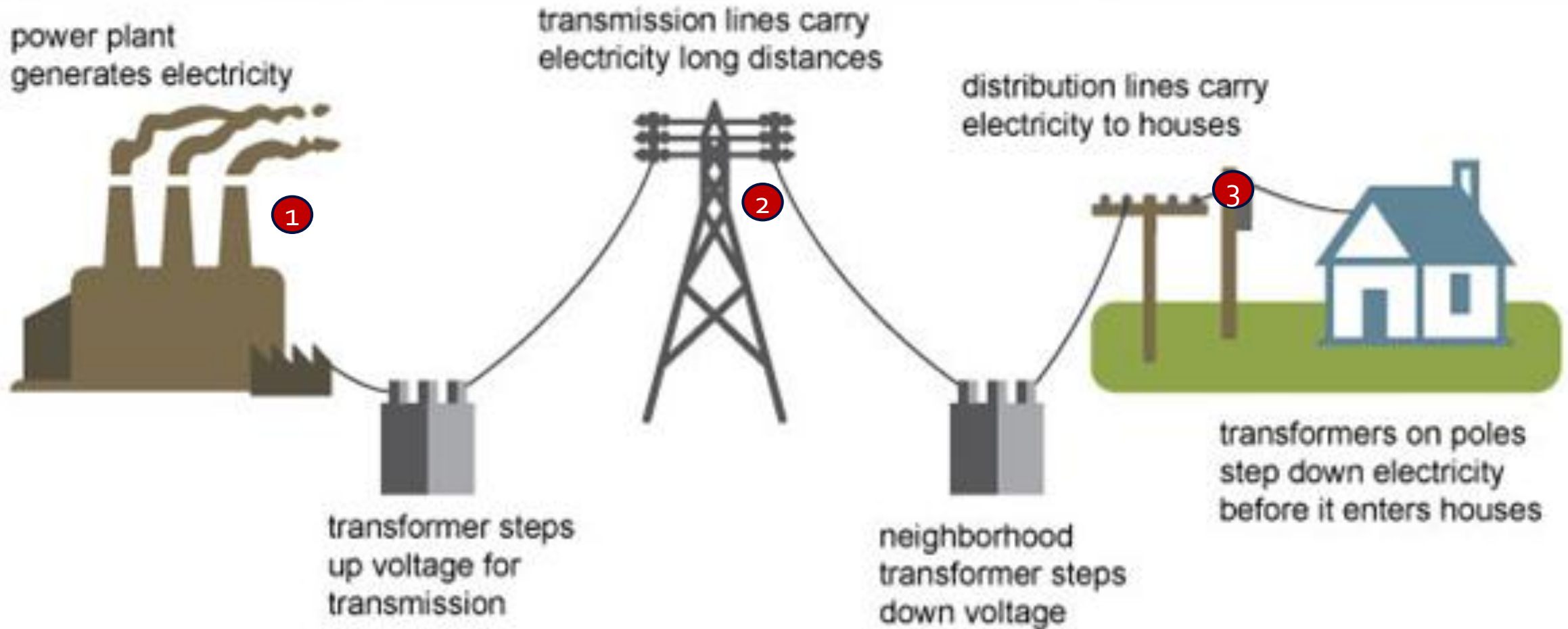


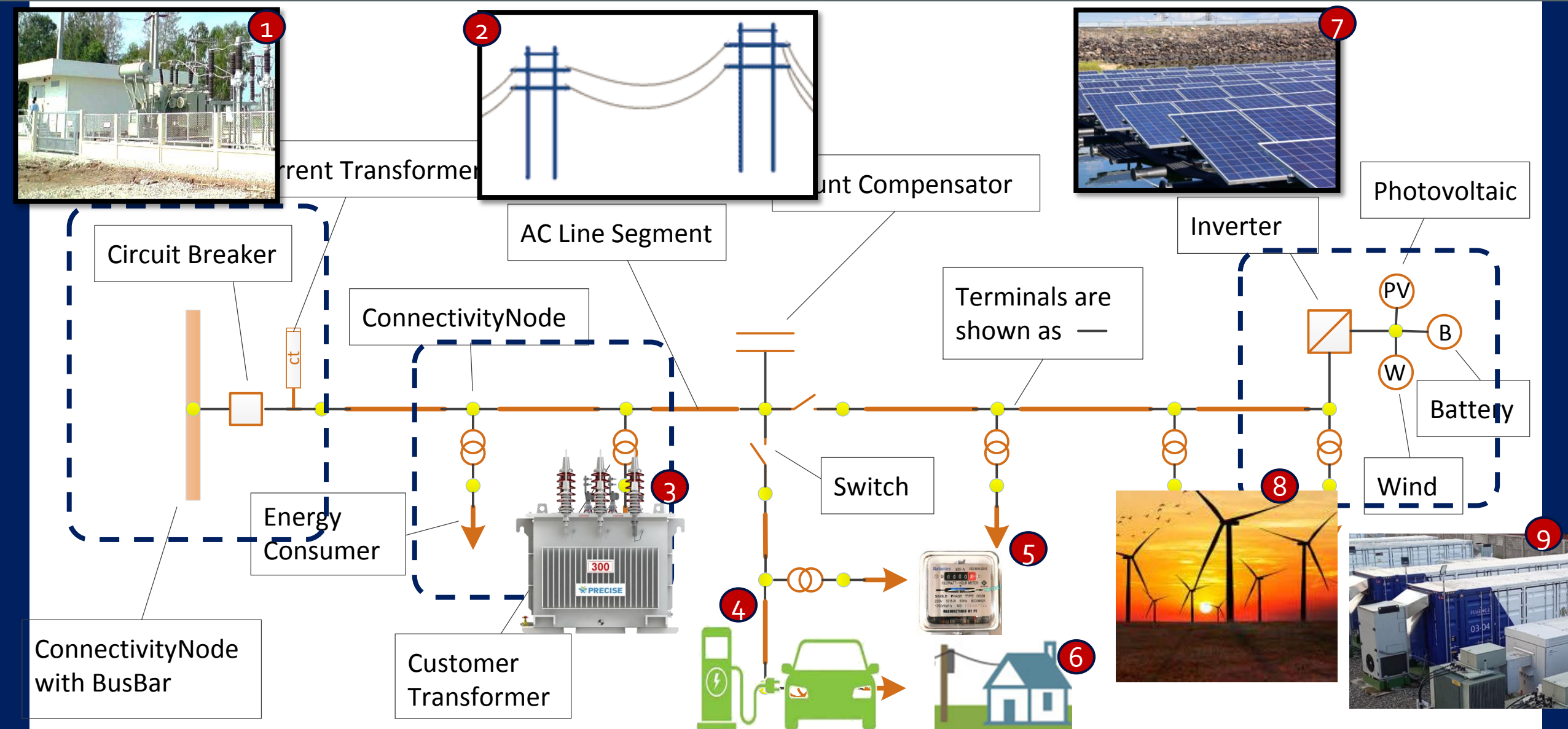
# CIM EXAMPLE

---

# Electricity generation, transmission, and distribution



# Power System became more complicated



# Grid Model in Substations

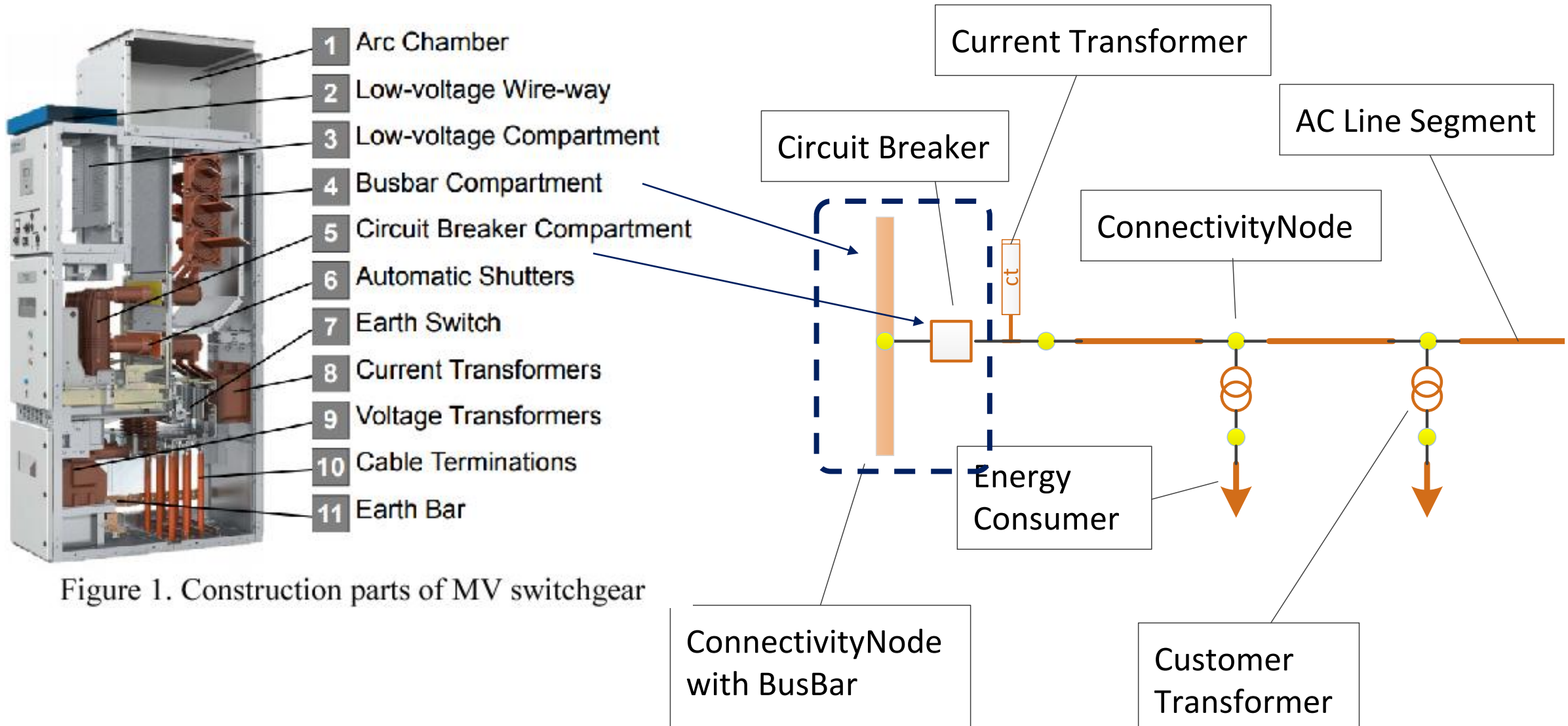
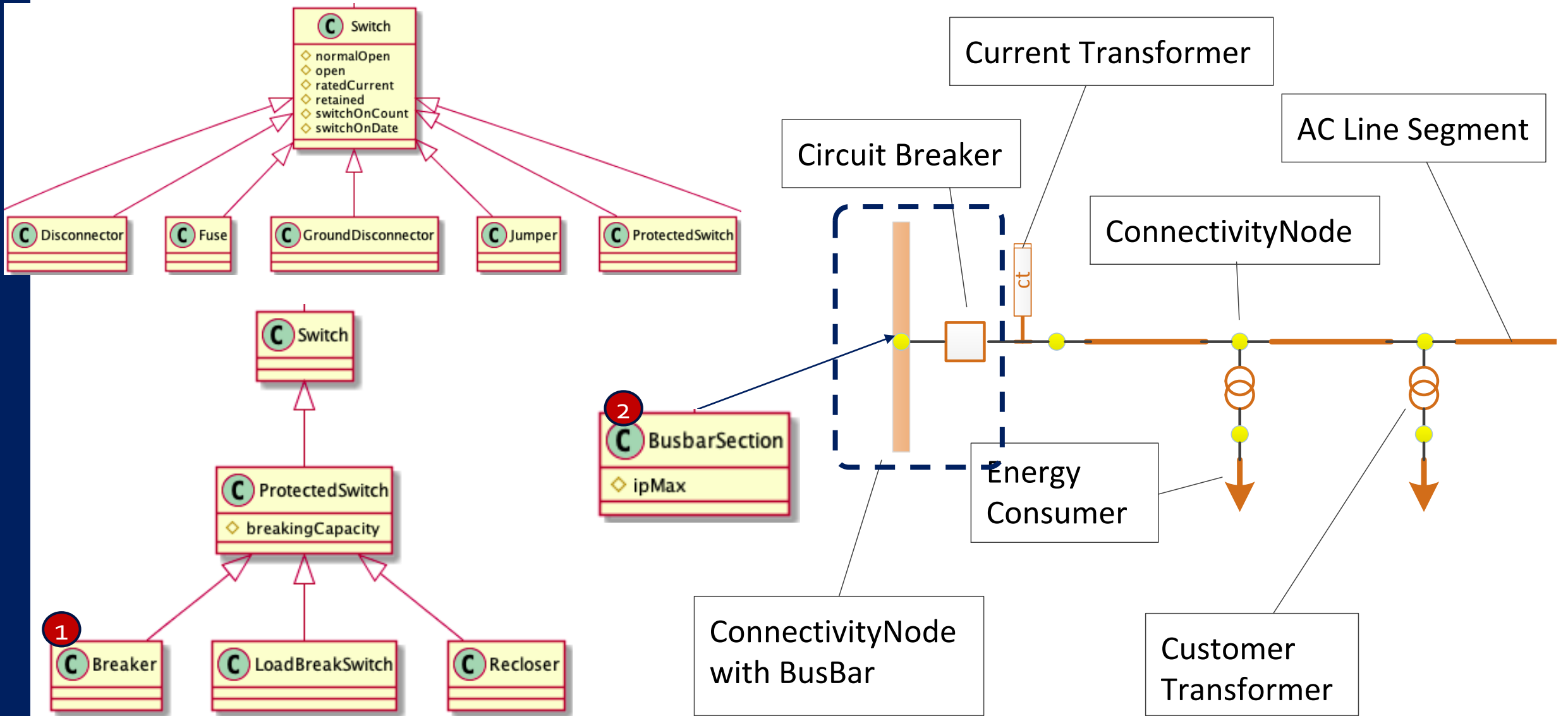


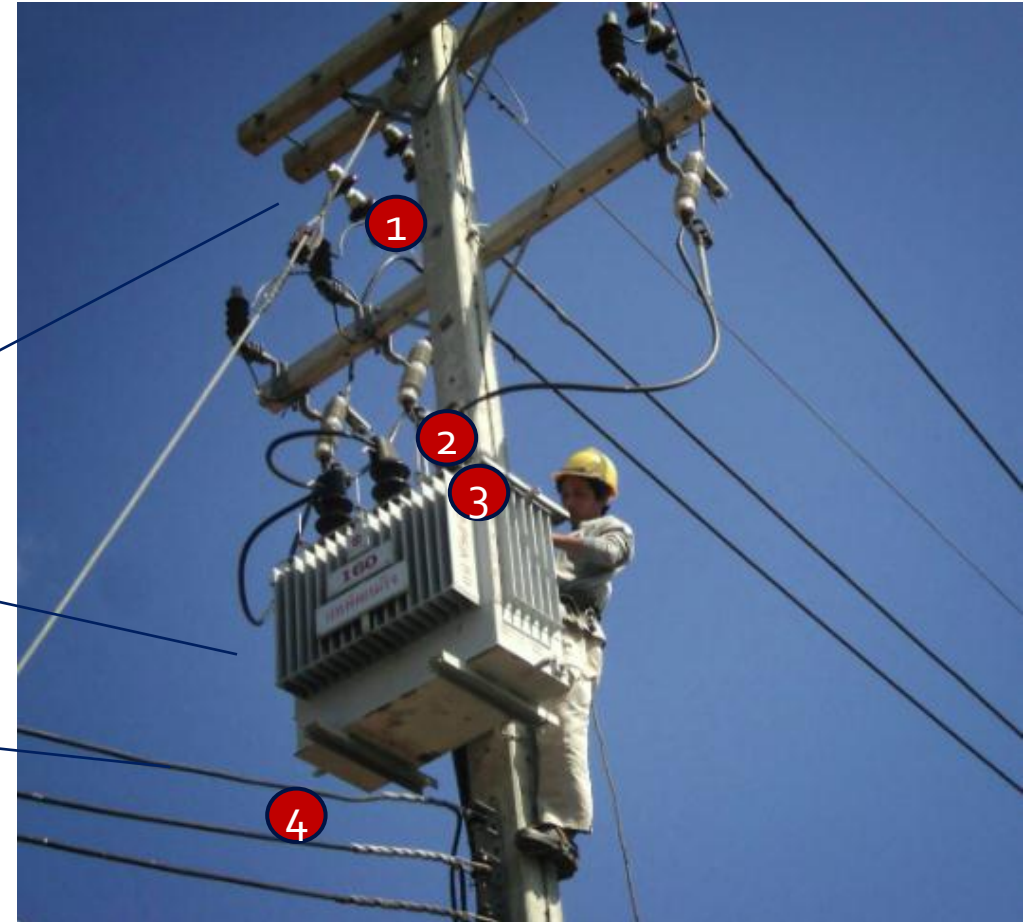
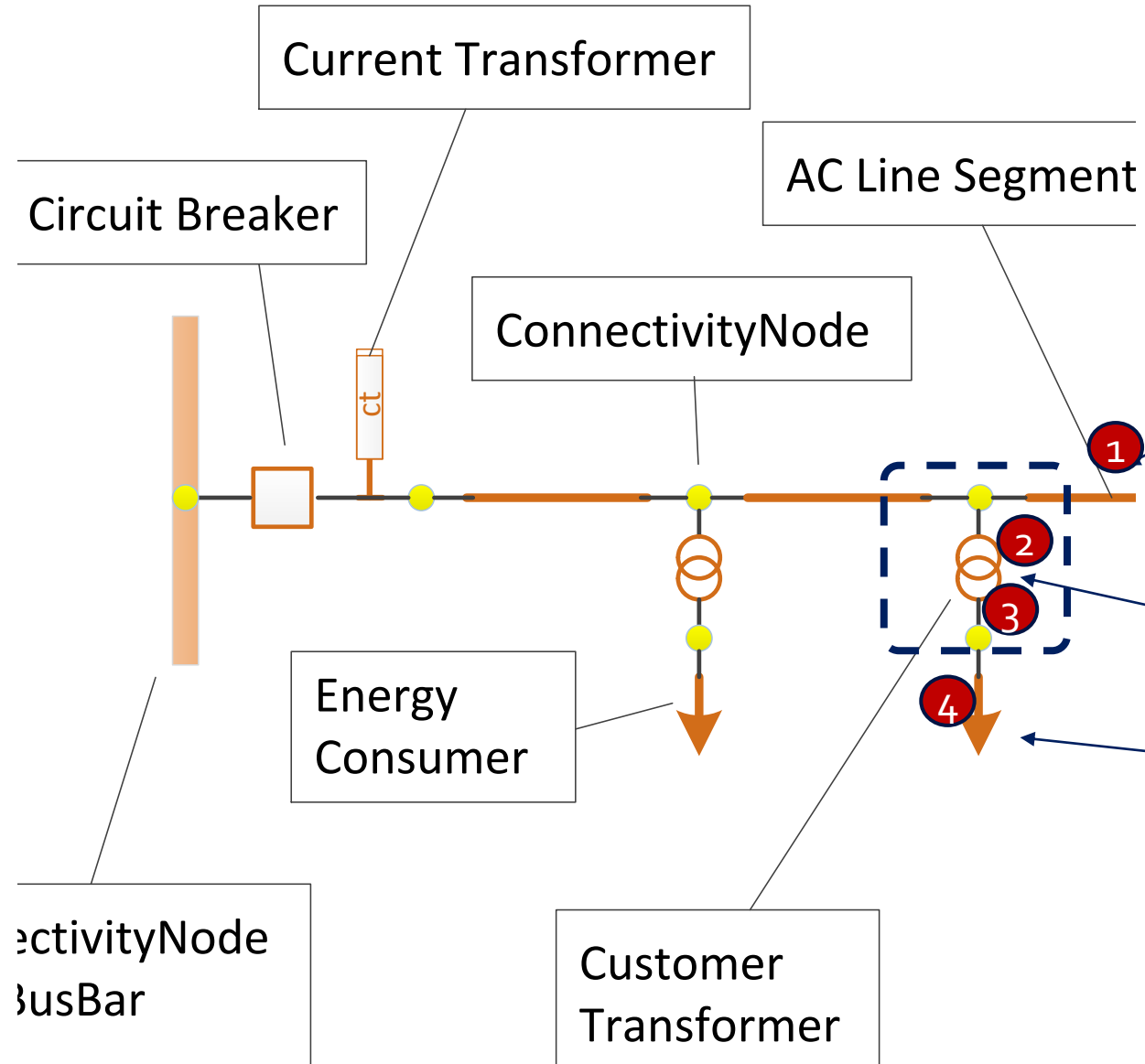
Figure 1. Construction parts of MV switchgear

# CIM examples : busbar and breaker

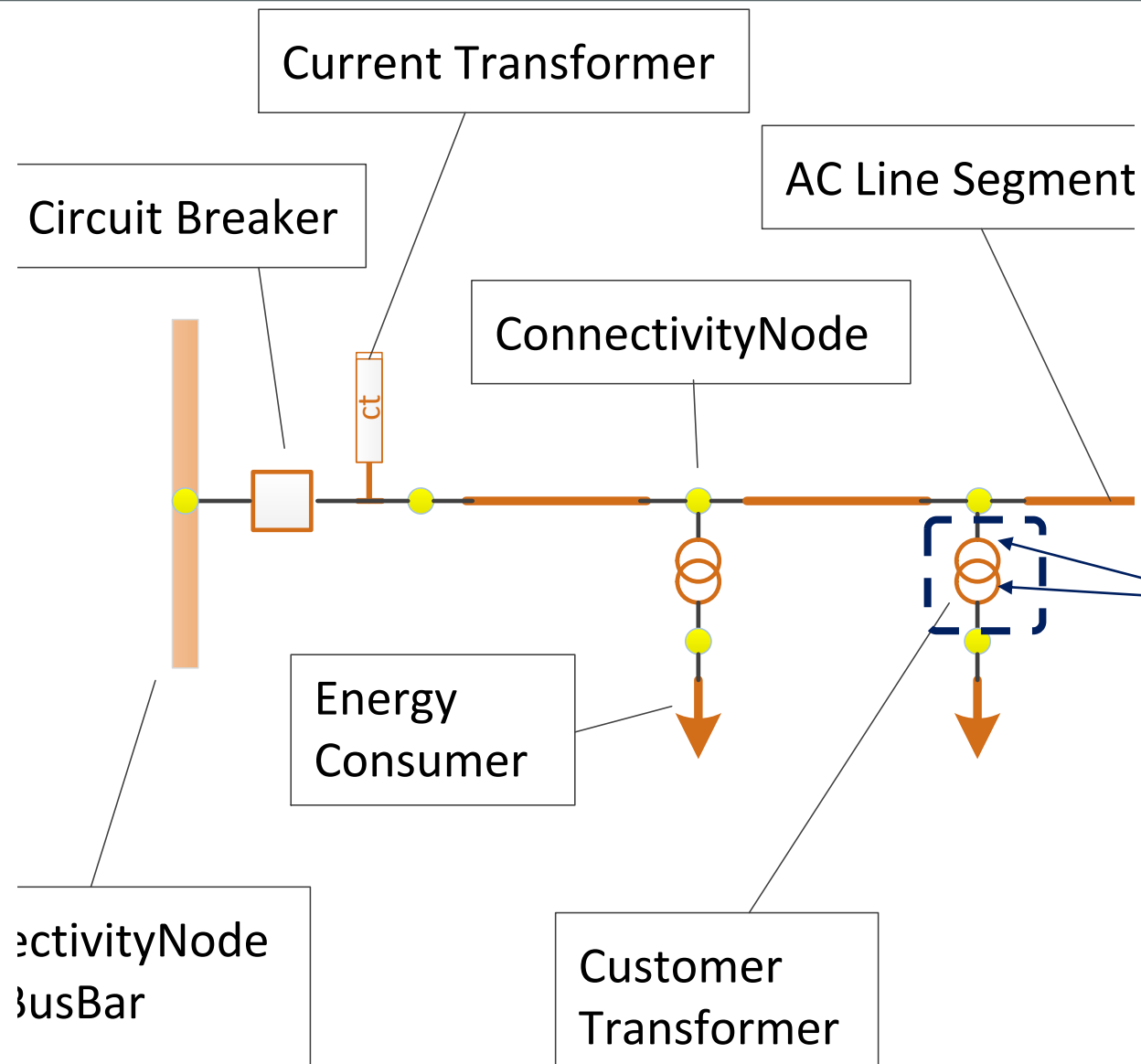




# Grid Model in Distribution System



# PowerTransformer as Equipment and Asset

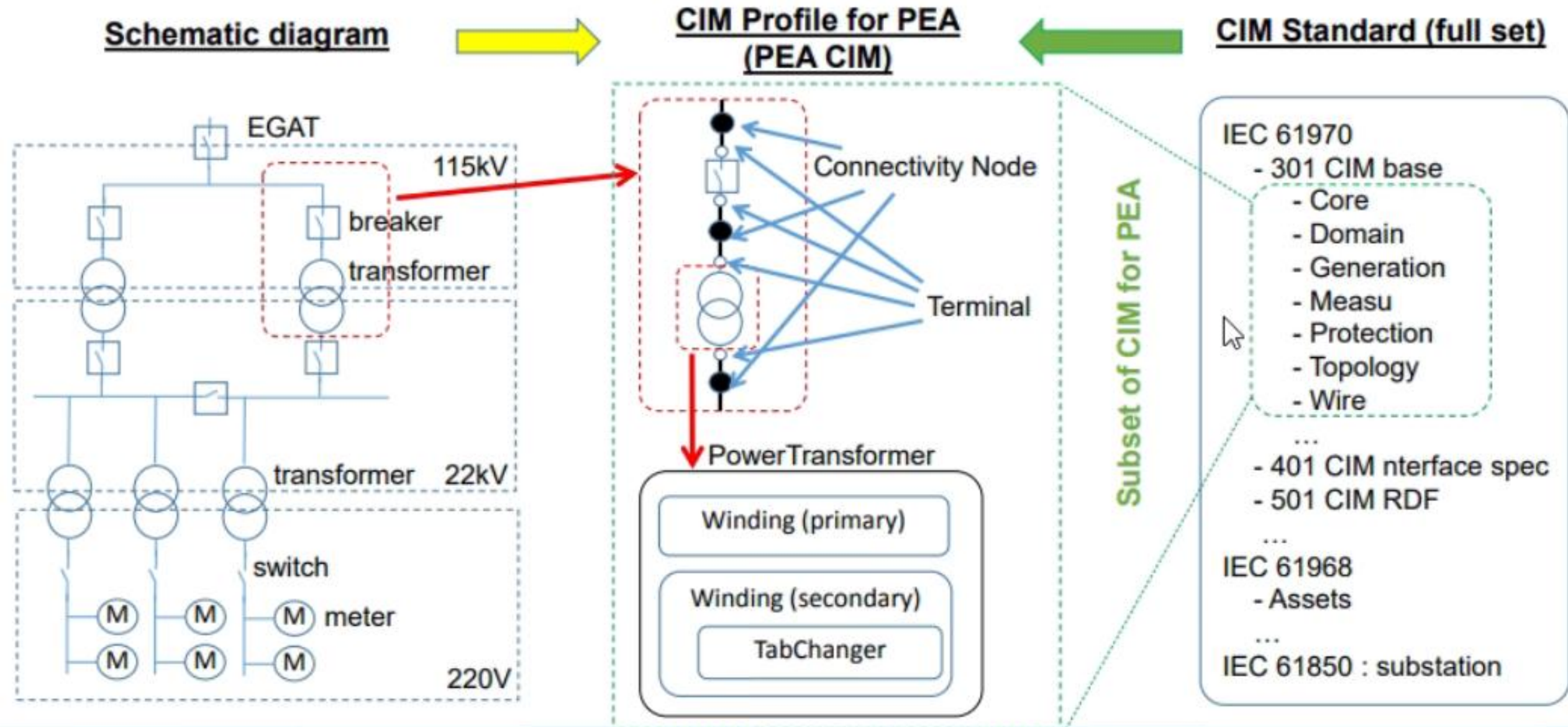


<b>C</b> PowerTransformer
<ul style="list-style-type: none"> <li>◇ beforeShCircuitHighestOperatingCurrent</li> <li>◇ beforeShCircuitHighestOperatingVoltage</li> <li>◇ beforeShortCircuitAnglePf</li> <li>◇ highSideMinOperatingU</li> <li>◇ isPartOfGeneratorUnit</li> <li>◇ operationalValuesConsidered</li> <li>◇ vectorGroup</li> </ul>

<b>1</b> <b>C</b> PowerTransformerEnd
<ul style="list-style-type: none"> <li>◇ b</li> <li>◇ b0</li> <li>◇ connectionKind</li> <li>◇ g</li> <li>◇ g0</li> <li>◇ phaseAngleClock</li> <li>◇ r</li> <li>◇ r0</li> <li>◇ ratedS</li> <li>◇ ratedU</li> <li>◇ x</li> <li>◇ x0</li> </ul>

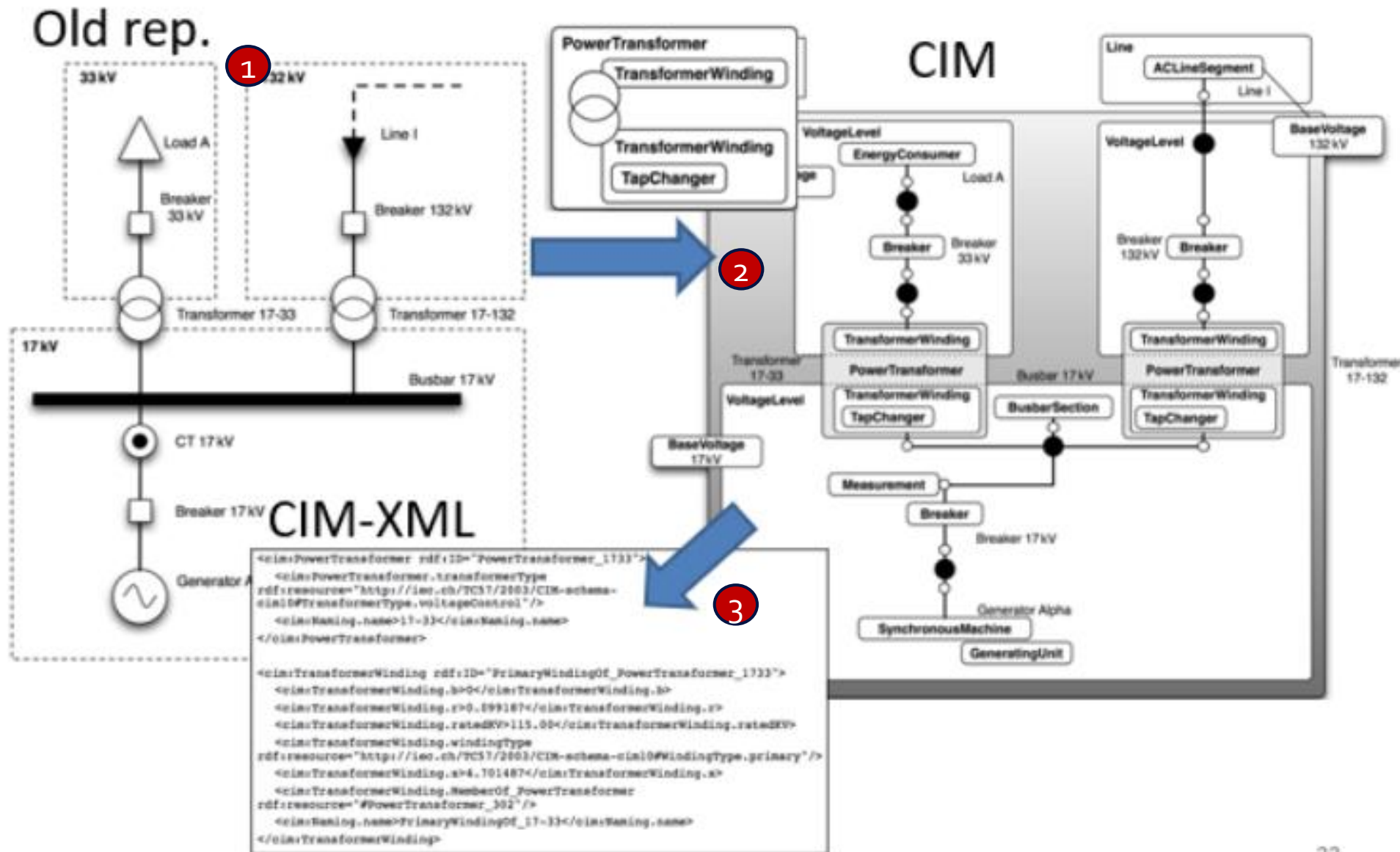
<b>2</b> <b>C</b> Asset
<ul style="list-style-type: none"> <li>◇ acceptanceTest</li> <li>◇ baselineCondition</li> <li>◇ baselineLossOfLife</li> <li>◇ critical</li> <li>◇ electronicAddress</li> <li>◇ inUseDate</li> <li>◇ inUseState</li> <li>◇ kind</li> <li>◇ lifecycleDate</li> <li>◇ lifecycleState</li> <li>◇ lotNumber</li> <li>◇ position</li> <li>◇ purchasePrice</li> <li>◇ retiredReason</li> <li>◇ serialNumber</li> <li>◇ status</li> <li>◇ type</li> <li>◇ utcNumber</li> </ul>

# CIM Profile : subset of CIM

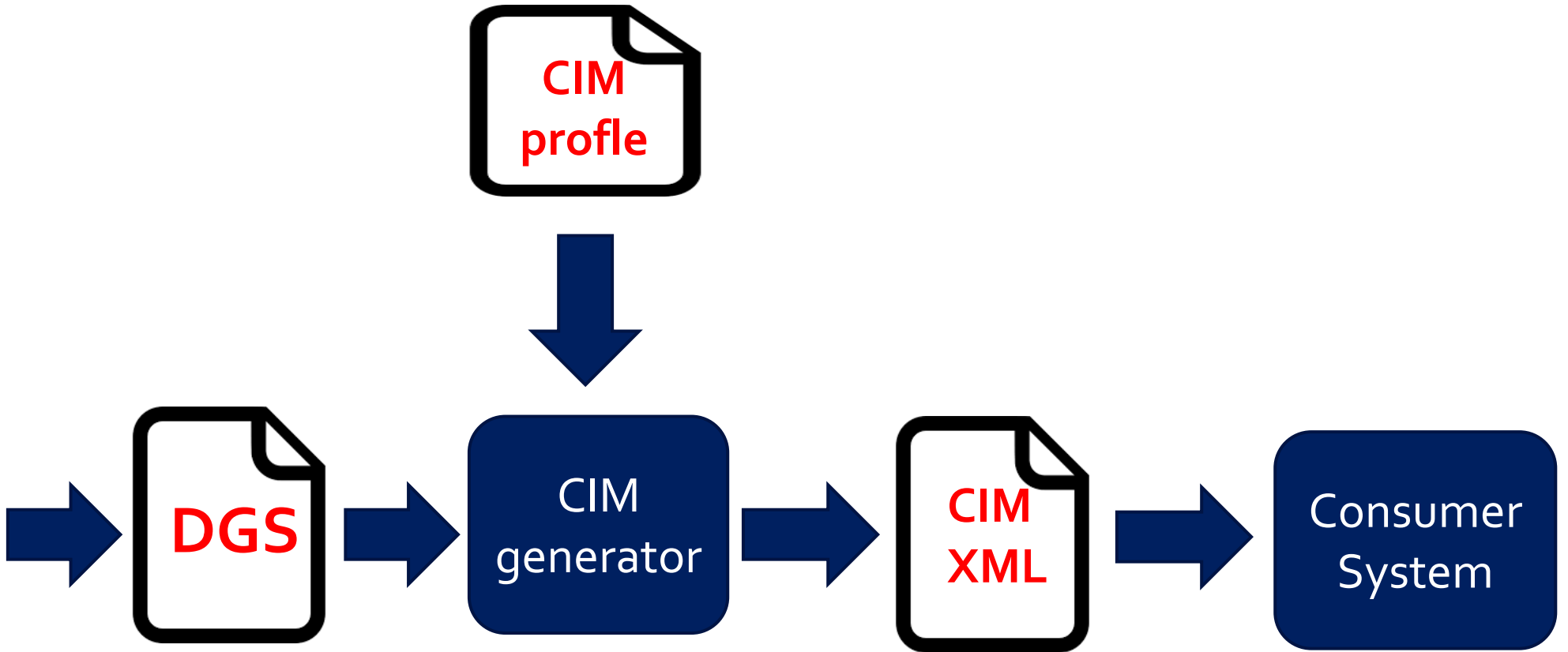




# มาตรฐานข้อมูลกลาง : CIM Standard



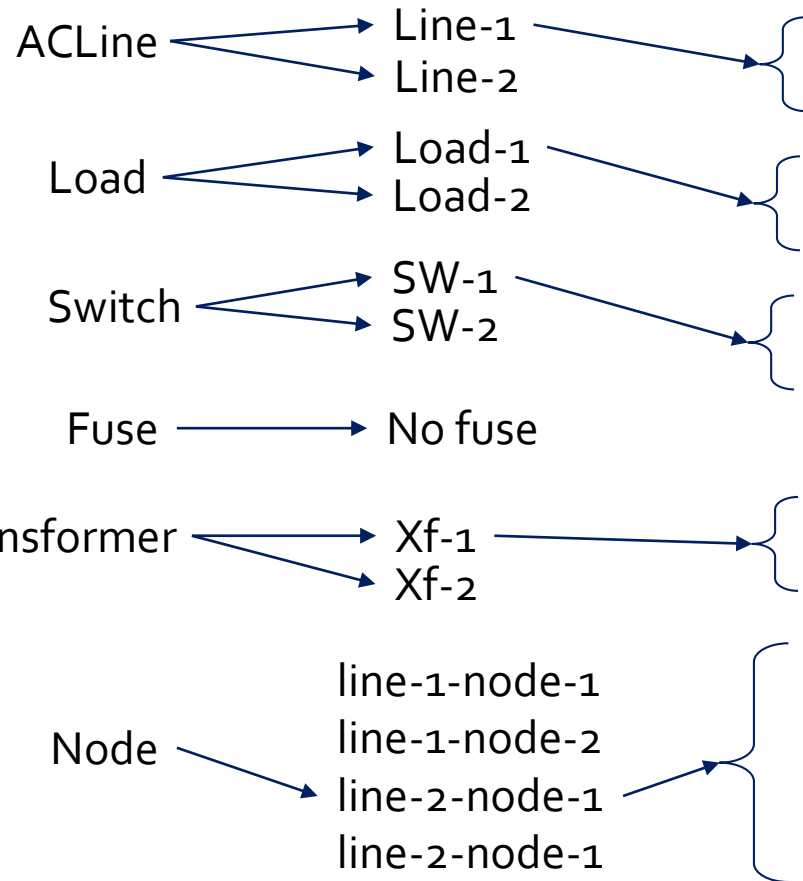
22







## DigSILENT file format (DGS)



```
$$General;No(i);Descr(a:40);Val(a:40)
1;Version;2.5
$$Classes;No(i);Name(a:15);DefaultType(a:15);DefaultFolder(a:40);
1;ElmLne;TypLne;
2;ElmLod;TypLod;
3;ElmCoup;TypSwitch;
4;ElmTr2;TypTr2;
6;RelFuse;TypFuse;

$$ElmLne;No(i);Name(a:40);typ_id(a:40);Station1(a:40);Cub
1;Line-1;...;line-1-node-1;...;line-1-node-2;...;...
1;Line-2;...;line-2-node-1;...;line-2-node-2;...;...
...

$$ElmLod;No(i);Name(a:40);typ_id(a:40);i_sym(i);mode_inp
1;Load-1;...;0;PQ;...;...;0;0;0;0;0;0;...;load-1-node-1;...
1;Load-2;...;0;PQ;...;...;0;0;0;0;0;0;...;load-2-node-1;...
...

$$ElmCoup;No(i);Name(a:40);typ_id(a:40);Station1(a:40);Cu
1;SW-1;...;...;SW-1-node-1;...;SW-1-node-2;...;...;1;1;
1;SW-2;...;...;SW-2-node-1;...;SW-2-node-2;...;...;1;1;
...

$$RelFuse;No(i);Name(a:40);typ_id(a:40);Station1(a:40);Cu

$$ElmTr2;No(i);Name(a:40);typ_id(a:40);Station1(a:40);Cub
1;Xf-1;...;...;Xf-1-node-1;...;Xf-1-node-2;...;...;...;
2;Xf-2;...;...;Xf-2-node-1;...;Xf-2-node-2;...;...;...;
...

$$Cubicles;No(i);Name(a:40);Station(a:40);Section(a:40);i
1;line-1-node-1;...;
2;line-1-node-2;...;
3;line-2-node-1;...;
4;line-2-node-2;...;
5;load-1-node-1;...;
6;load-2-node-1;...;
7;SW-1-node-1;...;
```

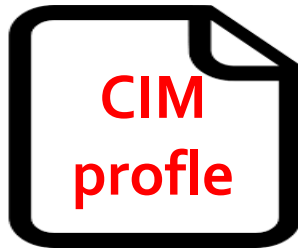


## CIM component

cim:BaseVoltage  
cim:nominalVoltage  
cim:Terminal  
cim:sequenceNumber  
cim:ConductingEquipment  
cim:ConnectivityNode  
cim:ConnectivityNode  
cim:ACLineSegment  
cim:PowerTransformer  
cim:PowerTransformerEnd  
cim:EnergyConsumer  
cim:Switch



# CIM profile format (IEC61970-501)



cim:BaseVoltage  
  cim:nominalVoltage  
cim:Terminal  
  cim:sequenceNumber  
  cim:ConductingEquipment  
  cim:ConnectivityNode  
cim:ConnectivityNode  
cim:ACLineSegment  
cim:PowerTransformer  
cim:PowerTransformerEnd  
cim:EnergyConsumer  
cim:Switch

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/TR/1999/PR-rdf-schema-19990303#"
  xmlns:cim="http://iec.ch/TC57/2016/CIM-schema-cim17#"
  xmlns:prf="http://utility.co.th/profile-1/#">

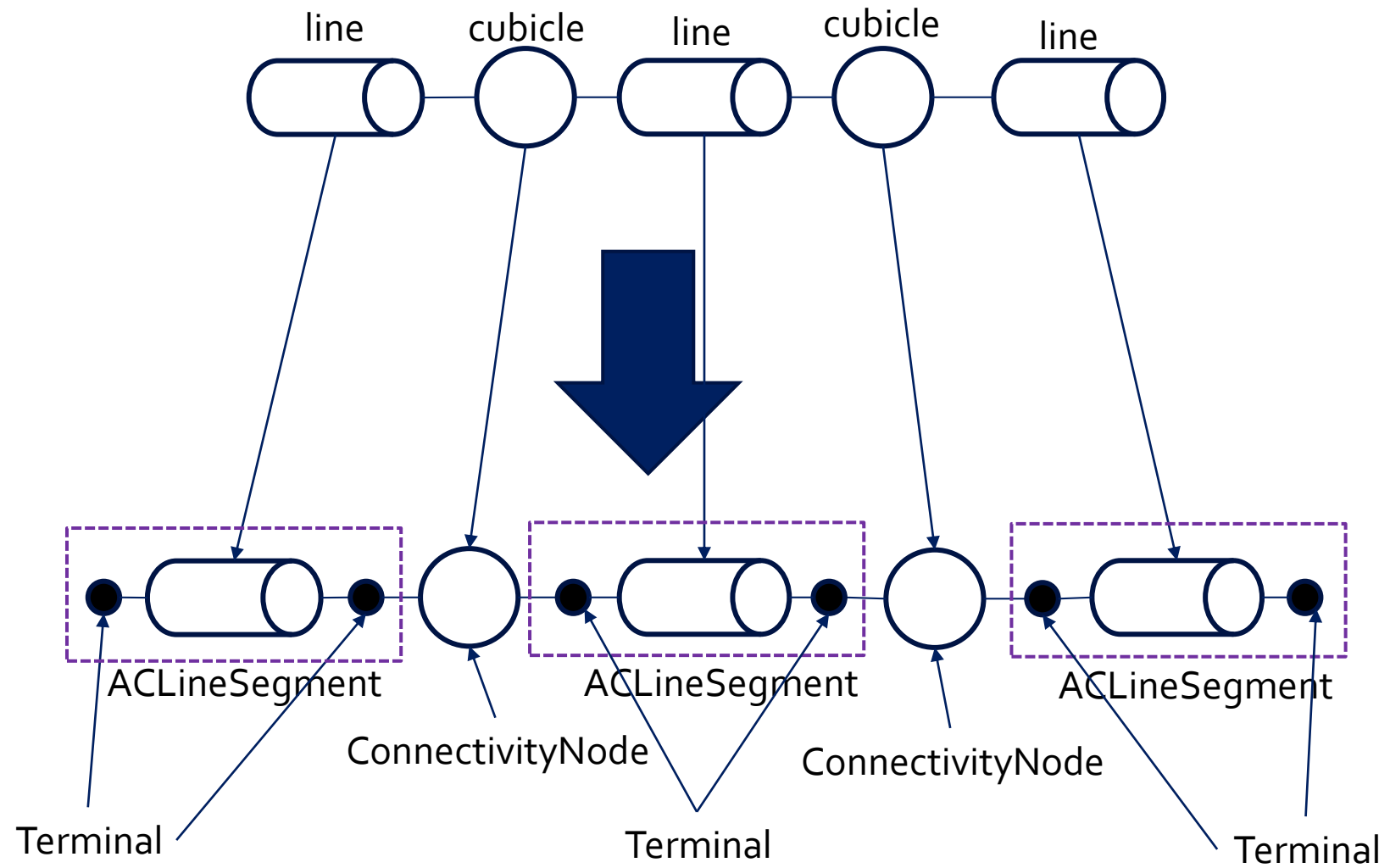
  <rdfs:Class rdf:ID="prf:BaseVoltage">
    <rdfs:subClassOf rdf:resource="cim:BaseVoltage"/>
  </rdfs:Class>
  <rdf:Property rdf:ID="prf:BaseVoltage.nominalVoltage">
    <cim:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdfschema-extensions-19990926#M:0..1"/>
  </rdf:Property>

  <rdfs:Class rdf:ID="prf:Terminal">
    <rdfs:subClassOf rdf:resource="cim:Terminal"/>
  </rdfs:Class>
  <rdf:Property rdf:ID="prf:ACDCTerminal.sequenceNumber">
    <cim:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdfschema-extensions-19990926#M:0..1"/>
  </rdf:Property>
  <rdf:Property rdf:ID="prf:Terminal.phases">
    <cim:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdfschema-extensions-19990926#M:0..1"/>
  </rdf:Property>
  <rdf:Property rdf:ID="prf:Terminal.ConductingEquipment">
    <cim:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdfschema-extensions-19990926#M:0..1"/>
  </rdf:Property>
  <rdf:Property rdf:ID="prf:Terminal.ConnectivityNode">
    <cim:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdfschema-extensions-19990926#M:0..1"/>
  </rdf:Property>

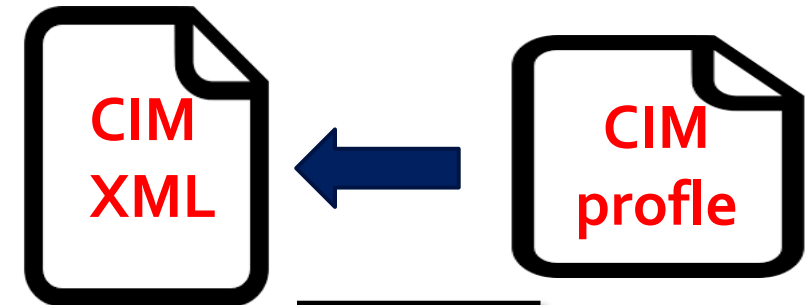
  <rdfs:Class rdf:ID="prf:ACLineSegment">
    <rdfs:subClassOf rdf:resource="cim:ACLineSegment"/>
  </rdfs:Class>
  <rdf:Property rdf:ID="prf:ConductingEquipment.BaseVoltage">
    <cim:multiplicity rdf:resource="http://iec.ch/TC57/1999/rdfschema-extensions-19990926#M:0..1"/>
  </rdf:Property>

  <rdfs:Class rdf:ID="prf:PowerTransformer">
```





# CIM data format (IEC61970-552)



```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs="http://www.w3.org/TR/1999/PR-rdf-schema-19990303#"
  xmlns:cim="http://iec.ch/TC57/2016/CIM-schema-cim17#"
  xmlns:md="http://iec.ch/TC57/61970-552/ModelDescription/1#"
  xml:base="urn:uuid:">
  <md:FullModel rdf:about="#_26cc8d71-3b7e-4ef8-8e92-8d9d557a4946">
    <md:Model.created>2022-10-24</md:Model.created>
    <md:Model.version>V1</md:Model.version>
    <md:Model.modelingAuthoritySet>http://utility.th
    <md:Model.description>CIM Unit Auth
    <md:Model.profile>http://utility.th
  </md:FullModel>

  <!-- Base Voltage -->
  <cim:BaseVoltage rdf:ID="_c2356069-e9d1-e79c-a924-378153cfbbfb">
    <cim:BaseVoltage.nominalVoltage>24</cim:BaseVoltage.nominalVoltage>
    <cim:IdentifiedObject.description>Base Voltage
    <cim:IdentifiedObject.name>24 kV</cim:IdentifiedObject.name>
  </cim:BaseVoltage>
  <cim:BaseVoltage rdf:ID="_36790ecd-55c2-030d-c553-685bef719df6">
    <cim:BaseVoltage.nominalVoltage>220</cim:BaseVoltage.nominalVoltage>
    <cim:IdentifiedObject.description>Base Voltage
    <cim:IdentifiedObject.name>220 V</cim:IdentifiedObject.name>
  </cim:BaseVoltage>

  <!-- ACLineSegment -->");
```

```
<!-- ACLineSegment -->");
  <cim:ACLineSegment rdf:ID="_498319bc-6c9e-c95a-32f3-5854b574caf0">
    <cim:IdentifiedObject.name>Ln175_579050</cim:IdentifiedObject.name>
    <cim:ConductingEquipment.BaseVoltage>_c2356069-e9d1-e79c-a924-378153cfbbfb
  </cim:ACLineSegment>
  <cim:Terminal rdf:ID="_0ccaa26c-ac7a-ea9d-4e9c-a924-378153cfbbfb">
    <cim:IdentifiedObject.name>Ln175_579050
    <cim:ACDCTerminal.sequenceNumber>1</cim:ACDCTerminal.sequenceNumber>
    <cim:Terminal.phases rdf:resource="http://iec.ch/TC57/2013/CIM-schema-cim16#PhaseCode.ABC"/>
    <cim:Terminal.ConductingEquipment>_498319bc-6c9e-c95a-32f3-5854b574caf0
    <cim:Terminal.ConnectivityNode rdf:resource="http://iec.ch/TC57/2013/CIM-schema-cim16#ConnectivityNode.ABC"/>
  </cim:Terminal>
  <cim:Terminal rdf:ID="_2e2d5164-a80f-799d-4e9c-a924-378153cfbbfb">
    <cim:IdentifiedObject.name>Ln175_579050
    <cim:ACDCTerminal.sequenceNumber>2</cim:ACDCTerminal.sequenceNumber>
    <cim:Terminal.phases rdf:resource="http://iec.ch/TC57/2013/CIM-schema-cim16#PhaseCode.ABC"/>
    <cim:Terminal.ConductingEquipment>_498319bc-6c9e-c95a-32f3-5854b574caf0
    <cim:Terminal.ConnectivityNode rdf:resource="http://iec.ch/TC57/2013/CIM-schema-cim16#ConnectivityNode.ABC"/>
  </cim:Terminal>
```

```
<cim:PowerTransformer rdf:ID="_54316ce3-c122-a063-2131-72e042597083">
  <cim:IdentifiedObject.name>Xfr197_776418</cim:IdentifiedObject.name>
</cim:PowerTransformer>
<cim:Terminal rdf:ID="_631513b8-83e9-6e4e-3a36-20566ffc03da">
  <cim:IdentifiedObject.name>Xfr197_776418-197_776418_c-197_776418</cim:IdentifiedObject.name>
  <cim:ACDCTerminal.sequenceNumber>1</cim:ACDCTerminal.sequenceNumber>
  <cim:Terminal.phases rdf:resource="http://iec.ch/TC57/2013/CIM-schema-cim16#PhaseCode.ABC"/>
  <cim:Terminal.ConductingEquipment rdf:resource="#_54316ce3-c122-a063-2131-72e042597083"/>
  <cim:Terminal.ConnectivityNode rdf:resource="#_4d1c9631-a93f-bf6c-af8c-60f3ba60a073"/>
</cim:Terminal>
<cim:Terminal rdf:ID="_a5631b74-04bb-172a-c2a1-105f0b2cfbfe">
  <cim:IdentifiedObject.name>Xfr197_776418-197_776418-197_776418</cim:IdentifiedObject.name>
  <cim:ACDCTerminal.sequenceNumber>2</cim:ACDCTerminal.sequenceNumber>
  <cim:Terminal.phases rdf:resource="http://iec.ch/TC57/2013/CIM-schema-cim16#PhaseCode.ABC"/>
  <cim:Terminal.ConductingEquipment rdf:resource="#_54316ce3-c122-a063-2131-72e042597083"/>
  <cim:Terminal.ConnectivityNode rdf:resource="#_29a84cbd-18bb-0d9b-9aa7-76096b86efb3"/>
</cim:Terminal>
<cim:PowerTransformerEnd rdf:ID="_631513b8-83e9-6e4e-3a36-20566ffc03da">
  <cim:IdentifiedObject.name>Xfr197_776418-197_776418_c-197_776418</cim:IdentifiedObject.name>
  <cim:TransformerEnd.endNumber>1</cim:TransformerEnd.endNumber>
  <cim:TransformerEnd.BaseVoltage rdf:resource="#_c2356069-e9d1-e79c-a924-378153cfbbfb"/>
  <cim:PowerTransformerEnd.PowerTransformer rdf:resource="#_54316ce3-c122-a063-2131-72e042597083"/>
  <cim:TransformerEnd.Terminal rdf:resource="#_631513b8-83e9-6e4e-3a36-20566ffc03da"/>
</cim:PowerTransformerEnd>
<cim:PowerTransformerEnd rdf:ID="_a5631b74-04bb-172a-c2a1-105f0b2cfbfe">
  <cim:IdentifiedObject.name>Xfr197_776418-197_776418-197_776418</cim:IdentifiedObject.name>
  <cim:TransformerEnd.endNumber>2</cim:TransformerEnd.endNumber>
  <cim:TransformerEnd.BaseVoltage rdf:resource="#_36790ecd-55c2-030d-c553-685bef719df6"/>
  <cim:PowerTransformerEnd.PowerTransformer rdf:resource="#_54316ce3-c122-a063-2131-72e042597083"/>
  <cim:TransformerEnd.Terminal rdf:resource="#_a5631b74-04bb-172a-c2a1-105f0b2cfbfe"/>
</cim:PowerTransformerEnd>
```

# 2019 Modern Electric Power Systems (MEPS) in IEEE

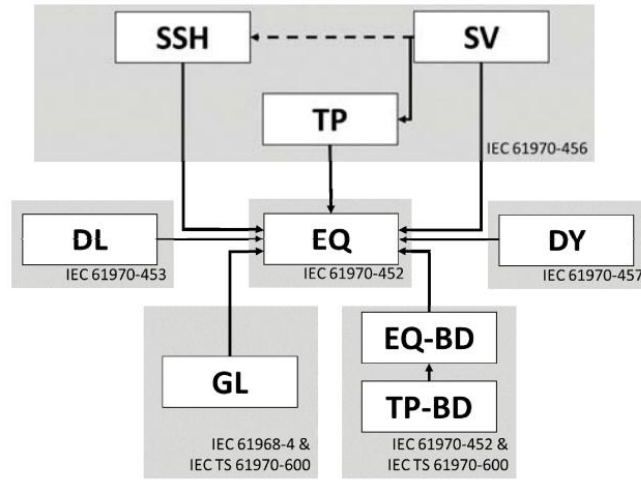


Fig. 2 CGMES 2.4.15 dependencies.

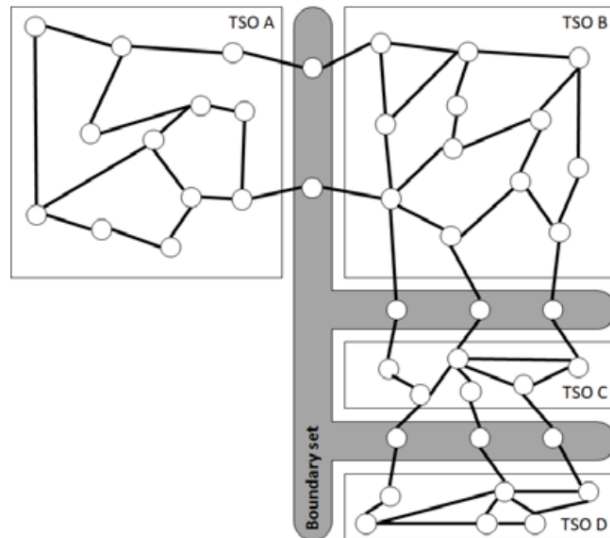


Fig. 4 Use case for boundary set application while assembling CGM.

## CGMES as an interface for multilateral grid modelling data exchange

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Wrocław, Poland  
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Tomasz Rogowski  
PSE Innowacje  
Wrocław, Poland  
tomasz.rogowski@pse.pl

**Abstract—** Common Information Model (CIM) is an important framework used to describe electrical power systems at different voltage levels, widely applied both in the area of event message exchange and in network topology and parameter exchange. Common Grid Model Exchange Specification (CGMES) is a superset of CIM, developed specifically to meet needs of ENTSO-E, related to coordination of different actions performed by Trans

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ENTSO-E, which was created in 2009, as a merge of six regional TSO associations (including UCTE), decided to build up on this initiative, by creating Common Grid Model Exchange Specification (CGMES) with its first release, based on CIM14 in 2011, and currently used version 2.4.15 based on CIM16 released in 2014. CGMES holds status of IEC Technical Specification IEC TS 61970-600-1 and 61970-600-

### VI. FUTURE

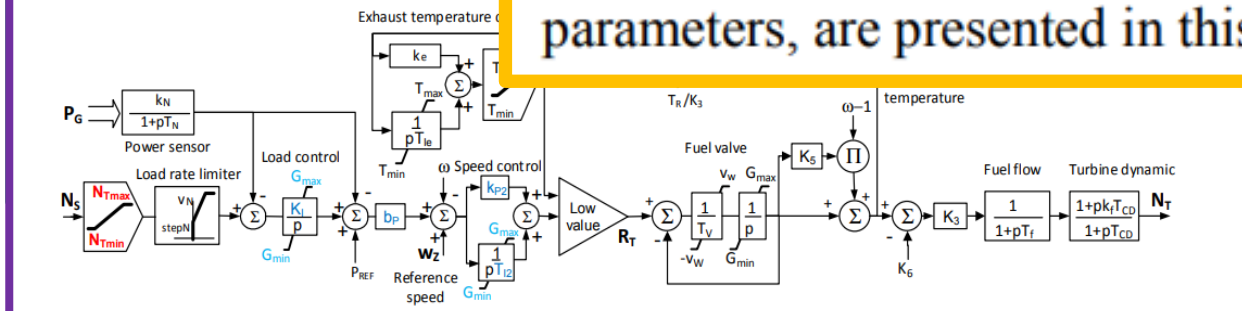
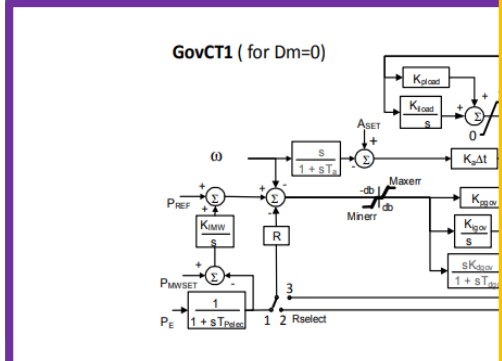
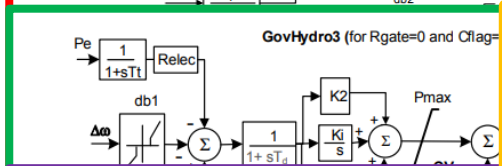
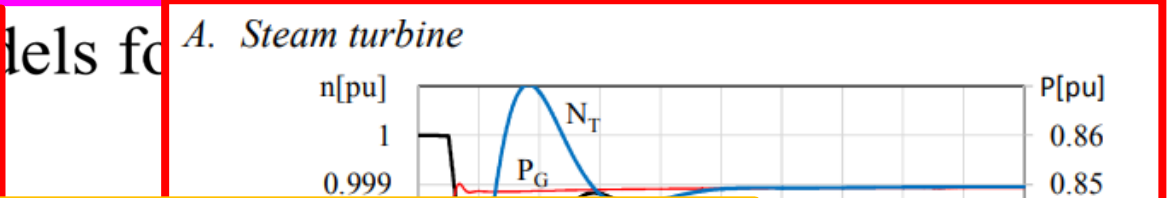
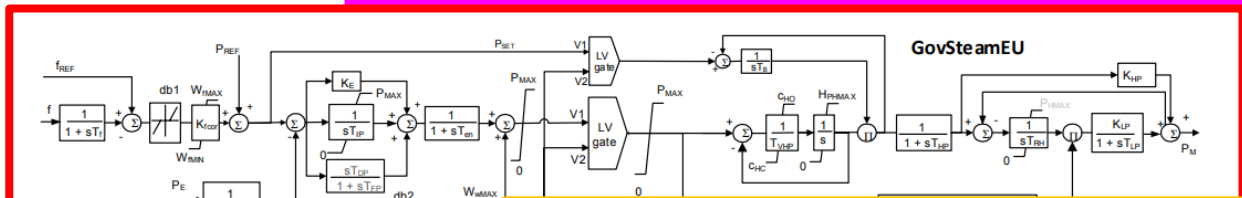
With ambitious targets set by European regulators in a form of Network Codes, new environment for Transmission System Operators is forging, in which multilateral data exchange and pan-European grid analysis and optimization is of high importance. CGMES, as standard based on CIM and tailored to ENTSO-E needs, is an important part of this process.

BUSINESS

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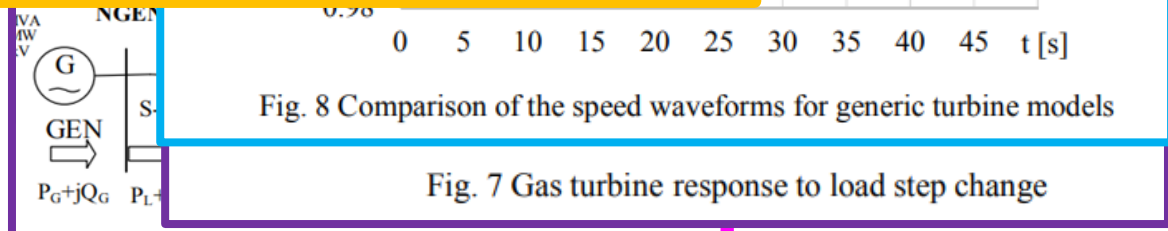
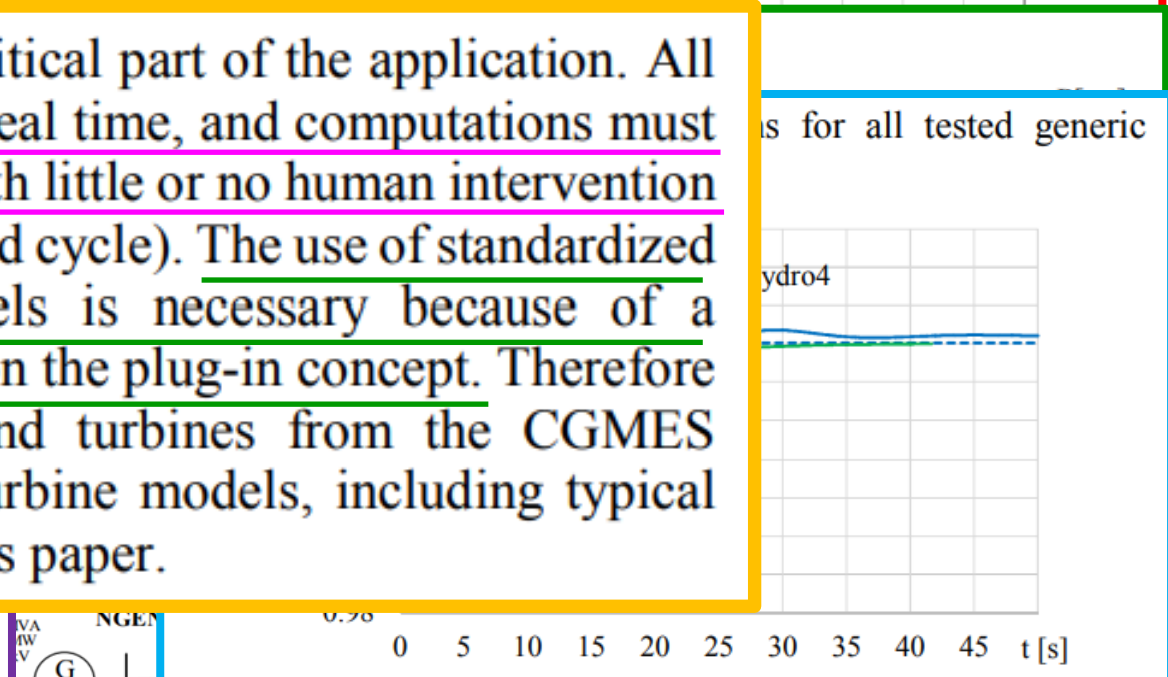
ing Congestion  
Short Circuit

# 2018 19th International Scientific Conference on Electric Power Engineering (EPE) in IEEE



Scheme of GovCT1 model (above simplified and modified according to [1]) and the corresponding alternative model GASA from the MODES library

Preparing input data is a critical part of the application. All data must be prepared in near real time, and computations must be carried out automatically with little or no human intervention (and in a tightly time constrained cycle). The use of standardized or compatible dynamic models is necessary because of a universal data interface based on the plug-in concept. Therefore generic models of exciters and turbines from the CGMES standard will be used. Such turbine models, including typical parameters, are presented in this paper.

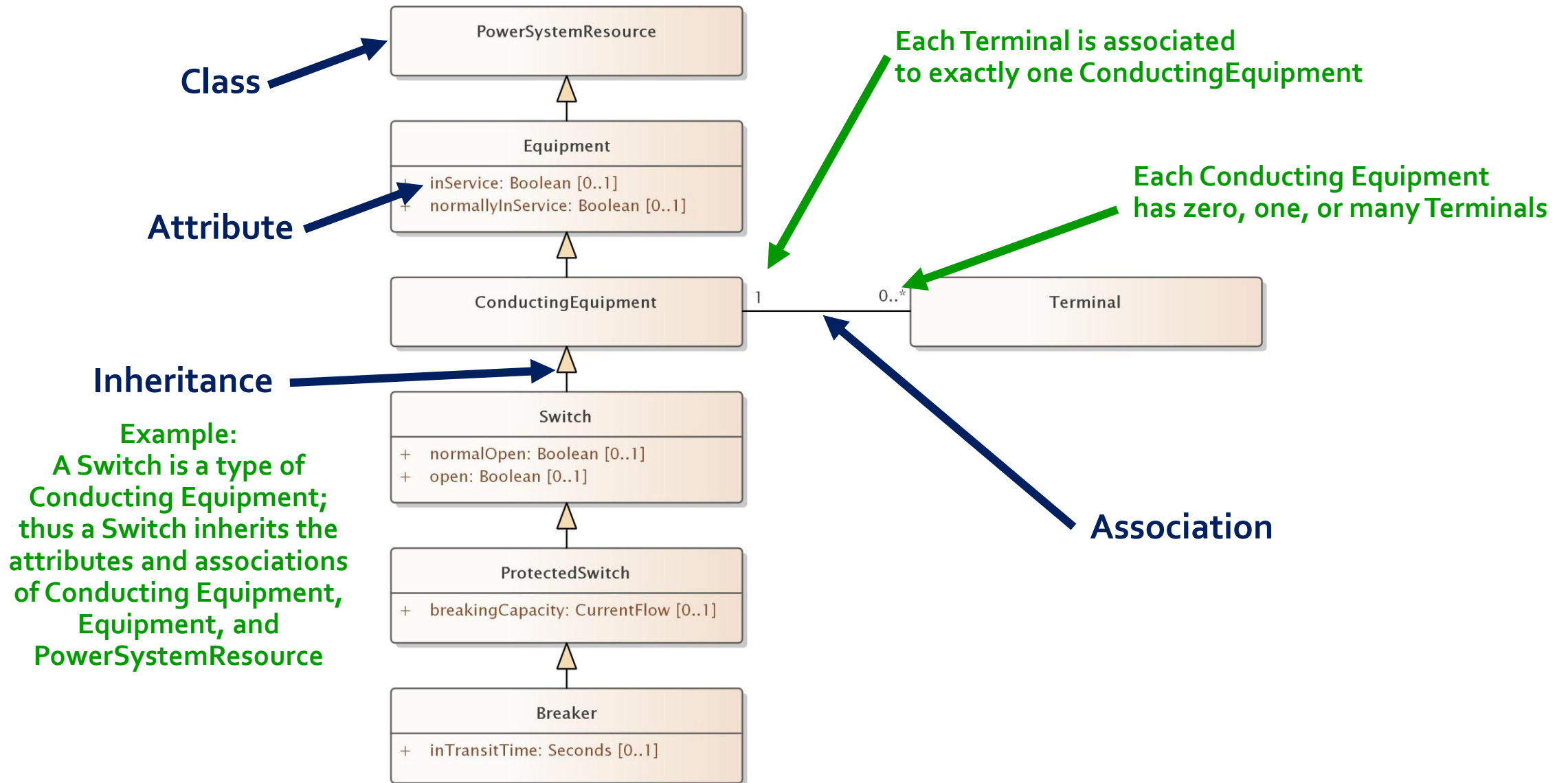


Single line diagram for the test grid configuration (according to [4])

Thank You



# UML Basics



# IEC 61970

