buildingSMART International

Activity Proposal

Project Name:

Defining openBIM-based Workflows and Exchanges for High Voltage Power Transmission and Distribution Projects

AKA "openBIM for HV Power"

General Information

Room Governance:

Infrastructure Domain (ID)

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1 GLOSSARY

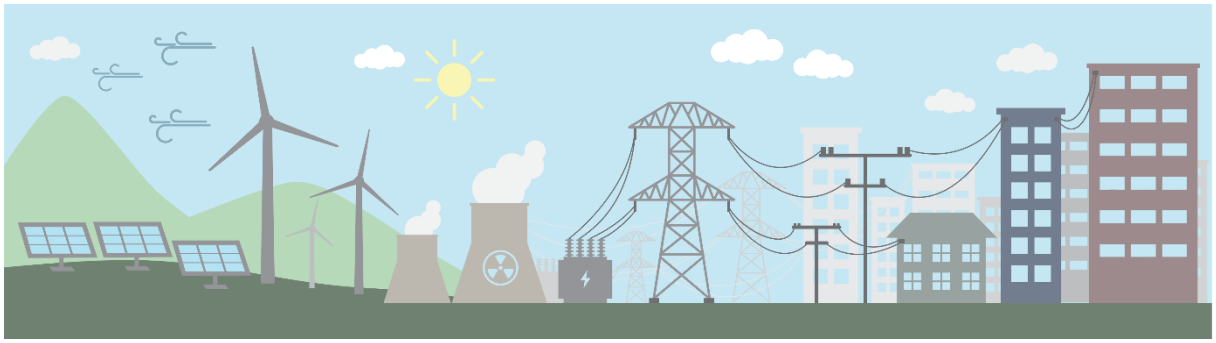
Body	Abbreviation	Short summary
buildingSMART International	bSI	buildingSMART is a global community of chapters, members, partners and sponsors led by the parent body, buildingSMART International. bSI is committed to creating and developing open digital ways of working for the built asset industry. bSI standards help asset owners and the supply chain work more efficiently and collaboratively through the entire project and asset lifecycle.
Expert Panel	EP	Brings in expert advice during the project, on a voluntary basis, during on average four meetings per year.
Electrical Domain	ED	Open forum within bSI responsible for the Electrical Engineering domain and all developments on IFC within this domain.
Infrastructure Domain	ID	Open forum within bSI responsible for the Infrastructure domain and all developments on IFC within this domain.
Infrastructure Domain Project Steering Committee	IDPSC	Body within the Infrastructure Domain responsible for managing the Infrastructure Domain projects, meets once a month and Project Lead presents the Project Dashboard during this meeting.
Infrastructure Domain Steering Committee	IDSC	Steers the Infrastructure Domain and is responsible for setting out strategy, managing initiatives and liaison with other Domains and bodies.
International Standardization Organization	ISO	Please follow this link for more information: http://www.iso.org/iso/home.html
Open Geospatial Consortium	OGC	Please follow this link for more information: http://www.opengeospatial.org/
Project Leader	PL	Responsible for managing the project and ensures the project is delivered within budget and on time.
Project Team	PT	Executes a project based on a project plan and delivers the results according to plan.
Standards Committee	SC	The senior governance body within bSI overseeing the standards process. It will comprise representatives from members and chapters.
Standards Committee Executive	SCE	Establishes and manages the bSI standards process and addresses procedural and programmatic issues.

Standards Committee Technical Executive	SCTE	Provides technical advice to the SC and SCE the bSI standards process and addresses project technical issues.

For more information please see the buildingSMART International Standards Process. This process describes the manner in which standards and other technical work is created and governed within buildingSMART International. It is available online: http://buildingsmart.org/standards/standards-process/

2 EXECUTIVE SUMMARY

With the extension of the IFC schema (via version 4.3) to include more built environment assets and related life cycle concepts in the planning, design, procurement, construction, and operation of transportation infrastructure, there is also increased interest in addressing utility infrastructure such as electrical power generation, long-distance transmission, and local distribution up to the point of service for a stationary asset or component (e.g., a office building, a residence, a train station, an airport, and etc.). This activity proposal addresses examining the requirements of high-voltage electrical power transmission and distribution data modeling and exchange to be shared using the openBIM processes and principles. It should be noted that the intent is NOT to replace any existing electrical engineering or energy industry standards but supplement them with an openBIM-based approach to the delivery, operations, and portfolio management of the power transmission and distribution network physical assets.



The activity proposal scope includes:

- Develop a domain-specific taxonomy detailing required physical and abstract concepts for high voltage power transmission and distribution;
- Link the taxonomy for power transmission and distribution to the Industry Foundation Classes (IFC);
- Publish the domain specific taxonomy (and links to other standards) in the buildingSMART Data Dictionary (bSDD).
- Develop requirements and specifications for individual use cases of data modeling and exchange within the life cycle of power transmission systems and components;
- Use the Information Delivery Specification (IDS) standard to define and share the requirements of the various use cases identified;
- Develop user deployment guidance materials for industry stakeholders and publish them in the Use-Case Management service (UCM).

Using this methodology all official versions of IFC (2x3, 4 and 4.3) can be used for the Power domain without software tools having to change the implementations.

Per the bSI Process, this activity will harness the input from a variety of power industry stakeholders in global, regional, national, and local realms to develop bSI standards and technologies that can be used effectively in any marketplace throughout the life cycle of systems and components.

This activity does not have the ambition to extend IFC and publish a new version. When the activity encounters modelling principles that are not in IFC yet they can be added to the list of requirements for either IFC 4.4 and/or IFC 5.

3 BACKGROUND

3.1 HISTORY

Recently, ISO has reviewed a new version of the IFC schema, 4.3, which expands the scope of the schema beyond the previous building domain to include horizontal infrastructure, such as rail and road networks, related bridge assets, and the ports and waterways domain. As such, buildingSMART International now refers to IFC as a semantic data model for “the built asset environment”, not just buildings. The Industry Foundation Classes (IFC) provide a ‘foundation’ as a base to include more constructed assets, potentially involving utility networks such as power and communications, as well as specific assets as power generation facilities.

In 2018, at the buildingSMART International Standards Summit in Paris, a number of attending delegates from chapters and chapters-in-formation indicated a desire to initiate the formation of a power generation and transmission room/domain. From a larger perspective, the intent was to include utilities (power, communication, water, and waste systems) in the more holistic “built asset” scope of IFC based information exchange. However, it was determined that there wasn’t enough focus or formal backing of that idea at the time to instigate an official formation, alongside the Rail and Infrastructure Rooms already in their formal inception.

Then in 2020, buildingSMART International initiated a new room/domain (originally called the Sustainable Energy Management Room, now known as the Electrical Domain) to address electrical engineering-related project delivery and operation of assets using openBIM methods and standards, with significant backing of new Strategic Advisory Council (SAC) members Schneider Electric and Siemens, as well as support by many national chapters (such as buildingSMART Germany, Switzerland, Italy, etc.), who were eager to form local working groups. This new room/domain’s initial focus was quickly established to be within the scope of the low-to medium voltage (<100kV, single-, split-, and three-phase) electrical engineering needs of a built asset/facility (aka power customer/consumer), but not power generation, long distance high-voltage transmission (~1000 to ~130kV), or local distribution (~70kV to 120V).

Subsequently, the German buildingSMART chapter initiated an industry roundtable identifying the further needs, objectives, and deliverables of high voltage generation, transmission, and distribution networks, including hybrid power storage/transmission systems. Simultaneously, the China buildingSMART chapter put together a parallel activity proposal to focus on offshore power generation and transmission to ground-based networks (IFC for Maritime). Further discussions led to narrowing the scope of this activity proposal to power transmission and distribution networks from the generation sources, but not the power generation assets themselves, up to the service point of a consuming asset, while also coordinating with parallel efforts focusing on those ends of the power/energy system.

3.2 OPPORTUNITY & INDUSTRY NEED

With the desire to amend the IFC semantic specification to facilitate more aspects and assets of the built environment, this project proposes an amendment to include high-voltage transmission and distribution. Within IFC, the currently defined IfcElectricalDomain (as well as pertinent, related concepts in the other domain-specific parts of the schema, such as, IfcBldgServiceElements, IfcSharedFacilitiesElements) is focused on on-premises, low-voltage (<100kV, single-, split-, and three-phase) electrical engineering needs of a built asset/facility, but not any power generation, long-distance transmission, and local distribution.

While the concept of BIM applied to the vertical/building sector has been thoroughly discussed and debated for no less than the last 20 years, the horizontal/infrastructure sector has been only recently (6-8 years) more actively observing and learning from such efforts and attempting to apply BIM principles and methods to its domain. In some ways, this may be simple as there are often “building” assets in infrastructure systems (e.g., train/bus station/terminal, airport terminal, etc.), but due to the unique physical and functional nature of systems and components (e.g., a rail network, its tracks, switching, signaling, communications, power, etc.), the application of BIM also requires a closer look of how an openBIM paradigm might accommodate data exchanges, as well as vendor-neutral data storage and usage, through industry consensus of semantic definitions of such large and complex systems and components.

The use of openBIM principles and standards is relevant for the entire life cycle of a power/energy network and can be used across all phases from planning to operation similar to buildings. The initiators of the “openBIM for HV Power” proposal have jointly defined the following opportunities and key added value benefits.

Planning & Design
Such added value benefits include:

- Transparent and consistent representation of planning and design processes;
- Improved quality, time savings, and better investment value through early definition of physical asset delivery and operational requirements, while reducing, if not eliminating, discrepancies between professional trades. This may include such well-known openBIM aspects as detailed virtual design, design coordination and error detection, accurate quantity calculation, and the 3D and 4D (animated) visualization of project delivery and operations;

Construction / Assembly
Such added value benefits include:

- Reduction of project delivery cost due to the reduction, if not elimination, of expensive rework due to inaccurate or uncoordinated design documentation;
- Improved project delivery logistics including material delivery, storage, staging, and assembly, as well as improved safety conditions from coordinated visualizations in the planning & design phase;
- Improved tracking of project delivery process and results through such means as laser/photogrammetry scanning of site conditions and comparison of scans to design/construction models;

- Improved quality of fabrication/installation and site safety with model-based VR/AR technologies and methods to augment field personnels' tasks and responsibilities;
- Higher quality post-construction documentation which may more fully and accurately annotate changes made in the field, leading to lower data handover from the project delivery team to the owner/operator.

Operation, maintenance, inventory, and (de-) recommissioning
Such added value benefits include:

- Simplified information handling with easier access to important project delivery and operation information across a plethora of systems and tools used by different stakeholders in their processes;
- Reduced threshold for establishing a handover baseline of asset information, enabling the owner/operator to have clear access to accurate and complete inspection, maintenance, and warranty information quickly after the end of project delivery.
- Improved understanding of asset attributes used for portfolio management and basis for future conversion and decommissioning work.

3.3 PROJECT GOVERNANCE

The proposed project will be executed and governed as a buildingSMART International project within the **Infrastructure** Domain, unless a new **Power** or **Utility** Domain or Working Group is established in the future.

3.4 RELATIONSHIP TO BSI STANDARDS, TECHNICAL WORK, AND TECHNICAL ROADMAP

- The current and upcoming publication of ISO/DIS 16739-1 - Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries — Part 1: Data schema (IFC4.3). Specific focus will be on the IfcElectricalDomain layer and amending the scope to include power transmission/distribution;
- IFC Amendments and domain defined property definitions will be established. These will be published in the buildingSMART Data Dictionary (bSDD), as well as potential multi-lingual translations;
- The Use Case Management Service (UCMS) may be used to develop the various use case descriptions – potentially including business case/process and information requirements (as IDS files);
- Coordination with the concurrent Activity Proposal "Offshore Power Generation (Maritime)" proposal.

3.5 RELATIONSHIP TO OTHER STANDARDS AND TECHNICAL WORK

- Electrical Engineering domain-specific industry standards, from such organizations as IEC, IEEE, VDE, NEMA;
    - IEC 61936-1
    - VDE 0101

- IEC 60685
  - IEC 62271
  - IEC 62305
  - IEC 81346
  - IEC 60071
  - IEC 61970-301
  - IEC 61850
  - DIN EN 50341
  - IEC 61360-4 - IEC/SC 3D - Common Data Dictionary (CDD - V2.0015.0004)
  - …
- ISO/DIS 7817 - Building information modelling — Level of information need
- ISO 16757 - Data structures for electronic product catalogues for building services
  - Replacement for VDI 3805 (being withdrawn)
- ISO 19650 - Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)
- Industry 4.0 standards
  - RAMI 4.0, ECLASS: product view, CIM (Common Information Model according to IEC 61970) Operational view from SGAM
- ECLASS IEC 61360
- ETIM

4 SCOPE & OBJECTIVES

4.1 SCOPE STATEMENT

While the Electrical Engineering subject is a large one which includes building and infrastructure built asset sectors, the purpose of this project is to focus on electrical power transmission and distribution networks and related assets *between* the power generation source and the service nodes of power consumption (as noted in the figure below). The power consuming assets include any type (building, campus, infrastructure asset and/or network, etc.), but not the electrical engineering inside of buildings and infrastructure assets/networks.

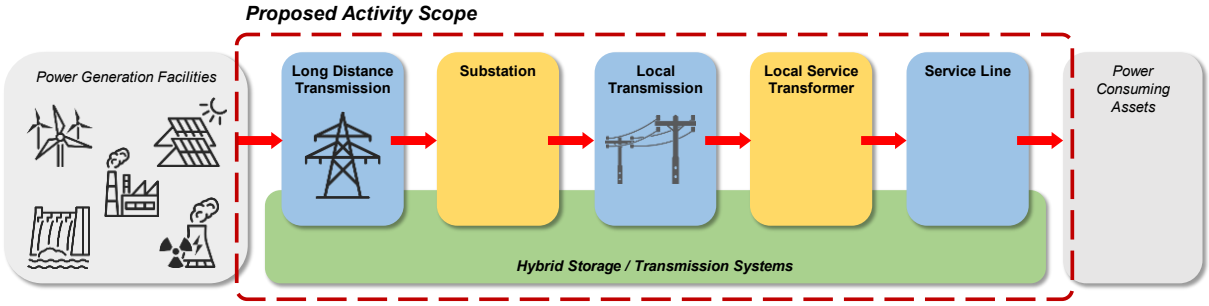


Figure 1: Proposed activity scope within electrical power network

Functionally, the intent of this activity is to focus on project delivery and asset definition from an openBIM-based perspective, the design, procurement, installation, and asset management of ***power transmission and distribution assets***, NOT the electrical engineering standards for specific products/assets, services, and actual power distribution management.

4.2 OBJECTIVES

The primary goal of this initiative is to facilitate the adoption of openBIM standards in the Power/Energy industry for asset design, delivery, and management with a focus on optimizing openBIM processes and promoting the widespread implementation of IFC by a variety of industry stakeholders – including but not limited to: software developers, product vendors, planners/designers, construction firms, and owners/operators.

4.3 APPROACH

The overall approach to the proposed activity is to divide and conquer the larger overall goals and objectives into smaller working groups focused on specific topics. This includes, but is not limited to or dependent on, the following:

- High-level, domain life cycle Process Map;
- Taxonomy of industry components, systems, and processes and their corresponding relationships to the IFC;
- Systems/asset identification for HV power transmission grids/networks (~1000 to ~130kV) and local distribution (~70kV to 120V), including transmission lines/cables (overhead and/or underground), related support structures;

- Systems/asset identification for power conversion/distribution nodes such as substations and local distribution transformers;
- Systems/asset identification for “hybrid” grid transmission and storage;
- “Green” or “sustainable” standards and assets.
- Exploration of potential data modeling and exchange use cases and technical requirements.

Each project working group will establish tasks and deliverables within the larger overall framework of the proposed activity.

4.4 CHALLENGES

Challenges to execution of the project may include:

- Stakeholders’ lack of knowledge of buildingSMART International, its standards, and openBIM principles. Educational content and outreach through liaisons and industry events may help eliminate this gap and facilitate the transfer of knowledge needed for execution of the project.
- Finding project leadership that has sufficient knowledge of openBIM processes, principles and the standards and services related to this activity.
- Finding an early and low-threshold entry point to the project tasks in achieving overall goals and objectives as quickly as possible. It is important to have participants and stakeholders understand the scope, goals, and tasks, agreeing in principle to the value of openBIM-based methods, technologies, and standards.

5 DELIVERABLES

5.1 PUBLISHED OUTPUT

5.1.1 WP-1: Industry White Paper(s) on openBIM for Power/Energy Sector

A. Power/Energy Domain Taxonomy

- Taxonomy and properties (in property sets) from Working Groups
- Linking (and potentially replacing) classes with IFCs
- Linking (and potentially replacing) properties with IFC defined properties and Psets.
- Published in buildingSMART Data Dictionary (bSDD)

B. Life Cycle Process Map

- Overall Life Cycle BPMN
- Identification of possible exchange points in the process
- Coordination/harmonization with other industry standards organizations
- Expert Panel review and feedback

5.1.2 WP-2: Individual Use Cases / Exchanges

- Business case narratives and requirements for openBIM-based workflows
- Detailed Process Map per Use Case, related to life cycle Process Map
- Information requirements per use-case, defined using Information Delivery Specification (IDS) standard

5.1.3 WP-3: User Deployment Documentation

- Demos/tutorials
- Sample data sets
- Published in UCM.

5.2 INTELLECTUAL PROPERTY RIGHTS

All products created during the execution of the project, including resulting deliverables, are owned and copyrighted by buildingSMART International Ltd. with all rights reserved and granted as determined on a case-by-case basis. Please refer to the IP Policy document for further details.

6 RESOURCES & PROJECT EXECUTION

6.1 RESOURCES & SKILLS

6.1.1 Tools

Project Management will utilize the bSI Monday.com portal, with a Project Board to track progress and milestones.

Process Maps will be created and published in BPMN XML.

General documentation and publishing will be coordinated with bSI, either utilizing GitHub, web pages, or MS Word and Excel.

Project materials shall be collected and stored via bSI's Box.com and/or buildingSMART Services like bSDD and UCM.

bSDD content will need an authoring and management platform compatible with the bSDD technical requirements.

6.1.2 Project Management:

The following skills are needed for general Project Management. They may be fulfilled by one or more persons, as deemed necessary:

- Project Manager – General project oversight, progress tracking though Monday.com boards, coordination with International Program Coordinators (IPCs), and liaison/project rep with the project and domain Steering Committees, SCE, SCTE, Technical Services, and Standards Committee. Project manager needs to have sufficient knowledge of IFCs, the relation of IFC and bSDD and IDS.
- Communications Coordinator – bSI and public communications and marketing materials. Also coordinating project-centric workshops at bSI Standards Summits, other industry events, or otherwise arranged on-line or in-person meetings.
- Technical Coordinator – Providing technical support, especially on IFC specifications, the relation of IFC and bSDD and IDS. Coordinating input/feedback from bSI Technical Services, SCTE and project participants
- Task / Working Group Leaders – Working with the PM & TC to organize input and output from project working sub-groups. May be primary output authors.

6.1.3 Project Participants

Input and support from industry-related experts in the power/energy fields include:

- Planning & design
- Construction

- Operations - Power transmission & distribution system operators (overhead & underground networks, including substations)
- Software
- Planning & design
- Procurement & construction management
- Asset management / operations

6.1.4 Additional Resources:

Additional resources may be needed for the following:

- Development of deployment/implementation guidelines/documentation for end users
- IDS creation for identified exchanges

6.2 PROJECT EXECUTION & MANAGEMENT

The Project Manager will report to the regular room/domain steering committees on a monthly basis, as well as the SCE and SCTE, if deemed necessary. The PM will also hold regular Project Steering Committee meetings with the primary project sponsors to review project progress and any challenges requiring PSC input/advice.

As per the Approach, the working groups will each plan monthly or biweekly online working meetings, 2 hours in duration each, and at least two in-person/hybrid meetings per year during the semi-annual bSI Standards Summits to present intermediate results or run working group workshops. Each working group will have a leader responsible for organizing meetings, meeting notes, and output.

Participants should expect dedicating an average of 12 hours per month on working group tasks over the duration of the project.

6.3 LIAISONS

Because of the scope and complexity of the industry and project, it is important to coordinate with stakeholders within and external to bSI. This includes:

- bSI Domains (Rooms)
- Construction, Product, Infrastructure, Electrical, Rail Domains
- IFC for Maritime (Maritime Power Generation subdomain)
- bSI Chapters and local working groups
- External Industry Groups
- IEC

6.4 STAKEHOLDERS

Current stakeholders include:

- buildingSMART Germany and its Working Group “openBIM for Energy Industry”:
- Manuela Tielmann, AKG Software Consulting GmbH

- Christian Schleinitz, A+S Consult GmbH
- Michaela Imbusch und Leon Hanke, AUCOTEC AG
- Amir Abbaspour, Alexandra Krämer und Katrin Trautmann, BKW Infra Services Europa SE
- Marcus Heimann und Christian Diederich, DB Energie GmbH
- Markus Graf, Dehn SE
- Dominik Häring, Drees & Sommer
- Felix Kretschmann, elevait GmbH & Co. KG
- Wolfgang Eyrich und Nils Weber, Entegra Eyrich + Appel GmbH
- Fabiana Oscari-Bergs, Gobar Consulting Group
- Richard Bornhoffer und Kerstin Hanke, Hitachi Energy Germany AG
- Katja Horenk, Michael Grübnau und Matthias Hahn, LTB Leitungsbau GmbH
- Dirk Natzius, Siemens Energy Global GmbH & Co. KG
- Felix Noll, Gerd Lepke, Jasmin Then und Axel Puttkammer, TenneT TSO GmbH
- Paul Fritz Mendel, VNS - Versorgungsnetz Service GmbH
- Christian Mützel, individual member
- Rene Strempel, individual member
- Mario Riebenstahl, individual member
- Dr. Ilja Krybus, individual member

More stakeholders are welcome to join the effort per reference and recommendation of the bSI SCE, SCTE, and Standards Committee

7 WORK & TIME SCHEDULE

The proposed Work Packages 1 & 2 can be achieved in 24 months, WPs 3 & 4 the following 12 months for a total of 36 months.

As indicated earlier, expectations are that participants will spend an average of 12 hours per month on meetings and activities to fulfill work package output. PM and Task/Working Group Leaders should expect to spend an average of 24 hours per month.

8 BUDGET & FUNDING

The project benefits from the in-kind support of volunteer participants and chapters. The project work is conducted on a voluntary basis, and to minimize costs associated with travel and venue rental, all meetings and collaborations will take place online.