### Clear guidance on appropriate use of CIM classes for transformer instance modeling.

GMDM Issue #5

There is discussion of transformer modeling in 61970-301, 61970-452, and 61968-13, along with documentation in the UML. The sources, taken together, do not present cohesive guidance for the population of CIM objects describing transformers for unbalanced power flows.

There is a need for:

* Foundational information, completely apart from the CIM classes or their use, regarding how transformers are modeled in network models used for balanced power flows vs the transformer modeling required to support unbalanced power flows. *This guidance probably belongs in either 301/the UML or some sort of ‘how to use the CIM’ document.*
* A general description of the CIM’s approach to meeting the modeling requirements identified in the bullet above: how the high-level design of the CIM information model supports transformer descriptions adequate for various types of network analysis. Presumably this would address concepts like:
  + Balanced vs unbalanced
  + Star vs mesh
  + Direct impedance modeling vs nameplate and test result modeling of impedance calculation inputs
  + Short cuts (like expressing impedance definitions on a single winding)
  + Etc.

It should cover the purpose of each of the major classes. *This content should go in 301/the UML.*

* A detailed description of how the CIM classes should be used. What classes should be instantiated and what attributes should be populated under what circumstances. A useful way to present this information might be to give examples of ‘best practice’ modeling for various types of typical transformers. It would probably need to consider the type of network analysis for which the transformer model is being created.

It would cover topics like when TransformerTank-based modeling should be used or when impedances can be expressed using PowerTransformerEnd attributes. It would address the relationship among related attributes, for example the relationship among:

* PowerTransformer.vectorGroup
* TransformerTankEnd.orderedPhases and .grounded (along with .rground and .xground, if appropriate)
* TransformerEndInfo.connectionKind and .phaseAngleClock

Given the complexity of the CIM information model for transformers (14 classes not including tap/tap changer modeling which has an additional ~9 classes), this kind of ‘best practice’ modeling guidance is essential for interoperability. *This guidance belongs in some sort of ‘how to use the CIM’ document.*

The document called **Transformer references.docx** collects together descriptions from 61970-301, 61970-452, and 61968-13, the UML, the CIM Primer and a paper written by Tom McDermott and could serve as a resource.

