UNITED STATES

DEPARTMENT OF AGRICULTURE

RURAL UTILITIES SERVICE

SUMMARY OF

ITEMS OF ENGINEERING INTEREST

AUGUST 1997

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ABBREVIATIONS

AAC	All Aluminum Conductor
AAAC	All Aluminum Alloy Conductor
ACSR	Aluminum Conductor Steel Reinforced
ACSR/TW	Aluminum Conductor Steel Reinforced - Trapezoidal Wire
ACSR/AW/TW	Aluminum Conductor Aluminum Clad-Steel Reinforced - Trapezoidal Wire
ACSR/SD	Aluminum Conductor Steel Reinforced - Self-Damping
ACSS	Aluminum Conductor Steel Supported
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
BIL	Basic Impulse Level
CATV	Cable Television
CFR	Code of Federal Regulations
CITCEM	Commercial and Industrial Transformer Cost Evaluation Model
DTCEM	Distribution Transformer Cost Evaluation Model
EPA	Environmental Protection Agency
EPR	Ethylene Propylene Rubber
EPRI	Electric Power Research Institute
ESD	Electric Staff Division
G&T	Generation and Transmission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronics Engineers
kV	Kilovolt
RUS List of Materials	RUS Informational Publication 202-1, “List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers”
NEC	National Electrical Code
NECA	National Exchange Carrier Association
NFPA	National Fire Protection Association
NESC	National Electrical Safety Code
NRECA	National Rural Electric Cooperative Association
NUP	Net Utility Plant
O&M	Operation and Maintenance
OFM	Owner Furnished Materials
OTS	Optimal Transformer Sizing
PES	Power Engineering Society
REA	Rural Electrification Administration
RUS	Rural Utilities Service
SCADA	System Control and Data Acquisition
SSAC	Steel Supported Aluminum Conductor
T&D	Transmission & Distribution
TOC	Total Owning Cost
UCA	Utility Communications Architecture
URD	Underground Rural Distribution
UV	Ultraviolet
VR	Vibration-Resistant

CODES and STANDARDS

General Compliance with Codes

With respect to general code compliance, in most cases, RUS borrowers' facilities fall under the National Electrical Safety Code (NESC). Usually, borrowers' facilities are installed outdoors on property owned or leased by borrowers (for access by only qualified personnel) and such electric facilities fall under the purview of the NESC. In some cases, borrowers' outside facilities may also have to comply with state or local code requirements that stipulate details that are in excess of the NESC. However, for the most part, borrowers only need to deal with the NESC. This usual focus on the NESC can lead to the impression that the NESC is the only code requiring compliance.

In fact, at a recent meeting, the statement was made that the NESC is the only code which borrowers needed to observe...and this blanket statement is the concern here.

Code compliance depends on where equipment and facilities are located. And there may be situations where borrowers install or need to install electric facilities and equipment in or on customers' buildings and structures which, in such cases, fall under the purview of the National Electrical Code (NEC), NFPA 70.

Because of concerns for liability, insurance, etc., when installing electrical equipment in or on a customer's building, borrowers must ensure that:

- Equipment and facilities are installed by a competent electrician, and where required by state or local ordinances, a duly registered electrician; and

- The installation complies with the NEC and all required local codes.

It is simply prudent utility practice to be certain that all company installations are in full compliance with all pertinent, applicable, codes or requirements.

If you would like more information or have any questions, please call Harvey Bowles, Chief, Distribution Branch, at (202) 720-5082.

NESC Rule 152 on Location of Transformers

At a recent engineering meeting, a question arose as to whether there is an RUS or NESC provision which specifies a required distance between an oil-filled, pad-mounted, transformer and a non-fire resistant building.

NESC Rule 152 covers the applicable provisions and it mandates that common sense prevail. The rule specifies installation provisions for the location and arrangement of transformers and regulators in both indoor and outdoor environments, and specifically mentions provisions for transformers and regulators that are oil-filled.

One of the concerns addressed in Rule 152 is the spread of fire by the possible spewing of flaming oil from transformers or regulators. The rule requires that the installation of liquid-filled transformers utilize one or more of the methods cited in Rule 152 to minimize fire hazards. The method that is applied must be chosen with consideration of the degree of fire hazard associated with the equipment being installed. Recognized methods cited in Rule 152 include use of less flammable liquids, space separation, fire-resistant barriers, automatic extinguishing systems, absorption beds, and enclosures. The rule advises that the amount and characteristic of the liquid contained should be considered in the selection of space separation, fire-resistant barriers, automatic extinguishing systems, absorption beds, and enclosures that confine the liquid of a ruptured transformer tank, all of which are recognized as safeguards.

Although only generalized provisions are specified and specific distances and clear cut provisions are not specifically addressed in Rule 152, the rule is clear that the utility must give more than cursory consideration to where an oil-filled transformers is to be located. It is up to the utility to research and determine the relative hazard of the equipment to be installed and to install it appropriately.

The least expensive method to consider for most rural electric installations appears to be the space separation method. Transformers should be installed a sufficient distance away from flammable structures, such as wood structure houses, etc., to avoid the possible spread of fire from spewing oil in the event the transformer sustains damage that causes it to erupt and experience oil containment failure. The separation distances to use will be dependent on the characteristics of the liquid involved and the concerns suggested in Rule 152. RUS recommends that borrowers contact the transformer manufacturer for recommendations appropriate for their products.

If you would like more information or have any questions, please call Harvey Bowles, Chief, Distribution Branch, at (202) 720-5082.

NESC Rule 350 F on Bonding

Rule 350 F of the NESC states that all above ground metallic power and communications apparatus, such as electric and telecommunications metallic pedestals, terminals, apparatus cases, transformer cases, etc., should be bonded to one another whenever they are separated by 6 feet (1.8 meters) or less. The purpose of the bonding, of course, is the safety of personnel and the general public: to keep such facilities at the same electrical potential and prevent people from being able to contact two possible sources of differing electric potential.

Although Rule 350 F is not a mandated provision (because it uses “should” rather than “shall”), it nevertheless requires significant consideration and obligation on the part of utilities. Each time

that a utility or, when applicable, multiple utilities elect not to observe a rule, there must be good documented reasons for not observing the provision. For example, in the case of Rule 350 F, utilities cannot make a blanket policy provision to not bond; they must consider each occurrence, evaluate the conditions, and document the various reasons why bonding is inappropriate at each location.

Some borrowers are most conscientious of the Rule 350 F bonding provision (e.g., routinely installing bonding conductors at their pedestals), while in some cases their neighboring utilities (including electric, telecommunications, CATV, etc.), are less enthusiastic. We know of a situation where a borrower provided a bonding conductor with one end solidly connected to its exposed pedestal metal and the other end made available to the neighboring utility for connection (bonding) to their nearby metallic closures. For unknown reasons, the neighboring utility chose to ignore the borrower's bonding cables and the NESC bonding provision.

In situations where a neighbor ignores the bonding provision, because of the liability involved, RUS believes that it is in the borrowers best interests to contact the other utility to advise of the NESC provision and the generosity of the borrower's available bonding conductor and otherwise attempt to convince the other party to complete the required bonding. If bonding continues to be rejected after this attempt, the borrower should obtain and record the reasons provided by the utility. The bonding wire provided should be removed from access to the public and consideration should perhaps be given to electrically insulate the borrower's enclosure metal.

If you would like more information or have any questions, please call Trung Hiu, Electrical Engineer, Distribution Branch, at (202) 720-1877.

Lightning Bolt Symbol

Borrowers should be certain that the markings on underground rural distribution (URD) power cable that they purchase is durable. Recently, RUS has learned that some URD cable markings are easily removed by simple hand rubbing and there is a need for caution.

Rule 350G of the NESC requires that a lightning bolt symbol be indented or embossed in the outermost cable jacket at a spacing of not more than 1 meter (40 inches). The intent of the indenting/embossing code provision is that the marking be relatively permanent and that it remain intact during normal handling and installation activities. Compliance of cable marking that is easily removed by simple hand rubbing is questionable.

One way to make certain that compliant marking is obtained is to add review of the marking to the check list at the cable receiving loading dock. Cable with non-compliant marking should be rejected and returned to the manufacturer.

If you would like more information or have any questions, please call Trung Hiu, Electrical Engineer, Distribution Branch, at (202) 720-1877.

Safety Signs and Symbols

In previous Items of Engineering Interest, we discussed the ANSI standards for environmental and facility safety signs. These standards are intended to promote uniform national practice, and include considerable changes from some past safety sign practices. As RUS underground construction drawings and specifications are revised, we plan to delete standards for safety signs and refer to the applicable ANSI standards, which are:

- ANSI Z535.1 Safety Color Code
- ANSI Z535.2 Environmental and Facility Safety Signs
- ANSI Z535.3 Criteria for Safety Symbols
- ANSI Z535.4 Product Safety Signs and Labels
- ANSI Z535.5 Accident Prevention Tags (for Temporary Hazards)

These coordinated standards are intended to apply to every permanent or temporary safety sign or tag including those on electric utility systems. These standards prescribe details for colors, shapes, and panel layout for the three panels: (1) the signal word panel, (2) the message panel, and (3) a pictorial/symbol panel.

The safety signs most applicable to RUS electrical systems are DANGER and WARNING. With a DANGER sign, there is an imminent hazard - you are in the area where the hazard is located. If you do not avoid the hazard, the result could be death or serious injury. With the WARNING sign there is a potential hazard - you are safe where you are, but if you go further, you will enter a DANGER area or situation.

RUS recommends that a DANGER sign be placed inside pad-mounted equipment and substations where there is exposure to live parts. RUS further recommends that a WARNING sign be placed on the exterior of pad mounted cabinets and all external sides of substation fences. WARNING signs should be conspicuously located on or near doors, gates, removable barriers, or other entrance areas. State regulatory agencies or insurance companies may have additional recommendations on this topic.

If you would like more information or have any questions, please call Trung Hiu, Electrical Engineer, Distribution Branch, at (202) 720-1877.

RUS Standards and Specifications

General - RUS develops and maintains standards and specifications for various types of electric distribution and transmission materials and equipment and construction. Borrowers are required to utilize these standards and specifications in the design and construction of their facilities, regardless of the source of financing for the facilities.

Purposes - There are a myriad of reasons for developing, maintaining and using RUS standards and specifications. Of course for RUS, borrowers' use of our standards and specifications provides us maximum assurances that the design and construction of your system will be adequate enough for borrowers to provide safe, economical, and reliable electric service to their customers. This also helps borrowers attain a revenue stream sufficient to repay outstanding RUS and supplemental loans This last concern is somewhat selfish but, nevertheless, an important one because it is our trust to all taxpayers to be assured that their (and our money because we are tax payers too) is used wisely and effectively and in accordance with the purposes of the Rural Electrification Act.

For borrowers, reasons for using RUS standards and specifications are as equally self-serving. For starters, a cooperative can deal more easily and more efficiently with contractors who are familiar with planned facilities because they are similar to the facilities they see on the systems of all the RUS borrowers with whom they do business. This sameness helps contractors because they are already familiar with the borrower's basic design and construction. This standardization helps contractors cut their costs which, for competitive reasons, they can pass on to borrowers in their prices. Additionally, the sameness of RUS standards really serves borrowers during times of emergencies, such as natural disasters that devastate systems and require massive efforts to repair and get those meters spinning again. RUS borrowers' crews from many counties and States can and do converge on a service area and most efficiently pitch right in and help the restoration process using the tools, knowledge, and materials they use on their own system.

Support for Standards - Borrowers all across America demonstrate their support for RUS standards and specifications by their numbers and strong membership on the National Rural Electric Cooperative Association's (NRECA) Transmission and Distribution Engineering Committee (T&D Committee). More than 70 RUS borrowers' engineers are members of the various subcommittees operated by the T&D Committee. NRECA founded the T&D Committee for the expressed purpose of assuring the continued development and maintenance of RUS standards and specifications. RUS strongly supports the NRECA T&D Committees, as well. In fact, our support includes assigning eight RUS staff members to work closely with each of the subcommittees that have been formed; and we have established a high priority on our limited available travel funds for staff to attend all T&D Committee meetings. In recent years, the Rural Electric Consulting Engineering Association has joined the various T&D subcommittees and offers an additional source of engineering expertise and professional depth to the NRECA T&D Committee efforts. A list of the T&D Committee members is included as Appendix B.

If you would like more information or have any questions, please call Mike Agudo, Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980.

Standards Development

RUS standards and specifications are developed under the public review and comment provisions of the Federal Register process. In order to promulgate a required standard or specification, RUS first develops a draft of the concepts and ideas that RUS considers important and needed to affect

adequate system utility in the very broad range environment to which electric facilities are exposed all across rural America.

Once a draft is ready, we must then have notice of our intentions published in the Federal Register as a "Proposed Rule." The notice must detail in its front-end "supplemental" text the purpose of the proposed standard or specification and the reasons for its need, especially addressing needs for changes to an existing standard or specification. The public is advised in the notice that it has (usually) 60 days in which to provide RUS written comments which RUS must consider before making any final decisions.

In some cases, rather than developing our own standard or specification, we may utilize a specification or standard developed by some other entity, usually a consensus generated document prepared by a nationally recognized standards body such as the Institute of Electrical and Electronics Engineers (IEEE), the American Society for Testing and Materials (ASTM), the American Wood Preservers Association (AWPA), the American National Standards Institute (ANSI), etc. In such cases, RUS' "Proposed Rule" advises that we plan to "Incorporate by Reference" the document prepared by the outside group. In recent years, RUS has been developing some of its standards and specifications with the help of the NRECA T&D Committee.

Following expiration of the comment period and consideration of all comments received, RUS must have a "Final Rule" published in the Federal Register. The front-end "supplemental" text of the Final Rule must address all comments received and relate why the comments we accepted were deemed appropriate to accept, how we incorporated the comment into the specification, and why some comments received were not accepted for inclusion in the specification.

Because of the required public process, resulting RUS standards and specifications include reasonable perspective from all quarters of interest: consulting engineers, borrowers' engineers, contractors, material suppliers, etc.

Standards Availability - RUS standards and specifications can be found in the United States Code of Federal Regulations (CFR) under the United States Department of Agriculture's Title 7, and RUS' Chapter XVII, parts 1700-1799, specifically at 7 CFR 1728, "Electric Standards and Specifications for Materials and Construction." If you need any RUS standards or specifications, please contact RUS' Program Support and Regulatory Analysis Staff at (202) 720-8674. If you are connected to the Internet, you may also be able to download some of our standards and specifications through the RUS Home Page (http://www.usda.gov/rus/), which is discussed later in this document.

If you would like more information or have any questions, please call Mike Agudo, Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980.

Use of Alternative Materials

Manufacturers often develop "new and better" products to replace or supplement existing product lines. Often, these products incorporate the use of "alternative" materials, that is materials other than those traditionally used in that particular product. For example, originally, guy markers (then called guy guards) were made of wood. Later wood was replaced with steel. More recently, plastics have been used.

When evaluating the use of alternative materials, it is necessary to look at the entire assembly, not just a particular aspect of the product. It is also necessary to determine which parameters are important, as well as which ones are not. For example, there are some tests performed on crosslinked polyethylene cable that are not performed on ethylene propylene rubber (EPR) cables because of characteristics that EPR cables have. Only by careful evaluation is it possible to determine the impact of the product on the system and if there may be any system degradation because of its use. Although steel poles and fiberglass crossarms are mentioned in the following discussion, the intent is to show concerns about the use of any "alternative" material.

RUS material and equipment requirements need to be performance-based. However, it is necessary to keep in mind that each "new" type of material may present its own set of unique problems. For example, steel poles present new problems that we did not have to consider with wood poles. Steel poles are not equivalent in all respects to wood poles. Fiberglass crossarms are not equivalent in all respects to wood crossarms.

The following are some of the important issues to consider:

1. Crossarms need to be dimensionally the same as wood crossarms in order to be interchangeable. The crossarms must be framed the same. There is a concern about field drilling. How does a manufacturer "prove" that its crossarms can be field drilled, while another's cannot be?

2. The crossarms need to withstand the mechanical loads placed upon it. RUS has historical transverse loads that are used in structure design. Can the crossarms withstand these loads without deformation? How much deformation is acceptable? Can the crossarms withstand the vertical loads without exceeding the deflection limits in the 60 inch (1.5 meter) crossarm brace spec? Do we need to consider that fiberglass is much more flexible than wood? The limit in the brace spec may have been based on crossarm breakage. A fiberglass arm is more likely to "recover" after a heavy load is removed. There is a need to keep a limit of some kind because vertical deflection affects sag. Do we need just a deflection limit, or do we also need a minimum ultimate strength? How would ultimate strength be defined? Transverse deflection limits may also be needed because of sag considerations.

3. What are the electrical characteristics of a fiberglass crossarm? How should it be tested? Should an impulse wave be used, or should a steady-state voltage be used?

4. Wood crossarms need to be treated to prevent decay. Likewise, fiberglass crossarms need to be "treated" for protection from the environment. Is an ultraviolet (UV) inhibitor sufficient? How should it be tested? Is UV the only environmental factor to be considered? Should the use of "alternative" crossarms be limited to those areas not subject to contamination? Does RUS need to consider water getting inside the foam filler compound? How is this different from a wood crossarm getting wet from rain? How does the fiberglass crossarm perform in temperature extremes? Are there any particular considerations that we need to consider when wood crossarms are used at temperature extremes?

5. What other tests would be needed to show that fiberglass crossarms are equivalent to wood crossarms?

The same issues would apply to other "alternative" materials and products. While steel poles may have the same strength as wood poles, there are many differences. Can steel poles be field drilled? What needs to be done so that the entire pole assembly, not just the pole top assembly, is electrically equivalent? On distribution structures, unlike transmission structures, the hardware has traditionally not been grounded. Does this design philosophy need to be re-thought? Is it possible for a line crew to work a steel pole "hot" from the pole? While the vast majority of RUS borrowers have bucket trucks available, it is occasionally not possible to get a bucket truck to a particular pole.

If you would like more information or have any questions, please call Harvey Bowles, Chief, Distribution Branch, at (202) 720-5082.

Procurement of Materials

When purchasing the type of materials included in the RUS List of Materials (RUS Informational Publication 202-1, "List of Materials Acceptable for Use on Systems of RUS Electrification Borrowers,") RUS borrowers may only purchase materials that have a current acceptance or technical acceptance. For convenience, materials that have been accepted by Technical Standards Committees (other than technical acceptances) are shown in the RUS List of Materials.

When performing work for an RUS borrower, contractors are to supply only items that have full RUS acceptance or obtain the borrower's concurrence prior to purchase and use of a RUS conditionally accepted item or RUS technically accepted item.

RUS will determine, on a case-by-case basis, whether to allow use of a non-accepted item in emergency situations, for experimental use, or to meet a specific need. An emergency means a situation wherein the supply of listed material and equipment from the industry is not readily available, or the standard designs are not applicable to the borrower's specific problem under consideration.

Under these conditions, borrowers may request permission to use products that have not received acceptance from Technical Standards Committee "A". The following outlines the information that is to be included in a request to the appropriate regional division:

1. The request is to be submitted by the borrower - not the manufacturer, a distributor of the product, or a consultant. When requests are sent in by someone other than the borrower, it is impossible to tell if the borrower concurs with the request.

2. Description of the product, including manufacturer's name and catalog number, drawing, catalog sheet, etc., including appropriate test reports.

3. Description of project - how many units or structures? (RUS does not normally grant blanket approvals.)

4. Are there any unusual field conditions of which RUS may not be aware?

5. A. Technical justification - why is this product better suited for the specific project than presently accepted material? (If the borrower has previously used this product, experience data should be submitted as a part of the technical justification.)

   B. Economic justification - if the product is technically equal, is there an economic benefit?

6. As a condition of approval, borrowers need to submit experience data on the item.

Once this information is received, RUS will review the request and respond to the borrower. Timely submission of the information discussed above will generally expedite this review.

If you would like more information or have any questions, please call Harvey Bowles, Chief, Distribution Branch, at (202) 720-5082 or Mike Agudo, Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980.

NRECA Materials Subcommittee

ESD requested and the NRECA T&D Committee agreed to establish a special subcommittee to conduct a thorough review of the RUS List of Materials. The purpose of the review is for the subcommittee to provide RUS with recommendations for improving the RUS List of Materials. The review is to look at categories of material and equipment items only, not specific manufacturers' products. The intent is to look for categories of items that are obsolete, categories that perhaps should be included but presently are not, and to recommend better ways to list currently included categories for greater borrower utility. The Chair of Technical Standards Committee "A" is our liaison with the Materials Subcommittee. We will keep you updated on the progress as it develops.

If you would like more information or have any questions, please call Mike Agudo, Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980.

Feedback Welcome

RUS welcomes feedback from borrowers, manufacturers, engineers, and others on the standards and specifications that we produce and the materials and equipment that we accept. All feedback is welcome, both positive and negative. Your thoughts, ideas, and accounting of experience with RUS standards and with RUS accepted and technically accepted materials helps us help you better. Positive comments about standards and specifications let us know we are on the right track with these standards and guide us to remain focused. Comments that detail deficiencies or inadequacies do the same thing; they let us know that you and, most likely, other borrowers have a tainted tool that needs improvement. The same is true for the materials and equipment that RUS accepts. Your input can help us help you to have only quality products available.

Please send your comments and concerns related to RUS standards, specifications, and RUS materials and equipment acceptances to Michael E. Agudo, Chair, Technical Standards Committee "A" (Electric), RUS, Stop 1569, 1400 Independence Ave SW, Washington, DC 20250-1569. You may also E-mail the Chair at magudo@rus.usda.gov.

If you would like more information or have any questions, please call Mike Agudo, Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980.

EQUIPMENT and MATERIALS

EPA's Distribution Transformer Cost Evaluation Model

In April 1995, the U.S. Environmental Protection Agency (EPA) launched the Energy Star Transformer Program which was designed to encourage utilities to purchase and install high-efficiency, cost-effective transformers on their distribution systems. The Program promotes the best practices in the utility industry and recognizes those utilities which have made a commitment to using high-efficiency transformers. It relies on the ingenuity and technical know-how of U.S. industries to both improve the economy and protect the environment.

In an effort to assist utilities in considering both the economic and environmental benefits of energy-efficient distribution transformers, EPA has developed a number of technical tools which include the Distribution Transformer Cost Evaluation Model (DTCEM), Optimal Transformer Sizing (OTS) Model, and Commercial and Industrial Transformer Cost Evaluation Model (CITCEM). Released in December of 1996, DTCEM Ver. 1.0 is an easy, yet

comprehensive computing tool designed for evaluating multiple distribution transformer bids. The DTCEM prompts the user to enter utility-specific information (e.g., load characteristics and load factors) and manufacturer bid data in a user-friendly fashion. Quick and Summary Reports are automatically generated after the DTCEM program is run. These reports present analysis of the total owning cost, cost of energy saved, simple payback and emission reduction potential. The reports also provide information on other factors that should be considered in transformer purchasing decisions.

The DTCEM allows utilities to easily evaluate the cost-effectiveness of new distribution transformer purchases using the industry-accepted total owning cost (TOC) method. By assigning dollar values per watt to core and winding losses (referred to as the 'A' and 'B' factors respectively), the TOC calculates for the sum of the purchase price and the total levelized annual cost of transformer losses over the transformer's life cycle.

The TOC is expressed as:

TOC = BP + A*CL + B*WL

where: **BP** is the Bid Price or Purchase Price
CL is the Core Loss (watts)
WL is the Winding Loss (watts)
A is the Dollar value assigned to a watt of transformer core loss ($/watt)
B is the Dollar value assigned to a watt of transformer winding loss ($/watt)

The core and winding losses are inherent to the transformers being evaluated. These data are provided by the transformer manufacturers as part of bid information. Factors A and B are the dollar values of power losses that occur as a result of energizing a transformer. Factor A is multiplied with the core (no-load) loss of the transformer while factor B is multiplied with the winding (load) loss of the transformer. The resulting values are added with the purchase price of the transformer to obtain the total owning cost. The values of A and B factors in the above expression are peculiar to the electric system of the purchasing electric utility. These values can be readily calculated using the DTCEM. The calculation of A and B factors take into consideration the utility's load characteristics and cost factors. The data required for the calculation can be entered quickly and easily through a series of input screens and on-line help. The DTCEM software package, which comes in a 3.5-inch diskette, requires minimal computing capability-- 386 SX PC or better with 4 MB RAM, Microsoft Windows 3.1 or later, and 4 MB hard disk space. Installation of the software is very straightforward.

The DTCEM (Ver. 1.0) is made available by EPA to electric utilities and cooperatives, free of charge, for their evaluation. All electric utilities and cooperatives and other entities are invited to establish a partnership with EPA and voluntarily participate in the Energy Star Transformer Program. As a partner in the Program, utilities must agree to perform an economic analysis of their new transformer purchases using a standard industry methodology, and purchase the cost-effective transformers that meet EPA's Energy Star guidelines. In return, EPA will provide technical assistance and other resources to partners in performing cost evaluation of distribution transformers. In addition, EPA will provide communication tools and will publicly recognize the "Energy Star Partners" for their commitment to energy saving and air emissions reduction.

If you would like more information or have any questions, please contact Peter South, Manager, Energy Star Transformer Program, EPA, at (202) 233-9482 or by E-mail at south.peter@epamail.epa.gov, or call Mike Agudo, Chair, Technical Standards Committee "A" (Electric), at (202) 720-0980 or Jim Bohlk, Electrical Engineer, Distribution Branch, at (202) 720-1967.

Guidelines for Approving the Use of Steel Distribution Poles

RUS is presently using the following guidelines when considering borrowers' requests for the approval of the use of steel distribution poles. In order to assist the RUS staff in considering such requests, we request that borrowers consider all of the following and, as a minimum, adequately address in writing items 2 through 8 of the following in their requests submitted to RUS.

1. Approval is only being granted on a case-by-case trial basis to gain experience;

2. Because approval is only being considered for site specific projects, define the project and where the steel poles will be installed.

3. Specifically state the maximum number of steel poles to be used.

4. Furnish sound reasons for using steel poles. If favorable cost is the main reason, then an analysis, using sound engineering economics, of the cost of using steel poles compared to standard RUS construction with wood poles should be furnished.

5. Provide a description of the proposed steel poles and the method(s) of corrosion protection to be utilized when manufactured, when placed in service and future maintenance.

6. RUS regulations require that all assembly units must be built according to RUS construction standards. If nonstandard construction is being proposed, then furnish sufficient dimensioned drawings and other technical information for RUS' evaluation of the design.

7. Except for various miscellaneous material items, RUS regulations require that borrowers use materials that RUS has fully, conditionally or technically accepted. A compilation of accepted materials may be found in the RUS List of Materials. Contact the Chair, Technical Standards Committee "A" (Electric) for information on technically accepted items. If the proposed design uses materials that do not fall into the any of the acceptance categories above, then furnish RUS sufficient information, data and test results of all such materials for evaluation and approval determinations.

8. Provide a statement regarding the anticipated impact that the steel pole, pole-top assembly design may have on the possible electrocution of raptors. Also state the mitigation measures that will be incorporated in the design to minimize such possibilities.

The following information should be considered by borrowers when considering the use of steel poles:

- RUS strongly advocates a minimum lightning impulse withstand strength (often incorrectly and simply referred to as a BIL level) of 300 kV for distribution pole top assemblies. A minimum of 300 kV withstand has to be maintained at dead-end assemblies. (Withstand strengths of less than 300 kV will usually facilitate flashovers of lightning strikes to or proximate to distribution lines. A recloser operation, which will cause lights to flicker, is usually required to clear the resulting arc. Thus, a minimum of 300 kV withstand is required to maintain a reasonable quality of service. Standard RUS pole type assemblies, with wood poles, have a minimum withstand strength of 350 to 400 kV.) If the steel pole design is less than 300 kV, borrowers should consider what additional measures, such as the installation of surge arresters, might be used to minimize flashovers, or, what impact a design with less than 300 kV might have on the quality of service.

- A steel pole may be used as a grounding conductor if the pole meets the sufficient conductivity and low impedance requirements of the NESC and RUS specifications. However, a directly embedded steel pole is not recognized in the NESC as a grounding electrode. Thus, the NESC and RUS requires that separate driven ground rods or grounding electrodes be used for all equipment, surge arresters and other required system grounds.

- Borrowers should use stainless steel or galvanized steel ground rods and non-copper ground wire in the soil on steel pole lines to mitigate the corrosive effects of buried dissimilar metals in close proximity.

- RUS advocates using steel poles that meet the strength requirements of the NESC Grade B construction. The design of the distribution line itself only needs to meet NESC Grade C construction. Extreme ice conditions and appropriate high winds should be considered in the construction design.

- The design of unguyed angle and dead-end steel pole structures should consider pole deflection and greater embedment depths.

RUS does not judge the above items to be onerous. Each item is important for a sound and safe design. The relevant items above, plus several other design considerations, are incorporated in RUS construction drawings and specifications for overhead distribution lines.

If you would like more information or have any questions, please call Jim Bohlk, Electrical Engineer, Distribution Branch, at (202) 720-1967.

Special Conductors - Transmission Lines

Recent transmission line designs submitted to RUS from borrowers have specified conductors other than conventional ACSR conductors. These designs were for both new lines and reconductoring/upgrade projects intended to improve reliability or to increase line capacity.

Type ACSR/TW (trapezoidal-shaped aluminum wires, also ACSR/AW/TW, where AW stands for the aluminum-clad steel core wires in the ACSR), has been selected for some line upgrade projects. The ACSR/TW conductors, covered by ASTM B-779, use a "type" designation rather than the number of strands used for conventional ACSR. Compared with a conventional ACSR with the same aluminum area, an equivalent ACSR/TW is approximately 10% smaller in conductor diameter, which reduces the transverse wind load on line and support structures. As an alternative, ACSR/TW is available with overall conductor diameter equivalent to conventional ACSR. In this case, an equal diameter ACSR/TW gains 20-25% increase of aluminum area, a significant decrease in the resistance and an increase in the current-carrying capacity of the line. Ground clearances and strength of the existing structures and line components usually are analyzed or checked based on the diameter, weight, and sag tension of the ACSR/TW conductor. The RUS List of Materials currently includes, on a conditional basis, two suppliers of ACSR/TW conductors in various sizes up to 795 kcmil, 26/7 stranding, (Type 16).

Vibration Resistant Conductors - Another use of TW type conductor is for self-damping type conductors, ACSR/SD, which are constructed of core steel wires surrounded by layers of trapezoidal-shaped aluminum wires, designed to maintain a small annular gap between the layers under conductor tension. Internal damping results from interaction of the different natural vibration frequencies of the steel core and aluminum layers and movement within the gap. The damping permits a design at higher conductor tension under loaded and unloaded conditions without damper devices or additional vibration protection. Generally, ACSR/SD is applicable for the larger transmission conductor sizes and has the disadvantage of increased conductor handling and installation costs.

Twisted-pair conductors (also known as type T-2, VR, and Duplex) may be used in areas prone to conductor galloping. Twisted-pair conductors are included on the Conditional List for Item av in the RUS List of Materials. The conductor sizes are limited to standard ACSR and AAAC conductors in the RUS preferred sizes (AAC conductor is not included in the RUS List of Materials). With the increase of experience using this conductor, installation cost premium has decreased from the initial 15 to 20% to 5 to 10% over conventional ACSR conductors. See also the 1996 Items of Engineering Interest for further information on twisted-pair and type ACSS conductors used for transmission projects.

A new type of oval-shaped conductor designed for conductor galloping-prone lines is being developed and tested by Southwire. The conductor uses a spiral, oval cross-section which presents a changing profile for wind action and ice formation, similar in concept to the twisted-pair conductor, but without the variability and added installation cost associated with the twisted-pair design. Connection, hardware and installation of the oval conductors should be similar to conventional ACSR conductors. ASTM is beginning the process of developing new specifications for the oval conductor.

If you would like more information or have any questions, please call Bing Chan, Electrical Engineer, Transmission Branch, at (202) 720-0999.

Line Rating/Uprating

In recognition of the new utility environment, transmission engineers are re-examining practices and methods used for line design, including conductors. Economic factors such as open-access, retail-wheeling, and constraints on new line construction will intensify the pressure to increase thermal rating of existing (and new) transmission lines at minimum cost or modifications. At a "Symposium on Thermal Ratings of Overhead Transmission Conductors," held at the July, 1996 IEEE-PES meeting in Denver, presentations included the following topics on the effects of sustained high temperatures on conductors, attachments, hardware, and accessories:

- Reasons for Thermal Limits on Bare Overhead Conductors;
- Applications of IEEE Standard 738-1993 for Static Ratings;
- Some Sag Calculation Uncertainties with ACSR at High Temperatures;
- Sags and Tensions Equalization at High Temperatures;
- Measuring Conductor Sag at High Temperatures; and
- Operation of Conductors and Accessories at High Temperatures.

Attempts may be made to utilize any margin or cushion possessed by existing lines, for example, higher conductor temperature and sag may be permitted when the actual conductor-to-ground clearance is found to be higher than the minimum required by code. Utilities are beginning to collect high temperature data, previously unavailable, for their lines. One opinion expressed during the presentations was: For line rating, the prudent course to follow is a conservative approach due to the present uncertainties and concerns of conductor creep, loading history, and the accuracy of stress-strain data used for the sag-tension calculations under sustained high temperature.

Some of the proposed line rating methods being considered involve modification of existing methods or use of an entirely new approach. For example: assuming less conservative weather parameters used in conventional static line rating calculations; permitting higher maximum conductor temperatures than previously used; and adopting a "real-time" or dynamic thermal rating system. Some of these proposed methods are currently being studied under research projects funded by the Electric Power Research Institute (EPRI).

If you would like more information or have any questions, please call Bing Chan, Electrical Engineer, Transmission Branch, at (202) 720-0999.

Maximizing the Reliability of Separable Connectors

Some factors reported as contributing to premature failure of URD cable separable connectors (e.g., elbows) include inferior lubricants and misapplication of lubricants on connectors. Most separable connector manufacturers usually supply two distinct lubricant packages for installation - one to be used on elbow/insert interface and the other on elbow/cable interface. Unfortunately, many line personnel cannot differentiate between them as there is little visible difference. Also, there have been vendors that have sold lubricants that do not meet the requirements of the connector manufacturers. The ANSI/IEEE Std. 386 Working Group is working to establish specific requirements for lubricants and has requested that manufacturers include a list of "acceptable" lubricants with their products.

If you would like more information or have any questions, please call Trung Hiu, Electrical Engineer, Distribution Branch, at (202) 720-1877.

Discussion of Common Power System Grounding Methods

The simplest and most effective method of power system grounding is to solidly connect the neutrals of any wye connected transformers or generators directly to earth. This method has two major advantages:

1. It is simple and inexpensive in that it requires no extra equipment; and

2. It minimizes the magnitude of over voltage which will appear on the unfaulted phases during a ground fault, providing a resulting reduction in the stress on line insulation, as compared with other methods. This is the reason that solidly grounded neutrals are a necessity where reduced BIL insulation designs are to be used.

In spite of these advantages of the solidly grounded system, there are associated disadvantages such that other grounding methods are often used. These disadvantages all stem from the fact that a solidly grounded system produces the greatest magnitude of ground fault current when a fault-to-ground occurs. It is realized that with a grounded neutral system perhaps 95 percent or more of all faults start as a single phase-to-ground fault. If the amount of ground current that flows can be controlled and the fault is cleared promptly, the amount of damage at the fault will be reduced and the fault will most likely be restricted so as not to involve more than the one phase. This may result in preventing burn-downs, reduction in the cost of making repairs, and reduction in the frequency or extent of maintenance on the breakers which interrupt the fault. In the case of generators or transformers, the difference in repair costs may be that of replacing a few damaged coils as compared with completely replacing the generator or transformer which may be necessary where oil fires and explosion follow the transformer fault, or where heavy fault currents melt down coils and burn and weld together extensive areas of laminated electrical steel in the transformer core or generator stator iron. Since the damage done is approximately proportional to I^2t, much more benefit can be gained with reduction of current than by reduction in time. Under certain conditions, single-phase-to-ground faults can give rise to short circuit

currents 50 percent higher than the three-phase short circuit current. Thus, breakers, whose ratings make them entirely capable of interrupting three-phase faults, may have severe difficulty handling a single-phase-to-ground fault. In view of the above, the potential savings in damage and repair costs or avoiding the cost of having to install larger breakers may justify avoiding the simple and inexpensive solidly grounded system in favor of a more complex and expensive system which will provide control of the magnitude of fault current.

In the selection of grounding equipment and methods, many factors must be considered. It is desirable from the reduction of fault damage, repair costs and switching equipment maintenance to limit ground fault current as much as possible. However, the greater the limitation of ground fault current, the higher the possible transient overvoltages which will be encountered on the unfaulted phases. Expected overvoltage levels will determine the equipment insulation levels required and the ratings of lightning arresters required to protect the connected equipment, and will consequently affect costs. Therefore, these factors are in conflict with the desire for maximum fault current limitation. Whether resistors or reactors are used to limit the fault current will determine the degree of overvoltage expected on a given system for a given degree of current limitation, and thus effect the selection of the use of resistors or reactors. Whenever grounding of any kind is used, it is obvious that fault current will flow when a normally ungrounded conductor becomes grounded. It is necessary that relays, fuses, or other protective devices sense and operate to clear the fault. Since the degree of current limitation employed may well have a serious effect upon the ability of these devices to operate as desired, the degree of current limitation which can be employed may well be determined by the sensitivity of the protective devices used. Conversely, the type and sensitivity of the protective devices required may be determined by the degree of current limitation selected.

Thus, the selection of the value to which the ground fault is to be limited becomes the problem of making a selection between minimum ground fault current to limit damage, the minimum ground fault which will give adequate protective device operation, and the maximum ground fault current which generator or transformer windings can tolerate.

In conclusion, there are several important points with respect to impedance grounding of system neutrals that are often overlooked.

1. Since grounding equipment is electrically active in a circuit only during a ground fault, considerable money can be saved by buying equipment rated for short time duty. Grounding equipment for a station with all underground circuits will be expected to be subjected to very infrequent faults, and since cable faults are usually permanent, repeated reclosing attempts will probably not be made. Under these circumstances, a short time rating of the grounding equipment of 5 seconds or less may be adequate. However, grounding equipment installed in a station having all overhead circuits will be subjected to the cumulative heating effect of perhaps many closely spaced feeder faults during severe storm conditions, each circuit outage being accompanied by several unsuccessful closing attempts. Under these conditions, equipment having a rating on a 10 minute or more basis may be considered.

2. Impedance neutral grounding equipment must always be considered hot, since there is no telling when a fault to ground will occur and raise the neutral end of the equipment to full phase to ground voltage. This poses a safety problem and creates a problem of how to maintain the equipment unless the generator, transformer, bus, or station for which the impedance furnishes the ground is shut down.

3. Where a multiplicity of grounding units are employed, care must be exercised in switching facilities for load transfer to avoid the danger that someone will get caught operating disconnects for transfer just as a ground fault occurs. If multiple units are used, care must be exercised that the protective relaying will operate and coordinate properly through the range of conditions possible with the multiple units.

4. Where impedance grounding is used, all neutrals in the same zero sequence system must be grounded through the same impedance. Otherwise, the original impedance will shunt or short circuit and raise the ground fault current above the desired design value.

If you would like more information or have any questions, please call Mike Eskandary, Electrical Engineer, Transmission Branch, at (202) 720-9098.

Utility Communications Architecture

The technical areas that are changing the most rapidly in the electric power business are automation and telecommunications. Automation technology is now almost entirely digital and communication is very rapidly going in the same direction. System Control and Data Acquisition (SCADA) systems, reclosers, voltage regulators, meters, radios, and even sensors inside transformers are now digital. When different software packages or digital devices need to communicate with one another, they use a protocol, a sort of “language.” When the different elements don't speak a common language, there is a problem. This is not an insurmountable problem, but it can be an expensive one. It can be dealt with by using protocol converters and custom software. Another solution is to get all the automation/digital “stuff” to speak the same “language.” Such a “language,” Utility Communications Architecture (UCA), has been developed by EPRI and NRECA's Rural Electric Research program. It is a suite of open communication protocols tailored to achieve seamless, enterprise-wide data transfer throughout utilities. Late last year, a demonstration of UCA was held at United Power Association in Elk River, Minnesota, and at some of its distribution cooperatives. Products from eight different vendors all spoke UCA to each other. SCADA and IED (intelligent electronic device) vendors as well as vendors of other types of hardware and software are now beginning to sell commercial products that speak UCA. As you automate your cooperative, you should make a conscious decision about the protocol that the devices and systems speak.

If you would like more information or have any questions, please call Mike Agudo, Chair, Technical Standards Committee “A” (Electric), at (202) 720-0980, or Martin Gordon of NRECA's Rural Electric Research program at (703) 907-5840. You can also contact the UCA

Exchange by phone at (800) UCA-EXCH or by E-mail at uca@plxs.com. Detailed technical documentation about UCA 2.0 can be downloaded over the Internet at ftp.epri.com/PowerDelivery/UCA.

Why Does RUS Have 7 CFR 1726 Contracting Procedures?

RUS is mandated by Congress and the American taxpayer to see that RUS loan and loan guarantee funds are used efficiently, effectively and fairly. To this end, RUS issues policies and procedures that encourage competitive bidding as much as possible. Competitive bidding generally results in the lowest cost and treats contractors fairly, allowing equal opportunity, where all eligible contractors can benefit from RUS program funds. RUS also issues standard contract forms to promote efficiency through uniformity and familiarity in contract documents. The RUS contracting procedures help ensure that the Government and your members are getting the maximum benefit from their investment in the rural infrastructure.

Where Are RUS Contracting Policies and Procedures? - RUS' Electric Program Construction Contracting Policies and Procedures are included under 7 CFR Part 1726. RUS consolidated 6 bulletins and 25 forms into this regulation, providing more concise and flexible requirements.

A tabular summary of some of the key provisions and dollar limits of 7 CFR 1726 follows this material. For answers to some of the frequently asked questions about 7 CFR 1726, see RUS Bulletin 1726-601, "Electric System Construction Policies and Procedures - Interpretations."

How Are the New Requirements Different? - RUS listened to the concerns of the rural electric community, and put in place some major changes:

- Bidding, contract approval, and other requirements of 7 CFR 1726 only apply to projects that that are financed with RUS loan or guaranteed loan funds (including reimbursable projects.) The old requirements in RUS Bulletin 40-6 (now rescinded) applied to all construction, regardless of the source of funding.

- Borrowers now have increased flexibility in procurement practices. A number of provisions in 7 CFR 1726 include cumulative dollar limits that apply on a "per calendar year" basis and Owner Furnished Materials (OFM) costs are not counted against these dollars limits. The old requirements in RUS Bulletin 40-6 generally had dollar limits on a "per contract" basis and included OFM.

- Dollar thresholds which determine the procurement procedure to be used have been raised. Generally, it is the borrower's responsibility to decide what procurement procedure to use for electric distribution line construction up to the larger of $250,000 or 1% of Net Utility Plant (NUP) per calendar year. Similar borrower latitude applies to other types of construction.

- RUS has added a new streamlined bidding procedure, called *multiparty unit price quotations*. This procedure generally involves obtaining three or more written unit

price quotes and awarding contracts on the lowest evaluated cost. It can be used for electric distribution line construction for the larger of $350,000 or 1.5% of NUP per calendar year. This is in addition to the limits noted above as being the borrower's responsibility.

- RUS has also added a more flexible bidding procedure specifically for procurement of communications and control facilities. This procedure, called *multiparty negotiation*, generally involves obtaining quotes from three or more bidders, but award of the contract need not be to the low bidder.

- Fewer contracts are subject to approval by RUS:

  - Generally, distribution contracts and contracts for headquarters facilities are not subject to RUS approval.

  - Contracts for transmission and substation construction and communications and control facilities below $250,000 or 1% of NUP (up to $500,000 for distribution borrowers, $1,500,000 for power supply borrowers) generally won't require RUS approval.

- Subcontracts are no longer subject to RUS approval.

- Borrowers may now use RUS Form 792 in lieu of Form 830 when all materials are owner furnished. Form 792 offers less cumbersome close-out procedures.

- The number of contract close-out forms to be submitted to RUS has been sharply reduced.

If you would like more information or have any questions, please call Fred Gatchell, Deputy Director, Electric Staff Division, at (202) 720-1398.

This summary does not include all requirements. See 7 CFR 1726 for detailed requirements.

SUMMARY OF RUS ELECTRIC CONTRACTING PROCEDURES

Facility or Contract Type	Bidding Procedure					Contract Approval
	Borrower Responsibility	Multiparty Quotations	Formal Competitive Bidding	Informal Competitive Bidding	Multiparty Negotiation	
Distribution Line Construction	≤$250,000 or 1% of NUP/CY	≤$350,000 or 1.5% of NUP/CY (Unit Price)	All Other	N/A	N/A	N/A
Substation and Transmission Line Construction	≤$250,000 or 1% of NUP/CY (NTE $2,000,000)	N/A	All Other	N/A	N/A	≥$250,000 or 1% of NUP/ Contract (NTE $500,000 for Dist; $1,500,000 for PS)
Generation Equipment and Construction	≤$1,500,000	N/A	Yes	Yes	RUS Approval Required	Specific Contracts
Buildings	N/A	≤$250,000 or 1% of NUP/CY (NTE $1,000,000) (Lump Sum)	All Other	N/A	N/A	N/A
Communications and Control	≤$250,000 or 1% of NUP/CY (NTE $2,000,000)	N/A	N/A	N/A	All Other	≥$250,000 or 1% of NUP/ Contract (NTE $500,000 for Dist; $1,500,000 for PS)

Note: All limits are exclusive of the cost of owner furnished materials

Abbreviations: CY - Calendar Year; Dist - Distribution Borrower; N/A - Not Applicable; NTE - Not To Exceed; NUP - Net Utility Plant; PS - Power Supply Borrower

ADMINISTRATIVE and OTHER

Electric Industry Restructuring

During this transitional period in the electric industry, RUS remains committed to engineering and architectural standards that protect and improve the reliability of borrowers' electric systems. The transition from a highly regulated monopoly industry to an industry that is governed to a large degree by the forces of the free market must not downgrade the quality of electric service in rural America.

Recently RUS has placed more of the responsibility for ensuring system safety and reliability in the hands of borrowers. RUS, for example, no longer needs to approve system improvements unless these improvements are to be financed with RUS loan funds. RUS will continue to issue and revise standards and specifications. All borrower construction must meet these standards regardless of the source of financing.

RUS has recently increased the number of engineers in both line and staff offices. This increase in staff supports RUS' commitment to electric system reliability.

The RUS Principles for Electric Utility Industry Restructuring below stress this commitment.

RURAL UTILITIES SERVICE

PRINCIPLES FOR ELECTRIC UTILITY INDUSTRY RESTRUCTURING LEGISLATION

Deregulation and competition in some industries has resulted in savings for consumers. However, an unintended and unfortunate consequence of these changes in rural areas has often been a decline in the availability and quality of service and increased costs to customers. Airline deregulation is an example. The transition to a more competitive electric power sector should seek to minimize these adverse impacts and to preserve the benefits of a more than 60 year old Federal partnership with states and local communities to bring and maintain universal electric service to rural America.

The Rural Utilities Service has two main goals in the development of legislation:

- To ensure the continued availability of reliable, high quality electric service at a reasonable cost to rural consumers; and;
- To protect the integrity of the Government's loan portfolio.

RUS believes that legislative proposals for restructuring the electric utility industry should be guided by the principles of Reliability, Fairness, and Flexibility.

RELIABILITY: The transition to a more competitive industry environment and retail customer choice must maintain the reliability of the nation's electric systems. Electric industry reforms should not harm the existing electric infrastructure in rural America.

- Utilities, suppliers, and power marketers must be held accountable for system integrity.
- Adequate back-up sources of power and transmission capacity must be maintained.
- All utilities, suppliers, and power marketers must adhere to regional reliability standards. Enforceable mechanisms for assuring reliability with penalties for noncompliance must be developed.

FAIRNESS: A transition to a more competitive electric sector with retail choice should be fair and equitable to all consumers--including rural Americans, to existing electric utilities, and to Federal taxpayers who support the RUS program.

- All consumers and consumer classes should have the opportunity to share fully and fairly in any benefits of electric industry restructuring.
- Affordable, reliable, universal electric service, long the foundation of State and Federal law, should be preserved and protected in rural and other at risk areas. A variety of state and/or Federal mechanisms designed to achieve this goal should be considered. Possible options include, but are not limited to, a fund financed with a wires surcharge, similar in concept to the National Exchange Carrier Association (NECA) pool for telephone service, territorial exemptions to retail wheeling, allocation of "life line" customers to competitive generation providers, supplier of last resort designation.
- The diversity of the nation's electric utilities in size, resources, customer load, corporate structure, and regulatory status should be recognized. Implementation plans and mechanisms providing for fair and equitable recovery of system changes, transition costs, and stranded investment should not discriminate against any class of utility.
- Any wholesale and retail choice plan must respect the unique structural features of consumer-owned cooperatives, both financial and corporate. Among other matters, the plans must:
  - Allow not-for-profit, consumer-owned cooperatives to recover all stranded investment;
  - Permit recovery of investment by power supply (Generation and Transmission - G&T) borrowers stranded as a result of load loss incurred by distribution borrowers due to competition;

  - Permit a return on member-provided equity for appropriate purposes including the calculation of transmission and distribution access fees and provision of other services to non-members;

  - Preserve the benefits of Federal loans to rural utilities and consumers, including an offset in the calculation of charges for system access and other services provided to others.

- Existing retail and wholesale power contracts, including the all-requirements wholesale power contracts, which are critical to the structure of the RUS financed cooperatives, must be respected.

- The existing tax-exempt status of cooperatives under 501(c)(12) must not be jeopardized as a result of transactions or corporate restructuring either required or encouraged by any choice plan.

- Existing loan obligations should be honored. The financial viability of cooperative utilities to repay these Federal obligations should be assured through approval of retail and wholesale rates and access charges that are adequate to cover debt service and/or through fair and equitable recovery of stranded costs.

FLEXIBILITY: Any legislative proposal for utility industry restructuring should allow for a flexible, adaptable transition process that accommodates: the diversity of electric utility industry; state regulatory structures and policies; evolving industry conditions; and consumer education. The process should allow for experimentation and evaluation to learn from experience and to correct mistakes.

- There is no need for a "one size fits all" retail choice requirement. Differences among states should be respected. Federal legislation should offer states the opportunity to develop retail choice plans to suit their needs.

- Non-regulated, consumer-owned cooperatives should similarly be given adequate opportunities to tailor the transition to customer choice to their unique structure.

- A single national "date certain" for retail choice and rigid implementation schemes should be avoided because of the potential of disproportionate harm to small utilities that lack resources to withstand an abrupt transition.

- The transition to a more competitive electric utility sector will be a period of experimentation for utilities, generation providers, consumers, and regulators. Any implementation plan for retail competition must be flexible enough to allow participants to adapt to evolutionary changes in the electricity markets and must permit sufficient time and experience to develop new and refined institutional, technological, and practical responses to the challenges presented.

If you would like more information or have any questions, please call Sue Arnold, Financial Analyst, Program Support and Regulatory Analysis, at (202) 690-1078, E-Mail: sarnold@rus.usda.gov.

RUS Technical Publications

RUS has published several items recently of interest to the RUS electric engineering community. These publications include:

- 7 CFR 1724, "Electric Engineering, Architectural Services and Design Policies and Procedures." This proposed rule, published on August 4, 1997, contains RUS requirements on engineering and architectural services and system design. These policies and procedures are presently contained in seven RUS bulletins, which will be rescinded after this regulation becomes effective. This proposed rule would simplify RUS requirements relating to architectural and engineering services and the planning and design of electric distribution, transmission, and generation systems and facilities owned by RUS borrowers, and substantially reduce the number of engineering documents that must be submitted to RUS. Comments on this proposed rule are due by October 3, 1997.

- 7 CFR 1730, "Electric System Operation and Maintenance" (O&M). This proposed rule, published on April 16, 1997 contains RUS requirements on electric system O&M and the policy on RUS' review and evaluation of borrowers' O&M practices. It also includes revisions to RUS Form 300, Review Rating Summary, and will replace RUS Bulletin 161-5, Electric System Review and Evaluation. Comments have been received and are now being incorporated into the final rule. RUS is also preparing a companion publication, Bulletin 1730-1, "Electric System Operation and Maintenance (O&M)," to provide guidelines related to O&M, including a rating guide for RUS Form 300.

- 7 CFR 1789, "Use of Consultants Funded by Borrowers." This rule, published on September 16, 1996, allows RUS to use consultants funded by the borrowers to facilitate timely action on funding applications and other RUS approvals. Consultants may provide financial, legal, engineering, environmental, or other technical advice and services in connection with the RUS review of the borrower's request.

- Bulletin 1724E-204, "Guide Specification for Steel Pole and H-Frame Structures," dated June 6, 1997. This guide specification, which replaces REA Bulletin 62-12, "Guide Specifications for Steel Pole Structures" (June 1983), is to provide RUS borrowers with a basis for procuring adequate single pole and H-frame steel transmission line structures. Use of this specification should help eliminate ambiguities that might arise in the evaluation process of competitively bid steel pole procurements.

  This suggested purchase specification covers the technical aspects of design, materials, welding, inspection, delivery, and protective coatings of single circuit steel pole and

steel H-frame structures, 115 kV to 230 kV. This specification does not include contract (front-end) documents or specifications for construction. This specification may be expanded to include double circuit structures and structures over 230 kV.

The Transmission Line Subcommittee of the NRECA T&D Engineering Committee contributed significantly to the revision. For further information, contact Don Heald at (202) 720-9102.

If you need any of these publications, please contact RUS' Program Support and Regulatory Analysis Staff at (202) 720-8674. Many RUS publications are also available via Internet at:

http://www.usda.gov/rus/

Publications in Progress

Timber Specifications: RUS is in the process of revising the following three bulletins that cover pressure treating poles and crossarms, and their respective quality control:

- 1728F-700, "RUS Specification for Wood Poles, Stubs and Anchor Logs;"
- 1728H-701, "RUS Specification for Wood Crossarms (Solid and Laminated) Transmission Timbers and Pole Keys;" (7 CFR 1728.201) and
- 1728H-702, "RUS Specification for Quality Control and Inspection of Timber Products" (7 CFR 1728.202).

Topics currently being considered for revision include:

1. Removal of the Insured Warranty Plan as an acceptable plan for supplying poles due to lack of use,
2. Elimination of the requirement for borrowers to notify RUS of their timber product purchases during the previous year,
3. Reinstatement of the acceptance and listing of inspection agencies and treating plants in the RUS List of Materials,
4. Requirement for a heat sterilization during kiln drying or steam conditioning of poles,
5. Boring each distribution pole to check penetration of preservative, similar to the existing requirement for transmission poles.
6. Requirement for inspection agencies to have their company designation branded or tagged on the pole face, and

7. Elimination of the 10 percent allowance of preservative retention reduction at the time of shipment to the borrower.

RUS is hereby soliciting input from electric borrowers and others as to necessary changes to the aforementioned bulletins. Comments or suggestions should be sent to H. Robert Lash, Chief, Transmission Branch, RUS, Stop 1569, 1400 Independence Ave SW, Washington, DC 20250-1569, E-mail: blash@rus.usda.gov. All comments are welcome.

RUS is also working on the following publications:

- RUS Bulletin 1724E-206, "Guide Specification for Prestressed, Spun, Concrete Poles." This guide specifications, which is nearing completion, provides a basis for procuring prestressed, spun, concrete poles. This purchase specification covers the technical aspects of design, materials, manufacturing, inspection, testing, and delivery of prestressed, spun concrete poles.

  The Transmission Line Subcommittee of the NRECA T&D Engineering Committee developed the basis of this bulletin. The bulletin should be available this fall, 1997. For further information, contact Don Heald at (202) 720-9102.

- RUS Bulletins 1728F-810 and 1728F-811, "Electric Specifications and Drawings for 34.5 kV through 230 kV Transmission Lines." RUS expects the final rule covering the revision of these bulletins to be published during the summer of 1997.

  RUS has made editorial changes and changes to improve clarity of the bulletins. RUS borrowers and other users of RUS electric transmission line specifications have proposed corrections to several drawings. RUS and RUS borrowers have also suggested modifications to clarify and modify some of the drawings. RUS also has renumbered and reformatted these bulletins in accordance with the agency's publications and directives system. These bulletins were formerly known as RUS Bulletins 50-1 and 50-2. For further information, contact Don Heald at (202) 720-9102.

- RUS Bulletin 1728F-803, "Specifications & Drawings for 24.9/14.4 kV Line Construction." RUS expects the proposed rule covering the revision of this bulletin to be published during the summer of 1997. The proposed revision includes a new drawing assembly designation system as well as a number of clarifications, modifications, and updates to these drawings. For further information, contact Jim Bohlk at (202) 720-1967.

- RUS Bulletin 1728F-806, "Specifications & Drawings for Underground Electric Distribution." RUS expects the proposed rule covering the revision of this bulletin to be published during the summer or fall of 1997. The proposed revision includes a

number of clarifications, modifications, and updates to these drawings. For further information, contact Trung Hiu at (202) 720-1877.

RUS 1998 Electric Engineering Seminar

RUS is planning to conduct a seminar on rural electric distribution and transmission system engineering and operation in March, 1998. The program will include presentations on various topics of interest to the rural electric engineering community.

In addition to the formal presentations, this seminar will provide an opportunity for the participants from around the country to share experiences and ideas of mutual interest. Distribution system managers, engineers, and line superintendents as well as personnel of consulting engineering firms are expected to attend this seminar. RUS is planning to hold this seminar in conjunction with NRECA's "TechAdvantage 98."

If you would like more information or have any questions, please call Fred Gatchell, Deputy Director, ESD, at (202) 720-1398.

RUS Has a World Wide Web Home Page

RUS is on the World Wide Web with an Internet Home Page. Come visit us at the following address:

http://www.usda.gov/rus/

Our Home Page is very easy to use. As you browse, you will notice that some words and phrases are underlined and usually highlighted in blue. These words are linked to other areas of our home page and to other web sites. Clicking the left button on your mouse when your cursor is on highlighted words will take you to different screens and allow you to read more about the topics described by these words.

Some of our files are stored in ***.pdf** format and are viewable by using the Acrobat Reader software package. The Acrobat Reader is available as freeware from Adobe Systems, Inc., at the Adobe Acrobat Home Page. We have placed a "Get Acrobat" button at several locations on our web site. Clicking on this button will enable you to download the Acrobat Reader from the Adobe Acrobat Home Page.

RUS Mission Statement - Find out why we are here and what we do by reading our mission statements. To access the RUS Mission Statement, click on the first option in the Main Menu entitled, RUS Mission Statement and Organization. Once you've read about what we do, please take some time to read about some of our accomplishments. You can do so by going back to the Main Menu and selecting Electric Program and then clicking on the words good work on the following screen.

We have mission statements for each of our programs.

Our Programs - We provide financing and technical assistance to enable organizations to build electric, telecommunications, and water and waste facilities to serve residents in rural areas. Home pages have been set up for each program. Learn more about them by clicking on the underlined topics highlighted in blue at our Main Menu.

In addition to the Electric, Telecommunications, and Water and Waste programs, we offer a special program which provides funding for Distance Learning Facilities and Telemedicine Facilities. Information about this program can also be found by going to the Distance Learning and Telemedicine Home Page from the Main Menu.

Check out these opportunities and others which are available to you and your community before you move on.

Regulations and Bulletins - Many of our bulletins and regulations are now available on our web site. These documents may be accessed by selecting the RUS Regulations option at the Main Menu. They are stored as text, Microsoft Word for Windows (Version 6), and *.pdf files. You may either view them or download them as needed.

Forms for the Electric Program - We are in the process of converting many of our forms to electronic files. Some of these files are already available and can be accessed by clicking on the word Forms on the Home Page for the Electric Program or by clicking on Grant Application Guide and Download Application Forms on the Distance Learning and Telemedicine Home Page.

Directory of Key Staff Members - We have included the telephone numbers, regular mail, and E-mail addresses of all key staff members in our agency. This information is available by State and by division in the Home Pages for the Electric and Water and Waste Programs.

Information Superhighway - Since launching its National Information Infrastructure initiative, the Administration has vigorously promoted the development of an Information Superhighway and universal service in rural America. Our agency is in the forefront of this effort for rural America. For more information, please select the Information Superhighway option from the Main Menu.

1996 Farm Bill and Its Impacts on the Rural Utilities Service - A synopsis of significant impacts the 1996 Farm Bill will have on the Rural Utilities Service can be found under the RUS Farm Bill Provisions selection on the Main Menu.

Industry Links - This section has links to many borrowers, State Commissions, and industry organizations.

Future Plans for this Web Site - We foresee this web site playing a significant role in exchanging information with our customers in the future. We welcome your input and ideas. We are here to serve you. Comments and suggestions may be sent to wmaster@rus.usda.gov.

Other Websites - Appendix C includes a list of various Internet sites. They include Government sites, publications on-line sites, regional utility group sites, power marketing administration and

other governmental generation sites, electric industry trade and professional associations, and individual company sites. This list is in no way all inclusive and RUS is in no way promoting companies listed over those not on the list.

If you would like more information or have any questions, please call Sam Morgan, RUS Web Master, at (202) 720-1914, or Sam Pooré, Electric Program Web Master, at (202) 720-1922.

Transmission and Distribution Engineering Committee

In 1991, NRECA established its Transmission and Distribution Engineering Committee (T&D Committee) to work with REA (now RUS) in the development and maintenance of electric transmission and distribution standards and specifications, and the exchange of engineering information of mutual interest to rural electric utilities. The T&D Committee is composed of some of the most dedicated and talented individuals from NRECA and from electric cooperatives all across the United States. These individuals routinely donate several weekends and considerable amounts of other personal time each year to fulfill their commitments to the Committee.

We want to use this opportunity to thank these individuals and the organizations that sponsor their participation. See Appendix B for the T&D Committee Roster.

If you would like more information or have any questions, please call Mike Agudo, Chair, Technical Standards Committee “A” (Electric), at (202) 720-0980.

APPENDIX A

RURAL UTILITIES SERVICE
ELECTRIC STAFF DIVISION

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Mike Eskandary Electrical Engineer
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APPENDIX B

NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
Committee Chairman		
Overt L. Carroll	Clark RECC	Winchester, KY
NRECA Staff Coordinator		
Jim Dedman	NRECA	Arlington, VA
David Altman	Lumbee River EMC	Red Springs, NC
Dominic Ballard	East Kentucky Power Co-op	Winchester, KY
David Beam	North Carolina EMC	Raleigh, NC
Alan Blackmon	Blue Ridge EC	Pickens, SC
Gregory Broussard	Jackson EMC	Jefferson, GA
John Burch	Florida Keys EC	Tavernier, FL
James Byrne	Poudre Valley REA	Fort Collins, CO
Jim Carter	NRECA - WQC	Spartanburg, SC
Steve Cress	Tipmont REMC	Linden, IN
James Crouch	Fairfield EC	Winnsboro, SC
Russ Dantzler	Mid-Carolina EC	Lexington, SC
Berl Davis	Palmetto EC	Hilton Head, SC
Bruce Dreyer	Middle Tennessee EMC	Murfreesboro, TN
Charles Emerson	Trico EC	Tucson, AZ
Doug Emmons	Hoosier Energy REC, Inc.	Bloomington, IN
Mark Evans	Upper Cumberland EMC	Carthage, TN
Ronnie Frizzell	Arkansas EC Corp.	Little Rock, AR
David Garrison	East Central Oklahoma EC	Okmulgee, OK
David Gebhardt	LaPlata EA	Durango, CO
Phil Gelhorn	East Central EA	Braham, MN
Ed Giesler	Tri-County EC	Portland, MI
Allan Glidewell	Southwest Tennessee EMC	Brownsville, TN
Weldon Gray	Concho Valley EC	San Angelo, TX
Ron Gunnell	Randolph EMC	Asheboro, NC
Charlene Ham	Rusk County EC	Henderson, TX
Wayne Henson	East Mississippi EPA	Meridian, MS

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NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
Bill Hetherington	Lee County EC, Inc.	North Ft. Myers, FL
Vince Heuser	Nolin RECC	Elizabethtown, KY
Jon Hodge	Kaufman County EC, Inc.	Kaufman, TX
Jerrod Howard	Central Electric Power Co-op, Inc.	Columbia, SC
Robert Johnson	Arkansas EC Corp.	Little Rock, AR
Joseph Joplin	Rutherford EMC	Forest City, NC
Kendrick Kirschenmann	Rushmore EPC	Rapid City, SD
Allan Kunze	Lower Colorado River Authority	Austin, TX
Wally Lang	Minnkota Power Co-op, Inc.	Grand Forks, ND
Terry Lee	South Mississippi EPA	Hattiesburg, MS
Carl Liles	Western Farmers EC	Anadarko, OK
Gregory Lindsly	Dixie EMC	Baton Rouge, LA
Troy Little	Four County EPA	Columbus, MS
Charles Lukkarila	United Power Assn.	Elk River, MN
Charles (Bubba) McCall	Oglethorpe Power Corp.	Tucker, GA
John Mitchell	Rappahannock EC	Fredericksburg, VA
David Moore	Johnson County EC	Cleburn, TX
Ken Murphy	Tallapoosa River EC	LaFayette, AL
William Murray	Berkeley EC	Moncks Corner, SC
Tom Myers	Berkeley EC	Moncks Corner, SC
Ace Necaise	Singing River EPA	Lucedale, MS
Stuart Nelson	Lower Colorado River Authority	Austin, TX
Jim Newberg	Missoula EC, Inc.	Missoula, MT
Rod Nikula	Wright-Hennepin CEA	Rockford, MN
David Obenshain	Piedmont EMC	Hillsborough, NC
Bob Oldham	Southern Maryland EC	Hughesville, MD
Michael Pehosh	Ozarks EC	Fayetteville, AR
Chris Perry	Nolin RECC	Elizabethtown, KY
Peter Platz	Coast Electric Power	Bay St. Louis, MS
John Rodgers	Nodak EC, Inc.	Grand Forks, ND

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NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
Terry Rosenthal	Laclede EC	Lebanon, MO
Paul Rupard	East Kentucky Power Co-op	Winchester, KY
Brad Schmidt	Cass County EC	Fargo, ND
Glenn Sell	Union Rural EC	Marysville, OH
Lewis Shaw	Brunswick EMC	Shallotte, NC
Robert Siekas	Cherryland EC	Grawn, MI
Jim Skeen	Plumas-Sierra Rural EC	Portola, CA
Gordon Sloan	Sulphur Springs Valley EC	Willcox, AZ
Thomas Slusher	Union EMC	Monroe, NC
Michael Smith	Singing River EC	Lucedale, MS
Paul Spears	Tri-County EC	Azle, TX
Gary Stein	Wabash Valley Power Assn.	Indianapolis, IN
Blaine Strampe	Federated REA	Jackson, MN
Vernon W. Strickland	Intercounty ECA	Licking, MO
Tom Suggs	Natchez Trace EPA	Houston, MS
Fred Terwilliger	Central EC, Inc.	Parker, PA
Brian Tomlinson	Denton County EC, Inc.	Corinth, TX
John Twitty	Alabama EC	Andalusia, AL
Scott Wehler	Adams Electric Co-op	Gettysburg, PA
John Westby	Verendrye EC, Inc.	Velva, ND
Kenneth Winder	Moon Lake Electric	Roosevelt, UT

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NRECA TRANSMISSION & DISTRIBUTION ENGINEERING COMMITTEE

MEMBER	ORGANIZATION	LOCATION
CONSULTANT MEMBERS		
Jim Bardwell	SGS Witter, Inc.	Albuquerque, NM
Keith Bartels	Martin & Associates, Inc.	Mitchell, SD
George Chapman	Patterson & Dewar Engineers, Inc.	Decatur, GA
Peter Daly	Power System Engineering, Inc.	MADISON, WI
Bob Dew	Southern Engineering Company	Atlanta, GA
Don Gray	SGS Witter, Inc.	Albuquerque, NM
Emmett Green	Allgeier, Martin & Associates, Inc.	Joplin, MO
Joe Perry	Patterson & Dewar Engineers, Inc.	Decatur, GA
Gene Smith	SGS Witter, Inc.	Lubbock, TX
Mike Smith	SGS Witter, Inc.	Albuquerque, NM
James Stewart	Stewart Engineering, Inc.	Anniston, AL
Ed Thomas	Utility Electrical Consultants	Raleigh, NC
Mike Waters	Utility ElectricalConsultants	Raleigh, NC

APPENDIX C

WEBSITES

The following is a list of various Internet sites. They include government sites, publications on-line sites, regional utility group sites, power marketing administration and other governmental generation sites, electric industry trade and professional associations, and individual company sites. This list is in no way all inclusive and RUS is in no way promoting companies listed over those not on the list.

If you would like more information or have any questions, please call Don Heald, Structural Engineer, Transmission Branch, at (202) 720-9102.

Regulatory Resources	
Code of Federal Regulations	www.access.gpo.gov/nara/cfr/index.html
Code of Federal Regulations	law.house.gov/cfr.htm
Department of Energy (DOE)	www.doe.gov/
DOE Energy Information Administration (EIA)	www.eia.doe.gov
DOE Office of Environmental Management(OEM)	www.em.doe.gov/
DOE Office of Science & Technological Information	www.osti.gov/
Environmental Protection Agency	www.epa.gov/epahome/index.html
Federal Emergency Management Agency	www.fema.gov/
Federal Energy Regulatory Commission	www.ferc.fed.us
Federal Register	www.access.gpo.gov/su_docs/aces/aces140.html
Government Printing Office	www.gpo.gov
Internal Revenue Service	www.irs.ustreas.gov/
National Association of Regulatory Utility Commissioners	www.erols.com/naruc
NRECA's "Other Links"	www.nreca.org
NRECA's "Rules & Regs"	www.nreca.org
Nuclear Regulatory Commission	www.nrc.gov/
Occupational Safety and Health Administration	www.osha.gov
OSHA, Electrical Power Generation, etc,	www.osha_slc.gov/Preamble/Elect_toc/Elect_ toc_by_sect.html
Rural Utilities Service (Electric Program)	www.usda.gov/rus/electric/

State Environmental Regulatory Agencies	
State Environmental Regulations Hotlink Directory	www.law.cornell.edu/
Scott Rubin's Utility Resources	home.ptd.net/~sjrubin

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WEBSITES

Regional Utility Groups	
Missouri Basin Systems Group	www.mbsg.com
North American Electric Reliability Council	www.nerc.com

Power Marketing Administrations and Other	
Alaska Power Administration	www.alaska.net/~swillis/apa.html
Bonneville Power Association	www.bpa.gov
Tennessee Valley Authority	www.tva.gov
Western Area Power Association	www.wapa.gov

Electric Industry Trade and Professional Associations	
American National Standards Institute	www.ansi.org
American Public Power Assoc.	www.appanet.org
American Society for Testing and Materials	www.astm.org
Association of Energy Service Professionals	www.aesp.org
Canadian Electricity Assoc.	www.intertower.com/cea.html
Edison Electric Institute	www.eei.org
Electric Power Research Institute (EPRI)	www.epri.com/
Institute of Electrical and Electronics Engineers	www.ieee.org
National Association of Regulatory Utility Commissioners	www.erols.com/naruc/
National Council on Competiion and the Electric Industry	www.erols.com/naruc/nccei.htm
National Electrical Manufacturers Association	www.nema.org/nema/contact/index.html
National Rural Electric Cooperative Association	www.nreca.org
National Rural Telecommunications Cooperative	www.nrtc.org
Power Marketers Association	www.intr.net/pma

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WEBSITES

Publications OnLine	
Electric Advertiser	www.ea-online.com
Electric Light & Power Magazine	www.pennwell.com/elp.html
Electric Power Industry Organization Directory	www.electricnet.com/orgs.htm
Electrical World & Information Technologies for Utilities	www.electricalworld.com
News Page Electric Power Industry	www.newspage.com/newspage/ cgi-bin/walk.cgi/newspage/ info/d13/d4
Power Delivery Products News	www.pdpn.com
Power Magazine	www.powermag.com/
Power Quality Magazine	www.powerquality.com
Public Utility Reports	www.pur.com/
Rural Electrification Magazine	www.nreca.org/rem/remag.html
Transmission & Distribution World Magazine/Intertec	www.intertec.com

Directories	
Directory of Organizations Relating to the Electrical Power Industry	www.electricnet.com/orgs.htm
ElectricNet OnLine Directory-buyers guide for electrical products and services	www.electricnet.com/main.htm
m.i.u.e Utility Directory	www.webfeats.com/preecs/miue/ resources.html
RCI EnergyWeb	www.reddy.com/etweb/etweb.htm

Other	
Future prices of electricity (NYMEX)	www.ino.com/cgi-bin/ gw?exch=nyrmex
Government approved sureties list	www.fms.treas.gov/c570.html
Parties excluded from Government contracts	www.arnet.gov:8000/epls/owa/ epls.main_menu
Transmission System Info. Network	www.tsin.com/

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WEBSITES

Company Websites	
ABB Power T & D Company, Inc.	www.abb.com:80/americas/usa
Advanced Control Systems, Inc.	acsatlanta.com
Advanced Optical Controls, Inc.	www.dgsys.com/
AGEMA Infrared Systems	www.agema.com
AlberCorp	www.alber.com
Amber, A Raytheon Company	www.amber-infrared.com/
American Video Communications	www.americanvideo.com
AMP, Incorporated	www.amp.com
Ansoft Corporation	www.ansoft.com
Arbiter Systems, Inc.	www.arbiter.com
Arnco Corporation	www.arncocorp.com
Associated Engineering Company	www.keco.com
AT Plastics Inc.	www.atplas.com
AVO International	www.avointl.com
Baker Division of Sonoco	www.dec.tis.net/baker/
Basic Measuring Instruments	www.electrotek.com/bmi/
Basler Electric Company	www.basler.com
BJ Software	www.realflex.com/~bjsoftwr
Black & Veatch	www.bv.com
C&D Charter Power Systems, Inc.	www.cdpowercom.com
CAE Electronics Ltd.	www.cae.ca
Cannon Technologies, Inc.	www.cannontech.com
CESI	www.cesi.it
CMP Inc. LEADING-EDGE TECHNOLOGIES	www.x-mentor.com/cpm
Consulting-Specifying Engineer	www.csemag.com
Cooper Power Systems	www.cooperps.com/
COPEK ELECTRO	www.x-mentor.com/copek
CRC Industries, Inc.	www.crcindustries.com
Cutler-Hammer Inc.	www.cutlerhammer.com
Delta-X Research	www.hydracen.com/dx
Demark	www.demark.com
DILO Company, Inc.	www.dilo.com
Doble Engineering Company	www.doble.com
Dynapower Corporation	www.dynapower.com
Electrotek Concepts, Inc.	www.electrotek.com/
Enghouse Systems Limited	www.enghouse.com
ESRI	www.esri.com
Evans Consoles, Inc.	www.econsole.com

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WEBSITES

FOCAS, Inc.	www.focas.com
The Foxboro Company	www.foxboro.com
GE Transmission and Distribution	www.ge.com
General Physics Corporation	www.genphysics.com
Heary Bros. Lightning Protection Company, Inc.	www.hearybros.com
Holaday Industries, Inc.	www.holadayinc.com
I.S.I. Group, Inc.	www.isigroup.com
Information Technologies for Utilities/IT and Electrical World	www.electricalworld.com
Inframetrics, Inc.	inframetrics.com
Integrated Engineering Software	www.integrated.mb.ca/ies
Irby Construction Company	www.irby.com
James Martin & Company	www.jamesmartin.com/
Kavouras, Inc.	www.kavouras.com
KEMA	www.kema.nl
Koontz-Wagner Electric Company, Inc.	www.koontz-wagner.com
Kuhlman Electric Corporation	www.keco.com/
Lightning Eliminators & Consultants, Inc.	www.lightningeliminators.com
Maintenance and Diagnostics, LLC (M&D,LLC)	www.atmnet.com/~mandd
Maysteel Corporation	maysteel.com
Mehta Tech, Inc.	www.mehtatech.com
Micra systems	www.micrasys.com
Micromonitors Inc.	www.micromonitors.com
Microwave Data Systems	www.mdsroc.com/
Milsoft Integrated Solutions, Inc.	www.milsoft.com/
MPHusky Corporation	www.mphusky.com/mp
PenMetrics, Inc.	www.penmetrics.com
PennWell Publishing Company; Conventions and Exhibitions	www.pennwell.com
Positron Industries Inc.	www.positroninc.com
Powell Industries, Inc.	www.powl.com
Power Technologies, Inc.	www.pti-us.com
Powertech Lab Inc.	ewu.bchydro.bc.ca
Quazite	www.mmfg.com
Ripley Company	www.ripley-tools.com
Sediver, Inc.	www.sediver.com
SNC Manufacturing Company, Inc.	www.sncmfg.com
Sonoco Products/Baker Division	www.dec.tis.net/baker/
Southern Company	www.southernco.com

APPENDIX C

WEBSITES

Southwire Company	www.southwire.com
Tamaqua Cable Products Corporation	www.pottsville.com/tamaqua
Techron Division of Crown International	www.crownintl.com
Telog Instruments	www.telog.com
Teltone Corporation	www.teltone.com
3M	www.mmm.com
Trayer Engineering Corporation	www.trayer.com
Trenwa, Inc.	www.trenwa.com/
TrueTime, Inc.	www.nbn.com/people/truetime/truetime.htm
UE Systems Inc.	www.uesystems.com
Underground Devices, Inc.	www.udevices.com
Utility Automation	www.penwell.com
UVEX Safety, Inc.	www.uvex.com
The Von Corporation	www.voncorp.com
Weiss Instruments, Inc.	www.thomasregister.com/weissinstruments
Westinghouse Power Generation	www.westinghouse.com
X-Mentor, Inc.	www.x-mentor.com