配 AMI
		5	與 Modbus Mapping	
		...		
	90	2	控制中心	階層調度
		3	狀態監測	修護處
		5	PMU 資訊傳輸	系統穩定
		6	配電自動化 DA	配
		7	PV、儲能及其他 DER INVTs	再生處
		8	電動車充電物件模型	配
		9	電池儲能	
		10	DER 排程	DR
		12	WAN 工程指引	通訊處
		13	Steam and gas turbines	發
		14	FACTS 資料模型	系統穩定
	...			

2.(3)IEC 61850標準擴充延伸例

過渡時期之調適 既有DNP3變電所與IEC 61850變電所 IEC 61850-80-2/IEEE 1815.1



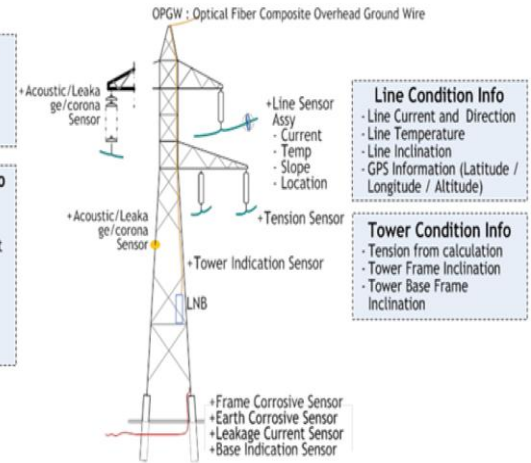
2.(3)IEC 61850標準擴充延伸例

IEC 61850-90-3 CM(狀態監視)

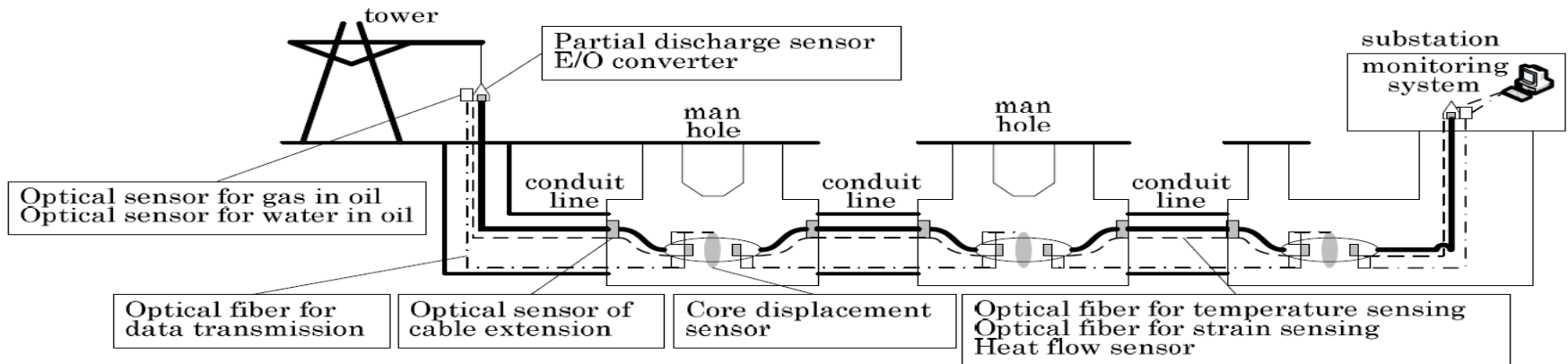
- Transformers, LTCs
- GIS
- Lines, UG cables
- Sta. batteries



- Insulator Condition Info**
 - Corona
 - Leak Current
 - Acoustic
- Meteorological Info**
 - Wind Velocity and Direction
 - Humidity and Ambient Temperature
 - Rain fall
 - Snowfall
 - Sunshine
 - Salt

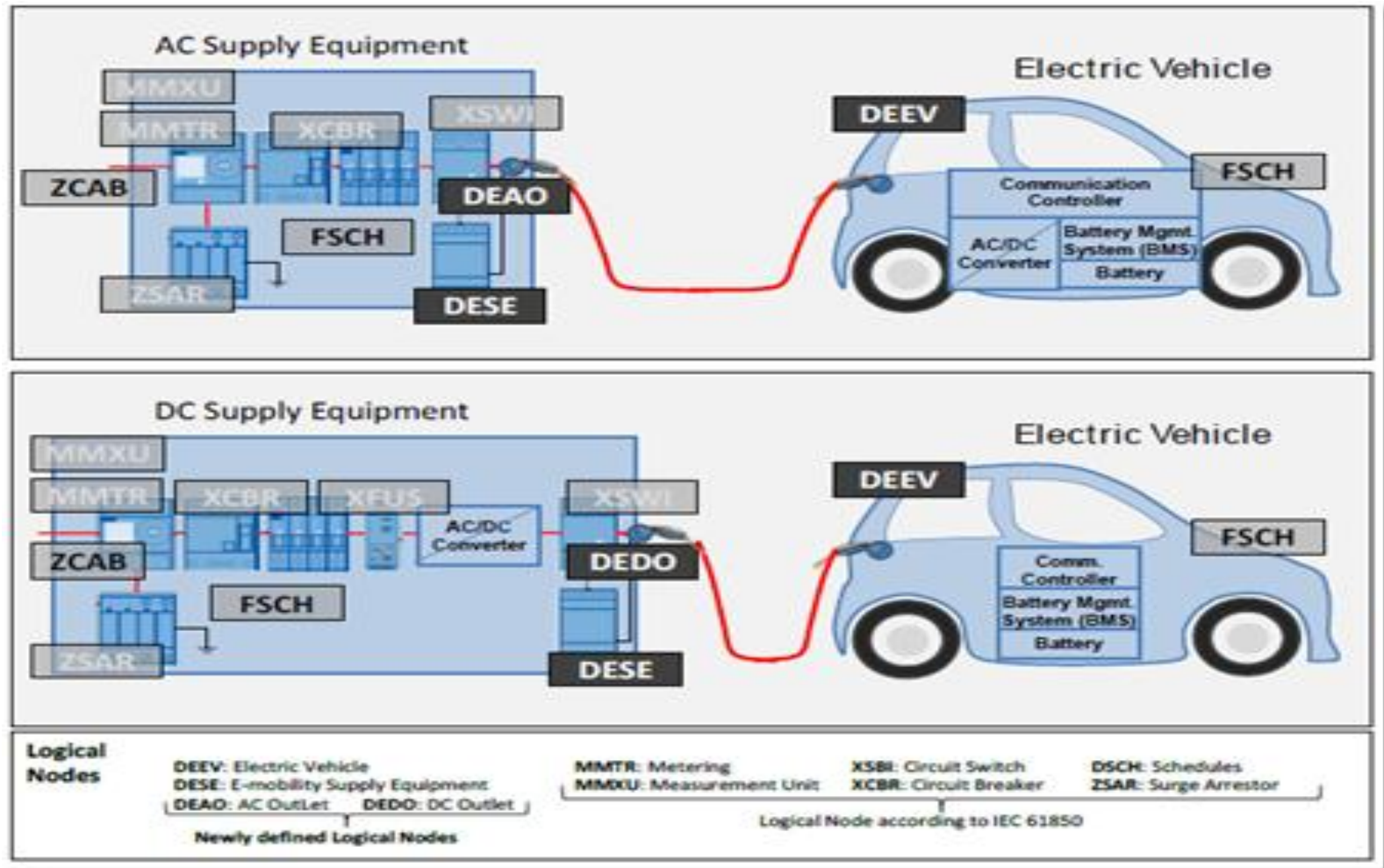


- Line Condition Info**
 - Line Current and Direction
 - Line Temperature
 - Line Inclination
 - GPS Information (Latitude / Longitude / Altitude)
- Tower Condition Info**
 - Tension from calculation
 - Tower Frame Inclination
 - Tower Base Frame Inclination



2.(3)IEC 61850標準擴充延伸例

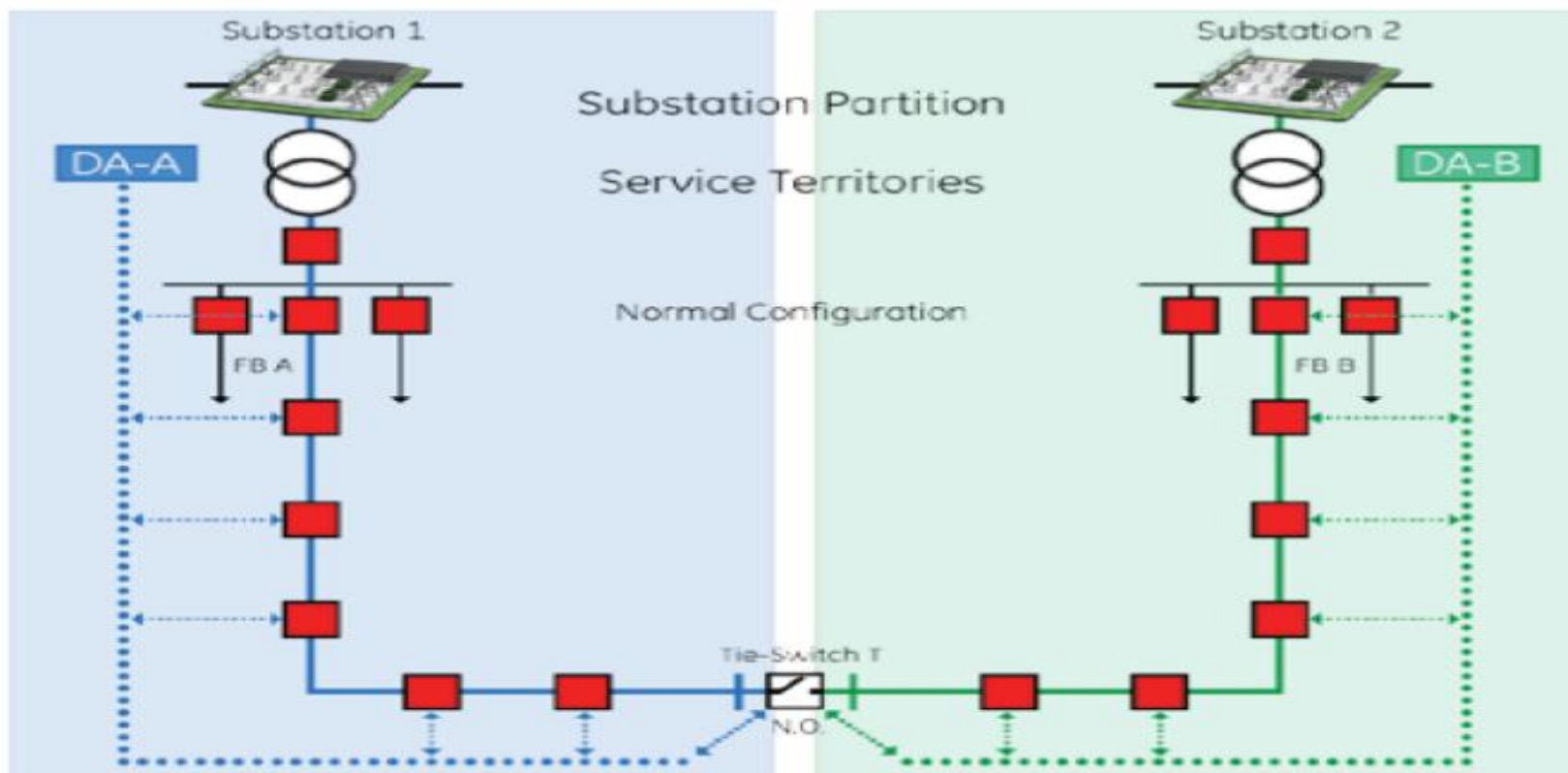
IEC 61850-90-8電動車充電系統模型



摘自Netted Automation GmbH

2.(3)IEC 61850標準擴充延伸例

IEC 61850-90-6 DA(配電自動化)



DA:DSCADA / FLISR / VVC...

配電自動化:配電SCADA/饋線故障位置檢出故障隔離與服務恢復/
饋線電壓無效功率控制/...

3.(1)採用認證過之標準產品及系統

- 對不同廠商互通性提供基本的保障
- 品質保障因素考量
- IEC 61850-10標準/UCAIug
- 新版及A級認證設備或系統

3.(2) 認證機構及可用之產品系統

有哪些UCAIug許可認證機構

Tester	Level
ABB Switzerland Ltd	Level B: Server Ed1 And GOOSE Performance
ALSTOM GRID UK LTD Substation Automation Solutions	Level B: Server Ed1/Ed2
Central Power Research Institute (CPRI), Bangalore, India	Level A: Server Ed1
DNVGL Nederland	Level A: Server/Client Ed1/Ed2, GOOSE Perf. And 9-2LE
Korea Electrotechnology Research Institute (KERI)	Level A: Server Ed1/Ed2 And Client Ed1
Korea Testing Laboratory (KTL) Seoul, Korea	Level A: Client Ed1
NARI-RELAYS Electric Co., Ltd. Nanjing, China	Level B: Server Ed1
Schneider Electric Shanghai, China	Level B: Server Ed1/Ed2
TUV Rheinland Industrie Service GmbH, Cologne	Level B: Server Ed1
TUV SUD Munich, Germany	Level A: Server/Client Ed1/Ed2 And 9-2LE
Xuchang KETOP Testing Technology Co., Ltd, Henan, China	Level A: Server Ed1 And 9-2LE

有哪些可用標準產品及系統

Edition 2 Client Systems
Edition 1 Client Systems

Edition 2 Server Devices
Edition 1 Server Devices

GOOSE Performance
Edition 1 Sampled Value Publishers
(Merging Units)

Ethernet Switches

目前 約有600 IEC 61850認證產品
(引述自29 Oct 2015 - Netted Automation GmbH)

喜歡用哪家認證產品?

3.(2) 尋找可用之標準產品及系統

以KEMA為例

DNV-GL

TEST REGISTER FOR IEC 61850

June 2015

- Edition 2 Client Systems
- Edition 1 Client Systems
- Edition 2 Server Devices
- Edition 1 Server Devices
- GOOSE Performance
- Edition 1 Sampled Value Publishers (Merging Units)
- Ethernet Switches

KEMA

IEC 61850 Test Register

Test Register for

- IEC 61850 Ed1 Client Systems
- IEC 61850 Ed1 Server Devices
- IEC 61850 Ed1 Sampled Value Publishers (Merging Units)
- IEC 61850 Ethernet Switches

Updated: February 6, 2013

IEC 61850 Test Register

IEC 61850 Test Register for

- Ed.1 Client Systems
- Ed.2 Server Devices
- Ed.1 Server Devices
- GOOSE Performance
- Ed.1 Sampled Value Publishers (Merging Units)
- Ethernet Switches

Updated: August 28, 2014

3.(2) 從認證文件找設備或細部規格

PICS *Protocol Implementation Conformance Statement:*
Which Communication services are supported ...


PIXIT *Protocol Implementation Conformance
Extra Information for Testing:*
Restrictions and Limitations found in a device ...


MICS *Model Implementation Conformance Statement:*
Models supported ...


TICS *Tissue Implementation Conformance Statement:*
Which tissues have been
implemented: www.tissue.iec61850.com


SICS *SCL Implementation Conformance Statement:*
Which aspects of SCL have been implemented in a
Tool


New


 13-1397_ElipsePower_Client_Certificate.pdf

 13-1398 Elipse Power Test report.pdf

 Elipse IEC 61850 Client Driver MICS.pdf

 Elipse IEC 61850 Client Driver PICS.pdf

 Elipse IEC 61850 Client Driver PIXIT.pdf

 Elipse IEC 61850 Client Driver TICS.pdf

設備或系統除了要具認證證書外，為使用者對廠商之設備或系統之能力有更明確的了解，也可請廠商提供其送認證單位審查之 PICS、PIXIT、MICS、TICS、SICS 文件。

IEC 61850 Edition 2 – New feature
SCL implementation conformance statement (SICS)

4.(1)推廣應用之未來效益

A.降低公司營運成本

A)降低新購設備及系統成本、備品庫存成本：

標準化產品設備系統廠商來源多

B)降低系統建置、施工、變電所空間土地成本：

MU系統之使用，線路及設備空間縮小

C)降低規劃、運轉、訓練、維護等人力成本：

系統規劃、測試等工具採單一統一標準

D)降低工安成本：現場施工維護較簡單

E)降低配合未來整體智慧電網建置成本：

IEC將IEC61850與智慧電網其他領域標準運用之互通性列為重點項目

4.(1)推廣應用之未來效益

B.強化電力系統

A)提高電力運維效率：

因IEC 61850標準之量測、監視、控制、保護規劃、實作、及變更彈性大。

B)提高系統品質穩定：

因設備及系統認證系統完善公開，
容易與PMU、FACTS、DA等系統結合運用。

C)提高系統效能：

監視控制再生能源應用之管理與應用-包含水風分散式能源。

D)提高系統安全：

IEC 61850應用IEC 62351安全機制。

E)適應未來智慧電網需求：

不同領域(發、輸、配、用戶、市場、操作、服務)系統整合應用容易。

4.(1)推廣應用之未來效益

C. 繁榮產業、振興經濟

A) 帶動電力自動化軟體產業升級：

Client端SCADA軟體、設備模擬軟體、規劃軟體、測試軟體...

B) 帶動變電所一次設備產業升級：

如變壓器廠商、斷路器廠商、...

C) 帶動變電所二次設備產業升級

如IED、MU、Power Meter、RTU、PLC、IPC或控制器產業升級

D) 帶動變電所通訊設備產業

E) 帶動測試驗證認證產業

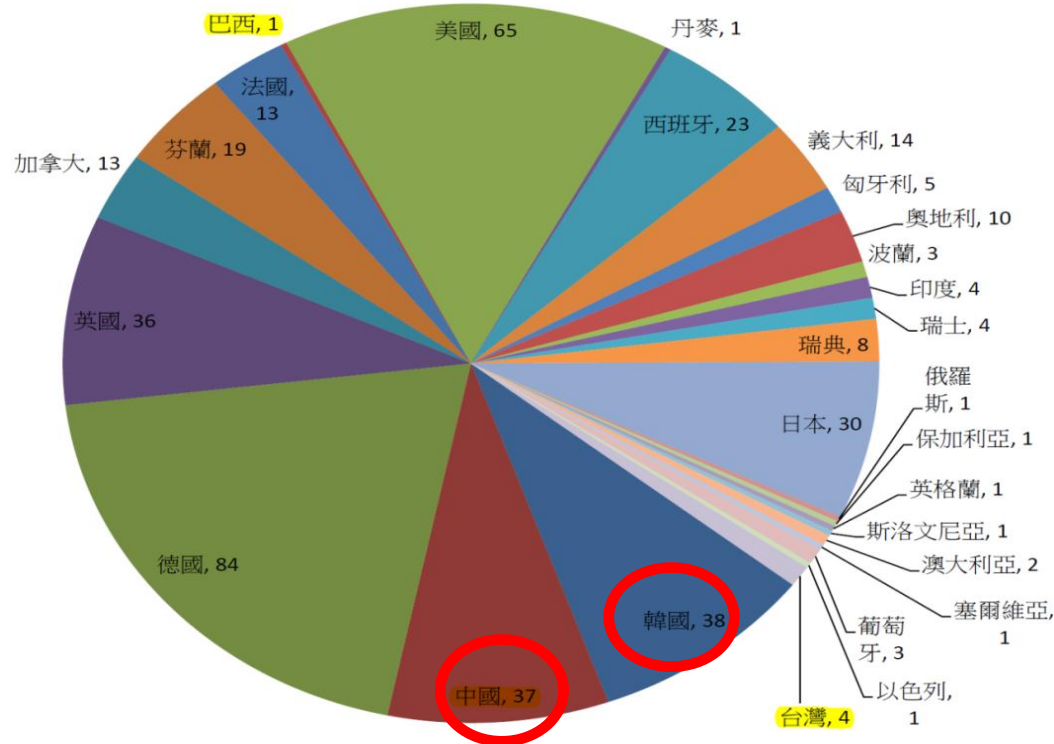
F) 帶動IC產業，電力電子產業等...

4.(2)世界主要國家應用現況例

各國都重視IEC 61850產業發展 電業升級→產業繁榮→經濟振興

Ed.1 Client Systems
Ed.2 Server Devices
Ed.1 Server Devices
GOOSE Performance
Ed.1 Sampled Value Publishers (Merging Units)
Ethernet Switches

DNV-KEMA認證 IEC61850設備/系統統計



統計根據:

IEC 61850 Test Register

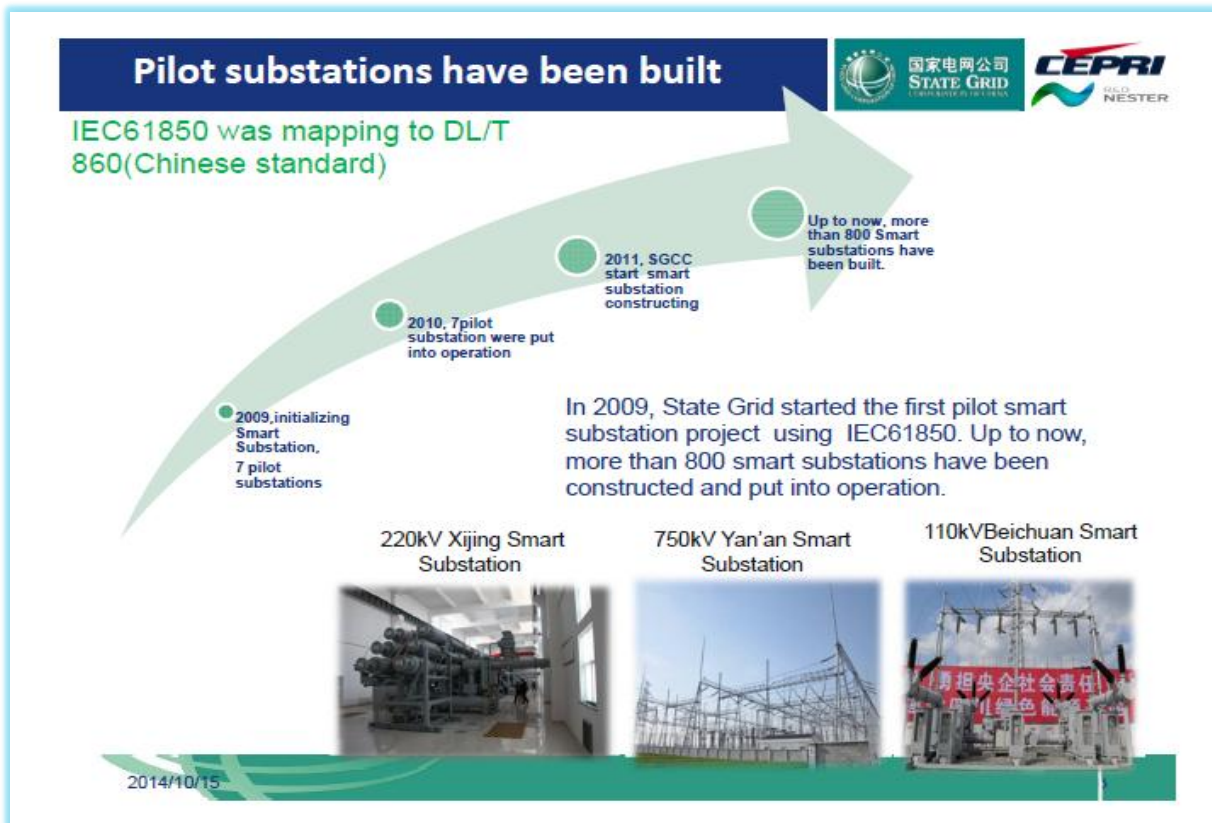


August 28, 2014

4.(2)世界主要國家應用現況例

中國大陸智慧變電所之發展

DL/T860 → 2009-2014(800所) → 2015以後(6000所)



The Data Acquisition in Smart Substation of China: According to the experience of the pilot project of smart substation of China, the smart substation will be constructed in large-scale in China and the plan that 6000 smart substations will be constructed in China until 2015 is published by the State Grid Corporation of China.

4.(3) 推廣應用作法

現階段-先導型系統進一步測試應用

- 先導型智慧變電所設備擴增多廠家互通性測試
- 先導型智慧變電所系統功能、可靠度及效能測試
- 先導型智慧變電所設備校時系統及對事故資料整合應用
- 先導型不同智慧變電所間之線路保護功能應用
- 智慧電網智慧變電所資通安全測試研究
- 先導型電廠智慧化變電所與風廠資訊智慧化整合應用
- ...

未來-其他擴充標準之應用

- IEC 61850其他擴充標準之應用
- 智慧電網其他領域標準整合應用
- ...

簡報完畢
敬請指教