

STN	Rozhranie aplikačného programu pre systémy riadenia elektrickej energie (EMS-API). Časť 452: Model profilov CIM pre statický prenos siete.	STN EN 61970-452 33 4621
------------	---	--

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Obsahuje: EN 61970-452:2013, IEC 61970-452:2013

118952

Úrad pre normalizáciu, metrológiu a skúšobníctvo SR, odbor SÚTN, 2014
Podľa zákona č. 264/1999 Z. z. v znení neskorších predpisov sa môžu slovenské technické normy rozmnožovať a rozširovať iba so súhlasom Úradu pre normalizáciu, metrológiu a skúšobníctvo SR.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 61970-452

December 2013

ICS 33.200

English version

**Energy management system application program interface (EMS-API) -
Part 452: CIM Static transmission network model profiles
(IEC 61970-452:2013)**

Interface de programmation d'application pour
système de gestion d'énergie (EMS-API) -
Partie 452: Profils du modèle de réseau de
transport statique CIM
(CEI 61970-452:2013)

Schnittstelle für Anwendungsprogramme für
Netzführungssysteme (EMS-API) -
Teil 452: CIM-Statistische-
Übertragungsnetzwerk-Modell-Profile
(IEC 61970-452:2013)

This European Standard was approved by CENELEC on 2013-09-16. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 57/1366/FDIS, future edition 1 of IEC 61970-452, prepared by IEC/TC 57 "Power systems management and associated information exchange" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61970-452:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-06-20
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-09-16

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

Endorsement notice

The text of the International Standard IEC 61970-452:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated :

IEC 61970-552 NOTE Harmonised as EN 61970-552.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61970-1	-	Energy management system application program interface (EMS-API) - Part 1: Guidelines and general requirements	EN 61970-1	-
IEC/TS 61970-2	-	Energy management system application program interface (EMS-API) - Part 2: Glossary	CLC/TS 61970-2	-
IEC 61970-301	-	Energy management system application program interface (EMS-API) - Part 301: Common information model (CIM) base	EN 61970-301	-
IEC 61970-501	-	Energy management system application program interface (EMS-API) - Part 501: Common Information Model Resource Description Framework (CIM RDF) schema	EN 61970-501	-



IEC 61970-452

Edition 1.0 2013-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Energy management system application program interface (EMS-API) –
Part 452: CIM Static transmission network model profiles**

**Interface de programmation d'application pour système de gestion d'énergie
(EMS-API) –
Partie 452: Profils du modèle de réseau de transport statique CIM**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2013 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



IEC 61970-452

Edition 1.0 2013-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Energy management system application program interface (EMS-API) –
Part 452: CIM Static transmission network model profiles**

**Interface de programmation d'application pour système de gestion d'énergie
(EMS-API) –
Partie 452: Profils du modèle de réseau de transport statique CIM**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XF

ICS 33.200

ISBN 978-2-8322-1041-3

Warning! Make sure that you obtained this publication from an authorized distributor. Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.
--

CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references.....	10
3 Overview of data requirements.....	10
3.1 Overview	10
3.2 General requirements	10
3.3 Transformer modeling.....	11
3.4 Modeling authorities.....	12
3.5 Use of measurement classes	13
3.5.1 General	13
3.5.2 ICCP data exchange	14
3.6 Voltage or active power regulation	14
3.7 Use of curves	14
3.7.1 General	14
3.7.2 Generating unit reactive power limits	14
3.8 Definition of schedules.....	15
4 CIM Equipment Profile	15
4.1 CIM Equipment Profile General	15
4.2 Concrete Classes	15
4.2.1 Accumulator	15
4.2.2 AccumulatorValue	16
4.2.3 ACLineSegment.....	17
4.2.4 ActivePowerLimit	18
4.2.5 Analog	19
4.2.6 AnalogValue	20
4.2.7 ApparentPowerLimit.....	20
4.2.8 BaseVoltage	21
4.2.9 Bay.....	21
4.2.10 Breaker.....	22
4.2.11 BusbarSection	23
4.2.12 ConformLoad.....	23
4.2.13 ConformLoadGroup	24
4.2.14 ConformLoadSchedule.....	25
4.2.15 ConnectivityNode	26
4.2.16 ControlArea	26
4.2.17 ControlAreaGeneratingUnit	27
4.2.18 CurrentLimit.....	27
4.2.19 CurveData	28
4.2.20 DayType	29
4.2.21 Disconnecter.....	29
4.2.22 Discrete	30
4.2.23 DiscreteValue	30
4.2.24 EnergyConsumer	31
4.2.25 EquivalentBranch.....	32
4.2.26 EquivalentInjection.....	33
4.2.27 EquivalentNetwork	34

4.2.28	EquivalentShunt.....	34
4.2.29	FossilFuel.....	35
4.2.30	GeneratingUnit.....	35
4.2.31	GeographicalRegion	38
4.2.32	GrossToNetActivePowerCurve	38
4.2.33	HydroGeneratingUnit.....	39
4.2.34	HydroPump.....	41
4.2.35	IEC61970CIMVersion.....	41
4.2.36	ImpedanceVariationCurve	42
4.2.37	Line	42
4.2.38	LoadArea	43
4.2.39	LoadBreakSwitch	43
4.2.40	LoadResponseCharacteristic.....	44
4.2.41	MeasurementValueSource	47
4.2.42	MutualCoupling	47
4.2.43	NonConformLoad.....	48
4.2.44	NonConformLoadGroup	50
4.2.45	NonConformLoadSchedule	50
4.2.46	NuclearGeneratingUnit.....	51
4.2.47	OperationalLimitSet	52
4.2.48	OperationalLimitType	53
4.2.49	PhaseTapChanger	54
4.2.50	PhaseVariationCurve	56
4.2.51	PowerTransformer	56
4.2.52	RatioTapChanger.....	57
4.2.53	RatioVariationCurve	58
4.2.54	ReactiveCapabilityCurve	59
4.2.55	RegularTimePoint	60
4.2.56	RegulatingControl	61
4.2.57	RegulationSchedule	62
4.2.58	Season	63
4.2.59	SeriesCompensator	63
4.2.60	ShuntCompensator	64
4.2.61	StaticVarCompensator	65
4.2.62	StationSupply.....	67
4.2.63	SubGeographicalRegion	68
4.2.64	SubLoadArea.....	68
4.2.65	Substation	69
4.2.66	Switch.....	69
4.2.67	SwitchSchedule	70
4.2.68	SynchronousMachine	71
4.2.69	TapSchedule	73
4.2.70	Terminal	74
4.2.71	ThermalGeneratingUnit.....	75
4.2.72	TieFlow.....	76
4.2.73	TransformerWinding	77
4.2.74	Unit	79
4.2.75	VoltageLevel.....	79
4.2.76	VoltageLimit.....	80

4.2.77	WindGeneratingUnit.....	81
4.3	Abstract Classes.....	82
4.3.1	BasicIntervalSchedule.....	82
4.3.2	ConductingEquipment.....	82
4.3.3	Conductor.....	83
4.3.4	ConnectivityNodeContainer.....	84
4.3.5	Curve.....	84
4.3.6	EnergyArea.....	85
4.3.7	Equipment.....	85
4.3.8	EquipmentContainer.....	86
4.3.9	EquivalentEquipment.....	86
4.3.10	IdentifiedObject.....	87
4.3.11	LoadGroup.....	88
4.3.12	Measurement.....	88
4.3.13	MeasurementValue.....	90
4.3.14	OperationalLimit.....	90
4.3.15	PowerSystemResource.....	91
4.3.16	RegularIntervalSchedule.....	91
4.3.17	RegulatingCondEq.....	92
4.3.18	SeasonDayTypeSchedule.....	93
4.3.19	TapChanger.....	93
4.4	Enumerations.....	95
4.4.1	ControlAreaTypeKind.....	95
4.4.2	CurveStyle.....	95
4.4.3	FuelType.....	96
4.4.4	GeneratorControlSource.....	96
4.4.5	OperationalLimitDirectionKind.....	96
4.4.6	PhaseTapChangerKind.....	97
4.4.7	RegulatingControlModeKind.....	97
4.4.8	SeasonName.....	98
4.4.9	SVCControlMode.....	98
4.4.10	SynchronousMachineOperatingMode.....	98
4.4.11	SynchronousMachineType.....	99
4.4.12	TapChangerKind.....	99
4.4.13	TransformerControlMode.....	99
4.4.14	UnitSymbol.....	100
4.4.15	WindingConnection.....	101
4.4.16	WindingType.....	102
4.5	Datatypes.....	102
4.5.1	ActivePower.....	102
4.5.2	AngleDegrees.....	102
4.5.3	ApparentPower.....	102
4.5.4	Conductance.....	103
4.5.5	CurrentFlow.....	103
4.5.6	Length.....	103
4.5.7	Money.....	103
4.5.8	PerCent.....	103
4.5.9	Reactance.....	104
4.5.10	ReactivePower.....	104

4.5.11 Resistance.....	104
4.5.12 Seconds	104
4.5.13 Susceptance.....	104
4.5.14 Voltage	105
4.5.15 VoltagePerReactivePower	105
5 Amplifications and conventions	105
5.1 Overview	105
5.2 XML file validity	105
5.3 Normative string tables	105
5.4 Roles and multiplicity	107
Annex A (informative) Model exchange use cases	108
Annex B (informative) Modeling authorities	112
Annex C (informative) Common power system model (CPSM) minimum data requirements.....	114
Bibliography	119
Figure 1 – Two winding transformer impedance	11
Figure 2 – Three winding transformer impedance	12
Figure A.1 – Security coordinators.....	108
Figure A.2 – CIM model exchange.....	109
Figure A.3 – Revised CIM model exchange.....	110
Figure A.4 – Hierarchical modeling	111
Figure C.1 – Example model configuration.....	118
Table 1 – Valid measurementTypes.....	13
Table 2 – Profiles defined in this document.....	15
Table 3 – Valid attribute values	105

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ENERGY MANAGEMENT SYSTEM APPLICATION
PROGRAM INTERFACE (EMS-API) –**
Part 452: CIM Static transmission network model profiles**FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61970-452 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/1366/FDIS	57/1384/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

A list of all parts in the IEC 61970 series, published under the general title *Energy management system application program interface (EMS-API)*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This international standard is one of the IEC 61970 series that define an application program interface (API¹) for an energy management system (EMS²).

The IEC 61970-3x series of documents specify a Common Information Model (CIM). The CIM is an abstract model that represents all of the major objects in an electric utility enterprise typically needed to model the operational aspects of a utility. It provides the semantics for the IEC 61970 APIs specified in the IEC 61970-4x series of Component Interface Standards (CIS). The IEC 61970-3x series includes IEC 61970-301: Common Information Model (CIM³) base, and draft standard IEC 61970-302: Common Information Model (CIM) Financial, EnergyScheduling, and Reservation.

This standard is one of the IEC 61970-4x series of Component Interface Standards that specify the functional requirements for interfaces that a component (or application) shall implement to exchange information with other components (or applications) and/or to access publicly available data in a standard way. The component interfaces describe the specific message contents and services that can be used by applications for this purpose. The implementation of these messages in a particular technology is described in IEC 61970-5.

This standard specifies the specific profiles (or subsets) of the CIM for exchange of static power system data between utilities, security coordinators and other entities participating in a interconnected power system, such that all parties have access to the modeling of their neighbor's systems that is necessary to execute state estimation or power flow applications. Currently only one profile, the Equipment Profile, has been defined. A companion standard, 61970-552⁴, defines the CIM XML Model Exchange Format based on the Resource Description Framework (RDF) Schema specification language which is recommended to be used to transfer power system model data for the 61970-452 profile.

¹ Footnote 1 applies to the French version only.

² Footnote 2 applies to the French version only.

³ Footnote 3 applies to the French version only.

⁴ To be published.

ENERGY MANAGEMENT SYSTEM APPLICATION PROGRAM INTERFACE (EMS-API) –

Part 452: CIM Static transmission network model profiles

1 Scope

This part of IEC 61970 forms part of the IEC 61907-450 to 499 series that, taken as a whole, defines at an abstract level the content and exchange mechanisms used for data transmitted between control centers and/or control center components.

The purpose of this document is to rigorously define the subset of classes, class attributes, and roles from the CIM necessary to execute state estimation and power flow applications. The North American Electric Reliability Council (NERC) Data Exchange Working Group (DEWG) Common Power System Modeling group (CPSM) produced the original data requirements, which are shown in Annex C. These requirements are based on prior industry practices for exchanging power system model data for use primarily in planning studies. However, the list of required data has been extended to facilitate a model exchange that includes parameters common to breaker-oriented applications. Where necessary this document establishes conventions, shown in Clause 5, with which an XML data file must comply in order to be considered valid for exchange of models.

This document is intended for two distinct audiences, data producers and data recipients, and may be read from two perspectives.

From the standpoint of model export software used by a data producer, the document describes a minimum subset of CIM classes, attributes, and associations which must be present in an XML formatted data file for model exchange. This standard does not dictate how the network is modelled, however. It only dictates what classes, attributes, and associations are to be used to describe the source model as it exists. All classes, attributes, and associations not explicitly labeled as recommended or conditionally required should be considered required with the following caveat. Consider, as an example, the situation in which an exporter produces an XML data file describing a small section of the exporter's network that happens to contain no breakers. The resulting XML data file should, therefore, not contain an instance of the Breaker class. On the other hand, if the section of the exporter's network does contain breakers, the resulting data file should contain instances of the Breaker class that include, at a minimum, the attributes and roles described herein for Breakers. Furthermore, it should be noted that an exporter may, at his or her discretion, produce an XML data file containing additional class data described by the CIM RDF Schema but not required by this document provided these data adhere to the conventions established in Clause 5.

From the standpoint of the model import used by a data recipient, the document describes a subset of the CIM that importing software must be able to interpret in order to import exported models. As mentioned above, data providers are free to exceed the minimum requirements described herein as long as their resulting data files are compliant with the CIM RDF Schema and the conventions established in Clause 5. The document, therefore, describes additional classes and class data that, although not required, exporters will, in all likelihood, choose to include in their data files. The additional classes and data are labeled as recommended or as not required to distinguish them from their required counterparts. Please note, however, that data importers could potentially receive data containing instances of any and all classes described by the CIM RDF Schema.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE For general glossary definitions, see the International Electrotechnical Vocabulary, IEC 60050.

IEC 61970-1, *Energy management system application program interface (EMS-API) – Part 1: Guidelines and general requirements*

IEC 61970-2, *Energy management system application program interface (EMS-API) – Part 2: Glossary*

IEC 61970-301, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

IEC 61970-501, *Energy management system application program interface (EMS-API) – Part 501: Common Information Model Resource Description Framework (CIM RDF) schema*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN