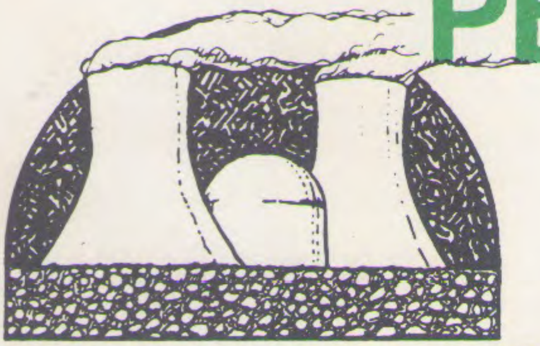
V CONFERÈNCIA CATALANA PER UN FUTUR SENSE NUCLEARS



- ECOLOGISTES I EMPRESES ELÈCTRIQUES.

EARTH DAY 1991 DIA DE LA TERRA

Auditori del Centre Cultural
Plaça de Sant Jaume
Jaume I, 2 Barcelona
Dia 25 d'abril de 1991
a les 18,45 h.

Organització: Grup de Científics i Tècnics per un Futur No Nuclear. Apartat de Correus 10095 . 08080 Barcelona
Institut d'Investigacions sobre Ciència i Tecnologia.

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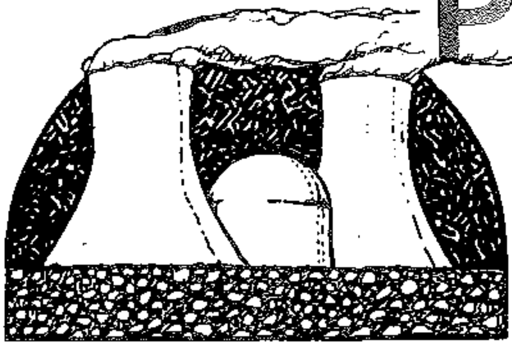

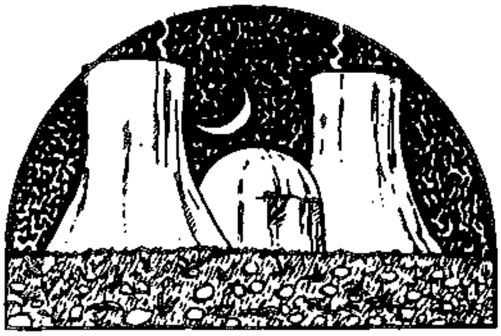

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ANNEXES

1. PRESENTACIO DE LA Va CONFERENCIA

1. PRESENTACIO DE LA Va CONFERENCIA

El contingut d'aquesta Conferència representa un tomb respecte al de les quatre conferències anteriors, dedicades principalment a presentar els problemes patits i potencials de l'energia nuclear. En certa manera però aquesta Conferència enllaça amb la primera, en la que es van presentar els plans per tancar les Centrals Nuclears a la Gran Bretanya i a França.

Aquesta Va Conferència presenta tres accions de caire molt diferent però orientades a prescindir de les Centrals Nuclears. La primera, el llibre "La Ruta de la Energía" que presenta la qüestió energètica de manera comprensiva per a tothom, la història de l'energia nuclear, els seus problemes i el seu tractament preferencial per part de les institucions, alhora que les possibilitats d'estalvi i d'utilització de les energies renovables.

La segona, la campanya "Viure Sense Nuclears" és una acció valenta de més de duescentes entitats que no només exposa que és urgent, possible i avantatjòs abandonar l'energia nuclear, sinó que ha presentat al Congrès dels Diputats una llei per iniciativa popular que estableix la renúncia a la generació nuclear d'electricitat i exigeix al govern l'elaboració en sis mesos d'un pla de tancament i desmantellament de les nou centrals nuclears en funcionament a l'Estat.

La darrera acció, és el Pla de New England (EEUU) per augmentar l'eficiència energètica del sistema elèctric. Aquest pla és fruit d'un imperatiu legal i arriba a límits dificilment imaginables abans. New England pot estalviar entre el 35% i el 57% del seu consum d'electricitat millorant l'eficiència energètica, segons les anàlisis del New England Energy Policy format per 26 grups, ecologistes i organitzacions de consumidors principalment. Certament, allà on s'estableixin plans com aquest sobraran les nuclears.

Cap d'aquestes tres accions és unicament "antinuclear". Si bé la contaminació radioactiva és molt seriosa, no és l'única que causa problemes. Es per aixó que aquestes accions antinuclears també són anti-contaminació deguda a altres fonts energètiques i proposen reduir el consum, utilitzar bé les fonts renovables i eliminar la contaminació derivada de l'energia en la mesura que la tècnica ho permeti.

2. PRESENTACIO DEL LLIBRE "LA RUTA DE LA ENERGIA"

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3. PRESENTACIO DE LA CAMPANYA "VIURE SENSE NUCLEARS"

Promouen la campanya a Catalunya:

Anoia Verda i Neta
Assemblea Alternativa
Assemblea Antinuclear del Baix Camp
Assemblea Ecologista Salt Verd
Agrupació Naturalista de la Garrotxa
Centre de Recursos per la Pau «Perifèria» del Guinardó
Col.lectiu per la Pau de Cornellà
Comissió per la Pau, el Desarmament i la Solidaritat de Sant Andreu
Comitè Antinuclear de Catalunya
Comitè Antinuclear de Tortosa
Coordinadora Antitrasvassament d'Aigües de l'Ebre
Coordinadora per la Defensa de Serra Marina
Coordinadora pel Desarmament i la Desnuclearització Totals
Coordinadora d'Ecologia, Desarmament i Desenvolupament de Vilanova i la Geltrú
Dones Antimilitaristes
«El Geperut» de Telefònica
«Gram-Enlace» de Santa Coloma de Gramenet
Greenpeace
Grup Ecologista de Bellvitge
Grup Ecologista de la Assemblea d'Estudiants Progressistes (U.A.B.)
«L'Alzina» de Manresa
«L'Ortiga», Comissió pel Desarmament i la Desnuclearització, i «Entorn la Pau» de Badalona
Revista *En Pie de Paz*
Revista *mientras tanto*
Sants No Nuclear
«Sirga», Grup Ecologista de la Ribera d'Ebre, Priorat i Terra Alta
Viure Sense Nuclears de les Terres de Lleida

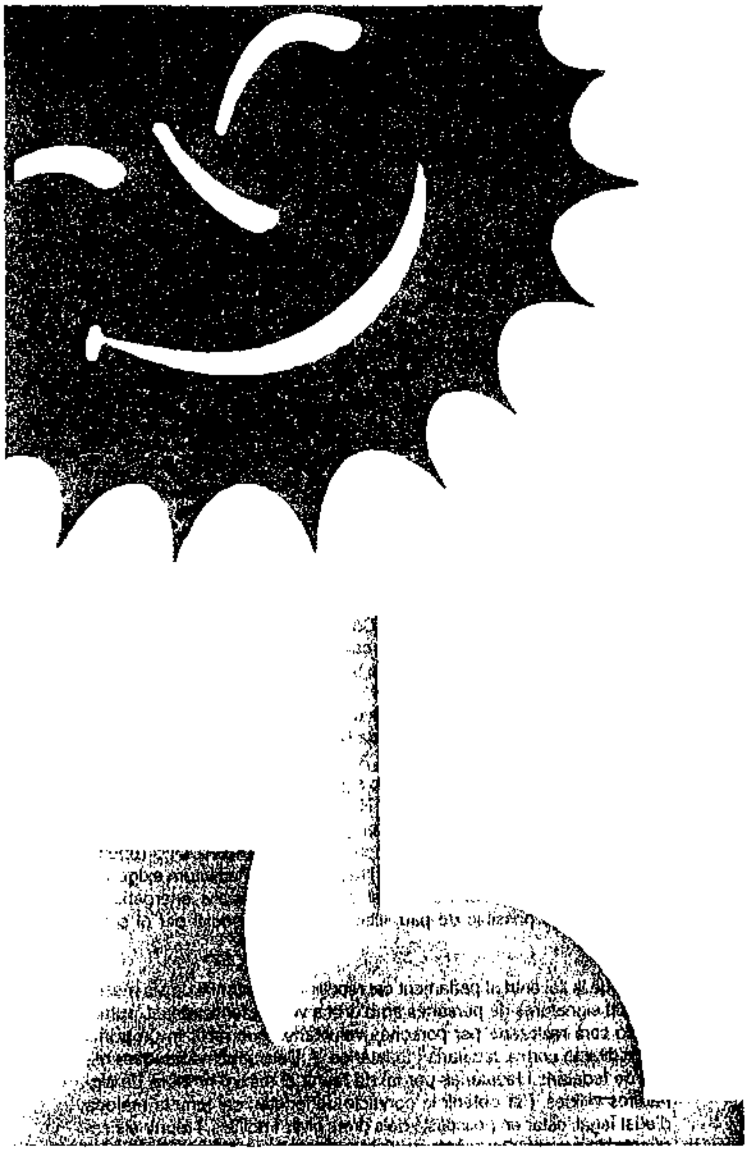
i les Comissions promotores de *Viure sense nuclears* a Badalona, Bon Pastor, Caldas de Montbui, l'Hospitalet, Nou Barris, Poble Nou, Olot, Sabadell, Santa Coloma de Gramenet, Tarragona, el Vallès Oriental, Banca i Estalvi, Institut Nacional de la Seguretat Social, Seat, Universitat Autònoma de Barcelona i Universitat de Barcelona.

Donen suport:

Alternativa Verda
Comissions Obreres
Coordinadora Feminista
Coordinadora de Comitès de Solidaritat
Esquerra Republicana de Catalunya
Federació d'Associacions de Veïns
Fundació per la Pau
Germandat Obrera Catòlica (HOAC)
Iniciativa per Catalunya
Justícia i Pau
Lliga Comunista Revolucionària
Moviment Comunista de Catalunya
Partit dels Comunistes de Catalunya
Sindicat de Treballadors del Taxi de Catalunya
Unió de Pagesos
Unió Sindical de Treballadors de l'Ensenyament de Catalunya

COMISSIÓ PROMOTORA
Gran de Gràcia, 126, pral.
08016 BARCELONA
Tel. (93) 217 95 27

VIURE SENSE NUCLEARS



VIURE SENSE NUCLEARS

VOLEM «VIURE SENSE NUCLEARS»!

La campanya «Viure sense nuclears» vol exposar a la societat, amb tota mena de mitjans i d'accions, que és urgent, possible i avantatjós abandonar l'energia nuclear i encaminar-nos cap a un model energètic alternatiu, diversificat en les fonts, estalviador en els usos, descentralitzat en l'espai, participatiu i democràtic en la seva organització social, decidit i gestionat sobiranament a cada nació, i basat en els recursos renovables i les tecnologies dolçes que poden sustentar *un benestar real en harmonia amb l'entorn.*

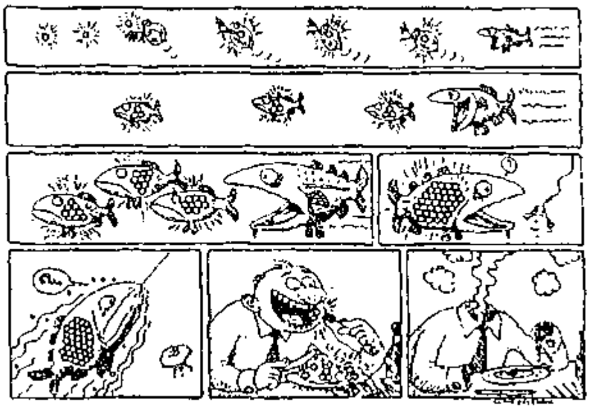
Per defensar aquesta alternativa energètica, ecològica i social més de dos-cents grups ecologistes hem presentat al Congrés de Diputats una llei per iniciativa popular que estableix la renúncia a la generació nuclear d'electricitat i exigeix al govern l'elaboració en sis mesos d'un pla de tancament i desmantellament de les nou centrals nuclears en funcionament. Aquesta és ara com ara la campanya més ambiciosa mai empresa pel moviment antinuclear a l'Estat espanyol. Hem escollit la iniciativa legislativa popular perquè és l'únic mecanisme de democràcia directa actualment existent a la Constitució espanyola que ens permet intervenir *amb veu pròpia* a la cambra, sense haver de dependre de cap dels grups parlamentaris que hi tenen representació.

El moment escollit és decisiu: abans del debat del nou *Plan Energético Nacional* (PEN), i enmig de l'escalada bèl.lica al Golf Pèrsic que ja està provocant la tercera crisi del petroli. Ara com mai és evident que la perpetuació de l'actual model energètic significa una destrucció ecològica i un malbaratament de recursos al Nord, i una expoliació dels pobles empobrits del Sud, que ens aboquen cap a guerres devastadores. La pau, l'alliberament dels pobles, la conservació de recursos no renovables per a les generacions futures, i l'harmonia amb la Natura exigeixen imperiosament un canvi del model energètic. L'estalvi energètic és l'única garantia possible de pau, llibertat i igualtat social per al segle XXI.

Per a què la llei entri al parlament cal recollir en un termini de sis mesos 500.000 signatures de persones amb dret a vot i autenticades. L'autenticació serà realitzada per persones voluntàries que realitzin un tràmit d'acreditació com a fedataris i fedatàries. A Catalunya necessitem milers de fedataris i fedatàries per tal de reunir el màxim nombre de signatures vàlides. Per obtenir la condició de fedatari cal tenir la majoria d'edat legal, estar en possessió dels drets civils i polítics, i reunir els següents documents: fotocòpia del D.N.I. o passaport, una declaració jurada signada (l'imprés de la qual us facilitaran les mateixes comissions promotores) i un certificat d'antecedents penals (que tramitaran directament dites comissions promotores). Per tal de finançar autònomament la campanya, també us demanem una aportació econòmica de 1.000 pessetes —o més, si podeu.

La tasca dels fedataris i fedatàries és de vital importància. Consisteix a comprobar que la identitat del qui signa en els plecs correspon a les dades assenyalades pel propi interessat, tràmit imprescindible per a la validesa de cada signatura. Les Juntes Electorals comprovaran que les persones signants estan inscrites al cens de la província, i les que no siguin autenticades o no corresponguin a electors d'aquella província seran invalidades pel recompte del mig milió necessari per a la defensa de la llei al Parlament.

Aquesta campanya només podrà dur-se a terme si totes i tots els qui volem VIURE SENSE NUCLEARS donem un cop de mà per aconseguir fer realitat les 500.000 signatures, i transformem la recollida en el clam antinuclear més fort que mai s'hagi sentit a la nostra terra. *Fes't-te fedatari o fedatària.* Proposa als grups socials, veïnals, sindicals o polítics en què participis que se sumin a les comissions de suport i col.laborin amb la campanya organitzant punts de recollida de signatures, donant a conèixer la iniciativa als seus membres, i fent aportacions en diner o materials. Organitza debats i encontres al teu lloc de treball, centre d'estudi o ateneu popular. Participa a la Comissió Promotora de «*Viure sense Nuclears*» al teu poble, la teva comarca, el teu barri. Si avui no som actius, demà encara serem radioactius!



La campanya catalana «Viure sense nuclears» és comuna a la que s'organitza a totes les nacions i regions de l'Estat espanyol, promoguda pels col.lectius antinuclears, ecologistes i pacifistes. A cada lloc les Comissions Promotores ecopacifistes organitzen comissions de suport integrades per tota mena d'associacions veïnals, feministes, de solidaritat, sindicats i partits polítics que vulguin col.laborar amb la iniciativa antinuclear.

La Comissió Promotora de «*Viure Sense Nuclears*» a Catalunya es reuneix tots els dilluns a la tarda al Centre de Treball i Documentació (carrer Gran de Gràcia 126-130, pral., 08026 Barcelona, telèfon 93-2179527), i qualsevol dia a la tarda hi podeu deixar el vostre encàrrec. Si voleu contribuir econòmicament, també podeu fer un ingrés al compte corrent nº 141.2-004211-29 de la Caixa de Catalunya a nom de la Comissió Promotora de la Iniciativa Legislativa Antinuclear. No us ho perdeu! Us esperem!

INICIATIVA LEGISLATIVA POPULAR PRESENTADA AL CONGRÉS DE DIPUTATS PER LA CAMPANYA *VIURE SENSE NUCLEARS.*

EXPOSICIÓ DE MOTIUS

L'energia nuclear està en crisi a tot el món. Les dramàtiques conseqüències dels accidents de Harrisburg i Txernòbil, els riscs per a la salut de les persones, el problema irresolt dels residus, la manca de rendibilitat d'aquestes instal.lacions i una opinió pública cada dia més contrària al seu ús, són factors d'aquesta crisi. Un bon nombre de països desenvolupats ha renunciat a la producció nuclear d'electricitat sense que el seu nivell de benestar hagi minvat. És el cas de sis dels dotze països de la Comunitat Econòmica Europea. Entre aquests països hi ha Dinamarca que, a més de posseir la renda per càpita més alta de la CEE, produeix l'energia més barata i Itàlia que, tot i que consumeix 1,5 vegades l'electricitat de l'Estat espanyol, va tancar les seves centrals nuclears l'any 1987 després d'un referèndum. No són casos únics. Àustria, Austràlia i Nova Zelanda tampoc no produeixen electricitat d'origen nuclear. Avui es pot dir sense que sigui cap exageració que l'energia nuclear ha esdevingut un malson fins i tot per a aquells que la van impulsar.

El tancament de les centrals nuclears és una necessitat urgent. El risc de nous accidents es multiplica dia a dia, com demostra l'exemple de Vandellós I. La quantitat de residus que complica la solució, n'incrementa el cost i augmenta la hipoteca del futur; amb relació a aquest tema, és imperatiu el desmantellament del cementiri nuclear d'El Cabril i també supeditar la creació de nous cementiris nuclears al tancament de les centrals. La crisi ambiental del nostre temps exigeix en breu un canvi de model energètic basat en la participació ciutadana a cada nacionalitat i regió, que obri les portes a una nova forma de desenvolupament ecològicament fonamentada.

En virtut d'això,

ARTICLE PRIMER

Es renuncia a la producció i importació d'electricitat d'origen nuclear a tot el territori de l'Estat espanyol. En conseqüència,

1.- No s'iniciarà la construcció de cap nova central nuclear.

2.- Es renuncia a obtenir electricitat d'origen nuclear en aquelles plantes inicialment concebudes com a centrals nuclears que tenen autorització de construcció (Lemóniz I i II, Valdecaballeros I i II i Trillo II) sotmeses actualment a moratòria.

ARTICLE SEGON

Queda prohibida la importació, exportació i trànsit de substàncies i equips de generació d'electricitat d'origen nuclear, tant si han estat produïdes en aquest Estat com en tercers.

DISPOSICIÓ ADDICIONAL PRIMERA

El govern presentarà al Parlament, en el termini màxim i improrrogable de sis mesos, un pla de tancament i desmantellament urgent de totes les centrals nuclears, que començarà amb les de primera generació – Zorita i Garoña – i continuarà amb les restants.

DISPOSICIÓ ADDICIONAL SEGONA

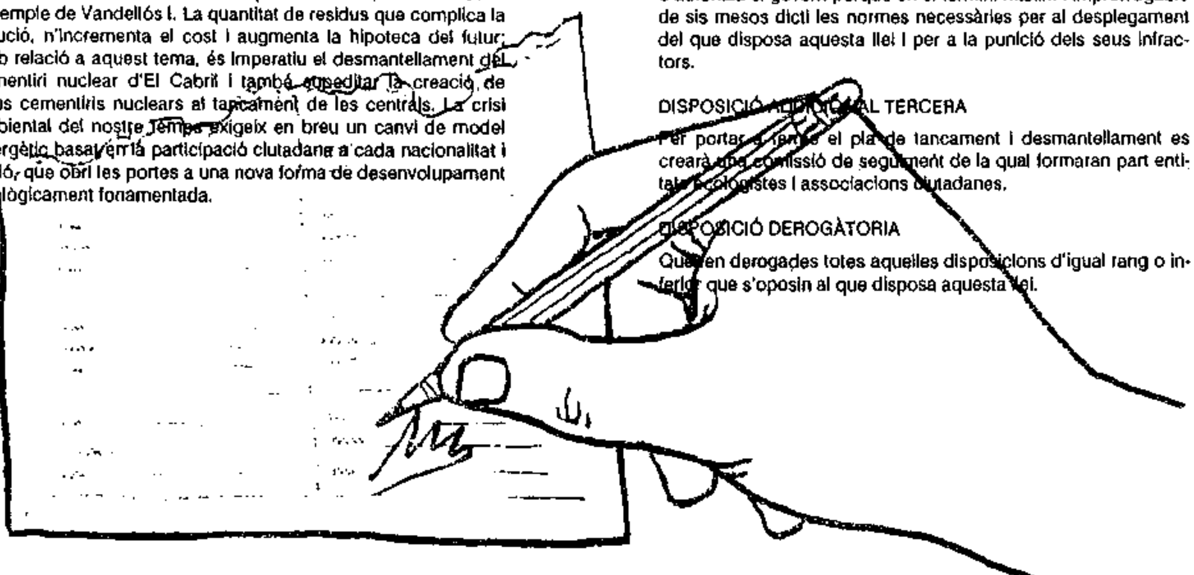
S'autoritza el govern perquè en el termini màxim i improrrogable de sis mesos dicti les normes necessàries per al desplegament del que disposa aquesta llei i per a la punició dels seus infractors.

DISPOSICIÓ ADDICIONAL TERCERA

Per portar a terme el pla de tancament i desmantellament es crearà una comissió de seguiment de la qual formaran part entitats ecologistes i associacions ciutadanes.

DISPOSICIÓ DEROGATÒRIA

Queden derogades totes aquelles disposicions d'igual rang o inferior que s'oposin al que disposa aquesta llei.



7 *Les reserves mundials d'urani són limitades.* Els promotors de la indústria nuclear pretenien solucionar l'escassetat d'urani aprofitable amb una segona era de reactors ràpids supergeneradors, els quals haurien de proporcionar més material fissible del què consumirien. Però també resultaren els més perillosos. Els enormes problemes de control elevaren el cost fins a fer-lo del tot forassenyat. Era un vertader mite econòmic, i arreu s'estan abandonant ja els plans de supergeneració per al futur. Això vol dir que *la generació elèctrica nuclear té els anys comptats.*

8 *La indústria nuclear no ha superat la prova del mercat. El dilema entre seguretat i rendibilitat l'ha duta fins a la fallida.* Es pensava obtenir electricitat a uns preus que només tenien en compte una part molt petita dels costos i els riscos. Però, tot i així, han resultat sense cap fonament. Les avaries constants, les protestes dels veïns, els advertiments de molts científics i les accions del moviment antinuclear han obligat a establir majors mesures de seguretat. Els costos de construcció s'han disparat, han augmentat les demores, les aturades freqüents han disminuït la utilització efectiva, la rendibilitat i la inversió privada han caigut.

La demanda d'energia prevista també era exagerada. L'alça del preu del petroli ha posat fi a la correlació tabú entre creixement econòmic i consum energètic: *amb menys energia obtenim els mateixos béns i serveis que abans.* El consum d'electricitat ha augmentat encara menys del que s'havia previst. Des de 1975 la crisi s'ha estès al negoci electronuclear. Els encàrrecs han caigut en picat i s'han abandonat moltíssims projectes. La clau del futur està en l'estalvi i la diversificació de les fonts d'energia. Les centrals nuclears només serveixen per produir electricitat cada cop més cara. *La crisi econòmica de la indústria nuclear és, en el fons, una crisi de necessitat, de credibilitat i de legitimitat.*

On ha tingut la protecció de l'estat, com a França o l'estat espanyol, el negoci nuclear ha sobreviscut millor i continua sent un poderosíssim grup de pressió. Però a costa d'un excés de capacitat de generació, de l'abandó d'altres alternatives, del sacrifi de l'estalvi i la conversió de l'electrificació en un imperatiu. *En lloc de satisfer una necessitat real, les companyies elèctriques cerquen suscitar-la en un mercat captiu.* La fixació de tarifes elèctriques ha traslladat als consumidors els costos d'una mala gestió. Com a resultat, *el model energètic espanyol es troba entre els més ineficients, malbaratadors i absurds.*

9 *La renúncia a produir electricitat nuclear és econòmicament viable i avantatjosa si ens encaminem cap a un altre model energètic.* En tots els països desenvolupats, la meitat o més del consum energètic és demanda de calor, i més d'un terç són combustibles líquids per al transport. Qualsevol central nuclear desaprofita dos terços de l'energia en forma de calor residual. Només l'altre terç s'aprofita com a electricitat. Però els usos que requereixen electricitat són enormement limitats. Un sistema més diversificat, basat en convertidors múltiples, de petita escala i adaptat als usos concrets que satisfan necessitats reals, permetria gaudir d'un major benestar consumint molts menys recursos.

Per exemple: una central nuclear de 1.000 Mw pot substituir-se per panells solars o per cogeneradors a gas, o per un millor aïllament tèrmic, o per equipaments més eficients, que permetin estalviar 10 Kw en 100.000 edificis, o 2 Kw en mig milió. *Però la protecció sense mesura que l'estat dóna als interessos monopolistes de les companyies elèctriques, i l'abandó d'altres alternatives, prolonga artificialment la vigència d'un model caduc* que permet a uns pocs obtenir grans beneficis a costa de grans perjudicis per a la societat i grans danys a la natura.

Ens cal un nou model energètic a l'alçada del nostre temps. Després de Txernòbil el món ha començat a plantejar-se l'abandonament definitiu de la generació nuclear d'electricitat. La consciència de la gravetat planetària del deteriorament mediambiental obliga a accelerar la reconversió ecològica de les formes d'obtenir i utilitzar energia. I la nova crisi de l'Orient Mitjà ha tornat a recordar que la pau, la llibertat, la igualtat i la sobirania dels pobles depenen de l'opció entre mantenir un ordre ecològicament irracional o, més enllà del malbaratament, *dirigir els esforços cap a les energies renovables.*

Per aquestes raons el projecte de llei que presentem insta el govern a elaborar un pla de tancament i desmantellament urgent de les centrals nuclears que tenen permís d'explotació, a renunciar a produir electricitat nuclear a les que estiguin en moratòria, i a no construir en el futur cap nova central nuclear. *Ara és el moment del canvi. Esperar només augmentarà la dificultat i el cost en el futur.*

10 Aquest projecte de Llei es presenta al Congrés dels Diputats per la via de la iniciativa legislativa popular per un motiu important: *la imposició de l'opció electronuclear ha estat, de bon començament, una història antidemocràtica.* Amb el suport del poder del diner i del mateix estat va aconseguir vèncer. Però quasi mai convèncer. Les decisions d'abandonar-la sempre han estat, en canvi, profundament democràtiques, basades en l'exercici real de la sobirania popular i, sovint, amb la participació directa dels ciutadans. Els referèndums d'Àustria el 1978 i Itàlia el 1987 en són un bon exemple.

El nou model energètic que ens cal exigeix, al seu torn, una ampliació de l'exercici real de la democràcia. *L'opció nuclear només podia imposar-se contra la voluntat popular. Una opció ecològica només serà possible si fomenta la participació ciutadana i la sobirania real a cada lloc, cada poble i cada nació.* Per aquesta raó les persones que donem el nostre suport a aquest projecte de Llei el presentem al Congrés dels Diputats a través de l'única esquerda de democràcia directa que permet l'actual ordenament polític de l'estat espanyol.

Viure sense nuclears.

VIURE SENSE NUCLEARS

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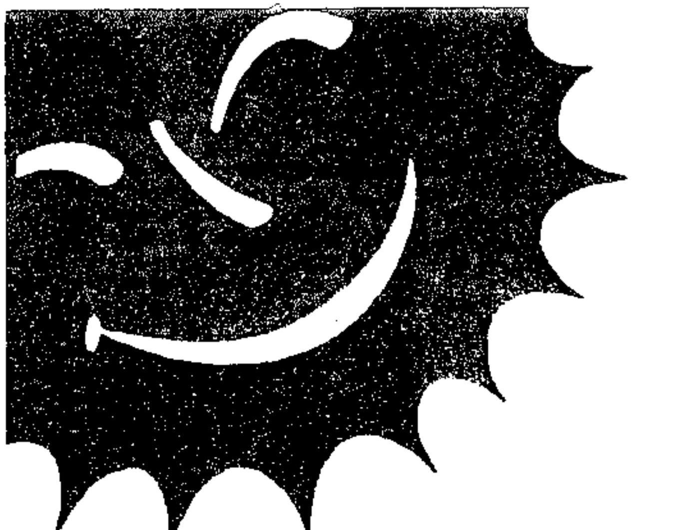
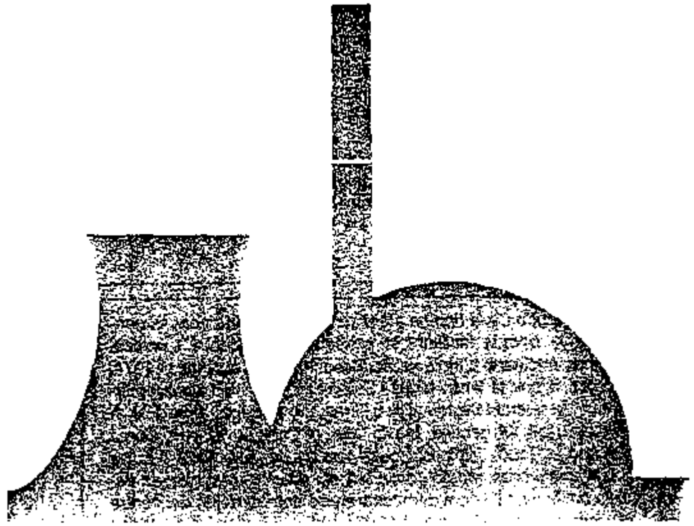




DEU BONES RAONS PER TANCAR LES NUCLEARS

La generació nuclear d'electricitat a partir de la fissió nuclear és un dels errors tecnològics, ecològics i econòmics més greus del nostre temps. Lluny d'assegurar el nostre benestar, s'ha convertit en una importantíssima font de malestar. En interès de les generacions futures i del món que estem obligats a llegar-los, cal posar-hi fi. La Comissió Promotora de la Iniciativa Legislativa Antinuclear considera que *la renúncia a la producció d'electricitat d'origen nuclear és imperiosa moralment i possible econòmicament* per les raons següents:

1 *Totes les activitats de la indústria nuclear generen contaminació radioactiva*, i la radiobiologia ha demostrat que cap dosi és inòcua. La vida radioactiva de molts elements es prolonga milers d'anys, i alliberar-los al medi té efectes acumulatius que es multipliquen en els éssers vius. Abans que els efectes es manifestin en forma de tumors cancerígens, poden transcórrer dècades. Les malformacions hereditàries poden aparèixer en successives generacions. En suma: la indústria nuclear imposa a la població un risc per a la salut sense que mai no se li hagi consultat directament el seu parer.

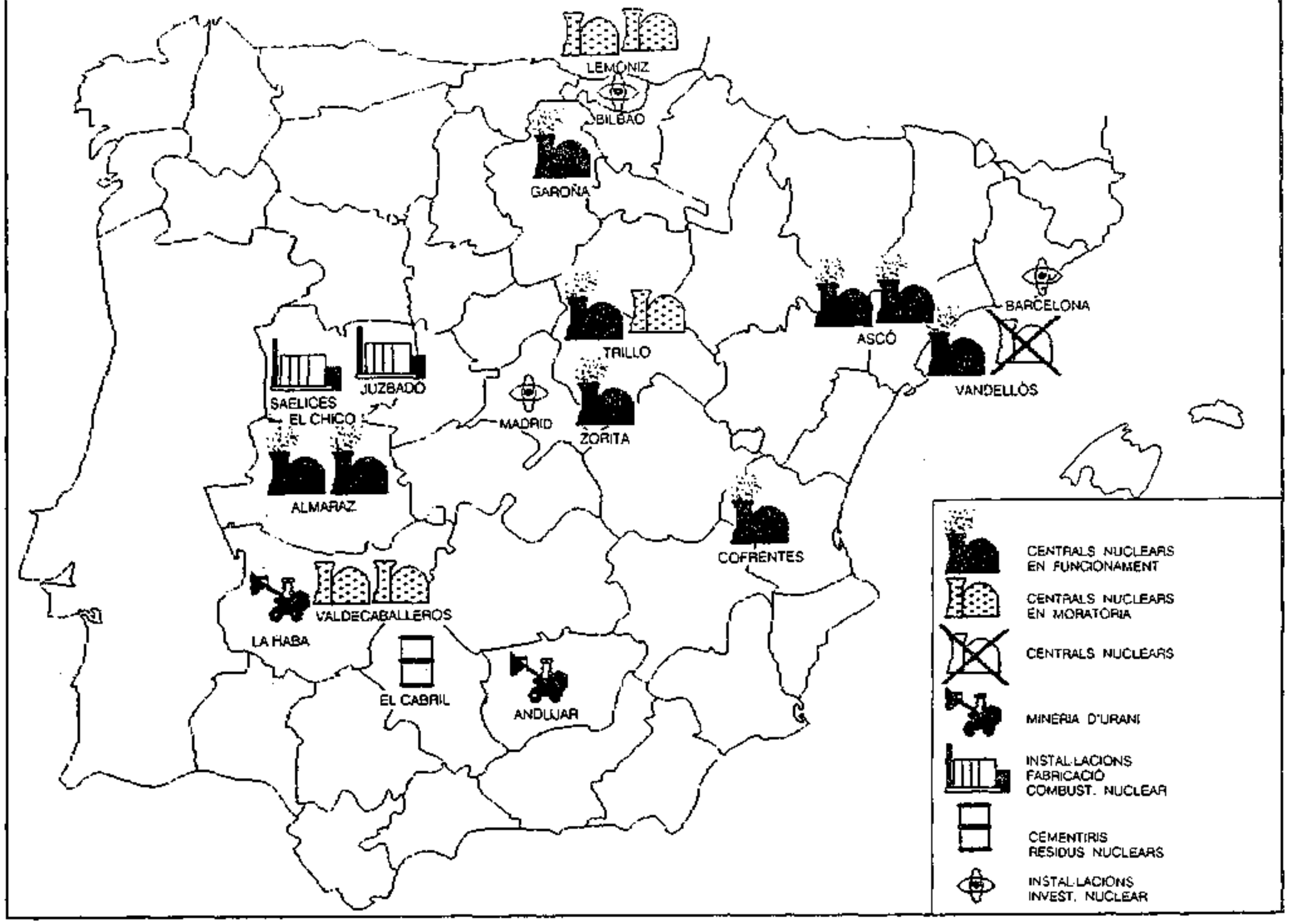
2 Les centrals nuclears produeixen una gran quantitat de residus radioactius, i creen un problema que segueix sense solució: ¿qui pot garantir la seguretat d'aquest material altament radioactiu al llarg de desenes de milers d'anys? ¿qui es farà càrrec del cost i la custòdia? De fet, el problema no és tècnic sinó ètic: *¿té dret la nostra generació a deixar aquesta herència terrible als qui vindran després?* Aquesta és una raó fonamental per tancar com abans millor totes les centrals nuclears: mentre continuïn funcionant seguiran generant residus que augmenten la hipoteca per a les generacions futures.

3 L'entorn es veu afectat per les conseqüències que podrien derivar-se, tant d'un desastre natural com, en particular, d'un acte deliberat d'extorsió o sabotatge de caràcter bèl.lic o colpista. *Amb uns quants quilograms de plutoni és relativament fàcil construir una bomba nuclear.* La indefensió davant aquestes amenaces pot portar la societat a triar entre seguretat i llibertat. Per contrarestar-les, els governs tendeixen a adoptar mesures de caràcter policial i militar que minven drets dels ciutadans. *En el debat nuclear està en joc la llibertat i la sobirania dels pobles.*

4 *Nascuda de la bomba atòmica, la indústria nuclear alimenta la bomba* facilitant la proliferació horitzontal i vertical d'armes nuclears. L'Índia va aconseguir l'arma nuclear el 1974, es sospita que la tenen Israel i Sud-àfrica, i podrien aconseguir-la més de quaranta estats: l'Iraq, l'Iran, Líbia, Egipte, Síria, Pakistan, el Brasil, l'Argentina, Mèxic, Xile, el Canadà, Taiwan, Corea del Sud, el Japó, Filipines, i quasi tots els de l'Est i Oest d'Europa. *Aquesta presumpció converteix els reactors nuclears en cavalls de Troia*, tal i com demostraren els bombardejos del centre nuclear iraquià de Tamuz el 1980 i 1981. Una discussió seriosa sobre els costos de l'opció nuclear ha d'incloure també els relacionats amb la defensa, la pau i la llibertat dels ciutadans.

5 Als riscos del funcionament normal s'afegeixen els de qualsevol error, fallada o imprevist mecànic o humà. La història de la indústria nuclear és un seguit d'incidents i accidents. *Veritables catàstrofes com les de Windscale* (Gran Bretanya) *el 1957, Harrisburg* (Estats Units) *el 1979 i Txernòbil* (Unió Soviètica) *el 1986, han demostrat quin és l'abast del risc que la indústria nuclear obliga a assumir*. La magnitud d'un accident nuclear greu no resisteix cap comparació: els efectes perduraran vàries generacions. La negativa de les companyies d'assegurances a cobrir els riscos d'accidents nuclears parla per ella mateixa.

MAPA NUCLEAR DE LA PENÍNSULA IBÈRICA



ELABORACIÓ: *COMITÈ ANTINUCLEAR DE CATALUNYA, 1990*

Txernòbil va causar la mort immediata de 31 persones. Més de 100.000 han hagut d'emigrar. Prop de 50.000 Km^2 de terres quedaran improductives mig segle o més. Un milió i mig de persones han quedat afectades per radiacions d'alt nivell, i el nombre probable de càncers en els pròxims 70 anys pot arribar a mig milió. Txernòbil va demostrar que els efectes d'un accident nuclear no coneixen fronteres. *A mesura que l'edat mitjana dels reactors augmenta, s'incrementa també la probabilitat d'accidents.* El que va produir-se el 19 d'octubre de 1989 a Vandellòs I només és un primer avís. L'únic segur de les centrals nuclears és la seva inseguretat. *No volem centrals més segures, volem estar segurs sense centrals nuclears.*

6 Un cop esgotada la seva vida útil, *les centrals nuclears seran immensos residus* que la societat haurà de custodiar desenes d'anys. No hi ha precedents de desmantellament de reactors nuclears de gran potència, ni d'emmagatzemament segur de les seves parts contaminades de radioactivitat. Però hauran de mantenir-se aïllades durant generacions, i fins ara la tecnologia mai no ha pogut garantir que una estructura es mantindrà intacta al llarg de tant de temps. Aquesta hipoteca ja no pot eliminar-se. Però la seva càrrega pot disminuir si tanquem el parc nuclear abans que arribi al màxim nivell d'irradiació.

4. LA IMPLEMENTACIO DE L'EFICIENCIA ENERGETICA A NEW ENGLAND: UNA EXPERIENCIA DE COL.LABORACIO ENTRE ECOLOGISTES I EMPRESES ELECTRIQUES

* POWER TO SPARE
  A PLAN FOR INCREASING NEW ENGLAND'S COMPETITIVENESS THROUGH ENERGY EFFICIENCY
  NEW ENGLAND ENERGY COUNCIL, JULY 1987

Power To Spare

A Plan for Increasing New England's Competitiveness Through Energy Efficiency

July 1987

New England Energy Policy Council
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Acknowledgments

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New England Energy Policy Council

Who We Are

The Council is a group of public interest organizations and state agencies from all six New England states that have joined together to ensure that the region's growing electrical service needs will be met at the lowest monetary and environmental cost.

Why We Joined Together

The production and distribution of electricity in New England has an enormous impact on the region's economy, competitiveness and quality of life. New England's electricity system also now stands at an historic crossroads. Robust economic and population growth suggests steadily increasing demand for electrical services. But attempting to meet this demand by building ever-larger baseload power plants has proven an unwise and uneconomic strategy: since the mid-1970s, New England has poured hundreds of millions of dollars into the construction of cancelled plants. And the completed plants have caused significant rate increases and a drain on precious capital resources. We have joined together to ensure that the region avoids repeating these costly mistakes.

Our Goals

Ultimately, developing the most cost-effective and environmentally sound strategy to supply our electrical needs will require several approaches:

- A substantial portion of the growth of our future electrical needs can be met by increasing the efficiency of electrical use and not by new supply.
- The answer to our energy needs must include a regionwide analysis and solution, since our electricity is already planned, generated, transmitted and funded on a regional basis.
- The regional energy strategy must minimize financial and social costs to the region.
- The regional strategy must be developed through open public debate and discussion.

Council Members

Action, Inc. (MA)
Campaign for Ratepayers' Rights (NH)
Center for Ecological Technology (MA)
Coalition for Consumer Justice (RI)
Connecticut Citizens Action Group
Connecticut Division of Consumer Counsel
Conservation Law Foundation of New England
Energy Conservation Coalition (Washington, D.C.)
Energy Federation, Inc. (MA)
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League of Conservation Voters
Maine Audubon Society
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Union of Concerned Scientists
Vermont Natural Resources Council
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Executive Summary

Power to Spare

A Plan for Increasing New England's Competitiveness through Energy Efficiency

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New England Energy Policy Council, July 1987

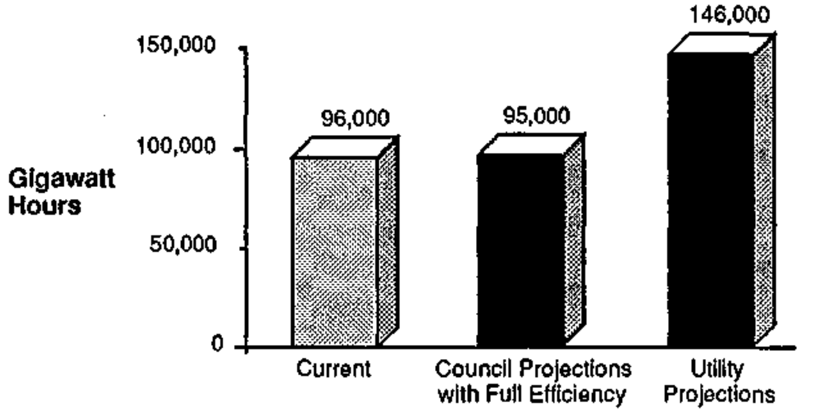
Recently, there has been much public debate and discussion about how to meet New England's electricity needs. The region's electrical utilities, predicting electric demand growth of 2% annually or more, have warned of imminent power shortages if new power plants are not built. And the New England Governors' Conference recently called for long-term power planning to ensure that the region taps the cheapest power sources first — whether that source is increased electrical efficiency or new power plants.

The choice of options has profound economic and environmental implications for New England. Building more multi-billion dollar power plants would be both expensive and risky. New generating facilities face uncertain construction and fuel costs as well as unpredictable electric demand. New power plants would also damage the quality of New England's air, water and landscape.

The New England Energy Policy Council (composed of the leading environmental and consumer organizations in the region concerned with regional electricity supply) recently undertook a collaborative research effort to determine whether New England could meet a substantial portion of its power needs by dramatically increasing the efficiency with which energy is used rather than by producing more of it.

The resulting analysis demonstrates that New England could meet between 35% and 57% of its total electricity requirements in the next two decades through the efficiency improvements studied in the Council's report. Moreover, the analysis shows that New England's power needs could be met in this fashion while maintaining or increasing the rate of economic growth projected by the utilities.

Full Efficiency vs. Utility Projections (2005)



Source: New England Utilities; New England Energy Policy Council.

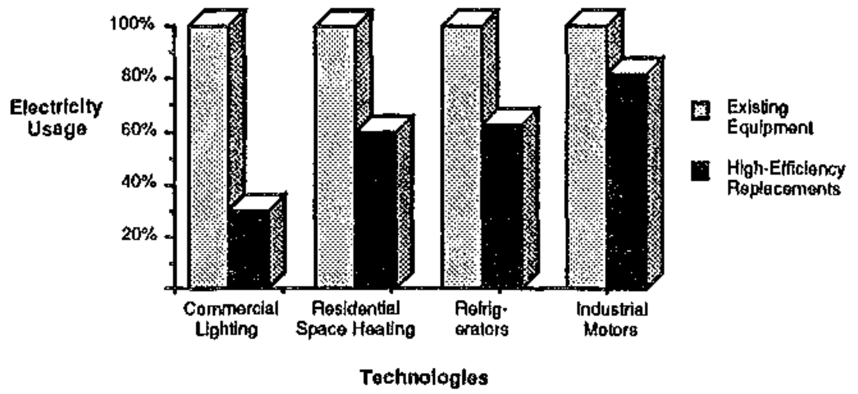
The Council's analysis looked at the potential for increasing electrical efficiency in New England by utilizing proven, commercially available technologies which provide the same quality of service (e.g., light, refrigeration, and electric motor drive), but use substantially less energy than existing equipment. The resulting savings in electricity can be seen as a new source of energy — a source which costs less than any alternative supply. ❑

Energy Efficiency at Work

Overall Savings

Three electric utilities in the nation — Tampa Electric, Public Service Electric & Gas Co. (NJ), and the Sacramento Municipal Utility District — have undertaken efficiency improvement programs which they predict will reduce by 50% the growth in their customers' demand for electricity in the next ten years. A recent report of independent consultants to the Boston Edison Company concluded that if the utility implemented cost-effective efficiency improvements, it could "eliminate all load growth through the end of this century."

Savings from Efficient Technologies



Electricity use of existing equipment vs. commercially available high-efficiency replacements.

Source: Lawrence Berkeley Laboratory; ACEEE; Manufacturers (efficiency gains). New England utilities (existing use).

Energy Efficient Products

Examples of these technologies include:

Lighting: Electric use from lighting in office buildings, schools and stores can be reduced as much as 80% by installing a package of energy-saving measures such as high-efficiency compact fluorescent lights, reflectors, high-frequency ballasts, use of natural lighting, and automated control systems to target lighting needs.

Electric Heat Reductions: Simply adding extra insulation and plugging air leaks in electrically heated homes can result in 40% lower electric use for the same comfort level.

High-Efficiency Motor Technology: About a fifth of all electricity produced in New England is consumed by industrial motors. At a minimum, 18% of this energy could be saved by the use of high-efficiency motors and the use of electronic controls which more finely tune motor outputs to match production demand.

High-Efficiency Ventilation and Cooling Equipment: Innovations in space cooling and ventilation equipment, combined with lower heat produced by high-efficiency lighting, can reduce electric consumption for cooling and ventilation in New England by 50-60%.

Replacing existing inefficient equipment with these technologies is like shutting the windows in a drafty house: energy that previously leaked away is retained and used, with the same effect as if a "new" source of energy had been added.

The performance characteristics and savings of these and other commercially available products were obtained from leading electrical efficiency experts such as the federally sponsored energy research facility, Lawrence Berkeley Laboratory. The Council then analyzed what would happen if these technologies were installed in all appropriate situations or locations utilizing electricity in New England. In addition to analyzing the impact of current commercially available technologies, the Council also separately analyzed the impact of using more advanced technologies which leading energy experts predict will become commercially available within the study period. Data on current and future uses of electricity was taken from the region's electrical utilities. ❑

Lighting Savings in Rhode Island

The University of Rhode Island, with the help of the New England Electric System, recently reduced electricity use for lighting by 78% on large portions of its Kingston, RI campus. These reductions were achieved by replacing low-efficiency with high-efficiency lights, and reduction of unnecessarily high lighting levels. As a result, the campus saved $200,000 per year on its electricity bill — substantially more than the cost of obtaining the reductions.

Building Efficiency in Massachusetts

Through the use of better insulation and high-efficiency cooling and heating equipment, the 900,000 square foot Massachusetts State Transportation Building in Boston uses approximately 40% less electricity than a comparably sized conventional office building. Annual electricity savings exceed $1 million.

Results of Analysis

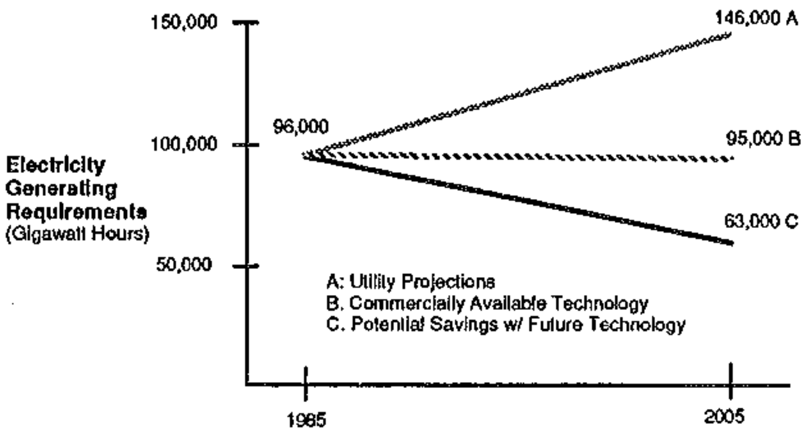
The results show that, at full efficiency, New England would require 35% to 57% less electricity in the year 2005 than current utility projections, with the same level of economic activity and personal comfort. The amount of "peak" generating capacity required to service year 2005 demand would be reduced by an even greater percentage.

Put another way, at full efficiency, New England could be using less electricity and generating capacity than it is using today even with the level and pace of economic growth predicted by the region's utilities.

In addition, the Council's analysis shows that, in most cases, power supplied through installation of high-efficiency equipment costs between one quarter and one half the price of power supplied from new power plants. The study also notes that, dollar for dollar, investments in electrical efficiency equipment are less risky, cause fewer environmental problems, and create far more jobs than capital-intensive power plant construction.

It is important to stress that the Council's analysis looks at what could happen if all cost-effective electrical efficiency improvements were fully implemented. The Council's analysis does not attempt to predict what level of efficiency will in fact be realized. That will depend on how vigorously New England's decisionmakers pursue electrical efficiency. Nevertheless, it is striking to note that if only half of the Council's lower estimate of efficiency potential were realized, New England's total electric demand would be approximately 17% lower than predicted by the region's utilities — enough difference to eliminate the need for several coal or nuclear plants. ❑

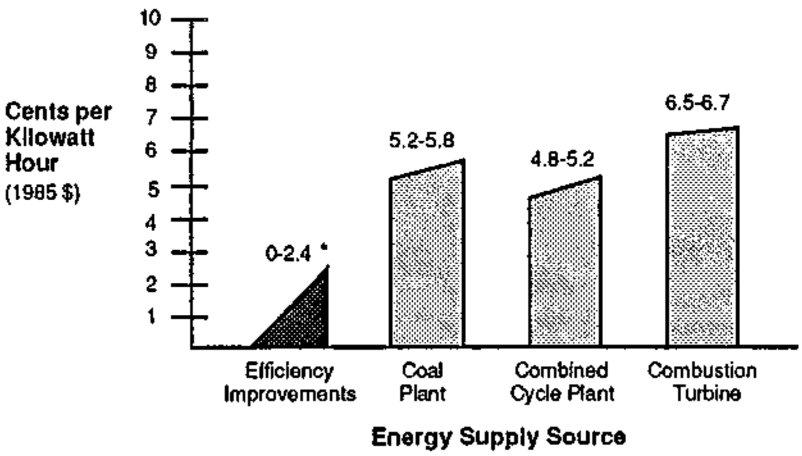
Energy Savings Potential



New England Electricity Generation Requirements 1985-2005: Utility Projections vs. Increased Use of Efficient Technologies.

Source: New England Utilities; New England Energy Policy Council.

Electricity Production Costs



Comparison of costs of energy from efficiency programs vs. new plants.

Source: Energy Systems Research Group; California Energy Commission; New England Energy Policy Council.

*With the exception of motors, commercial ventilation, clothes dryers, and home air conditioners. (3.4-4.7 ¢ per kilowatt hour)

Successful Load Management

California utilities have implemented a program that enables them to obtain shared load reductions from large customers during "peak" hours without interruption of the customers' businesses. The available reductions have already reached 60 megawatts of capacity — an amount equivalent to several New England peak generating plants.

Obstacles to Efficiency

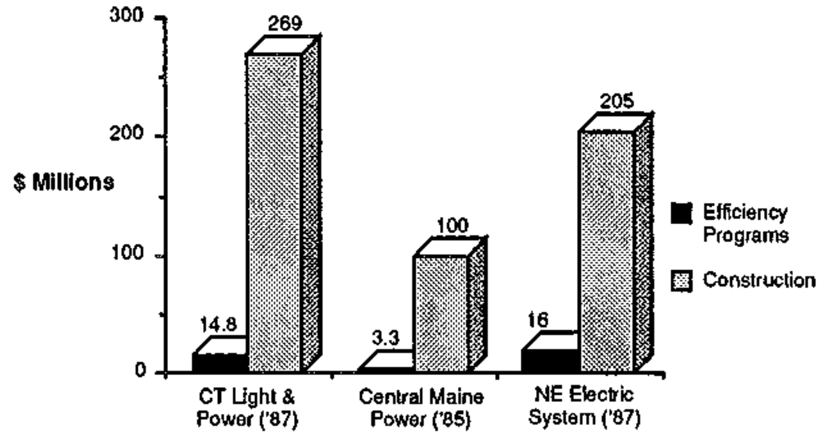
However, as noted, these efficiency improvements will not happen by themselves. Serious obstacles exist to their implementation. For example,

Lack of Information: Many of these technologies are relatively new and markets for them are not well developed; consequently, information about them has not been widely disseminated to consumers and utilities;

Lack of Resources or Incentives: Many electric users, especially small businesses and homeowners, do not have the capital or incentives to purchase new equipment because they often do not receive all of the economic benefits of the resulting electrical savings;

Lack of Utility Action: Even the region's most active utilities are still spending on end-use efficiency only a small fraction of the amount they are spending on building power plants and transmission lines. ❑

The Efficiency Spending Gap



Expenditures in $ millions of three major New England utilities on construction and electrical efficiency improvements.

Sources: Northeast Utilities; Central Maine Power; NEES; Moody's 1986 Public Utility Manual; Investor Responsibility Research Center.

Action Plan

To overcome these obstacles and make our region as electrically efficient as it can be, the New England Energy Policy Council proposes in this report a detailed 12-point electrical efficiency action plan for New England. These actions include:

Short Term Actions

- the region's utilities should immediately undertake a substantial investment program to design and fund efficiency improvements in homes, businesses and industry;
- utilities must fund technologies and programs that reduce New England's maximum or "peak" electrical demand, to delay the need for new generating capacity;
- states must adopt regulatory and rate policies to ensure that utility planning gives top priority to economically sound efficiency investments;

Long Term Actions

- develop a New England Energy Laboratory to develop information on performance and savings of efficiency technology;
- require utilities to undertake integrated "least-cost" planning;
- stimulate a marketplace for efficiency improvement technology;
- increase the energy efficiency levels required by state building codes;
- create a freer market in regional electricity services; and
- plan New England's electricity needs on a regional basis, in a long-term and publicly accountable fashion.

Summary

In summary, the analysis shows that, if New England succeeds in tapping even a fraction of the cost-effective efficiency gains identified in the report, there will indeed be substantial "power to spare" — power that is cheap, creates jobs, and does not pollute. But to achieve that goal, New England regulators, utilities and the public must join together to pursue the Council's recommended policies immediately, before the region engages in another costly, risky, and ultimately unnecessary round of power plant construction. ❑

Power To Spare

A Plan for Increasing
New England's Competitiveness
Through Energy Efficiency

New England Energy Policy Council

July 1987

The purpose of this report is to explore the dramatic role that increased efficiency in the use of electricity can play in meeting New England's future energy needs.

I. Purpose of this Report

The New England Energy Policy Council consists of the leading consumer and environmental organizations in the region, and state consumer advocates. The Council was formed in Fall 1986 out of a concern for the way in which New England's electricity needs will be met in the coming decades. The purpose of this report is to explore the dramatic role that increased efficiency in the use of electricity can play in meeting those needs. This report also examines how increased electrical efficiency can enhance New England's competitiveness and economic vitality.

Finally, this report sets forth a 12-point program for tapping all cost-effective electrical efficiency potential. ❑

II. Background

Recently, there has been much public debate and discussion about New England's growing electricity needs and how best to meet them. In June 1985, the New England Governors' Conference, Inc. (NEGC) undertook an extensive study of the issue. In December 1986, the NEGC issued its *Final Report*.[1] That report reviewed a projection by the region's electrical utility companies that New England's demand for electricity will most likely grow by approximately 2.2% annually until the year 2000. The report also reviewed the utilities' suggestion that additional electrical generating facilities and power purchases, as well as increased electrical efficiency, may be needed to meet or reduce this increased demand. The Governors' report called for the initiation of long-term "least cost" planning to ensure that New England can economically meet its electric needs.[2]

In developing a long-term regional plan, however, it is apparent that a strategy relying primarily upon expansion of New England's production of electricity from new generating facilities — or committing to significant new power purchases — poses large risks to the region's economy and environment.

The Consequences of New Power Plants

On the economic side, such a power expansion program would be very costly and risky. New England already spends over $7 billion a year for electricity, reflecting utility rates which are 25% higher than the national average.[3] Another round of accelerated power plant construction in New England would consume additional billions of dollars for more long lead time projects. Uncertain demand growth, unpredictable fuel prices, and volatile interest rates and construction costs create a less than favorable prospect for such a traditional path. The last such round of plant construction — in the early to mid-1970's — contributed substantially to the doubling of regional electric rates between 1974 and 1985, and resulted in the expenditure of hundreds of millions of dollars for plants that were ultimately abandoned due to slower-than-expected demand growth and lack of financial feasibility.[4]

Building more power plants will also take a tremendous toll on New England's environment. New England's coal-and oil-fired plants already emit over half a million tons per year of sulfur dioxide and nitrogen oxides, the major causes of acid rain,[5] while New England's nuclear plants produce 200-250 metric tons/year of high level radioactive waste.[6] Trash-burning and wood-fired plants emit toxic compounds such as dioxin and acid gases.[7] In addition, lacing the region with new power plants and transmission lines would dramatically lower the quality of our already threatened landscape.

This economic and environmental damage cannot be avoided simply through expanded power purchases from Canada. Even ignoring environmental damage to that nation, Canadian power purchase agreements entail costly long-term, capital-intensive commitments and many have been tied to the price of fossil fuels, which can escalate unpredictably.

Increased electrical efficiency is still not seen by most companies as a major supply resource equivalent to new generating capacity.

Building, costly and environmentally intrusive high-voltage transmission lines through New England is also a necessary component of an expanded power purchase strategy. Finally, stepped-up power purchases increase New England's dependence on foreign imports and ensure a steady flow of capital out of the region, just as building more power plants would increase our dependence on coal and foreign uranium and oil.

The Potential for Efficiency

The adverse economic and environmental risks of increased production of electricity has led the region's decision-makers increasingly to examine the potential for more efficient use of our existing electricity supply. As will be shown below, increasing New England's electrical efficiency would:

- Be substantially cheaper than building or buying an equivalent power supply;
- Be less risky than investment in equivalent generating capacity, because it can be tailored by increments to changing demand and does not require decade-long capital-intensive construction projects;
- Decrease adverse environmental impacts;
- Create more permanent jobs for New England than would transient bursts of capital-intensive plant construction.

These virtues of increased electrical efficiency led the New England Governors' Conference in its December 1986 *Final Report* to call for "an immediate acceleration in the planning and implementation" of investments in efficiency.[8]

Yet seven months later, the Governors' call has not been visibly heeded. Although some of the region's utilities have made some outstanding individual program efforts in the past few years, increased electrical efficiency is still not seen by most companies as a major supply resource equivalent to new generating capacity.[9] In addition, New England's utility commissions have not put forth a clear set of policies and incentives designed to achieve the maximum cost-effective electrical efficiency improvements.

This report attempts to take the Governors' call seriously. It represents the first comprehensive effort to assess on a region-wide and uniform basis the economic and technical potential for increased electrical efficiency. The report also sets forth several very specific short-and long-term policies and actions which must be taken by utilities and public officials in order to realize this potential. ❑

III. New England Electric Use: Current and Future

New Englanders currently consume a little under 100 billion kilowatt hours (kwh) per year and about 18,000 megawatts (MW) at peak load — roughly the output of eighteen large coal or nuclear plants.[10]

The New England Governors' Conference Power Planning Committee recently reviewed projections by the region's utilities that electricity consumption is likely to grow by 2.2% annually through the year 2000, and that New England's peak demand is likely to increase by 27% to about 23,500 megawatts (MW) — the energy equivalent of five new large coal or nuclear plants.[11]

There are several reasons to doubt that this electricity growth will in fact occur even if the efficiency improvements suggested in this report are not implemented: New England's utilities have historically overestimated demand by a substantial margin.[12] However, the New England Energy Policy Council agrees that, for planning purposes, it is appropriate to assume that New Englanders will continue to demand substantially more light, heat, cooling, and motor drive in the coming decades. The question then becomes: how much can increased electrical efficiency contribute to meeting this projected increased demand?

To answer that question, it is necessary first to look at how New England uses electricity currently, and how that use is expected to change in

Electrical efficiency improvements should not be confused with chilly homes and idle industrial capacity.

the near future. A numerical description of these uses and trends is contained in Appendix 3 to this report. In brief, that description shows that:

- Most of New England's electricity is used by industries and commercial facilities (offices, stores, hospitals, schools) — which comprise only 10% of all customers;
- New England's electricity is used mostly for a few basic tasks including, most prominently, lighting (23%), industrial motors (21%), and space conditioning (19%).
- New construction — particularly new office and retail buildings — accounts for much of the expected increase in demand over the next decades.

These trends suggest that some of the greatest potential for electrical efficiency improvements exists in commercial and industrial facilities, and particularly in lighting, motor drive, and space conditioning. The description also suggests that increasing the electrical efficiency of new construction is an important key to an energy efficient future. ❑

How New England Uses Electricity

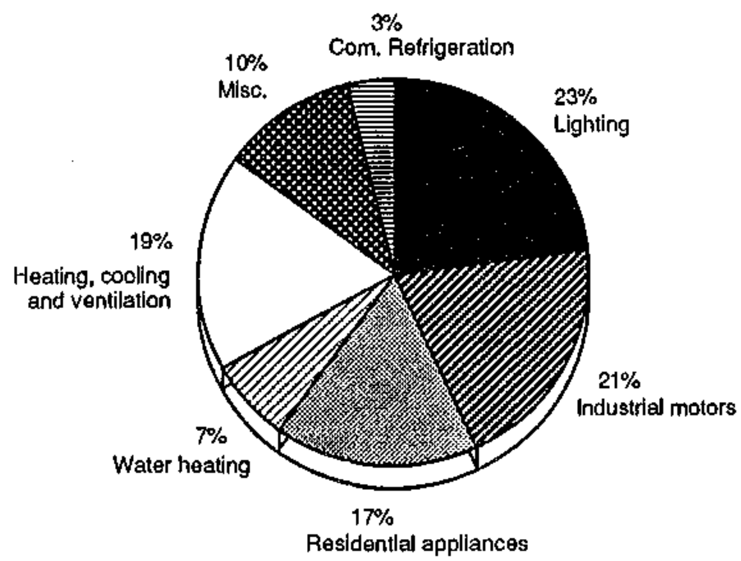


Figure 1: Percentage of annual average consumption by end use.

Source: New England utilities; Electric Power Research Institute; New England Energy Policy Council.

IV. Opportunities for Electric Use Efficiency

As used in this report, electrical efficiency improvements (sometimes also called "demand side management" measures) include:

1. Measures which allow electricity customers to receive the same amount and quality of light, heat, refrigeration, or mechanical output with less electricity input than before the measure was undertaken (traditionally, such measures have been labelled "conservation"); and

2. Measures which shift an electricity customer's use of electricity away from certain hours of the day (typically early evenings in winter and mid-afternoons in summer) when New England's power plants are experiencing maximum, or so-called "peak," demand from other customers. Traditionally labelled "load management," these measures are important because (1) by reducing present "peak" demand, they reduce the total amount of time New England's utilities must run their most expensive "peak" generating facilities; and (2) by reducing future "peak" demand growth, these measures can ultimately reduce the total amount of new generating capacity which New England's utilities must have on line to both meet that "peak" demand and serve as "reserve" in case of plant malfunction or planned maintenance.

Electrical efficiency improvements should not be confused with chilly homes and idle industrial capacity. Added hardship is not and should not be the answer to our energy needs.

New efficient technologies allow the same level of electrical service to be provided with dramatically less electricity input and generating capacity.

Economic growth, convenience and comfort can be achieved simultaneously with efficiency.

Electrical efficiency improvements today are based on an explosion of developments in high technology, advanced materials, and simple good design that allow *the same level of electrical service to be provided with dramatically less electricity input and generating capacity.* These developments include:

- New lighting equipment that saves 70–80% of existing lighting electricity consumption (a high percentage of the region's total)
- High-efficiency industrial motors and computerized motor controls that can save approximately 20% of electricity used by New England industry
- Insulation techniques which reduce annual residential electric space heating requirements by at least 40%
- Computer controls that allow large industrial and commercial customers to collectively reduce their peak demand on a spot basis with no impact on sensitive production processes
- High-efficiency air conditioners and other home appliances which consume 20–50% less electricity than their inefficient counterparts.

These developments are not futuristic dreams, but rather reliable "off the shelf" technology which can be purchased today.

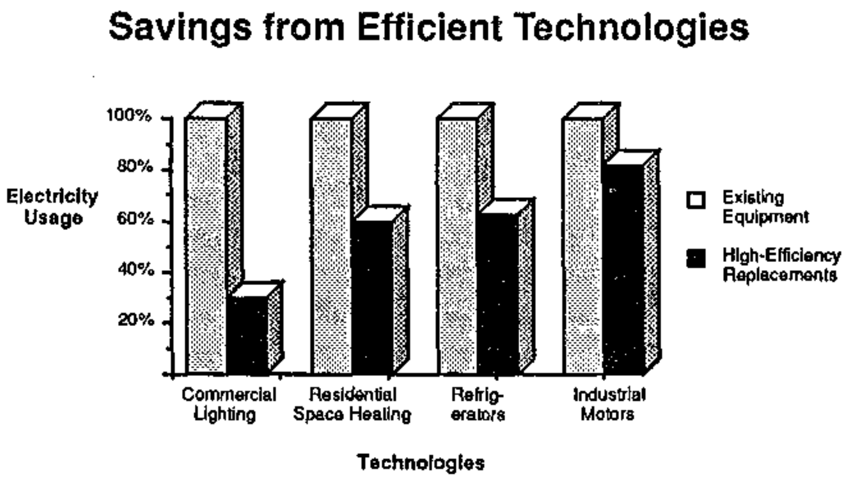


Figure 2: Electricity use of existing equipment vs. commercially available high-efficiency replacements.

Source: Lawrence Berkeley Laboratory; ACEEE; Manufacturers (efficiency gains). New England utilities (existing use).

Item: The University of Rhode Island, with the help of the New England Electric System, recently reduced its electricity use for lighting by 78% on large portions of its Kingston, RI campus. This reduction was accomplished by replacement of existing incandescent and mercury vapor lights with efficient fluorescent and high-pressure sodium lights. It did not even include many measures such as electronic ballasts which could have reduced consumption even more. These replacements paid for themselves in saved electricity in less than one year.[13] Lighting savings of greater than 75% in commercial buildings have been routinely demonstrated.[14]

Item: Through the use of more efficient compressors, and better design and insulation, the most efficient mass-marketed refrigerators use roughly 40% less electricity than the average New England stock.[15]

Item: By using sophisticated computer-based system controls, electrical utilities in California are able to obtain load reductions from large industrial and commercial customers on short notice during periods of peak demand. These controls provide the utility with an effective additional capacity of 60 MW, the equivalent of a small power plant. A recent consultants' report to the Boston Edison Company estimated that as much as 8% of the Company's current peak demand could be saved through such controls.[16]

Item: Through the use of better insulation, double-paned glass, a heat recovery system, monitoring of building mechanical functions, and a

The Council's analysis does not attempt to predict what level of efficiency will in fact be realized. That will depend on how vigorously New England's decision-makers pursue electrical efficiency.

limited menu of high-efficiency lighting measures, the 900,000 square foot Massachusetts State Transportation Building in Boston uses approximately 40% less electricity than a comparably sized conventional office building. Electricity savings exceed $1 million annually.[17]

Moreover, the power and potential of these technologies is increasing rapidly while their cost is coming down, just like the computer technology which has made many of these devices possible.

In essence, these new efficiency and load management approaches can be considered collectively as a new kind of "power plant." They can be "built" to meet a specific peak capacity or electricity need, and in fact they "produce" power more reliably (thus avoiding the need for costly "reserve" capacity) than conventional power plants.

As will be shown below, the problem is not the availability of the "efficiency improvement power plant," but the creation of policies to ensure that it gets built before the region embarks on more costly, environmentally intrusive and perhaps unneeded electricity generating plants.

❑

V. Total Electrical Efficiency Potential in New England

The estimates of New England's efficiency potential contained in this report are fully documented and described in Appendix 1. The following is a brief outline of the method and results of these estimates.

A. Method

To determine how much electrical efficiency could contribute to meeting New England's energy needs in an economic fashion, the Council's first step was to identify the most efficient commercially available devices and practices applicable to each specific category of electrical use — lights, refrigeration, motors, etc. This "commercially available savings" inventory was developed from information supplied and reviewed by the Lawrence Berkeley Laboratory (the federal government's principal energy efficiency research institute), the American Council for an Energy Efficient Economy (an independent research organization), and other energy experts. In addition, the Council compiled a "potential savings" inventory of energy-efficient technologies which are not all currently commercially available, but which leading energy experts believe are likely to become available during the study period.

The next step was to identify from the "commercially available savings" inventory those technologies and practices which, based on their current or expected market cost, could produce a kilowatt hour of increased efficiency for less than or equal to the utility's cost of producing a kilowatt hour of electricity from new and existing generating plants.

Finally, the Council applied these technologies and practices to each category of electrical use projected by the region's utilities for the year 2005 to determine what percentage of average consumption and peak demand for those uses could be saved through increased efficiency.

It is important to stress that the Council's analysis looks at what could happen if all cost-effective electrical efficiency improvements were fully implemented. The Council's analysis does not attempt to predict what level of implementation will be in fact realized. The Council felt it was important to identify this "technical potential" rather than attempting to predict in advance how vigorously that potential would be pursued, because the question of how quickly resources are devoted to implementation is precisely the issue before regional decision makers today. It is equally important to note, however, that there are many conservative assumptions built into the Council's estimates. (These conservatisms are more fully explained in Appendix 1):

- The Council's "commercially available savings" estimate does not take into account significant improvements in efficiency technology occurring during the study period. *Only technologies on the market as of Spring 1987 are included.* Electricity efficiency technology is progressing rapidly and such

If all cost-effective efficiency improvements were fully implemented, New England could be using 35% to 57% less electricity in the year 2005 than the utilities currently predict, even with robust economic growth.

progress during the forecast period is likely to continue, particularly as markets for such products expand;

- The Council's "commercially available savings" estimate does not take into account future reductions in the cost of the technologies utilized; as markets and hence production increase, the cost of efficiency measures is likely to drop;

- The Council's "commercially available savings" estimate excludes potential energy and peak demand reductions possible with cost-effective fuel-switching (e. g., installing gas hot water heaters in place of electric hot water heaters where natural gas service exists) and with well-documented potential improvements in transmission and distribution efficiency;

- Both "commercially available savings" and "potential savings" estimates generally excluded efficiency measures that might be economically competitive if included in buildings being built today but not economic if retrofitted into existing buildings. Yet, as noted above, a substantial percentage of New England's projected load growth results from new buildings; and

- The Council's "commercially available savings" estimate assumes relatively high efficiencies for existing industrial equipment (despite the almost complete absence of data to support such high-efficiency assumptions), and does not consider some possible substantial improvements in industrial drive train and industrial process efficiency.

B. Results

As shown in Appendix 1, and summarized in figure 3 the results of the Council's analysis are striking. They show that, *if all cost-effective efficiency improvements were fully implemented, New England could be using 35% to 57% less electricity in the year 2005 than the utilities currently predict, even with robust economic growth.*

The study results (Appendix 1, Table E) also reveal that the amount of "peak" generating capacity required to service year 2005 demand would, at full efficiency, be less than capacity required today, *even in the absence of additional load management measures targeted at reducing peak demand.* Such measures, discussed in Appendix 2, would reduce peak demand by an even greater amount.

Just as importantly, as figure 4 shows, *power supplied through installation of high-efficiency equipment generally costs on average between one quarter and one half the price of power supplied from new power plants.* That is, the efficiency "power plant" is substantially less expensive than the output of a conventional generating facility.

While these conclusions may appear surprising at first glance, they are in line with the conclusions of many utilities and independent studies elsewhere in the nation:

- At least three electric utilities in the nation — Tampa Electric, Public Service Electric & Gas Co. (N. J.), and Sacramento (Ca.) Municipal Utility District — expect utility-sponsored electrical efficiency improvements to reduce their load growth within the next decade by approximately 50%. A fourth utility, Florida Power & Light, anticipates savings of approximately 40%[18].

- A recent independent analysis commissioned by the Boston Edison Company found that sufficient cost-effective electrical efficiency improvements were available to allow the utility to "eliminate all load growth through the end of this century." The analysis demonstrated that, in the commercial lighting sector alone, efficiency improvements could save approximately 71%–85% of present electrical consumption at a fraction of the cost of new power generation.[19]

- A 1987 study conducted by the federally sponsored Lawrence Berkeley Laboratory analyzed potential electricity efficiency improvements in 70% of residential uses in Michigan and found savings of 61% of total sector usage technically achievable by the year 2005.[20]

- In 1983, the Pacific Northwest's utilities deferred all new large central generating facilities indefinitely, relying in large part upon a system-wide analysis showing approximately 5150 MW of efficiency gains achiev-

Power supplied through installation of high-efficiency equipment generally costs from one quarter to one half the price of power supplied from new power plants.

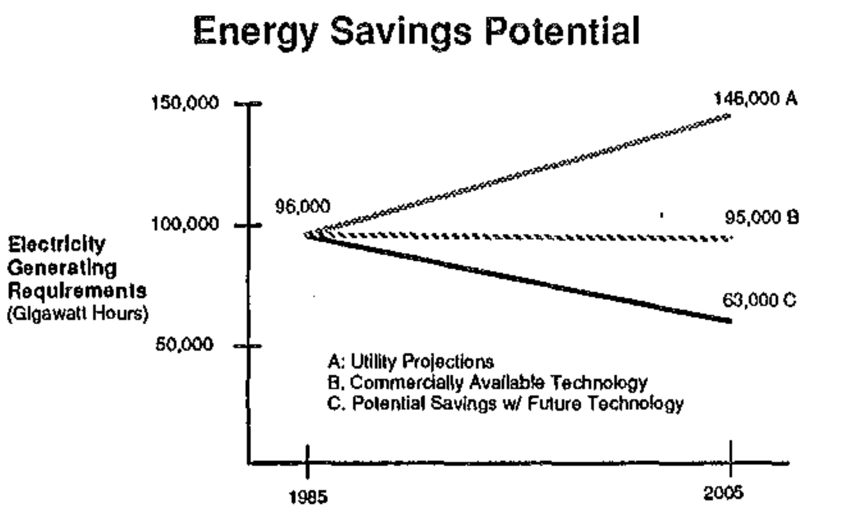


Figure 3: New England Electricity Generation Requirements 1985-2005: Utility Projections vs. Increased Use of Efficient Technologies.

Source: New England Utilities; New England Energy Policy Council.

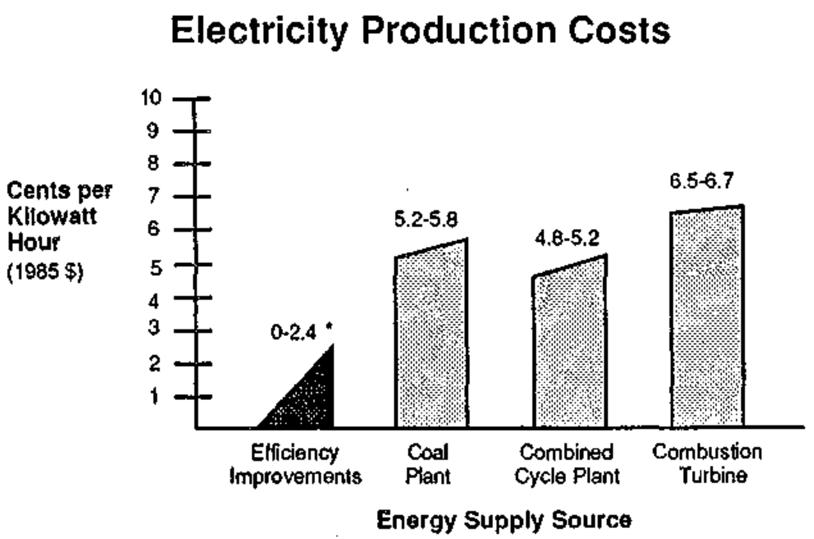


Figure 4: Comparison of costs of energy from efficiency programs vs. new plants.

Source: Energy Systems Research Group; California Energy Commission; New England Energy Policy Council.

able over the next twenty years, at an average cost of 1. 8 cents per kilowatt hour.[21]

Obviously, however, even if only a fraction of the Council's estimate of efficiency potential were achieved by the region's utilities, the implications for New England's economy and environment are enormous. ❑

*With the exception of motors, commercial ventilation, clothes dryers, and home air conditioners. (3.4-4.7 ¢ per kilowatt hour)

Lacking the time, staff or resources to fully investigate the market for electrical efficiency options, electricity customers have left many cost-effective opportunities untapped.

VI. Obstacles to Increasing Electrical Efficiency

As noted, this report estimates the technical potential for electrical efficiency improvements in New England. It does not tell us what will happen, but what could happen if all cost-effective efficiency gains were tapped.

In fact, if "business as usual" prevails, little of the identified potential will be realized. Despite the New England Governors' Conference's call for accelerated efficiency investment, New England's utilities currently project that only 1,066 MW of load will be saved through efficiency improvements by the year 2,000, less than 5% of the otherwise prevailing peak demand.[22]

Although this assumption may be unduly pessimistic, it is fair to ask: If the identified efficiency improvements are so cost-effective, why aren't individual electrical customers currently making such investments on a scale sufficient to eliminate New England's electric growth? Just as importantly, why are the region's utilities not sponsoring all of the available potential improvements?

Recent research and common sense suggest several reasons. These reasons fall into four broad categories:

- *Lack of information.* Consumers in all sectors and the utilities themselves lack information about the availability, cost and reliability of many efficiency measures, many of which are very new to the market; consumers and utilities also lack information about the efficiency of existing electrical uses, thus making it hard to evaluate the potential gains;

- *Lack of direct benefits or control.* Consumers are often unable to capture the full economic benefits of efficiency measures, either because they occupy rental property (in which case efficiency improvements may accrue to the landlord) or because they pay only the average cost of electricity, not the cost of producing electricity from new, more expensive plants;

- *Lack of financing.* Consumers require much shorter paybacks than do the utilities for electricity-saving investments, and consequently will not spend their limited capital on such improvements;

- *Lack of strong utility action.* While many utility managers recognize the value of investments in electrical efficiency, utilities have traditionally spent no more than a small fraction of their resources on tapping efficiency gains.

A. Lack of Information

For the most part, electrical efficiency improvement technologies of the kind described in this report are relatively new. A combination of post-1973 increases in energy costs and developments in electronics and advanced materials have only recently made them possible and desirable, leading to a rapid and dizzying explosion in the market.[23]

Consequently, as with any new product (personal computers in the mid-1970's come to mind), even sophisticated business consumers lack all the necessary information about product reliability, availability and compatibility with their business needs. Recent analyses commissioned by Northeast Utilities and the Boston Edison Company concluded that many business customers "evinced a certain bewilderment at the array of choices now being touted by vendors and the trade press" and express concern about the reliability of efficiency technologies and their purveyors.[24] To take a simple example, few nonspecialists in New England have even heard of such straightforward energy efficiency technologies as compact fluorescent light bulbs, even though such bulbs are mass-produced in Europe and have received mass distribution in some United States utility territories.

Even where high-efficiency product information is readily available, prospective purchasers such as commercial landlords are skeptical of claims that high-efficiency fixtures will not degrade the quality of a particular office environment.[25] Nor does there exist a uniform industry-wide quality certification mechanism for efficiency technologies. Lacking the time, staff or resources to fully investigate the market for electrical efficiency options — especially where electricity costs are but a fraction of the business and household budget — electricity customers have left many cost-effective opportunities untapped.

Another information gap hobbling

The obstacles suggest that the one player with the requisite resources and incentives — the utilities themselves — should be purchasing all cost-effective efficiency improvements.

efficiency gains is the region's lack of knowledge about existing efficiencies. It is not surprising, for example, to find recently that a large industrial electricity user — a Maine paper mill — had never measured the embedded efficiencies of its existing motors, even though motors accounted for virtually all of its electric demand.[26] Without such crucial "baseline" information, it is difficult for utilities and customers to clearly perceive the true gains that would result from installing electrical efficiency technologies, or to target programs to areas of greatest potential.

B. Lack of Direct Benefits and Control

Even where adequate information is available, incentives to adopt efficiency technology are often split between the potentially benefitting parties. The simplest version of this problem appears in leased commercial and residential buildings, where landlords have little incentive to reduce electrical consumption if tenants are entirely responsible for electric bills, and tenants are reluctant to make large capital improvements in leased space. In a variation of this theme, commercial leases often include a fixed pass-through of electrical costs calculated by square foot; reductions of this fixed fee involve time-consuming and complicated lease negotiations.[27] Not surprisingly, utility-sponsored efficiency improvement programs that require customer contributions have often made little headway in leased buildings.[28]

Another kind of split incentive is inherent between a single utility customer, and the utility, representing all utility customers. Generally speaking, a utility customer pays only the cost of electricity from the utility's existing mix of plants (the "average cost"). But utility customers as a whole benefit from any efficiency investment that provides energy or capacity at less than the higher cost of a new power plant ("marginal cost"). Accordingly, many efficiency purchases that are cost-effective from the utility's standpoint are foregone by individual utility customers who do not bear the full brunt of their decision.

Put another way, an individual's calculation to forego electricity efficiency investments, while perhaps rational for that individual, is disastrous for New England as a whole because it contributes to the need for expensive and risky new power plants.

C. Lack of Financing

Most utility customers do not have an unlimited pool of money to invest in electrical efficiency improvements. Moreover, in all but a few businesses, electricity is a minor component of overall costs. Consequently, very few businesses believe that they can justify spending money on electrical efficiency improvements that do not pay for themselves in less than two to three years, especially in a volatile business and regulatory climate.[29] For homeowners, particularly the poor, paybacks must be almost immediate.

By contrast, the utilities, with larger pools of capital and regulated rates of return, operate in an environment which permits significantly longer paybacks, particularly for long-term capacity investments. Consequently, many efficiency investments are foregone by individual capital-constrained customers even though they are attractive to the utility and its customers as whole as a means of staving off the need for costly new power plants. As noted below, this suggests that utility funding of efficiency improvements — or buying a surrogate "power plant" at the point of end use — is attractive, producing benefits for both parties to the agreement.

D. Lack of Strong Utility Action

Each of the above three obstacles (informational constraints, split incentives, capital constraints) suggests that the one player with the requisite resources and incentives — the utilities themselves — should be purchasing all cost-effective efficiency improvements. And in fact, many of New England's utilities have begun to do so.

Programs in hot water heater load reduction, rebates for selected energy efficient equipment, and "shared savings" have resulted in national recognition for such companies as the New England Electric System, Central Maine Power Company, and Northeast Utilities. Many of New England's utility commissions and state energy planning agencies have given strong support and encouragement to these efforts.

Despite these laudable innovations, however, the evidence suggests that efficiency improvements are not even close to receiving their full consideration as a competitive supply resource in utility planning.

First, as mentioned previously, New England's utilities are currently

The financial priorities of New England's utilities are still devoted almost entirely to new power production rather than efficiency.

planning for electrical efficiency improvements yielding less than a 5% reduction of otherwise prevailing year 2000 electrical demand. This is well below the potential described in this report, and in the estimates of other utilities and national studies cited.

Second, it is clear that the financial priorities of New England's utilities are still devoted almost entirely to new power production rather than efficiency. In recent years, for example, the three New England utilities recognized as regional leaders in efficiency improvements — Central Maine Power, New England Electric System, and Connecticut Light and Power — *had conservation and load management budgets which represented a small fraction of the amount they spent on construction of generating and transmission facilities.*[30]

This resource imbalance continues. For example, over the next two decades, Northeast Utilities, New England's largest utility, plans to spend thirty times more on power purchases than on demand side management even though the utility concedes that its planned efficiency measures are twenty times cheaper than equivalent power purchases.[31] While traditional power supply options no doubt have a place in the region's future energy mix, the need for greater balance is manifest.

Third, most of the utility-sponsored efficiency programs in place in New England are very limited in scope or only at a pilot stage.

For example,

- The bulk of these programs consist of providing efficiency information, "energy audits," and very limited hardware investments such as hot water heater wraps and weatherstripping.
- Barely half of the region's major utilities have even pilot programs to help customers purchase high-efficiency equipment, and these programs are almost exclusively confined to limited categories of hardware rather than to all cost-effective equipment.
- Likewise, only three of the region's twelve major utilities have programs addressing electrical efficiency in new construction (and none of those programs actually provide direct subsidies to builders or homeowners for more efficient construction techniques).
- Finally, no utility in the region has fully implemented the type of comprehensive energy retrofit program described in Section VII below which is designed to elicit and fund all cost-effective efficiency improvements in the residential, commercial and industrial sectors.[32]

In short, despite many excellent "first generation" programs in place throughout the region, the region's utilities have not developed advanced programs designed to address all end uses, utilizing all cost-effective measures.

While such a program may seem

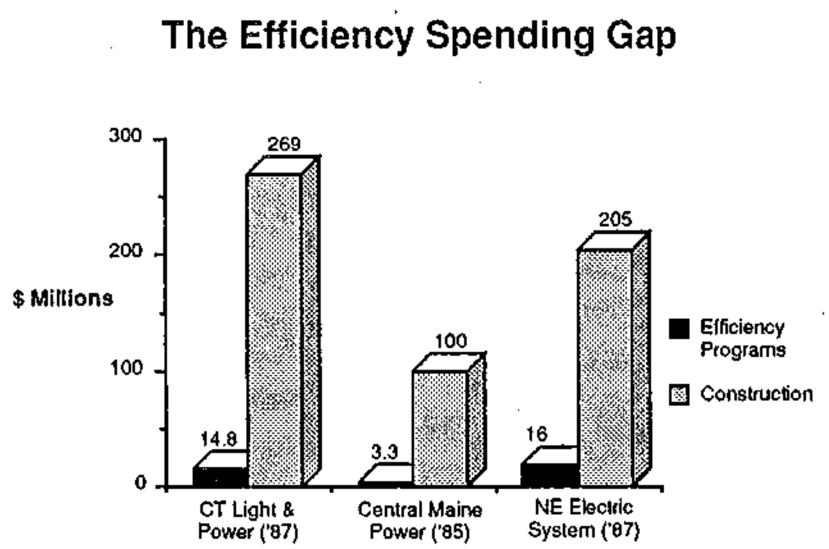


Figure 5: Expenditures in $ millions of three major New England utilities on construction and electrical efficiency improvements.

Sources: Northeast Utilities; Central Maine Power; NEES; Moody's 1986 Public Utility Manual; Investor Responsibility Research Center.

The obstacles to full electrical efficiency run deep. So must the policies designed to eliminate those obstacles.

quite ambitious, the nation already has several examples of electrical efficiency programs that have achieved very broad implementation:

- The Hood River (Oregon) Conservation Project, sponsored by the Pacific Power & Light Company and the Bonneville Power Administration, succeeded in modifying 95% of all electrically heated homes with increased insulation and other weatherization measures; nearly all of these retrofits entailed major construction work.[33]

- An air conditioner rebate program in Austin, Texas has achieved a new-house penetration rate of 90 per cent.[34]

- Arkansas Power & Light Company has placed half of its irrigation customers and 40% of its residential customers on load management switches.[35]

Other examples of similarly successful electric efficiency programs are discussed in Appendix 2 to this report.

In sum, the limits to realization of the efficiency gains identified in this report are not technical, but institutional. Money and managerial attention, if marshalled properly, can ensure that New England becomes as proficient at supplying electrical efficiency as it has traditionally been at generating power. ❑

VII. An Action Plan for New England

As suggested above, the obstacles to full electrical efficiency run deep. So must the policies designed to eliminate those obstacles. Attacking informational gaps, clarifying proper economic signals, and mobilizing utility capital are not easy tasks. Accomplishing them will require utility and governmental action, coordinated on a regional basis.

Because the task is so large, but the need is so pressing, the New England Energy Policy Council believes that a phased approach to implementing electrical efficiency is desirable.

The Council's policy recommendations, set forth below and in detail in Appendix 2, entail both short-and long-term actions. The short-term actions, which could be implemented within the coming year, are designed to capitalize on the utilities' existing capital resources, incentives, and marketing infrastructure to "prime the pump" for efficiency investments. The longer-term actions, which could be implemented over the next five years, focus on developing a market environment, information base, and regional planning context to ensure that New England achieves the most electrical efficiency possible in the decades to come.

A. Short-Term Actions: Pump-Priming By The Utilities

Much has been written about the desirability of allowing electrical efficiency technology simply to compete on its own strengths in the open market place with electricity itself, rather than having utilities plan for increased efficiency investments on behalf of their customers. Many utilities have argued, with some justification, that their expertise is in producing and distributing kilowatt hours, and that it is a tall order to expect them to reorient their business toward delivering electrical services (that is, light, heat, motor drive) with the fewest possible kilowatt hours. Better, some say, to leave it all to the "free market."

However, as we have seen, numerous obstacles stand in the way of a completely free and efficient market for electricity savings: lack of readily accessible information; the inability of customers to reap the full value of their efficiency investments; and the shorter paybacks required by end-use customers. As a result, large energy efficiency potential is going untapped and in some cases lost forever (new residential and commercial construction, for example).

The region's utilities have the capital and the obvious incentive to achieve very large efficiency gains in their customers' use of electrical services over the next several years. By taking a far more active role in efficiency improvements than is presently the case, the utilities can buy valuable time for the region, nurture markets for efficiency technology, and defer the need for new generating capacity until a fuller transition to market-based efficiency can take place.

Several specific actions should be taken within the next year to ensure that the region's utilities play this role:

New England's energy policymakers should require utilities to adopt a program to design and fund all cost-effective efficiency measures at the user end.

1. Comprehensive End-Use Efficiency Design.

As noted previously, New England utilities' traditional focus on simply providing audits and limited rebates for specific hardware measures will be of limited effectiveness. Most customers lack the knowledge, interest, or real incentive to pursue these savings.

Therefore, *New England's energy policymakers should require utilities to adopt a program to design and fund all cost-effective efficiency measures at the user end.* Each utility would employ "design teams" that would go into businesses and residences to determine the full package of measures which beats the utility's marginal cost of supplying power over a period comparable to the life of the measures. The utility would be required to draw from up-to-date measures whose cost and performance had been certified by a special engineering division or affiliate of the company; ultimately, this task could be assumed by a regional entity (see recommendation 7 below). The utility would then be required to install the measures and fund them.

In a study commissioned by the Boston Edison Company, Putnam, Hayes & Bartlett analyzed a number of options, and recommended such a program to the utility (see Appendix 4). Such a program could initially focus on the utility's largest commercial and industrial customers. Boston Edison has recently responded by beginning to develop such a program, offering to pay all the costs of efficiency designs and up to half the cost of their implementation.

2. Customized Rebates

For those customers not readily reached by the comprehensive design program, utilities should be required to provide funding to reimburse customers for their purchase of efficiency measures. Rebates would be made per kw or kwh of demonstrated savings, with the maximum rebate amount equivalent to the present value of the savings.

Item: Pacific Gas & Electric Company reports that in one year alone its customized rebate program elicited new savings of 350 million kwh — enough to supply over 50,000 New England homes.[36]

3. Targeted Mass Retrofits

While in general it is preferable to install efficiency measures as part of a comprehensive site analysis, many measures (e. g. low flow showerheads, compact fluorescent light bulbs, residential weatherization) are so cost-effective and easy to install that utilities should be required to distribute or install them for nominal cost on a mass basis.

4. Programs to Increase the Efficiency of New Construction

As noted above, a large portion of growth in electricity sales and peak demand over the next 15 years can be accounted for by sales to new buildings and facilities. *New England's energy decisionmakers should require utilities to help implement full efficiency in new construction*, including:

- *Hook-up fees and incentives.* Utilities should pay developers or home purchasers an incentive for incorporating high-efficiency design into new construction, and, conversely, assess the developer or owner a fee for inefficient design that reflects the increased cost which the utility incurs to service that unnecessary demand;
- *Efficiency design assistance.* Utilities should make available to developers at nominal cost expertise on high-efficiency building design and fixtures.

Item: The Bonneville Power Administration has instituted a project in which developers are paid the added design and construction costs of making new commercial buildings at least 30% more electrically efficient than required by a model regional building code.[37]

5. Load Management Initiatives

Approximately 10% of New England's total electrical generating capacity is needed simply to meet dramatic leaps in demand during a few afternoon hours on a handful of days of the year (typically in January and August).[38] Rather than building expensive new capacity to meet these infrequent demand "spikes," *New England regulators should require utilities to develop programs which will enable and encourage customers to scale back their electrical demand during these few crucial hours*, including:

Many of the Council's proposals can be adopted quickly without significant change to the utility or regulatory structure.

ommends that all utilities should be required to prepare, for periodic regulatory review, integrated least-cost electrical service plans which identify the costs, risks, and environmental impacts of various options available to meet projected need.

9. Auctions for Efficiency Improvements

To encourage the ultimate development of a truly competitive market for electrical efficiency, the region's utilities should develop an auction process. As in the current system for buying power from independent power producers in Maine and Massachusetts, each utility would be required to determine a supply decrement and develop a request to solicit bids to fill this decrement with efficiency measures. Ultimately, the auction could be expanded to include bids for power supply as well as for efficiency improvements, thus forcing small power and utility-built plants to compete directly against efficiency measures.

10. More Energy-Efficient Building Codes

As noted above, increasing the electrical efficiency of new construction is a regional imperative. While incentives and hook-up fees may encourage such efficiency, New England would benefit greatly from establishing a legal "floor" for the efficiency of new construction in building codes. Despite some recent revisions, no state building code in New England fully captures cost-effective efficiency levels. A regionwide model code should be prepared for adoption by each state.

C. Longer-Term Actions: Regional Least-Cost Efficiency Markets And Coordination

New England's electricity generation and distribution system is more tightly integrated than perhaps anywhere else in the nation: essentially, all power in the region is dispatched interchangeably, as if by a single utility. Consequently, when cost-effective efficiency investments go untapped in one utility's territory, the customers of other utilities suffer through a higher-cost regional power mix and the necessity of maintaining an additional, higher regional "reserve margin."[40]

Just as the region's policy makers should implement policies to ensure that market distortions do not prevent adoption of cost-effective efficiency improvements within individual utility territories, so also policies should be implemented to ensure that the New England region as a whole does not miss out on cost-effective improvements. These policies include:

11. Creating a Free Market in Regional Electricity Services

To ensure that the region as a whole taps maximum efficiency opportunity, several remedies must be applied to existing regional market distortions:

- The region's utilities must eliminate disincentives to efficiency contained in the New England Power Pool (NEPOOL) contract;
- The region's utilities should work toward wholesale price contracts which more closely reflect the market value of power;
- In evaluating the cost-effectiveness of efficiency investment, the region's utilities should take into account the market value of "capacity" saved by efficiency improvements which can be sold to other utilities in the region.
- Mechanisms should be established to allow New England's utilities to jointly fund efficiency initiatives and share in the savings, just as is currently the case with new power plants.

12. Regional Power Planning Coordination

A mechanism must be created that allows the New England region to obtain better control over its long-term electricity future. There must be a regional forum to conduct ongoing, publicly accountable power planning.

These proposals do not exhaust the policy options that would help realize the efficiency potential described in this report. They are an important start, however, and many of them can be adopted quickly without significant change to the utility or regulatory structure. ❑

To avoid any possible energy shortfalls in the next two years, the Council's load management proposals should be adopted immediately.

- Rate structures which discourage electrical use during peak demand hours, including rates which reward customers for curtailing consumption upon notice by the utility;
- Utility funding of load management measures such as equipment that allows office buildings to chill water at night for cooling use during peak summer days, and direct utility control of end-uses such as hot water heating;

Item: A report recently prepared for the Washington Electric Cooperative (VT) found that the utility could shave its peak load by over 20% through the installation of refrigerator, water heater, lighting, electric space heating and school lighting and heating load management measures.[39]

- The formation of large commercial and industrial customers into "load shedding cooperatives" which can collectively reduce their peak electric demand, while sharing such reductions among each cooperative member in an economically optimal fashion.

If the region's utilities are correct in their recent claims that New England's current capacity will soon be insufficient to meet peak load, it is all the more imperative that these measures be adopted immediately.

6. Regulatory Treatment of Efficiency Investments

The region's utility commissions should implement generic approaches to further encourage the region's utilities to undertake efficiency investments. These include:

- Allowing utilities to place capital investments in end-use efficiency into the rate base as if they were investments in an equivalent generating plant;
- Establishing minimum efficiency investment targets for each utility, such as the funding of all measures which, on a life-cycle basis, cost less than equivalent generating capacity.
- Adjusting a utility's allowable rate of return to reflect its degree of progress in developing a truly least-cost energy supply plan.

B. Longer-Term Actions: Improving Planning And The Market

To get the maximum cost-effective electrical efficiency improvements in place, utilities and consumers must develop the requisite information, and experience the requisite incentives, to undertake these improvements. Creating the proper balance of planning and a correct market environment for efficiency will take more than simply utility action, including:

7. Development of a New England Energy Laboratory

As noted above, much of customers' — and utilities' — slow pace in adopting efficiency measures stems from lack of information about the availability of various technologies, concerns about their reliability, and an incomplete understanding of the efficiency of existing end-uses, particularly in New England industry.

To rectify this gap, the New England states should establish and fund a New England Energy Laboratory. With a full-time staff advised by experts from the utilities, the electrical manufacturing industry, universities, and independent research institutes, the New England Energy Laboratory would:

- Test and certify the reliability and savings yield of available electrical efficiency improvement technology, and make the results available to both the public and the utilities for use in planning comprehensive efficiency designs (item 1 above);
- Undertake studies of existing electrical efficiency in various end-use sectors in New England; and
- Work with New England universities to develop research and development programs for electricity improvement technology and curricula for the training of electrical engineers specializing in end-use energy efficiency.

8. Integrated Least-Cost Planning

The New England Governors' Conference in their December 1986 *Final Report* called for utility planning to ensure that the region's utilities tap the cheapest supply sources — including efficiency improvements — first. To implement this idea, the New England Energy Policy Council rec-

Improving electrical efficiency would enhance our competitiveness and economic stability, accelerate job creation, and improve environmental quality.

VIII. Regional Benefits of Maximizing Electrical Efficiency

Meeting New England's future electrical service needs through increased efficiency rather than through another round of new plant construction is a strategy with enormous benefits for the region. Such an approach would enhance our competitiveness and economic stability, accelerate job creation, and improve environmental quality.

A. Enhanced Competitiveness and Economic Stability

New England uses approximately 40% more electricity per capita than Japan, and 20% more per capita than West Germany.[41] Increasing our electrical efficiency has obvious implications for our international competitiveness.

From a domestic standpoint, meeting New England's electricity needs through efficiency improvements could reduce long-run utility expenditures for new power supply, and hence electricity costs, by a substantial amount in the coming decades. For a region which already suffers some of the highest electric rates in the nation, this is not an insignificant factor in its future attractiveness to business and industry.

A light industrial manufacturer deciding whether to locate a production facility in New England or the Midwest or South, for example, currently faces *electric rates in New England which are substantially higher than in those other locations.*[42] *This differential would widen greatly if New England were to embark on a new round of costly plant construction.* The last such construction binge in New England helped contribute to the doubling of the region's average rates between 1974 and 1985, and left substantial capital wasted on plants that were abandoned due to collapse in demand growth.[43] The huge rate volatility which attends large construction programs harms the competitiveness of existing New England business and will discourage new electrically intensive businesses from locating in the region.

By contrast, an efficiency improvement strategy would lower costs and increase the predictability and stability of rates in New England. Unlike conventional power plants, efficiency improvements need not be purchased in huge, indivisible "chunks," but can rather be purchased in kilowatt increments. This means that the region need not commit itself to enormous, long lead time capital investments subject to radical swings in demand, interest rates, construction costs, regulatory requirements, and other factors that inflate costs and may ultimately lead to plant abandonment.

Put another way, efficiency investments would allow New England to manage and control power demand rather than passively responding to it, where there is a risk and high probability of guessing wrong. When tens of billions of ratepayer dollars are at stake, this is the kind of control which is vital to the health of New England's economy.[44]

B. Job Creation

In addition to ensuring lower rates and rate stability, an aggressive efficiency improvement program could, according to a recent federal study, be expected to result in *up to four times as many stable, high-quality jobs in New England as would an alternative strategy of massive plant construction.*[45] As the study explains:

> The literature generally concludes that expenditures on conservation generate more regional employment opportunities than expenditures of the same size on power plant construction and operation. There are several contributing reasons for this. First, conservation programs tend to be more labor-intensive than construction programs. Second, conservation programs are less dependent on imports from other regions than is the construction of power plants.[46]

In addition to these direct job impacts, the efficiency improvement strategy also increases jobs by freeing up for investment and expenditure the precious capital resources that would otherwise be spent on less economically productive construction projects.[47] In other words, *dollars saved on plant construction can be retained in the region to stimulate growth.*

Jobs associated with efficiency improvements have several other advantages over those associated with plant construction:[48]

- The incremental and flexible

This report sets forth a path for New England's electricity future — one which is less costly, less risky, and less environmentally intrusive than the alternatives.

nature of efficiency improvement investments allows for close matching of programs and employment cycles;

- Efficiency improvements do not demand rare labor skills requiring extended training, and thus a larger fraction of jobs can be captured by local labor;
- Efficiency improvement projects are geographically dispersed and decentralized, thus avoiding the socially disruptive "boom town" phenomenon associated with large construction projects.

Policy makers should also note that there is a very particular economic advantage which a program of electrical efficiency improvements would offer New England: the potential reinvigoration and enhancement of the region's electrical equipment and high-technology sector. While major New England electrical manufacturers such as General Electric suffer from downturns in turbine and transformer orders, a major push for efficiency such as is suggested in this report would create enormous demand for other electrical products such as high-efficiency lighting equipment, motors, heating equipment, etc. Similarly, accelerated electrical efficiency investment (much of the best of which involves the use of computer-aided controls) could benefit New England's high-technology computer and electronics industry, providing an important buffer against any future downturn in the regional economy.

In short, there is abundant evidence that the program of efficiency improvements described in this report would put the region's labor, as well as capital, resources to their most productive use.

C. Environmental Benefits

New England's quality of life — as well as its ever-growing tourism industry — demands that our natural resources not be sacrificed unnecessarily. As noted above in Section II., virtually every form of electricity generation — oil, coal, wood, nuclear, hydroelectric, wind — requires some trade-off of our air, water, or scenic resources. Efficiency improvements entail no such sacrifices.[49]

New Englanders will resist the siting of major new generating and transmission facilities until it can be demonstrated that all cost-effective efficiency opportunities have been exhausted. Accordingly, the measures and policy initiatives discussed in this report could spare the region a new wave of acrimony and polarization that would no doubt result from the pursuit of less environmentally benign energy options. From an environmental standpoint, then, aggressive efficiency improvements are the only energy source about which it can be truly said: New England has everything to gain, and nothing to lose. ❑

IX. Conclusion

This report sets forth one path for New England's electricity future — one which the New England Energy Policy Council believes is less costly, less risky, and less environmentally intrusive than any other alternative.

An extraordinary convergence of events has focussed our region's attention on the key issues in our electricity future. Now is the time to act on the efficiency strategy laid out in this report. If we do so, there is every reason to be optimistic about the future competitiveness and quality of life of New England. ❑

Footnotes

1. New England Governors' Conference Inc., *A Plan for Meeting New England's Electricity Needs:* Final Report of the New England Governors' Conference, Inc.'s Assessment of New England's Electricity Situation (December 1986) ["Governors' Report"].
2. *Governors' Report, id.* note 1 at 55.
3. Electric Council of New England, *Electric Utility Industry in New England: Statistical Bulletin 1985* (1986) at 1, 13 ["ECNE Bulletin"]. In 1985, the average New England electricity customer paid 8.24 cents per kilowatt hour, or over 25% more than the national average. Edison Electric Institute, *Statistical Yearbook of the Electric Utility Industry* (1986) at 74 ["*EEI Statistical Year Book*"]. Only four states in the nation — Alaska, New Jersey, New York and Hawaii — had higher average rates than New England as a whole. *Id.* Connecticut boasted the second highest average rate in the country, after Hawaii. *Id.*
4. *ECNE Bulletin, id.* note 3 at p. 16. Cancelled baseload plants include Pilgrim 2 (Massachusetts), Montague 1 and 2 (Massachusetts), Charlestown 1 and 2 (Rhode Island), Seabrook 2 (New Hampshire), and Richmond 1 and 2 (Maine).
5. Office of Technology Assessment, *Acid Rain and Transported Air Pollutants: Implications for Public Policy* at 150-51 (June 1984).
6. The U.S. Department of Energy estimates that every 800 – 1000 MW commercial nuclear reactor utilizes 110 – 115 metric tons of nuclear fuel annually, a third of which is removed annually. Energy Information Administration, Department of Energy, *Commercial Nuclear Power: Prospects for the U.S. and the World,* Publication No. 0438 (1985). Currently, New England has approximately 5500 MW of installed nuclear generating capacity. NEPOOL, 1986 Annual Report at 5. A conservative calculation thus suggests annual waste of 200 –250 metric tons.
7. California Air Resources Board, *Air Pollution Control at Resource Recovery Facilities* at 74;215 (May 24, 1984).
8. *Governors' Report, id.* note 1 at 10; see also *id.* at 45-46.
9. See text of this report at Section VI.D.
10. Annual 1986 kilowatt consumption figure is from New England Power Pool, 1986 *Annual Report* at 6. Annual peak figure is taken from projected 1987 August peak in New England Power Pool, *NEPOOL Forecast Report of Capacity, Energy, Loads and Transmission 1987 – 2002* (April 1, 1987) at 1.
11. *Governors' Report, id.* note 1 at 18, based on 1986 NEPOOL figures.
12. The region's utilities have historically predicted far more electric load growth than has actually occurred. In the late 1970's, for example, the New England Power Pool (a consortium of most of the region's electric utilities) predicted that New England would experience a peak demand of 21,502 MW in 1985. NEPOOL, *Report of the NEPOOL Load Forecasting Task Force on the NEPOOL Model-Based Forecast of New England Electric Energy and Peak Load 1979 – 1989* (March 1, 1979). Actual consumption in that year was only 17,401 MW. ECNE Bulletin, *id.* note 3 at 11. Thus, the utilities overestimated demand by 23%.
13. See NEES Energy, Inc., *Lighting Study: University of Rhode Island* (July 1986). While this project did result in the reduction of some lighting levels, these reductions were reported to have met with the approval of the university community. See note 16 below at VI-4.
14. For example, a recent lighting retrofit by the State of Connecticut, utilizing electronic ballasts and high-efficiency fixtures, saved 77% of lighting power, with the measures paying for themselves in under two and half years. Energy User News, May 27, 1985 at p. 1, 7.
15. The Whirlpool ET17HK1M uses approximately 744 kwh/yr of electricity. Howard Geller, *et al., Acid Rain and Electricity Conservation* (Draft) at p. 3-40, note 17 (American Council for an Energy Efficient Economy, Washington, D.C. April, 1987). By contrast, New England's utilities estimate that the average residential refrigerator in the region consumes 1203 kwh/yr. See Table D–2 of Appendix 1 to this report.
16. Putnam, Hayes & Bartlett, Boston Edison Review Panel: *Final Report,* "Supporting Documents on Conservation and Load Management" at VI-21-23 (March 1987) ["BECO Report"]. The report estimated that Boston Edison Company could save as much as

200 MW through such controls. *Id.* at VI-22. Boston Edison's current peak load is approximately 2500 MW.

17. Commonwealth of Massachusetts, Executive Office of Administration and Finance, *Managing Massachusetts Government: Progress to Date*, Chapter 1, "Energy Conservation," at p. 10; Personal Communication with John Wetherell, Chief Engineer, State Transportation Building.
18. Investor Responsibility Research Center, *Generating Energy Alternatives: Demand-Side Management and Renewable Energy at America's Electric Utilities* (Washington, D.C. 1987) at 12.
19. Boston Edison Review Panel, *Final Report* (March 1987), Vol. I at S-8, 28.
20. Florentine Krause, personal communication (Lawrence Berkeley Laboratory, Berkeley, CA 1987).
21. Northwest Power Planning Council, *Northwest Conservation and Electric Power Plan* (1986) at 5-12.
22. *Governors' Report, id.* note 1 at p. 19.
23. A recent study performed for the United States Department of Energy by the Battelle Pacific Northwest Laboratory noted that "[o]f the ten energy-saving technologies selected for detailed analysis, several are new enough and radically different enough from existing technologies that their commercial availability is probably not reflected in the [existing DOE] models ... ." R.J. Moe, *et al., The Electric Energy Savings from New Technologies* (January 1986) (Prepared for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830) at p. 2.1. See also *Id.* at 10.2-10.3 (High frequency ballast technology, while known to be more efficient since the 1950's, did not achieve economic feasibility until energy price increases in the early 1970's and the refinement of certain electronic switching devices by the auto industry).
24. *BECo Report*, note 16 at VI-10-11; Temple, Barker & Sloane, *Mid-Program Market Analysis of the Western Massachusetts Electric Company's Performance Contracting Pilot Program* (March, 1987).
25. *BECo Report, id.* note 16 at VI-11.
26. Testimony of Orrin Merrill (paper mill's chief conservation engineer), April 19, 1987, at page 33, *In re Great Northern Nekoosa Corporation Application for Permit for the Proposed Big "A" Hydroelectric Project*, Maine Land Use Regulation Commission Docket No. HP-0005.
27. *BECo Report, id.* note 16 at VI-11.
28. Pre-filed Testimony of Frederick R. Locke, Western Massachusetts Electric Company, Mass. DPU 86-280 (1986), Appendix 3 at p. 6. (Describing finding of third party energy service companies that leased buildings have "little or no potential" for energy savings contracts).
29. *BECo Report, id.* note 16 at VI-11; California Public Utilities Commission, *1984 Energy Conservation Program Summary* (1985) at 6; R. Stobaugh & D. Yergin, *Energy Future* 195-96 (1981). In the Big "A" proceeding, referred to in note 26 above, it was revealed that Great Northern Paper Company had failed to invest in a motor replacement program which its own engineers estimated could save the Company over $2 million annually, with an average payback of 3 months. Exhibit 924, *id.* note 26. The Company simply did not place high priority on expediting the project. Testimony of Orrin Merrill, *id.* note 26, April 19, 1985 at page 70.
30. In 1987, Connecticut Light and Power estimated construction spending for electricity production and distribution facilities at approximately $269 million. See Connecticut Light and Power, Form 10-K (Dec. 1986) at p. 14. For the same year, conservation and load management expenditures were projected at $14.7 million. See Connecticut Light and Power *Energy Alliance Annual Report* (April 1987), p. VI-33, exhibit R. The New England Electric System projects that it will spend $205 million on construction in 1987, NEES 1986 Annual Report at 19, while spending $8.5 million on efficiency improvements, NEES News Release, 1/28/87. In 1985, Central Maine Power spent $3.3 million on conservation and load management. Investor Responsibility Research Center, *Generating Energy Alternatives*, n. 18 at 75. In the same year, CMP spent $100 million on construction, including accrued interest on construction (AFUDC). Central Maine Power Co., *Annual Report* (1986) at p. 23.
31. In its response to Data Request AG-JPC-3, Western Massachusetts Electric Company, Mass. DPU 86-280, Northeast Utilities noted that between 1987 and 2010, it planned to spend an average of $334,071,000 per year to purchase an average of 469 MW of capacity per year from Qualifying Facilities, a

rough (undiscounted) average of $712/kw. During the same period, the Company projects, it will spend an average of $10,110,000 per year on conservation and load management, yielding an average of 269 MW of capacity — for a rough (undiscounted) average of $38/kw.

32. The Boston Edison Company's newly announced "Design Plus" program, however, will begin to explore this concept for the utility's largest commercial and industrial customers. *Boston Globe*, Business Section, p. 2, (June 10, 1987).
33. R. Cavanagh & E. Hirst, "The Nation's Conservation Capital" (Draft)(Natural Resources Defense Council, San Francisco, California)(June 2, 1987) at p. 4-5.
34. Rocky Mountain Institute, "Advanced Electricity-Savings Technologies and the South Texas Project," *Report to the City of Austin Electric Utility Department* (December 31, 1986) at p. 94.
35. *Id.* at p. 118.
36. Pacific Gas Electric Company, *A Report on 1985 Energy Management and Conservation Activities* at p. 7. The current average annual electric use by a home with electric space heat is about 6,726 kwh. New England Electric System, Supplement 3A to *Long-Range Forecast for the Ten Year Period 1987 – 1996* (Vol. 3) at p. 34.
37. Bonneville Power Administration, "The Energy Edge Project: 'A Design Challenge That Pays': Project Description" (October 1986).
38. For example, about 10% of Boston Edison's and Central Maine Power's capacity is needed for 2% of the year. See Boston Edison Company, *Long-Range Forecast of Electric Power Needs and Requirements,* (January 17, 1986), Vol I at p. K-13; Central Maine Power Co., *Conservation and Load Management Update* (April 1987) at Figure 1.
39. Energy Solutions, Inc. (Barre, VT), *Energy Efficiency Supply Options for Washington Electric Cooperative,* Volume I at p. 3 (November 1986).
40. The addition of new large power plants to meet regional demand increases the regional reserve requirement necessary to hedge the risk of the new plant's outrage. For example, New England's newest baseload unit, Millstone III, was responsible for an increase in regional reserve margin of between 2 and 4% — or the equivalent of an additional small coal plant. See Ex. CLF-WTS-12 at 3; Ex. CLF-WTS-35 at 5-9, Western Massachusetts Electric Company, Mass. DPU 85-270.
41. New England in 1986 utilized 101 billion kwh, with a population of 12.66 million. NEPOOL 1986 Annual Report at 6; New England Governor's Conference. In the same year, Japan consumed 677 billion kwh with a population of 121 million, and West Germany consumed 404 billion kwh with a population of 61 million. International Energy Agency, "Quarterly Energy Balances of OECD Countries: Fourth Quarter 1986 and Earlier" (Draft) (1986).
42. *EEI Statistical Yearbook,* note 3 at 74.
43. See note 4.
44. Much of the nation's heavy industry has already learned this lesson. Current trends in the petrochemical, automotive, tire and paper industries reveal a pattern of reduced expenditure on fixed capital and enhanced expenditure on work-flow improvements and increasing the efficiency of existing capital stock. See *New York Times,* D1 (4/20/87).
45. Compare Bonneville Power Administration, *U.S. Dep't. of Energy, Employment Effects of Electric Energy Conservation* at A-3 and A-11 (April 1984) (report prepared by Charles River Associates under Contract No. DE-AC79-83BP39210).
46. *Id.* at 2.
47. *Id.* at 5, A-9, A-10.
48. *Id.* at 6-7.
49. Although concerns have recently surfaced around the impact of increased building insulation on indoor air quality, there is reason to believe that properly designed ventilation and other measures can reduce if not eliminate these impacts. See Ralph Cavanagh, et al., *Comments of the Natural Resources Defense Council on the Bonneville Power Administration's Draft Environmental Impact Statement on New Energy-Efficient Homes Programs: Assessing Indoor Air Quality Options* (May 18, 1987).

Table C-1
Sources of Electricity End-Use Efficiency Data (Commercially Available Technology Case)

End Use	Measure	Savings	Cost (cents/kwh)	Source
Residential				
Refrigerator	*Whirlpool ET17HK1M*	uses 744 kwh/year	1.2	Geller (1987), p. 3-40 note 17, & p. 3-12.
Freezer	*Woods OC50* (chest)	uses 450 kwh/year	0.4	Geller (1987), p. 3-40, note 20.
	Frigidaire UFE16DL (upright) (weighted ave. @ 50/50)	uses 610 kwh/year (530 kwh/year)		Geller (1986a), p. 5.
Cooking	Improvements: increased insulation improved door seals reduced thermal mass new heating element configuration reduced contact resistence (surface) more reflective pans beneath elements	18.6%	2.1	Geller (1987), pp. 3-24 and 3-25
Lighting	**Package of measures:** compact flourescents for incandescents *Phillips/Norelco SL-18* high-pressure sodium for porch & yard security lighting	60%	2.1	Krause (1987),; Geller (1987), p. 3-16 to 3-18; Davis (1987) (fitting problems).
TV	**Best available models:** color tv	uses 150 kwh/year	0.0	Hunn (1986), pp. 253–254.
	b & w tv	uses 25 kwh/year	0.0	Hunn (1986), pp. 255–256
Clothes dryer	moisture sensor model *Sears #26F66811N*	10–15%	4.7	Geller (1987), p. 3–20
Dish washer	models w/no-heat drying cycle *Sears #22F15071N*	33%	0.0	Geller (1987a) Sears (1987), p. 1592
Clothes washer	N/A	0%	N/A	

End Use	Measure	Savings	Cost (cents/kwh)	Source
Water heating	**Package of measures:**	50%	<2.5	Hunn (1986), pp. 89 & 212–220.
	tank wrap & bottom board insulation			*id.*, pp. 213–214, & 222
	anti-convection valves			*id.*, p. 220.
	pipe insulation			*id.*, p. 220.
	low-flow fixtures			*id.*, p. 215.
	front-loading clothes washer *Gibson WS 27M6-P*			*id.*, p. 164. NPPC (1986), V.II pp. 5-29.
	water-efficient dishwasher *Sears #22F15565N*			Hunn (1986), p. 164. NPPC (1986), V.II pp. 5-29.
Room a/c	upgrade to EER of 9.0	24%	4.2	Krause (1987)
Central a/c	upgrade to SEER of 10.0 and reflective window film	34%	4.5	Geller (1987), Table 3.11 & p. 3–22. Krause (1987)
Space heating	envelope improvements (package costing up to $0.02/kwh)	40%	2.0	Krause (1987)
Heating auxiliary	heating load reduction from envelope improvements	30%	<2.5	Krause (1987)

Commercial

End Use	Measure	Savings	Cost (cents/kwh)	Source
Cooling	**Combined savings** (load reduction & improved efficiency)	50% [1]		
	load reduction from: **lighting savings** (about 15% of lighting savings)	30%		
	reflective windows/film (Heat Mirror)			Usibelli (1985), pp. 6-1 & 6-60 to 61.
	Package of measures:	30%	2.0	
	economizers			Usibelli (1985), p. 2-19.
	high-efficiency chillers *Trane Centravac*			*id.*, p. 2-8.
	chiller downsizing			
	chiller capacity modulation *York Turbomodulator*			Usibelli (1985), p. 2-12.
	filter chiller water			
	clean condenser coils			

End Use	Measure	Savings	Cost (cents/kwh)	Source
Ventilation	**combined savings** (load reduction & improved efficiency)	60%[1]		Usibelli (1985), p. 2-74.
	load reduction from lighting savings (15% of lighting savings)	35%		
	package of measures:	40%	4.3	
	high-torque fan belts *Uniroyal High Torque Drive*			RMI (1986d), pp. 23 – 24
	duct/fan cleaning			Usibelli (1985), pp. 2-67.
	high-efficiency motors			*id.*, p. 2-73.
	variable air volume (VAV) conversion			*id.*, p. 2-62 to 2-64.
	cut duct friction			*id.*, p. 2-68.
	tape duct leaks			*id.*, p. 2-67.
	scheduled controller			*id.*, p. 2-70.
	occupancy sensors			*id.*, p. 2-71.
Heating	**net savings** (load increase from lighting savings & improved efficiency)	0%[1]		
	load increase	(20–25%)		
	package of measures:	24.6%	<2.5	Gardiner (1984), pp. D-30ff.
	shell improvements			Mazzuchi (1982)
	O & M improvements			
	advanced glazing *Heat Mirror glass*			
	heat recovery from exhaust air *Gaylord Heat Reclaim Unit*			Mazzuchi (1983)
Lighting	**package of measures:**	70%	<2.0	P,H & B (1987), Table VI-1, pp. VI-5 to 9.
	Davis (1987)			
	high-efficiency bulbs *Phillips–34W Econ-o-Watt Lite White lamps*			Usibelli (1985), p. 5-13.
	electronic dimmable ballasts *XO Industries*			*id.*, pp. 5-5 to 5-6.
	specular imaging reflectors *Maximum Technology "Bright Idea"*			Davis (1987)
	day-light dimming			Usibelli (1985), pp. 5-5, 5-6, 5-28, & 5-29.
Refrigeration	**best available measures (typically):**	50%	<2.0	EPRI (1986a) PG & E (1986) Usibelli (1985), Ch. 3.
	glass doors and strip curtains for display cases			
	multiplex unequal parallel compressors			
	evaporatively cooled condensers			
	hot gas defrost			
	floating head pressure			
	mechanical/ambient subcooling			
	energy management controls			
	dedicated dehumidification			

End Use	Measure	Savings	Cost (cents/kwh)	Source
Water heating	**package of measures:**	40%	<2.5	
	residential measures as appropriate			Hunn (1986), pp. 89 & 212–220.
	flow reduction devices			*id.*, p. 215.
	heat recovery systems			Mazzuchi (1983), p. iii.
Cooking	best available equipment	20%	1.0	RMI (1987), p. 25 RMI (1986d), p. 12–13.
Miscellaneous	package of motor improvements & selective purchase of office equipment	30%	2.0	RMI (1985), pp. 142–143
Industrial				
Motor drive	average savings from high efficiency motors & adjustable speed drives	18.3%	3.4	Geller (1987), pp. 3-3 to 3-7.
Electrolysis	n/a	0%	n/a	
Process heating	**package of measures:**	10%	0.2	
	insulation			RMI (1987), p. 44 Train (1985), at II:304-312.
	control systems			
Lighting	**package of measures (typically):** high pressure sodium for mercury flourescent upgrade (applied to scenario based on Arkansas industrial survey)	32%	2.0	Geller (1987), p. 3-7 to 3-9.
Space heating	**package of measures:** weatherization heat recovery	25%	<2.0	RMI (1985), pp. 144–145
Agriculture				
Dairy farming	**package of measures:** more efficient milk coolers heat pumps for residual water heating lighting improvements fanpower reductions	48%	<2.5	RMI (1985), p. 146–147.

Table C-2
Sources of Electricity End-Use Efficiency Data
(Potentially Available Technology Case)

End Use	Measure	Savings	Cost cents/kwh	Source
Residential				
Refrigerator	Advanced technology	uses 176 kwh/year	3.0	Geller (1986), p. 3-16, 3-9, Table 1.
Freezer	Advanced technology	uses 135 kwh/year	3.0	Geller (1986), p. 3-20, Table 3.
Cooking	**package of measures:** microwave ovens increased insulation improved door seals reduced thermal mass improved oven controls bi-radiant ovens new heating element configuration reduced contact resistance (surface) more reflective pans beneath elements reduced heat capacity elements induction cooktops	50%	<4.7	RMI (1986c), pp. 15 - 17 & 20 - 21. Geller (1986), pp. 7-1 to 7- 16.
Lighting	**package of measures:** compact flourescents for incandescents (advanced lamps) high-pressure sodium for porch & yard security lighting	85%	2.1	Krause (1987) Davis (1987), fitting problems.
TV	best available models: color tv b & w tv	 uses 60 kwh/year uses 25 kwh/year	 0.0 0.0	 RMI (1986c), p. 17. Hunn (1986), pp. 255 - 256
Clothes dryer	heat pump dryer	55%	6.6	Geller (1987), p. 3-21, Table 3.10
Dish washer	Ecotech (water pressure driven)	100%	<3.0	Geller (1986), p. 4-20, Table 3

End Use	Measure	Savings	Cost cents/kwh	Source
Clothes washer	**package of measures:**	55%	1.4 - 3.3	RMI (1986c), p. 14 & 17 - 18.
	improved controllers high-efficiency motors power factor controllers			
Water heating	**package of measures:**	83%		Hunn (1986), p. 89 & 212-220
	tank wrap & bottom board insulation		<2.5	*id.*, p. 213-214
	anti-convection valves pipe insulation low-flow fixtures			
	front-loading clothes washer *Gibson WS 27M6-P*			Hunn (1986), p. 164. NPPC (1986), V.II p. 5-29.
	water-efficient dishwasher *Ecotech*			Hunn (1986), p. 164. NPPC (1986), V.II p. 5-29.
	heat pump water heater solar heaters			
Room a/c	upgrade to EER of 11.5	31%	<5.0	Krause (1987)
Central a/c	**package of measures:**	41%	<5.0	Geller (1987), Table 3.11 & p. 3 - 22.
	reflective windows/films internal gain reductions upgrade to SEER 11.0/downsize			
Space heating	**package of measures:** envelope improvements: retrofit measures up to $0.06/kwh superinsulation advanced glazing heat pump heating systems solar heating systems	80%	<5.0	RMI (1985), p. 139.
Heating auxiliary	load reduction from envelope improvements	30%	<2.5	Krause (1987)
Commercial				
Cooling	**combined savings** (load reduction & improved efficiency)	80%[1]		RMI (1986d), p. 42.
	load reduction from: better lighting efficiency reduced internal gain from motors advanced glazing envelope improvements	50%		

End Use	Measure	Savings	Cost cents/kwh	Source
Cooling	**package of efficiency measures:**	50%	2.0	RMI (1987), p. 33 - 34.
	economizers			Usibelli (1985), p. 2-19.
	high-efficiency chillers			*id.*, p. 2-8.
	chiller downsizing			RMI (1987), p. 28–30.
	chiller capacity modulation			Usibelli (1985), p. 2-12.
	filter chiller water			RMI (1986d), p. 17.
	clean condenser coils			RMI (1986d), p. 16 - 17.
Ventilation	**combined savings** (improved	60%[1]		Usibelli (1985), p.2-74.
	efficiency & load reduction	35%		
	from lighting savings			
	(15% of lighting savings)			
	package of measures:	40%	4.3	RMI (1987), p. 33 - 34.
	high-torque fan belts			RMI (1986d), p. 23 - 24.
	duct/fan cleaning			Usibelli (1985), p. 2-67.
	high-efficiency motors			*id.*, p. 2-73.
	variable air volume (VAV) conversion			*id.*, p. 2-62 to 2-64.
	cut duct friction			*id.*, p. 2-68.
	tape duct leaks			*id.*, p. 2-67.
	scheduled controller			*id.*, p. 2-70.
Heating	**net savings**	25%[1]		
	(load increase from lighting savings & improved efficiency)			
	load increase	(20-25%)		
	package of measures:	50%	<2.5	RMI (1987), p. 31.
	shell improvements			Gardiner (1984), pp. D-30ff.
	O & M improvements			
	advanced glazing			
	heat recovery			
	heat pumps			
Lighting	**package of measures:**	85%	1.2	RMI (1987), p. 23 & 34
	high-efficiency lamps			Davis (1987)
	(advanced lamps)			
	electronic dimmable ballasts			
	XO Industries			
	specular imaging reflectors			
	Maxiumum Technology "Bright Idea"			
	day-light dimming			
	day-lighting			
	improved maintenance (cleaning)			

End Use	Measure	Savings	Cost cents/kwh	Source
Refrigeration	**best available measures:** multiplex unequal parallel compressors evaporatively cooled condensers hot gas defrost floating head pressure mechanical/ambient subcooling energy management controls dedicated dehumidification **gain reduction measures:** flexible air barriers food case enclosures	50%	<2.0	Usibelli (1985), Ch.3 EPRI (1986a) PG&E (1986) RMI (1986c), pp. 9-11
Water heating	**package of measures:** flow reduction measures heat recovery heat pump water heaters standby loss reduction measures	85%	0.1	RMI (1987), p. 24 Mazzucchi (1983)
Cooking	**best available equipment**	30%	1.0	RMI (1987), p. 25 RMI (1986d), p. 12 - 13.
Miscellaneous	package of motor improvements & selective purchase of office equipment	30%	2.0	RMI (1985), p. 142 - 143
Industrial				
Motor drive	**package of drive improvements:** efficient motors adjustable speed drives fast control systems power-factor controllers improvements in mechanical drive train			RMI (1985a)
Process industries		22.5%	<2.0	RMI (1985), pp. 144 - 145.
Other industries		40%	<2.0	RMI (1985), pp. 144 - 145.
Electrolysis	n/a	5%	<2.5	RMI (1985), pp. 144 - 145
Process heating	**package of measures:** insulation control systems heat recovery	20%	0.2	RMI (1987), p. 44 Train (1985), at II:304- 312.

End Use	Measure	Savings	Cost cents/kwh	Source
Lighting	**package of measures:**	70%	<2.5	RMI (1985), pp. 144 - 145.
	high-frequency HID ballasts commercial sector measures as applicable advanced lamps			RMI (1986a)
Space heating	**package of measures:**	25%	<2.0	RMI (1985), p. 144 - 145
	weatherization heat recovery			
Agriculture				
Dairy farming	**package of measures:**	48%	<2.5	RMI (1985), p. 146 - 147.
	more efficient milk coolers heat pumps for residual water heating lighting improvements fanpower reductions			

Notes

1. Ventilation and cooling load reduction is assumed to be 35% [Putnam, Hayes, & Bartlett (1987), p. VI-7]; savings are allocated equally (in amount) between ventilation and cooling (see RMI (1987), p. 18 for a review of simulation results regarding lighting savings/HVAC interactions). Heating load increase is estimated to be 20-25%. Cooling and ventilation savings from efficiency measures are from combined eligibility and savings calculations for these end uses in RMI (1986d, 1987).

Table D-1
Total Efficiency Potential with Commercially Available Technology – New England 1985

Sector	Electricity sales 1985 (GWH)	Efficiency factor	Efficiency Sales (GWH)	Savings (GWH)
Residential	31929	0.62	19659	12270
Commercial	29357	0.49	14307	15050
Industrial	25156	0.81	20463	4693
Streetlighting	794	0.70	556	238
Other	1101	0.63	693	408
Totals	**88337**		**55678**	**32659**

Table D-2
Residential Sector Efficiency Potential – New England 1985

End use	% sales	1985 GWH	1985 KWH/year	Effic. KWH/year	Efficiency factor	Efficiency sales (GWH)	Savings (GWH)
Refrigerator	0.192	6136	1203	744	0.62	3795	2341
Freezer	0.043	1361	1123	530	0.47	642	719
Range	0.078	2478	754		0.81	2007	471
Lighting	0.093	2974	689		0.40	1190	1784
TV	0.060	1901	336	175	0.52	990	911
Clothes dryer	0.070	2225	889		0.88	1958	267
Clothes washer	0.009	277	78		1.00	277	0
Dish washer	0.018	589	302		0.67	395	194
Water heater	0.159	5076	3485		0.50	2538	2538
Room a/c	0.030	971	385		0.76	738	233
Central a/c	0.009	299	1096		0.66	197	102
Space heating	0.131	4169	9281		0.60	2501	1668
Heating aux.	0.028	903	271		0.70	632	271
Miscellaneous	0.080	2570	508		0.70	1799	771
Totals		**31929**				**19659**	**12270**

Overall efficiency factor: 0.62

Table D-3
Commercial Sector Efficiency Potential - New England 1985

End use	% Sales	Electricity sales (1985) (GWH)	Efficiency factor	Efficiency sales (GWH)	Savings (GWH)
Cooling	0.12	3379	0.50	1690	1690
Ventilation	0.10	2873	0.40	1149	1724
Heating	0.11	3151	1.00	3151	0
Lighting	0.43	12581	0.30	3774	8807
Refrigeration	0.10	2952	0.50	1476	1476
Water heating	0.03	902	0.60	541	361
Miscellaneous	0.10	2897	0.70	2028	869
Cooking	0.02	622	0.80	498	124
Totals		**29357**		**14307**	**15050**

Overall efficiency factor: 0.49

Table D-4
Industrial Sector Efficiency Potential - New England 1985

End use	% Sales	Electricity sales (1985) (GWH)	Efficiency factor	Efficiency sales (GWH)	Savings (GWH)
Motors/process	0.364	9153	0.82	7478	1675
Motors/other	0.355	8922	0.82	7289	1633
Electrolysis	0.048	1198	1.00	1198	0
Process heat	0.085	2141	0.90	1927	214
Lights	0.134	3369	0.68	2291	1078
Space heating	0.015	373	0.75	280	93
Totals		**25156**		**20463**	**4693**

Overall efficiency factor: 0.81

Appendix 2

A Twelve Point Electric Efficiency Action Plan for New England

To realize the full "technical potential" of electrical efficiency improvements outlined in this report, the region's decisionmakers should take the following twelve specific steps to overcome obstacles to those improvements.

These twelve steps are divided into short-term and long-term actions. The short-term actions are aimed at taking advantage of all cost-effective efficiency opportunity within our existing knowledge base and market structure. The longer term actions are designed to improve that knowledge base and market structure to put efficiency improvements on a truly equal footing with electricity generating investments.

A. Short-Term Actions: Pump-Priming By The Utilities

Much has been written about the desirability of allowing electrical efficiency technologies simply to compete on their own merits on the open market place with electricity itself, rather than having utilities plan for increased efficiency investments on behalf of their customers. Many utilities have argued, with some justification, that their expertise is in producing and distributing kilowatt hours, and that it is a tall order to expect them to reorient their business toward delivering electrical services (that is, light, heat, motor drive) with the fewest possible kilowatt hours. Better, some say, to leave it all to the "free market."

However, as we have seen, numerous obstacles stand in the way of a completely free and efficient market for electricity savings: lack of readily accessible information; the inability of customers to reap the full value of their efficiency investments; and the shorter paybacks required by end-use customers. As a result, large energy efficiency potential is going untapped and in some cases lost forever (new residential and commercial construction, for example).

The region's utilities have the capital and obvious incentive to achieve very large efficiency gains in their customers' use of electrical services over the next several years. By taking a far more active role in efficiency improvements than is presently the case, the utilities can buy valuable time for the region, create markets for efficiency technology, and defer the need for new generating capacity until a fuller transition to market-based efficiency can take place.

Several specific actions should be taken within the next year to ensure that the region's utilities play this role:

1. Comprehensive End-Use Efficiency Design.

Recent analysis has suggested that New England utilities' traditional focus on providing information and providing limited rebates on specific hardware measures will be of limited effectiveness for several reasons:

- The utilities' information and market incentive efforts have often been limited to "first generation" efficiency measures such as water heater wraps and 34W fluorescent tubes rather than on the full range of current available technology in high-efficiency lighting, motor drive, etc.
- As discussed in Section VI., electricity consumers (even large and sophisticated businesses) lack the time, information, incentive, and necessary capital to respond fully to rebates and informational programs;
- The focus on specific hardware or third-party "shared savings" contractor programs risks harmful "cream-skimming" in which only the easiest measures are installed (e.g., lighting tube replacement), to the exclusion of other measures with higher costs but even greater savings (e.g. installing task lighting and sophisticated lighting controls).

All of these factors have pointed to the need for more active utility involvement in designing and funding comprehensive efficiency improvements for their end use customers. Only the utility can capture the full system value of efficiency measures; just as important, the utilities have a significant reservoir of credibility with customers (particularly industrial and commercial customers) which could be utilized to overcome skepticism toward new technologies.

A recent report commissioned by the Boston Edison Company and prepared by the consulting firm Putnam, Hayes & Bartlett (Appendix 4) sets forth a proposal which capitalizes on the utility's resources and overcomes many of the barriers identified above. The proposal, if adopted New England-wide, would require each utility to develop the capability to perform or have performed for it site-specific efficiency designs. The utility's "design teams" would determine the full package of efficiency measures which beats the utility's marginal cost of supplying power over a period comparable to the life of the measures.

The utility would be required to draw from up-to-date measures whose cost and performance had been certified by a special engineering division or affiliate of the company; ultimately, this certifying function could be replaced by the New England Energy Laboratory (see 7 below). For a typical office building, for example, the "design team" might determine that significant savings could be gained through installation of new lighting measures (compact fluorescent bulbs, high-frequency ballasts, daylight dimmers, occupancy sensors, "task" lighting), installation of triple-glazed windows, high-efficiency air conditioning units, etc.

After determining the optimal package of efficiency measures, the utility would be required to install the measures and fund them (possibly with appropriate cost-sharing by the customer).

Recently, the Boston Edison Company announced that it would pursue such a program for its 1500 largest commercial customers.[1] Because it will take some time for this program to reach its full effectiveness New England-wide, the initial focus — as with Boston Edison — should probably be on the utility' largest commercial and industrial customers and on areas where savings potential is known now to be the largest: lighting and motors.

2. Customized Rebates

In addition to offering comprehensive end-use efficiency design, the utilities should be required to provide funding to reimburse customers for their purchase of efficiency measures. Rebates would be made per kw or kwh of demonstrated savings, with the maximum rebate amount equivalent to the present value of the utility's long-term marginal cost. Periodic re- audits may be necessary for small buildings to ensure that savings, and concomitant energy management practices, are being maintained. To encourage the full adoption of all cost-effective measures, this program should include joint utility-customer sharing of the cost of feasibility studies to determine specific end use improvements and their cost.

Pacific Gas and Electric Co. has successfully implemented such a program, and reports both high penetration rates and significant savings.[2] The Bonneville Power Administration has also recently introduced such a program to encourage electrical efficiency improvements in the Pacific Northwest's aluminum sector; in this program, the utility pays aluminum smelter operators a fixed amount for every kilowatt hour saved, however that savings is accomplished.[3]

3. Targeted Mass Retrofits

While in general it is preferable to install efficiency measures as part of a comprehensive site analysis, many measures (e.g. low flow showerheads, compact fluorescent light bulbs, residential weatherization) are so cost-effective and easy to install that utilities should be required to distribute or install them for nominal cost on a mass basis.

Along these lines,

- Mass commercial lighting retrofits have been proposed recently for Austin and Seattle;
- Nearly all electrical resistance-heated houses in Hood River County (Oregon) were weatherized; and
- The municipal utility in Traer, Iowa, in cooperation with North American Philips Lighting Co., recently distributed high-efficiency light bulbs to all of its residential customers, for an estimated savings of $50 per year per household.

4. Programs to Increase the Efficiency of New Construction

As discussed in Appendix 3, a large portion of growth in electricity sales and peak demand over the next 15 years can be accounted for by sales to new buildings and facilities. Yet, if present patterns continue, that building stock will be highly inefficient; many new mix-used developments create new capacity demand equivalent to that of a small city.

This pattern is in part due to the failure of existing building codes to require maximum electrical efficiency, and in part due to the fact that developers and their customers are not forced to bear the economic impact of the marginal electricity costs associated with the addition of inefficient buildings to the system. These failures represent enormous lost efficiency opportunity, since it is far easier to incorporate energy-efficient features into a building at the time it is constructed than to retrofit those features later.

New England utility regulators should take strong steps to ensure that the region's new building stock incorporates the maximum cost-effective electrical efficiency:

- **Hook-up Fees and Incentives.** Utilities should pay developers or home purchasers an incentive for incorporating high-efficiency design into new construction, and, conversely, assess the developer or owner a service hook-up fee to help recover the additional power demands caused by inefficient design.

The hook-up fee would vary with the intensity of the peak power demand placed by each customer on the system beyond a certain minimum level. The fee would be based on the estimated summer and winter peak demand of a building per unit of space, and the estimate of the capital cost of new capacity to meet this demand. The fees collected would be earmarked to fund the utility's other efficiency improvement programs.

For highly efficient buildings that exceed a given efficiency "baseline," the fee would be negative i.e. an incentive payment to the developer. To avoid subsidizing increased electrical usage, however, buildings with electrical resistance heat would be ineligible for an incentive payment.

These fees would transfer some of the costs of electricity-inefficient development from all ratepayers to the developers of inefficient buildings, thus creating a strong incentive for efficient construction.

Such programs have strong precedent around the nation:

- Central Maine Power Co. has recently instituted hook- up charges for residential customer.[4]

- The Modesto (Ca.) Irrigation District provides incentive payments of up to $475 to purchasers of homes whose electrical efficiency exceeds an average baseline, which is 13% higher than required by the California State Building Standards, some of the most stringent in the nation.[5]

- The Bonneville Power Administration has instituted a pilot project in which developers are paid the added design and construction costs of making new commercial buildings at least 30% more electrically efficient than required by a model regional building code; program participants are selected through a competitive process.[6]

■ **Efficiency Design Assistance.** Utilities should make available to developers at nominal cost expertise on high- efficiency building design and fixtures. In addition, the utilities should provide a "high efficiency certification" for new buildings incorporating prescribed efficiency measures; the certification could be used by developers in marketing the buildings.

5. Load Management Initiatives

Approximately 10% of New England's total electrical generating capacity is needed simply to meet dramatic leaps in demand during a few afternoon hours on a handful of days of the year (typically in January and July/August)[7]. Rather than building expensive new capacity to meet these infrequent demand "spikes," New England regulators should require utilities to develop programs which will enable and encourage customers to scale back their electrical demand during these few crucial hours.

At present, however, the region's utilities have tapped only a small fraction of the potential peak savings pool.[8] *If NEPOOL is correct in its assertions that the region's capacity is presently inadequate to reliably serve peak load, immediate implementation of these programs is imperative.*[9]

These actions would include:

■ **New Rate Structures.** Several opportunities are available to structure electric rates to signal the high system value of electricity use during peak periods. These include "time of use rates" which vary in predetermined increments according to hour of use, and "interruptible rates" which are essentially discounted rates to large industrial and commercial customers who agree to interruption of service on short notice during peak periods. All of the region's utility commissions should require their utilities to adopt rate structures which more directly reflect the long-run cost of new capacity to the region, and thus encourage cost-effective curtailment.

Item: By offering a special discount Large Power Seasonal Time of Use Rate to its large industrial and commercial customers, United Illuminating was able to shift 29% of the participating customers' load away from the 1986 summer peak hour.[10]

■ **Direct Utility Control of End-Uses.** Many small businesses and residential customers would find it burdensome to respond to differentiated rate signals. For these customers, it may be more appropriate for the utility to directly control the use of large end-uses such as water heaters and air conditioners during peak periods. Several New England utilities have already implemented such programs, utilizing radio controls and direct control through the power line. These programs should be expanded throughout New England.

■ **Utility Purchase of Load Management Technology for Customers.** Numerous technologies are available which enable electricity users to reduce their demand during peak periods. These technologies include "chilled storage" (cooling water at night for use in space conditioning during the peak period of the following day), air conditioner cycling, and standby generators. A recent study prepared for the Washington Electric Cooperative (Vt.) estimated that *the utility could reduce its peak load by more than 20% through the use of load management technologies.*[11]

The utilities should be required to fund these technologies in the same manner as traditional "conservation" measures (see item 1 above).

■ **Load-Shedding Cooperatives.** While important, the

To ensure that the region as a whole taps maximum efficiency opportunity, several remedies must be applied to existing regional market distortions:

■ **Modifying Regional Power Pooling Constraints.** New England utilities trade electricity and capacity among one another on a nearly constant basis. But there is reason the believe that the rules under which those trades take place may understate the value of efficiency investments.

First, utilities caught short of capacity receive only a "deficiency" charge for capacity provided by the regional power pool to fill the gap. This charge has historically been well below the cost to the region of providing such marginal capacity. This below-"market" pricing has perversely shielded those utilities which have made the least effort to control their peak demand. Regional regulators should insist that deficiency charges more closely reflect the marginal cost to the region of making up the deficiency.

Second, the region's utilities have historically capped their non-emergency wholesale sales of capacity to one another at the "embedded cost" of that capacity, rather than at the market value of that capacity. This both rewards slow efficiency improvements by the purchasing utility and understates to the selling utility the true economic value of efficiency investments that may "free up" more of the seller's capacity. The region's regulators should encourage the utilities to explore capacity sale arrangements which more fully reflect the economic value of such capacity.[18]

■ **Make Off-System Sales a Component of Avoided Cost.** As noted, utilities in New England sell power and capacity through intermediate- and long-term contracts with other New England and northeastern utilities. Yet the revenue of these sales is rarely reflected in the "avoided cost" used to measure the value of efficiency programs which free up new capacity for potential sale and thus provide real benefits to the selling utility's ratepayers. This arrangement results in a systematic under-valuation of efficiency. Regulators should explicitly include off-system sales as a credit to efficiency investments which make those sales possible.

■ **Encourage Intra-NEPOOL Wheeling of Efficiency Gains.** Presently, New England's utilities have invested in efficiency gains in their own service territory almost exclusively. There is no reason, however, why this limitation should exist; utilities should be encouraged to invest in cost- effective efficiency opportunity wherever it exists, and be permitted to "wheel" the saved power back to its territory or other utilities for sale — just as utilities currently do with jointly owned regional generation facilities.

The region's regulators should expressly permit such cross- territory investment in, and transmission of, new "supply" from efficiency investment. The region's regulators should also require utilities to eliminate any physical and legal transmission barriers which may currently prevent such investment.

12. Regional Power Coordination.

New England's regional utility system is run as an integrated whole. To a large extent, power supply planning is also done on a regionwide basis by the New England Power Pool (NEPOOL), a consortium of public and private utilities which account for virtually all electric power sales in the region. NEPOOL continually evaluates projected electric demand, and its Generation Planning Task Force provides analysis to member utilities on the combination of generation and transmission facilities which will meet that demand in the most economical way. These analyses have led to the construction of, and provided the public justification for, a number of large baseload power plants in the region, including Seabrook.

Despite the fact that private power planning takes place on a coordinated regional basis, public investment review is fragmented over six state jurisdictions. This fragmentation often results in wildly divergent policies and practices which together frustrate the ability to plan rationally for electrical services at the lowest possible cost to the entire region.

The New England Energy Policy Council believes this situation is unacceptable, and may account in part for the utilities' continued emphasis on new power generation as opposed to aggressive efficiency investments. New England must develop a regional, public forum for considering power planning issues that intimately affect the economic and environmental fate of our region.

Although present efforts by the New England Governors' Conference Power Planning Committee to share information among states are laudable, considerably more staff and resources will be necessary to develop and implement detailed least-cost electricity supply plans and policies that make sense for the region as a whole.

At a minimum, the New England Governors should staff and fund an ongoing regional electricity planning body. That body would research regional electricity needs and develop and evaluate specific policies of the type contained in this report, and, where appropriate, propose a coordinated regional strategy to implement them.

A still more effective approach might entail the creation of a regional power planning council, members of which would be appointed by the governors of each state. The council, in addition to studying the region's electric needs and preparing a regional strategy to meet them, would be authorized to intervene in any state utility commission proceeding that has a potential impact on the region's power supply. ☐

Footnotes

1. *Boston Globe*, Business Section, p. 2, 6/10/87.
2. Pacific Gas & Electric Company, *A Report on 1985 Conservation Activities* at p. 7.
3. See Bonneville Power Administration, Division of Commercial and Industrial Programs, Office on Conservation, *Bonneville Power Administration Program Description for the Aluminum Smelter Conservation/Modernization Program* (November 1986).
4. Stipulation, Central Maine Power Company, *Investigation Into Cost of Service of Customer Classes and Rate Design*, Maine Public Utilities Commission Docket No. 86-2.
5. Gordon Ryan, *A History of the Development of the Power Saver Program: 1985-1987* (Paper presented to the Massachusetts EOER Conference, Boston, Massachusetts, January 1987).
6. Bonneville Power Administration, "The Energy Edge Project: 'A Design Challenge That Pays': Project Description" (October 1986).
7. For example, about 10% of Boston Edison's and Central Maine Power's capacity is needed for 2% of the year. See Boston Edison Company, *Long-Range Forecast of Electric Power Needs and Requirements*, (January 17, 1986), Vol. I at p. K-13; Central Maine Power Co., *Conservation and Load Management Update* (April 1987) at Figure 1.
8. The region's utilities claim only 373 MW of peak load reduction capability for August 1987, or 2% of unadjusted peak load. New England Power Pool, *NEPOOL Forecast Report of Capacity, Energy, Loads and Transmission 1987 - 2002* at 1 (1987).
9. NEPOOL Chairman Stephen Sweeney recently stated that the region's utilities "continue to be concerned about the potential deficiencies ... in the high growth contingency case. ... [W]e have serious reservations whether sufficient gas turbines could be built by 1990 or 1991 to cover the deficiencies in the event they are the preferred alternatives." Letter to New England Governor's Conference, November 18, 1986.
10. Energy Planning Department, United Illuminating, *A Preliminary Evaluation of the Load Impacts of the Optional Rates Approved in Docket 85-12-04* (December 15, 1986) at p. 3.
11. Energy Solutions, Inc. (Barre, VT), *Energy Efficiency Supply Options for Washington Electric Cooperative*, Volume I at 3 (November 1986).
12. *BECo Report* at VI - 22.
13. See Wisconsin Electric Power Company, *Wisconsin Public Service Commission Docket No. 6630-UR-100* (1986) at 53-54.
14. *Governor's Report* at 55.
15. See Cavanagh, "Least-Cost Planning Imperatives for Electric Utilities and Their Regulators," *10 Harvard Environmental Law Review* 299 (1986); Wellinghoff & Mitchell, "A Model for Statewide Integrated Resource Planning," *Pub. Util. Fort.*, Aug. 8, 1985 at 19, 19-20; Colton, Conservation, "Cost-Containment and Full Energy Service Corporations: Iowa's New Definition of 'Reasonably Adequate Utility Service'", 34 *Drake L. Rev.* 1, 3 (1984-85).
16. Sixth Stipulation Regarding Energy Management and Conservation, *Maine Public Utilities Commission Docket No. 85-83* (November 3, 1986).
17. The addition of new large power plants to meet regional demand increases the regional reserve requirement necessary to hedge the risk of the new plant's outage. For example, New England's newest baseload unit, Millstone III, lead to an increase in regional reserve margin of between 2 and 4% — or the equivalent of an additional small coal plant. See Ex. CLF-WTS- 12 at 3; Ex. CLF-WTS-35 at 5-9, Western Massachusetts Electric Company, DPU 85-270.
18. The Federal Energy Regulatory Commission has recently signalled its intention to open regional bulk power marketing to greater competition, and has accepted rate filings designed to achieve this end. See, e.g., Pacific Gas & Electric Co., 38 *F.E.R.C. Rep.* 61,242 (Docket No. ER87-97-001) (March 12, 1987).

Appendix 4:
Excerpts from Putnam, Hayes and Bartlett, Supporting Documents on Conservation and Load Management Prepared for Boston Edison Review Panel (March 1987)

Conclusions

This review of the economic potential of lighting conservation measures leads to the following conclusions.

- Theoretical calculations of economic potential lead to results that are very nearly unbelievable.

- The results of more applied analysis suggest that, while the theoretical calculations may be subject to a fair degree of uncertainty, even under pessimistic assumptions the savings that can actually be achieved right now are still so cheap, compared with BECo's avoided costs, that a major reorientation of BECo's supply/demand planning program appears to be in order.

II. RECOMMENDED C&LM PROGRAM FOR BECO

A. C&LM Market Failure

The obvious question that presents itself at the end of a review of the technical and economic potential of C&LM is, "If this works so well and is so cost-effective, why isn't everyone buying it?" To get an answer, we interviewed a number of landlords and tenants in Boston's commercial sector to find out how they view their incentives to invest in C&LM. We spoke with those responsible for evaluating technologies and making recommendations to management. Due to time and resource constraints, we chose to concentrate on lighting technologies. Most of our findings are, however, broadly applicable to the full array of electricity-consuming technologies.

Results of Commercial Landlord and Tenant Interviews

The first theme that emerged in our interviews was confusion. The pace of development in efficient energy-using and energy-conserving technologies has been accelerating in the past few years,* and the people we spoke with evinced a certain bewilderment at the array of choices now being touted by vendors and the trade press.

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* According to the RMI report cited above ("Advanced Electricity-Saving Technologies and the South Texas Project"), "Most of the best electricity-saving devices on the market today were not on the market a year ago. The same was true a year ago."

A second theme was that new technologies often do not perform as well as -- or at least in the same way as -- those they replace. Some of those whom we interviewed professed skepticism toward the notion that C&LM measures could reduce costs with no degradation in the quality of services for which they use electricity. Landlords, in particular, noted that tenants are extremely sensitive to even the smallest alterations in lighting level or quality, or to the appearance of fixtures, and that experiments with new technologies often elicit negative reactions from tenants. Both tenant and landlord interviewees noted also that new technologies had been vetoed on occasion by architects retained to maintain their building's design standards. We suspect this is another indication of the proliferation of technologies, and of the wide variation in performance that can be found.

A third theme was that three years is often the longest acceptable payback for C&LM investments. A variety of reasons was given. One software development company said their industry was too volatile to take a longer view. An employee of a building management company said he couldn't trust the DPU to maintain any given rate structure for more than three years. Others simply indicated that three years is a limit fixed by business practice.

A fourth theme was that the structure of leases blurs economic incentives. Commercial tenants in the Boston area commonly pay a fixed fee for electricity regardless of usage, up to some ceiling (e.g., 3.5 watts/square foot). Usage is monitored occasionally, and if it exceeds the ceiling, meters are installed and the tenant is billed directly for use above the ceiling. For tenants whose use does not exceed the ceiling, to benefit from C&LM economics would require renegotiating the fixed fee in their lease. This is certainly possible, but the electricity fee is usually so small relative to the rent (1 to 4 percent), that renegotiation seems unduly difficult.

Tenants are also billed for their share of the building's "common area" electricity consumption. Here the initiative for C&LM measures generally would have to come from the building management company. But the building manager's incentive to invest is blurred because (1) he passes common area electric costs through to tenants automatically; and (2) he would need the consent of all tenants to make a C&LM investment.

Conclusions from Interviews

We concluded from these interviews that there exist substantial failures in the operation of private incentives in the market for C&LM savings. Therefore, exclusive reliance on the private sector to achieve the appropriate social level of C&LM investment is likely to take much longer than if the private market is aided by a push to overcome consumers' confusion and skepticism on the performance and economics of C&LM technologies.

B. Description of Proposed Program

We propose a C&LM program for BECo consisting of the following elements:

1. BECo would establish an affiliate to perform research, testing, and certification of C&LM technologies. An advisory board of outside C&LM experts would be formed to assist this affiliate (hereafter, "BECo Labs").

2. BECo would also establish -- either in-house, by contract, or both -- a capability to perform C&LM site designs throughout its service area, concentrating first on lighting in buildings with high lighting concentrations (commercial, institutional, industrial, and apartment buildings). Using the most current projections of BECo's avoided costs, the design teams would determine the optimal C&LM plan for each site, using up-to-date measures whose cost and performance had been certified by BECo Labs.

3. BECo would invite third parties to bid to supply and install the C&LM measures specified by the design teams for individual buildings or portions thereof. (BECo could establish an unregulated affiliate to compete in this bidding process.)

4. Third parties could also bid to install measures that departed from those approved by BECo Labs and/or did not conform to the package specified by the design team, on two conditions. First, the total amount of proposed KW and kWh savings could not be less than the quantities proposed by the design team for the job in question; and second, savings would have to be measured or certified.

5. BECo would submit to the owner and tenants (if any) of each building a report summarizing the work of the design team and explaining the economics of the recommended investments. BECo would then invite each owner or tenant to bid the amount it would be willing to contribute to the cost of the recommended measures (if the owner/tenant wished to finance its contribution) or the share of the savings it would be willing to relinquish to the utility (if it wished the utility to provide financing).

6. BECo would then calculate the "net bid" for each building. This would be the difference between the installation bid and the owner/tenant's contribution (or relinquished savings) bid. It is the amount that ratepayers would have to pay for the design package of C&LM measures in a particular building.

7. BECo would then calculate for each building the ratio of the net bid to the projected generation costs that would be avoided by installing the design C&LM package. BECo would rank buildings according to this measure -- cost per dollar of avoided cost -- and proceed to sign contracts with installation firms and owners/tenants, beginning with the bid that saves a dollar of avoided cost at the lowest price.

8. BECo would move up the ranked list of bids, signing contracts until the cost per dollar of avoided cost matched the cost being paid in the QF process. Beyond this, no costlier C&LM savings would be purchased.

9. Contracts signed with firms bidding to install C&LM measures would generally entail full payment of the bid amount at the time the installation work was complete. In exceptional cases, payment for measures whose savings were especially difficult to predict would be made annually and on the basis of kWh actually saved, with periodic measurement to ascertain actual savings. The amount paid per kWh saved would, however, be established at the time the contract was signed, and would not depend on actual avoided costs.

10. For ratemaking purposes, the costs of BECo Labs and the design teams would be recoverable as cost-of-service. We recommend that as a gesture of support, the DPU allow these costs to be collected on a prospective rather than an historical basis. BECo would be entitled to include up-front payments for kWh savings in the rate base. Annual payments per kWh saved would be recovered as part of the fuel adjustment.

11. As an incentive to BECo, the DPU would also allow the utility to retain a certain percentage of the net avoided costs "below the line" for ratemaking purposes. In this way, the benefit of these savings would be shared between BECo's ratepayers and shareholders.

* TESTIMONY OF D.I. FOY ON BEHALF OF THE CONSERVATION LAW FOUNDATION OF NEW ENGLAND
U.S. DEPARTMENT OF ENERGY, FIELD HEARINGS ON A NATIONAL ENERGY PLAN, PROVIDENCE, R.I., 29-12-1989

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TESTIMONY OF DOUGLAS I. FOY
ON BEHALF OF
THE CONSERVATION LAW FOUNDATION OF NEW ENGLAND

UNITED STATES DEPARTMENT OF ENERGY
FIELD HEARINGS ON A NATIONAL
ENERGY PLAN

PROVIDENCE, R.I.

CORRECTED COPY FILED DECEMBER 29, 1989

(ORIGINAL COPY FILED DECEMBER 1, 1989)

Vermont Office: • 9 Bailey Avenue • Montpelier, VT 05602 • (802) 223-5992

Admiral Watkins, Deputy Secretary Moore, Deputy Secretary Stuntz, and Department Staff:

I am Douglas I. Foy, Executive Director of the Conservation Law Foundation (CLF), a non-profit environmental law organization representing seven thousand members in the six New England States. CLF appreciates the opportunity to present its views on the key elements of a sound national energy plan.

It is appropriate that you have chosen to hold hearings in New England. For our region is presently at the forefront of creative solutions to the nation's energy dilemma. CLF, working cooperatively with eight of our former utility adversaries, is beginning to demonstrate that increasing the <u>efficiency of use</u> of our energy resources is by far the least expensive, most environmentally sound, and readily available energy "supply" available to the nation. We are demonstrating this in spades for the electricity sector, but there is no reason the same approaches cannot be applied with equal effect to direct fuel use and transportation.

<u>The New England Efficiency Explosion</u>

A little background. In mid-1987, New England faced a public policy crisis of the first order. Our utilities claimed that our generating capacity was inadequate to meet growing electric demand, and that new capacity was needed imminently or the lights would go out. Indeed, that summer, sub-optimal performance of our large nuclear facilities, and a string of rough weather, caused the lights to dim on a few occasions.

CLF argued, however, as it had for years, that the best long-term policy response was not necessarily to go out and blanket the landscape with expensive new power plants. If a fraction of the utility capital that had traditionally been spent on power supply could be diverted to investments in energy efficiency, we posited, the need for such plants would be much reduced.

With the help of the Lawrence Berkeley Laboratory and others, we documented our conclusions in a report entitled "Power to Spare." (Attachment 1). There we showed that a very aggressive program of utility investment to make our region's new buildings efficient, and to retrofit old buildings and industrial plants with high efficiency equipment, could avoid <u>all</u> growth in electric demand over the next two decades, even with the utilities' assumed rate of population and economic growth. And such an investment program would produce power at a third to half the cost of conventional new power supply -- putting aside its obvious environmental benefits. Unfortunately, we noted, the utilities' priorities seemed far out of line with the proper strategy: they were spending 20 to 50 times more on new generation and transmission than on less expensive energy efficiency.

We recognized, of course, that such a large scale investment program had never been undertaken. But we had to start somewhere. Accordingly, CLF brought or intervened in a series of cases before four of our region's six utility commissions, laying out a practical blueprint by which such a program would be carried out, and requesting the commissions to order their jurisdictional utilities to follow this path. CLF also suggested that, to avoid ongoing polarization and dispute about what constituted proper adherence to the blueprint, the utilities be required to work with us and other public parties to design and monitor the programs.

It surprised even us when the first commission we approached agreed. In Connecticut Light & Power's 1987 rate case, the state utility regulators ruled that the company had not done nearly enough to promote energy efficiency -- particularly for new construction -- and ordered the company to double its expenditures on end use efficiency. And, in a most novel fashion, it strongly suggested that the company come back to the commission with a plan that had the support of the interveners.

The rest, as they say, is history. After the order came down, my co-panelist Bill Ellis, CEO of Connecticut Light & Power's parent company, agreed to what is perhaps the utility executive's version of a riverboat gamble. Bill agreed to fund the best energy efficiency program designers in the nation to work under CLF's direction but in cooperation with his company to design and field the best and most aggressive efficiency investment programs that could be created. In two months of intense but creative negotiation, we had ready to go what was at the time the most advanced efficiency programs in the nation.

Under these programs, the utility hires architects, energy analysts, industrial designers, and engineers -- at its own expense -- to come up with the best packages of high efficiency lighting, heating, cooling, motor, building shell, and industrial process improvements -- for both new and existing buildings and homes. The utility then pays to have these efficiency improvements made -- up to the point where they are no longer less expensive than building or buying an equivalent new power supply. In most cases, the customer's financial obligation is limited to funding only the shortest-payback efficiency measures.

Note that there is a world of difference between this new approach to energy efficiency and traditional utility "conservation" programs, which consisted of thousands of "energy audits" not acted upon, public relations campaigns, and maybe a small rebate for customer-initiated equipment purchases. The hypothesis that we are testing with these new programs is that a utility will get what it pays for. If it wants to blanket its service territory with high efficiency lighting, motors, and other measures, it must take the financial and logistical burden off its customers' shoulders.

The early returns suggest that our hypothesis is correct. Connecticut Light & Power's programs for the commercial and industrial sector have been out on the street for only a year, and its program for new construction is already capturing <u>over 30%</u> of annual new floorspace in its territory; the retrofit program has customers standing in long queues awaiting their turn. Traditional utility efficiency programs were lucky if they hit even 10% of their intended market after 5 years. We are now entering the crucial program monitoring and refinement stage where CLF and the company will be trying to learn from mistakes and successes and make the programs even more effective.

As documented in Attachment 2 to this testimony, the cooperative approach pioneered by CLF and Connecticut Light & Power has now been replicated throughout New England, and a typical program-by-program description is contained in Attachment 3. We are now actively involved with eight utilities which represent three-quarters of the region's power demand.

In 1990 alone -- the first year of major program activity -- those utilities will be spending about $200 million on efficiency improvements for customers -- about four times 1988 levels. Those levels are projected to increase as fast as the market can soak up efficiency; expenditures of $500 million annually, or about 10% of gross utility revenues, are likely two to three years from now. They may be even higher if, as I will discuss in a moment, we can make the necessary ratemaking changes to allow utilities to profit from these efficiency investments. The utilities officially expect to displace a third or more of their otherwise occurring demand growth through these programs; some tentative scenarios, however, suggest that flat or <u>negative</u> load growth is not out of the question -- particularly under the higher expenditure scenarios.

Implications of the New England Experience

So we have a success story here in New England that I commend to you as you ponder a national energy strategy. We are showing that large scale efficiency works. You could do worse than to try to make national policy that would instigate similar activity elsewhere in the nation.

The obvious and immediate economic benefits of spreading the New England approach, great as they are, are overwhelmed by the environmental benefits. Take the current debates over controlling acid rain and global warming -- environmental problems for which our energy usage is largely responsible. The battle unfortunately appears to have been joined by those who believe a stable climate and clean air warrant the cost, and those who believe the price tag is too high.

Both positions miss a big point. Energy efficiency is a negative cost environmental protection strategy; environmental benefits aside, it saves far more than it costs. To take just one New England example, the Massachusetts Electric Company, with CLF's assistance, has designed a program which will in 1990 spend approximately $37 million on energy efficiency in new buildings and plants, and retrofits. As Attachments 4 and 5 demonstrate, those 1990 investments will eliminate over a million tons of CO_2 emitted into the atmosphere. The social cost of avoiding that CO_2 varies, by program, from minus $2.14/ton to minus $100/ton. As Attachment 6 demonstrates, if all U.S.

utilities undertook an energy efficiency program in 1990 at Massachusetts Electric's modest start-up level, we could abate approximately 220 million tons of CO 2 over the life time of those efficiency devices, at a comparably negative net cost. That would be a significant dent in our annual 5 billion ton CO 2 emissions rate.

By contrast, abating that same quantity of CO 2 emissions through tree-planting carries a significant positive net cost of nearly $250 to $1,238/ton of CO 2 avoided. That does not mean that we should not pursue these other global warming mitigation strategies. Just that we are even more foolish if we ignore the better-than-free ones staring us right in the face.

Now, should we expect our nation's electric utilities to carry forward this effort vigorously without financial reward? A little common sense tells us that a business will not risk a tenth of its revenues on a major enterprise without some prospect of return. Accordingly, CLF has now begun to work with New England utilities to develop a utility rate mechanism by which the companies will earn back a portion of the savings they create by pursuing energy efficiency. This approach, described generically in Attachment 7, put forward by CLF and New England Electric to Massachusetts and Rhode Island regulators, does two important things. First, it negates any net revenue loss between rate cases that occurs from efficiency investments. And second, it provides a direct incentive to maximize efficiency investment, by allowing the utility company a monetary slice of the savings which gets larger as the pie expands. This approach may not be right for all jurisdictions, but something like it, we believe, will be necessary to move energy efficiency from a utility side line to the center of the action.

Conclusion

In my limited time with you today, I have not been able to set forth a detailed, comprehensive national energy efficiency strategy. CLF, however, would be happy to work with DOE staff to suggest ways in which New England's successes could be replicated elsewhere. But the necessary starting point is to make such an efficiency strategy the cornerstone of our national energy plan, and to do so beyond lip service.

Efficiency is economic; is it is clean; and there is an abundance of it. The same cannot be said of other energy sources. Let 1990 by the year that federal energy policy turned the corner toward exploiting our best and most flexible resource.

ANNEXES

EL GRUP DE CIENTIFICS I TECNICS PER UN FUTUR NO NUCLEAR - GCTPFNN organització científica sense afany de lucre, inscrita en el Registre d'Associacions de la Generalitat de Catalunya (22 de setembre de 1987, número 9328, Secció 1a del Registre de Barcelona), amb domicili provisional a efectes de notificació al carrer a la ciutat de Barcelona (Codi Postal 08031); i en el seu nom

representació que té acreditada per escriptura notarial d'apoderament atorgada el davant , Notari de l'Il.lustre Col.legi de Barcelona, es dirigeix a Vté. i li

EXPOSA

- que el passat 19 d'octubre de 1989 va tenir lloc a la Central Nuclear de Vandellòs I un accident, l'origen del qual no ha estat explicat clarament,

- que en funcionament "normal" la C.N.Vandellòs I ha abocat, al llarg de l'any 1988, a l'atmosfera 950'75 Curies de radioctivitat, en forma d'efluents gasosos (746'4 Ci) i liquids (204'35 Ci), segons reconeix el Cosejo de Seguridad Nuclear en els Informes al Congreso de los Diputados,

- que en funcionament "normal" de la C.N.vandellòs I s'escapen 2 Tm. de CO_2 (Diòxid de Carboni), gas utilitzat en la refrigeració del nucli del reactor, segons s'ha reconegut en diferents mitjans de comunicació,

- que cada molecula del gas Diòxid de Carboni està composada d'un àtom de Carboni i de dos àtoms d'oxigen,

- que els àtoms de Carboni, en estar sotmesos al bombardeig neutrònic que té lloc a l'interior del nucli del reactor, es transformen en C-14 (Carboni-14, un isòtop radioactiu del Carboni, element que té una vida mitjana de 5.730 anys i és un emissor de radiació Beta pur),

- que el Diòxid de Carboni que s'escapa del nucli conté molécules amb l'àtom de carboni estable substituit per C-14,

- que el C-14 es troba de forma natural a la biosfera, essent un component del Carboni (el seu nivell natural és de 6'1 pCi per cada gram de l'element Carboni), i que les emissions de Diòxid de Carboni contenint C-14 impliquen un augment de la radioactivitat natural de la biosfera,

- que en funcionar una Central Nuclear, les beines que contenen el combustible experimenten fisures, per les quals s'alliberen productes de fissió que van a parar al fluid refrigerant, que alhora també conté productes d'activació neutrònica,

- que el preinforme del Consejo de Seguridad Nuclear manifesta que al llarg de l'accident no van haver-hi abocaments en quantitats superiors a les autoritzades, però també manifesta que el nucli del reactor va estar sotmès a condicions de treball extremes (pressions de 29'7 bar i temperatures de 310oC).

- que generalment els aparells i sistemes de vigilancia radiològica emprats a les nuclears de l'Estat Espanyol són dissenayts per a detectar només les radiacions Gamma i no la radiació Beta,

i per tot això SOL:LICITA

- que s'obrin diligències judicials per esbrinar si hi han hagut o no abocaments i/o fuites d'elements radioactius cap a l'atmosfera i/o cap a les aigües, i en quina quantitat,

- que s'esbrini la idoneitat per a la detecció de fuites i/o abocaments d'elements radioactius dels sistemes de vigilancia que estaven en funcionament abans, durant i després de l'accident del 19/10/1989, tant per part de l'empresa Hispano Francesa de Energia Nuclear S.A. com per part del Servei de Coordinació d'Activitats Radioactives del Departament d'Indústria i Energia de la Generalitat de Catalunya,

- que es quantifiquin les fuites de Diòxid de Carboni ocorregudes durant l'accident, ja que el Carboni-14 és un element radioactiu de 5.730 anys de vida mitjana que tots els éssers vius podem assimilar en estar constituits per àtoms de Carboni i qualsevol augment de C-14 a la biosfera por suposar un perill per tots els éssers vius,

- que s'esbrini si les fuites de Diòxid de Carboni varen anar acompanyades de fuites de productes de la fissió nuclear (com ara I-131, Cs-134, Cs-137, etc) i/o productes d'activació neutrònica.

A Barcelona, el 21 de desembre de 1989

G G.T P F.N.N.
Apartat de ... 95
08C...
(CAT...)

Sr. Fiscal Jefe de l'Audiència de Tarragona

ADMINISTRACION
DE JUSTICIA

0 6004237

FISCALIA TARRAGONA
Solicitud nº 56
Día 8-2-90

En relación con el escrito que han enviado a la Fiscalía del Tribunal Superior de Justicia de Cataluña y que ha sido incorporado a las Diligencias Informativas, que con anterioridad al mismo se habían iniciado por esta Fiscalía, pongo en su conocimiento que una vez se valoren los informes recibidos y los pendientes de recibir de diversos organismos, se les citaría para comparecer en esta Fiscalía en el supuesto de ser necesarias algunas aclaraciones.

Tarragona, 8 de Febrero de 1990.
EL FISCAL JEFE,

FISCALIA

Sr. D.

Vandellòs, més greu encara

Les explicacions del CSN no convencen els experts

Xavier Pujol

El nord-americà Richard E. Webb, expert de reconegut prestigi internacional en l'estudi dels possibles riscos en cas d'un accident nuclear i especialista en jurisdicció constitucional, ha manifestat, segons ha pogut saber aquest diari, que l'accident succeït a la Central Nuclear Vandellòs I hauria pogut tenir "conseqüències imprevisibles".

Aquesta opinió, manifestada en el curs de la recentment celebrada IV Conferència Catalana per a un Futur Sense Nuclears, va ser la conseqüència immediata d'un intercanvi d'opinions entre el mateix Webb i Jacobo Díez, director tècnic del Consell de Seguretat Nuclear. En aqueta conversa, celebrada telefònicament, Díez va indicar que el CSN no podia excloure la possibilitat d'una fusió del nucli en el cas hipotètic d'una falta de refrigeració d'aquest. Així mateix, va manifestar també que no disposa de cap mena d'informe tècnic sobre les conseqüències probables d'una falta de refrigeració del nucli de la Central de Vandellòs.

Segons Webb, aquesta falta de previsió és especialment greu, i més si es té en compte que durant l'incendi a la central es va donar aquesta situació. En la seva opinió, en el cas de fusió del nucli, les condicions de pressió i temperatura poden esdevenir extremes i possibilitar que el vas que contè el reactor —d'un acer especialment reforçat— s'esberli. Així mateix, apunta la possibilitat, ja comprovada experimentalment, que la tapa d'aquest vas pugui sortir disparada com a conseqüència de les condicions extremes. En aquest sentit, en una sessió experimental desenvolupada als EUA, Webb va poder comprovar que una tapa que exercia una força de diverses tones sortia disparada a gairebé un quilòmetre d'alçada.

Accés a la informació

Richard E. Webb és doctor en enginyeria física nuclear (Universitat Estatal d'Ohio, 1972) i especialista en dret constitucional. Des de fa anys, treballa com a independent en l'estudi dels possibles riscos d'un accident nuclear. Com a tal, ha investigat els accidents a Three Miles Island (Harrisbourg) i més recentment Txernòbyl, tots dos qualificats com els més greus de la història recent de les centrals nuclears. Darrerament, Webb ha centrat els seus estudis en l'accident de Vandellòs, central de característiques similars a la soviètica.

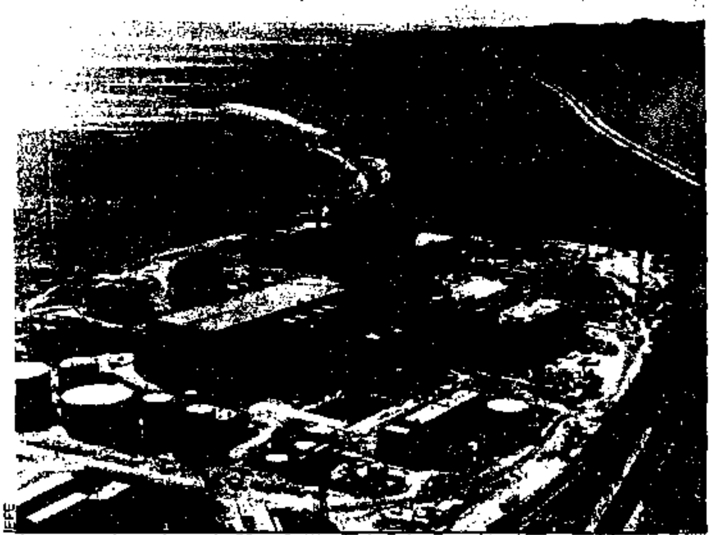
Per portar a terme les seves investigacions, l'expert internacional considera bàsic l'accés a la informació. En qualsevol cas, els responsables de les centrals estan obligats a facilitar informació la qual, d'altra banda, és considerada d'interès públic. No obstant això, qualsevol accident d'envergadura ha estat sempre, com ell mateix reconeix, envoltat d'un gran secretisme i el contingut de les informacions tècniques no s'ha fet mai públic fins dies després de l'accident. En aquest sentit, Vandellòs, de la mateixa manera que els casos de Harrisbourg i Txernòbyil, no ha estat una excepció.

Durant la conversa entre Webb i el director tècnic del CSN, Jacobo Díez, l'expert internacional va tenir grans dificultats per poder disposar de dades tècniques per completar el seu informe. En un moment de la conversa, segons ha sabut l'AVUI, Jacobo Díez es va negar a facilitar qualsevol tipus d'informació nova relativa a l'accident, tot i que Webb s'havia acreditat corresponentment. Per a l'enginyer nuclear, l'incident és especialment sorprenent per quant aquesta és una fórmula habitual de treball per a la recollida de dades, tant als EUA com a l'Europa Occidental.

Hauria pogut passar

Malgrat les dificultats, la informació facilitada pel CSN a requeriments de Webb, el qual considerava insuficient el darrer informe fet públic per aquest organisme, apunta possibilitats realment catastròfiques. En la ponència presentada a la IV Conferència Catalana, el científic destacava que el "risc o la probabilitat d'un accident en el qual es perd el confinament del nucli és força alt, contràriament a les opinions oficials, que diuen que la possibilitat d'un accident catastròfic és especialment baixa, i el risc d'accidents es manté en termes d'acceptabilitat".

"Hi ha —segons Webb— un nombre virtualment infinit de diferents tipus d'accidents catastròfics en els reactors d'aigua pressuritzada o a altes temperatures, els quals són precisament els més usats a Espanya i a l'Europa Occidental". "Entre aquestes possibilitats —afirma— hi ha la fusió del nucli per pèrdua de refrigeració o pèrdua del refrigerant del reactor. Això pot provocar, sens dubte, grans explosions i, per tant, l'alliberament de productes tòxics a l'atmosfera".



EFE
La central nuclear de Vandellòs ja ha tingut més d'un problema

Un futur sense nuclears

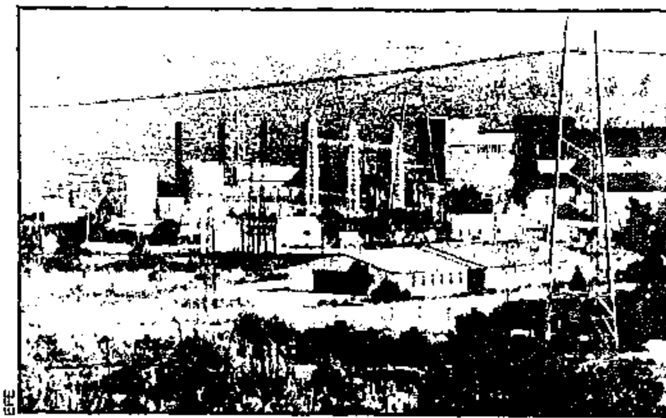
■ La Conferència Catalana per a un Futur sense Nuclears que se celebrava el passat 25 d'abril va coincidir amb el quart aniversari de l'accident de Txernòbyl. La trobada, organitzada pel Grup de Científics i Tècnics per a un Futur No Nuclear, va tenir com a objectiu desvetllar l'interès de l'opinió pública respecte als riscs i l'amenaça de l'energia nuclear. En efecte, tot i ésser considerats ocells de mal averany, van predir l'accident de Harrisburg i posteriorment el de Txernòbyl. En el cas de Vandellòs, les causes apuntades com a origen de l'accident, també formaven part de les seves prediccions.

Sens dubte, el coneixement científico-tècnic de les instal.lacions i de les conseqüències d'una possible errada o un eventual accident, els ha fet guanyar reconeixement. Això ha provocat que a molts països existeixin comissions especialitzades i de caràcter independent per a l'anàlisi d'una catàstrofe nuclear.

Aquestes comissions d'experts disposen de tota la informació necessària per al correcte desenvolupament de la seva feina i utilitzen, si cal, una trucada telefònica per a obtenir-ne les dades necessàries. I això passa als EUA o a l'Europa Occidental, on ningú no es posa nerviós per les consultes d'un tècnic, si no és que té alguna cosa que amagar o que, simplement, la feina que cal fer no estigui feta.

Nous conflictes a Vandellòs pel tancament

El futur PEN ha d'obrir-se ara cap a l'energia solar



EFE

Vandellòs ha tancat portes i ha obert nous conflictes

Josep Puig

Hem tancat Vandellòs I! Ha hagut d'ocórrer un seriós accident perquè el ministeri d'Indústria i Energia decidís finalment cedir a la pressió de bona part de la societat catalana, que a poc a poc, però inexorablement, ha anat fent seus els raonaments i els arguments que el moviment ecologista i antinuclear català anava difonent des dels seus inicis, fa ben bé una vintena d'anys (a la primera meitat de la dècada dels 70 van néixer el Grup Antinuclear d'Ascó i el CANC-Comitè Antinuclear de Catalunya).

A més, la realitat ha donat la raó a tot allò que els ecologistes hem anat mantenint (solament cal fer una ullada a la premsa ecologista de finals dels anys 70: *Userda, Alfalfa, Bien, ...*). Fins i tot ara, una vegada tancada Vandellòs I, veurem com es confirmen les afirmacions dels ecologistes referents al desmantellament de les nuclears.

Encara avui, transcorreguts més de 45 anys des que l'equip de científics dirigits per E. Fermi posaren en funcionament el primer reactor nuclear a la Universitat de Chicago (2 de desembre de 1942), continua sense estar resolt el problema dels residus generats per tot el cicle del combustible nuclear —des del moment de l'extracció del mineral d'urani fins que el mateix urani surt del reactor una vegada utilitzat— i continua sent una incògnita el que passarà amb els reactors nuclears escampats arreu del món una vegada hagi finalitzat la seva vida útil.

Després de la seva vida útil (que s'estima teòricament en 30 anys, a despit que mai cap reactor ha funcionat durant aquest temps), un reactor nuclear arriba a estar tan contaminat radioactivament que el seu funcionament no seria segur per a les persones que hi treballen. El desmantellament segur i l'emmagatzemament dels residus resultants del desmantellament serà un procés difícil, perillós i a més molt car, ja que es requeriran tècniques especials encara no perfeccionades (molts crítics dubten que mai arribin a existir) i llocs especials (encara no trobats) per dipositar les restes.

I és urgent donar una resposta a tots aquests interrogants, ja que serà necessari paral.litzar el funcionament d'uns 360 reactors arreu del món en els pròxims 25 anys, que hauran arribat a la fi de la seva vida útil.

Una sola experiència

Cada reactor nuclear de 1.000 megavats (MW) conté unes 8.000 tones d'estructures d'acer, uns 80.000 m3 de formigó i més de 1.600 km de barres de ferro. A més d'això, el desmantellament d'un reactor nuclear de 1.000 MW genera aproximadament 18.000 m3 de residus de baixa activitat, una quantitat equivalent a un camió de gran tonatge, cada dia, durant quatre anys.

De les úniques experiències acumulades fins avui, es refereix l'una al desmantellament d'un reactor de 22 MW (Elk River), el qual va funcionar únicament 4 anys. El departament d'Energia —DOE americà— va tardar 3 anys a desmantellar-lo. L'altra és un reactor de 72 MW (Shippingport), el primer que va començar a produir electricitat als EUA (1957) i que va ser tancat l'any 1982. En aquest cas, el DOE va recobrir de formigó el vas d'acer del reactor i va enviar la massa resultant (unes 1.000 tones) a la reserva nuclear de Hanford (Washington). D'aquesta manera es va impedir, de facto, la valuosa experiència que hauria estat el seu desmantellament a despit de ser un reactor comercial relativament petit.

Cada dia que passa, i a tot el món, s'estan deixant d'operar un creixent nombre de reactors i altres s'han tancat permanentment a causa d'accidents, errors de disseny o fi de la seva vida útil. A finals de 1989 el nombre de reactors nuclears a l'espera del seu desmantellament eren una trentena, amb una potència instal.lada superior a 6.000 MW.

El prestigiós Worldwatch Institute de Washington ha avaluat que el cost de desmantellament d'una planta nuclear de 1.000 MW pot estar comprès entre 175 i 750 milions de dòlars. Per tant el cost de desmantellament dels 360 reactors que abans de 25 anys hauran de passar per aquest procés estarà comprès entre 63 i 270 mil milions de dòlars (entre 6 i 27 bilions de pessetes!).

Nova equivocació

La indústria nuclear no solament haurà d'aprendre com desmantellar les centrals nuclears i l'Administració pública no solament haurà de fer front al problema de què fer amb el combustible irradiat i els residus procedents del desmantellament, sinó que bona part dels residus hauran de mantenir-se aïllats de la biosfera més de 10.000 anys, o sia un període de temps més gran que tota la història registrada.

També aquesta vegada la indústria nuclear es va equivocar afirmant que el desmantellament d'una central nuclear seria un negoci rendible (ja que confiava que la venda de components usats superaria els costos propis del desmantellament).

Per tant, cada vegada és més evident que no es coneixerà realment el que significa el desmantellament d'un reactor nuclear dels que actualment estan en funcionament fins que se n'afronti a la pràctica el desmantellament d'un. Avui és una incògnita tant el cost de desmantellament de les nuclears de l'Estat espanyol com la tecnologia que s'hi haurà de fer servir. ¿Qui haurà de pagar aquests costos? ¿Les empreses elèctriques que han anat repartint beneficis als seus accionistes? ¿O la societat a la qual se li va imposar l'opció nuclear? Conseqüentment, la qüestió clau de la indústria nuclear, al llarg de la dècada dels 90, no serà la seva expansió sinó el desmantellament i la descontaminació dels reactors que vagin acabant la seva vida útil o vagin sofrint accidents.

Després d'haver constatat que la indústria nuclear als Estats Units d'Amèrica s'ha mantingut al llarg de la dècada dels 80 en una crisi sense sortida —entre 1980 i 1989, la quantitat de residus generats s'ha duplicat, els costos s'han quadruplicat i els incidents/accidents han excedit la quantitat de 34.000; al llarg d'aquests 10 anys el nombre de treballadors exposats a dosis mesurables de radioactivitat ha estat de 832.000. A més, cap nova central nuclear s'ha comprat des de l'any 1978 i, en finir 1989, només 9 reactors nuclears estaven *oficialment* en construcció i d'aquests s'espera que només 3 s'arribin a acabar—, s'evidencia que l'eficiència energètica i les renovables s'han convertit en l'alternativa més neta, més barata, més segura i socialment més acceptable a l'energia nuclear.

Amb la manifesta validesa de la crítica ecologista no té cap mena de justificació que el plan energèticonacional, que a la tardor es discutirà a les Corts espanyoles, inclogui la posada en funcionament d'alguna nova central nuclear. Comença a ser hora que el PEN deixi de ser el que fins ara ha estat i obri, d'una vegada i decididament, la porta a l'era solar.

L'energia necessària

Sis Estats dels EUA ofereixen una pauta per al bon ús energètic

Josep Puig

Els fets que van esdevenir al golf Pèrsic són fruit de les conveniències polítiques de les antigues potències colonials, les quals feren néixer una munió d'estats-nació fictícis que disposaven de grans magatzems subterranis de petroli, i que posen en evidència, una vegada més, que la via industrialista de desenvolupament només es pot sostenir si va acompanyada d'una variada forma de sistemes de domini, entre ells, l'econòmic i el militar.

Han passat ja disset anys des de l'anomenada primera "crisi" del petroli. A més, al llarg de tot aquest temps s'han anat fent evidents les conseqüències ecològiques de la producció massiva d'electricitat mitjançant els combustibles fòssils i nuclears.

A Catalunya l'accident ocorregut la tardor passada, a la central nuclear de Vandellòs 1, va palesar irregularitats de tota mena, dissenys defectuosos, fallades de manteniment, incompliment de normatives, etc. Encara avui no sabem amb certesa les seves conseqüències radiològiques (el mateix *Informe del Consejo de Seguridad Nuclear* atribueix fallades als equips de mesura, aquells que sobresurten dels nivels de fons considerats "normals").

En aquesta situació no hi podien mancar les veus d'aquelles persones que tornen a proposar l'energia nuclear com a "solució" als problemes derivats dels combustibles fòssils. Ja siguin als problemes ecològics com els geopolítics.

Són les mateixes veus que reiteradament en el passat erraren, una i altra vegada, les previsions de l'evolució de les necessitats energètiques.

Les mateixes veus que ja l'any 1969 varen preveure per a l'any 1980 unes necessitats de potència instal.lada nuclear a l'Estat espanyol de 8.000 megawatts (MW), que l'any 1972 preveieren 15.000 MW per a l'any 1983, i que l'any 1975 varen preveure 22.700 MW per a l'any 1985. Avui la potència nuclear operativa a l'Estat espanyol és lleugerament superior als 7.000 MW.

Alternatives errònies

Una de les conseqüències d'aquelles il.lusòries previsions nuclears ha estat el traspàs a mans de l'Estat de bona part de la propietat del parc nuclear espanyol, per evitar l'enfonsament econòmic del sector elèctric privat.

Buscar en la nuclear l'alternativa als problemes associats al petroli seria tornar a incórrer en els errors del passat. Després dels informes i estudis publicats pels investigadors del Rocky Mountain Institute (fundat l'any 1984 per Amory i Hunter Lovins, i avui considerat un dels centres més prestigiosos que hi ha al món pel que fa a qüestions energètiques), continuar defensant la nuclear hauria de ser considerat un "delicte" social, econòmic i ecològic.

Tampoc són alternativa les grans instal.lacions termoelèctriques basades en el carbó, a causa dels seus impactes ecològics.

Únicament poden ser considerades de transició en el cas que incorporin tecnologies de combustió "netes" (és a dir, que no contribueixin significativament a l'enverinament de l'atmosfera descarregant-hi gasos que produeixin pluges àcides o gasos que incrementin l'efecte hivernacle, com el diòxid de carboni). Avui cap país industrialitzat pot continuar defensant que per viure millor cal produir i consumir més energia.

Els vats negatius

Ben al contrari, el repte és instal·lar negawatts (és a dir, watts negatius) als sistemes elèctrics. Així, per exemple, la simple substitució d'una bombeta d'incandescència de 75 watts per un fluorescent compacte, d'alta eficiència i baix consum, de 18 watts (que produeix la mateixa llum però té una vida 13 vegades més llarga) allibera 57 watts per a altres usos. És a dir, *genera* 57 negawatts.

Però, a més a més, al llarg de la seva vida útil, aquesta nova bombeta alentirà l'efecte hivernacle i reduirà la pluja àcida (evitant les emissions d'1 tona de diòxid de carboni i 9 kg de diòxid de sofre si l'electricitat es produïda per una tèrmica de carbó o evitarà la producció de 0,5 Curies d'Estronci-90 i Cesi-137 (elements radioactius que tota nuclear escampa per la biosfera) i d'uns 25 mg de plutoni —equivalent al poder explosiu de 385 kg de TNT o d'una radiotoxicitat equivalent a 2.000 dosis productores de càncer pulmonar—).

El mateix ocorre en substituir qualsevol artefacte elèctric actual per altres energèticament més eficients.

Exemples contundents

Que això no és cap utopia ecologista (encara que els ecologistes han estat tradicionalment els que han defensat l'ús eficient de l'energia i han copsat la importància política d'aquestes mesures) ho demostren alguns fets.

Per exemple, als Estats Units i, en concret, a New England. En aquest territori que comprèn els Estats de Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island i Vermont, la història ve de lluny i es remunta a començaments de la dècada dels anys 80 quan aquests territoris dels EUA tenien l'índex més gran de creixement del consum elèctric de tots els Estats Units. Les empreses elèctriques, per fer-hi front, proposaven construir grans centrals tèrmiques per importar hidroelectricitat del Canadà. L'oposició va sorgir dels ecologistes que s'agruparen sota la senyera de: conservació i prou potència instal.lada.

Quan les elèctriques sol.licitaren als organismes reguladors estatals l'autorització per construir noves tèrmiques, els ecologistes foren capaços de frenar l'autorització, dient que les inversions eren "imprudents", ja que conservar l'energia és molt menys car que instal.lar nova capacitat de generació.

Fins i tot davant un proposat embassament a Maine, els ecologistes demostraren que la simple utilització de motors elèctrics eficients, en comptes dels que s'estaven fent servir, alliberaria la mateixa quantitat d'energia que la que la central hidroelèctrica pensava produir. I a un cost 5 vegades més reduït.

Una vegada els ecologistes assoliren convèncer els organismes estatals perquè no autoritzessin nova capacitat de generació elèctrica, romania la qüestió pràctica de com convèncer les empreses elèctriques perquè invertissin en artefactes energèticament eficients.

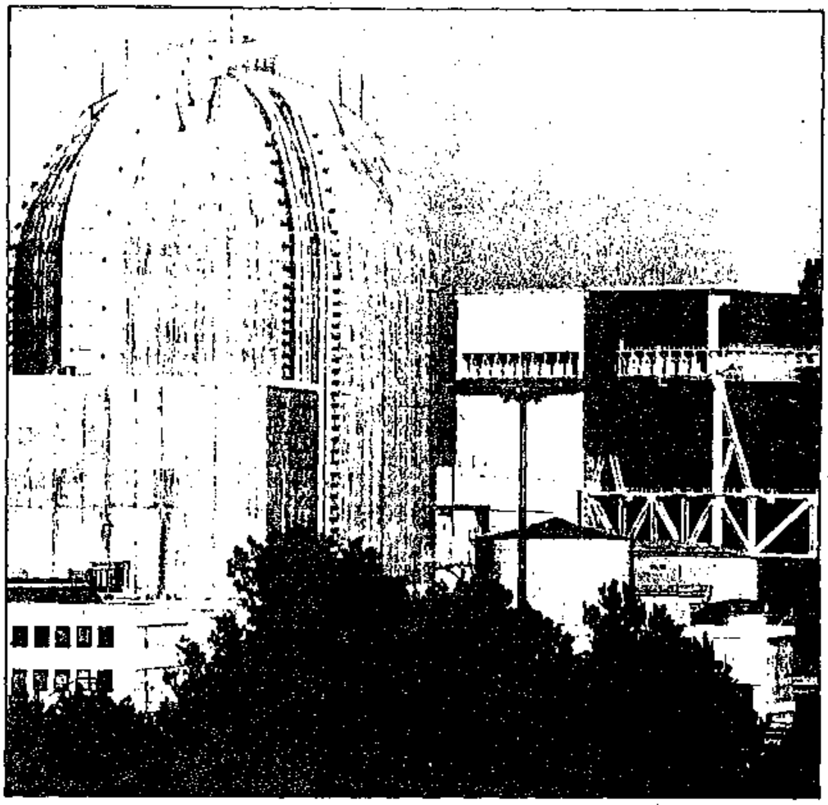
La resposta va venir l'any 1988 quan la Northeast Utilities —NU— va ser desafiada per la Conservation Law Foundation —CLF—, una organització no governamental ecologista amb seu a Boston, presentant una demanda davant la Connecticut Public Utilities Commission —CPUC—. La CLF va guanyar el cas i la CPUC va ordenar a la NU treballar conjuntament amb els ecologistes de la CLF en el disseny d'un pla per a l'ús eficient de l'energia. I no solament això, sino que, inusualment, s'obligà l'empresa elèctrica a pagar el treball dels consultors energètics escollits pels seus adversaris ecologistes.

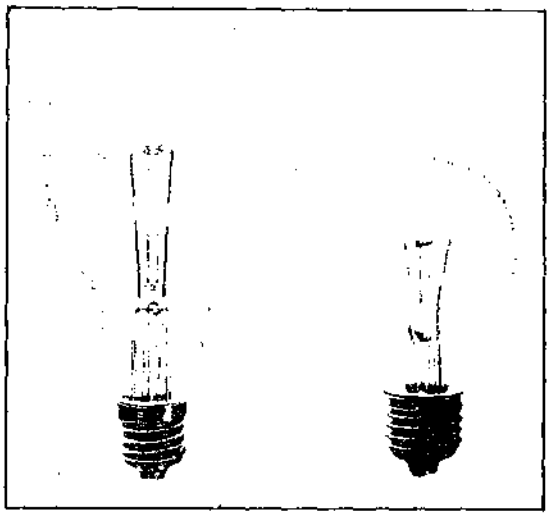
Tota una revolució: ecologistes fent servir els diners de les elèctriques per canviar les estratègies de les empreses, quan pocs anys abans els executius de les empreses elèctriques etiquetaren les campanyes ecologistes com "terrorisme informatiu".

El programa inclou l'assistència a arquitectes i promotors per minimitzar el consum elèctric en les noves edificacions, la reconversió d'habitatges, oficines i fàbriques perquè utilitzin els artefactes elèctrics més eficients, el redisseny de plantes i processos industrials. Així s'espera que la demanda elèctrica davalli a la meitat i a un cost menor.

Des que aquest programa es va anunciar a Connecticut, una onada de reformes s'ha estés per totes les elèctriques de New England. Avui 12 empreses elèctriques de New England tenen programes similars, tots implementats en col.laboració amb la CLF i sota la mirada atenta dels organismes reguladors estatals.

La CLF espera que aquests programes eliminin la necessitat de noves plantes de generació termo-elèctriques (de combustibles fòssils i nuclears) a New England al llarg de les properes dècades. Els beneficiaris: les empreses elèctriques (tindran més guanys) i els usuaris (les tarifes seran més baixes).





AVUI

Substituir aparells i estris elèctrics per altres de més eficaços és el millor camí per a l'estalvi energètic i el respecte al medi ambient

Recentment —estiu 1990—, la Conservation Law Foundation ha estat guardonada per l'American Council for an Efficient-Energy Economy amb el premi per fer de l'eficiència energètica la font dominant i més profitosa dels nous serveis a New England.

La 'perestroika' elèctrica

La CLF considera que encara resta molt treball per fer, ja que les empreses elèctriques són dominades per enginyers i planificadors financers que tenen poca o nul.la experiència en la implementació de programes d'eficiència energètica i que el seu compromís amb aquesta nova era de *perestroika* elèctrica és encara poc ferma. Per això, la CLF creu que les empreses elèctriques necessitaran encara un suport i una pressió constant per part dels ecologistes per arribar a ser un model per a les altres elèctriques dels EUA i del món.

Si aquests programes tenen èxit (i els primers resultats van confirmant les expectatives) demostraran que els programes d'eficiència energètica seran un dels assoliments importants en matèria de política energètica de la passada dècada.

Ara que a l'Estat Espanyol s'està replantejant la qüestió energètica per als anys que vindran, ignorar aquesta via per cobrir les necessitats d'energia amb el mínim impacte sobre el medi natural i social suposaria no solament miopia política sinó també malbaratament dels recursos econòmics disponibles en un país. Llàstima que els responsables energètics del govern català i de les empreses elèctriques que subministren el mercat català hagin fet gala, al llarg dels darrers anys, de tanta manca d'imaginació i de tan poca capacitat d'adaptació a les noves circumstàncies mundials.

En definitiva, cal també una *perestroika* elèctrica a Catalunya. Podria ser l'aportació catalana a la reorganització del sector elèctric de l'Estat espanyol.

Josep Puig i Boix és doctor enginyer industrial, professor de recursos energètics a la UAB i membre del Grup de Científics i Tècnics per un Futur No Nuclear

Ascó y Almaraz cambiarán los generadores de vapor por un defecto de corrosión

MEDIO AMBIENTE

■ Un proceso ya conocido de corrosión afecta a los tubos de intercambio de calor, lo que amenaza con disminuir la potencia eléctrica de estas centrales

ANTONIO CERRILLO

BARCELONA. – Las centrales nucleares de Ascó (Tarragona) y Almaraz (Cáceres) deberán sustituir sus generadores de vapor, a partir de 1994, a consecuencia de un defecto de diseño del material que amenaza con disminuir la potencia de su producción eléctrica. Las empresas propietarias de estas centrales han empezado a estudiar ya en el extranjero las tareas de recambio de estos generadores con el objetivo de planificar unas operaciones a las que se destinarán unos 80.000 millones de pesetas.

El defecto que sufren los cuatro grupos nucleares (Ascó I y II, y Almaraz I y II) consiste en un proceso de corrosión que afecta a los tubos de los generadores de vapor suministrados en su día por la compañía Westinghouse. En total, deberán ser cambiados 12 generadores de vapor, ya que cada planta tiene tres de ellos en su edificio de contención.

Larga planificación

Los tubos del generador de vapor transportan agua a altas temperaturas procedente del núcleo y, por un intercambio de calor, calientan el agua a temperatura ambiente del circuito secundario para producir vapor. Este vapor, fuera del edificio de contención, activa las turbinas que producirán la energía eléctrica.

La planificación del recambio de generadores, ya iniciada, requiere unos cinco años, por lo que los trabajos pueden iniciarse a partir de 1994. Las empresas propietarias de Ascó y Almaraz deberán estudiar las posibles ofertas que hagan las compañías de ingeniería para vender los nuevos generadores de vapor y realizar las tareas de recambio.

Las empresas que están en buenas condiciones para poder reponer el generador de vapor son Siemens-KWU (Alemania), Westinghouse (EE.UU.) y Framatome (Francia). En la valoración de la oferta será muy tenida en cuenta, a buen seguro, la experiencia profesional anterior de la empresa en la sustitución de este mismo tipo de generadores, así como otros criterios de seguridad, financiación y plazos de realización, según fuentes de la Asociación Nuclear de Ascó (ANA), que aglutina a las empresas propietarias de la central (Fecsa, 52,5 por ciento; Endesa, 40 por ciento, e Hidruña, un 7,5 por ciento). La organización de los trabajos puede verse afectada de alguna manera por la decisión de Fecsa de vender a Endesa un 30 por ciento de su participación en Ascó, de lo que informó "La Vanguardia" el viernes.

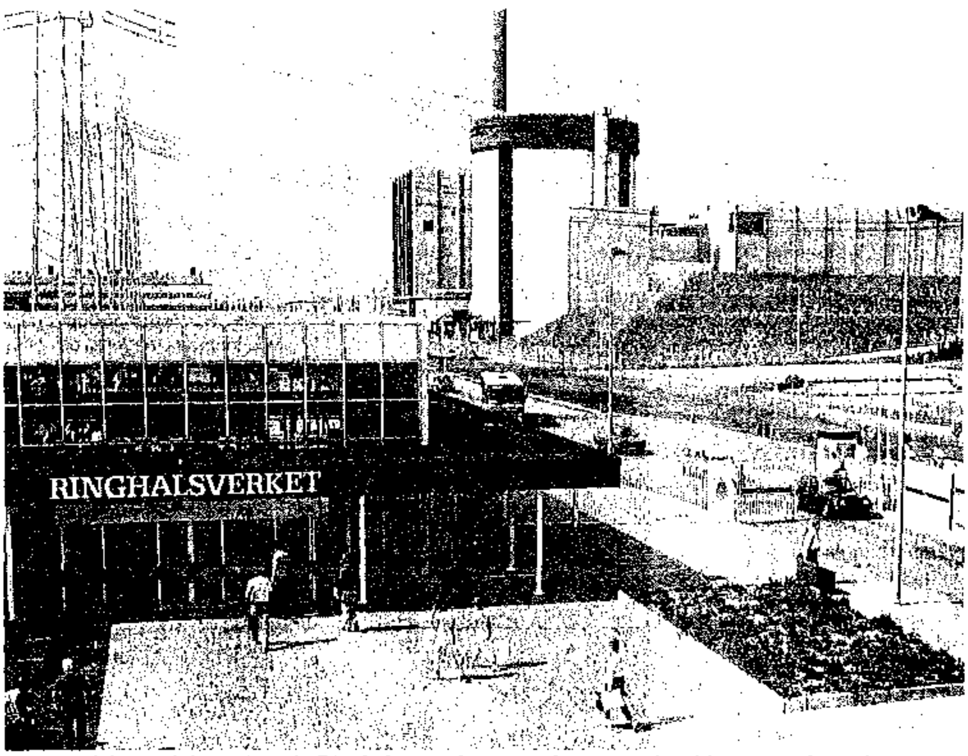
La anomalía detectada en los tubos de los generadores de vapor comporta una pérdida de espesor de las conducciones, lo que, en caso de derivar en una rotura definitiva, puede provocar que el agua del circuito primario contamine el circuito secundario.

Taponar los tubos

La principal repercusión de este problema, sin embargo, no es los posibles problemas de seguridad, sino la merma en la potencia de la producción eléctrica de la central, según las mismas fuentes de ANA. Ahora, cuando tras las revisiones que se hacen se detecta que alguno de los tubos padece la pérdida de espesor, la conducción es taponada, de manera que deja de funcionar. Esta fórmula comporta lógicamente que cuantos más tubos quedan fuera de servicio, más disminuye la capacidad de intercambiar calor y, por lo tanto, de producir vapor y energía. Según los técnicos, con una revisión anual ya se puede detectar un problema a tiempo.

Los generadores de vapor afectados fueron suministrados por Westinghouse, algunos de los cuales han debido ser sustituidos en otros países, también por este mismo defecto (denominado "stress corrosion cracking").

Este problema concreto fue detectado por primera vez en una nuclear de Estados Unidos en 1975. ●



Aspecto del complejo nuclear de Ringhals, una de cuyas plantas sustituyó los generadores de vapor

Modelo sueco para aumentar la potencia

■ El recambio de los generadores de vapor podría comportar un incremento del nivel de potencia de las plantas españoles afectadas, si se aplica la misma fórmula que la practicada en la planta de Ringhals II, en Suecia. La sustitución de los generadores de vapor en esta planta (dado que la compañía explotadora es estatal) debió ser autorizada por el Parlamento, que vivió un animado debate sobre la conveniencia o no de hacer un gasto tan elevado, teniendo en cuenta la vida limitada de la planta. Al final, la respuesta fue subir un nueve por ciento el nivel de potencia para recuperar la inversión.

El debate se trasladó a la opinión pública, sobre todo cuando la cuestión se discutía en el Parlamento y al agujerearse el edificio de contención. El proceso coincidió con una población aún sensibilizada por el accidente de Chernobil, en 1986. (Desde entonces, el porcentaje de población que está contra la energía nuclear ha bajado desde un 65 por ciento a un 40 por ciento.)

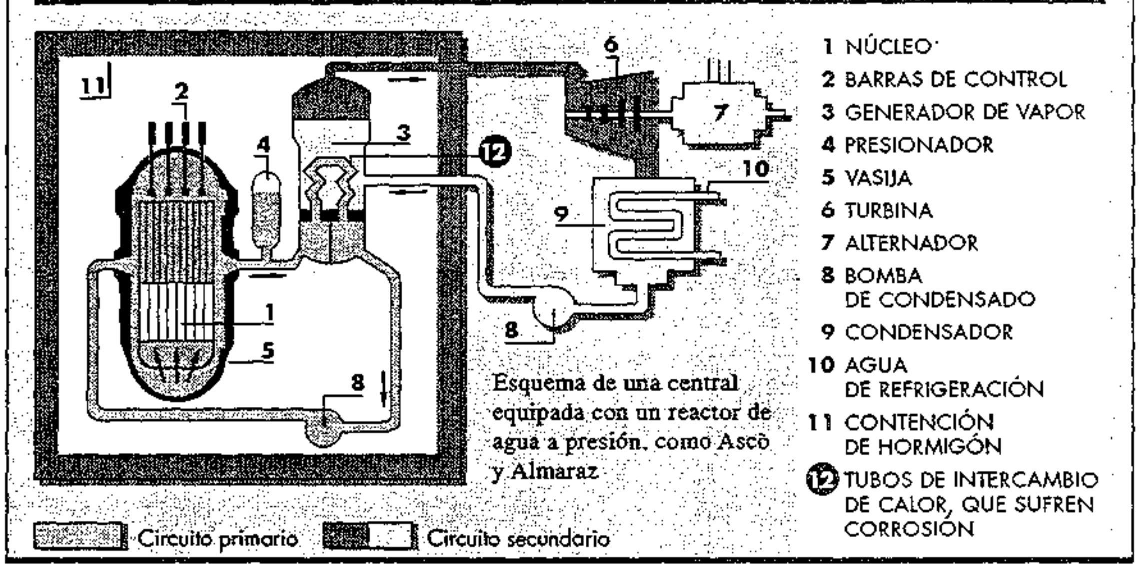
El recambio de los generadores de vapor es la mayor operación de mantenimiento en las centrales en los próximos años. En España el seguimiento y control lo hará el Consejo de Seguridad Nuclear.

Ascó y Almaraz quieren cargar al usuario el coste de los nuevos generadores

MEDIO AMBIENTE

■ La sustitución de los generadores de vapor averiados obligará a realizar obras en el edificio de contención de las plantas de Almaraz para hacer esta operación, que será más sencilla en Ascó

REACTOR DE AGUA A PRESIÓN



Esquema de una central equipada con un reactor de agua a presión, como Ascó y Almaraz

LA VANGUARDIA

ANTONIO CERRILLO

BARCELONA. – Las centrales nucleares de Ascó (Tarragona) y Almaraz (Cáceres) han propuesto al Gobierno acogerse al marco legal estable para cargar en la tarifa eléctrica el coste de la sustitución de sus generadores de vapor defectuosos. El recambio de los generadores de vapor se iniciará a partir de 1994 y tendrá un coste de unos 80.000 millones.

El defecto de los cuatro grupos nucleares (Ascó I y II, y Almaraz I y II) consiste en un proceso de corrosión que afecta a los tubos de intercambio de calor, y que amenaza con disminuir la potencia de la producción eléctrica de estas centrales. Por esta razón, deberán ser cambiados 12 generadores de vapor, dado que cada planta tiene tres de ellos.

En concreto, las empresas han propuesto una repercusión en la tarifa que puede estimarse, en valores de 1990, en unas 0,019 pesetas por kilowatio hora distribuido, o un incremento medio adicional del 0,15 por ciento en la tarifa a partir de la fecha de sustitución de los generadores, y mientras dure la vida económica de la central.

El decreto 15/38 de 11 de diciembre de 1987 prevé que las inversiones extraordinarias que realicen las empresas eléctricas puedan ser consideradas como gastos de coste del servicio, lo que da derecho a repercutirlo en las tarifas. La decisión final corresponde al Ministerio de Industria.

Las centrales han empezado a estudiar el recambio de estos generadores, que podría ser llevado a cabo por Siemens-KWU (Alemania), Westinghouse (EE.UU.) o Framatome (Francia). En la valoración de la oferta que realicen estas empresas, será muy tenida en cuenta, a buen seguro, la experiencia anterior.

La anomalía detectada en los tubos de los generadores de vapor conlleva una pérdida de espesor de las conducciones, lo que, a la larga, puede provocar que el agua del circuito primario contamine el secundario. Ahora, cuando se detecta que alguno de los tubos padece la pérdida de espesor, la conducción es taponada, y deja de funcionar. Esta fórmula comporta lógicamente que cuantos más tubos queden fuera de servicio, más disminuye la capacidad de intercambiar calor y, por lo tanto, de producir vapor y energía. Los técnicos consideran que con una sola revisión anual los efectos de esta anomalía pueden ser evitados.

En el caso de las dos centrales de Almaraz se deberá hacer un gran agujero en el edificio de contención para poder extraer los viejos generadores e instalar los nuevos. Sin embargo, en Ascó la puerta de entrada de equipos servirá para hacer esta operación. ●

Los 72 días que cambiaron una central sueca

■ Uno de los modelos que servirá para el cambio de los generadores de vapor es el que fue realizado en la planta de Ringhals II, cerca de Gotemburgo (Suecia). El recambio fue realizado por Siemens, cuyos equipos organizaron una planificación que concretaba los trabajos con un detalle de dos horas. La operación, realizada entre mayo y julio de 1989, duró 72 días. En este caso se debió hacer un agujero en el edificio de contención, para lo cual se taladraron las capas de hormigón y plancha de acero de la estructura, destinada a confinar la actividad en esta parte de la planta. Luego la "pared" se repuso.

Enormes plataformas hidráulicas en el exterior del edificio de contención y una grúa polar, en el interior, fueron necesarias para sustituir el viejo generador de vapor (de 20 metros de altura y 308 toneladas) por otro nuevo de 330 toneladas. Se trataba de operaciones que requerían un encaje muy preciso con las demás conexiones, por lo que fue necesario, previamente, hacer pruebas a escala real de presión para comprobar que no había fugas. Todo ello obligó a crear residencias especiales para los trabajadores, a hacer trabajos de descontaminación y a extremar las medidas de protección radiológica.

UGT asegura que los bomberos no están preparados para una alerta nuclear

ADMINISTRACIÓN

■ Tras el incendio de Vandellòs I, CC.OO. denunció falta de preparación. Para UGT "hoy estamos peor"

FRANCESC PEIRÓN

BARCELONA. – Los representantes de UGT en los Bomberos de la Generalitat denunciaron ayer la falta de preparación en caso de alerta por accidente nuclear. UGT afirmó que los bomberos, además de carecer de formación para afrontar una situación de este tipo, tampoco disponen de los vehículos idóneos, de material o de equipos personales adecuados. Este sindicato también señaló que ha propuesto la creación de un cuerpo voluntario de especialistas, pero subrayaron que la Generalitat no ha respondido.

"Un año y medio después del accidente de Vandellós I estamos peor que antes", explicó Miguel Ibars, secretario general de la sección sindical de UGT de Bomberos de Cataluña. Según este representante, la única medida adoptada por el Departament de Governació tras el incidente de Vandellós I, en octubre de 1989, ha consistido en "una visita turística de los bomberos de Tarragona a las instalaciones nucleares, en la que se ofrecía una gran comida. Pero no se les enseñaba nada, ya que al recinto controlado no entraban. Una visita que casi se puede calificar de escolar". Fuentes de Governació indicaron que el responsable de la dirección general de Prevención y Extinción de Incendios, Josep Ramon Dueso Paratge, se encontraba de viaje y que sería este director general el que respondería, a partir del lunes, a las afirmaciones de UGT. Sin embargo, estas fuentes confirmaron que se han producido las citadas visitas a instalaciones nucleares, aunque matizaron que "son ellos (UGT) los que dicen que son visitas turísticas o escolares. El objetivo es que los bomberos conozcan una central".

Según estas fuentes de Governació, UGT, en relación a CC.OO: es muy minoritario en cuanto a representación en este sector. Ayer por la tarde fue imposible localizar a representante alguno de CC.OO. para que se pronunciara, pero la agrupación de bomberos de este sindicato, tras el grave accidente de Vandellós I, ya denunció la falta de formación y de equipos adecuados para actuar en este tipo de siniestros, así como falta de información.

Los representantes de UGT explicaron que ellos han hecho sondeos con bomberos de las zonas nucleres de Tarragona y que sería posible reunir los 50 voluntarios que consideran necesarios para formar un cuerpo de especialistas. Francesc García, responsable en UGT del departamento de funcionarios de la Generalitat, indicó que la Administración no responde, "porque no sabe cómo afrontar el caso".

EFE

La central Vandellòs I después del incendio del 20 de octubre de 1989

Faltan medios

Para este sindicalista, en la escuela de bomberos de la Generalitat, ubicada en Bellaterra, se enseña a trabajar en casos de incendios en pisos, en bosques, en zonas rurales, a actuar en accidentes..., pero no se hace adiestramiento alguno para intervenir en industrias altamente tóxicas o en centrales nucleares. "Estas empresas –subrayó– deberían tener sus equipos, pero son insuficientes y en caso de accidente en una nuclear, que son competencia del Estado, debemos intervenir por su influencia en el entorno".

Además de la escasez de material y vehículos –algunos en servicio desde 1963, según UGT–, los representantes de este sindicato dijeron que hay "una falta notoria" de personal –desmentido por Governació–, y de mandos, ya que "no se han producido ascensos desde 1981". ●

Sociedad

Industria impone a Hifrensa la máxima multa por el incendio que cerró Vandellòs I

ENERGÍA

■ La empresa propietaria deberá pagar 70 millones de pesetas por el retraso en la comunicación del accidente producido en octubre de 1989, que hubiera impedido activar los planes de urgencia

MAR DÍAZ-VARELA

MADRID. – El Ministerio de Industria ha sancionado a Hifrensa, la empresa propietaria de Vandellòs I, con una multa de 70 millones de pesetas por el incidente registrado el 19 de octubre de 1989, que dio lugar al cierre de la central. Ésta es la multa más alta impuesta hasta el momento por la Administración por un accidente nuclear y tendrá que ser autorizada por el Consejo de Ministros. La sanción responde al retraso en la comunicación de información a la Administración, lo cual pudo impedir la puesta en marcha de los dispositivos de seguridad pertinentes si la gravedad del incidente hubiera sido mayor. Según fuentes de la Administración, esta multa no responde a las causas que dieron origen al incidente, sino a la falta de información concreta suministrada al Consejo de Seguridad Nuclear (CSN) y a la baja calidad de la información proporcionada. Ambas cosas "han sido consideradas como una grave irresponsabilidad de la empresa, por lo que el Estado ha decidido sancionarla con la máxima multa impuesta hasta el momento y que asciende a 70 millones de pesetas".

El incidente se produjo el 19 de octubre de 1989, a las 21.30 horas, cuando se registró un incendio que no fue comunicado al CSN hasta casi una hora y media después. "Este retraso en la comunicación al comité de seguridad de la CSN habría impedido poner en funcionamiento los planes de urgencia y el PENTA externo de la central, lo que habría tenido gravísimas consecuencias si la avería hubiera sido mayor."

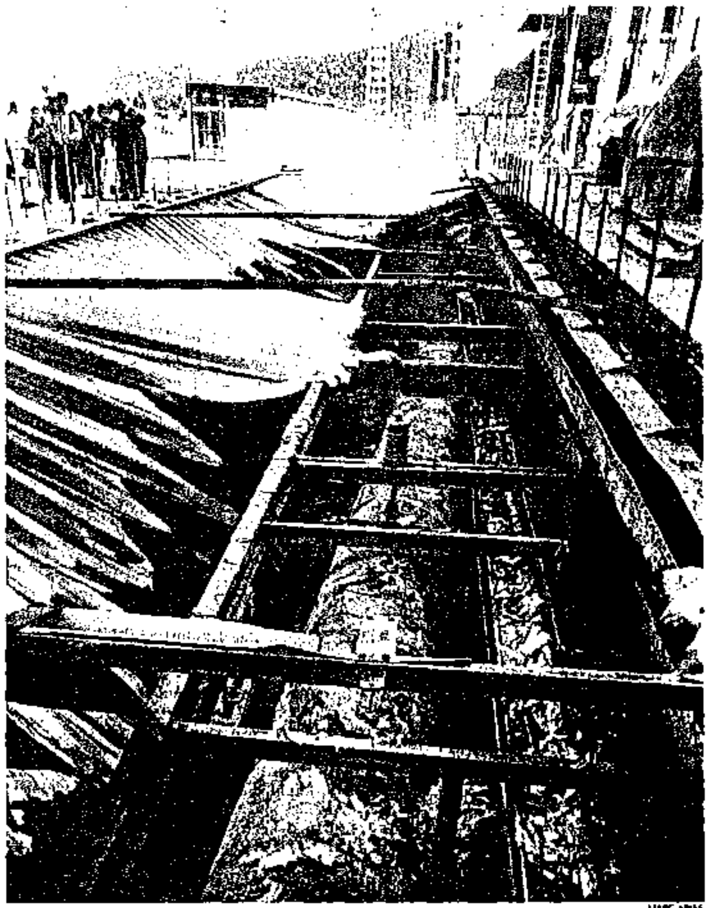
Las mismas fuentes aseguran que, por ejemplo, este retraso habría hecho perder un tiempo precioso para evacuar la zona si la gravedad del accidente lo hubiera requerido, ya que es el CSN el responsable de activar los planes de urgencia civil. Por lo tanto, la sanción responde no a la responsabilidad del incidente, sino a la desinformación, falta que ha sido considerada como "muy grave" tanto por el Consejo de Seguridad Nuclear, como por el Ministerio de Industria.

La multa responde a los expedientes presentados ante el Ministerio de Industria por el gobernador civil de Tarragona, el 26 de octubre de 1989, y el informe provisional realizado por el Consejo de Seguridad Nuclear, presentado el 26 de noviembre del mismo año. Ambos informes provocaron el cierre de la central nuclear, anunciado en el Parlamento por el ministro de Industria, Claudio Aranzadi, que argumentó razones económicas. Según Aranzadi, las inversiones que requería la planta para operar de nuevo con absolutas garantías de seguridad superaban el coste de obtener la misma energía (700 megawatios) de otra forma, concretamente a través del carbón de importación.

El ministerio sanciona la falta de información de la empresa al Gobierno Civil de Tarragona y al Consejo de Seguridad Nuclear

En la carta que remitió a Hifrensa el pasado jueves, el Ministerio de Industria argumenta que la empresa encargada de la gestión de la central incurrió en una falta grave al retrasarse en la comunicación del incidente. Añade que la normativa indica explícitamente que en caso de siniestro nuclear "debe comunicarse al Consejo de Seguridad Nuclear tan pronto como sea posible y en ningún caso en un periodo de tiempo superior a los treinta minutos".

A partir de la comunicación de esta sanción, Hifrensa cuenta con un plazo de ocho días para presentar sus alegaciones, y antes de dos meses el Consejo de Ministros deberá autorizar la multa. Ésta es la sanción más cara impuesta hasta el momento por la Administración, ya que hasta el momento se habían impuesto multas inferiores a los cinco millones de pesetas, dentro del límite al que está autorizado el ministro de Industria. ●



MARC ARIAS

El incendio se inició en la zona de producción eléctrica de la central nuclear

La Fiscalía investiga la responsabilidad penal

■ La Fiscalía de la Audiencia Provincial de Tarragona investiga si la empresa propietaria de Vandellòs I, Hispano-Francesa de Energía (Hifrensa), es responsable directa del accidente ocurrido el 19 de octubre de 1989, que provocó el cierre definitivo de la central nuclear, informa Rosa Mari Bosch.

La Fiscalía lleva las diligencias del caso conjuntamente con el Juzgado de Reus, después de que dicho juzgado incoara un procedimiento judicial en virtud de una querella presentada por un grupo ecologista contra la central, según informó el fiscal José María Parra.

El juez Javier Alvar ya ha tomado declaración al director de la planta, a diversos bomberos y al inspector residente del Consejo de Seguridad Nuclear. La complejidad de tipificar como ecológico el presunto delito cometido por Hifrensa dificulta las investigaciones, según fuentes cercanas al caso.

El Ministerio de Industria optó en mayo de 1990 por el cierre de Vandellòs I, alegando razones económicas, al juzgar que la reapertura obligaría a efectuar inversiones cercanas a los 50.000 millones de pesetas para garantizar todos los requisitos de seguridad, cuando era posible obtener energías alternativas. En su informe definitivo, las condiciones impuestas por el Consejo de Seguridad Nuclear para la reapertura de la planta eran tan costosas que casi obligaban a construir una central nueva.

Tras la retirada del combustible no gastado, proceso en el que se invertirán unos cinco años, Enresa, la empresa pública encargada de gestionar los residuos radiactivos, asumirá la clausura definitiva de la instalación nuclear.

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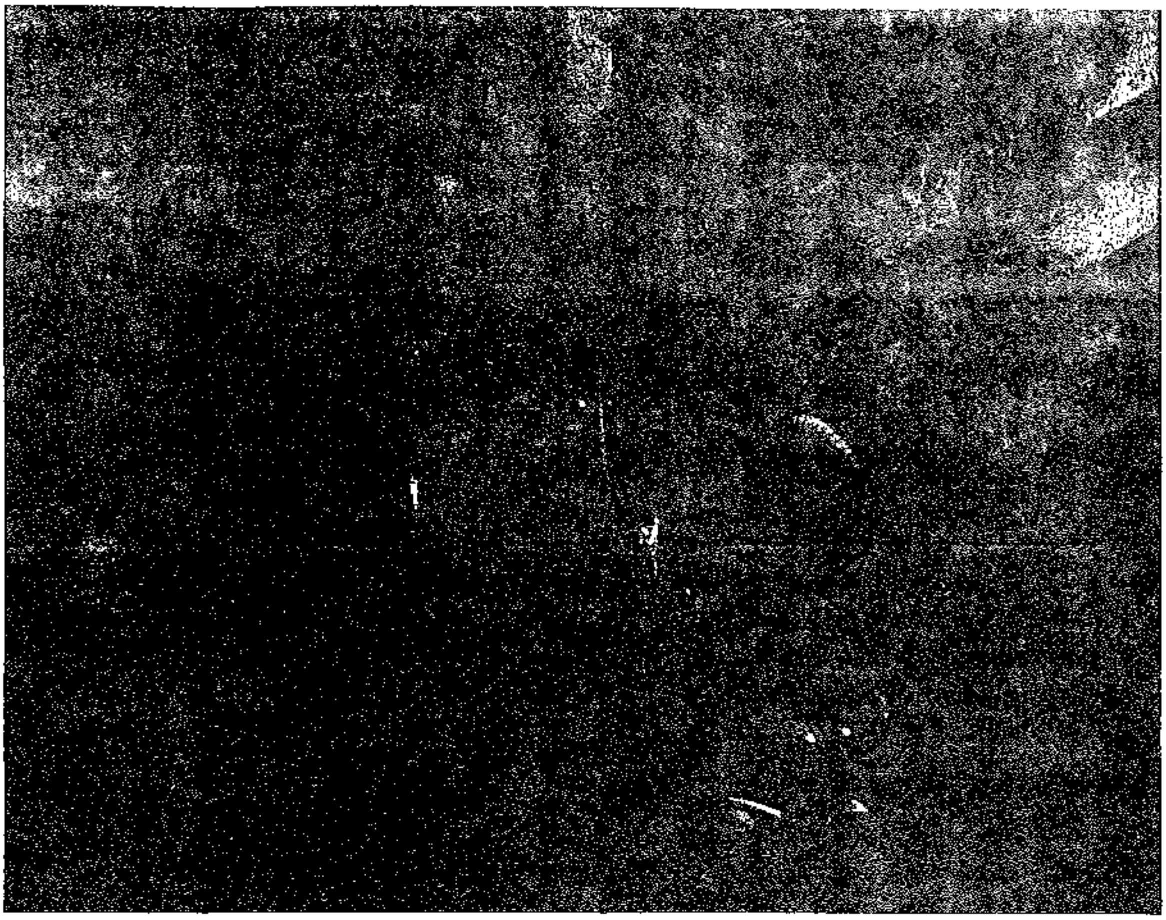


Los hijos de la radiación

Cuando se cumplen cinco años del accidente nuclear de Chernóbil, miles de niños han sido víctimas del cáncer. Otros muchos sufren enfermedades de oscuro diagnóstico. Todos viven de espaldas a una naturaleza contaminada que antes fue su paraíso y ahora es su enemigo mortal.

CHERNOBIL

TEXTO: JOHANNA WIELAND
FOTOGRAFÍA: HANS MADEL

17.3.91

La desactivación total de los edificios de la central fue realizada tres meses después del accidente

EL DESASTRE

En la madrugada del 26 de abril de 1986, se produjo la mayor catástrofe nuclear de la historia: la explosión de la planta de energía nuclear de Chernóbil. El accidente liberó entre 30 y 40 veces más material radiactivo que las bombas atómicas de Hiroshima y Nagasaki en 1945, y las pérdidas humanas, materiales y económicas han sido incalculables. La primera evacuación comenzó 36 horas después del accidente, que se conoció oficialmente antes en Suecia que en la URSS. Se tardó 12 días en extinguir el fuego, y más de 135.000 personas fueron trasladadas con retraso a otras zonas. Sólo dos personas perecieron en la explosión y 28 resultaron muertas por irradiación, pero el escape radiactivo sigue matando, y sus víctimas se contarán por miles. La nube tóxica afectó a los territorios agrícolas de buena parte de Europa oriental, sobre todo a las repúblicas soviéticas de Ucrania, Moldavia y Bielorrusia; a las regiones de Silesia y Bohemia, en Checoslovaquia y Polonia, y a las comarcas rumanas en torno al delta del Danubio. Los científicos calculan que todavía habrá entre unos cuantos miles y 150.000 víctimas, y más durante los próximos 50 años. Tampoco hay cifras sobre los niños que nacerán con defectos físicos ni los miles que crecen en hospitales, afectados por leucemia, cáncer y otras enfermedades.

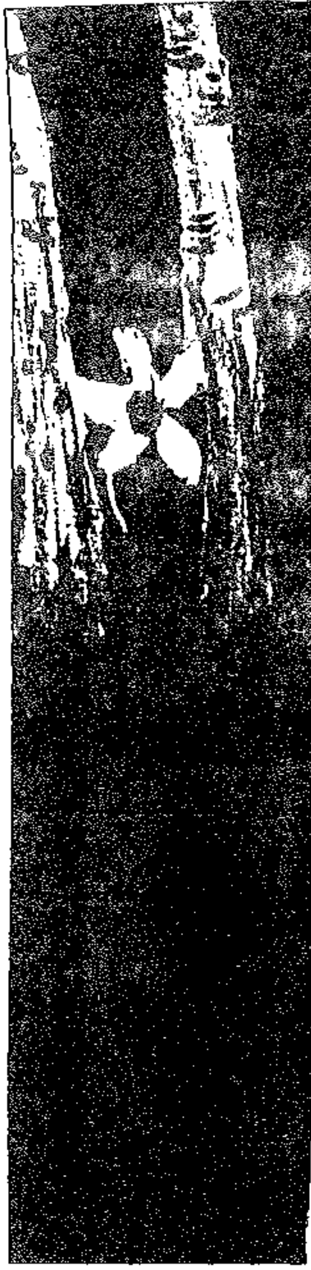
Serguéi tiene 15 años y habla como una persona mayor. Las palabras preferidas de Serguéi son "antes" y "en aquellos tiempos". Cuando dice *antes* se refiere a cuando iba a nadar en las tardes de verano, y en invierno se deslizaba con sus esquís a través de los campos que rodeaban el pueblo de Osrogladij. *Antes* era cuando se podía morder una manzana sin tener que pensarlo y se le hacía a uno la boca agua. En aquellos tiempos, Serguéi tenía 10 años, y su perro *Bimschek* vivía todavía.

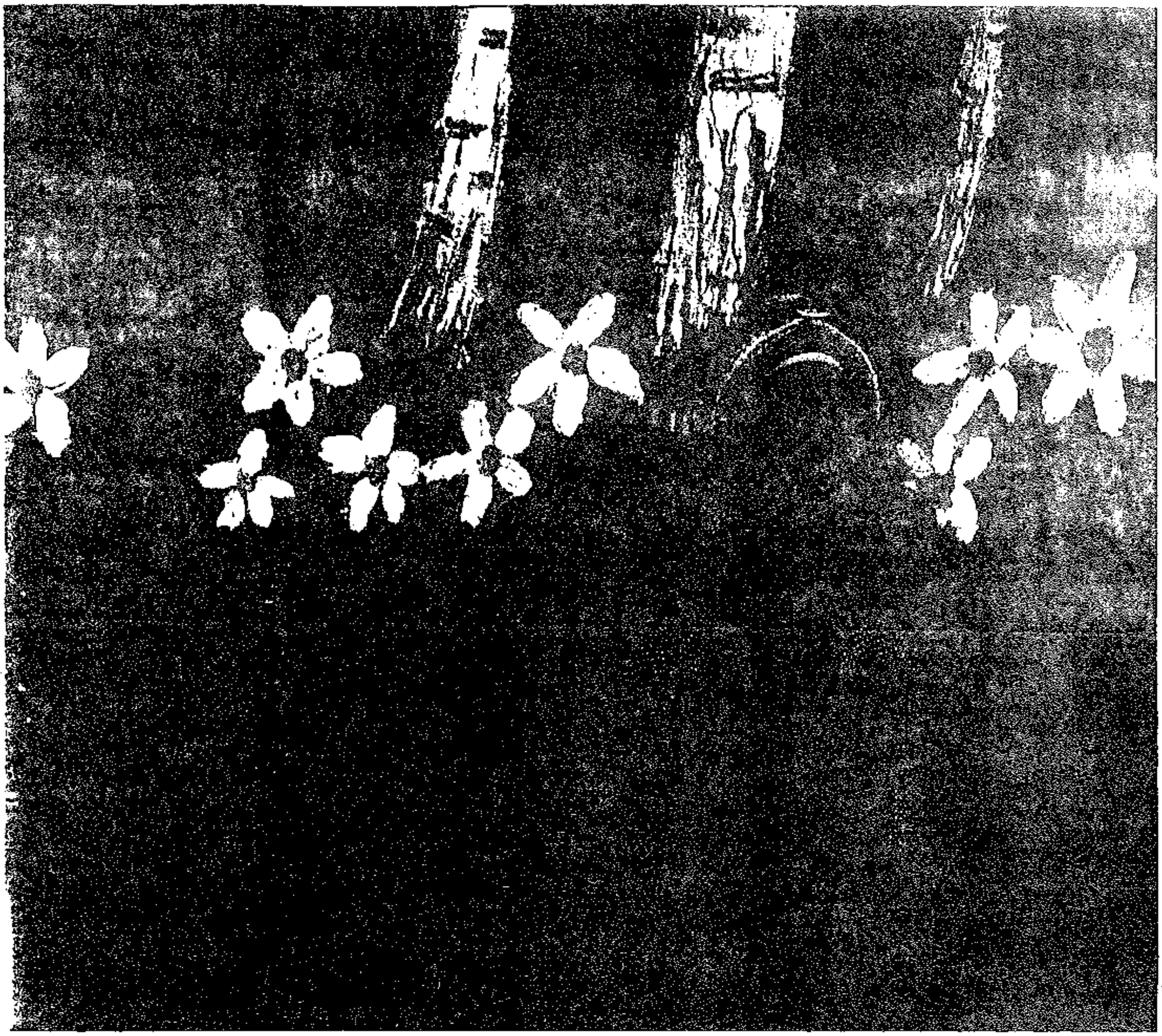
Serguéi está sentado en la cama y estruja nerviosamente un paquete de cigarrillos entre los dedos. Serguéi fuma mucho. Cuando se pone Astra sin filtro entre los labios parece un niño que hubiera crecido demasiado pronto. Su habitación es un museo lleno hasta los topes con las reliquias de una infancia que ha desaparecido. Los esquís de fondo están apoyados en la pared. No los ha utilizado desde hace años. Y esto es porque los bosques y praderas de afuera están contaminados para los próximos mil años. Un cartel de *Lassie* que cubre la pared de arriba abajo recuerda al perro que tanto echa de menos Serguéi.

Serguéi divide los 15 años de su vida en dos épocas: "Antes de la catástrofe" y "después de la catástrofe". El 26 de abril de 1986 fue el día de la transición, y nunca lo olvidará. Su voz, que todavía no es ni la voz grave de un hombre ni la aguda de un niño, se quiebra cuando lo cuenta.

"Era viernes. ¡Hacía tan buen tiempo! La verdad es que hacía demasiado calor. Mi padre y yo cargamos las cañas en el coche y nos fuimos a Pripjiat". Este río, al que las tierras mezcladas con turba de la Polessje ucraniana y bielorrusa tiñen de marrón, es conocido por su riqueza piscícola. A su orilla se encuentra, entre la ciudad provinciana de Chernóbil y la moderna *ciudad atómica* de Pripjat, la central nuclear Lenin. Es, con los 4.000 megavatios de rendimiento de sus cuatro bloques, una de las más grandes de la URSS.

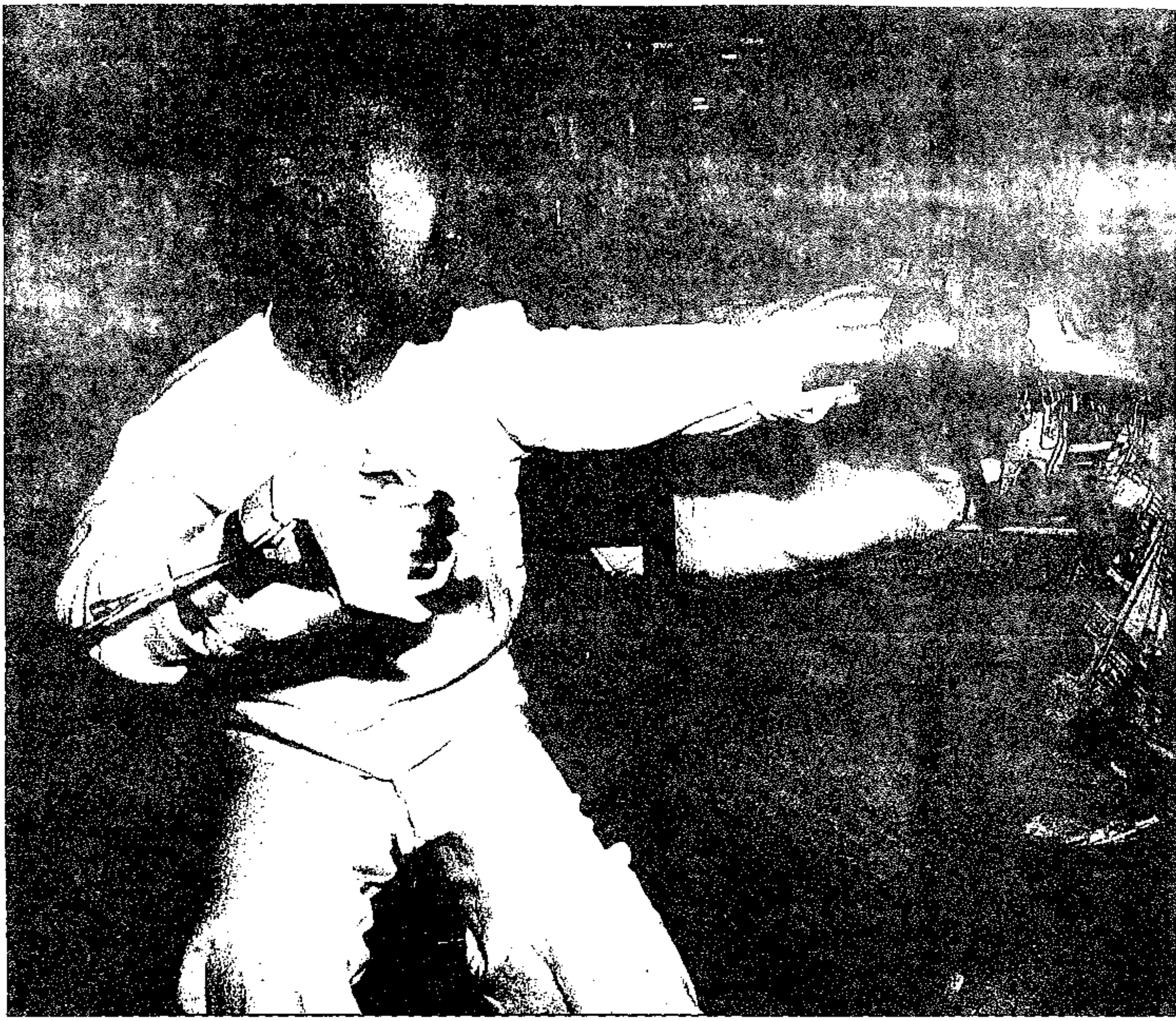
"Cuando llegamos plantamos la tienda. Estaba justo en la orilla del río, y cuando se estaba tumbado dentro todavía se podía ver el agua". El delgado muchacho se inclina hacia delante como si las palabras fueran una carga. Nuestras preguntas hacen daño. Sólo una profunda calada al cigarrillo ayuda a pasar el nudo en la garganta. Por la tarde, /PASA A PÁG. 61





Ruleta rusa

La radiactividad se ha extendido, como en una alfombra llena de parches, ante todo por las regiones de Mogiliov y Gomel. Un total de 35.000 niños y 67.000 adultos viven aquí bajo la dictadura de las prohibiciones, que, según la Cruz Roja Internacional, hacen imposible una vida aceptable. Está prohibido cazar, pescar, recoger setas, bayas o hierbas curativas. Está también prohibido cultivar jardines y criar animales. La nube radiactiva ha hecho de los habitantes de esta tierra fértil mendigos de la caridad pública, ya que dependen de los suministros de alimentos de otras comarcas. Saben que la radiación no conoce ninguna *dosis inocua;* incluso las más pequeñas cantidades de radiaciones ionizadas pueden, a menudo, pasados años o décadas, acarrear cáncer o enfermedades genéticas, con todas sus consecuencias. Pero nadie sabe cuál es el *valor límite;* es como las reglas del juego de la ruleta rusa.



Medicina occidental

Casi todos los niños internados en el hospital de Minsk proceden de las regiones altamente contaminadas de Bielorrusia. Ante la falta de departamentos hematológicos y oncológicos infantiles allí, los médicos echan de menos la bendita medicina occidental en un medio en el que faltan hasta jeringuillas desechables. En Minsk, las posibilidades de curación de la leucemia están en un 17%, mientras que en Viena están en un 70%.

En el pasillo del departamento de cáncer infantil en el primer hospital de la ciudad de Minsk, apesta a pintura al óleo. Los trabajadores arrastran ladrillos escaleras arriba y, mientras tanto, algunos niños se mueven con escasa energía en los pasillos. Lograr esos mínimos movimientos es todo un triunfo para los médicos. Las punciones provocan dolores y gemidos que dejan a los niños aletargados, ajenos a todo deseo de diversión.

VIENE DE PÁG. 58/a las dos, un técnico del puesto de mando desconecta el sistema de refrigeración de emergencia. Él debe esperar, y los operadores lo interpretan como una prueba. Más tarde, el Estado Mayor soviético, en su informe al Departamento Internacional de Energía Atómica, en Viena, notificará que el personal ha manejado el reactor como un piloto que "dirige un avión a gran altitud y abre las puertas".

Mientras que Serguéi y su padre hacen sopa de pescado en el campamento y por fin se meten en la tienda para dormir, el piloto se estrella. A la 1.23.58, dos explosiones despedazan el reactor y el edificio. El techo vuela por los aires y el volcán nuclear despide fragmentos de materiales a altas temperaturas, chispas, fuego, pedazos incandescentes de combustible y grafito hacia la atmósfera. Núcleos radiactivos con una actividad de cuatro trillones de bequereles contaminan las nubes y el viento, que llevará la radiactividad en dirección a la República de Bielorrusia. Así se pone en camino alrededor del globo terráqueo el frente meteorológico contaminado.

"Fue divertido", recuerda Serguéi de la última excursión a pescar de su vida. "Incluso habíamos pescado una lucioperca, y habíamos pensado comérnosla por la noche con mi madre". El sábado por la mañana, Serguéi y su padre cargaron su captura en el coche. A una distancia de 30 kilómetros, los bomberos intentan apagar el fuego atómico, exponiéndose de forma suicida. Padre e hijo viajan a casa justo bajo las nubes que transportan de manera inadvertida la mezcla radiactiva, compuesta sobre todo por yodo 131, cesio 137 y estroncio 90, hacia Ostrogadij.

Justo una semana después, Serguéi se halla sentado junto con sus compañeros de colegio en un autobús de evacuación que les llevará a una residencia de vacaciones en el mar Báltico.

"Mi madre lloraba, y yo creo que también", dice algo avergonzado, y su voz vuelve a quebrarse. Cuando Serguéi vuelve después de tres meses, Ostrogadij ha sido evacuado y se encuentra en la *zona prohibida*. Nunca más ha vuelto a entrar en la casa de sus padres.

Han pasado cinco años desde la avería. Serguéi, el pequeño campesino, ha ido a parar a una vivienda de nueva construcción en la cenagosa periferia de Bragin. El reactor que estalló está enterrado en un *sarcófago* de hormigón. Ya tiene grietas. Los tres bloques no destruidos de la central Lenin producen otra vez corriente, y Bragin, alejada 60 kilómetros de la tumba titánica de la era atómica, vuelve a ser una capital de distrito normal, abandonada de la mano de Dios, en el extremo sureste de Bielorrusia.

Es sábado y una fina lluvia cae sin parar. Ante la tienda de alimentación hay una cola de personas silenciosas. Sólo una anciana maldice de cuando en cuando: "¡Diablo!". Mujeres con toallas bajo el brazo se apresuran a lo largo de las fachadas de las casas hacia el balneario. Ante el registro civil, un fotógrafo dispara su cámara hacia una pareja que, sonriéndose, se acurruca bajo un paraguas. En Bragin es fin de semana.

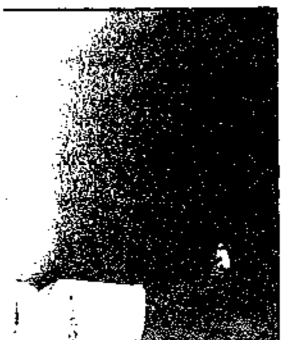
Por supuesto, la tranquilidad en la plaza de Lenin es un espejismo, porque los signos de la catástrofe bajo cuyas sombras deben vivir los 4.000 habitantes de esta ciudad sólo se han escondido. En un segundo vistazo, se puede apreciar en las calles las casas abandonadas; pequeñas notas en los árboles de la avenida ofrecen viviendas en las zonas no contaminadas de la república. Y la mujer que se balancea al compás de su lamento, ¿qué va a pasar?, no llora con lágrimas de alegría. Es la tía de la novia, y tiene miedo por los niños que su sobrina traerá al mundo.

Bragin está contaminado con más de un millón de bequereles por kilómetro cuadrado. Pero al ser la normalidad una cuestión de definición, el Ministerio de Sanidad soviético ha declarado Bragin ciudad normal. "Controles continuos" es lo que prescribe la consigna, que también autoriza la vida en medio de aquella región en estado de emergencia en que se han convertido los 7.000 kilómetros cuadrados del superdistrito de Bielorrusia (superficie casi tres veces tan grande como El Sarre).

La radiactividad se ha extendido, como en una alfombra llena de parches, ante todo por las regiones de Mogiliov y Gomel. Un total de 35.000 niños y 67.000 adultos viven aquí bajo la dictadura de las prohibiciones, que, según la Cruz Roja Internacional, hacen imposible una vida aceptable.

Tiempo atrás se llamaba a la Polessje el jardín de Bielorrusia, y la circunscripción de Bragin se encontraba en medio de él. "En aquellos tiempos", dice Serguéi, "nuestros sovjoses en Ostrogladij eran conocidos por sus cultivos de frutas, por los vinos de frutas y por las conservas". Se encoge de hombros. "Seguramente, mientras tanto, han talado los árboles". El joven evita hábilmente las prohibiciones que han acabado con la vida en el distrito de Bragin: prohibido cazar, prohibido pescar, prohibido recoger setas, bayas o hierbas curativas. Prohibido cultivar jardines y criar animales. La nube radiactiva ha hecho de los habitantes de esta tierra fértil mendigos de la caridad pública, ya que dependen de los suministros de alimentos de otras comarcas.

Igual que los pueblos de Potemkin por la nada, Bragin está constituido en sí mismo por el miedo. En Bragin, una persona, tanto vieja como joven, enferma o sana, puede asimilar a lo largo de su vida una contaminación de 35 rem; a partir de ahí comienza la amenaza para su salud. Este *valor límite* está de tres a cuatro veces por encima de lo que una/PASA A PÁG. 62



VIENE DE PÁG. 61/persona asimila en Moscú, Múnich o Roma por radiación natural. Y, además, la radiación no conoce ninguna *dosis inocua;* incluso las más pequeñas cantidades de raciaciones ionizadas pueden, a menudo, pasados años o décadas, acarrear cáncer o enfermedades genéticas, con todas sus consecuencias. El *valor límite* —que nadie sabe cómo debe ser controlado— es como las reglas del juego de la ruleta rusa. Cualquiera puede ancanzarlo en cualquier momento. La gente de Bragin sabe esto. Y deben olvidar esta certeza para poder soportar Bragin.

Wowa, el amigo de Serguéi, ignora la pregunta con un malhumorado gesto de la mano. Su cazadora vaquera es su fortaleza, y ni una vez se desprende de ella en la sofocante habitación de Serguéi. Wowa ha puesto el orgullo como una careta sobre la cara y dice insensible: "¿Ante qué debo tener miedo?, ¿ante la muerte acaso? Todos la hemos evitado".

También Wowa correteó por ahí fuera en aquellos días de la primavera de 1986, cuando la nube limpió el cielo contaminado de núclidos —"y descalzo, eso lo sé bien"—. El Ministerio de Sanidad soviético calcula que muchos miles de niños asimilaron una dosis peligrosa para sus glándulas tiroideas de yodos de corta vida. Viven con un riesgo de cáncer sustancialmente más elevado, y deben ser observados a lo largo de toda su vida.

Los cuerpos de Serguéi y Wowa son objeto de los intereses de la medicina desde hace cinco años. Tres veces al año se *miden* sus glándulas tiroideas. Médicos extranjeros les han extraído sangre, les han cortado las uñas de los dedos de las manos y también pelos, y los han metido en bolsitas donde ponen sus nombres. Siempre han llevado dosímetros consigo —"ellos dicen que dentro de 20 años vamos a tener problemas"—. Serguéi no dice quiénes son *ellos*.

Ellos les han encerrado 12 horas diarias en el colegio durante cuatro años y han hecho que una profesora, a la que la *nube* convirtió en guardián de cárcel, les vigilara. *Ellos* les han hecho jugar al pimpón y al billar como terapia ocupacional contra su ansia de salir al mundo exterior. Estos interminables años han acabado con sus ganas de vivir. A la joven maestra de Wowa y Serguéi, los jóvenes se le antojan como "viejos que ya tienen la vida a sus espaldas. Ya nunca más han vuelto a tener curiosidad".

Los *cuidados* de los adultos les han dejado la leve sensación de ser conejillos de Indias en un gigantesco experimento al aire libre sobre los efectos a largo plazo de la contaminación radiactiva. "Si esto es peligroso, ¿por qué no nos sacan de aquí?". Por primera vez aparece el movimiento en el cuerpo joven y larguirucho de Wowa. Sus padres intentan desde hace años abandonar Bragin. Hasta ahora ha sido en vano. En todas partes de Bielorrusia hay escasez de viviendas y de dinero para construirlas. Wowa llega de un salto a la ventana y la abre bruscamente. "¿Ves eso de allí?", pregunta, y señala el armazón de una nueva construcción que se encuentra en el lindero del estrecho terreno del polígono del aeródromo. "Me gustaría saber para quién construyen ésos de ahí".

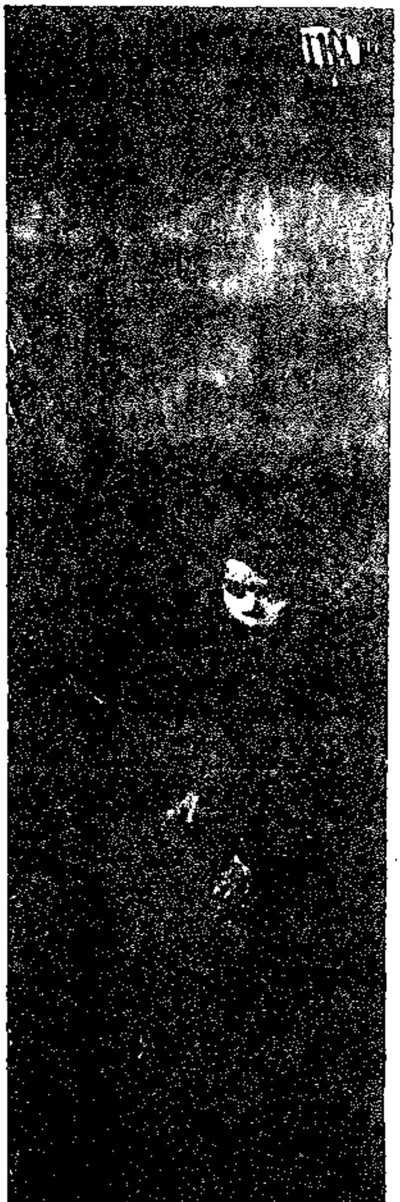
Los vestigios de naturaleza no contaminada adornan la sala de descanso de los niños en el segundo piso de la escuela de Bragin. Un par de abedules, cuidadosamente atornillados a suelo y techo, hacen de bosque bielorruso. Entre los troncos, alguien ha colocado dos ciervos disecados y un jabalí. Delante de la composición se aprecian un par de tiestos.

"Los niños", dice el director de la escuela de Serguéi y Wowa, "son siempre niños". Alexandr Ivanovitsch Lubakin quiere dar una imagen paternal y acaricia en la nuca a una niña que se nos ha acercado. "Miren lo contentos de la vida que están. Todo muy normal".

Normal es la hipoteca del inmueble del colegio. *Normal* es la jornada colegial de los niños hasta 14 años, que dura desde las 7.30 hasta las 19.00. Parece *normal* que los niños ya no coman con los padres en casa y que por eso se les sirvan cuatro comidas en el colegio. De todas maneras, no es tan *fácil* conseguir alimentos para sus 780 alumnos. Las deliciosas manzanas verdes que se encuentran a quintales en la despensa del colegio se consiguen en Moldavia para Bragin; las sandías vienen del centro de Asia, y la leche viene de una central lechera de la circunscripción de Gommel. Según el sello del departamento de Sanidad del distrito, está *limpia:* contaminada con no más de 370 bequereles por litro, y, por tanto, apta para el consumo de los niños. En Alemania, los críticos expertos en radiación consideran 10 bequereles como límite conveniente. El director intenta sonreír. Parece como si su propia consigna de resistir le hubiera extenuado. Entre sus frases se entrevé el esfuerzo que le cuesta adaptarse interiormente a este estado de excepción. "Esta escuela está condenada a muerte. En algún momento deberemos irnos todos". Se *recomendará* a las familias con niños abandonar la ciudad. Cada mes desaparecen algunos de sus alumnos; en Bragin predomina, como en todas partes de la zona, la falta de profesores. Los pedagogos y los médicos fueron los primeros que abandonaron los lugares contaminados.

Hasta que la ciudad esté vacía de personas. Alexandr Ivanovitsch aguantará, cansado pero tenaz. El método de su pedagogía de la catástrofe se llama *control*. Su meta es desacostumbrar ya a los más pequeños de su confianza infantil en la naturaleza.

El campo de alrededor está rodeado de letreros invisibles. Sobre ellos está escrito "Prohibido pisar". Nosotros, adultos, no vemos los letre-/PASA A PÁG. 64



Miedo y huida

"Reactor", "avería", "radiactividad" son palabras que repiten con pavor los habitantes de Bartolomevska, una ciudad situada a unos 180 kilómetros del reactor que estalló. Durante tres años, Chernóbil fue para la gente de Bartolomevska sólo un accidente que había ocurrido "ahí abajo", en Ucrania. Un día aparecieron los soldados también en la circunscripción de Vetka con los contadores Geiger. Oficialmente dijeron que la contaminación era baja, pero a algunos les llegaron rumores de que sería aconsejable que desaparecieran lo antes posible. Cuando pidieron que se les aclarara la situación, sólo consiguieron la respuesta de que obedecían órdenes y no podían decir más. El lugar está contaminado con 1,5 millones de bequereles por kilómetro cuadrado, y está considerado como inhabitable desde 1989. La transparencia informativa, la famosa *glasnost*, ha tardado mucho tiempo en encontrar el camino hacia Bartolomevska.

Setas envenenadas
La primera prohibición que llegó a Bartolomevska fue la de bañarse. Inmediatamente se prohibió coger setas. También los habitantes de Bragin recitaban las listas de las prohibiciones: "¡No comáis frutas de los árboles! ¡No recojáis bayas!". De todas maneras, casi nadie respeta la lista de acciones prohibidas. Las madres están cansadas de sorprender a sus hijos. ¿Dónde deberían encerrarlos? Es casi imposible evitar el peligro que se camufla en lo más apetitoso de la naturaleza. Ni siquiera se puede beber aquí la leche de vaca que permite a otros niños ser fuertes y crecer. Para los pequeños, las vacas se reducen a personajes de dibujos animados.

VIENE DE PÁG. 62/ros, pero los niños los ven muy bien. "Oleg, ¿qué haces?, ¡cuidado!". El hermano de Wowa es hoy el payaso de la disciplinada fila. Las trenzas de Natascha botan por delante de la cara de él y pronto se le escapa la pelota, que rueda sobre la hierba. Oleg sale corriendo. Llega justo hasta la frontera entre el negro alquitrán y el césped verde. Oleg ha comprendido con cada célula de su organismo que el asfalto es limpio y la hierba sucia. Él está en el borde, sobre las puntas de sus pies, y con las puntas de los dedos rescata el juguete de la suciedad.

Oleg tenía tres años cuando estalló el reactor. Todavía no había dejado que el sol tostase su barriguita en la arenosa zona de baño del Braninka; no conoce los bancos de peces bajo los sauces, y su hermano le ha llevado sólo una vez con él al bosque. En el jardín donde el pequeño Oleg observaba a su madre cuando arrancaba la mala hierba ya no crece nada comestible. El pez nada en la lata. Las gallinas salen de la *cárcel*, de las celdas de la ganadería en masa. Las setas están sucias o son la pegajosa masa-boleto con sombrero de chocolate que se venden en la panadería. Pero Oleg no echa nada de menos, o eso parece.

"Si no se les instiga, olvidan moverse. Sencillamente se quedan acurrucados donde se les ha sentado". A los niños pequeños, según dice la cuidadora, les parece simplemente inquietante todo aquello que es verde y crece fuera. Evitan el sol y la lluvia. Ningún maestro podrá hacer creer nunca a Oleg y a Natascha que las nubes del cielo son solamente vapor de agua condensado, y que la lluvia únicamente es hidrógeno y oxígeno.

"Bueno, estaba André". Yekaterina Yevgenievna recuerda algo aliviada a un pequeño sublevado ante la disciplina. El pequeño de 10 años desaparecía todas las tardes una y otra vez. Nadie sabía dónde se escondía hasta que los trabajadores descubrieron en el bosque una cabaña hecha de hojas, y en ella estaba André sentado. La maestra entendió perfectamente sus pequeñas huidas. Después le castigó.

En el terreno que está entre los nuevos edificios, el viento arremolina las hojas. El polvo de la cercana calle principal reposa sobre los bancos, los árboles y los andamios oxidados. Volodia, Natascha, Dimitri e Irina han hecho un fuego. Despide mucho humo. Los niños están en cuclillas, acurrucados a sotavento. Nadie estorba su juego.

Durante tres años, Chernóbil fue para la gente de Bartolomevska sólo un accidente que había ocurrido "ahí abajo", en Ucrania. Un día aparecieron los soldados también en la circunscripción de Vetka con los contadores Geiger. "Oficialmente dijeron que la contaminación era baja", dice el padre de Natascha, "pero a algunos les soplaron que deberíamos desaparecer lo antes posible. Les preguntamos: ¿por qué no lo decís en voz alta? Y la respuesta fue: órdenes". El lugar está contaminado con 1,5 millones de bequereles por kilómetro cuadrado, y está considerado como inhabitable desde 1989.

La *glasnost* (transparencia informativa) ha tardado mucho tiempo en encontrar el camino hacia Bartolomevska. No ha sido únicamente el Comité Estatal de Hidrometeorología de Moscú, con su presidente a la cabeza, Yuri Israel, que hoy en día aparece en todas las circunscripciones contaminadas como el secretista, el que ha archivado su información en un clasificador de actas con el sello de *secreto*. Muchos han tejido la red de mentiras y autoengaños que se ha mantenido durante demasiado tiempo en Bartolomevska.

Mientras tanto, la gente de Bartolomevska ya se ha ido hace un año; según una resolución del Consejo de Ministros de la República de Bielorrusia, las familias con hijos y mujeres embarazadas deben ser reasentadas hasta finales de marzo de 1990. Como Natalia e Iván, a los que se ha prometido una vivienda en Grodno, en el norte de la república. Sólo que ellos no saben dónde está exactamente. "Seguramente sólo sobre el papel".

La madre de Volodia, Valentina Dimitrievna Sosnizkaia, levanta el vaso y sonríe: "Nastarovia [a vuestra salud], ¡y por que volvamos a vernos!". Volodia y su familia abandonan el terreno caliente. Para ellos, Grodno se ha hecho realidad.

Ninguno de los niños del lugar está sano. Volodia tiene *mala sangre*. Lo que eso significa no lo saben ni él ni su madre. "Seguramente no es peligroso", dice el joven, de 14 años, decidido. Le crispa los nervios cuando su madre habla de enfermedades. Cuando él se va, Valentina Dimitrievna nos cuenta lo mucho que le cansa la escuela y que a veces casi no le puede despertar. Natascha e Irina tosen. Ellas,/PASA A PÁG. 66

Fuegos y reactores
Volodia, Natascha, Dimitri e Irina han hecho un fuego que despide mucho humo. Los niños están en cuclillas, acurrucados a sotavento. Nadie estorba su juego, y creen que es un pequeño reactor. En la voz de Volodia vibra una nota de orgullo: ha recordado una palabra difícil. Echa otro puñado de hojarasca al fuego: radiactividad. Los niños, como siempre, copian a los mayores, y con sus miedos y palabras entretejen discusiones sin fin. Los niños viven en un habitáculo en el que la humedad ha teñido las paredes de un negro mohoso. Las seis personas que componen la familia de Volodia se reparten en tres habitaciones.

VIENE DE PÁG. 64/como todos sus amigos, están permanentemente y durante mucho tiempo resfriadas. André tiene dolores de cabeza y sangra un par de veces al mes por la nariz, cuenta su madre. "Ocurre de repente, y siempre cuando sus dolores de cabeza son especialmente fuertes".

Las madres se han vuelto superprotectoras y miedosas. "Los rayos han envenenado nuestras cabezas". Los cínicos llaman a eso *radiofobia*.

Nina Michailovna Rasuvaieva, pediatra de la policlínica de la circunscripción de Vetka, ya no puede oír esta palabra. Todos los días se sientan en su consulta madres aterrorizadas con hijos enfermos. "Encuentro normal que las madres de aquí tengan miedo por la salud de sus hijos", dice, "y comprensible cuando se preguntan cómo soportan los niños la pérdida del hogar". También el miedo hace enfermar.

Y está justificado. Las enfermedades infantiles que trata Nina Michailnovna en la policlínica se parecen a los relatos de Bartolomevska como un huevo a otro. "Los niños están exhaustos, cansados y susceptibles". El número de anemias se ha elevado levemente; la doctora está preocupada por los tres niños enfermos de leucemia sólo en el año 1988; no se explica bien la ictericia que nuevamente ha hecho estragos durante todo el año. Además, no tiene cifras exactas sobre la frecuencia de enfermedades infantiles en la circunscripción de Vetka debido a que los reconocimientos masivos son dirigidos por comisiones médicas *independientes* de Minsk y de Moscú. También estuvieron ya aquí médicos de Suecia, Alemania, Japón y EE UU. Ellos vienen, examinan y desaparecen con los datos.

El sida de Chernóbil, así es como se llama a las nuevas enfermedades en las zonas contaminadas. Porque con cada sorbo de leche contaminada, con cada mordisco de carne sucia, los niños asimilan mínimas cantidades de radionúclidos, cesio y estroncio 90. Este elemento de larga vida se enriquece sobre todo en los huesos en crecimiento; bajo este ataque interno de larga duración, la defensa propia del organismo se derrumba. Los científicos temen que en las zonas contaminadas de Bielorrusia, Ucrania y la Federación Rusa, toda una generación de niños sufra daños no agudos prácticamente no descritos en los libros de texto.

"Naturalmente", dicen los médicos, "debemos dar a los niños mejores alimentos. Pero, ¿cómo?". La madre de Natascha saca un manoseado talón del bolsillo de su abrigo: autoriza la compra de un kilo de azúcar al mes por cabeza. En Bartolomevska ya sólo hay copos de avena, sémola de trigo y normal, arroz, pastas alimenticias y aceite en los mercados, así como las raciones especiales de cinco piezas de carne y alimentación infantil para el *erizo atómico*. En las tiendas del centro del pueblo hoy sólo hay hileras de botellas de zumo. No hay nada excepto pan y leche, y un cajón de tomates casi verdes. La dependienta se apoya aburrida en la estantería. A lo mejor viene mañana una entrega desde Vetka.

"¿Comemos rublos?", impreca el padre de Natascha, y tira un puñado de sucias novelas sobre la mesa. "Grabovia" (el dinero de la tumba). En los últimos meses, todos han recibido el doble del sueldo normal. Sin embargo, 400 rublos son tan poco como 200 cuando con ellos se puede comprar tanto como nada.

La ruina avanza despacio, pero imparable, en la destrucción del lugar. Bartolomevska fue una vez un pueblo grande. Las casas de madera se apiñan pared con pared a lo largo de la calle arbolada que está detrás de la empalizada. En los jardines abandonados, las ortigas se multiplican en macizos arbustos. Los árboles frutales están rebosantes de frutas que ya nadie cosecha. Bartolomevska fue en su día un bello pueblo, con sus casas de alegres colores y elegantes jardines. En algunos todavía florecen ásteres. Los adornos de madera que cubren puertas y ventanas son tan frágiles que parecen flechas hechas a mano.

La contaminación radiactiva causa leucemia y cáncer. Eso se sabe desde Hiroshima y Kazakistán. Después de 10 años se registró en Hiroshima una cantidad superior de casos de leucemia. En la colonia mormona de Dakota del Sur, que está a unos 250 kilómetros de los terrenos de pruebas atómicas en el desierto de Nevada, aumentaron cinco veces los niveles de leucemia después de siete años. De todas formas, la muerte de Chernóbil todavía no ha mostrado su cara. Ningún científico puede decir hoy cuántas personas morirán. Los cálculos van desde unos miles hasta 150.000 víctimas, y más en los próximos 50 años. ■