



# Smart Grid Standards Information

Version 1.6

Thursday, May 13, 2010

## Section I: Use and Application of the Standard

### A. Identification and Affiliation

|    |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Number of the standard                         | C12.1-2008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2. | Title of the standard                          | American National Standard for Electric Meters Code for Electricity Metering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 3. | Name of owner organization                     | ANSI                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 4. | Latest versions, stages, dates                 | 2008                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 5. | URL(s) for the standard                        | <a href="http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+C12.1-2008">http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+C12.1-2008</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 6. | Working group / committee                      | ANSI SC12.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 7. | Original source of the content (if applicable) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 8. | Brief description of scope                     | This Code establishes acceptable performance criteria for new types of ac watt-hour meters and auxiliary devices. It describes acceptable in-service performance levels for meters and devices used in revenue metering. It also includes information on related subjects, such as recommended measurement standards, installation requirements, test methods, and test schedules. It serves as the standard for electro-mechanical meters and a directly reference standard for higher accuracy solid state meters. This Code for Electricity Metering is designed for those concerned with the art of electricity metering, such as utilities, manufacturers, and regulatory bodies. |

### B. Level of Standardization

|    |                                                                                                                  |                                                                                                                                                                                                            |
|----|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Names of standards development organizations that recognize this standard and/or accredit the owner organization | ANSI, NEMA                                                                                                                                                                                                 |
| 2. | Has this standard been adopted in regulation or legislation, or is it under consideration for adoption?          | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No #####                                                                                                                                  |
| 3. | Has it been endorsed or recommended by any level of government? If "Yes", please describe                        | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No State Commissions                                                                                                                      |
| 4. | Level of Standard (check all that apply)                                                                         | <input type="checkbox"/> International <input checked="" type="checkbox"/> National <input checked="" type="checkbox"/> Industry <input type="checkbox"/> de Facto <input type="checkbox"/> Single Company |
| 5. | Type of document                                                                                                 | <input checked="" type="checkbox"/> Standard <input type="checkbox"/> Report <input type="checkbox"/> Guide <input type="checkbox"/> Technical Specification                                               |

## Section I: Use and Application of the Standard

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|------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6.                     | Level of Release                                                                       | <input checked="" type="checkbox"/> Released <input type="checkbox"/> In Development <input type="checkbox"/> Proposed                                                                                                                                                                                                                 |
| <b>C. Areas of Use</b> |                                                                                        |                                                                                                                                                                                                                                                                                                                                        |
| 1.                     | Currently used in which domains? (check all that apply)                                | <input checked="" type="checkbox"/> Markets <input checked="" type="checkbox"/> Operations <input checked="" type="checkbox"/> Service Providers<br><input type="checkbox"/> Generation <input checked="" type="checkbox"/> Transmission <input checked="" type="checkbox"/> Distribution <input checked="" type="checkbox"/> Customer |
| 2.                     | Planned for use in which domains? (check all that apply)                               | <input checked="" type="checkbox"/> Markets <input checked="" type="checkbox"/> Operations <input checked="" type="checkbox"/> Service Providers<br><input type="checkbox"/> Generation <input checked="" type="checkbox"/> Transmission <input checked="" type="checkbox"/> Distribution <input checked="" type="checkbox"/> Customer |
| 3.                     | Please describe the Smart Grid systems and equipment to which this standard is applied | Electricity Meters                                                                                                                                                                                                                                                                                                                     |

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| <b>Section I: Use and Application of the Standard</b> |
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|                                                             |
|-------------------------------------------------------------|
| <b>D. Relationship to Other Standards or Specifications</b> |
|-------------------------------------------------------------|

## Section I: Use and Application of the Standard

|    |                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Which standards or specifications are referenced by this standard? | <p>ANSI/IEEE C63.4-2003, Methods of Measurement of Radio-Noise Emissions From Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz</p> <p>ASQ Z1.4-2003, Sampling Procedures and Tables for Inspection by Attributes</p> <p>ASQ Z1.9-2003, Sampling Procedures and Tables for Inspection by Variables for Percent Nonconforming</p> <p>ASTM B117-2003, Standard Practice for Operating Salt Spray (Fog) Apparatus</p> <p>ASTM G155 2005, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials</p> <p>Code of Federal Regulations (Telecommunication) CFR 47, Part 15—Radio Frequency Devices, Subparts A—General and B—Unintentional Radiators</p> <p>Chapter 13 “The Customers’ Premises, Service and Installations”, Handbook for Electricity Metering, 10th Edition, Washington, D.C.: Edison Electric Institute, 2002</p> <p>IEEE 1-2000, IEEE Recommended Practice: General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation</p> <p>IEEE Std 100-2000, The Authoritative Dictionary of IEEE Standards Terms</p> <p>IEEE C37.90.1-2002, IEEE Standard Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems Associated with Electric Power Apparatus</p> <p>IEEE C57.13-1993, IEEE Standard Requirements for Instrument Transformers</p> <p>IEEE C62.41.1-2002, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits</p> <p>IEEE C62.41.2-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits</p> <p>IEC 60068-2-6 (1995), Environmental Testing - Part 2: Tests, Test Fc: Vibration (Sinusoidal)</p> <p>IEC 60068-2-27 (1987), Environmental Testing, Part 2: Tests, Test Ea and Guidance: Shock.</p> <p>IEC 61000-4-2 (2001), Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement</p> <p>IEC 61000-4-4 (2004), Electromagnetic Compatibility (EMC), Part 4-4: Testing and Measurement Techniques - Electrical Fast Transient/Burst Immunity Test</p> <p>International Safe Transit Association, Test Procedure 1A, Performance Test for Individual Packaged-Products Weighing 150 lb. (68 kg) or Less, (revision date: 2001) , Vibration and Shock</p> <p>NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum)</p> <p>NFPA 70-2005, National Electrical Code</p> <p>UL 50-1995, UL Standard for Enclosures for Electrical Equipment</p> |
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## Section I: Use and Application of the Standard

|    |                                                                      |                                                                                                  |
|----|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 2. | Which standards or specifications are related to this standard?      | ANSI C12.10, ANSI C12.20                                                                         |
| 3. | Which standards or specifications cover similar areas (may overlap)? | IEC 62052-11, IEC 62053-11, IEC 62053-21, IEC 62053-22, IEC 62053-23, IEC 62053-52, IEC 62053-61 |
| 4. | What activities are building on this work?                           | Newer editions of metering standards                                                             |

### E. Dept of Energy Smart Grid Characteristics

Please describe how this standard may encourage each of the following:

|    |                                                                      |                                                                           |
|----|----------------------------------------------------------------------|---------------------------------------------------------------------------|
| 1. | Enables informed participation by customers                          | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ##### |
| 2. | Accommodates all generation and storage options                      | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ##### |
| 3. | Enables new products, services and markets                           | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ##### |
| 4. | Provides the power quality for a range of needs                      | <input type="checkbox"/> Yes <input type="checkbox"/> No <b>N/A</b>       |
| 5. | Optimizes asset utilization and operating efficiency                 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ##### |
| 6. | Operates resiliently to disturbances, attacks, and natural disasters | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ##### |

## F. Priority Areas Previously Mentioned by FERC and NIST

Please describe if and how this standard may be applied in each of the following areas. Note that there is space in section J to discuss any other significant areas where the standard may be applied.

|    |                                                               |                                                                                                                            |
|----|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1. | Cybersecurity and physical security                           | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Provides method for security seal for tamper detection |
| 2. | Communicating and coordinating across inter-system interfaces | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No N/A                                                    |
| 3. | Wide area situational awareness                               | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No N/A                                                    |
| 4. | Smart grid-enabled response for energy demand                 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Provides kW and kWh data                               |
| 5. | Electric storage                                              | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Can provide bi-directional kWh data                    |
| 6. | Electric vehicle transportation                               | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No requirements not fully defined                         |
| 7. | Advanced metering infrastructure                              | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Provides the metering data                             |
| 8. | Distribution grid management                                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Can provide kW and kWh data                            |

| <b>G. Openness</b> |                                                                                                          |                                                                                                                                                                                                                    |
|--------------------|----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                 | Amount of fee (if any) for the documentation                                                             | \$134                                                                                                                                                                                                              |
| 2.                 | Amount of fee (if any) for implementing the standard                                                     | None                                                                                                                                                                                                               |
| 3.                 | Amount of fee (if any) to participate in updating the standard                                           | None                                                                                                                                                                                                               |
| 4.                 | Is the standard documentation available online?                                                          | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br><a href="http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+C12.1-2008">http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI+C12.1-2008</a> |
| 5.                 | Are there open-source or reference implementations?                                                      | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No N/A                                                                                                                                            |
| 6.                 | Are there open-source test tools?                                                                        | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No N/A                                                                                                                                            |
| 7.                 | Would open-source implementations be permitted?                                                          | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No N/A                                                                                                                                            |
| 8.                 | Approximately how many implementers are there?                                                           | 10's                                                                                                                                                                                                               |
| 9.                 | Approximately how many users are there?                                                                  | 1000's                                                                                                                                                                                                             |
| 10.                | Where is the standard used outside of the USA?                                                           | ANSI Meter Market, primarily in the Americas, also some countries in Asia                                                                                                                                          |
| 11.                | Is the standard free of references to patented technology?                                               | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                |
| 12.                | If patented technology is used, does the holder provide a royalty-free license to users of the standard? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not Patented                                                                                                          |
| 13.                | Can an implementer use the standard without signing a license agreement?                                 | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                |
| 14.                | Are draft documents available to the public at no cost?                                                  | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                                |
| 15.                | How does one join the working group or committee that controls the standard?                             | Attend a meeting of the Subcommittee                                                                                                                                                                               |
| 16.                | Is voting used to decide whether to modify the standard? If Yes, explain who is permitted to vote.       | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No at the Subcommittee level, consistent participants; at the Main Committee level, a balance of voting members in the three ANSI categories      |
| 17.                | Is an ANSI-accredited process used to develop the standard?                                              | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                |
| 18.                | What countries are represented in the working group or committee that controls the standard?             | USA, Canada                                                                                                                                                                                                        |

## H. Support, Conformance, Certification and Testing

|    |                                                                                            |                                                                                                                                                                                                                                                     |
|----|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Is there a users group or manufacturers group to support this standard?                    | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                                                                 |
| 2. | What is the name of the users group or manufacturers group (if any)?                       |                                                                                                                                                                                                                                                     |
| 3. | What type of test procedures are used to test this standard? (please check all that apply) | <input checked="" type="checkbox"/> Internal to the lab<br><input checked="" type="checkbox"/> Published by standards organization<br><input type="checkbox"/> Published by users group<br><input type="checkbox"/> No procedures, informal testing |
| 4. | Are there test vectors (pre-prepared data) used in testing? (please check all that apply)  | <input checked="" type="checkbox"/> Internal to the lab<br><input type="checkbox"/> Published by standards organization<br><input type="checkbox"/> Published by users group<br><input type="checkbox"/> No procedures, informal testing            |

|     |                                                                                                                                                    |                                                                                                                                                                                                                                   |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.  | What types of testing programs exist?<br>(check all that apply)                                                                                    | <input type="checkbox"/> Interoperability Testing<br><input checked="" type="checkbox"/> Conformance Testing<br><input type="checkbox"/> Security Testing<br><input type="checkbox"/> No Testing                                  |
| 6.  | What types of certificates are issued?<br>(check all that apply)                                                                                   | <input type="checkbox"/> Interoperability Certificate<br><input checked="" type="checkbox"/> Conformance Certificate<br><input type="checkbox"/> Security Certificate (text document)<br><input type="checkbox"/> No Certificates |
| 7.  | Are there rules controlling how and when to use the logo?                                                                                          | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Standard has no logo                                                                                                                 |
| 8.  | Is there a program to approve test labs?                                                                                                           | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                                               |
| 9.  | Approximately how many test labs are approved (if any)?                                                                                            | 10's Number of labs able to do the tests                                                                                                                                                                                          |
| 10. | Is there a defined process for users to make technical comments on the standard or propose changes to the standard and have these issues resolved? | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                               |
| 11. | Is there a published conformance checklist or table?                                                                                               | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                               |
| 12. | Are there defined conformance blocks or subsets?                                                                                                   | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                                                                                                                       |
| 13. | Approximately how many vendors provide test tools?                                                                                                 | 10's                                                                                                                                                                                                                              |
| 14. | Are there tools for pre-certification prior to testing?                                                                                            | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                               |
| 15. | Can vendors self-certify their implementations?                                                                                                    | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                               |
| 16. | Is there application testing for specific uses?                                                                                                    | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                                                                                                                       |
| 17. | Is there a "golden" or "reference" implementation to test against?                                                                                 | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                                               |
| 18. | Who typically funds the testing? (check all that apply)                                                                                            | <input type="checkbox"/> User <input type="checkbox"/> Users Group <input checked="" type="checkbox"/> Vendor<br><input type="checkbox"/> Confidential                                                                            |
| 19. | Is there a method for users and implementers to ask questions about the standard and have them answered?<br>(check all that apply)                 | <input checked="" type="checkbox"/> Yes, official interpretations<br><input checked="" type="checkbox"/> Yes, informal opinions<br><input type="checkbox"/> No                                                                    |
| 20. | Does the users' group (or some other group) fund specific tasks in the evolution of the standard?                                                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                               |
| 21. | Is the users' group working on integration, harmonization or unification with other similar standards?                                             | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                               |
| 22. | What other standards is this standard being integrated, harmonized, or unified with (if any)?                                                      | ANSI C12.7, ANSI C12.10, ANSI C12.20                                                                                                                                                                                              |
| 23. | Are there application notes, implementation agreements, or guidelines available describing specific uses of the standard?                          | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable                                                                                                                       |

## J. Notes

Please present here any additional information about the standard that might be useful:

1. This Smart Grid Information document's focus is on data flow. The subject standard (ANSI C12.1) is about the accurate generation (measurement) of such data, and thus many of this document's fields are not applicable.

## Section II: Functional Description of the Standard

### K. GridWise Architecture: Layers

Please identify which layers this standard specifies, as described in

[http://www.gridwiseac.org/pdfs/interopframework\\_v1\\_1.pdf](http://www.gridwiseac.org/pdfs/interopframework_v1_1.pdf), and the applicable section of the standard. Note the mapping to the Open Systems Interconnect (OSI) model is approximate.

|    |                                                             |                                                                                                                                                          |
|----|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | <b>Layer 8: Policy</b>                                      | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Sets kWh accuracy standards for regulatory authorities.                              |
| 2. | <b>Layer 7: Business Objectives</b>                         | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No #####                                                                                |
| 3. | <b>Layer 6: Business Procedures</b>                         | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No #####                                                                                |
| 4. | <b>Layer 5: Business Context</b>                            | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No #####                                                                                |
| 5. | <b>Layer 4: Semantic Understanding (object model)</b>       | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No #####                                                                                |
| 6. | <b>Layer 3: Syntactic Interoperability (OSI layers 5-7)</b> | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No #####                                                                                |
| 7. | <b>Layer 2: Network Interoperability (OSI layers 3-4)</b>   | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No #####                                                                                |
| 8. | <b>Layer 1: Basic Connectivity (OSI layers 1-2)</b>         | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Provides basic interface between electrical grid (wires) and data (kWh measurements) |

### L. GridWise Architecture: Cross-Cutting Issues

Please provide an explanation in the box beside the heading for any questions answered "Not applicable". If the question is not applicable because the function is provided in another layer or standard, please suggest any likely candidates. Note that "the standard" refers to the technology specified by the standard, not the documents themselves.

|    |                                                                          |                                                                                                                        |
|----|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
|    | <b>Shared Meaning of Content</b>                                         | ANSI C12.1 standard does not involve the transfer of data or a data model                                              |
| 1. | Do all implementations share a common information model?                 | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 2. | Can data be arranged and accessed in groups or structures?               | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 3. | Can implementers extend the information model?                           | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 4. | Can implementers use a subset of the information model?                  | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
|    | <b>Resource Identification</b>                                           | ANSI C12.1 standard does not involve the transfer of data or a data names                                              |
| 5. | Can data be located using human-readable names?                          | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
| 6. | Can names and addresses be centrally managed without human intervention? | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable            |
|    | <b>Time Synchronization and Sequencing</b>                               | ANSI C12.1 standard does not involve the transfer of data or time                                                      |
| 7. | Can the standard remotely synchronize time?                              | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Provided in another layer |
| 8. | Can the standard indicate the quality of timestamps?                     | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Provided in another layer |

## Section II: Functional Description of the Standard

|     |                                                                                                                 |                                                                                                                                                                                                             |
|-----|-----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | <b>Security and Privacy</b>                                                                                     | ANSI C12.1 standard does not involve the transfer of data or the security of data                                                                                                                           |
| 9.  | Where is security provided for this standard?                                                                   | <input type="checkbox"/> Within this standard<br><input checked="" type="checkbox"/> By other standards                                                                                                     |
| 10. | Does the standard provide authentication?                                                                       | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                         |
| 11. | Does the standard permit role-based access control?                                                             | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                         |
| 12. | Does the standard provide encryption?                                                                           | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                         |
| 13. | Does the standard detect intrusions or attacks?                                                                 | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                         |
| 14. | Does the standard facilitate logging and auditing of security events?                                           | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                         |
| 15. | Can the security credentials be upgraded remotely?                                                              | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> No Credentials                                                                                                 |
| 16. | Can the security credentials be managed centrally?                                                              | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> No Credentials                                                                                                 |
| 17. | Please list any security algorithms and standards used                                                          | none                                                                                                                                                                                                        |
| 18. | Please provide additional information on how the standard addresses any "Yes" answers above                     | #####                                                                                                                                                                                                       |
| 19. | Please provide additional information about why any of the questions listed above do not apply to this standard | ANSI C12.1 standard does not involve the transfer of data                                                                                                                                                   |
|     | <b>Logging and Auditing</b>                                                                                     | #####                                                                                                                                                                                                       |
| 20. | Does the standard facilitate logging and auditing of critical operations and events?                            | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                         |
| 21. | Can the standard gather statistics on its operation?                                                            | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                                                                                                 |
| 22. | Can the standard report alerts and warnings?                                                                    | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                                                                                                 |
|     | <b>Transaction State Management</b>                                                                             | #####                                                                                                                                                                                                       |
| 23. | Can the standard remotely enable or disable devices or functions?                                               | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                                                                                                 |
|     | <b>System Preservation</b>                                                                                      | #####                                                                                                                                                                                                       |
| 24. | Can the standard automatically recover from failed devices or links?                                            | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable<br><input type="checkbox"/> Provided in another layer                                           |
| 25. | Can the standard automatically re-route messages?                                                               | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable<br><input type="checkbox"/> Provided in another layer                                           |
| 26. | Can the standard remotely determine the health (as opposed to just connectivity) of devices or software?        | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                                                                                                 |
|     | <b>Other Management Capabilities</b>                                                                            |                                                                                                                                                                                                             |
| 27. | Please describe any other system or network management capabilities the standard provides.                      | none                                                                                                                                                                                                        |
|     | <b>Quality of Service</b>                                                                                       | #####                                                                                                                                                                                                       |
| 28. | Is data transfer bi-directional?                                                                                | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                         |
| 29. | Can data be prioritized?                                                                                        | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                                                                                                 |
| 30. | What types of reliability are provided?                                                                         | <input checked="" type="checkbox"/> Reliable <input type="checkbox"/> Non-guaranteed<br><input type="checkbox"/> Both <input type="checkbox"/> Either<br><input type="checkbox"/> Provided in another layer |

## Section II: Functional Description of the Standard

|     |                                                                                                                                                                        |                                                                                                                                       |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 31. | Can information be broadcast to many locations with a single transmission?                                                                                             | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                           |
| 32. | Please describe any other methods the standard uses to manage quality of service.                                                                                      | #####                                                                                                                                 |
|     | <b>Discovery and Configuration</b>                                                                                                                                     | #####                                                                                                                                 |
| 33. | Can the software or firmware be upgraded remotely?                                                                                                                     | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                           |
| 34. | Can configuration or settings be upgraded remotely?                                                                                                                    | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                           |
| 35. | Can implementations announce when they have joined the system?                                                                                                         | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                           |
| 36. | Can implementations electronically describe the data they provide?                                                                                                     | <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable                                      |
|     | <b>System Evolution and Scalability</b>                                                                                                                                | #####                                                                                                                                 |
| 37. | What factors could limit the number of places the standard could be applied?                                                                                           | No technical limits                                                                                                                   |
| 38. | What steps are required to increase the size of a system deploying this standard?                                                                                      | Buy more meters, wire more sockets                                                                                                    |
| 39. | Is the information model separate from the transport method?                                                                                                           | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable                           |
| 40. | Does the standard support alternate choices in the layers(s) below it?                                                                                                 | <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> No layers below                          |
| 41. | List the most common technology choices for layers implemented below this standard                                                                                     | none                                                                                                                                  |
| 42. | Does the standard support multiple technology choices in the layers above it?                                                                                          | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> No layers above                          |
| 43. | List the technologies or entities that would most commonly use this standard in the layer above                                                                        | AMI system, wired or wireless; demand response                                                                                        |
| 44. | Please describe any mechanism or plan to ensure the standard is as backward-compatible as possible with previous versions                                              | Meters built to this standard have a long service life and members (users) of the standards subcommittee ensure maximum compatibility |
| 45. | Please describe how the design of this standard permits it to be used together with older or legacy technologies                                                       | Changes to standard are generally small                                                                                               |
| 46. | Please describe how the design of this standard permits it to co-exist on the same network or in the same geographic area with similar technologies, and give examples | Not applicable                                                                                                                        |
| 47. | <b>Electromechanical</b>                                                                                                                                               | #####                                                                                                                                 |

### M. Architectural Principles

Please describe how this standard may apply any of these principles:

|    |                                                                           |                                           |
|----|---------------------------------------------------------------------------|-------------------------------------------|
| 1. | Symmetry – facilitates bi-directional flow of energy and information      | Can measure bi-directional flow of energy |
| 2. | Transparency – supports a transparent and auditable chain of transactions | N/A                                       |

## Section II: Functional Description of the Standard

|    |                                                                                                                                                                                         |     |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| 3. | Composition – facilitates the building of complex interfaces from simpler ones                                                                                                          | N/A |
| 4. | Loose coupling – can support bilateral and multilateral transactions without elaborate pre-arrangement                                                                                  | N/A |
| 5. | Shallow integration – does not require detailed mutual information to interact with other components                                                                                    | N/A |
| 6. | Please list any other architectural models, reference architectures or frameworks this standard was designed to be compliant with, e.g. W3C, IEC TC57, OSI and how it fits those models | N/A |