

TRÄSTOLPAR FÖR KRAFT- OCH TELELEDNINGAR

RAPPORT

*Från konferens i Fort Collins
Colorado, USA, oktober 1989*

BILAGA

*Energitjänstprogram 1990 från
Puget Sound Power & Light Company
Seattle, Washington, USA*

FÖRFATTARE

*Tore Peterson, Svenska Kommunförbundet
Marie-Louise Edlund, Svenska Träskyddsinstitutet
Ted Sandqvist, Televerket
Sven Svenson, Vattenfall
Ulf Wagenborg, Svenska Kraftverksföreningen - VAST
Gösta Johnsson, Sydkraft
Anders Gustavsson, AB Lidingö Energiverk*

UTSKRIFT

Marie Klasson, Statens energiverk

FÖRORD

I det svenska kraft- och telenätet finns ca 10 miljoner trästolpar som är impregnerade med kreosot eller salt. Svenska Träskyddsinstitutets utskott för trästolpar har till uppgift att initiera och utvärdera olika forskningsprojekt i syfte att få fram bra stolpar. Vidare arbetar utskottet med att ta fram metoder för provning och förstärkning av stolpar samt reimpregnering.

I utskottets verksamhet ingår också att följa den tekniska utvecklingen i andra länder. Sex ledamöter från utskottet deltog i en stor internationell konferens om trästolpar för kraft- och teleledningar i Fort Collins, Colorado, USA. Efter konferensen gjordes ett studiebesök hos kraftföretaget Puget Sound & Light Company, Seattle, Washington.

Denna rapport har skrivits av konferensdeltagarna Marie-Louise Edlund, Svenska Träskyddsinstitutet, Ted Sandqvist, Televerket, Sven Svenson, Vattenfall, Ulf Wagenborg, Svenska Kraftverksföreningen VAST, Gösta Johnsson, Sydkraft samt Tore Peterson, Kommunförbundet. Marie Klasson, statens energiverk, har svarat för redigering och utskrift av rapporten.

Anders Gustavsson, AB Lidingö Energiverk, har gjort en sammanfattning av Puget Power energitjänstprogram. Hela programmet redovisas i bilaga.

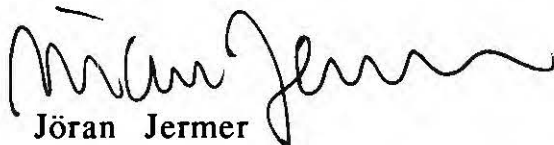
Stockholm den 25 juni 1990



Tore Peterson

Ordförande

Svenska Träskyddsinstitutet



Jöran Jermer

Föreståndare

Svenska Träskyddsinstitutet

Rapport från konferens om trästolpar för kraft och
teleledningar, Fort Collins, Colorado, USA 1989-10-25-27

Innehåll:	Sid
Förord	2
Inledning	3
Sammanfattning	5
1. Stolpmaterial	5
2. Impregnering	6
3. Impregneringsmedel	7
4. Efterbehandling - reimpregnering	10
5. Bedömning och provning av trästolpar	12
6. Skötsel och reparation av trästolpar	14
7. Minnesanteckningar från studiebesök 1989-10-30 hos Puget Sound Power & Light Company, Seattle	16
8. Puget Power program om energitjänster 1990	20
9. Kort sammanfattning av programmet på svenska	65

INLEDNING

Svenska Träskyddsinstitutet vars verksamhet delvis betalas genom anslag från STU har bl a till uppgift att verka för olika forskningsprojekt inom området träskydd och att resultaten från denna forskning kommer till praktisk tillämpning. Institutet svarar för bevakning av den tekniska forskningen och utvecklingen inom träskyddsområdet såväl inom landet som internationellt.

Institutets utskott för trästolpar arbetar med frågor som berör hela ledet avverkning i skogen, torkning, bearbetning, impregneringsmedel, metoder vid impregnering, efterbehandling, lagerhantering, användning och underhåll av trästolpar för kraft- och teleledningar. Miljöfrågorna som rör impregneringsverk, träskyddsmedel och därmed impregnerade stolpar har under de senaste åren uppmärksamats alltmer. Det gäller smetiga kreosotstolpar som under vissa förhållanden kan vara ett arbetsmiljöproblem. Även impregnerade stolpars eventuella påverkan på miljön har studerats. Den miljöfråga som särskilt uppmärksamats är äldre impregneringsverk där rester efter tidigare verksamhet kommit idagen. Från stolpanvändarnas synpunkt har stolparnas motståndskraft mot röta aktualiserats. Metoder för icke förstörande provning av stolpar ute i linjerna har efterlysts. Syftet med arbetsutskottets verksamhet är att stolpindustrin ska utveckla en bra stolpe som är miljövänlig och motståndskraftig mot röta. Forskning och utveckling måste också drivas för att få fram bättre och miljövänligare medel för impregneringen och impregneringsmetoder.

Samtidigt har statliga utredningar tagit upp frågor om olika problem med impregnerat trä. Arbetarskyddsstyrelsens utredning "Minskade risker med träskyddsmedel" föreslår ett antal åtgärder i syfte att minska användningen av impregnerat virke. Miljöavgiftsutredningen har

för avsikt att föreslå miljöavgifter på träskyddsmedel. Båda utredningarna vill begränsa användning av impregneringsmedel och impregnerat trävirke. Härtill kommer att kemikalieinspektionen ifrågasätter om inte vissa nu använda kemikalier för träimpregnering helt borde förbjudas.

Skulle utredningarnas förslag och kemikalieinspektionens intentioner förverkligas fullt ut får det konsekvenser för användare av impregnerat virke, medelstillverkare och stolpimpregnerare. Då det gäller trästolpar för kraft- och telenätet finns det idag inte ersättningsmaterial som är tekniskt och ekonomiskt lika bra.

Mot denna bakgrund är det angeläget att den tekniska utvecklingen av alternativa impregneringsmetoder och medel på den internationella marknaden följs och tillvaratas i Sverige.

Svenska Träskyddsinstitutet förordade att en svensk delegation skulle delta i en internationella konferensen för trästolpar som anordnades i Fort Collins i Colorado, USA.

SAMMANFATTNING

Konferensen, som samlat 200 deltagare från hela världen, var indelad i 14 sektioner. Totalt hölls ett 30-tal föredrag.

1. Stolpmaterial

Bror Moldrup, The Danish Wood Treating Co gav en överblick över användningen av olika träslag, impregneringsmedel och årlig stolpförbrukning i olika europeiska länder. I Sverige, Norge, Finland, Belgien, Grekland och Italien används uteslutande olika tallarter som stolpmaterial, i de nordiska länderna *Pinus sylvestris*. I övriga redovisade länder användes gran till mellan 50 och 100 %.

I ett par föredrag redogjordes för situationen när det gäller trästolpar i Brasilien resp för möjligheter och bakslag med stolpar av kokosnötpalm i Mocambique. Information lämnades också om Australiens möjligheter att leverera impregnerade trästolpar på världsmarknaden samt om standard för stolpar av eucalyptusträ. Bl a noterades att stolpar av eucalyptus har hög mekanisk hållfasthet.

Alan Mailing, Koppers Australia Pty Ltd, Sidney, behandlade kreosotimpregnerade pålar för kaj- och brokonstruktioner samt grundpålar för byggnadskonstruktioner. Erfarenheterna visar att rätt impregnerade pålar har betydande fördelar i förhållande till betongpålar och stålprofiler som relativt snabbt vittrar sönder respektive får svåra korrosionsskador. Detta visar att det för många konstruktioner är svårt att få fram verkligt bra alternativ till rätt impregnerat trä.

2. Impregnering

Bror Moldrup, Brande, Danmark, rapporterade att totalt beräknas 2,1 miljoner stolpar bli impregnerade årligen i Europa. 1/3 av dessa impregneras med kreosot, 2/3 med salt.

CCA är det dominerande saltimpregneringsmedlet i Europa men i vissa länder, som Tyskland, Schweiz och Österrike används CCB (koppar, krom, bor) eller CCF (koppar, krom, fluor).

Utvecklingen går mot bättre miljöskydd vid anläggningarna, accelererad fixering av saltmedel, forcerad torkning av råa stolpar samt impregneringsteknik som medger olika impregneringsgrad i olika delar av stolpen.

Donn Keefe, American Wood Preservers Bureau (AWPB), Springfield, Virginia, USA, berättade om AWPB, en förening till vilken amerikanska träimpregneringsföretag är anslutna.

AWPB utarbetar normer för impregneringsanläggningarnas utförande, drift och underhållskrav samt krav på impregneringskvaliteten för olika medel och träslag.

Det ansågs av största vikt att köparna av impregnerade stolpar var medvetna om kvalitetskraven, ställer dessa vid inköp och även kontrollerar att man verkligen erhåller stolpar som är impregnerade enligt kraven.

I Norden har vi redan dessa krav på såväl anläggningarna som på det impregnerade virket. Även här gäller dock att inköpare och kontrollanter måste vara medvetna om kraven och följa upp att man får rätt kvalitet på sina impregnerade stolpar.

3. Impregneringsmedel

David Webb, Koppers Industries Inc., Pittsburgh, Pennsylvania, USA rapporterade att i USA används pentaklorfenol, kreosot och CCA för impregnering av stolpar. Sedan 1988 har AWWPA (American Wood-Preservers' Association) godkänt även kopparnaftenat för impregnering av stolpar av "southern pine" och Douglas gran. Någon långtidserfarenhet har man dock, enligt talaren, inte av detta medel. Han sade sig inte tro på någon utveckling mot helt nya system av impregneringsmedel för stolpar utan anser att utvecklingen kommer att gälla förbättringar av nu använda medel.

Scott Grov, Mooney Chemical, Cleveland, Ohio, USA, framhöll å andra sidan att kopparnaftenat har använts som impregneringsmedel i USA i över 40 år. Det har dock kommit i bakgrunden i förhållande till de tre stora medlen, pentaklorfenol, kreosot och CCA. Pentaklorfenol har enligt honom ca 65 % av USA-marknaden, kreosot ca 20 %, CCA och kopparnaftenat resten med en övervikt för CCA. I samband med att Environmental Protection Agency (EPA) har för avsikt att klassa avfall från pentaklorfenol, kreosot, arsenik och koppar som "miljöfarligt avfall" har kopparnaftenatet åter kommit på tal som ett mindre miljöfarligt impregneringsmedel.

Kopparnaftenat är en djupgrön viskös olja som späds ut med något organiskt lösningsmedel. Kopparnaftenat är lösligt i vatten. Det är EPA-registrerat och godkänt för impregnering av trä. Kopparnaftenatet är inte korrosivt eller elektriskt ledande. Medlet kräver inte några nya impregneringsanläggningar.

Pentaklorfenol behandlades av Bruce K Bernard, Scientific Research Associates, Inc., Washington, D.C USA som gått igenom tillgänglig litteratur rörande medlet men inte funnit några belägg för att det skulle vara så farligt som man hävdade från t ex EPA. Dioxinerna, som förekommer i små mängder som förorening i pentaklorfenol, skulle utgöra den värsta faran. De dioxiner som återfinns i pentaklorfenol är emellertid inte av de giftigaste varianterna. (Det finns minst 75 olika dioxiner).

Pentaklorfenol skulle också brytas ned i naturen och alltså inte på sikt utgöra någon miljöfara.

Wolman ET är ett CCA-saltmedel som redan tidigare funnits på amerikanska marknaden. Om detta talade Craig McIntyre, Hickson, Monroeville, Pennsylvania, USA.

Han nämnde att i USA har EPA föreslagit att klassa dropp och avfall från pentaklorfenol, kreosot, krom och arsenik som farligt avfall ("hazardous Waste").

Från flera håll anser man nu att man kommer att få problem med främst pentaklorfenolen och att kreosot anses besvärligt att arbeta med p g a stolparna i vissa fall kan bli smetiga. Då återstår således CCA-medlen.

Även Alan Preston, Chemical specialities, Inc., Charlotte, North Carolina USA talade om CCA.

Impregnering med CCA (koppar, krom, arsenik) ger stolpar med något hårdare yta än impregnering med kreosot. Detta förorsakar problem för de amerikanska linjearbetaren vars stolpskor är annorlunda utformade än de svenska och svåra att använda i hårt material.

För att komma till rätta med detta problem har man genom åren lagt ner stor möda på att göra CCA-stolpar

"mjukare". I detta föredrag presenterade författaren ett vattenavvisande additiv som kan tillsättas CCA-lösningen och som ger stolpar som är lättare att klättra i, har bättre väderbeständighet och samma rötbeständighet som stolpar impregnerade med ren CCA.

En annan talare nämnde att om man tillsätter en speciell olja till CCA-medlet får stolpen en mjukare yta som kan accepteras av linjemontörerna.

Chemonite är varubeteckningen på ett saltimpregneringsmedel som från början var av typ ACA (Ammonical Copper Arsenate) men sedan vidareutvecklats till ett ACZA-medel (Ammonical Copper Zink Arsente).

Barton A Ecklund, Technical Consultant for the Chemonite Council, Santa Rosa, Carlifonia, USA, rapporterade att vid impregneringen med detta medel tillämpas en varmprocess till skillnad mot det normala vid impregnering med CCA-medel, då man arbetar utan värme. Chemonite beskrevs som ett miljövänligare medel än pentaklorfenol och kreosot.

Från Chemonite ansåg man att livslängden minskat för såväl pentaklorfenol- som kreosotimpregnerade stolpar p g a att man "spätt" ut oljorna. För Chemonite ansågs förändringen från ACA- till ACZA-medel med värme vid impregneringen ha förbättrat impregneringskvaliteten och ökat stolparnas livslängd.

En intressant effekt som man kunnat konstatera med ACZA-medlet är att risken för hackspettsskador minskar.

Även i ett rätt spekulativt föredrag kring frågor om hur man skyddar miljön utan att förlora stolparna redovisades försök där det visat sig att hackspettar undviker stolpar impregnerade med chemonite.

Eftersom även ACZA-medlet innehåller arsenik är det dock tveksamt om Chemonite är ett alternativ till de CCA-medel som används i Sverige.

Slutligen kan nämnas att Philip Opsal, Philip Mason Opsal, P.C., Tucson, Arizona, USA, i ett anförande om "Mother Nature's Way" talade om möjligheterna att extra-hera naturligt förekommande fungicida (svampdödande) kemikalier ur t ex bark, kärnved eller resistenta träslag. Dessa kemikalier skulle sedan användas för impregnering av icke resistenta träslag. Lovande försök har utförts, t ex används på något sågverk barkextrakt (som lakats ut med vatten) som blånadsskyddsmedel. Frågan om naturligt förekommande fungicider i koncentrerad form är harmlösa för människor och miljö kunde dock inte besvaras.

Även en annan talare redovisade naturens egna skyddsmedel och möjligheterna att utnyttja dem. Intressanta synpunkter som borde föranleda fortsatt forskning.

4. Efterbehandling - reimpregnering

Marie-Louise Edlund, Swedish Wood Preservation Institute, Stockholm redovisade ett projekt som genomförts i Sverige under en 5-årsperiod och där olika kemikalier för efterimpregnering av stolpar undersökts avseende spridning av kemikalier i träet och svampdödande effekt. Projektet fokuserades på borater då dessa ur miljösynpunkt är de som är lättast att acceptera. Boraterna visade god spridning i träet och hade god svampdödande effekt i de behandlade partierna. En viss urlakning kunde dock registreras efter 5 år. Den bästa svampdödande effekten visade DFCK-pasta som användes i Sverige fram till 1977 då den förbjöds av miljöskäl.

Jeffrey Morell, Oregon State University, Corvallis, Oregon USA, berättade att för efterbehandling av stolpar används sedan 1969 s k "fumigants" i USA. Dessa kemikalier tillförs träet i vätskeform och avger gaser som desinfierar träet och förhindrar nyetablering av svamp och insekter.

Kemikalierna är i sig giftiga och måste hanteras med försiktighet. För att förenkla hanteringen och minska riskerna med medlen pågår vidareutveckling. Olika sätt att kapsla in kemikalierna har prövats liksom att göra dem mindre flyktiga. Ett annat sätt att förbättra hanteringen är att få fram kemikalier i fast form, vilka kan avge gaser i träet efter applicering. En sådan produkt har nyligen registerats på den amerikanska marknaden.

Terry Amburgey, Mississippi State University, Mississippi State, USA, informerade om en pasta bestående av borax och borsyra som provats för efterbehandling av stolpar för att förhindra eller stoppa angrepp av röta och insekter. Prov har utförts på såväl oimpregnerat trä som på CCA-impregnerade stolpsektioner.

Ett "bandage" med pastan viras runt stolpen i markbandet och de vattenlösliga medlen diffunderar in i träet. Efter 5,5 år har man funnit en god spridning av kemikalierna i träet även ovanför bandaget.

I försöksledet med behandling av tidigare oimpregnerade stolpar fann man efter fyra år att samtliga helt obehandlade stolpar var svårt rötskadade medan de som behandlats med borax-kopparnaftenat var helt skadefria under bandaget men uppvisade begynnande angrepp i partier ovanför detta. Kemiska analyser visar också på en god spridning av framför allt borax men även av kopparnaftenaten.

För att komma ifrån användningen av kemikalier för bekämpning av rötsvampar pågår forskning där antagonism mellan olika svamptyper utnyttjas. Bernard King, Dundee Institutet of Technology, Dundee, Scotland, redogjorde för arbeten utförda med Trichoderma, en svamp som hämmar tillväxten av flera rötsvampar. Försöken med efterbehandling av stolpar har hittills varit lovande men det är fortfarande flera års forskning kvar innan metoden kan användas i praktiken.

En annan metod som redovisades innebär användande av 2-komponentplast som injiceras i hålrum i stolpen (efter röta och hackspettar). Kaviteterna rengörs till friskt trä genom bortfräsning ("tandläkarteknik"). Det bortfrästa materialet suges ut, varefter 2-komponentmassan sprutas in i hålrummet. Metoden bedöms ej vara ekonomiskt lönsam och miljömässigt godtagbar i Sverige.

5. Bedömning och provning av trästolpar

Ett föredrag behandlade inspektion och impregnering av trästolpar i drift. I föredraget redovisades motiven för att inspektion bör ske. Såväl traditionella metoder som nya koncept, icke förstörande metoder redovisades. Icke förstörande metoder för att bestämma hållfastheten, exempelvis Pole-Test, ökar möjligheten att fastställa stolpens status och de åtgärder som ev bör vidtagas.

Detta innebär att de nya koncepten gör att företagen får förbättrade möjligheter att noggrannare och mer ekonomiskt fastställa åtgärdsprogrammen.

Vidare informerades om ny teknologi och nya verktyg typ Pole-Test med vars hjälp livstidskostnaderna för trästolpledningar kan minimeras genom att underlaget för bedömning av underhållsåtgärder såsom förstärkning eller stolpbyte förbättrats.

En talare påpekade variationen i hållfasthet hos trästolpar. Bedömningen enligt vanliga metoder bygger på genomsnittsvärden, vilket kan leda till stora felbedömningar. Därför har i samarbete med Electric Power Research Institute (EPRI) utarbetats en metod för bestämning av hållfastheten som minimerar variationerna i värderingen i jämförelse med den "visuella" inspektions-tekniken och där varje stolpe blir rätt hållfasthetsvärderad.

Vidare redovisades en testutrustning för tillstånds-kontroll av stolpar med hjälp av röntgen. Apparaturen och dess skötsel är sådan att det ej är rimligt att använda den för fältarbete.

En annan utrustning som redovisades bygger på att en last lägges på stolpen, varefter man med hjälp av vissa grund-data och dataprogram får fram stolpens hållfasthet. Programmet bygger på ett par tusen tester. Det ifrågasattes om inte böjpåkänningen skadade stolpen, vilket dock ej ansågs vara fallet.

För hållfasthetsundersökning på trästolpar av gran har man utnyttjat ultraljud och pilodyn. Undersökningen som omfattade nya stolpar visar att impregneringen försämrade hållfastheten hos provstolparna med 10-20 %. Man har även funnit att reimpregneringen med Cobra-metoden ej försämrar hållfastheten. Användning av ultraljud på stolpar i drift kräver vidare forskning.

I USA har ett stort antal broar byggts på impregnerade pålar. På dessa brokonstruktioner krävs regelbundna röt-skadeundersökningar, berättade M. Cherif Aggour, University of Maryland, College Park, Maryland, USA.

Inspektionen av pålarna utförs i likhet med den metod som vi använder för rötskadeundersökning av kreosotstolpar d v s med hammare och provborr. Rötskadeundersökning genom hamring, avlyssning av resonansljudet och känslan i handen vid hammarens återstuds kräver god erfarenhet och är givetvis svår att utföra under vatten. Sedan en större bro kolapsat i Maryland trots regelbundet återkommande besiktningar beslöts att man måste studera möjligheterna till förbättrade besiktningsmetoder. Forskningsarbetet har resulterat i ett instrument som bygger på ultraljud-principen.

Genom att sända lågfrekvent ultraljud från en sändare som tryckts mot den väl rengjorda stolpytan genom träet till en diamentralt placerad mottagare och mäta hastighetsminskningen på ljudet kan man avgöra om virket är friskt eller dåligt. Hastigheten avtar med ökade rötskador. Det uppmätta värdet jämförs med det värde som gäller för friskt virke för aktuellt träslag. För att konstatera eventuella skador måste sändare och mottagare flyttas längs stolpen. Instrumentet Pole-test beräknas kosta ca 6000\$ (40 000 kr).

Ultraljudtekniken bör även kunna användas på svenska furustolpar salt- eller kreosotimpregnerade för att konstatera om de är rötskadade. Det är dock mer tveksamt om man kan mäta rötskadedjupet i en saltstolpe eller de invändiga skadorna i en kreosotstolpe.

6. Skötsel och reparation av trästolpar

Bounneville Power Administration's principer för inspektion och underhåll av trästolpar i transmissionsledningar redovisades. Programmet bedömdes ge besparingar motsvarande 15 milj kronor årligen. Detta berodde främst på följande:

- a) Ytan i markbandet reimpregnerades vart 12:e år. Av miljöskäl användes numera kopparnaftenate.
- b) Inre desinfektion för att skydda mot svampar och insekter i markbandet. Tillämpas för äldre stolpar.
- c) Specialbehandling av rot- och toppdel i samband med impregneringen ges en 100% inträngning i dessa delar, vilket i sin tur innebar att inre röta var obetydligt förekommande.

Även några studier kring skötsel av trästolpar avrapporterades. En åtskillnad kan göras mellan kvalitet och hållfasthet vid värdering av stolpen enligt nedan:

Metod	Primärt syfte
a) Värdering av stolpkvaliteten	Värdera reimpregneringskravet för att förlänga livslängden
b) Värdering av hållfastheten i stolen	För att bestämma lastbärande kapaciteten hos stolpen, såväl nya som i drift.

OSMO-C-TRUSS™

WOOD POLE RESTORATION SYSTEM

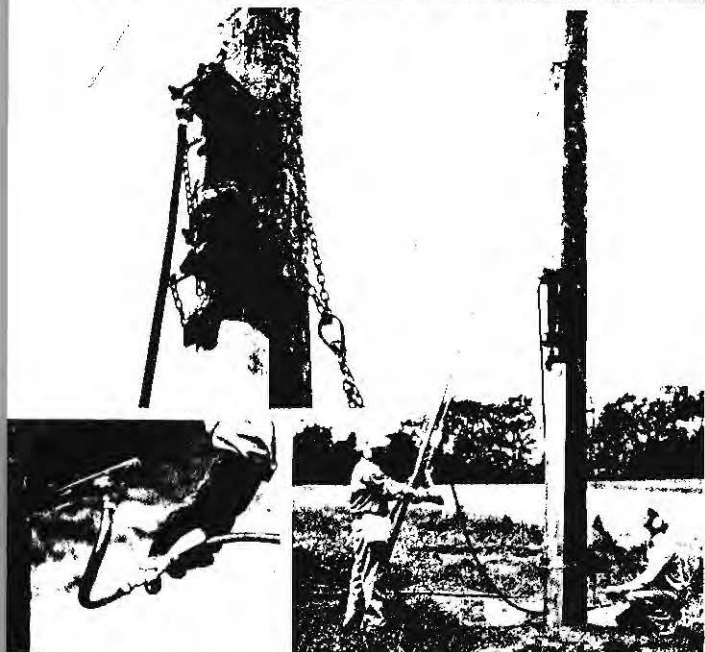
Restores groundline strength

Extends pole life

Avoids costly pole change-out

Eliminates service interruptions





Inspection

Excavation to the depth of 18 inches is required to reveal the hidden areas below ground where decay is most likely to occur. A combination of sounding, boring and removal of existing decay by a trained, experienced inspector indicates decay voids, shell thickness and insect infestation. If decay has weakened the pole to below National Electrical Safety Code standards for replacement, the inspector evaluates the shell thickness above ground to determine the suitability for pole restoration.

Treatment

OsmoPlastic® is applied to the pole exterior during groundline inspection. Application is made from 3 inches above groundline to 18 inches below and is then covered with OsmoShield™. This paper backed polyethylene film helps the treatment to deeply penetrate the outer shell thereby protecting up to 90 percent of the pole's strength.

The pole restoration crew injects at 100 PSI pressure an internal treatment such as Hollow Heart® solution. This procedure saturates the wood which surrounds existing decay voids so that future deterioration is controlled until retreatment is recommended.

Fumigants such as WoodFume® or TimberFume® are used to treat solid wood where decay voids do not exist or when a pole cannot be excavated due to concrete or other obstructions.

Installation

The installation equipment is completely portable and causes virtually no disturbance to the pole surroundings. After the air hammer is raised into position with a pike pole, a crew member uses a pull down winch to maintain steady downward pressure while driving the steel. A second winch and chain is used to hold the truss tightly against the pole which insures a good union between the steel and wood.

A minimum of four galvanized steel bands are tightened with a pneumatic or hand tensioner to secure the truss edges with the pole surface. Double-wrapped bands are used on all large and double truss installations. Each band is secured with two galvanized seals which are pneumatically crimped to provide a bond stronger than the bands themselves.

The finished installation conforms to the pole without unsightly projections. It's appearance has gained public acceptance from pole owners nationwide.

Time Proven

The Osmo-C-Truss™ is a time-tested method for restoring the groundline strength of utility poles. With installations in service since the early 1960s, the C-Truss has been used to reinforce more poles than all other systems combined.

Cost Effectiveness

The best reason for such widespread use is that the C-Truss system is the most cost effective way to return a pole weakened at groundline to serviceable strength. Even small poles can be economically restored. Poles in backyards, along fences and buildings, or set in concrete or asphalt represent some of the more difficult and costly replacements. The flexibility of the Osmose installation equipment provides the means that allow these difficult poles to be restored at a fraction of the cost of replacement.

Design

The shape of the Osmo-C-Truss™ has been optimized with a computer-aided-design process. Most distribution poles therefore can be restored to their original NESC transverse loading requirements using only one truss. This applies even with little or no remaining wood at groundline.

Truss Matching

A computer program is used to match the proper size truss to a range of pole sizes based on the particular requirements of a pole owner. Using this program for grade B construction, the NESC requires an overload capacity factor (OCF) for transverse loading of 4.0 in wood and 2.5 in the C-Truss. This is because steel is a much more consistent and dependable material than wood. Also, the C-Truss resists deterioration because it is protected by heavy galvanizing. The flexibility of the C-Truss system can provide restoration to any overload capacity factor ranging from 2.67 to 4.0. An application table for your system can be obtained from your local Osmose representative.

High Strength Trusses

Trusses designated with an "R" have a flat reinforcing rib welded on the inside of the C-Truss extending above and below the groundline. These C-Trusses develop higher bending moment capacity so a greater percentage of poles can be restored with a single C-Truss. They also allow restoration of taller poles.

Double Trusses

Two C-Trusses can be installed on poles requiring higher strength which effectively doubles the amount of restored bending moment capacity. Retainer brackets and thru-lags can be used with the C-Trusses to prevent twisting.

Double Protection

The experience and in-depth training of Osmose inspectors and the flexibility of equipment provides pole owners with double protection:

Protection against restoring poles which should actually be replaced for reasons such as woodpecker damage or split tops.

Protection against identifying a pole "non-reinforceable" because of difficult access or nearby obstructions.

Quality

The value and quality of an Osmose Pole Restoration system is backed by our trained personnel and long standing history. Osmose inspectors and restoration foremen are career employees. Many are graduates of forestry schools and are highly trained and motivated to do the job right. Pole owners confirm the high quality level of Osmose workmanship and materials in regular quality control checks.

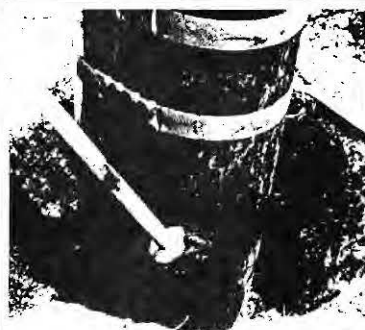
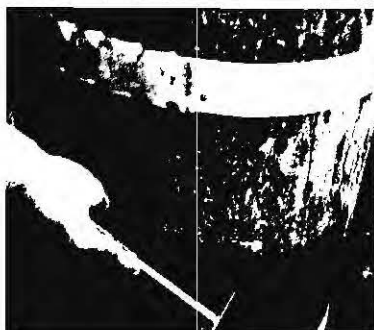
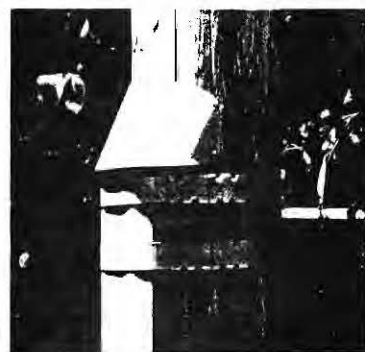
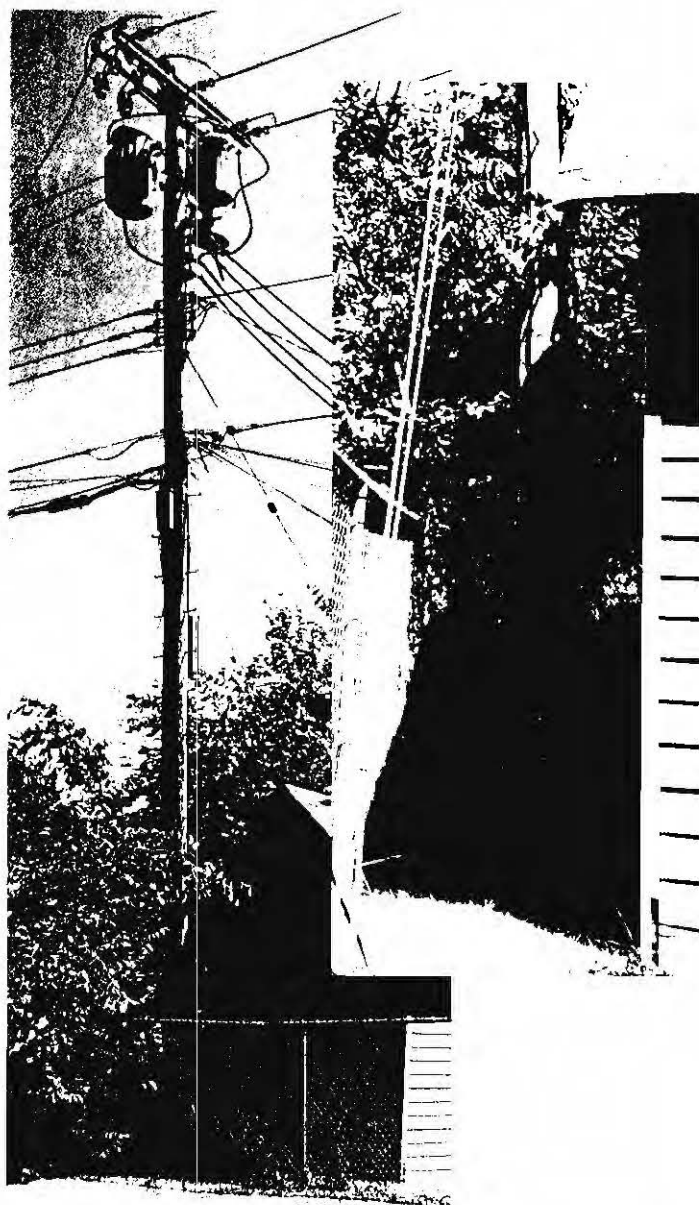
All products are manufactured under strict specifications. Each Osmo-C-Truss™ is stamped with the "heat number" to confirm the steel chemistry and mechanical properties.

Retreatment

Osmose procedures include a comprehensive program of external and internal treatment of every pole restored with a C-Truss. A major benefit of the C-Truss is that it provides easy access for subsequent inspection and treatment. With systematic reinspection and retreatment the life of most poles can be extended indefinitely.

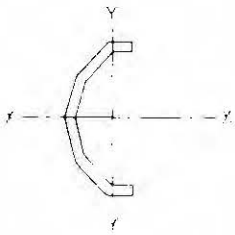
Re-use Truss

When restored poles need to be changed out due to reconstruction or other considerations, the same C-Truss can in most instances, be used to restore another pole. An Osmose crew can install a reusable C-Truss for the cost of driving the steel only, which means even greater cost savings.



Osmo-C-Truss™ Specifications

Truss Nominal Width (in.)	Theoretical Ultimate Strength (ft-lb)	Typical* Tested Strength (ft-lb)	Standard Truss Length (ft)
6	21,075	21,440	10
7	25,515	27,200	10, 11
8	35,040	40,060	11, 12
9	55,110	60,800	11, 12, 13
9R	73,300	80,100	11, 12, 13
10R	90,565	103,500	11, 12, 13



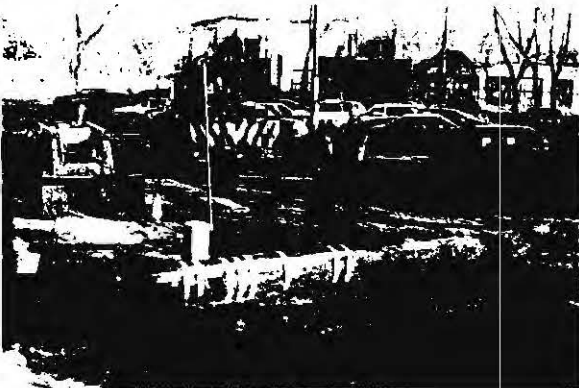
*Testing Witnessed By Independent Testing Laboratories

C-Truss Material:

A-572 Steel Grade 60
Minimum Yield 60,000 PSI
Galvanized Per ASTM A-123

Strapping Material:

2" x .055" Minimum
Minimum Tensile 86,000 PSI
Minimum Load 10,000 lb
Galvanized 2.0 oz. per sq. ft.



The Osmo-C-Truss System has been thoroughly tested by Osmose, independent laboratories and pole owners nationwide. Ongoing testing includes both static and test-to-failure procedures, which insure the best value for the pole owner. Testing details and results are available on request.

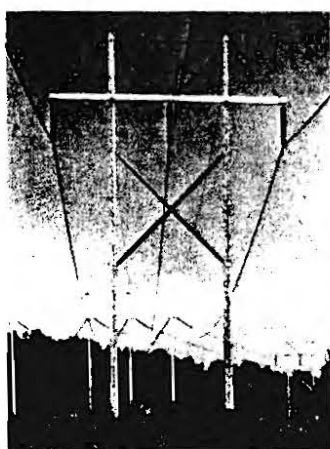


For further information contact your local Osmose representative or
OSMOSE WOOD PRESERVING, INC., Utilities Division, 980 Ellicott Street, Buffalo, NY 14209
1-800-877-POLE, in New York State and Canada 716/882-5905

OSMOSE ENCASEMENT

WOOD POLE RESTORATION SYSTEM

*A unique alternative
to Pole Replacement*



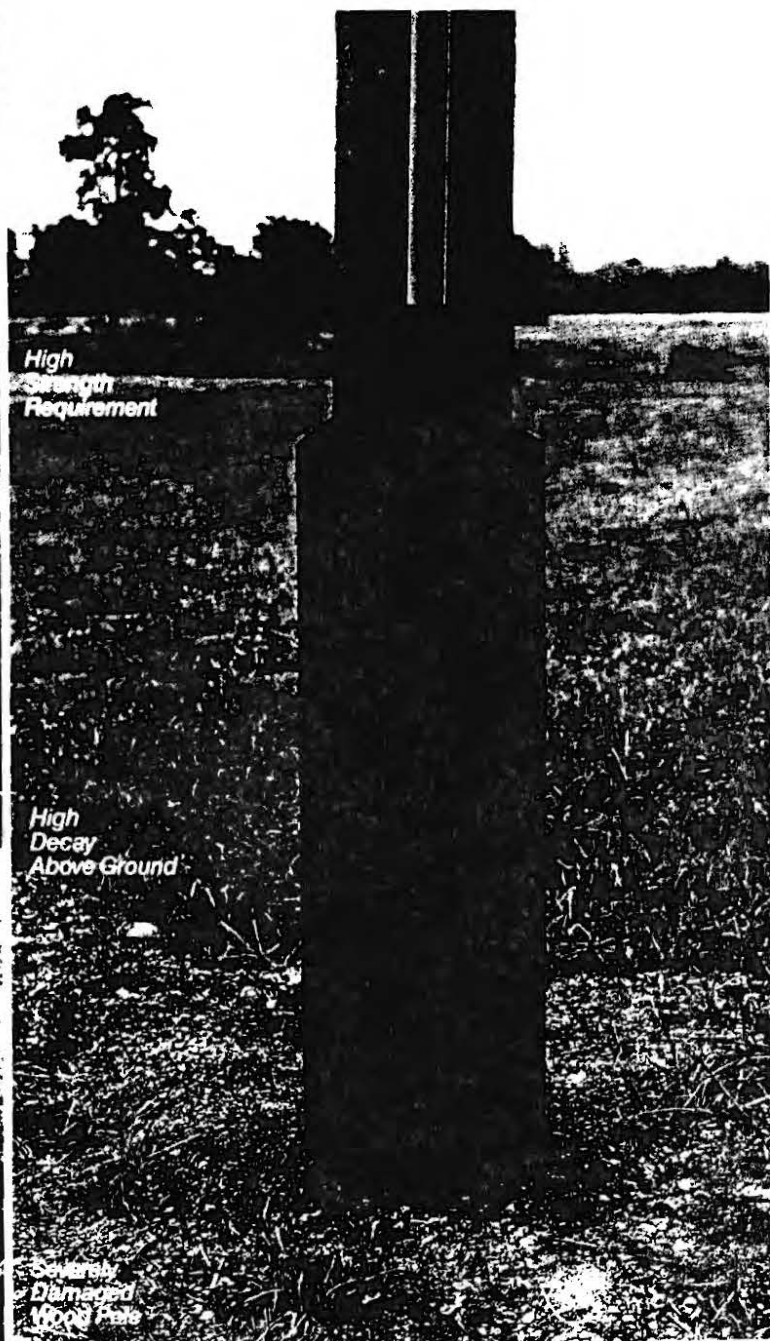
High
Strength
Requirement



High
Decay
Above Ground



Severely
Damaged
Wood Pole



Decay Conditions

The four elements necessary for wood to decay are moisture, oxygen, food, and temperature. Wood is composed of cellulose and lignin. These compounds are the food supply for fungi and insects. Sufficient oxygen for fungi to exist is not only present in the atmosphere but also usually occurs in the soil to a depth of approximately 18 inches. Temperatures above 50°F are conducive to decay while moisture levels in the groundline area are almost always sufficient to promote decay.

Moisture in a pole comes from above and below the groundline. External water enters the pole butt especially through checks and cracks and also moves up internally by capillary action and vapor diffusion toward the groundline. Additionally, the natural hygroscopic properties of wood chemically attracts moisture from the air into the cellular tissue thus causing wood to shrink and swell as the relative humidity changes. This in turn promotes checks and cracks. The absorbed moisture when combined with rain seeping into checks and cracks, creates "free water" which then travels down toward the groundline. As a result of these natural occurrences, it is impossible

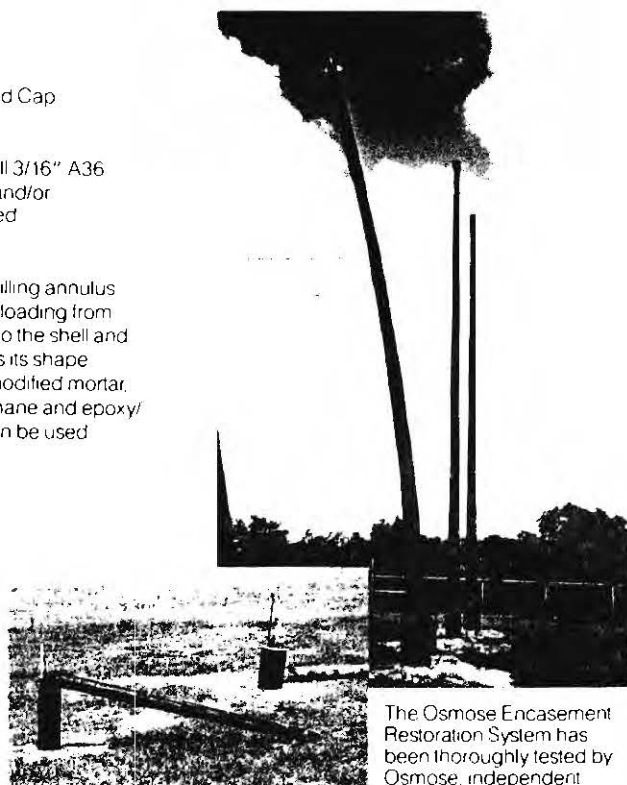
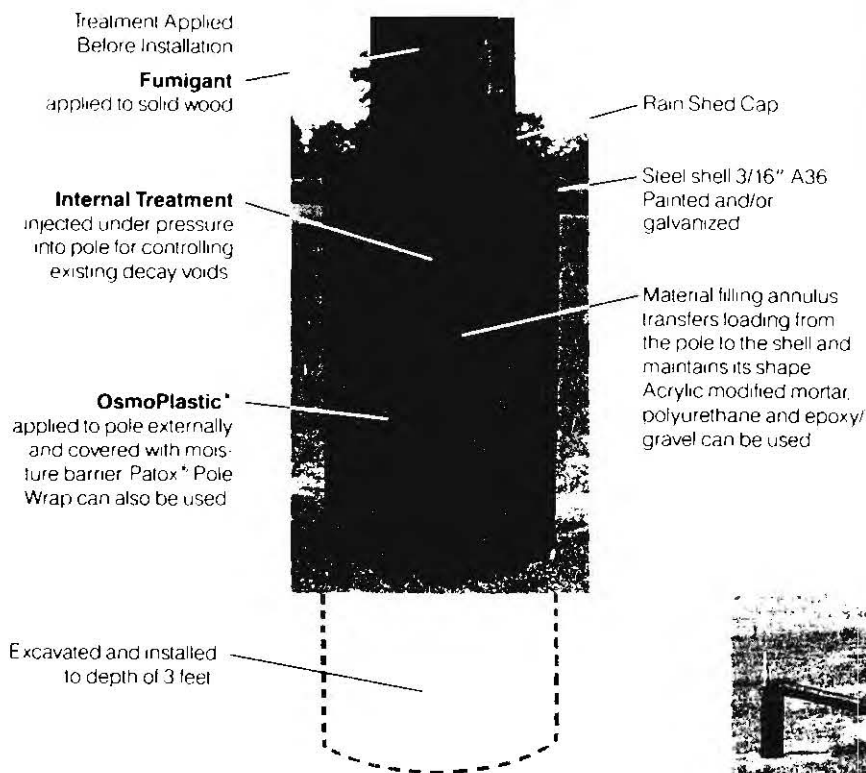
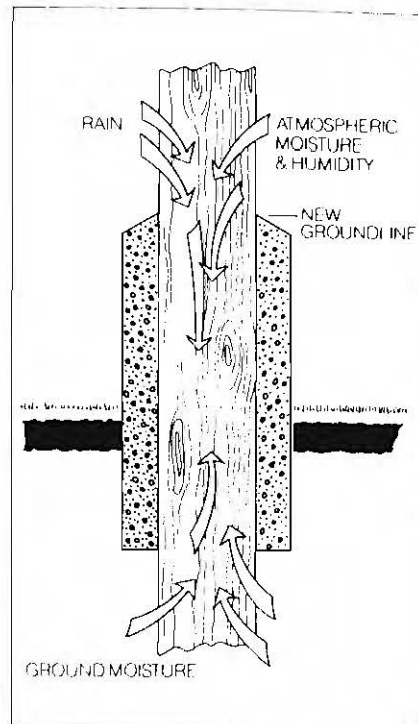
to eliminate moisture and air from the groundline section of a pole.

New Groundline Level

The encasement system effectively raises the groundline of a pole to the top of the filler material. This creates conditions for additional decay at both the original and new groundline. Moisture migrating up and down the pole will not dissipate into the environment at the original groundline as the encasement confines it within the pole. Since moisture and oxygen cannot be eliminated, a pole needs proper supplemental treatment before installation of the encasement to control fungi and insect infestation.

Wood Preservation

Supplemental treatment includes removal of external decayed wood and application of OsmoPlastic®. The preservative deeply penetrates by osmosis (equalization of fluids through semiporous wood cell walls) to protect the vital shell area. A pressurized internal treatment is also injected through a series of holes to saturate the wood surrounding existing decay. Solid wood is then treated with fumigants for control of incipient decay.



The Osmose Encasement Restoration System has been thoroughly tested by Osmose, independent laboratories and pole owners nationwide. Ongoing testing includes both static and test-to-failure procedures, which insure the best value for the pole owner. Testing details and results are available on request.



For further information contact your local Osmose representative or OSMOSE WOOD PRESERVING, INC., Utilities Division, 980 Ellicott Street, Buffalo, NY 14209 1-800-877 POLE, in New York State and Canada 716/882-5905

Minnesanteckningar från besök den 30 oktober 1989 hos
Puget Sound Power & Light Company, Seattle.

Värdar för Puget Power:

Gerald A. Betzold
Keith Krall

Från Sverige:

Marie-Louise Edlund
Gösta Johnsson
Sven Svenson
Tore Peterson

Puget Powers distributionsområde är 11 700 km² stort (motsvarande Skånes yta) med 700 000 kunder. Nyttillskottet på kunder har de senaste åren varit ca 12 000/år. Puget Power har 2 500 anställda. Endast 50 % av bolagets om- och utbyggnader av kraftanläggningar görs med egen personal. Den andra hälften köps in utifrån. Överföringsledningarna sköts centralt och distributionsnäten lokalt. Puget Power har ca 275 000 trästolpar, 50 % Ceder och 50 % Douglasgran. Rötskadebesiktning utförs i samband med underhållsbesiktning och alltid med entreprenör.

Våra värdar ansåg att det är svårt att få bolaget att anslå tillräckligt med medel för underhåll av trästolparna.

Impregnering av stolpar

Puget Power använder Pentaklorfenol som impregneringsmedel. För några år sedan köpte man ett antal koppar-naftenatimpregnerade stolpar. Erfarenheterna från dessa stolpar har inte ännu utvärderats.

Den mest utsatta delen av en trästolpe är stolproten som kommer i direkt kontakt med jorden. För att få bättre motståndskraft mot röta impregneras denna del efter incising (perforering med många små hål). Alternativt borrar 2 till 3 tum djupa hål så att impregneringsmedlet kan tränga in i virket.

Livslängden för Puget Powers trästolpar bedöms till ca 40 år medan medellivslängden är ca 25 år. Många utbyten får göras på grund av andra skador än av röta.

Besiktning av stolpar

Nya stolpar stickprovskontrolleras vid leveransen.

På 50-talet utförde Puget Power en kraftfull insats med rötskadebesiktning och förstärkning av trästolpsbeståndet. Sedan har "satsningar" varit måttliga fram till 1988 då man ånyo börjat satsa kraftfullt. I planeringsprogrammet för trästolpar har man ett besiktningsintervall på 15 år. Man arbetar för närvarande på att lägga upp en databas för kraftbolagets trästolpar. Staten Washington har inget myndighetskrav för trästolpbesiktning. Sådant krav förekommer dock i en del andra stater.

Besiktningsmännen använder en liten handdator för inprogrammering av uppgifter om stolparna. Handdatorns uppgifter överförs sedan via telefonnätet till den centrala databasen.

Rötskadebesiktningen utföres med hammare och tillväxtborr. Sedan ett halvår har man börjat utvärdera ett nytt instrument, Pole-Test. Stolpar som dömts ut på konventionellt sätt provas med Pole-Test. Om erfarenheterna från försöket blir bra kommer kraftbolaget att helt gå över till att använda Pole-Test vid rötskadebesiktningen.

Förstärkning av stolpar

Puget Power förstärker med U-balkar som klamras fast på skadade stolpar. Förstärkningen kostar 2 600 kr per stolpe. Stolpbyte kostar 9 750 kr. Ett annat alternativ som företaget provar är glasfiberförstärkning av skadade stolpar. Försöken kommer att utvärderas under 1990.

Stolparna reimpregneras alltid i samband med förstärkningen. Alternativa stolpmateriel har provats i mindre omfattning. Erfarenheten från dessa prov visar dock att trästolpar är både lämpliga och ekonomiska.

Övrigt

Puget Power har inga problem med korrosion på Fe-Al-linor eller med skarvar för dessa. Termograferingsutrustning av linskarvar och kontaktställen har använts i ett antal år. Inspektionen görs alltid från marken eftersom användandet av helikopter blir för dyrt.

Det är mycket få stolpar som faller på grund av rötskador och riskerna för personskador är liten eftersom man alltid använder skylift.

Puget Power bedriver ingen egen forskning men stöder EPRI och universitetet.

Konsumentråd

Puget Power arbetar på att få ner elförbrukningen. Man hjälper till att finansiera isolering av bostäder, installation av effektivare värmepannor samt arbetar med ett brett program för energitjänster.

Kraftbolaget är angeläget att få ner elförbrukningen för att inte behöva bygga ut dyrbar elproduktion. Bolaget vill gärna lyssna och reagera på elkundernas krav och förslag till effektiv elanvändning.

För nio år sedan påbörjades ett program med konsument grupper (Consumers Panel). För närvarande har bolaget 66 sådan oberoende grupper med 1 576 elkunder. Hittills har grupperna gjort 1 150 rekommendationer i 24 olika ämnen. De flesta av dessa har beaktats. Där bolaget av olika skäl inte kan förverkliga förslagen ges motivering här-för.

Efter besöket har kraftbolaget översänt ett energitjänst-program för 1990. Detta program medföljer denna rese-rapport som bilaga.

CUSTOMER PROGRAMS

1990

- O RESIDENTIAL WEATHERIZATION
- O RESIDENTIAL LOW-INCOME WEATHERIZATION
- O RESIDENTIAL WATER HEATING
- O RESIDENTIAL COMFORT PLUS™
COMFORT PLUS™ OPTIONS
- O COMMERCIAL ENERGY MANAGEMENT
- O INDUSTRIAL ENERGY MANAGEMENT
- O DESIGN ASSISTANCE
- O COMMERCIAL / INDUSTRIAL MAJOR ACCOUNTS
- O LIGHTING SERVICES
- O ENERGY ACCOUNTING SERVICE
- O POWER CONDITIONING

RESIDENTIAL - EXISTING HOMES

Weatherization Program

The purpose of this service is to assist customers by providing home energy audits and cash grants in making weatherization improvements to their homes or apartments.

TARGET MARKET

Every total electric customer in the Company's service territory, with electric heat installed prior to February 5, 1989. Usually a heat pump installation is the major improvement for homes constructed after 1980. Homes built after 1980 typically have adequate levels of insulation in the attic, walls and floors; the windows are usually insulated as well.

BENEFITS TO CUSTOMERS

- o Free home energy audit
- o Lower electricity bills
- o More comfortable living areas, warmer with less drafts
- o Increases the value of the residence
- o Financial incentives

BENEFITS TO CONTRACTOR

- o Technical and marketing support
- o Stable source of work and income

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company
- o Recognition as a leader in conservation
- o Reduced high bill complaints

MAJOR FEATURES

- o Free home energy audit
- o Increased levels of insulation in ceilings, floors and walls
- o Storm windows or insulated glass
- o Insulation of furnace ducts
- o Heat pump space heating systems
- o Cash and interest financing options.

IMPLEMENTATION

Incoming customer requests are received by the Customer Call Center, by division staff and the 1-800 HEA Hotline. The five operating divisions coordinate the daily customer and contractor support required.

RESIDENTIAL - EXISTING HOMES

Low Income Weatherization Program

The purpose of this service is to assist qualified low income Puget Power customers by providing free weatherization improvements to their homes or apartments.

TARGET MARKET

All low income, all electric customers in the Company's service territory with electric heat installed prior to February 5, 1989. Currently, low income is defined as 125% of the Federal Poverty level.

BENEFITS TO CUSTOMERS

- o Free home energy audit
- o Lower electricity bills
- o More comfortable living areas, warmer with less drafts
- o Free technical and operating support
- o Additional repair services provided by Community Action Agencies

BENEFITS TO CONTRACTORS

- o Technical and marketing support
- o Stable source of work and income
- o Entry into other weatherization opportunities

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company
- o Recognition for outstanding customer service
- o Reduced high bill complaints
- o Ability to address customer needs without special rates

MAJOR FEATURES

- o Free home energy audit
- o Increased levels of insulation in ceilings, floors and walls
- o Storm windows or insulated glass
- o Infiltration measures, including weatherstripping, caulking, door and window repair and replacement, etc.
- o 100% Grant on approved weatherization measures.

IMPLEMENTATION

The Low Income Weatherization Program is administered primarily through the local Community Action Agencies (CAA). The CAA pays the balance of the weatherization measures, if needed, with Federal funding.

RESIDENTIAL - EXISTING HOMES

Water Heating Program

The purpose of this service is to assist customers by providing them options to purchase or rent more energy efficient water heaters.

TARGET MARKET

Single family customers whose water heater efficiency and performance can be enhanced; generally, these are customers with water heaters which are older than seven years.

BENEFITS TO CUSTOMERS

- o Free 24 hour maintenance service (rental program)
- o Prompt installation within 24 hours
- o Properly sized tanks so customer has an adequate supply of hot water
- o Lower electricity bills
- o Adaptable (can be located almost anywhere)
- o Better longevity and reliability due to better specifications

BENEFITS TO CONTRACTORS

- o Increased sales of energy efficient water heaters
- o Co-op advertising
- o Free training and inspection

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company
- o Additional identification with energy efficient products and services
- o Improved customer awareness of Company programs

MAJOR FEATURES

All programs feature a conservation grant because of the utilization of highly energy efficient water heaters.

- o Rental Only - free 24 hour maintenance
- o Rental & Finance Only - low monthly fee
- o 8 tank sizes to meet unique family needs
- o Finance & Water Heater Grant Only - 10 year warranty tanks; 5 year warranty on elements; 1 year warranty on thermostats and labor

IMPLEMENTATION

This program is primarily handled by participating contractors and Customer Programs water heating staff responding to customer requests for energy efficient water heaters. The majority of business offices are also providing this service to their customers. The programs are communicated to customers through several media (bang-tail, bill inserts; radio; newspaper and direct mail).

RESIDENTIAL - NEW CONSTRUCTION

COMFORT PLUS™ & COMFORT PLUS Options Programs

The purpose of this service is to assist area builders and new home buyers achieve regional Model Conservation Standards for energy efficiency in new homes and apartments by providing free technical assistance and cash grants.

TARGET MARKET

All area builders of total electric single family homes and apartments. All Puget Power customers who are interested in building or purchasing a new total electric home.

BENEFITS TO CUSTOMERS

- o Lower electricity bills
- o More comfortable home; cleaner, quieter
- o Lasting value; better built, more efficient home
- o Improved indoor air quality

BENEFITS TO TRADE ALLIES

- o Cash incentives
- Marketing and technical support
- Improved customer satisfaction
- o Free design assistance and plan review
- o On-site consultation and inspection
- o Advertising incentives
- o Lighting design services

BENEFITS TO PUGET POWER

- o Helps to meet the energy growth needs of the Company
- o Leader in achieving regional goals in energy efficiency
- o Reduced high bill complaints

MAJOR FEATURES

Many features focus on the building shell in order to reduce heat loss while maintaining customer comfort. Such features include:

- o Higher levels of insulation and more cost effective methods of installing insulation
- o Enhanced window designs (low-E, argon filled, thermal break frames)
- o Controlled ventilation; air quality and moisture controls

Additional features address the heating system. These include:

- o Heat pump options
- o Zonal heating options

An important feature of the COMFORT PLUS™ Program is the Options Program. This feature enables a builder, who is not prepared to select all the features required to achieve Model Conservation Standards goals, to select from any of the features summarized above. The aim of this program is to assist these builders in learning and becoming more comfortable with all of the COMFORT PLUS™ features.

IMPLEMENTATION

The five operating divisions coordinate the daily customer and builder contact and support. The program is communicated to builders and home buyers through home shows, trade shows and various communication media (bang-tail, bill inserts, newspaper, television and radio).

COMMERCIAL / INDUSTRIAL

Commercial Energy Management - Existing Facilities

The purpose of this service is to assist customers by providing energy analysis and cash grants in making energy efficiency improvements to their businesses.

TARGET MARKET

Those facilities with potential for cost-effective improvements to mechanical, water heating, thermal shell, and lighting systems.

BENEFITS TO CUSTOMERS

- o Lower electricity bills
- o Improved comfort
- o Increased facility value
- o Increased profitability
- o Increased marketability of lease space

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company
- o More predictable load shapes for future resource planning
- o Recognition as a leader in conservation
- o Reduced high bill complaints

MAJOR FEATURES

Customers receive no-cost energy audit / analyses and project management services backed by cash grants to facilitate installation. Key measures include:

- HVAC equipment and control upgrades
- Heat pumps
- Variable speed motor drives
- Lighting system modifications
- Insulation

IMPLEMENTATION

The program is primarily operated through division Energy Management Engineers with technical and administrative support from corporate staff. Outside consultants are utilized for large or multiple facility customers. Requests are routinely prescreened in the division prior to formal application for service.

COMMERCIAL / INDUSTRIAL

Industrial Energy Management

The purpose of this service is to assist customers by providing energy analysis and cash grants in making energy efficiency improvements to their industrial processes.

TARGET MARKET

All Puget Power industrial customers, particularly those customers on rate schedules 46 and 49.

BENEFITS TO CUSTOMERS

- o Lower electricity bills
- o Increased process efficiency
- o Increased profitability
- o Improved competitive advantage

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company
- o Helps meet energy growth needs
- o More predictable load shapes for future resource planning
- o Recognition as a leader in conservation
- o Reduced high bill complaints

MAJOR FEATURES

- o No-cost energy audit / analyses and project management
- o Cash grants to facilitate installation

IMPLEMENTATION

The service is delivered through Energy Management Engineers. Outside consultants are utilized for large or complex projects.

COMMERCIAL / INDUSTRIAL

Design Assistance - New Construction

The purpose of this service is to assist owners, developers, architects and engineers in the development of new energy efficient facilities. By providing technical analysis, computer modeling and experienced energy management skills, the Company will be a valuable member of the customer's conceptual design team. Design Assistance funding is provided by the Bonneville Power Administration (BPA). The goal of this service is to get commercial facilities built to higher levels of efficiency than regional Model Conservation Standards.

TARGET MARKET

Commercial new construction and major remodels

BENEFITS TO CUSTOMERS

- o Lower electricity bills
- o Know their anticipated energy use before construction begins
- o Analysis of alternative systems, construction methods and designs
- o Design analysis at no cost
- o Simplified energy code compliance

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company
- o Recognition as a leader in conservation
- o Reduced future high bill complaints
- o Network with design professionals, facility owners, developers, etc., to promote efficient use of electricity.

MAJOR FEATURES

- o Computer simulation of energy efficient alternatives
- o Economic analysis of alternative strategies
- o Installation criteria prepared on the basis of desired system performance

COMMERCIAL / INDUSTRIAL

Major Accounts

The purpose of this service is to strengthen business relationships with major commercial / industrial customers and to improve the effectiveness of delivering services to them. The Company's largest 100 customers purchase about 1/4 of all energy sales through over 2,000 accounts. This concentration of decision making offers significant opportunities for effective service delivery, including rate administration, billing and energy management.

TARGET MARKET

Currently those customers within the Top 100 corporate ranking, but is applicable to customers at risk, new large commercial / industrial customers, politically sensitive customers, etc.

BENEFITS TO CUSTOMERS

- o Service delivery commensurate with the customer's needs
- o Improved communications through specifically assigned personnel
- o Current information regarding utility services and electro-technologies

BENEFITS TO PUGET POWER

- o Ability to be more efficient in responding to individual customer needs
- o Early indication for identifying conservation opportunities
- o Early indication of load shifts, revenue charges, major expansion, etc.
- o Strengthen Company image as a caring, full service energy provider

MAJOR FEATURES

Individualized service plans are prepared for each customer with specific follow-up responsibilities assigned to insure proper completion. The process is dynamic and requires frequent contact to ensure that the Company is constantly improving the effectiveness of its service.

IMPLEMENTATION

Customer requests are processed by Energy Management Engineers. Analyses are performed by customer's design team, outside consultants or Puget Engineers. Reports, project oversight and tracking are performed by Company personnel. The Design Assistance service is promoted to local architects, developers, engineers and others through pertinent trade organizations.

LIGHTING SERVICES

Area / Flood / Street Lighting Programs

Customers are now provided with expanded full service street and area lighting. The selection of street lighting luminaires and poles have been expanded to offer more options for residential and commercial applications. Security lighting is enhanced with the use of area and flood light luminaires installed on existing Company distribution poles.

TARGET MARKET

- o Street lighting - developers, municipalities, water districts, home owners associations
- o Area lighting - residential and rural areas with overhead distribution
- o Flood lighting - commercial businesses with increased lighting requirements for security, provided from the existing overhead distribution system

BENEFITS TO CUSTOMERS

- o Lower electricity bills
- o Variety of luminaires and poles
- o Improved safety and security
- o Proper application of luminaires and light sources

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company

MAJOR FEATURES

Provides a comprehensive method to select, lease and install energy efficient lighting systems for residential and business applications depending on the availability of Company facilities

IMPLEMENTATION

Account teams are established with the Top 25 accounts and include an executive, energy engineer, business office manager and division operations engineer. Efforts are currently underway to pursue stronger relationships with the remaining 75 customers.

The Top 100 accounts have been identified; service plans are underway and relations with these accounts are being strengthened

COMMERCIAL / INDUSTRIAL

Energy Accounting Service

The purpose of this service is to assist the customer in quantifying and understanding their energy use and operation. This is accomplished by cross referencing current energy usage to historical data, weather and other facility parameters. A small fee is charged for each report.

TARGET MARKET

Those owners with multiple facilities, such as school districts, grocery stores, office buildings, etc.

BENEFITS TO CUSTOMERS

- o Energy management planning and budgeting tool
- o Lower electricity bills

BENEFITS TO PUGET POWER

- o Helps meet the energy growth needs of the Company
- o Reduced high bill complaints
- o Contributes leads to other programs and services

MAJOR FEATURES

- o Concise summary of energy use characteristics in multiple facilities
- o Presentation tailored to the customer's needs
- o Customer account analysis by experienced energy management engineers that includes all fuels

IMPLEMENTATION

The program is delivered through division Energy Management Engineers. Customer Programs personnel track the energy data and prepare reports as required by the customer. Fees are based on the number of meters tracked and the number of reports.

IMPLEMENTATION

Offered through division customer service with technical, promotional and administrative support from the Customer Programs staff.

COMMERCIAL / INDUSTRIAL

Power Conditioning

The purpose of this program is to assist customers in identifying and solving electrical disturbance problems by providing a comprehensive analysis and "troubleshooting" service. Electrical disturbances may cause problems for sensitive electronic equipment, such as computers, cash registers, control equipment, etc.

TARGET MARKET

All commercial / industrial customers with sensitive electronic equipment.

BENEFITS TO CUSTOMERS

- o Better understanding of electrical disturbance sources and solutions
- o Avoid unnecessary costs due to equipment failure
- o Offers a service not readily available locally
- o Receives unbiased technical assistance that typically is not available from product vendors

BENEFITS TO PUGET POWER

- o Alleviate perception of the utility as "the source of the problem"
- o Strengthens relationship with customers, positioning the Company as a full service provider

MAJOR FEATURES

- o Unbiased technical assistance using state-of-the-art testing equipment
- o Customer receives personalized professional analysis with recommendations

IMPLEMENTATION

Customer requests / concerns are typically referred by Customer Service Engineers on a case-by-case basis. Customers are able to request assistance through both Customer Service and Energy Management Engineers. Coordination of power monitoring equipment, technical support and written response are provided by Commercial / Industrial services staff. Additional assistance is coordinated with T & D Engineering.

Third Revised Sheet No. 83
Canceling Second Revised
Sheet No. 83

WN U-60

RECEIVED
JAN. 6, 1989

WASH. UT. &
TRANS. COMM.

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff G

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE

AVAILABILITY OF ENERGY CONSERVATION SERVICE TO EXISTING BUILDINGS:

1. Building Energy Conservation Service - This service described below is available for permanently located residential or non-residential buildings, including mobile homes, which utilize electricity as the primary energy source for permanently installed space heating and/or cooling. It is not available for buildings where the primary source for space heating and/or cooling was converted to electricity from another energy source after February 5, 1989. It is also not available for buildings under construction or to be constructed as of February 5, 1989. Tenants are eligible for this service only if they have obtained prior written consent and secured other necessary actions from the building owner in order to effect the conservation measures or modifications.
2. Lighting Energy Conservation Service - This service described below is available to owners of electric lights or lighting systems.
3. Water Heating Energy Conservation Service - This service described below is available for residential or nonresidential building structures which utilize electricity for water heating.
4. Process Energy Conservation Service - This service described below is, at the Company's option, available to owners of permanent facilities utilizing electric energy for commercial or industrial processing purposes.
5. Energy Efficient Water Heater Replacement Service - This service described below is available to customers who are replacing their electric water heaters.
6. Solar Water Heating Energy Conservation Service - This service described below is available for residential or non-residential building structures which utilize electricity for water heating. Tenants are eligible for this service only if they have obtained the prior written consent and secured other necessary actions from the building owner in order to effect any conservation measure which would involve an alteration of either the building structure or its fixtures.

ISSUED January 6, 1989 **EFFECTIVE** February 16, 1989

By Authority of Order of WUTC in Cause U-89-2597-T

ISSUED BY PUGET SOUND POWER & LIGHT COMPANY

BY G. B. Swofford **TITLE** Vice President, Rates

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff G

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE
(Continued)

DESCRIPTION OF SERVICE:

1. Building Energy Conservation Service - Service will be provided with the goal of achieving conservation of electric energy in buildings. Upon request, the Company will, without charge, perform an energy analysis which will identify cost-effective electric energy conservation measures and which may include, but are not limited to, any or all of the following:
 - a. Ceiling insulation
 - b. Wall insulation
 - c. Floor insulation
 - d. Storm/insulated windows and doors
 - e. Caulking of windows and doors
 - f. Weatherstripping of windows and doors
 - g. Automatic time-controlled thermostats
 - h. Insulation of heating ducts
 - i. Modifications to heating, ventilating, and cooling systems
 - j. Energy control system modifications
 - k. Heat pumps for space heating and cooling

In the event that demand for residential building energy conservation service exceeds the Company's ability to provide the service without delay, priority will be given to low-income elderly households. Low-income elderly households means those residential households which are headed by a person 60 years of age or over and in which the combined annual income of the occupants is less than 125 percent of the federally established poverty level. The Company shall determine whether a household qualifies as a low-income elderly household.

2. Lighting Energy Conservation Service - Service will be provided with the goal of achieving conservation of electric energy through improved efficiency of indoor or outdoor lighting. Upon request, the Company will perform a free analysis which will identify cost-effective energy conservation modifications to lighting systems.

ISSUED January 6, 1989 **EFFECTIVE** February 16, 1989
By Authority of Order of WUTC in Cause U-89-2597-T

ISSUED BY PUGET SOUND POWER & LIGHT COMPANY

BY G. B. Swofford **TITLE** Vice President, Rates

Second Revised Sheet No. 83-b
Canceling First Revised
Sheet No. 83-b

WN U-60

RECEIVED
JAN. 6 1989

WASH UT &
TRANS COMM

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff G

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE
(Continued)

Upon the request of any customer served under Schedules 50, 51, or 52, the Company will convert or retrofit the lighting fixtures in the customer's outdoor lighting system, free of charge, to the extent that such measures are cost effective.

3. Water Heating Energy Conservation Service - Upon request, the Company will furnish, free of charge, an insulation wrap for electric water heaters no larger than 120 gallons capacity.
4. Process Energy Conservation Service - Service will be provided with the goal of achieving conservation of electric energy through improved efficiency of electric energy process applications. Upon request, the Company will perform a free analysis which will identify cost-effective process energy conservation modifications.
5. Energy Efficient Water Heater Replacement Service - When an electric water heater no larger than 120 gallons capacity is to be replaced, the Company will, upon request, make a payment toward the cost of installing a new efficient electric water heating system meeting the following requirements, to the extent practicable:
 - a. The new water heater must have insulation equal to the maximum amount in commercially available water heaters, which amount the Company shall determine;
 - b. Heat traps may be installed in the hot and cold water lines;
 - c. Accessible water pipes up to three feet from the tank must be insulated; and
 - d. Low flow devices for showers served by the water heater may be installed.

The Company may expand this set of requirements as additional water heating conservation measures are developed. The amount of the payment shall be determined by the Company based upon the kilowatt-hour savings that the Company estimates will result from the replacement.

ISSUED January 6, 1989 EFFECTIVE February 16, 1989

By Authority of Order of WUTC in Cause U-89-2597-T

ISSUED BY PUGET SOUND POWER & LIGHT COMPANY

BY G. B. Swofford TITLE Vice President, Rates

WN U-60

WASH. UT. &
TRANS. COMM.

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff G

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE
(Continued)

6. Solar Water Heating Energy Conservation Service - Upon request, the Company will make a payment toward the cost of replacing or supplementing an existing electric water heater with a solar water heating system. The payments by the Company will be made after installation of a solar system meeting Company specifications. The amount of the payments shall be \$300 for systems having more than 35 square feet of net solar collector aperture and \$100 for systems having from 15 to 35 square feet of net solar aperture. Such payment will be made only if the person utilizing the service executes the Company's agreement regarding this service. The person utilizing the service shall be responsible for selection, purchase, and installation of the solar system.

OWNER- AND OCCUPANT-PROVIDED LABOR:

The owner or occupant may elect to perform labor to install conservation measures paid for in whole or in part under the terms of this schedule. However, until the Company has agreed to accept such labor, the Company will not be obligated to provide funds to pay for materials installed. The Company will not provide funds to pay for such labor.

FINANCING OF CONSERVATION MEASURES - GRANT:

Upon request and upon acceptance by the Company, the Company will grant an amount of funds, as determined below, to be used to help pay the reasonable cost of effecting the cost-effective conservation measures and modifications described above. The grant will be made available only upon execution of the Company's Standard Conservation Agreement.

Cost-effective measures and modifications shall be those that do not cost (including the Company's administrative cost) more per kilowatt hour of energy savings than the Company's full avoided cost as set out below:

<u>Measure Life in Years</u>	<u>Full Avoided Cost Per Kilowatt Hour</u>	
	<u>Space Heating Applications</u>	<u>Non-Space Heating Applications</u>
10	\$.043	\$.033
12	.048	.037
15	.056	.044
20	.064	.051
25	.069	.055

ISSUED June 26, 1989 **EFFECTIVE** July 27, 1989

ISSUED BY PUGET SOUND POWER & LIGHT COMPANY

BY G. B. Swofford **TITLE** Vice President, Rates

0155-03

Third Revised Sheet No. 83-d
Canceling Second Revised
Sheet No. 83-d

RECEIVED
JUN 26 1989

WN U-60

WASH. UT. &
TRANS. COMM.

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff G

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE
(Continued)

The Company will apply this cost-effectiveness test on a combined basis where more than one measure is installed and the cost of each measure is reasonable.

The cost of cost-effective measures and modifications shall be shared by the Customer and the Company as follows:

The Customer, other than low-income customers, shall pay a percentage of the full cost of the measures and modifications. This percentage is based on the ratio of the Customer's first two-year estimated savings to the Company's full avoided costs shown above.

The Company will pay the difference between the full cost of the measures and modifications and the Customer's portion of such costs, provided that in no case will the Company's proportional payment exceed its full avoided costs per kilowatt hour shown in the table above. Any costs of measures and modifications in excess of the full avoided costs shall be paid by the Customer.

For low-income customers, the Company will pay the full cost of the measures and modifications up to full avoided cost. "Low-income customers" means those residential households in which the combined annual income of the occupants is less than 125 percent of the federally-established poverty level.

ISSUED June 26, 1989 EFFECTIVE July 27, 1989

ISSUED BY PUGET SOUND POWER & LIGHT COMPANY

BY G. B. Swofford TITLE Vice President, Rate

0155-03

WN U-60

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff G

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE
(Continued)

AVAILABILITY OF ENERGY CONSERVATION SERVICE TO NEW BUILDINGS:

1. Single-Family and Multi-Family Residential Units - This service is available to new single-family and multi-family residential units which utilize electricity as the primary energy source for permanently installed space heating and/or cooling, and which are constructed after the effective date of this schedule. The Company will, pursuant to an agreement, provide grants to the owner of the residence to be built, up to the maximum amounts shown below, toward the cost of energy-efficient measures in new residential construction which meet the requirements of energy efficiency as set forth in the Northwest Power Planning Council's Conservation and Electric Power Plan as amended. Such measures may include, but are not limited to, any or all of the following:

- a. Ceiling insulation
- b. Wall insulation
- c. Floor insulation
- d. Insulated windows/doors
- e. Advanced framing and dry wall construction
- f. Heat recovery ventilation
- g. Nonheat recovery ventilation
- h. Caulking and weatherstripping
- i. Heating, ventilation, air conditioning (HVAC)
- j. Heat pump
- k. Water heating

Climate Zone	Single Family	Multi-family	
		Per Bldng	Per Lvng Unit
I (0-5999 annual degree days)	\$1,000	\$1,000* +	\$250
II (6000-7999 annual degree days)	\$1,250	\$1,250* +	\$250

*Includes the first living unit in each building.

Additional grants of \$500 for each single-family and \$250 for each multi-family living unit are available when such units include an installed Heat Recovery Ventilation System.

ISSUED June 26, 1989

EFFECTIVE July 27, 1989

ISSUED BY PUGET SOUND POWER & LIGHT COMPANY

BY G. B. Swofford

TITLE Vice President, Rates

Second Revised Sheet No. 83-f
Canceling First Revised
Sheet No. 83-f

WN U-60

RECEIVED
JUN 26 1989

WASH. UT. &
TRANS. COMM.

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff G

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE
(Continued)

Payment for individual qualifying measures will be based on the amount of projected energy savings by such qualifying measures proportional to that which would be achieved by implementing the full Model Conservation Standards. The Company will provide assistance in determining which measures will insure energy efficiency in each building by utilizing regionally approved energy-efficiency evaluation methods. Payment will be made to the owner building the residence upon completion of installation and subject to verification by the Company that the qualifying measures have been installed.

2. **Manufactured Single-Family Homes** - Customers who purchase during the period July 15, 1989, through December 31, 1990, new manufactured single-family homes which are certified for receiving BPA assistance under its Model Conservation Standards, and which utilize electricity as the primary source of space heating, will be eligible for a grant of up to \$2,000, including the BPA assistance, toward the purchase of each such home. The payment of grants by the Company will be pursuant to a separate written agreement and subject to verification by the Company that the manufactured home has been properly and permanently installed and is in compliance with applicable laws and regulations relating to construction, zoning, and land use.

Customers receiving a grant toward the cost of a manufactured home under this section shall not be eligible for additional grants otherwise available to single-family units under the provisions of Section 1. above.

3. **Commercial Buildings** - This service is available to new commercial buildings which utilize electricity as the primary energy source for permanently installed space heating and/or cooling and which are constructed after the effective date of this schedule. The Company will, pursuant to an agreement, provide technical assistance to determine energy efficiency improvements to the structure and to the heating, ventilation, air conditioning, and lighting systems which will insure that the building meets or exceeds the Northwest Power Planning Council's Conservation and Electric Power Plan as amended. Such measures may include, but are not limited to, any or all of the following:

ISSUED June 26, 1989EFFECTIVE July 27, 1989

ISSUED BY PUGET SOUND POWER & LIGHT COMPANY

BY

G. B. Swofford

TITLE

Vice President, Rates

PUGET SOUND POWER & LIGHT COMPANY
Electric Tariff GWASH UT &
TRANS COMM

For Commission's Receipt Stamp

SCHEDULE 83
ENERGY CONSERVATION SERVICE
(Continued)

- a. Ceiling insulation
- b. Wall insulation
- c. Floor insulation
- d. Insulated windows/doors
- e. Duct and piping insulation
- f. Heat recovery
- g. Energy management systems
- h. Water heating systems
- i. Heating, ventilation, air conditioning (HVAC)
- j. Advance construction
- k. Lighting

LIMITATIONS:

The Company may limit the grants to any one building in order to meet annual budgetary requirements.

GENERAL RULES AND PROVISIONS:

Service under this schedule is subject to the General Rules and Provisions contained in this tariff and is limited to facilities receiving electric service from the Company. All installations and equipment must comply with all codes and permit requirements applicable in the state of Washington and be properly inspected, if required, by appropriate agencies. The Company may establish specifications regarding any conservation measures and modifications to be effected under this schedule and may conduct inspections to insure that such specifications are met.

ISSUED July 20, 1988 **EFFECTIVE** August 20, 1988**ISSUED BY PUGET SOUND POWER & LIGHT COMPANY****BY** G. B. Swofford **TITLE** Vice President, Rates

0155-03

CONSERVATION AND CUSTOMER PROGRAMS

Continue implementation of cost-effective conservation programs.

- o Continue existing programs (retrofit, new construction, and lost opportunity). Refining as required to improve effectiveness.
- o Develop programs to tap new conservation resources, while meeting customer needs.
- o Pursue competitive bidding for commercial and industrial conservation resources.
- o Continue education programs to raise customer knowledge and awareness of conservation.
- o Continue to develop working relationships within energy conservation trades, professionals and supply networks.

Support enactment of energy-efficient codes and standards.

Expand evaluation of conservation savings and cost-effectiveness.

Continue to enhance Puget Power's analytical capabilities in the areas of:

- o Market research
- o Marginal cost analyses
- o Load research
- o Estimating long-term conservation potential
- o Cost/benefit analyses.

Evaluate and acquire cost-effective long-term purchases of commercial conservation through competitive bidding.

DRAFT

Table 6. Summary of action plans for conservation resources.

	DARE I (1988-1989)	DARE II (1990-1991)	DARE III (1992-1993)
BOOM		DEVELOP PROGRAMS TO ADD 15 aMW DURING THE PERIOD.	DEVELOP PROGRAMS TO ADD 16.5 aMW DURING THE PERIOD.
BUST		DEVELOP PROGRAMS TO ADD 5 aMW DURING THE PERIOD.	DEVELOP PROGRAMS TO ADD 13 aMW DURING THE PERIOD.
INSTABILITY		DEVELOP PROGRAMS TO ADD 10 aMW DURING THE PERIOD.	DEVELOP PROGRAMS TO ADD 12 aMW DURING THE PERIOD.
DECLINING DEMANDS		DEVELOP PROGRAMS TO ADD 7 aMW DURING THE PERIOD.	DEVELOP PROGRAMS TO ADD 14 aMW DURING THE PERIOD.
DEREGULATION		DEVELOP PROGRAMS TO ADD 9 aMW DURING THE PERIOD.	DEVELOP PROGRAMS TO ADD 13 aMW DURING THE PERIOD.
GLOBAL WARMING		DEVELOP PROGRAMS TO ADD 10 aMW DURING THE PERIOD.	DEVELOP PROGRAMS TO ADD 14 aMW DURING THE PERIOD.
ACTION PLAN	CONTINUE PROGRAMS TO INCREASE END-USE EFFICIENCY WITH EMPHASIS ON LOW OPPORTUNITIES. COMPLETE A PLAN FOR CUSTOMER PROGRAMS TO MANAGE LOAD GROWTH AND LOAD SHAPE. CONTINUE TO EXAMINE END-USE CHANGES EXPAND THE MAJOR ACCOUNTS PROGRAM. CONTINUE IMPLEMENTATION OF COST-EFFECTIVE CONSERVATION PROGRAMS. RETAIN EXISTING WATER-HEATING LOADS TO MINIMIZE RATE IMPACTS. PARTICIPATE ACTIVELY FOR EFFICIENCY IMPROVEMENTS IN NEW CONSTRUCTION FOR BOTH RESIDENTIAL AND COMMERCIAL BUILDINGS. EXPAND USE OF DEMAND-SIDE ANALYSIS TOOLS. DESIGN RATE SCHEDULES THAT BETTER ALIGN REVENUES WITH COSTS.	CONTINUE IMPLEMENTATION OF COST-EFFECTIVE CONSERVATION PROGRAMS. SUPPORT ENACTMENT OF ENERGY-EFFICIENCY CODES AND STANDARDS. EXPAND EVALUATION OF CONSERVATION SAVINGS AND COST-EFFECTIVENESS. CONTINUE TO ENHANCE PUGET POWER'S ANALYTICAL CAPABILITIES IN THE AREAS OF MARKET RESEARCH, MARGINAL COST ANALYSIS, LOAD RESEARCH, LONG-TERM CONSERVATION POTENTIAL ESTIMATES, AND COST/BENEFIT ANALYSES. DEVELOP POLICIES ON DEMAND-SIDE RESOURCE ACQUISITION AND RATE STABILITY ISSUES. THESE INCLUDE LOAD RETENTION STRATEGIES, CAPACITY BENEFIT QUESTIONS, RATE DESIGN, AVOIDED COST DETERMINATIONS AND CONSERVATION TRANSFERS WITH OTHER UTILITIES. CONTINUE TO DEVELOP RATE SCHEDULES WHICH MORE CLOSELY ALIGN REVENUES WITH COSTS.	

DRAFT

Conservation Capability Building

Table of Contents

Section 1 - Programs and GWh conserved by year

Section 2 - Key Events by year

Section 3 - Glossary of terms

Conservation Capability Building

Key Events

1978	1979	1980	1981
Schedule 83(22 mills) State Energy Code Development	State Energy Code Development Home Shows & Fairs A&E Seminar Ground Source Heat Pump Evaluation	Electric moratorium Home Shows & Fairs	Consumer Panels Home Shows & Fairs A&E Seminar

Conservation Capability Building

1986	1987	1988	1989
ASHRAE(C/I MCS)	BPA MCS cost-effectiveness comment	State Energy Code Development	Sched 83 refile-Avoided cost method
Home Shows & Fairs	First DARE-least cost plan	Home Shows & Fairs	State Energy Code Development
Energy classes for customers	Home Shows & Fairs	Ventilation Heat Pump Wtr Htr Study	Home Shows & Fairs
C/I seminars	Consumer Panels	NW Power Plan comment	NW Power Plan comment
NW Energy Expo	Energy classes for customers	& Regional Issues	& Regional Issues
NW Currents newsletter	C/I seminars	Consumer Panels	Consumer Panels
Street of Dreams-Efficient Housing	A&E Seminar	C/I seminars	Area/Flood Light Program
President's Citation for Outstanding Service	Eagle Ridge MCS demonstration	NW Energy Expo	Bldr Connection Newsletter
		Clarkwood MCS demonstration	C/I seminars
			A&E Seminar

Capability Building

Year	MWh of Conservation obtained
1978	9
1979	26214
1980	84035
1981	85192
1982	75428
1983	102754
1984	82966
1985	73642
1986	66131
1987	67810
1988	46126
1989	25976 through 6/30/89

year	cumulative MWh of Conservation obtained
1978	9
1979	26223
1980	110258
1981	195450
1982	270878
1983	373632
1984	456598
1985	530240
1986	596371
1987	664181
1988	710307
1989	736283 through 6/30/89

year	cumulative GWh of Conservation obtained
1978	0
1979	26
1980	110
1981	195
1982	271
1983	374
1984	457
1985	530
1986	596
1987	664
1988	710
1989	736 through 6/30/89

Glossary

Explanation of terms, acronyms for Conservation Capability Building Exhibit

WHIK	Water Heater Insulation Kit - consisting of an insulated blanket that wraps around their water heater.
Energy Efficient Home	Informational program to encourage energy efficiency in new residential construction above and beyond existing code.
Residential Weatherization Loan	- Schedule 83 tariff approved 11/12/78 authorizes company to offer 10 year zero-interest loan for cost-effective conservation measures, up to 22 mills. Includes home audit, contractor lists, bid requirements and inspection.
Street Lighting Retrofit	A Conservation program to Convert Mercury Vapor street lighting fixtures to High Pressure Sodium-Company and customer owned.
Outdoor/Indoor Lighting Loan	- Audit and financial package for Conservation lighting modifications to increase efficiency.
C/I Energy Management Loan	- Schedule 83 tariff approved 11/12/78 authorizes company to offer 10 year zero-interest loan for cost-effective conservation measures to Commercial/Industrial(C/I) customers, up to 22 mills. Includes on-site audit, evaluation, report, bid specifications and inspection.
Renewable Resources	Free consulting service offered by our technical staff to install wind generators or solar water heating and space heating.
Res Weatherization Loans and Grants	- Revised Schedule 83, increased cost-effectiveness limit to 30 mills, added a cash grant option(71.8% of the cost-effective amount). Added program features: date of eligibility raised to Jan 82.
C/I Energy Management Loans & Grants	- Same as above
Solar Water Heating Grants	- Grants for installed solar water heating systems based upon collector surface area.
Heat Pump Loans & Grants	- Added heat pumps as a measure on weatherization program. Developed standards and inspection procedures for contractor installed systems.
Low Income Weatherization	- Provide 100% of the cost for weatherization in cooperation with Community Action Agencies. Puget grants 71.8% and the Community Action Agencies fund remainder using state funds.
Outdoor Lighting-Contractor Initiated	- Financing to replace mercury vapor fixtures with High Pressure Sodium. Contractor initiated. BPA funding.

WHEP	Water Heating Efficiency Program - provision of a \$70 grant toward the purchase of an installed energy efficient tank.
Institutional Buildings Program	Finance energy management measures to institutional buildings with partial funding from BPA/WSEO.
Model Energy Home	Informational program promoting energy efficient new construction beyond code.
SWAT	Senior Weatherization Attack Teams-Retired employees provide caulking and weatherstripping services to low income seniors.
HouseWarming	Puget provides 100% of the funding for weatherization of residences for low income seniors.
Water Heater Rental	Rental program to provide customers an option to install energy efficient water heaters.
RCS Audits	Residential Conservation Service -Free, Federally mandated Weatherization audits(only) of homes heated with other than electric heat.
Major Accounts	Individualized services to our largest Corporate accounts. Includes energy management services.
Energy Accounting	Monthly accounting and tracking of all energy consumption. Reports and graphs provided.
Lighting Design	Efficient lighting design services for residential new construction and remodels.
Water Heater Finance	12% financing for installed energy efficient water heaters.
Demand Pulse Metering	Demand pulse information to manage loads and equipment for commercial/industrial customers.
Comfort Plus/Options	Residential new Construction program designed to provide incentives to builders and owners to achieving Model Conservation Standards(MCS) goals in electrically heated homes. 'Options' feature further encourages builders to incorporate construction changes needed to achieve full MCS.
DesignPlus/Design Assistance	Commercial/Industrial new construction program offering incentives to designers and developers to design energy efficient structures which exceed the MCS standard.
Stonelined Water Heaters	Another Energy efficient water heater made available on our existing programs. Additional feature: long life(15 year guarantee).
Residential Weatherization Grant	Refiling of Schedule 83. Use avoided cost method to determine the Puget financing. Eligible structures constructed through 2/89. Removed loan option. Third party financing is available to our customers through agreement with local bank.

Key Events

- Schedule 83(22 mills) The first tariffed program offering a no-interest loan for cost-effective conservation measures installed(22 mills).
- State Energy Code Development - Participation on code writing committee to increase the standards for energy efficient construction. Resulted in the first State Energy Code
- Home Shows and Fairs Yearly participation in these events to increase the familiarity and exposure of conservation programs and activities.
- A & E Seminar Bi-annual meeting involving Engineers and Architects to discuss Energy Efficient methodology for new and retrofit structures.
- Ground Source Heat Pump Evaluation - Began longterm study of efficiency of ground source heat pumps as compared to common air-to-air units
- Electric Moratorium Restriction on hook-up of electric resistance heating for new construction. Thrown out by lawsuit filed by Seattle Master Builders.
- Consumer Panels Yearly activity where customers study several aspects of the company and provide suggestions on how to improve, adjust or change services. Conservation topics were: 80/81-Voluntary energy Conservation, Conservation in building codes, 82-Conservation building codes in the New Regional Plan, 82/83-Assistance to Low Income Elderly customers, 83/84-Energy Conservation versus predicted power surpluses, 87-Demand-Side Management Planning, 88-Energy Efficient Products and services, 89-Least-cost plan update, Home construction industry relationship.
- Schedule 83 refile(30 mills) - Revision of original rate schedule 83, changed cost-effectiveness limit to 30 mills and added a cash grant option(71.8% of the cost-effective amount).
- Energy classes for Customers- A cooperative project with the Washington State Energy Extension Service where classes were held throughout our service area on topics ranging from Solar greenhouses to wood heat to caulking and weatherstripping.
- Wind Generation Testing An in-depth assessment of the potential and obstacles involved in installing a small wind generation system. Two sites were monitored and studied.
- Solar Water Heater Testing - Study of residential and commercial installations where efficiencies were measured and energy savings were identified.
- Solar Space Heating Testing - Monitoring of several solar space heated homes to determine space heating contribution of solar energy.
- Residential Air Leakage testing - Blower door tests administered on super-insulated homes to determine the tightness of homes, and infiltration rates for energy savings.

C/I Energy Management Grant - see above

Low Income-full avoided cost - Puget pays 100% of the cost-effective weatherization for all low income customers in cooperation with Community Action Agencies.

Competitive Bidding Solicit bids for integrated-resource acquisition, supply and demand-side, of 100 aMW.

Manufactured Housing Addition to Comfort Plus program to include these structures. Manufactured Housing does not come under the purview of state codes so work was done to organize with the manufacturers to make available to our customers this option

- Water Heater Heat Loss testing - Laboratory testing of a variety of water heater efficiency measures, such as: heat traps, pipe wrap, bottom boards and WHIK's to determine potential energy savings.
- Solar Photovoltaic potential study - Literature search of the market potential of this technology to determine it's application for our service area.
- C/I Seminars Timely programs offered to Commercial/Industrial customers on topics such as: energy efficiency, variable speed drives, Preventative Maintenance and building commissioning.
- NW Power Plan comment & Regional Issues - Review, comment and participation in regional meetings to discuss and provide input into the Power Council Plan. Also involves regional participation in BPA, PNUCC and NELPA to understand and influence regional policy regarding conservation.
- Heat Pump Water Heater Study - Three year project to study the efficiency and cost-effectiveness of these appliances. Involved laboratory measurements, monitoring and installation of 50 units in employee residences.
- Lowflow Showerhead Study - Laboratory study of the flow rates of various products to replicate energy saving claims and to determine customer satisfaction with several models.
- Fluorescent Lighting Efficiency study - Involved testing energy consumption of a variety of products purporting to reduce energy consumption. Also measured lumen levels.
- Governors Award for Energy Innovation - Award received for developing programs and services to obtain conservation resources.
- National DOE Award for Energy Innovation - for "a distinguished contribution to our nations Energy Efficiency"
- 1st NW Energy Expo Major trade show for Commercial/Industrial customers with cooperation from other utilities and BPA. Provided full program of seminars and topical forums for conservation and energy management resources. Started in 1985, done again in 1986 and bi-annually after that.
- Super-Insulated Home Monitoring - study of 10 super-insulated homes, monitoring appliance and other end-use loads over a two year period to determine the interaction of loads and the energy conservation potential of specific measures.
- Street of Dreams - Efficient Housing - Involvement in a local new construction promotion where we could show the benefits of energy efficient housing in comparison to standard construction methods.
- Light Bulb Diode and Thermistor testing - comparison of manufacturer claims and energy consumption along with light output.

- ASHRAE(C/I MCS) American Society of Heating, Refrigeration and Air Conditioning Engineers(ASHRAE), Commercial/Industrial(C/I), Model Conservation Standards(MCS) - Participation on the ASHRAE Energy Committee to develop the Commercial MCS and to provide C/I code input for the State of Washington.
- NW Currents Newsletter A bi-monthly newsletter informing C/I customers of our programs and services along with topical articles on new methodology or energy efficient processes.
- Presidents Citation for Outstanding Service - Award for "outstanding service to the community and finding innovative private solutions to public problems."
- BPA-MCS cost-effectiveness comment - Participation on a regional task force to examine the results from a BPA program that discussed the cost-effectiveness of obtaining conservation resources by increasing the level of energy efficient building practices.
- DARE Study Demand and Resource Evaluation(DARE) - Examination within Puget to determine our least-cost plan for the future. Developed a specific action plan along with conservation programs to achieve cost effective conservation resources.
- Eagle Ridge-MCS Demonstration - A project designed to introduce to the builders, Realtors and Developers the concept of energy efficient housing in terms that they could identify as major benefits for potential buyers. All houses within the project met or exceeded the MCS guidelines.
- Ventilation Heat Pump Wtr Htr Study - Monitoring of a heat recovery heat pump water heater. Determination of cost-effectiveness, simple payback and conservation potential.
- Clarkwood MCS Demonstration - New Home construction project in Bellingham that introduced local builders, Realtors, Developers and customers to the benefits of energy efficient construction methods.
- Schedule 83 refile-new math, Avoided Cost - Refiling of Schedule 83. Use avoided cost method to determine Puget financing. Eligible structures constructed through 2/89. Removed Loan option. Third party financing is available to our customers through an agreement with a local bank
- Area/Flood Light Program - Energy Efficient High Pressure Sodium lighting leased in lieu of customer installation of inefficient lighting.
- Builder Connection Newsletter - A bimonthly letter to builders throughout our service area explaining the benefits of Comfort Plus construction methods along with products and construction techniques.

PUGET POWER

Customer Programs

THIRD • QUARTER • 1989

UPDATE

COMFORT PLUS™ New Residential Construction



So far this year the COMFORT PLUS™/Options program have had a total of 6,686* units under construction with agreements signed, well over the Energy Plus Goal of 3,500 for 1989.

During the third quarter 125 single family dwellings, and 396 multi-family units were completed under the COMFORT PLUS™ program. For the Options program, which provides partial grants for dwellings completed not quite up to Comfort Plus standards, we completed 230 single family dwellings, and 1,800 multi-family units.

* For the Options Program multi-family construction will be factored by an energy efficiency rate of 67% and an energy efficiency rate of 88% for single family construction.

Housewarming Program

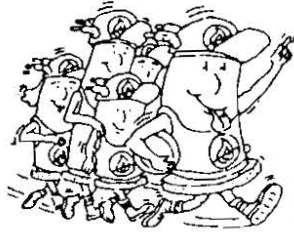
The Housewarming Program completed 47 single family dwellings this quarter, bringing our total for the year up to 240. Multi-Family had no completions this quarter, there have been 115 units completed year-to-date.

For the Housewarming and Low income Co-op programs, we have weatherized 820 units so far this year. This is 82% of the Energy Plus Goal for 1989.

On August 21, 1989 the new "LOW INCOME PROGRAM" began. Instead of tracking our low income customers separately based on age, they will now be combined under one program. Next quarter we will be reporting both Housewarming and Low Income Co-op together.

Water Heater Programs

During the third quarter 3,178 energy efficient water heater's were installed under the Water Heater Programs, bringing our total for the year to 9,373. At the end of September we are at 72% for the 1989 Energy Plus goal.



Residential Weatherization

This quarter 1,638 analyses were performed on single family dwellings, while 341 analyses were performed on multi-family units. So far in 1989 there have been a total of 6,222 single and multi-family analyses performed. Weatherization was completed on 509 single family residences, and 192 multi-family units.

Commercial/Industrial Weatherization

Forty-Two grants were given to Commercial/Industrial customer's this quarter, bringing the year-to-date total to 123 completions.



Design Assistance

The purpose of Design Assistance is to assist owners, developers, architects and engineers in the development of new energy efficient facilities, by providing technical analysis, computer modeling and experienced energy management skills. During the third quarter five Design Assistance jobs were completed.

Energy Accounting

This program assists customers in quantifying and understanding their energy use and operation. Currently, there are seven customers enrolled. Revenue for the quarter was \$3,050.

First Watch - Security Lighting Program

Over 85 commercial and residential customers have requested appointments, 22 contracts have been signed and 148 fixtures sold thru the third quarter of 1989 for the North Central pilot.

Home Watch

At the end of the third quarter, 970 sales demonstrations were completed resulting in 255 sales.

The update is produced quarterly by the Customer Programs Department to keep our readers up to date about our programs. Please contact Lori Martin, ext. 2446, or Ed Impala, ext. 3258 for additional information.

Customer Programs *UPDATE*

THIRD QUARTER 1989

Programs	Loans/Grants Issued	\$Amount Loans/Grants	Estimated MWh Savings
Residential Weatherization ¹	807	\$1,271,286	2,712
Water Heater Insulation (WHIK)	574	\$5,697	402
Water Heater Efficiency	769	\$53,830	588
Water Heater Rental	2,183	\$152,810	2,183
Water Heater Finance	226	\$15,820	226
Solar Water Heating	2	\$600	5
COMFORT PLUS™	521	\$270,750	1,331
Options Program	2,030	\$466,247	1,973
Commercial/Industrial ²	42	\$424,047	2,560
Total All Programs	7,154	\$2,661,087	11,980

PROGRAM TO DATE

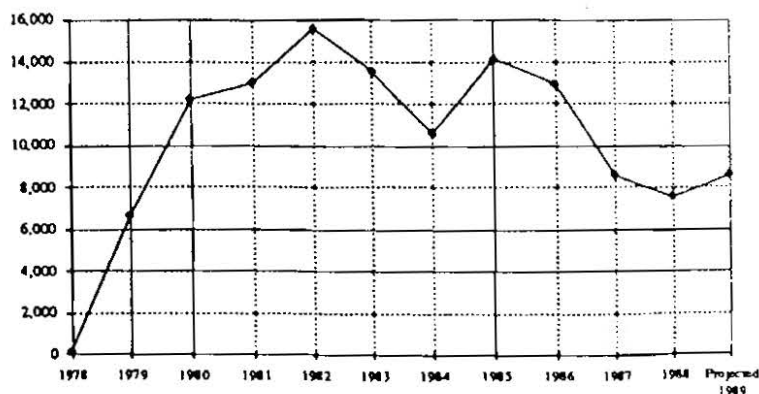
Programs	Loans/Grants Issued	\$Amount Loans/Grants	Estimated MWh Savings
Residential Weatherization ¹	71,452	\$99,226,775	253,488
Water Heater Insulation (WHIK)	268,575	\$3,728,464	187,487
Water Heater Efficiency	15,140	\$1,092,395	13,576
Water Heater Rental	32,429	\$2,270,030	32,429
Water Heater Finance	1,618	\$113,260	1,618
Solar Water Heating	819	\$242,700	1,998
COMFORT PLUS™	2,330	\$1,359,250	5,259
Options Program	5,392	\$1,248,313	5,083
Commercial/Industrial ²	3,668	\$35,953,546	235,890
Street Light Conversions	24,961	\$0	11,792
Total All Programs	426,384	\$145,234,733	748,620

¹ This includes subsequent, large multi-family, and housewarming jobs.

² This includes contractor lighting jobs.

Number of Residential Home Energy Audits Performed by year

The Residential Weatherization program is finishing its eleventh year. This graph shows the number of analyses performed over the years.



Puget Sound Power & Light Company Customer programs 1990

Kraftföretaget Puget Sound Power & Light Company ligger i staten Washington i nordvästra USA och har ca 700 000 abonnenter. Distributionsområdet är ca 4 500 sq miles (~12 000 km²). Man har tagit ett marknadsföringsprogram där man erbjuder olika energitjänster till olika kundkategorier.

Inriktningen är mot privatkunder, affärer, belysning och industri.

Ett exempel på energitjänst som riktar sig till privatkunder är kontroll och utbyte av varmvattenberedare. I denna tjänst ingår också service av varmvattenberedare och finansiering vid utbyte. Man utför detta arbete i samarbete med installatörer.

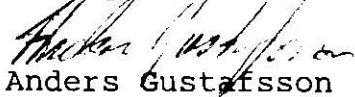
För industri ställer man bl a upp med kostnadsfria energibesiktningar. Man lämnar också ekonomiska bidrag till energieffektiva installationer. Datorprogram finns för att göra simuleringar av olika energilösningar.

Målsättningen med de olika energitjänsterna är bl a för privatkundens del att få lägre energikostnad, bättre service, bättre inomhusklimat och fri teknisk assistans. För industrikunderna är naturligtvis också vinsten att få lägre energikostnad man kan också uppnå förbättrade industriella processer.

För kraftföretaget ligger vinsten i att man dämpar ökningstakten på efterfrågan av energi, man får mindre klagomål på för höga elräkningar, det stärker också företagets image som ett energiföretag som kan ge full kundservice.

Programmet pekar på att man i USA kommit långt på vägen att marknadsanpassa energiföretagen, man har konkret gjort mycket av det vi nu diskuterar och planerar i Sverige.

Lidingö den 21 mars 1990


Anders Gustafsson