

Enhanced Information and Data Exchange to Enable Future TSO-DSO Coordination and Interoperability CIGRE JWG D2/C2.48

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Enhanced Information and Data Exchange

- Common Information Model (CIM)
- Fundamentals of CIM
- CIM Adoption
- Benefits of CIM



Common Information Model (CIM)

- Started in the US as project by the Electric Power Research Institute (EPRI) as Control Centre API (CCAPI)
- Adopted by International Electrotechnical Commission (IEC)
 - Standardised as IEC 61970-301 that is now developed by IEC Technical Committee TC57 Working Group 13
 - Standard defines "Software interfaces for operation and planning of the electric grid" as a series of packages and classes in the Unified Modelling Language (UML)
 - CIM now represents a wide series of related IEC standards as developed by multiple TC57 WGs

Smart Grid Architecture Model (SGAM)

- CENELEC/IEC
- Standardised Reference Layer Architecture
- Business and Function Layer Based Use Cases
- Wide range of whole system use cases: online & offline



Layered Reference Architecture

IEC TC57 62357-1 Power Systems & Information Exchanges Reference Architecture



CIM Adoption: Use Cases & Profiles



Formal Use Case Definition

IEC SyC Smart Energy - 62913 & 62559 series



TSO-DSO Business & System Use Cases

BUSINESS USE CASES

BUC 1 - Activation of DSO-connected resources for balancing purposes In market environment

BUC 2 - Coordination of distributed flexibility services in a marketplace

BUC 3/4 - Optimize active power management for congestion management purposes

BUC 5/6 - Optimize reactive power management for voltage control purposes

BUC 7 - Coordination of operational planning activities between TSO and DSO

BUC 8(1) - Optimise work programmes (TSO, DSO and SGUs)

BUC 8(2) - Coordination between TSO and DSO for distribution network reconfiguration

BUC 9 - Coordination of long-term network planning between TSO and DSO

BUC 10 - Improve system real-time supervision and control through better coordination (TSO, DSO and SGUs)

BUC 11 - Improve fault location close to the TSO-DSO interface

	SYSTEM USE CASES				
\rightarrow	Market Pre-qualification]←		\rightarrow	
	Market Offering]←		\rightarrow	
$ \rightarrow$	Market Services Activation]←		\rightarrow	E
	Contribution of DSO to voltage regulation]←		\rightarrow	for
/_	Disaggregated production and generation forecast in different network bus	┝		\rightarrow	e plat
1	Exchange short circuit levels at bay level for the next 24hours	┝		\rightarrow	orativ
A	Definition of activation levers and network equipment operation allowing the works programmes	┝		\rightarrow	ollab
7	Validation of works programmes]←		\rightarrow	a c
F 	Definition of annual optimal scheduling of works with impact in observability area	┝		\rightarrow	using
>	Process a HV/MV substation use limit (Smax) request]←		\rightarrow	Эĝ
\longrightarrow	Process a MV network reconfiguration request]←			har
\rightarrow	Definition of historical profiles disaggregated by type of consumption and generation	┝		\rightarrow	n exc
\rightarrow	Definition of representative network equivalent in observability area	┝	7		matic
\searrow	Update of Network models representation	}←		\rightarrow	lfor
Z	Network model validation]←		\rightarrow	<u>_</u>
	Real time supervision]←		\rightarrow	
\rightarrow	Improve fault location close to the TSO-DSO interface	}←		\rightarrow	

Introduction to CGMES

Common Grid Model Exchange Specification (CGMES v2.4.15)

A **CIM profile group** developed by ENTSO-E, for the exchange of operational and grid planning data among TSOs

Contains **various CIM profiles** for e.g. equipment, topology, input for load flows, load flow results, geographic data, etc.

CIM and CGMES are focused upon as **standardized data formats** that TSOs and DSOs could extend and adopt for data exchange

Develop and propose **CGMES extensions** such that information **Business Objects** in **TSO-DSO Use Cases** can be expressed in CGMES

CGMES extension method



1.For selected **Business Objects (BO)**, a CGMES **sub-profile** is derived.

2.If sub-profile cannot contain all Business Object data, a CGMES **extension** is proposed.

3.The proposal is presented to CGMES related working groups and developers

CIM profiles based on ESMP (European Style Market Profiles)

BUC 2 - Coordination of distributed flexibility services in a marketplace

Scope:

- Validation of TSO/DSO coordination mechanism to distributed flexibility resources procurement avoiding double or counter activation of the same flexibility resource by TSO and DSO
- Prevent the negative impact of offers activation in the networks
- Definition of the data that should exchange between the TSO, the DSO and the market operator.

Planned UK Regulatory Adoption of CIM: OFGEM

Overarching Aim: Enable competition and innovation, which drive down prices and result in new products and services.										
Ensure data can be used as strategic asset. Deliver a net-zero economy, at the lowest cost to consumers	Infrastructure and Asset Visibility. Revealing system assets and infrastructure, where they are located and their capabilities, to inform system planning and management.	Support digitalisation and data exchange. Enabling cheaper/faster market participation, improved planning and coordination and innovation.	Data Visibility Understanding the data that exists, the data that is missing, which datasets are important, and making it easier to access and understand data.							

The regulator's priority is to consumers. The goal is to stimulate regulated networks to digitalise, driving consumer benefits. The volume and complexity of data needed from DNOs to network users to drive these benefits, exceeds what can be shared with current data format.

Planned UK Regulatory Adoption of CIM: OFGEM

Parties exchanging data	DNO -> ESO	ESO -> DNOs	DNOs to market Participants		
Data/Document names	Week 24/50 data exchange	Week 42 data exchange	LTDS, NDP, DFES, Best View Scenario		
Brief Description	Details of the sub transmission network inc. DER effects on energy flows at cardinal points.	Data describing the transmission system at switch level. Includes fault level, peak demand etc.	Planning data and network information for those looking to connect to the network.		
Current exchange format	Exported from DNO systems in Excel, converted to CIM for ESO data ingestion.	Exported from ESO system in CIM, converted to Excel for DNO data ingestion.	Excel		
Future challenges	Increasing data complexity, volumes, and exchange frequency.	Increasing data complexity, volumes, and exchange frequency.	Demand for Planning data is ever increasing as market participants look to optimise business models.		

Planned UK Regulatory Adoption of CIM: LTDS

The <u>Long Term Development Statement (LTDS)</u> was designed to share high value planning data that would provide stakeholders with information for connecting to the Distribution networks.

So, what is the LTDS?

- The LTDS gives a 0-5 year view of planned network changes,
- It is published annually by each DNO.
- It gives a summary report describing the design and operation of the network.
- Information on planned developments that have secured finance.
- Detailed technical information for 132 kV and 33kV EHV networks including schematics, load, transformer data, fault level, generation, circuit data etc.

And what is wrong with it?

- Technical data is shared in an 11 year old MS excel spreadsheet template.
- Its very inaccessible, requiring registration.
- When it was designed flexibility markets were not anticipated.
- It does not meet the needs of present users.

Benefits of CIM

Digitalisation and Virtualisation of Energy Systems

- Information and data requirements are evolving rapidly across the energy sector
- Effective end-to-end use of information and data can provide valuable insight for consumers, system operators and energy market actors

Interoperability Benefits of CIM

Whole Energy System Operation and Management

- Enables interoperability across whole energy systems
- Interoperability with and across enterprises
- Supports optimum decarbonisation of whole energy systems
- Enables scalable and secure integration of Renewable Energy Sources



TDX-ASSIST

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