COMMISSION OF THE EUROPEAN COMMUNITIES

Proceedings

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS
Crete, Greece 11 - 13 November 1990

NATIONAL TECHNICAL UNIVERSITY
OF ATHENS
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Preface

The unification of the Community is no longer the high-minded dream of a handful of visionaries but a tangible reality. The challenge of completing the internal market by 1992 has captured the popular imagination not only inside the Community but also beyond its borders, particularly in Central and Eastern Europe.

Energy too, both as consumer good and indispensable working tool, is called upon to play its part in this process.

Already significant progress has been made towards unifying Community energy systems in important areas such as natural gas and electricity. At the same time accompanying policies are being implemented in the energy sector to reinforce and expand infrastructure, particularly in less developed regions of the Community, in service to the wider aim of greater social and economic cohesion.

The islands of the Community face specific problems in the area of energy supply precisely on account of their separation from continental Europe. They are also, however, some of the most promising locations for experimentation with alternative, local energy sources (e.g. solar, wind, biomass) which, besides providing energy supply, offer opportunities for employment and economic development.

There are also various Community energy programmes (VALOREN, THERMIE, regional energy planning, etc.), which, though not specifically aimed at the islands, can contribute to solving their problems.

The Symposium in Crete was organized jointly by the Secretariat-General for the Region of Crete and the Directorate-General for Energy of the Commission of the European Communities. Its main achievements were:

(1) an initial exchange of views and experiences between representatives of the islands, experts and Commission staff;

(2) the creation of a preliminary informal network for future contacts;

(3) the identification of sectors requiring in-depth study.

This book will, I believe, serve as a point of reference for the many who attended the Symposium and the many who did not have this opportunity, and - perhaps too - as a point of departure for further initiatives in the future.

C.S. Maniatopoulos
Director-General

Πρόλογος

Η κοινοτική ενοποίηση δεν είναι πλέον το ευγενές όνειρο ολίγων οραματιστών αλλά μια απτή πραγματικότητα. Η πρόκληση της Εσωτερικής Αγοράς του 1992 έχει αφυπνίσει όχι μόνον τον πληθυσμό της Ευρωπαϊκής Κοινότητας, αλλά και άλλους λαούς, ιδιαίτερα δε της Ανατολικής και Κεντρικής Ευρώπης.

Η **Ενέργεια**, αγαθό κατανάλωσης και ευημερίας όλων αλλά και ζωτικός παράγοντας στην παραγωγική διαδικασία της οικονομίας, εκλήθη να παίξει το ρόλο της.

Έτσι, σημειώνεται σημαντική πρόοδος στην κατεύθυνση της **ενοποίησης των ενεργειακών συστημάτων** της Κοινότητας σε σημαντικούς τομείς όπως του φυσικού αερίου και του ηλεκτρισμού. Παράλληλα, τίθενται σε εφαρμογή **συνοδευτικές πολιτικές** στον ενεργειακό τομέα που αφορούν την ενίσχυση και επέκταση έργων υποδομής, ιδιαίτερα στις λιγότερο ανεπτυγμένες περιοχές της Κοινότητας, συμβάλλοντας έτσι στην επίτευξη του στόχου για μια μεγαλύτερη κοινωνική και οικονομική συνοχή.

Ως γνωστό, τα νησιά της Κοινότητας, λόγω της γεωγραφικής τους απομόνωσης από τον ηπειρωτικό χώρο, αντιμετωπίζουν ιδιαίτερα προβλήματα στον ενεργειακό τους εφοδιασμό. Συγχρόνως όμως, παρουσιάζουν και ελπιδοφόρες προοπτικές για την αξιοποίηση των εγχωρίων εναλλακτικών πηγών ενέργειας, π.χ. ηλιακής, αιολικής, βιομάζας, που εκτός από τον ενεργειακό εφοδιασμό, προσφέρουν και ευκαιρίες απασχόλησης και οικονομικής ανάπτυξης.

Διάφορα κοινοτικά ενεργειακά προγράμματα όπως π.χ. το VALOREN, το THERMIE και ο περιφερειακός ενεργειακός προγραμματισμός, έστω και αν όχι ειδικά σχεδιασμένα για τα νησιά, προσφέρονται για την επίλυση των προβλημάτων τους.

Το Συμπόσιο που οργανώθηκε στην Κρήτη με την συνεργασία της Γενικής Γραμματείας της Περιφέρειας Κρήτης και της Γενικής Διεύθυνσης Ενέργειας της Επιτροπής των Ευρωπαϊκών Κοινοτήτων επέτυχε, μεταξύ άλλων,

α) μια πρώτη ανταλλαγή απόψεων και εμπειριών μεταξύ των εκπροσώπων των νησιών, εμπειρογνωμόνων, καθώς και των υπηρεσιών της Επιτροπής·

β) να δημιουργήσει ένα πρώτο άτυπο δίκτυο για μελλοντικές επαφές·

γ) να επισημάνει τομείς που θα πρέπει να μελετηθούν σε βάθος.

Πιστεύω ότι το περιεχόμενο αυτού του τόμου τον οποίο έχω την τιμή να προλογίζω, θα αποτελέσει μέσο αναφοράς για πολλούς, ακόμη και σ΄αυτούς που δεν είχαν την ευκαιρία να συμμετάσχουν στο Συμπόσιο, και ίσως να αποτελέσει έναυσμα για περαιτέρω πρωτοβουλίες.

Κ.Σ. ΜΑΝΙΑΤΟΠΟΥΛΟΣ
Γενικός Διευθυντής

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NATIONAL TECHNICAL UNIVERSITY OF ATHENS ENERGY POLICY UNIT

UNIVERSITE NATIONALE TECHNIQUE D' ATHENES UNITE DE POLITIQUE ENERGETIQUE

ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ ΟΜΑΔΑ ΕΡΕΥΝΑΣ ΓΙΑ ΤΗΝ ΕΝΕΡΓΕΙΑΚΗ ΠΟΛΙΤΙΚΗ

GENERAL SECRETARIAT OF THE REGION OF CRETE

SECRETARIAT GENERAL DE LA REGION CRETE

ΓΕΝΙΚΗ ΓΡΑΜΜΑΤΕΙΑ ΠΕΡΙΦΕΡΕΙΑΣ ΚΡΗΤΗΣ

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AIM

to investigate the specific energy problems in the Community islands in relation to the Community framework and to discuss perspectives, especially in the context of the internal energy market.

PARTICIPANTS

by invitation of CEC, about 150 representatives of island authorities, experts and decision makers involved in issues concerning energy in the islands.

ORGANISATION

COMMISSION OF THE EUROPEAN COMMUNITIES
Directorate - General for Energy
rue de la Loi 200,
B-1049 Brussels, Belgium

CONCEPT

CEC DG XVII - ENERGY:	Dr G. GERINI, Mr I. GALANIS, Mrs E. TSANTEKIDOU-BORG
NTUA - EPU:	Prof. J.-E. SAMOUILIDIS Dr Th. GOUMAS
REGION OF CRETE / G.S.:	Mr G. SENETAKIS

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SUNDAY	**11 November**
19:00 - 21:30	**Registration at CAPSIS hotel**
MONDAY	**12 November**
08:00 - 09:00	**Registration**
09:00 - 09:45	**OPENING SESSION**
	Welcome address Mr G. SENETAKIS, General Secretary of the Region of Crete
	Community energy policy Mr C.S. MANIATOPOULOS, Director General of DG for Energy CEC
	Power Supply 10-year Development Programme for Crete Prof. Th. XANTHOPOULOS, Director General of the Public Power Corporation
(9:45 - 10:15	Press conference)
09:45 - 10:45	**FIRST SESSION** **INTRODUCTION: THE COMMUNITY FRAMEWORK**
09:45 - 10:00	**The internal energy market and flanking policies:** Their relevance to the EC islands Dr G. GERINI, DG XVII
10:00 - 10:30	**The regional policy of EC, concerning energy:** - Community actions in Greece and future prospects Mr R. McKENNA, DG XVI - Community initiatives (philosophy, initiatives adopted, REGIS, REGEN) Mr Th. SARAMANDIS, DG XVI
10:30 - 10:45	**Coffee Break**

10:45 - 19:15	**SECOND SESSION PRESENTATION OF SOME CASE STUDIES AND ISSUES CONCERNING EC ISLANDS**	
	Chairman	**Dr J. TWIDELL**
	Rapporteur	**Prof. H. BAGUENIER**
10:45 - 11:00	**Bornholm (DK)**	Mr J. JESPERSEN
11:00 - 11:15	**Discussion**	
11:15 - 11:30	**Madeira (P)**	Mr J. MELIM MENDES
11:30 - 11:45	**Discussion**	
11:45 - 12:00	**Canary Islands (SP)**	Mr C. G. LAZARO
12:00 - 12:15	**Discussion**	
12:15 - 15:45	**Lunch Break**	
15:45 - 16:00	**Corsica (F)**	Mr F. ALFONSI
16:00 - 16:15	**Discussion**	
16:15 - 16:30	**Sardinia (I)**	Mr H. SCHENK
16:30 - 16:45	**Discussion**	
16:45 - 17:00	**Scottish Islands (UK)**	Mr R. MORRIS
17:00 - 17:15	**Discussion**	
17:15 - 17:30	**Coffee Break**	
17:30 - 17:45	**Cyclades, Lesvos, Crete (GR)**	Dr Th. GOUMAS, Mr G. GEORGOCOSTAS
17:45 - 18:00	**Discussion**	
18:00 - 18:15	**Azores (P)**	Prof. M. FORTUNA
18:15 - 18:30	**Discussion**	
18:30 - 18:45	**Guadeloupe (F)**	Mr M. FRAGER
18:45 - 19:00	**Discussion**	
19:00 - 19:15	**Conclusions by the Chairman**	

TUESDAY	**13 November**
09:30 - 12:30	**THIRD SESSION** **FUTURE ORIENTATION OF EC ACTION**
	Chairman **Prof. D. LALAS**
09:30 - 10:00	**Energy problems facing the EC islands** Inventory of issues raised during the previous session Prof. H. BAGUENIER, CEEETA
10:00 - 10:15	**Presentation of the preliminary results of the study "Energy in the Islands"** Mr J. P. LAUDE, COWIconsult
10:15 - 10:45	**Discussion**
10:45 - 11:00	**Coffee Break**
11:00 - 11:15	**Orientation of the Community's action** Mr I. GALANIS, DG XVII
11:15 - 12:00	**Discussion**
12:00 - 12:30	**Conclusions by the Chairman**

OPENING SESSION

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

WELCOME ADDRESS

G. Senetakis
General Secretary for the Region of Crete

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

WELCOME ADDRESS

by

Mr G. SENETAKIS
General Secretary for the Region of Crete

Ladies and Gentlemen,

It is a great pleasure to welcome you all in our Region, that is known to many of you, I believe, since it consists one of the greatest centers of tourists attraction in the Mediterranean Sea.

I hope that this Congress will contribute to the exchange of information and become fruitful especially for the scientists of our Region specialized in energy issues, who broadly accepted our invitation

With exceptional interest, we are going to listen to the presentation of the particular problems faced during the energy systems planning for EC islands and the chosen strategies for their solution.

The economic development figures of the Region are higher than the respective national rates. The regional economy is directed towards activities of the tertiary sector, that has been developing significantly, while in the primary and secondary sectors, lower progress has been recorded.

I believe that the choice of the Region of Crete, for the Congress holding, as a point of meeting for so many specialists on energy issues to talk about the energy problems in European Community islands, was particularly successful since the most severe problem of the Region of Crete may be that of energy.

Our first attempt is the application of a rational energy policy. The objectives of this policy are:

- To ensure the availability of multiple primary energy sources as the dependence on a limited number of sources sets up the threat of energy shortage.

- To achieve the exploitation of the local energy potential in the best way, technically, economically and socially.

- To aim at the improvement of energy use by avoiding the use of conventional fuels in cases that soft energy forms may cover the demand.

- To satisfy the particular demand for the environment protection, which becomes a necessity of survival.

- Finally, to meet in time the growing requirements of the economic and social development of the region.

The achievement of these energy policy aims seems to be particularly difficult in remote regions and, especially, in the islands whose specific geographical characteristics don't allow them to enjoy the benefits of a generally adopted energy policy.

So, it is necessary to plan a particular energy policy following the general National and Community framework.

I am glad that the study of Prof. J.-E. Samouilidis' scientific team (National Technical University of Athens) will be presented in this Congress.

This energy study was carried out thanks to CEC's initiative and consists a contribution to the solution of Region's energy problems. The proposed energy plan will be discussed elaborately in a specific meeting that will be organized by the Region Authorities in collaboration with the Technical Chamber, the Public Power Corporation and the Ministry of Industry, Energy and Technology, during which all the related to the study issues will be discussed.

For the achievement of the safest energy planning, the exchange of experience in dealing with such problems is also important.

This change is given by this Congress.

In particular, we expect to obtain data and proposals concerning the way the following problems can be dealt with:

- The multiplicity of the sources
- The improvement of energy use
- The protection of environment
- The use of new and renewable energy sources
- The planning of the islands' power systems.

Our sensitivity to the islands' energy problems, concerning mainly their power systems, is enhanced. This is due to the inflexibility presented by the rapid increase of energy demand, especially that of electricity.

According to estimations, the electricity demand covered by conventional fuels in the year 2000, if no interventions are made, will run at the rate of the 8300 TJ. On the other hand, if several already proposed investments, organizational and structural measures are taken, in 2000 the electricity energy demand will run at approximately 7100 TJ.

Consequently, according even to the most optimistic prospects, I would say that the best outcome that could be achieved is a reduction of only 15% in the power production by conventional means.

Therefore, no matter what efforts will be made for the achievement of the above goals, I should mention that there will still remain some electricity demand to be covered which will be more or less the double of the one existing today and which we must meet by the appropriate planning and expansion of the power system of Crete.

But as far as this is concerned, we will have the opportunity to listen to Mr Hamodrakas, Director of the Planning Department, of the Public Power Corporation.

I welcome you honourable members of the Congress to the autumn Crete. I wish you a pleasant stay and success in the Congress.

ΣΥΜΠΟΣΙΟ: ΕΝΕΡΓΕΙΑΚΑ ΠΡΟΒΛΗΜΑΤΑ ΣΤΑ ΝΗΣΙΑ ΤΗΣ ΕΥΡΩΠΑΙΚΗΣ ΚΟΙΝΟΤΗΤΑΣ

ΕΝΑΚΤΗΡΙΟΣ ΟΜΙΛΙΑ

του

κ. Γ. ΣΕΝΕΤΑΚΗ

Γενικού Γραμματέα Περιφέρειας Κρήτης

Κυρίες και Κύριοι Σύνεδροι,

Με μεγάλη χαρά σας καλωσορίζω στην Περιφέρειά μας που σε πολλούς από σας πιστεύω να είναι ήδη γνωστή αφού αποτελεί ένα από τους μεγαλύτερους πόλους έλξης τουριστών στη Μεσόγειο.

Το Συνέδριο αυτό, εύχομαι να συμβάλει στην αλληλοενημέρωση όλων μας και ιδιαίτερα του επιστημονικού δυναμικού της Περιφέρειας, ειδικευμένου σε ενεργειακά θέματα, που με μεγάλη προθυμία ανταποκρίθηκε στην πρόσκλησή μας.

Με ιδιαίτερο ενδιαφέρον θα παρακολουθήσουμε την παρουσίαση των ιδιαίτερων προβλημάτων που παρουσιάζει ο σχεδιασμός των ενεργειακών συστημάτων των Νήσων της Κοινότητας και τις επιλεγόμενες στρατηγικές αντιμετώπισής τους.

Η Περιφέρεια γνωρίζει δείκτες οικονομικής ανάπτυξης που ξεπερνούν τις αντίστοιχες εθνικές τιμές. Η περιφερειακή οικονομία στρέφεται προς δραστηριότητες του τριτογενή τομέα, ο οποίος αναπτύσσεται σημαντικά, ενώ στον πρωτογενή και δευτερογενή τομέα παρατηρούνται χαμηλότερες επιδόσεις.

Νομίζω ότι η επιλογή της Περιφέρειας της Κρήτης για τη διεξαγωγή του Συνεδρίου, σημείο συνάντησης τόσων ειδικών ενεργειακών επιστημόνων, για συζήτηση των Ενεργειακών Προβλημάτων στα Νησιά της Ευρωπαϊκής Κοινότητας, ήταν ιδιαίτερα επιτυχής αφού ίσως το υπ'αριθμόν ένα πρόβλημα της Περιφέρειας της Κρήτης είναι η αντιμετώπιση του ενεργειακού.

Η πρώτη προσπάθειά μας είναι η εφαρμογή μιας ορθολογισμένης ενεργειακής πολιτικής. Αντικειμενικοί σκοποί αυτής της πολιτικής είναι:

- Να εξασφαλίζει πολλαπλότητα και εναλλακτικότητα στις πρωτογενείς ενεργειακές πηγές. Η ενδεχόμενη εξάρτηση από περιορισμένο αριθμό πηγών συνιστά απειλή ενεργειακής ασφυξίας.

- Να επιτυγχάνει τη βέλτιστη τεχνικά, οικονομικά και κοινωνικά, αξιοποίηση του υφιστάμενου επιτόπιου ενεργειακού δυναμικού.

- Να επιδιώκει τη βελτίωση στη χρήση της ενέργειας με κύριο άξονα την αποφυγή χρήσης ενέργειας από συμβατικά καύσιμα εκεί όπου οι ανάγκες μπορούν να εξυπηρετηθούν με χρήση ήπιων μορφών ενέργειας.

- Να ικανοποιεί την ιδιαίτερη απαίτηση, η οποία μετατρέπεται σε ανάγκη για επιβίωση, της προστασίας του περιβάλλοντος.

- Και τέλος, να ανταποκρίνεται έγκαιρα προς τις εξελισσόμενες ανάγκες της οικονομικής και κοινωνικής ανάπτυξης της περιοχής.

Η πραγματοποίηση όλων αυτών των στόχων ενεργειακής πολιτικής εμφανίζεται ιδιαίτερα δυσχερής για περιοχές της περιφέρειας και ιδιαίτερα σε Νησιά. Ο ιδιαίτερος γεωγραφικός χαρακτήρας των Νησιών δεν επιτρέπει οι Νησιώτικες περιοχές να απολαύσουν τους καρπούς μιας γενικά υιοθετημένης εθνικής ενεργειακής πολιτικής.

Αντιθέτως, επιβάλλεται να σχεδιασθεί ιδιαίτερη ενεργειακή πολιτική, ενταγμένη στα γενικότερα εθνικά και κοινοτικά πλαίσια, που όμως θα λαμβάνει υπόψη τις τοπικές ιδιαιτερότητες.

Το διαπιστωμένο αυτό οξύ πρόβλημα των ιδιαιτεροτήτων έρχονται να θεραπεύσουν οι επί τούτου εκπονούμενες ιδιαίτερες ενεργειακές μελέτες.

Χαίρομαι που στο Συνέδριο αυτό θα παρουσιασθεί η μελέτη της ομάδας του Καθ. ΕΜΠ Εμμ. Σαμουηλίδη που αποτελεί μια συμβολή της Κοινότητας, αφού εκπονήθηκε με πρωτοβουλία της, προς την Περιφέρεια της Κρήτης. Η μελέτη αυτή θα συζητηθεί διεξοδικά σε ειδική ημερίδα, που οργανώνει η Περιφέρεια σε συνεργασία με το Τεχνικό Επιμελητήριο Κρήτης, τη ΔΕΗ και το Υπουργείο Βιομηχανίας, Ενέργειας και Τεχνολογίας, όπου θα συνεκτιμηθούν λεπτομερώς ιδιαιτερότητες σε σχέση με τη μελέτη. Εύχομαι πράγματι αυτή η μελέτη να αποδειχθεί ότι μπορεί να συμβάλει στην διευκόλυνση επίλυσης του ενεργειακού προβλήματος της Περιφέρειας.

Μεγάλη επίσης αξία για τον ασφαλέστερο ενεργειακό σχεδιασμό είναι η ανταλλαγή πείρας στην αντιμετώπιση τέτοιων προβλημάτων.

Την ευκαιρία αυτή δίνει το σημερινό Συνέδριο.

Ιδιαίτερα περιμένουμε να αποκομίσουμε δεδομένα και παραστάσεις για το πως αντιμετωπίζονται τα προβλήματα:

- Πολλαπλότητα των πηγών
- Βελτίωση χρήσης ενέργειας
- Προστασία του περιβάλλοντος
- Διείσδυση των νέων και ανανεώσιμων πηγών ενέργειας
- Σχεδιασμού των ηλεκτρικών συστημάτων Νήσων

Η ευαισθησία μας για όλες αυτές τις πλευρές του ενεργειακού προβλήματος των Νησιών με έμφαση των ηλεκτρικών τους συστημάτων, είναι αυξημένη λόγω της ανελαστικότητας που παρουσιάζει η εξέλιξη της ζήτησης των διαφόρων μορφών ενέργειας και ιδιαίτερα της ηλεκτρικής ενέργειας.

Οι διάφορες εκτιμήσεις συγκλίνουν στο ότι οι ανάγκες του έτους 2000 σε ηλεκτρική ενέργεια με συμβατικά μέσα, εάν δεν γίνουν παρεμβάσεις, θα είναι της τάξης των 8300 TJ, εάν δε πραγματοποιηθούν στο χρονικό διάστημα μέχρι το 2000 επενδυτικά, οργανωτικά και διαρθρωτικά μέτρα, που προτείνονται στη μελέτη, θα ανέλθουν σε περίπου 7100 TJ.

Ετσι και με τις πιο αισιόδοξες προοπτικές για την κάλυψη των αναγκών σε ηλεκτρική ενέργεια από τις οποιεσδήποτε παρεμβάσεις μας στο συνολικό ενεργειακό ισοζύγιο, θα επιτευχθεί, το μέγιστο θα έλεγα, μια μείωση της προβλεπόμενης παραγωγής ηλεκτρικής ενέργειας με συμβατικούς τρόπους μόνο κατά 15%.

Ετσι, παρά τις όποιες προσπάθειες για την επίτευξη του παραπάνω στόχου θέλω να επισημάνω ότι παραμένουν ακόμη για να ικανοποιηθούν ανάγκες σε ηλεκτρική ενέργεια που είναι περίπου διπλάσιες από τις σημερινές, τις οποίες καλούμεθα να εξυπηρετήσουμε με τον κατάλληλο σχεδιασμό και ανάπτυξη του ηλεκτρικού συστήματος της Κρήτης.

Αλλά περί τούτου θα έχομε την ευκαιρία να ακούσουμε την εισήγηση του Διευθυντή Προγραμματισμού της ΔΕΗ κ. Χαμόδρακα.

Κύριοι Σύνεδροι,

Σας υποδέχομαι και σας καλωσορίζω στην φθινοπωρινή Κρήτη.

Εύχομαι καλή διαμονή και επιτυχία στο Συνέδριο.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

COMMUNITY ENERGY POLICY

C. S. Maniatopoulos
Director General for Energy
at the Commission of the European Communities

Mr Secretary-General for the Region of Crete, Mr Secretary-General for Energy, Mr Mayor, Representatives of the islands of the European Community, Ladies and Gentlemen,

It is a pleasure and an honour for me hereby to proclaim this Symposium open.

First I would like to second the sentiments of the Secretary-General for the Region and welcome you to the hospitable island of Minos and of Europa, the unsuspecting girl once carried across the sea by a bull to these shores, lending her name to a new continent of which this island is today the furthest outpost.

Europa, through you, is present here again today. You have come from the four corners of the Community, from farflung islands in the Atlantic, Baltic, North Sea and Mediterranean, first and foremost because energy today is a subject of vital and urgent concern to everyone. But also because, scattered as you are around the Community periphery, you, more than others, have an interest in and need for collaboration and the exchange of views on all areas of contemporary European life.

I wish also, on behalf of the European Commission and, more particularly, of its Directorate-General for Energy, to thank the Secretariat-General of Crete for agreeing to host this Symposium and for its practical support in collaboration with local authorities and private initiatives. In particular I would like to thank Mr Senetakis, in charge of the organization of this Symposium.

I should also mention the team from the National Metsovios Polytechnic, which has collaborated closely with my staff in preparing this Symposium. Lastly I wish to thank Mr Gerini, head of the accompanying measures task force, and his team.

Before our discussions begin, I propose to outline for you in brief the Community's energy policy.

Today, on the threshold of a new millenium, the prospects are heartening for the future of Europe and for a new geopolitical order embracing, for the first time, the central and eastern regions of our continent.

Unfortunately, however, these prospects are overshadowed for the moment by the difficulties afflicting the Soviet economy and by recent events in the Middle East.

Both subjects lie, strictly speaking, outside our brief and, anyway, our time would not be sufficient to discuss the political and socio-economic implications of the events of recent months. But we all know how difficult it is to make forecasts in the energy sector, where political factors play at least as important a role as economic ones. Today we find ourselves faced with a new crisis on the oil market. Fortunately the Community is better prepared to face such crises today than it was in 1973.

And thanks to Community policies in the areas of energy saving, the geographical diversification of energy supplies and alternatives to oil, the Community today is less vulnerable to oil crises. The Commission, meantime, has been playing its role, recently submitting to the Council a proposal for a global approach to the crisis situation (e.g. in respect of oil reserves and the EC's role in the International Energy Agency).

Though the danger of an energy shortage is limited and our experience of other crises means that this time European industry will not have to mortgage its future, the gravity of the situation should not be underestimated. The normal upturn in energy demand in winter-time and the possibility of a military engagement in the Gulf represent real threats. We should therefore be fully prepared for the worst.

Above all we should not underestimate the likely consequences of the present situation for the planet's poorer countries and more backward regions. These could be catastrophic for the economies of those countries, and might even pitch the present geopolitical order out of balance.

Uncertainty and speculation in the area of prices are leading to instability and price increases, with the likelihood of increased inflation and a downturn in economic growth. These problems are becoming intolerable for developing countries and the countries of Eastern Europe, which consume large quantities of energy.

In summary I would say that the present crisis in the Gulf is not an energy crisis but, in the profoundest sense, a political one: it is a crisis of institutions and of geopolitical equilibria.

I have touched on these topics by way of situating our discussions vis-à-vis recent world developments.

Without further analysis, then, the conclusion must, in my view, be that the various oil crises of recent decades, coupled with the need for economic development and stability in Eastern Europe and the developing countries, make a real Community energy policy more imperative today than ever before.

The main emphases of Community policy in this area to date have been:

- the reduction of dependence on oil;
- the diversification of energy sources and of their geographical distribution;
- the role of coal and nuclear energy in the structure of energy systems;
- greater utilization of new and renewable energy sources;
- greater energy efficiency.

The results to date have been impressive. Dependence on oil has been brought down from 62% in 1973 to under 50% today. Energy efficiency has increased by about 20% in the same period.

At the same time, the healthy rate of economic growth in recent years has meant a concomitant increase in energy consumption. Also, comparatively low energy prices are a disincentive to efforts to increase energy efficiency being sustained.

The inevitable question, then, is:

> "Given the limits on available energy sources, how can economic growth be stimulated while at the same time protecting the environment and without endangering energy supply security?"

The first priority must be to restrain demand for energy through its more efficient utilization and redistribution.

Various measures and proposals to this end are currently under examination, including the famous energy tax proposal.

The second priority is the **rational management of available energy** to cover development needs. This means the transfer of technological and funding resources to less advanced regions of the Community and to developing countries, which is the aim of the new THERMIE programme (European technologies for energy management). Launched last June, it has a five-year budget of 700 million ECU.

The Commission also recently adopted another new programme named SAVE (Specific Action for Vigorous Energy Efficiency) aimed at energy conservation and spread over a four-year period.

More generally, a real and effective Community energy policy will have to reconcile the claims of energy supply security, economic growth and protection of the environment within the framework of a single internal energy market on a new, pan-European scale.

Regarding the **internal energy market**, I would here mention the significant progress towards unifying the Community's energy systems achieved at the two most recent Energy Minister Councils (in May and October). The adoption of three Community Directives on electricty and natural gas price transparency and the right to transit represents a first, but important, step in the direction of a single energy market.

In parallel with the completion of the internal market, the so-called **accompanying measures** are being implemented to further economic and social cohesion. These policies will counteract the adverse effects of the unification of energy markets.

A later speaker at today's session will go into greater detail on these points.

It is time to turn to the main theme of this Symposium and pose the question: which energy problems are specific to the Community's islands, and how can Community policies deal with these in such a way as to promote Community unification and economic and social cohesion?

Without getting lost in a labyrinth of detail, the following **problems** can be identified as common to most of the Community's offshore islands:

- high cost of energy supply, due to geographical location;

- dependence on imported energy, particularly oil;

- seasonal fluctuations in energy demand, often linked to intensive tourism;
- a dearth of material and technical infrastructure in the energy sector;
- particularly severe environmental constrictions, combined with tourism and geographical isolation.

On the other hand, the islands frequently have access to significant alternative sources of energy such as wind, sun or tidal power. It is estimated that, properly harnessed, these could cover a major proportion of energy requirements in certain isolated areas of the Community.

Directly and indirectly, Community policies are attempting to make a contribution to solving the energy problems of the islands through a whole range of initiatives: VALOREN, THERMIE, REGEN, demonstration programmes (DEMO), R&D projects, energy planning programmes, etc.

This Symposium provides a unique opportunity to examine and, more importantly, compare to what extent the above policies and programmes take due account of the specific features of the islands in the area of energy.

Your participation, and the location and timing of this Symposium, will serve to enrich our objectives and our activities.

Today we also have the opportunity to look at two matters of specific relevance to Crete but, I think, of general interest:

Firstly, the submission of the energy planning study for Crete. As you saw, I have been officially presented with the final version of this study. I do not want to go into details here, nor am I in a position to at this stage. My staff will be making an ongoing assessment of this project and will, I trust, be forwarding its main conclusions to all the interested parties throughout the Community.

I will confine myself to a few remarks relating to the more general economic and energy context of this study and to its principal conclusions and proposals.

Firstly, the **context**:

- Crete enjoys a high rate of economic growth compared to the Greek average; it also, however, faces an ongoing rise in energy consumption; I realise that dependence on imported oil, particularly for electricity production, gives cause for serious concern with regard to the future economic development of the island;

- the distance from mainland Greece makes a link-up with the national electricty grid and future natural gas grid technically possible but extremely costly;

- Crete also has significant alternative energy sources (particularly sun, wind, hyrdoelectricity and biomass); the efficient exploitation of these sources could undoubtedly contribute to the island's economic and social development, increasing its energy supply security.

As far as the study's **conclusions** are concerned, it comes up with a global energy plan for the year 2000 and defines **seven sectoral energy initiatives** to do with the exploitation of local energy sources and the rational utilization of energy.

I find particularly important the study's conclusion as to the need for **organizational structures** in Crete to facilitate implementation of the said energy plan.

Incidentally, the conclusions and findings of the study are perfectly in tune with the general emphases of the Community's energy policy.

It should be remembered, however, that this study, while undoubtedly of a high technical and scientific standard, is not an end in itself. The most important thing - and this goes for all the energy planning studies subsidized by the Directorate-General for Energy of the European Commission since 1982 - is that **its conclusions should be implemented via concrete projects, investments and organizational structures, etc.**

I therefore urge all those involved in the energy sector in Greece to work actively towards the better and more efficient management of energy on this island, lest energy become some new Minotaur sapping the life-force of its population. Rather let it be a springboard for the island's social and economic advancement.

The second matter, again, I think, of interest to all, is the inauguration of the Anóyia wind energy demonstration project, which is being co-financed by my Directorate-General.

I am happy to see that the local authorities have invited the participants at this Symposium to attend this inauguration this afternoon from 13.00 to 15.00.

A special booklet is available with details of the project. I hope that you will be better able on the ground to assess its various technical, economic and - for that matter - aesthetic aspects, and to exchange relevant experience.

Here I will limit myself to mentioning the significance of this project in terms of reducing water pumping costs in Anóyia through the use of renewable energy sources.

To finish: I trust that this Symposium will, like Ariadne's unravelling thread, help you steer a path through the energy problems of the islands so that we may meet effectively the aspirations of the inhabitants of all the Community's regions, particularly in this critical period in which we find ourselves.

Thank you.

ΣΥΜΠΟΣΙΟ

"Ενεργειακά προβλήματα των νησιών της Ερωπαϊκής Κοινότητας"

Κρήτη 11 - 13 Νοεμβρίου 1990

Κ.Σ. Μανιατόπουλος*

* Γενικός Διευθυντής Ενέργειας στην Επιτροπή των Ευρωπαϊκών Κοινοτήτων

Κύριε Γενικέ Γραμματέα Περιφέρειας Κρήτης, Κύριε Γενικέ Γραμματέα Ενέργειας, Κύριε Δήμαρχε, Κύριοι Εκπρόσωποι των νησιών των Ευρωπαϊκών Κοινοτήτων, Κυρίες και Κύριοι,

Με μεγάλη μου χαρά και τιμή κηρύσσω την έναρξη του Συμποσίου αυτού.

Και πριν απ΄όλα θα ήθελα να συμμερισθώ την ικανοποίηση του κ. Περιφερειάρχη και να σας καλωσορίσω και εγώ όλους στο φιλόξενο νησί του Μίνωα και της συζύγου του Ευρώπης. Θέλω επίσης να επισημάνω ότι νοιώθω υπερήφανος σαν Ευρωπαίος αλλά πάντα Έλληνας που σας υποδέχομαι στο νησί αυτό που αποτελεί την αφετηρία αλλά και ακρότατο σημείο της σημερινής Ευρώπης.

Η Ευρώπη με την παρουσία σας είναι σήμερα εδώ. Ήρθατε απ΄όλες τις γωνιές της Ευρωπαϊκής Κοινότητας, από τα πιό απομακρυσμένα νησιά του Ατλαντικού, της Βαλτικής, της Βόρειας Θάλασσας και της Μεσογείου, γιατί η Ενέργεια είναι για όλους μας τόσο ζωτικό και επίκαιρο θέμα. Και όχι μόνο γι΄αυτό: πιστεύω ότι εσείς που αποτελείτε το περίγραμμα της Ευρώπης, έχετε περισσότερο ανάγκη και συμφέρον συνεργασίας και ανταλλαγής απόψεων σε όλα τα θέματα της σημερινής Ευρωπαϊκής πραγματικότητας.

Θα ήθελα επίσης να ευχαριστήσω, εκ μέρους της Επιτροπής των Ευρωπαϊκών Κοινοτήτων, και ειδικότερα εκ μέρους της Γενικής Διεύθυνσης Ενέργειας, την Γενική Γραμματεία της Κρήτης για την προθυμία της να φιλοξενήσει το Συμπόσιό μας στην περιφέρειά της καθώς επίσης και για την υλική υποστήριξή της σε συνεργασία με τις τοπικές αρχές και την ιδιωτική πρωτοβουλία. Ιδιαίτερες είναι οι προσωπικές μου ευχαριστίες προς τον κύριο Σενετάκη, πρωτεργάτη της οργάνωσης του Συμποσίου αυτού.

Δεν θα πρέπει να παραλείψω να ευχαριστήσω και την ομάδα του Εθνικού Μετσοβείου Πολυτεχνείου που συνεργάστηκε στενά με τις υπηρεσίες μου για την οργάνωση του Συμποσίου. Τέλος θέλω να ευχαριστήσω τον κύριο Gerini, Τμηματάρχη της μονάδας Συνοδευτικών μέτρων και τους συνεργάτες του. Ευελπιστώ ότι οι ελπίδες όλων μας θα δικαιωθούν..

Πριν όμως αρχίσουν οι συζητήσεις επί του σημερινού θέματος, θεωρώ απαραίτητο να σας παρουσιάσω σύντομα τα γενικότερα πλαίσια της κοινοτικής ενεργειακής πολιτικής.

Κυρίες και Κύριοι, στα πρόθυρα του νέου αιώνα, βρισκόμαστε μπροστά σε μια νέα πραγματικότητα γεμάτη ελπίδα για μια νέα Ευρώπη, και μια νέα γεωπολιτική διάταξη (δομή) που για πρώτη φορά εκτείνονται προς την Κεντρική και Ανατολική Ήπειρό μας.

Οι ελπίδες για τις βαθειές αλλαγές που διανοίγονται στον χώρο αυτό επισκιάζονται, δυστυχώς, σοβαρά από τις δυσκολίες και δυσκαμψίες του Σοβιετικού συστήματος αφ΄ενός, και αφ΄ετέρου από τα πρόσφατα γεγονότα στην Μέση Ανατολή.

Δεν είναι το αντικειμενό μας αλλά και δεν θα επαρκούσε ο χρόνος για να συζητήσουμε εδώ τις πολιτικές και οικονομικοκοινωνικές διαστάσεις των εξελίξεων των μόλις τελευταίων μηνών. Όμως όλοι αντιλαμβανόμαστε πόσο δύσκολο είναι να γίνουν προβλέψεις στον τομέα της ενέργειας όπου οι πολιτικοί παράγοντες είναι εξίσου, αν όχι πιο σημαντικοί και από τους οικονομικούς. Σήμερα αντιμετωπίζουμε μια νέα κρίση στην πετρελαιαγορά. Ευτυχώς, αντίθετα από ό,τι συνέβη το 1973, η Κοινότητα σήμερα βρίσκεται σε καλύτερη θέση για ν΄αντιμετωπίσει τέτοιες καταστάσεις κρίσης.

Και πράγματι, χάρη στις κοινοτικές ενεργειακές πολιτικές για εξοικονόμηση ενέργειας, για γεωγραφική διαφοροποίηση του ενεργειακού εφοδιασμού της, για υποκατάσταση του πετρελαίου, η Κοινότητα είναι λιγότερο ευάλωτη σήμερα στις πετρελαϊκές κρίσεις. Άλλωστε η Επιτροπή έχει ήδη αναλάβει τις ευθύνες της. Έτσι, υπέβαλε πρόταση στο Συμβούλιο για μια συνολική αντιμετώπιση της κατάστασης κρίσης (π.χ. σχετικά με τα αποθέματα πετρελαίου και το ρόλο της ΕΟΚ στον Διεθνή Οργανισμό Ενέργειας).

Όσο όμως και αν ο κίνδυνος ενεργειακής έλλειψης είναι περιορισμένος, και η εμπειρία μας από τις προηγούμενες πετρελαϊκές κρίσεις επιτρέπει σήμερα στην βιομηχανία μας να μην υποθηκεύσει το μέλλον της, δεν πρέπει να υποτιμούμε την ένταση που επικρατεί. Οι αυξανόμενες ανάγκες του χειμώνα, και το κυριότερο οι επιπτώσεις μιας ενδεχόμενης πολεμικής σύρραξης στον Περσικό Κόλπο είναι απειλές υπαρκτές. Γι΄αυτό θα πρέπει να είμαστε πανέτοιμοι να αντιμετωπίσουμε και το χειρότερο.

Κυρίως δεν πρέπει να υποτιμούμε τις επιπτώσεις της παρούσας κατάστασης στις φτωχότερες χώρες του πλανήτη μας και τις πιό καθυστερημένες περιοχές. Οι επιπτώσεις αυτές θα είναι καταστρεπτικές όχι μόνο για την οικονομία τους, αλλά θα μπορούσαν να ανατρέψουν τη σημερινή γεωπολιτική ισορροπία.

Ιδιαίτερα σε ότι αφορά τις τιμές, η αβεβαιότητα που επικρατεί και η κερδοσκοπία, που καθορίζει το επίπεδό τους επιδεινώνουν τις ανατιμητικές τάσεις και την αστάθεια. Ιδού η ερμηνεία του αναμενόμενου πληθωρισμού και της μείωσης της οικονομικής ανάπτυξης. Δυστυχώς τα προβλήματα αυτά γίνονται αβάσταχτα τόσο για τις αναπτυσσόμενες χώρες, όσο και για τις χώρες της Ανατολικής Ευρώπης που καταναλίσκουν μεγάλες ποσότητες ενέργειας.

Θά ήθελα λοιπόν να καταλήξω με την άποψη ότι σήμερα η κρίση δεν είναι ενεργειακή αλλά βαθύτατα πολιτική, είναι κρίση θεσμών και φυσικά γεωπολιτικών ισορροπιών.

Κυρίες και Κύριοι,

Θεώρησα τα προαναφερθέντα απαραίτητα, για να τοποθετήσω τις συζητήσεις του Συμποσίου στα πλαίσια της επικαιρότητας.

Πιστεύω ότι χωρίς πιό πέρα ανάλυση μπορώ να συμπεράνω, ότι οι πετρελαϊκές κρίσεις μέχρι σήμερα, αλλά και η οικονομική ανάπτυξη και σταθερότητα της Ανατολικής Ευρώπης και των υπό-ανάπτυξη χωρών, απαιτούν σήμερα περισσότερο από ποτέ άλλοτε, μια πραγματική κοινοτική ενεργειακή πολιτική.

Οι κύριοι άξονες της μέχρι τώρα κοινοτικής πολιτικής ήσαν:

- η μείωση της εξάρτησης από το πετρέλαιο και οποιασδήποτε άλλης μονοεξάρτησης·
- η διαφοροποίηση των πηγών ενέργειας και της γεωγραφικής τους προέλευσης·
- ο ρόλος του άνθρακα και της πυρηνικής ενέργειας στην δομή την ενεργειακών συστημάτων·
- η περαιτέρω αξιοποίηση των νέων και ανανεώσιμων πηγών ενέργειας·
- η αύξηση της ορθολογικής χρήσης ενέργειας.

Η μέχρι τώρα κοινοτική ενεργειακή πολιτική είχε αξιόλογα αποτελέσματα. Χαρακτηριστικά, η εξάρτηση από το πετρέλαιο μειώθηκε από 62% το 1973 σε περίπου 50% σήμερα. Στο ίδιο χρονικό διάστημα, η ορθολογική χρήση ενέργειας αυξήθηκε κατά 20% περίπου.

Παρ΄όλ΄αυτά, η οικονομική ανάπτυξη των τελευταίων αυτών χρόνων είχε σαν επακόλουθο την αύξηση της κατανάλωσης ενέργειας. Επί πλέον οι σχετικά χαμηλές ενεργειακές τιμές απεθάρρυναν τις περαιτέρω προσπάθειες για μια ορθολογικότερη χρήση ενέργειας.

Το βασικό ερώτημα που τίθεται λοιπόν είναι:

με ποιό τρόπο θα μπορούσε να ενισχυθεί η οικονομική ανάπτυξη, λαμβάνοντας αφ΄ενός υπόψη τους περιορισμένους ενεργειακούς πόρους, και αφ΄ετέρου την ανάγκη ταυτόχρονης προστασίας του περιβάλλοντος χωρίς να τεθεί σε κίνδυνο η ασφάλεια ενεργειακού εφοδιασμού.

Η πρώτη προτεραιότητα είναι ο **έλεγχος της ενεργειακής ζήτησης** μέσω μιας αποτελεσματικότερης χρήσης της ενέργειας και μιας ορθολογικότερης ανακατανομής της.

Αυτή τη στιγμή διάφορα μέτρα και ιδέες συζητούνται προς την κατεύθυνση αυτή. Ανάμεσα σε άλλα και ο περίφημος ενεργειακός φόρος.

Η δεύτερη προτεραιότητα είναι η **σωστή διαχείριση της διαθέσιμης** ενέργειας για την κάλυψη των αναγκών ανάπτυξης. Τούτο σημαίνει την μεταφορά των τεχνολογικών και χρηματοδοτικών μέσων προς τις λιγότερο ευνοημένες περιοχές της Κοινότητας και τις αναπτυσσόμενες χώρες. Το νέο πρόγραμμα THERMIE (Technologie énergétique pour la Maitrise de l'Energie) επιδιώκει αυτό τον στόχο. Ξεκίνησε τον περασμένο Ιούνιο και είναι συνολικού ύψους 700 εκ. ECU για μια πενταετία.

Συμπληρωματικά, και πέραν του THERMIE, η Επιτροπή υιοθέτησε πρόσφατα ένα νέο πρόγραμμα το SAVE (Specific Action for Vigorous Energy Efficiency) τετραετούς διαρκείας που αποσκοπεί ακριβώς στην ενίσχυση της ορθολογικής χρήσης ενέργειας.

Σε γενικότερα πλαίσια, μια πραγματική και αποτελεσματική κοινοτική ενεργειακή πολιτική θα πρέπει να εξισορροπεί τις ανάγκες της ασφάλειας ενεργειακού εφοδιασμού, της οικονομικής ανάπτυξης και της προστασίας του περιβάλλοντος μέσα στα πλαίσια της ενιαίας εσωτερικής αγοράς ενέργειας και μιας νέας διευρωπαϊκής διάστασης.

΄Οσον αφορά την **Εσωτερική Αγορά Ενέργειας** θα ήθελα να αναφερθώ στη σημαντική πρόοδο προς την κατεύθυνση της ενοποίησης των ενεργειακών συστημάτων της Κοινότητας που επιτεύχθηκε κατά τα δύο πρόσφατα Συμβούλια Υπουργών Ενέργειας, του Μαΐου και του Οκτωβρίου. Η υιοθέτηση των τριών Κοινοτικών οδηγιών που αφορούν την διαφάνεια των τιμών ηλεκτρικής ενέργειας και του φυσικού αερίου καθώς και το δικαίωμα διαμετακόμισης (transit) των δύο αυτών μορφών ενέργειας αποτελεί το πρώτο αλλά καίριο βήμα προς μια Ενιαία Αγορά Ενέργειας.

Παράλληλα με την υλοποίηση της εσωτερικής αγοράς, οι λεγόμενες **συνοδευτικές πολιτικές** τίθενται σε εφαρμογή για την επίτευξη των στόχων της οικονομικής και κοινωνικής συνοχής. Οι πολιτικές αυτές αντισταθμίζουν τις ανεπιθύμητες επιπτώσεις της ενοποίησης των ενεργειακών αγορών.

Περισσότερες λεπτομέρειες σχετικά με τα δύο αυτά σημεία θα σας αναπτυχθούν σε επόμενη ομιλία της σημερινής συνεδρίασης.

Νομίζω, Κυρίες και Κύριοι, ότι έφτασε η στιγμή να θέσουμε τώρα το ερώτημα: ποιά είναι εν προκειμένω τα ειδικότερα ενεργειακά προβλήματα που αφορούν τα νησιά, και πως οι κοινοτικές πολιτικές μπορούν να τα ανατιμετωπίσουν ώστε να προωθήσουν την κοινοτική ενοποίηση και την οικονομική και κοινωνική συνοχή.

Χωρίς βέβαια να μπούμε στον Λαβύρινθο, μπορούμε να επισημάνουμε μια σειρά **προβλημάτων** που είναι νομίζω κοινά για τα περισσότερα νησιά:

- υψηλό κόστος ενεργειακού εφοδιασμού λόγω της γεωγραφικής απόστασης και της ιδιομορφίας των συνθηκών·
- μεγάλη εξάρτηση από εισαγόμενη ενέργεια, και ιδιαίτερα από το πετρέλαιο·
- μεγάλη εποχικότητα της ζήτησης ενέργειας, συχνά συνδεόμενη με μεγάλη τουριστική δραστηριότητα·
- σχετική ανεπάρκεια υλικο-τεχνικής υποδομής στον ενεργειακό τομέα.
- ιδιαίτερα αυστηρούς περιβαλλοντολογικούς περιορισμούς, συνδεδεμένους με την τουριστική δραστηριότητα και την γεωγραφική ιδιαιτερότητα.

Συγχρόνως όμως, συχνά τα νησιά διαθέτουν σημαντικές εναλλακτικές πηγές ενέργειας, όπως π.χ. αιολική, ηλιακή, των κυμάτων της θάλασσας (marremotrice), κλπ. Εκτιμάται ότι οι πηγές αυτές της ενέργειας θα μπορούσαν να καλύψουν σημαντικό μέρος της τελικής ζήτησης ενέργειας ορισμένων απομονωμένων περιοχών της Κοινότητας, αρκεί να δοθεί η κατάλληλη προσοχή..

΄Αμεσα ή έμμεσα οι κοινοτικές πολιτικές προσπαθούν να συμβάλουν στην λύση των ενεργειακών προβλημάτων των νησιών. Ας αναφέρουμε, π.χ. τα προγράμματα VALOREN, Επιδεικτικά (DEMO), ΄Ερευνας και Τεχνολογικής Ανάπτυξης, THERMIE, REGEN, ενεργειακού προγραμματισμού, κλπ.

Το Συμπόσιο αυτό δίνει την μοναδική ευκαιρία να εξετάσουμε και κυρίως να συγκρίνουμε πως οι ανωτέρω πολιτικές και τα προγράμματα λαμβάνουν υπόψη τις ιδιαιτερότητες των νησιών στον ενεργειακό τομέα.

Αναμφισβήτητα, τόσο η εκλεκτή παρουσία σας όσο και ο τόπος και ο χρόνος του Συμποσίου θα εμπλουτίσουν τους στόχους και τις δράσεις μας.

Σήμερα μας δίνεται επίσης η ευκαιρία να παρευρεθούμε και σε δύο άλλα γεγονότα που αφορούν άμεσα την Κρήτη, αλλά παρουσιάζουν ενδιαφέρον για όλους:

Πρώτα την παράδοση της μελέτης του ενεργειακού προγραμματισμού Κρήτης. ΄Οπως είδατε παρέλαβα επίσημα την τελική έκθεση της εν λόγω μελέτης. Δεν θα ήθελα αλλά και δεν θα μπορούσα σήμερα να αναφερθώ σε λεπτομέρειες. ΄Αλλωστε η υπηρεσία μου θα προβεί στην ενδελεχή εξέταση του έργου αυτού και ελπίζω να διαδόσει κατάλληλα τα βασικά της συμπεράσματα σ΄όλους τους ενδιαφερόμενους ανά την Κοινότητα.

Θα περιοριστώ μόνο στο να επισημάνω ορισμένα στοιχεία σχετικά με το γενικότερο οικονομικό και ενεργειακό **πλαίσιο** μέσα στο οποίο εκπονήθηκε η μελέτη αυτή, καθώς επίσης και τα βασικά **συμπεράσματα και προτάσεις της**.

Πρώτ΄απ΄όλα, το **πλαίσιο**:

- Η Κρήτη παρουσιάζει υψηλό ρυθμό οικονομικής ανάπτυξης, υψηλότερης από τον αντίστοιχο μέσο όρο της Ελλάδος. Αντιμετωπίζει όμως και αυξανόμενο ρυθμό κατανάλωσης ενέργειας για το μέλλον. Αντιλαμβάνομαι ότι η εξάρτηση από το εισαγόμενο πετρέλαιο, κυρίως για ηλεκτροπαραγωγή, παρουσιάζει λόγους σοβαρής ανησυχίας για την μελλοντική οικονομική ανάπτυξη του νησιού.

- Η γεωγραφική απόσταση από την ηπειρωτική Ελλάδα καθιστά τις διασυνδέσεις με το ηλεκτροδοτικό δίκτυο και το μελλοντικό δίκτυο φυσικού αερίου τεχνικά δυνατή μεν, με λύσεις όμως οικονομικά δαπανηρές.

- Συγχρόνως όμως η μεγαλόνησος διαθέτει σημαντικές πηγές εναλλακτικής ενέργειας, κυρίως ηλιακής, αιολικής, υδροηλεκτρικής και βιομάζας. Αναμφισβήτητα, η ορθολογική αξιοποίηση των πηγών αυτών θα μπορούσε να συμβάλει σημαντικά στην οικονομική και κοινωνική ανάπτυξή της, αυξάνοντας την ασφάλεια του ενεργειακού της εφοδιασμού.

΄Οσον αφορά τα αποτελέσματά της, η μελέτη καταλήγει με ένα ολοκληρωμένο ενεργειακό πρόγραμμα για το έτος 2000 και προσδιορίζει **επτά τομεακές ενεργειακές παρεμβάσεις** που αφορούν την αξιοποίηση των τοπικών ενεργειακών πηγών και την ορθολογική χρήση ενέργειας.

Αποδίδω ιδιαίτερη σημασία στο συμπέρασμα της μελέτης σχετικά με την ανάγκη δημιουργίας ενός **οργανωτικού σχήματος** στην Κρήτη που θα επιτρέψει την εφαρμογή του ενεργειακού προγράμματος που ανέφερα.

θέλω να καταλήξω στο ότι τα συμπεράσματα και οι προτάσεις της μελέτης οπωσδήποτε είναι συνεπείς με τις γενικές γραμμές της Κοινοτικής ενεργειακής πολιτικής.

Επισημαίνω, όμως, ότι η μελέτη, αναμφισβήτητα υψηλής επιστημονικής αξίας, δεν είναι αυτοσκοπός. Εκείνο που έχει μεγάλη σημασία, όπως και για όλες τις μελέτες ενεργειακού προγραμματισμού, που η Γενική Διεύθυνση Ενέργειας της Επιτροπής των Ευρωπαϊκών Κοινοτήτων ενισχύει οικονομικά από το 1982, είναι η **εφαρμογή των συμπερασμάτων τους με συγκεκριμένα έργα, επενδύσεις και οργανωτικές δομές, κλπ.**

Γι΄αυτό ελπίζω και παροτρύνω όλους τους ενδιαφερόμενους για το θέμα της ενέργειας στην Κρήτη, να συμβάλουν ενεργά στην καλύτερη και ορθολογικότερη διαχείρηση της ενέργειας στο νησί, ώστε η ενέργεια να μην αποτελέσει νέο Μινώταυρο που απομυζά την ικμάδα του νησιού. Αντίθετα να καταστεί ισχυρός μοχλός στην κοινωνική και οικονομική άνοδο του τόπου.

Δεύτερο γεγονός είναι τα εγκαίνια του αιολικού επιδεικτικού έργου των Ανωγείων η εκτέλεση του οποίου έχει συγχρηματοδοτηθεί από την Γενική Διεύθυνση Ενέργειας της Επιτροπής των Ευρωπαϊκών Κοινοτήτων.

Πληροφορούμαι μ΄ευχαρίστηση ότι οι τοπικές αρχές παρέχουν τη δυνατότητα σ΄όλους όσους συμμετέχουν στο Συμπόσιο να παρευρεθούν στα εγκαίνια αυτά που θα γίνουν σήμερα μεταξύ 13.00-15.00.

Λεπτομέρειες σχετικά με το αιολικό έργο παρέχονται γραπτώς σε ειδικό ενημερωτικό φυλλάδιο. Ελπίζω επίσης ότι επί τόπου θα μπορέσετε να εκτιμήσετε καλύτερα τις διάφορες τεχνικές και οικονομικές - και γιατί όχι - και αισθητικές πτυχές του έργου και να ανταλλάξετε σχετικές εμπειρίες.

Ετσι περιορίζομαι εδώ να υπογραμμίσω τη σημασία του έργου αυτού στην μείωση του κόστους άντλησης νερού στα ΑΝΩΓΕΙΑ με χρησιμοποίηση ανανεώσιμης πηγής ενέργειας.

Κυρίες και κύριοι, ευελπιστώ ότι το Συμπόσιο αυτό, σαν το μίτο της Αριάδνης θα μας χρησιμεύσει στο να ευμβαθύνουμε στον ενεργειακό προβληματισμό των νησιών και στο να απαντήσουμε αποτελεσματικά στις προσδοκίες των κατοίκων όλων των περιοχών της Κοινότητας ιδιαίτερα στην κρίσιμη περίοδο που διανύουμε.

Σας ευχαριστώ.

FIRST SESSION

INTRODUCTION:
THE COMMUNITY FRAMEWORK

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

INTERNAL ENERGY MARKET & FLANKING POLICIES: RELEVANCE FOR THE ENERGY SITUATION OF THE COMMUNITY'S ISLANDS

Dr G. Gerini
Commission of the European Communities - DG XVII

I will start with a brief look at the activities inherent in the creation of the internal energy market and those linked to the flanking policies in the energy sector. I will then try to pinpoint a number of issues concerning the possible impact on the socio-economic and energy situation of the Community's islands.

Completion of the internal market in 1992 involves two parallel and complementary lines of approach, The first of these is designed to create a unified European area by ensuring free movement of goods, persons, capital and services. The other is linked to the adaptation and development of economic activity in a bid to promote continuous and balanced expansion and strengthen economic and social cohesion in the Community.

In this overall context, energy is an essential component of the drive towards the internal market and of a number of sectoral policies, e.g. regional development and environmental policy, and as such comes under the heading of what are known as the "flanking" policies.

In May 1988 the Commission approved a working paper on the internal market for energy, which consisted first and foremost of a list of the obstacles to greater market integration, while also assessing the work still to be done in order to achieve a genuine opening-up of the energy market.

A. The current state of play

I will confine my attention to the activities for which the Directorate-General for Energy is directly responsible, leaving aside topics such as standards, the opening-up of public procurement and taxation, which apply to a number of sectors.

A first set of four proposals was sent to the Council a little over a year ago.

The aim was to remedy the situations which created the greatest obstacles to the energy market, namely the lack of price transparency and the compartmentalization of the markets.

These proposals relate to:

- transparency of gas and electricity prices charged to industrial end-users;

- increased trade as a result of the requirement to ensure the transit of natural gas and electricity;

- improved exchange of information on large-scale energy investments.

Three of these proposals, those relating to price transparency and the transit of gas and electricity, have either already been adopted by the Council, or their adoption is now no more than a formality.

The directive on transparency[1] requires firms and organizations to forward information on prices twice a year for a whole range of categories of gas and electricity consumers.

As regards gas and electricity transit, the directives which are shortly to be adopted formally introduce rights of transit between integrated electricity grids in order to step up and liberalize trade. They also provide for the creation of an organization to assist the Commission in making detailed arrangements for increased transit and, if necessary, to conciliate in the event of a dispute.

The adoption of these initial measures, in my view, constitutes an important step towards achieving the internal market for energy, in terms not only of the measures themselves, but also of the changes they have brought about in a long-standing situation.

The proposal concerning the exchange of information on energy investments with a Community dimension has not yet produced results.

Finally, discussions are under way within the Commission and with the government and professional bodies concerned on the principle of transporting energy within the Community on behalf of third parties.

This gives us a rough picture of what has been achieved so far. I would now like to move on to:

B. Future activities

Here again, I intend to outline the main issues without entering into details.

(a) Security of supply

The completion of the internal energy market entails devising a Community approach to security of supply.

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1 OJ L 185, 17.7.90.

In this context consideration must be given to the role of indigenous resources, the degree of diversification needed, the degree of competition to be maintained on the market, the scope of legislation on the production, distribution and use of energy and the interconnection of grids. This process must highlight the extent to which the Community dimension should gradually take over from the national dimension and how this should be achieved, taking into account the differences between the energy situations of the Member States.

(b) The external dimension

In defining a Community approach to security of supply, the external dimension must be taken into account, since the wish to guarantee security of supply is motivated by the desire not only to make maximum use of national and Community resources, but also to reduce the Community's energy dependency.

(c) Providing adequate networks

The way in which gas and electricity grids currently operate fails to make maximum use of resources. Moreover, rights of transit, possible third-party access and increased trade in a bid to increase the flexibility and security of supply will lead to wider use being made of the grids. This means that the existing equipment must be added to and new infrastructures built.

In the electricity sector for instance, some international interconnections need to be made. In the gas sector the operation will be on a larger scale, as it consists in making a new source of energy available in a number of Member States where it is not currently available.

In this context the Commission, on its own initiative, has already launched the Regen programme in connection with the Community's regional policy. Further work will also be carried out in 1990 on improving energy infrastructures under the broader aspect of trans-European networks.

(d) Improving market transparency

Transparent price-formation conditions - and, as a result, some degree of cost transparency - are a necessary adjunct to the proposal for a Directive on transparency of prices, particularly in sectors where there is insufficient competition (monopolies or exclusive rights; public companies).

Practical proposals are expected to be made in 1991.

(e) Finally, work is continuing on defining technical specifications and standards, with particular reference to harmonizing decision-making procedures concerning type-approval of equipment, and to the barriers arising from varying levels of environmental protection. Here again, proposals are to be made in 1991.

To conclude this section, I think it is fair to say that a number of activities are taking shape at the moment designed to ensure completion of the internal energy market. There is still a great deal to be done, but I believe that the process is now irreversible.

* * *

C. I will move on now to the second part of my talk, which concerns the flanking policies and is of more immediate concern to the islands.

I have already stressed the fact that energy is a component of a number of sectoral policies, such as regional development policy, and as such comes under the heading of flanking policies.

The Community is underpinning the strengthening of economic and social cohesion by the activities it carries out through the structural Funds (ERDF, ESF and EAGGF Guidance Section), the EIB and the other existing financial instruments. The energy sector obviously fits into this overall structure, since the activities in this sector tie in with the objectives of the structural Funds and the other instruments mentioned and, assuming that proposals are made on energy, with the action programmes presented by the Member States. I think that virtually all the islands in the Community receive assistance from the Funds. In addition, the Commission has right of initiative in respect of 15% of ERDF resources, which enables it to propose measures to the Member States which are of particular interest to the Community.

It is in this context that the Commission has taken a series of initiatives and adopted programmes in various fields such as the Valoren programme, which has been running for a few years now, and more recently the Regis and Regen programmes. I will confine my remarks to the Regen programme, as my colleagues from the Directorate-General for Regional Policy are due to speak to you about the other programmes.

The Regen (Regional Energy) programme relates exclusively to the energy sector. If the regions which are lagging behind (the so-called Objective 1 regions) are to reap the full benefits of the internal market, it is essential that they have infrastructure networks for transporting energy, and that these be connected up to the rest of the Community.

The extension of these networks is essential to the energy balance of those Member States still isolated from the rest of the Community, and therefore to reducing dependency on imported oil, and increasing security of supply.

This is the case in Portugal, Greece, Sardinia and Corsica, which do not have a network of gas pipelines. It is also true in Ireland, whose gas grid is not connected to that of the United Kingdom, and, in the context of electricity interconnections, to southern Italy and Greece.

These projects may therefore receive assistance from the Community, either for the equipment and construction work or for feasibility studies, depending on what stage has been reached. The overall allocation for this project is ECU 300 million.

The Regen programme, then, is a good example of a flanking policy for the 1993 internal market and for increased Community integration. Its completion will be of benefit in terms not only of integration of the energy market, and thus security of energy supply in the Community, but also in terms of of economic and social integration.

I would like to talk to you next about three projects being carried out by the Directorate-General for Energy specifically. The first of these is designed to promote energy programming studies at regional level, including islands, and in urban areas. Another is the Thermie programme which concerns the promotion and dissemination throughout the Community of innovative energy technologies, and the third is the Save programme designed to promote energy savings, which was recently approved by the Commission. These three projects have a common theme, which is that regional programming should highlight the potential of local resources and the rational use of energy, and produce projects which may subsequently receive assistance, depending on the degree of technological development, under the Thermie programme or the other programmes and financial mechanisms which exist (e.g. Save, EIB, etc.).

I will simply say a few words about energy programming; a more detailed paper will be given on the Thermie and Save programmes.

As far as energy programming is concerned, the Commission may make a financial contribution to studies, which is generally in addition to the contribution of the regional or local authorities and does not as a rule exceed 40% of the cost of the study.

It is possible to define in general terms a regional energy planning study covering for instance the systematic compilation, evaluation and use of energy statistics and economic and social data at regional or local level, with a view to preparing action plans and programmes or influencing regional energy and environmental policy.

As many of you are aware, a number of studies have already been carried out in the context of activities to assist islands such as the Cyclades, Lesbos, Madeira, Bornholm, the Canary Islands and Crete.

Following its call for proposals published this year (procedure launched at the beginning of 1990 and closed in May with 108 proposals), the Commission is to support 11 regional planning studies, 10 feasibility studies inherently linked to planning studies which have been completed and 11 studies relating to energy in towns. Of these projects, three relate to islands: feasibility studies on wind energy in Crete and geothermal energy on Lesbos and the common energy planning study for the Shetlands, Madeira and the Orkneys.

We intend to publish the 1991 call for proposals in December; among the most important criteria will be the insular or remote nature of the Community's outlying regions.

Other studies and projects are in progress and may culminate shortly in specific communications from the Commission to the Council. These concern energy in an urban environment, (partly as a follow-up to the recent publication of the Commission's Green Paper on the urban environment), and energy and rural society. The aim is to take a closer look at the interaction between energy and environment in an urban setting and the possible role for energy in developing rural society, and to propose appropriate action to the Council.

In addition, a study relating specifically to the energy situation of the islands of the European Community was recently launched by the Directorate-General for Energy, and its initial findings will be outlined tomorrow by the representative of the organization carrying out the study.

D. The third and final part of my talk aims to identify a number of key issues of interest to the Community concerning the energy environment of its islands, not purely from the energy angle, but with reference to economic and social cohesion in the Community.

I will be brief, as I feel sure that this symposium, and subsequent ones arising out of it, will provide an opportunity to look in greater detail at the activities and measures to be considered.

The first problem is undoubtedly the additional cost to be met in supplying energy to islands, whether for fuel transport or local generation of electricity, which is very often hampered by the limited range and size of the equipment available. A whole series of questions arises, but as a general rule the inhabitants of islands should not have to pay more for their energy than consumers on the mainland. We must then consider whether there are some situations where this principle does not apply, for what reasons and what action if any should be taken.

Tax is one of the main components of the energy prices charged on islands. Here again we should examine to what extent taxation can be used to meet the additional costs, and the level of reduction in tax revenue which is acceptable. Care must also be taken to ensure that a cut in tax on fossil fuels does not undermine alternative sources of energy which use local resources.

I believe that the representatives of the Azores and Madeira have launched discussions on this subject, and look forward to hearing from them.

Moving away from the prices issue, the other fundamental problem as I see it is the development of locally-based resources, which can be linked to the more efficient use of energy. This last point is of prime importance for islands even more than for communities on the mainland. Energy efficiency should be given top priority, and more work has to go into achieving this objective. Local energy sources certainly need to be exploited to a greater extent. The impression we get is that national, or even Community programmes devised to exploit these resources, whether hydro power, wind energy, solar energy or biomass, have often met with obstacles of various kinds, and sometimes with a lack of confidence or lack of willingness to tackle the problems involved.

On the other hand, connecting up an island's electricity and gas networks to the mainland or to neighbouring islands can often provide an alternative to the exploitation of indigenous resources. Such solutions are sometimes simpler but not necessarily more economical.

The information provided to us by the representatives of the islands during this symposium will enable us to make a clearer assessment of the situation, but I think that the conclusions must emphasize the issues inherently linked to the need for increased energy efficiency in remote areas, the impact of current programmes on the development of local energy potential and the arguments for and against stepping up or revising those programmes and, finally, in the same context, the role of connections to mainland networks.

I will conclude by stressing the importance and the role of locally-based energy bodies and, at a more general level, the need for sound energy programming and monitoring on islands.

Whatever the legal basis for the production and distribution of energy on islands, an appropriate energy programme is of prime importance. Energy has an essential role to play in economic and social development, and especially in island communities where proper management of energy, not just in terms of demand, but even more so I would say, in terms of supply, can be central to such development. We are convinced that sound energy programming carried out by a motivated local organization is a prerequisite for overcoming the energy problems faced by islands.

Overcoming energy problems also means in our view contributing to economic stability, the settling of populations, job creation, improving the effects of interaction between energy and the environment and, finally, strengthening Community integration and cohesion.

I am confident that this symposium will help us achieve these aims.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY & ISLANDS
STRUCTURAL FUND INTERVENTION

R. McKenna
DG XVI - Directorate General for Regional Policies
Commission of the European Communities

Mr McKENNA gave an overview of the situation regarding the reform of the Community's structural funds specifically mentioning energy.

He went on to look at how energy and islands have fared in the Community's new approach to regional development and to draw some conclusions on the interaction between the island and energy development equations.

Starting with a brief analysis of the reform which took effect on 1.1.1989, Mr McKENNA described its basic elements :

(1) Concentration on specific development objectives.

(2) Concentration of increased financial resources on the backward regions.

(3) Programming in partnership.

1989 was something of a transitional year with the adoption of Community Support Frameworks (CSFs) outlining the main priorities in the various regions for joint action between the Member States and the Community.

1990 was the first year of programmes operating on the ground.

Specific priorities of CSFs are cofinanced from the doubled structural funds of the Community. These are largely concentrated on Objective 1 regions (the backward regions). Of a total of 60 billion ECUs during the period 1989-1993, 38 billion is earmarked for Objective 1 regions.

Of this 38 billion ECUs probably 3 to 3.5% in total will end up in the energy sector.

Mr McKENNA recalled that Operational Programmes are now the norm in structural fund financing. The transition has not been easy. However, Community-wide agencies and authorities , are now beginning to realise that, where the Community structural funds are involved in jointly funded activities, decisions are made together in partnership.

The Partnership approach has seen varying degrees of success in the Member States. It is of course a wide concept, covering more than the involvement of Commission services in investment decisions. It goes well beyond this, raising political issues of the role of the regions (and by definition, therefore, the islands) in the determination of their own future. The consultative Committee of regional and local authorities set up by the Commission under the reform of the structural funds is a step on the way to regional legitimity.

Mr McKENNA spoke of the role of energy and islands in the Community Support Frameworks noting that new operational programmes were developed for islands as for other regions. On the broad level, energy continues to rank lower than transport as a priority.

He mentioned the special action plans allowed under the reform of the structural funds, the Commission initiatives. The list of these plans adopted by the Commission does not contain a programme aimed at the specific energy problems of islands. Mr McKENNA pointed out that, apart from some minor exceptions, the VALOREN programme was perceived as a failure as a programme for development of renewable energy and energy saving in the poorer regions. It is not surprising therefore that it is not followed by VALOREN II whereas STAR, its telecommunications counterpart is to be complemented by TELEMATIC, a new programme for advanced telecommunications.

Why has VALOREN failed or appeared to fail and can it be saved? There is no problem with its objectives - development of endogenous energy resources (e.g. geothermal/wind) and investment in energy saving. The reason is bad preparation and bad management. This applies at all levels including that of the Commission. However, at the implementing agency level, sound management is essential if programmes are to work. This has not been present for VALOREN in many Member States, including Greece.

Mr McKENNA considered that the message was clear. Success breeds success. Failure to implement programmes does not generate an atmosphere in which programmes are likely to be renewed or continued. This he considered especially important in the context of the future of structural fund activities in the regions after 1993.

BORNHOLM — Technology --- Environment
Additional costs for environment option = +/- 25% ?
Worth it. import/export

N.B. Interactive.

MADERE — VALOREN decisive for what?
No connection possible.
Energy problems should be seen in context of local economy and in view of social and economic cohesion.

CANARIES — General interconnection not on because of depth of sea.
Supply of water main problem.
Should be special financing in VALOREN, etc.

CORSICA — Hydro-potential very much underutilized. Link with France would be detrimental to local department.
Same goes for gas link to Sardinia.

SARDINIA	Electric cable (via Corsica/Elba --- Italy) originally installed to <u>export</u> electricity to mainland. Currently small imports.
SCOTTISH Isles	Island economy --- lack of competition prices

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SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

THE COMMUNITY INITIATIVES

The opinions expressed in this paper are attributable only to the author and do not necessarly reflect the official position of the Commission of the European Communities

T. A. Saramandis
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The aim of this presentation is to present a broad outline of Community initiatives, which are now, since the recent reform, an important component of the Community's structural funds. The subject of this symposium is very topical in light of the events which have been unfolding over the past few months in an area not very far from Crete and which have revived the debate on energy problems.

Before outlining the principles and the methods governing the various Community initiatives, I would first of all like to say a few words about the reform of the structural funds.

1. The reform of the structural funds

The three structural funds affected by this reform are : the Regional Development Fund (ERDF), ths Social Fund (SEF) and the Guidance Section of the European Agricultural Guidance and Guarantee Fund (EAGGF). Their reform is connected with the commitments entered into with the adoption of the European Single Act by which the Member States wanted to reaffirm their wish to progress towards European Union. For that purpose, they set themselves a certain number of concrete objectives likely to encourage greater integration, in particular economic and social integration. However, the maintenance or even worsening of regional disparities would saw seeds of social and political tensions which would be detrimental to the achievement of this objective.

To arrive at a satisfactory level of cohesion, the lagging areas will have to benefit fully from the completion of the internal market and to achieve a rate of growth significantly higher than the Community average. The reform of the Structural Funds has to be seen in this context. The main principles of the reform can be summarized as follows : First, it was agreed to double in real terms the resources available for structural action from 7 billion to around 14 billion in 1993. Secondly, it was decided to concentrate structural assistance on five precise objectives :

1. The development of the lagging regions;
2. The conversion of regions seriously affected by industrial decline;
3. The battle against long-term unemployment;
4. Vocational training for young people, and
5. The adaptation of agricultural structures (Objective 5a) and development of rural regions (Objective 5b).

Thirdly, new procedures were introduced to increase the efficiency of the operations of the Structural Funds. Under the reform, the emphasis has shifted from a project to a programme based approach. Therefore, the Funds intervene on the basis of operational programmes established according to a generalized planning strategy lasting for more than one year. Under the new system, the programming and the planning of Community interventions are steadily refined by means of a three stage process. First of all, the Member States have to submit development plans which indicate the principal measures and axes of development for which finance is sought from the Community. These plans are the basis for negotiation between the Commission, the Member State and the regional authorities concerned and lead to the establishment of a Community Support Framework (CSF). The CSF outlines the main priorities for structural action, the types of measures to be cofinanced and on indicative financial plan.

Finally, the Community decided that structural actions should be carried out in partnership between the Commission, the Member States and the regional and local authorities. This partnership should concern the planification and implementation of the actions of the Funds.

2. Regional development and energy problems

I would now like to turn to the links between the Community's regional development and energy policies. The Community wishes to encourage the conversion of areas affected by the decline in energy production; at the same time, it wishes to encourage the growth of the economy and employment in lagging areas through investments in the energy sector. The role of the Community is already important in this respect. In the past, the ERDF and the ECSC have provided considerable support for investments in the energy sector, as well as for the conversion of coal mining areas. Further assistance is envisaged in the future.

Between 1989 and 1993 the Structural Funds are expected to contribute over 1700 MECU towards energy investments selected as being of priority for the economic development of the Objective 1 regions.

The bulk of this will be taken up by Italy and Greece. In the former, the Community support framework includes provision for 879 MECU most of which will go towards the development of a natural gas distribution network in the Mezzogiorno. In Greece, assistance will be provided for investment in installations for the importation of natural gas.

Further important energy projects are to be assisted in Portugal, essentially electricity and gas installations in Lisbon, Porto, Coimbra and in the islands.

In addition to these new actions, the Objective 1 regions will continue to benefit from assistance under the VALOREN programme, which started in 1987 and for which 278 MECU of ERDF assistance is available for the period 1989-1991. This programme aims to assist the exploitation of endogenous energy potential in the less-favoured regions. It provides ERDF support for the exploitation of local energy resources, and of small deposits of peat and lignite, the efficient use of energy in Small and Medium Enterprises and the promotion, at regional level, of the improved use of energy potential.

Finally, certain areas of the Community can be given additional support from the structural funds within the framework of the Community Initiatives.

3. The Community Initiatives

The action of the Community through the structural funds is extended according to the provisions of two regulations. These regulations are

(EEC) 4253/88 (Article 11), which deals with the general coordination of the three funds, and (EEC) 4254/88 (Article 3), which deals specifically with the ERDF. In accordance with these regulations, the Commission can decide, on its own initiative, to give financial support to actions which are of Community interest, over and above the measures set out in the Community Support Frameworks (CSF). Some 15% of the ERDF budget is reserved for the financing of such initiatives.

The purpose of these initiatives is :

1. to help to solve problems resulting from the application of other Community policies;

2. to promote the application of Community policies at regional level, and

3. to help to solve problems common to certain areas.

<u>The financing of the Community initiatives</u>

For the 1989-1993 period, the amount available to the structural funds is 60,3 billion ECU. Of this amount, 5,5 billion ECU is reserved for the Community initiatives.

This amount will have initially to make it possible to finance the non-quota programmes and other existing Community programmes. Around 1,7 billion ECU of this was already committed for action under the old Community programmes (e.g. non-quota programmes, STAR, VALOREN, RESIDER and RENAVAL).

Of the 3,8 billion available for <u>new</u> Community initiatives, 3,2 billion is allocated on an indicative basis, to Objective 1,2 and 5(b) regions.

The Commission has already adopted 5 initiatives. Those are :

<u>Initiative</u>	<u>Financial indicative enveloppe</u>
RECHAR	300 MECU
ENVIREG	500 MECU
INTERREG	800 MECU
REGIS	200 MECU
STRIDE	400 MECU

REGEN (300 MECU), PRISMA (100 MECU), TELEMATIQUE (200 MECU) and EUROFORM, NOW and HORIZON (600 MECU) are expected to be adopted by the end of this year. The adoption of LEADER (400 MECU) is expected early 1991.

Amongst this package of initiatives, two are concerned, directly or indirectly, with energy.

A. REGEN Initiative

The Commission has already adopted the guidelines of this initiative.

To ensure that Objective 1 regions are able to derive full benefit from the internal market, they need infrastructure networks linked up to the rest of the Community.

In those regions there are a number of shortcomings and inadequacies in terms of primary natural gas grids and the interconnection of gas and to a lesser extent electricity grids.

Greece and Portugal, for example, do not yet have a gas pipeline network and Ireland, whose grid is not linked up to that of the United Kingdom, is confronted with the problem that its indigenous source of supply is running out. Also Greece and Ireland are not linked up to the European electricity grids.

Investment in energy networks should make it possible to reduce the proportion of total energy supplies accounted for by coal and oil, and thus help improve the environment.

Projects eligible under REGEN initiative mainly concern natural gas grids. Exceptionally, a project to interconnect electricity grids is taken into account.

The projects proposed are :

1. establishing natural gas transmission grids in Portugal and Greece,

2. interconnecting the natural gas grids of Ireland and the United Kingdom,

3. establishing a joint natural gas grid for Corsica and Sardinia,

4. interconnecting the Spanish and Portuguese grids,

and 5. interconnecting the electricity grids of Italy and Greece.

The total contribution of the ERDF to REGEN in the period 1990 to 1993 is estimated at 300 million ECU.

This initiative could be adopted by the Commission before the end of this year.

The second initiative which deals with energy is REGIS.

B. The REGIS initiative

This initiative was decided in order to provide assistance to the most remote regions of the Community.

These regions (Guadeloupe, French Guiana, Martinique, Reunion, Canary Islands, Azores and Madeira) falling under Objective 1 suffer because of their great distance from the rest of the Community.

As energy is concerned, and in order to encourage economic diversification, under the REGIS initiative, the Community can provide assistance for investments in small-scale energy production and links with existing distribution networks with particular emphasis on renewable energies, including geothermal energy.

The Community's contribution to REGIS for the period 1990 to 1993 is estimated at ECU 200 million.

For its implementation, Member States should submit proposals for operational programmmes within the six months of the 4/8/1990.

SECOND SESSION

PRESENTATION OF SOME CASE STUDIES & ISSUES CONCERNING EC ISLANDS

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

INTEGRATED ENERGY & ENVIRONMENTAL PLANNING FOR BORNHOLM

J. Jespersen
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SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

Heraklion, Crete 11.-13. november 1990

INTEGRATED ENERGY AND ENVIRONMENTAL PLANNING FOR BORNHOLM

by

Jørgen Jespersen, County of Bornholm, Denmark.

1. INTRODUCTION

An energy plan for the island of Bornholm (588 km², 46.000 inhabitants) was created in 1984-86, partly financed by the EC, DG XVII. The main goals were to strengthen the use of local and renewable energy resources (straw, wood, manure, sun and wind) and to lower the import of oilproducts.

The result so far has been an increase in the use of local resources for heating and electricity, now covering 15 % of the energy-demand for these purposes in 1989.

Due to higher priority of environmental aspects in general for the last years a new energy planning project for Bornholm has been carried through in 1988-90.

The project "Integrated Energy and Environmental Planning for Bornholm" is based on a philosophy, where environmental aspects are not merely considered as side-effects to energy production and energy consumption, but as important part of the planning analysis both in the formulation of the goals and in the evaluation of the changes of technologies and structures included in the planning.

Through a combination of technology and structure choices in the energy system of Bornholm, 3 energy scenarios for the year 2010 have been set up. These scenarios are compared to both the requirements of environmental quality and the requirements of energy service level.

In fig. 1 the idea of integrated energy and environmental planning is illustrated.

A number of special tools have been developed within the project:

- a catalogue comprising the relevant technologies available to cover the energy demands. Approx. 140 technologies have been studied.

- environmental priority lists comprising key parametres showing the effectiveness of changing from one technology to another to fulfil the given goals. One goal might e.g. be the reduction of CO_2 emission as cheap as possible.

- a computer based calculation model, which from a given energy demand and a number of selected technologies estimates the consequences for energy consumption, environmental impact as well and economy.

The participants in the project are

- The County of Bornholm
- The Danish Energy Agency
- The National Laboratory RISØ, Denmark
- The Physical Laboratory III, Technical University of Denmark
- The Danish Environmental Agency
- COWIconsult, consultant engineers, Denmark.

The project is financed by EC (DG XVII), The Danish Ministry of Energy, The Danish Energy Agency and The County of Bornholm.

2. Purpose.

The project is based on the assumption that the social development on Bornholm will follow the national trends , and that the physical development will follow the physical plans for Bornholm, i.e. the Regional Plan 1989-2000. So, despite the recent stagnation on Bornholm, it is assumed that the development on Bornholm should not deviate from the official expectations for development in Denmark as a whole.

As illustrated in fig 1 the social development goals can reflect the expansion in energy services. Energy is needed for operating a technology in a way satisfying the human needs. The fulfilled need is defined as the energy service.

In Table 2 the need for energy service on Bornholm is outlined for 1987 and 2010 respectively. The figures for 2010 are made up as increases of the 1987 values. The increases have been calculated from forecasts for population development, size of households, development in the public sector, development in the need for transportation and changes in production values for the industries.

3. ENERGY STATUS 1987

As a basis for the elaboration of scenarios, the present energy system of Bornholm has been analyzed. 1987 is the latest year where data for e.g. the demand for energy is available . The development since 1987 has been taken into account in the Reference Scenario for the year 2010.

The demand for energy can be divided as follows:

- Heating of buildings
- Lighting and tools
- Process purposes in industries and agriculture
- Transportation

The calculations of net heat consumption for space heating and domestic hot water are based on data from the Danish Housing and Building Registration (BBR) giving the exact data for heated buildingareas using different types of fuel.

Fig. 3 illustrates the total energy flow for Status 1987 for Bornholm.

The total energy consumption on user-level was in 1987 4.834 TJ (Terajoule), incl. losses in local power and heat production plants.

The consumption in the different sectors were:

- Heating:	2.367 TJ or 50 %,
- Lighting and tools:	477 TJ or 10 %,
- Process purposes:	1.076 TJ or 22 %,
- Transportation:	746 TJ or 15 %,
- Losses:	168 TJ or 3 %.

Calculations of the fuel consumption for imported electricity (97 %) is based on an average efficiency factor of 40% for power production on Zealand. The fuel consumption is therefore 2095 TJ. If this conversion loss is included, the losses in the heat and electricity production sector will amount to 26% for Bornholm.

For the user-level it is only possible to estimate the losses for the heating sector, as there is no data for conversion loss within the process and transport sectors.

The energy consumption for space heating and domestic hot water amount as mentioned to 2367 TJ. The corresponding net heat demand amount to 1824 TJ and the losses on the user-level is therefore approx. 23%.

4. ENVIRONMENTAL STATUS .

In order to fulfil the basic demands of environmental quality on Bornholm and in order to analyze how to fulfil these demands, the present environmental quality on the island has been evaluated at a part of this project. It is the first time that such an environmental status has been made for a county in Denmark.

The present pollution situation based on registrations and measurements together with the theoretical models for pollution is described.

Balances of emission, dispersion, deposition and decomposition have been set up for different pollutants, and based on these balances critical loads for the most important types of nature on Bornholm have been set up.

The critical load is defined as "the maximum deposition of a pollutant not causing any long-term harmful effects on the eco-system or on people".

The critical loads thus define the environmental criterias for the scenarios in the project.

The environmental evaluation includes sulphurdioxide (SO_2), nitrogen oxides (NO_x), cadmium (Cd), carbon dioxide (CO_2), polycyclic aromatic hydrocarbons (PAH) and dust particles.

These substances have been chosen because they cause different types of pollution as e.g.:

- global effects such as the green-house effect (CO_2)
- regional effects such as acidification (SO_2 and NO_x) and lack of oxygen in lakes (NO_x)
- local effect on the human health (dust particles, NO_x, PAH, dioxines and Cd).

Several energy sources contribute to the emission of pollutants to the air. In fact the energy system gives far the biggest contribution to airpollution from Bornholm. There are hardly no other emissions except from agriculture (e.g. evaporation from the fields).

The emissions from the energy system on Bornholm are shown in Table 4.

Table 5 illustrates that Bornholm has a net import of polutants related to energy consumption (SO_2, NO_x and cadmium) and that the amount of pollutants coming from Bornholm has a net export of ammonia (N_xH), which is caused by the agriculture.

The sulphur deposition originating from outside Bornholm is expected to decrease with about one third from 1980 to 1995 as a consequence of the restrictions already made concerning countries surrounding the Baltic Sea.

For sulphur and nitrogen it is in principle possible to estimate the critical loads.

For sulphur it is the acidification of soil which defines the limit. For nitrogen it can be either acidification, eutrophication or the concentration of nitrogen in the ground water that defines the limit.

The soil on Bornholm varies from thin sandy moraine layers on granite to areas with thick layers of heavy clay.

The sandy moraine is the most sensitive for acidification. Today the grade of acid (pH) in these areas is 4,1-4,2 in a depth of 30-50 cm in beech wood areas.

Calculations of critical loads for the soil in wood areas show that the sulphur and nitrogen load ought to be reduced by 60-70% compared to 1980.

The deposition of cadmium on Bornholm has been reduced by 50% during the period 1975-1985. Calculations on models show that the amount of cadmium in the agriculture soil has increased by 50% from 1950-1989. Considering the present cadmium load the cadmium amount in the soil will increase by 20% to 2050. To prevent the cadmium amount in the soil from increasing, further reductions (50-75%) on deposition, changes of agriculture practice and further reduction of cadmium in fertilizers are necessary.

The contribution of PAH to soil from Bornholm is not important. It has not been possible in the project to state the PAH coming from outside Bornholm, because of lack of datas.

All in all the analysis of the environmental status on Bornholm shows that the loads of sulphur, nitrogen and cadmium exceed the critical loads and that the future loads should be reduced more than what will be the result of the present development.

5 METHODOLOGY FOR ANALYSIS.

5.1. Description of methods.

The basic condition when analyzing the energy system on Bornholm and defining the scenarios is that the required estimated energy demands should be fulfilled.

By outlining a scenario a number of technologies are selected, so that the estinated energy demand is fulfilled. For these technologies:

- energy consumption classified by fuel types
- emissions of pollutants
- costs
- imports and
- employment

are calculated.

From the results it is seen whether the scenario fulfils the given environmental demands, e.g. emission of CO_2, consumption of energy resources etc. If the demands are not fulfilled the selected technologies are adjusted and a new calculation is made. This procedure is continued until the technologies found fulfil the demands. Thereafter it is estimated if there are technologies which can fulfil the demands with fewer costs. If this is the case new calculations are made until the cheapest possible solution is found.

To make these analyses a number of specific tools have been developed within the project:

- a catalogue comprising the technologies available to cover the energy demands.
- environmental priority lists comprising key parameters showing the effectiveness of changing from one technology to another to fulfil the given goals.
- a computer based scenario calculationmodel, which from a given energy demand and selected technologies estimates the consequences for energy, environment and economy.

In the following these tools are briefly described.

5.2 The Technology Catalogue.

In the catalogue is given the following information for each technology:

- Efficiency factor (for consumption technologies: energy consumption in relation to the produced energy demand).
- Load duration factor
- Life span
- Investment converted into annual costs
- Operation and maintenance costs
- Fuel costs
- Cost key parametres, defined as costs per produced/saved amount of energy for the given technology

The technologies of the catalogue are divided into four main groups:

- energy consumption technologies at end use level
- conversion and distribution technologies
- fuels and
- purification technologies.

Each main group is divided into a number of subgroups. As an example, the consumption technologies are divided into the following groups:

- consumption of space heat and domestic hot water
- electricity consumption
- consumption of energy for process purposes
- consumption of energy for transport

The catalogue comprises approximately 140 technologies.

Further, the technologies are classified after the technological level compared to the basic year 1987:

- Average Used Technology 1987,   AUT 1987
- Average Sold Technology 1987,   AST 1987
- Best Available Technology 1987,   BAT 1987
- Efficiency Advanced Technology,   EAT 1987

AUT 1987 is the level that detemines the energy status and the environmental status in the basic year.

AST 1987 determines the improvement which will be reached if no changes occur in the present energy and environmental policy.

BAT 1987 states the level which is certain to be obtainable in the future. The costs are outlined, as the products are already in the market.

ETA 1987 is an expression for the technology level, which is obtainable for new products within the nest 10 years. The technologies are based on well-known technologial science and to a certain extent om components available today. The technologies are not priced, but in some cases it is possible to make rough economical estimations.

Each technology is handled on a data sheet. By using the same framework for all technologies it is possible to compare e.g. energy efficiencies and environmental consequences. Each data sheet is concluded with a cost key parameter for selected operational situations, which makes it possible to make a rough economic comparison of different technologies and changes in technologies. The cost key parameter is independent of the reference in which the technology appears.

The costs are measured as the market price excluding duties and subsidies.

Fig. 6 shows as an example a datasheet for a refrigerator.

5.3 Environmental priority lists.

The catalogue can not give direct answer to which technologies will be the most effective to fulfil a certain goal. First of all such information require a well defined reference system and secondly a definition of what is best in the given situation. To select the technologies for the scenarios some environmental priority lists are outlined, defining the changes in the energy system.

Lists for the following objectives have been made in accordance with the four types of emissions structuring the scenarios:

- Reduction of carbon dioxide emissions as cheaply as possible
- Reduction of sulphur dioxide emissions as cheaply as possible
- Reduction of nitrogen oxide emissions as cheaply as possible
- Reduction of cadmium emissions as cheaply as possible

5.4 The Scenario Model

The scenario model has two purposes:

- to organize technological data for the supply and demand structure during the analyses of the scenarios.

- to carry out a number of iterations in order to reach the defined goals for environmental quality and development of energy services.

The model is constructed for use on a PC in the computer languages SYMPHONY (speadsheet) and IFPS (Interactive Financial Planning System).

The scenario model comprises two parts:

- Building and Net Heat Demand Model
- Consequence Analysis Model

With the Building and Net Heat Demand Model it is possible to calculate the net energy used for space heating and domestic hot water consumption. The model uses data from the Danish Energy Atlas, which o.a. contains precise data on building areas divided into different building categories and heating installations. Furthermore, the model is able to calculate energy conservation and investments related to energy conservation in the buildings.

The Consequence Analyses Model calculates the following items related to a scenario:

- the amount of gross energy divided amongst the energy sources
- the emissions of sulphur dioxide, nitrogen oxides,carbon dioxide, dust particles, polycyclic aromatic hydrocarbons and dioxines
- the total costs
- the imports
- the employment effect.

The calculation is separated in consumption categories.

First the total fuel consumption (incl. wind and solar energy) and the total need for electricity and district heating is calculated for each consumption category separately. Then the above mentioned emissions, costs etc.are calculated.

Next, the total fuel consumption (incl. wind and solar energy) for production of electricity and district heating is calculated.

When the last calculations are made the results are summarized and a total outline of the consequences of the calculated scenario is presented.

6. THE SCENARIOS.

6.1 Objectives.

A scenario is defined as a combination of energy consumption technologies and energy supply systems (based om specific energy sources), which in combination fulfil a given demand for energy services. Furthermore, a number of assumptions concerning fuel prices, discount rate etc. are parts of the scenario.

In the project three scenarios are outlined:

- a reference scenario
- a global environmental scenario
- a local environmental scenario

The scenarios within this project show future energy systems for on single year, the year 2010. The scenarios do not show methods for reaching the outlined energy and environmental systems in 2010.

The reference scenario gives an impression of the consequences of continuing the present development in technology as well as in energy and environmental policy. The total emissions in the reference scenario thus express a continuation of the present development.

For the reference scenario no demand concerning emission reduction has been outlined.

In the global environmental scenario the CO_2 emission defines the structure of the scenatio, as CO_2 is one of the most important green-house gases, which probably will cause world-wide changes in the climate in the future. The scenario is based on the recommendations from the UN report "Our common future", the Brundtland report.

The global environmental scenario must fulfil the demand of an 50% reduction ofthe CO_2-emission from the energy system in the year 2010 compared to the 1987-level.

Based on the estimated CO_2-emission in 1987 the demand for the scenario will be a CO_2-emission on maximum 253.000 tons in 2010.

The environmental critial loads in <u>the local environmental scenario</u> are based on the present environmental status on Bornholm. The local environmental scenario cencentrates on pollutants having mainly local consequences.

The emissions of SO_2, NO_x and the heavy metal Cd are used to construct the local environmental scenario, while the emissions of other pollutants are described only as a consequence of the scenario.

The biggest part of the deposition on Bornholm is caused by emissions outside Bornholm. Therefore, even a 100% reduction of the emissions from Bornholm will have very little influence on the environmental improvements. However, if the society on Bornholm and all other areas causing the pollution were to reduce the emissions by the mentioned percent, it is etsimated that the reduction in deposition would be sufficient.

Based on this conclusion it has been decided:

that the local environmental scenario must fulfil the following demands for reductions in the emissions from the energy system in the year 2010 compared to 1987:

- **SO_2 reduction of 70%**
- **NO_x reduction of 70%**
- **Cd reduction of 50%**

6.2 The Economic Assumptions.

Consequence analyses for all three scenarios have been based on the scenatio model described in Chapter 5. All calculated energy consumptions, emissions, costs and employment are annual values.

The calculation is in fixed terms. The price level for the annual costs is that of 1989. The costs comprise costs for fuel consumption. For the conversion and production technologies (i.e. heat installations in buildings and technologies used for production and distribution of heat and power) costs for implementation and running of the energy plants are also included. The discount rate used for converting capital costs into annual costs is 7%.

The other categories do not have the implementation and running costs included in the reference, but by setting up the environmental scenarios **additional** costs for implementation and running compared to the refence are included.

The costs are exclusive of duties and subsidies. The fuel prices for 2010 has been based on the forecasts from the Danish Ministry of Energy, which implies a heavy increase of the prices on fossile fuels.

The estimated costs give an idea of the size of the economic consequences for each scenario, but not precise information of the economy, as many of the prices included in the calculations are uncertain. This counts especially for the fuel prices and the costs of new energy technologies still being developed. Examples of such technologies include straw gasification plants and photovoltaic power plants.

Futhermore, the difficulties of getting detailed information of transport energy and process energy subjects should be mentioned. The reason for the difficulties is that contrary to heat and power supply matters, no planning tradition has been established concerning transport energy and process energy.

6.3 The Refence Scenario.

The Reference Scenario is an expression of a continuation of the present development.

It is presumed that smaller improvements of the energytechnologies used to generate the energy services will be made. It is also assumed that the net heat demand for existing buildings will remain unchanged as the improvements are compensated by depreciations of the buildings.

Futhermore, a few changes of the supply systems for the period 1987-2010 are assumed. Among these are district-heating plants in the 2 mayor cities, one is established in 1989, and the other is being build at the moment.

Futhermore 200 buildings with oil burners are assumed to get solar plants, and new wind turbines (250-500 kW) with a total output of 8 MW are assumed to be established.

The consequences of the Reference Scenario are shown on Fig. 7.

The gross energy consumption will increase with 12% compared to 1987. Fossil fuels will cover 90% and renewable energy 10% of the total consumption.

The total annual costs of the energy supply on Bornholm will increase by 55% compared to 1987. This large increase is due to the expected increase in fuel prices until 2010.

The environmental goals are far from fulfilled in the Reference Scenario, as the emission of nitrogen oxides is only decreasing by 40%, the emissions of sulphur dioxide and carbon dioxide are almost unchanged and the emission of cadmium is increasing by more than 80%.

6.4 The Global Environmental Scenario.

The Global Environmental Scenario is based on the environmental priority list for reduction of carbon dioxide. The cheapest ways of reducing the carbon dioxide emissions are:

- electricity savings and savings of process energy
- increasing use of renewable energy
- combined heat and power production.

The amount of renewable energy sources on Bornholm sets the upper limit for the energy consumption covered by renewable energy. The amount of new combined heat end power plants is limited due to the fact that it is only technologically and economically realistic to establish combined production in larger towns.

The scenario is outlined so that the total annual costs of the energy system are minimized. Maximum savings and use of the most efficient technologies are implemented for all energy services in the categories lighting/appliances, industrial purposes and transport.

It is assumed, that biogas and combined heat and power production are established on two existing district heating plants.

In Rønne the coal-fired cogeneration plant is assumed to be replaced by a straw and wood gasification plant with a gas engine for combined heat and power production.

Two new district heating plants based on straw gasification and combined heat and power production are established in other towns.

In some of the towns with district heating moderate heat savings are made, whilst in others heavy heat savings are implemented. The choice of types of district heating plants and the extent of the heat savings are adjusted in order to utilize the resources of wood, straw, waste and biogas 100%.

Finally, photovoltaic power plants with a total power of22 MW are assumed to be established. With an efficiency of 15%, the plants will have to cover an area of 150.000 m².

Since the realistic wind resource is fully used in the Reference scenario, no more wind turbines are assumed to be built in this scenario.

The total electricity production in the Global Sccnario consists of:

- 11% produced by wind turbines
- 16% produced by photovoltage
- 37% produced by cogeneration plants
- 36% produced by power plants on Zealand.

By using heat accumulators at the cogeneration plants, by exchanging electricity with Sweden and Norway (where it is easier to adjust the production of the hydro power plants) it is expected that the problems with "time-tied" electricity production can be solved totally.

In figure 7 the development in energy consumption in the Global Environmental Scenario is outlined. Compared to the Reference Scenario the total energy consumption decreases by over 30% and the net energy consumption decreases by 25%.
The share of renewable energy increases to approximately 30% of the total consumption.

In the Global Scenario all renewable energy resources are fully used (waste included), except solar energy and wood. The solar energy is only used up to 25%, and the wood is used up to 75%.

Th CO_2-emission goal (on 253.000 tonnes/year) has been fulfilled. Compared to the Reference Scenario the emissions of all pollutants are reduced - except for PAH and Cd - by approximately 50%. For PAH and Cd the reduction will be 30-35%.

The total costs/year are increasing by 10% compared to the Reference Scenario. This increase covers a large increase in costs for energy savings and improved efficiencies for the consumer categories (30%) and a smaller decrease in the costs for electricity and heat procuction (15%).

6.5 The Local Environmental Scenario

In the Local Environmental Scenario emissions of three different pollutants should be reduced at the same time.

Emissions of cadmium are most cheaply reduced by the same type of arrangements as emissions of carbon dioxide, which means:

- Electricity savings and savings of process energy
- Increasing use of renewable energy (not including waste)
- Combined electricity and heat production

Emissions of sulphur dioxide and nitrogen oxides are reduced most cheaply by:

- Electricity savings and savings of process energy
- Purification technologies, desulphurization of gas and low-NO_2-burning.

Therefore the Local Environmental Scenario has been built up by improving the Global Scenario.

The calculations of the scenario show that it is possible to fulfil the environmental goals, except for the reduction of cadmium, due to the etablishing of a refuse disposal plant, which is being built at the moment.The best methods to reduce the cadmium-emission from the waste plant would be by increased sorting and re-using the waste and by reducing the amount of cadmium used in the industrial products ending up as waste. If the cadmium-emission through these arrangements can be reduced to e.g. 10%, the total cadmium-emission would be in accordance with the emission goal.

Besides the arrangements implemented in the Global Environmental Scenario the following has been accomplished:

- For 50% of the individual heated buildings moderate heat savings are implemented, and for the rest of the buildings maximum heat savings are implemented. For all buildings with electric heating the maximum heat savings are maintained.

- A desulphurization plant is established on the cogeneration plant in Rønne.

- On two smaller cogeneration plants gas purification plants are established reducing the sulphur content of the straw gas to 0%.

- On relevant power plants in Zealand desulphurization and low-NO_x-burning are increased.

Figure 7 shows the development in the energy consumption in the Local Environmental Scenario compared to the Status, the Reference and to the Global Scenario. The gross energy consumption will drop a few percent compared to the Global Scenario and the share of renewable energy will increase to 33%.

The renewable energy resources are used in the same way as in the Global Scenario.

The emissions of SO_2 and NO_x will be reduced so that the goals are fulfilled.For the other pollutants the emissions are reduced a little compared to the Global Scenario.

The total costs increase by 20% compared to the Reference Scenario. Almost the total increase in costs is due to the increasing heat saving efforts, as the SO_2 and NO_x purification arrangements are rather cheap.

8. ACTION PLANS

8.1 Action Plans

The scenarios outlined illustrate different possible situations for the energy situation on Bornholm in the year 2010, showing that a great effort in the energy sector is needed to secure a sustainable environmental development in the future.

The goals for the future development must stay close to the goals set up for the Local Environmental Scenatio, in order that both the global goals concerning reduction of the greenhouse effect and the local goals fulfilling the critical loads for deposition of sulphur and nitrogen are met.

Bornholm is chosen as the "demonstration area" for this project. Hovwever, it does not mean that only Bornholm has to make changes in the energy sector to improve the environmental situation on the island. As mentioned before only a small amount of the pollutants come from Bornholm itself. Most pollutants are imported from surrounding areas, while Bornholm is exporting most of its own airpollution.

Therefore, a need for a national as well as an international effort is urgent.

In the spring of 1990 the Danish Government put forward a National Action Plan "ENERGY 2000" comprising a)goals for a reduction of CO_2, SO_2 and NO_x emissions from the energy sector, and b) an action programme which the Danish government intends to carry through. The goals are not as far reaching as in this project, but the action programme comprises those tools that will make it realistic to obtain an environmental sustainable energy supply in the near future, and thus also to reach most of the goals outlined in this project.

Action Programme in the Danish Government Plan ENERGY 2000.

The action programme comprises initiatives within four areas:

- energy consumption savings
- reorganizations and increased effectiveness of the heat supply systems, e.g. by increasing the production of combined heat and power
- increased use of cleaner energy sources, and
- research and development.

The savings in energy consumption are focused in particular on electricity savings and savings in industrial energy consumption. However, heat savings must also be made. The savings must be made by private consumers as well as in the private service sector, in the public sector and in the production fields.

The savings must for example be made through:

- a high price level for energy, including energy duties
- standards and labelling, e.g. strengthening of the building regulations and standards for electric appliances
- better consultancy services
- financing arrangements
- propagation of energy management
- "The State is in the Front"-campaigns
- information and education.

The coordination of the energy tasks could be increased by forming a regional "Energy Supply Company Bornholm", which could for example carry out the following tasks:

- combined heat and power production
- district heat supply
- electricity supply
- possible distribution of local fuels
- implementation of campaigns
- consulting services and financial arrangements

Establishment of an energy supply company could secure the best possible coordination in the conversion process, not only concerning the efforts within the common heat and electricity supply, but also concerning the motivation of, and the assistance to, the private consumers.

8.2 Summary of project experiences

During this project a number of concrete results regarding energy and environmental apects on Bornholm have been outlined. Besides this, some tools have been established which can be used generally in connection with combined energy and environmental tasks. Furthermore, a great deal of general experience combining the two different fields of energy and environment has been gained.

Is has been possible to outline scenarios which fulfil the environmental demands on Bornholm with little extra costs.

Through the project work two general tools for use in combined energy and environmental planning have been developed; the Technology Catalogue and the Scenario Calculation Model.

The Technology Catalogue has formed the basis for elaboration of the scenarios and has been a very valuable tool. Since the information in the Technology Catalogue is general, it can be used in similar projects. As propositions for further development the following can be mentioned:

- data for more technologies
- data concerning the energy and environmental aspects of construction and disposal of the technologies.

It is essential that the Catalogue can be updated regularly.

The Technology catalogue is the basis for the outlining of the environmental priority lists, which have been valuable tools for outlining the scenarios. The lists have given an overview of the possibilities for reduction of the emissions.

Based on the Scenario Calculation Model the consequences of the scenarios have been carried out. The model has been very useful in the project. Like the Technology Catalogue, the Scenario Calculation Model will be useful in similar project.

By adding a menu system to the model it would be easier to use.

The work with combined energy and environmental problems has been very profitable, establishing a comprehensive view of the relationship between energy and environment. Furthermore, it has been profitable that the total energy system (rather than one element e.g. the heating supply) has been involved, as some major pollution sources might otherwise have been over-looked.

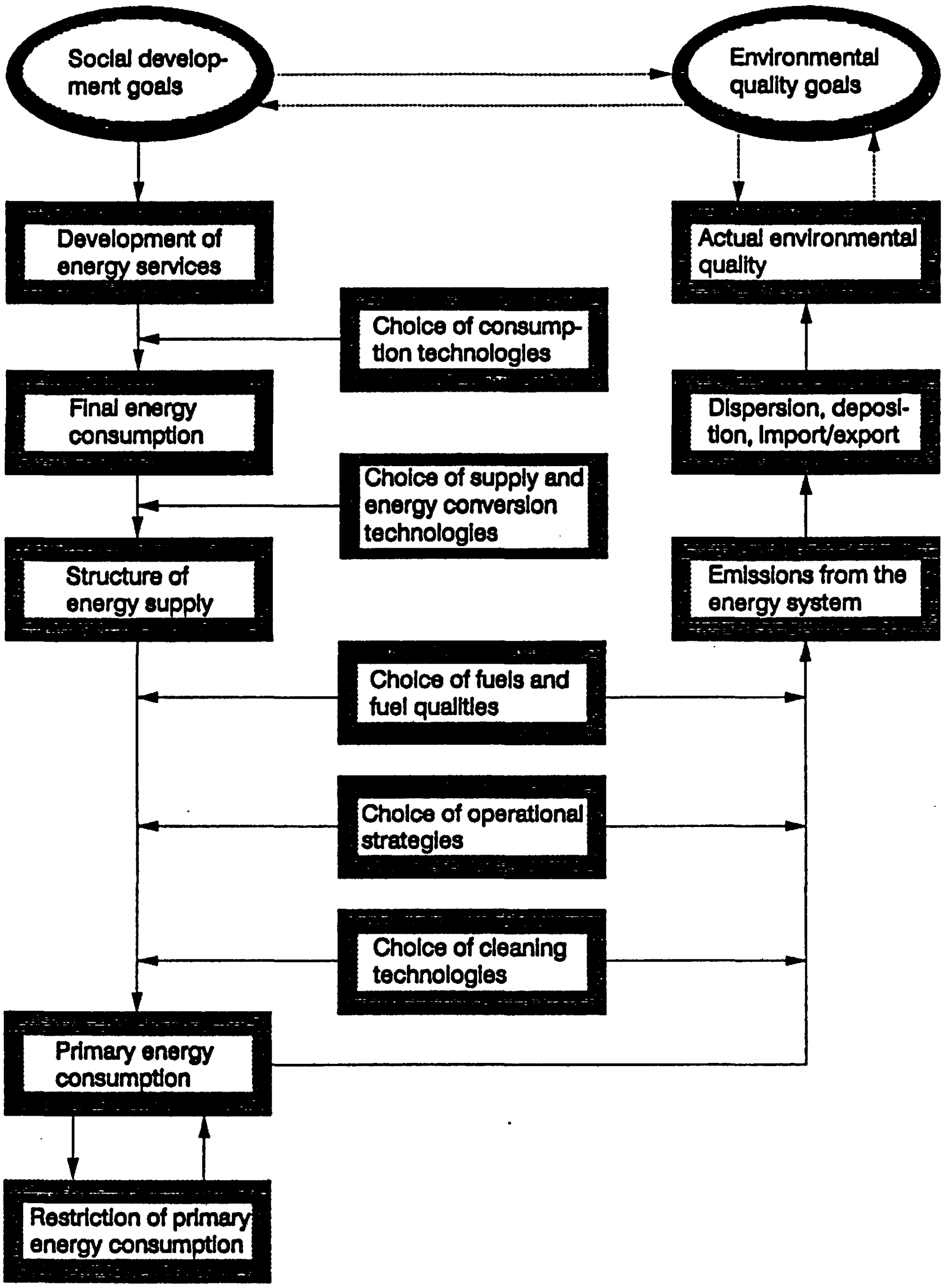

Fig.1-Methodolgy for analysis.

SECTOR	ENERGY SERVICE	ENERGY SERVICE DEVELOPMENT stated with selected indicators 1987	2010	INDEX 2010/1987
Space heating and domestic hot water	Heated area:	3,700,000 m²	4,000,000 m²	1.08
Electric appliances and lighting in households	Refrigerator:	14,000 pc	12,600 pc	0.90
	Freezer:	13,400 pc	16,200 pc	1.21
	Combifreezer:	7,600 pc	9,500 pc	1.25
	Washers:	14,000 pc	16,200 pc	1.15
	Electric cookers:	16,800 pc	17,700 pc	1.05
	Dishwashers:	5,300 pc	10,400 pc	1.96
	Lamps:	284,500 pc	357,900 pc	1.25
	Other appliances:	2,560,000 m² hous.ar.	2,730,000 m² hous.ar.	1.07
Electric appliances and lighting in private industry/service	Ventilation:[1]	546,000 m² build.ar.	634,000 m² build.ar.	1.16
	Cool/freeze:[1]	546,000 m² build.ar.	634,000 m² build.ar.	1.16
	Lightning:[1]	546,000 m² build.ar.	634,000 m² build.ar.	1.16
	Other appliances:[1]	546,000 m² build.ar.	634,000 m² build.ar.	1.16
Electric appliances and lighting in public industry/service	Ventilation:[1]	319,000 m² build.ar.	377,000 m² build.ar.	1.18
	Office appliances[1]	319,000 m² build.ar.	377,000 m² build.ar.	1.18
	Pumping:[1]	319,000 m² build.ar.	377,000 m² build.ar.	1.18
	Lighting:[1]	319,000 m² build.ar.	377,000 m² build.ar.	1.18
	Other appliances:[1]	319,000 m² build.ar.	377,000 m² build.ar.	1.18
Transport of persons	Transport:			
	by car:	406 mill. person-km	569 mill. person-km	1.40
	by routebus:	44 mill. person-km	62 mill. person-km	1.40
	by touristbus:	20 mill. person-km	28 mill. person-km	1.40
	by cycle/walk:	35 mill. person-km	50 mill. person-km	1.40
Transport of goods	Transport by truck:	36 mill. ton-km	55 mill. ton-km	1.55
Industrial purposes	All energy services within:[1]			
	- Food, bev., tob.	222 mill.DKK prod.val.	316 mill.DKK prod. val.	1.42
	- Wood & furniture	17 mill.DKK prod.val.	24 mill.DKK prod. val.	1.36
	- Metal industry	34 mill.DKK prod.val.	51 mill.DKK prod. val.	1.51
	- Agric. & nursery	439 mill.DKK prod.val.	650 mill.DKK prod. val.	1.48
	- Other industries	476 mill.DKK prod.val.	677 mill.DKK prod. val.	1.42

[1] Some energy services are not made up as an amount of services. An amount of units which is related to the energy service (e.g. square metres) is used to express the quantity of the service.

Fig.2-Delopment in the energy services.

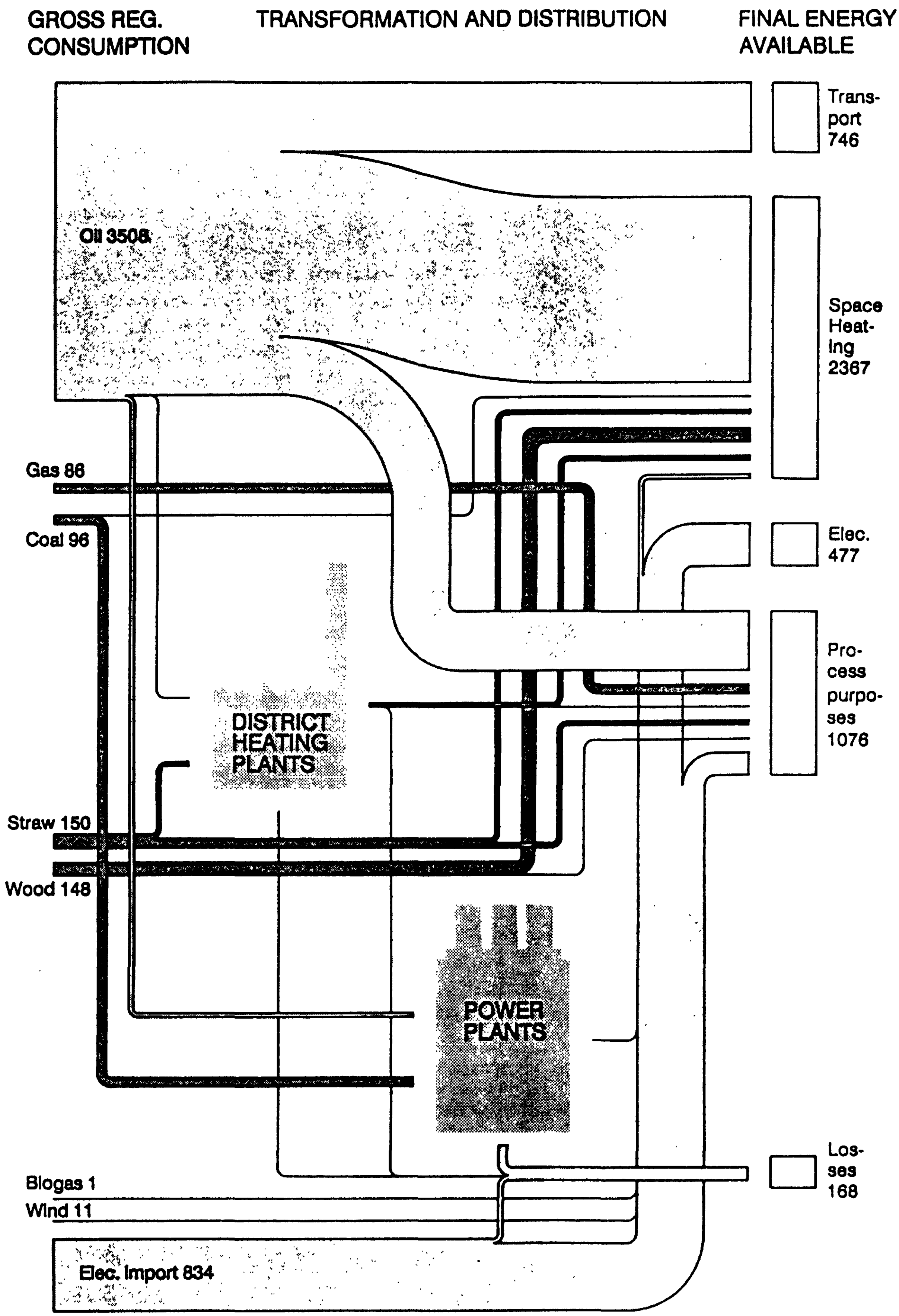

Fig.3-Energy flow for status 1987, figures in TJ/year.

Fuel	Fuel consumption TJ	Emissions SO_2 tons	NO_x tons	CO_2 1000 tons	PAH kg	Part tons	Cd kg
Petrol	618	0	478	44	100	0	1
Gas oil/diesel oil	2397	336	190	177	100	2	5
Fuel oil	493	364	76	36	0	28	1
Gas	86	0	9	6	0	0	0
Coal	96	71	19	10	0	13	0
Straw	150	20	15	0	200	61	0
Wood	148	19	12	0	7000	75	0
Electr. (import)	834	0	0	0	0	0	0
Electr. (wind etc)	12	0	0	0	0	0	0
Total	4834	810	799	273	7400	179	7

Fig. 4 - Emissions from Bornholm in 1987

	Emission from Bornholm	Total deposition on Bornholm	Deposition originated from Bornholm
SO_2-S	405	1040	20
NO_x-N	240	390	7
NH_x-N	1450	530	120
Cadmium	0,007	0,25	0,001

Fig. 5 - Emission and deposition of sulphur, nitrogen and cadmium on Bornholm in tons S, N and Cd per year, 1987. (Note, that the emissions of sulphur and nitrogen in table 4 are given as tons SO_2 and tons NO_x.)

MAINGROUP : 1. Consumption technologies at end use
SUBGROUP : 1.2 Electricity consumption for appliances in the domestic sector

TECHNOLOGY : Refrigerator

SHORT DESCRIPTION:

		TECHNOLOGY LEVEL *)			
		AUT 87	AST 87	BAT 87	EAT 87
ENERGY/TECHNOLOGY:					
Size	(litre)	175	175	196	175
Lifetime	(years)	16	16	16	16
Intensity index		100	77	29	17
Installed capacity	(W)	80	80	80	80
Utilization hours, compressor	(hours/year)	3750	2875	1100	625
Load factor, 4.00pm - 6.00pm		1,00	1,00	1,00	1,00
Comsumption per appliance	(kWh/year)	300	230	88	50
ECONOMY:					
Investment per appliances	(kr)	-	3570,00	3930,00	
- annual	(kr/year)		377,91	416,02	
Extra investment - annual	(kr/year)		,00	38,11	
Key figure AST => BAT	(kr/kWh)		-	,27	

REFERENCERS:

1. TR240, DEFU
2. NESA-Database
3. "Low electricity appliances"
4. TR233, DEFU
5. "OMNIBUS"

NOTES:

*) AUT 87 - Average Used Technology, 1987
AST 87 - Average Sold Technology, 1987
BAT 87 - Best Sold Technology, 1987
EAT 87 - Efficiency Advanced Technology, 1987

Fig.6

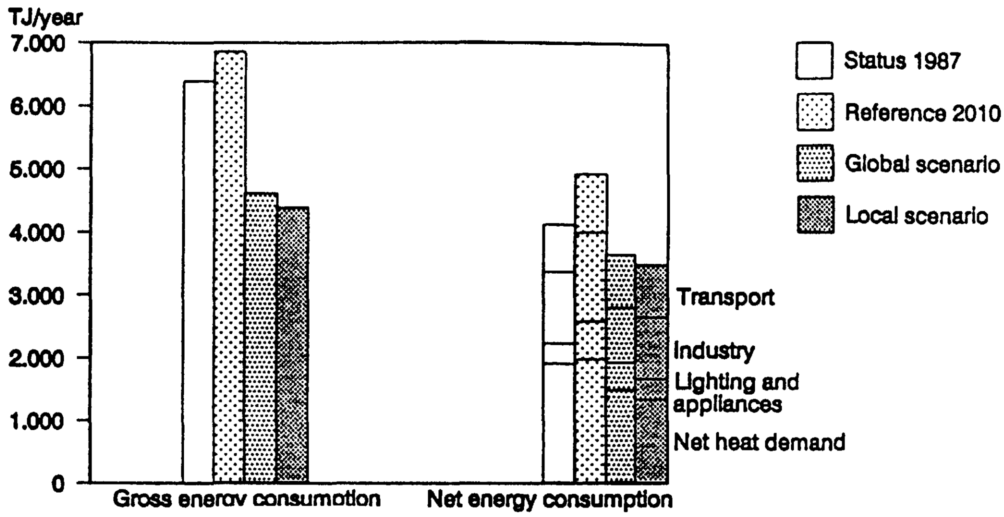

Fig.7-Energy consumption.

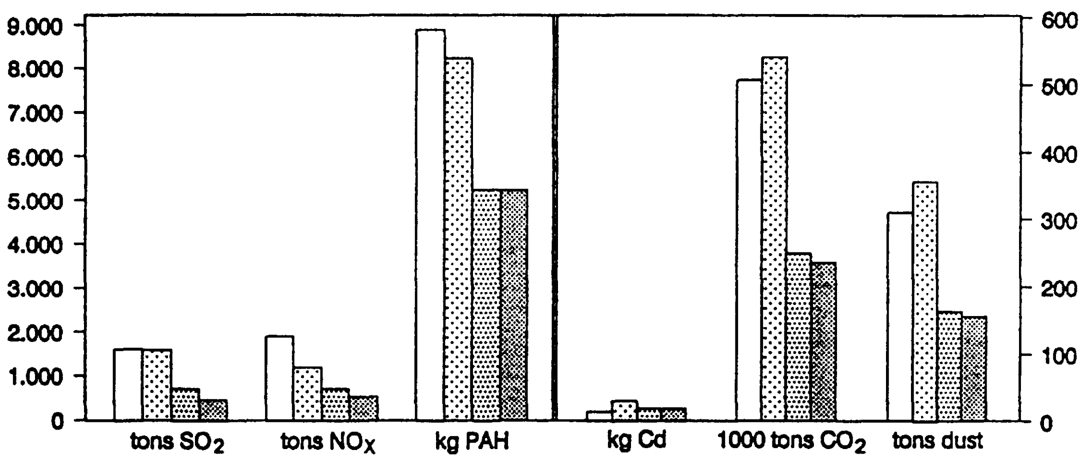

Fig.7,2-Emissions.

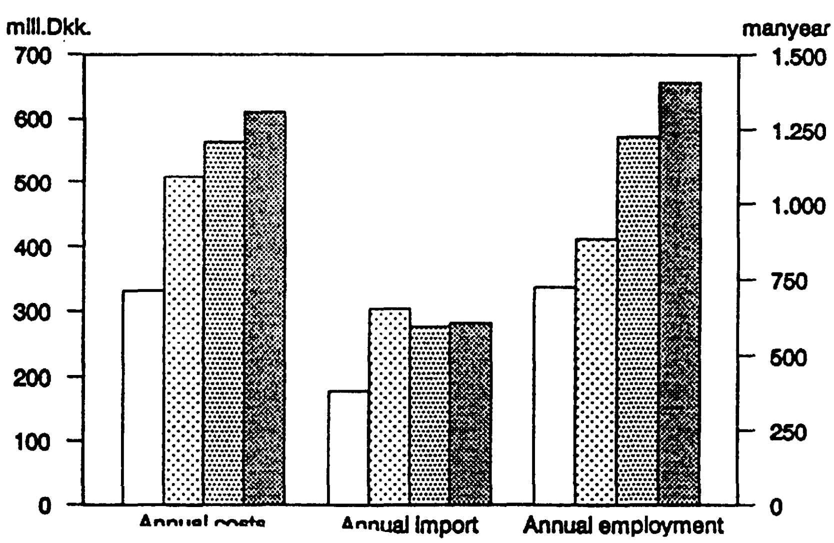

Fig.7,3-Total costs, import and employment.

INTEGRATED ENERGY AND ENVIRONMENTAL PLANNING FOR BORNHOLM.

The project is financed by EC (DG XVII), The Danish Ministry of Energy, The Danish Energy Agency and The County of Bornholm.

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Technical Department

8-52-60-3/90
6.11.1990 jj/kh109-6c
jj/kh000065

BORNHOLM. GENERAL INFORMATION

The island of Bornholm is situated in the Baltic Sea approx. 180 km south-east of Copenhagen.

The total area of Bornholm is 588 km². The maximum altitude is 165 m.

Average day temperature in january is - 0,1°C and in july + 16,6°C. The wind is mostly W-SW, often rather strong. In average the sun shines 1.800 hours per year (almost 10% more than the rest of Denmark).

The population amounts to 46.000 (1990). The population density is 80 persons/km², compared to 120 persons/km² in Denmark as a whole. Over the last 10 years the population has decreased by 1300 inhabitants.

The largest city is Rønne with 14.400 inhabitants. Other mayor towns are Nexø (3.700), Aakirkeby (2.200), Allinge-Sandvig (2.000) and Hasle (1.800).

Bornholm is one of Denmarks 14 counties. The County-Counsil as well as the 5 Municipalcounsils on the island are elected directly for a 4 years period.

Land-use in 1988 was:

- Agriculture 70%
- Forests/nature 22%
- Towns, roads etc. 8%

Housebuilding activities have for the last 10 years averaged 210 houses/year. Average size of households was approx. 2,4 persons in 1987.

The main industries on Bornholm are

- Fishery
- Agriculture
- Tourism.

The structure of these industries are changing rapidly.

The <u>fishery</u> and related industries have expanded strongly on Bornholm during the 1970's and in the beginning of the 1980's, but restrictions in the Baltic Sea have reduced landings considerably during the last few years. The reduction in landings has (and will have) a negative effect on the fishprocessing industry and the connected service enterprises. As a counteraction to this, landings of catches from foreign vessels are attracted.

In 1989 the landings on Bornholm were 91.500 tons, mostly cod, herring and salmon.

Machinery and installations of the enterprises handling the fish are up to date. Employment here is approx. 1.000 persons (1989).

Agriculture had a rather steady economical development during the 1970's. A stagnation was noted in the 1980's, because of the general price trend in the agriculture sector in the EC. In 1989 there were 1200 farms on Bornholm, with an average size of 31 hectars. The number of farms is declining rapidly, and thus the average size is increasing. There is an outspoken specialisation in corn, pigs or cattle. No new areas are available for cultivation.

Tourism on Bornholm expanded in the 1970's, but in the early 1980's this industry also stagnated. During the last few years there has been a new expansion, and in 1990 nearly 400.000 tourists visited Bornholm, mainly danes, swedes and germans.

The public sector (schools, social security, hospitals, environmental protection, administration a.s.o.) has gone through a remarkable expansion during the 1960's and the 1970's. In the 1980's there has been a reduction, due to the general decline in the danish economy.

ENERGY ON BORNHOLM

The energy-balance for 1987 for Bornholm is shown in figure 1.

The energy consumption in 1987 was 4.834 TJ comprising 2.367 TJ for heating, 477 TJ for electric appliances and lighting, 1.076 TJ for processing and 746 for transport; loss in production and distribution of electricity and district heating was 168 TJ.

Heating.

Most of the buildings on Bornholm have individual spaceheating based on imported oil. Since 1986 4 district heating systems have been established. One (in Rønne) is based on coal and oil, the others are based on surplus-straw as the primary fuel and oil for peak load and reserve consumption.

The total net demand for heating in 1987 was 1824 TJ. Fig. 2 ilustrates the distribution of heating demand on types of buildings and types of fuels respectively, and it appears that one-family houses and individual oilburners are the dominating categories.

Lighting and tools in the households and in the service sector are based on electricity.

Distribution of electricity consumption for lighting and appliances in households, public service and private service is illustrated in fig. 3.

The process energy consumption is assessed for selected branches. The calculation is based on the present sale of electricity from Østkraft (the electricity company on Bornholm) with specific data from larger industries.

Fig. 4 illustrates the distribution of process energy consumption, divided into branches and types of energy/fuels respectively. It appears that oil and electricity form respectively approx. 60% and 25% of the total energy demand. It also appears that agriculture, gardening and others (i.e. all small industries and quarries) are the biggest energy consumers. These branches cover approx. 80% of the oil consumption and approx. 35% of the electricity consumption.

The energy consumption for transport is 746 TJ, where petrol amounts to 83% and diesel to 17%.

The electricity supply on Bornholm is mostly based on import from Elkraft (the electricity company on Zealand), through the swedish electricity-network.

In 1987 the electricity import to Bornholm was 97 % out of the total electricity consumption on the island of 859 TJ. The remaining electricity demand (25 TJ) was, except from 1 TJ being produced from biogas, partly covered by power production on Østkraft's coal fired power plant in Rønne (13 TJ) and partly by electricity from 30 wind turbines (11 TJ).

Local energy resources.

As part of the analysis of the energy systems, the availability of renewable energy om Bornholm has been evaluated. Table 5 shows the amounts of renewable energy, which are immediate available for energy purposes. Including waste, the amounts of renewable energy amount to 1.600-2.200 TJ, which is about 35-45% of the gross energy demand in 1987.

Prices on energy in Denmark.

Energyprices per 1.11.1990 in Denmark are shown in table 6. The price for electricity varies from region to region; the price given is for Bornholm.

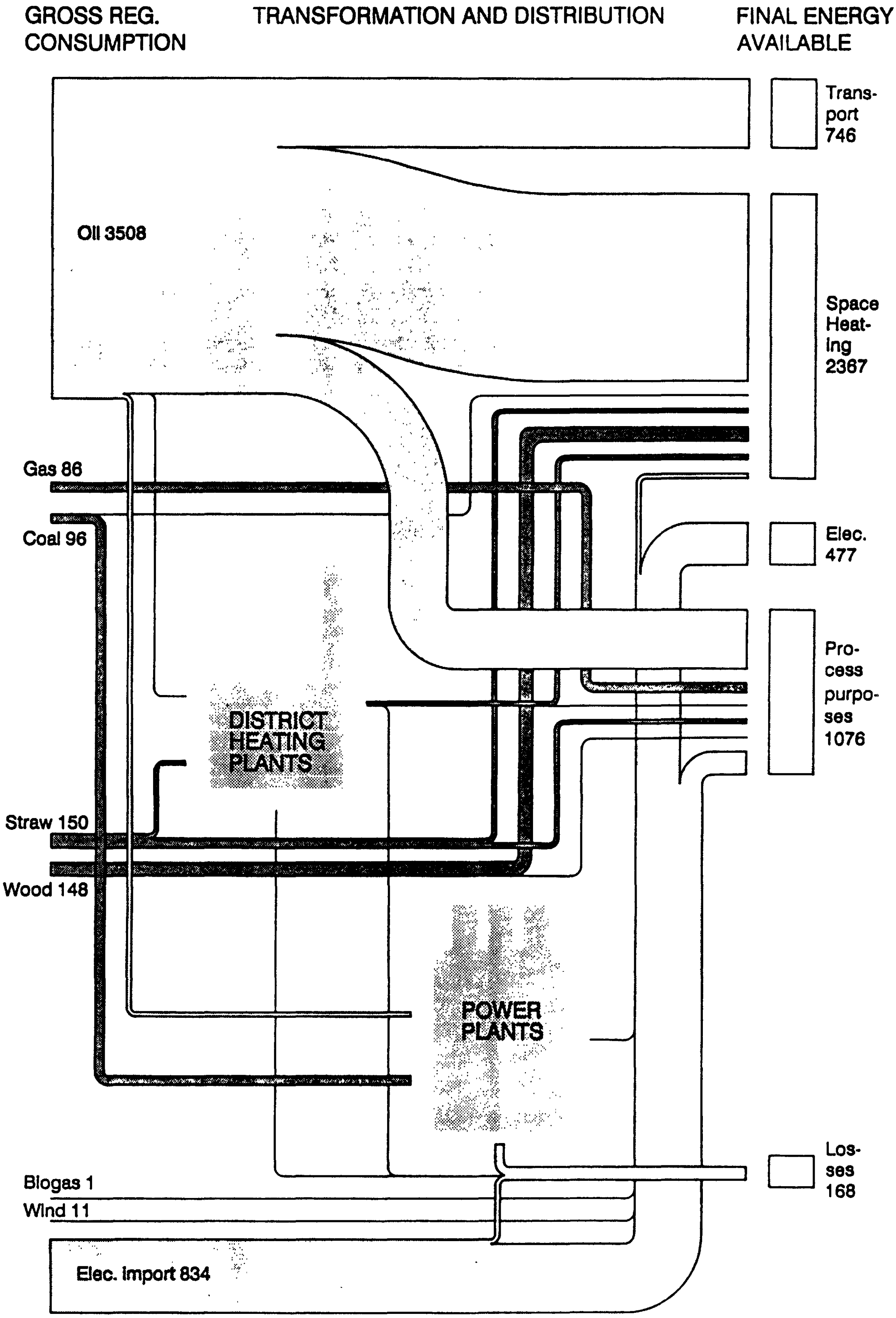


Fig. 1 Energy flow for Status 1987, figures in TJ/year

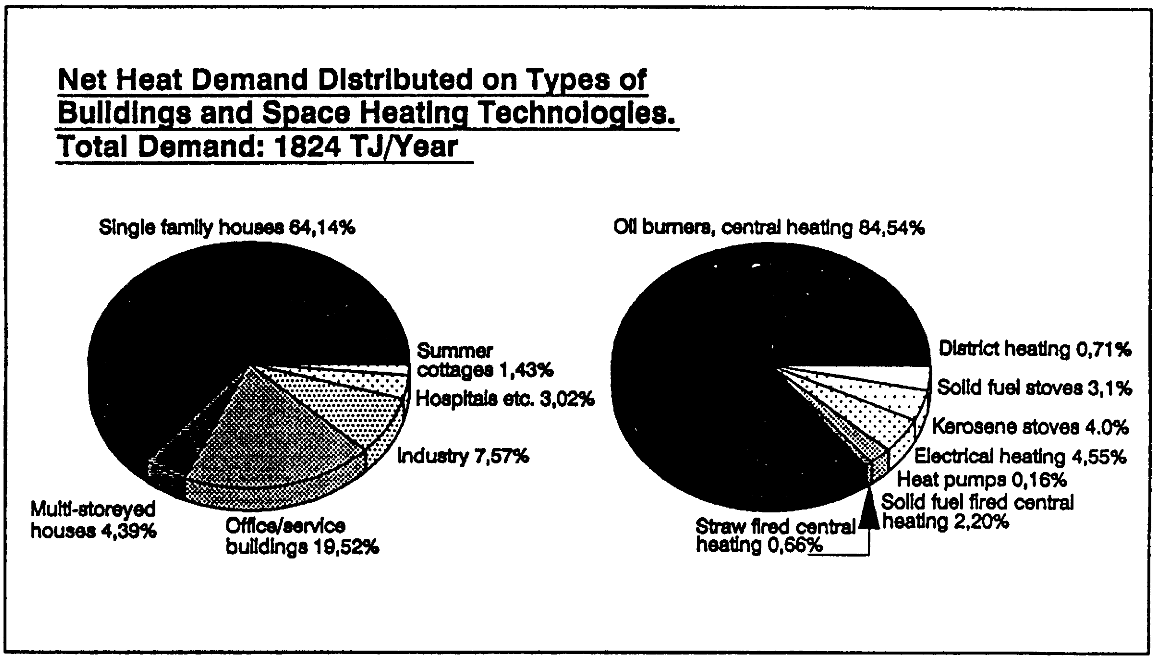

Net Heat Demand Distributed on Types of
Buildings and Space Heating Technologies.
Total Demand: 1824 TJ/Year
Single family houses 64,14%
Summer cottages 1,43%
Hospitals etc. 3,02%
Industry 7,57%
Multi-storeyed houses 4,39%
Office/service buildings 19,52%
Oil burners, central heating 84,54%
District heating 0,71%
Solid fuel stoves 3,1%
Kerosene stoves 4.0%
Electrical heating 4,55%
Heat pumps 0,16%
Solid fuel fired central heating 2,20%
Straw fired central heating 0,66%

Fig. 2

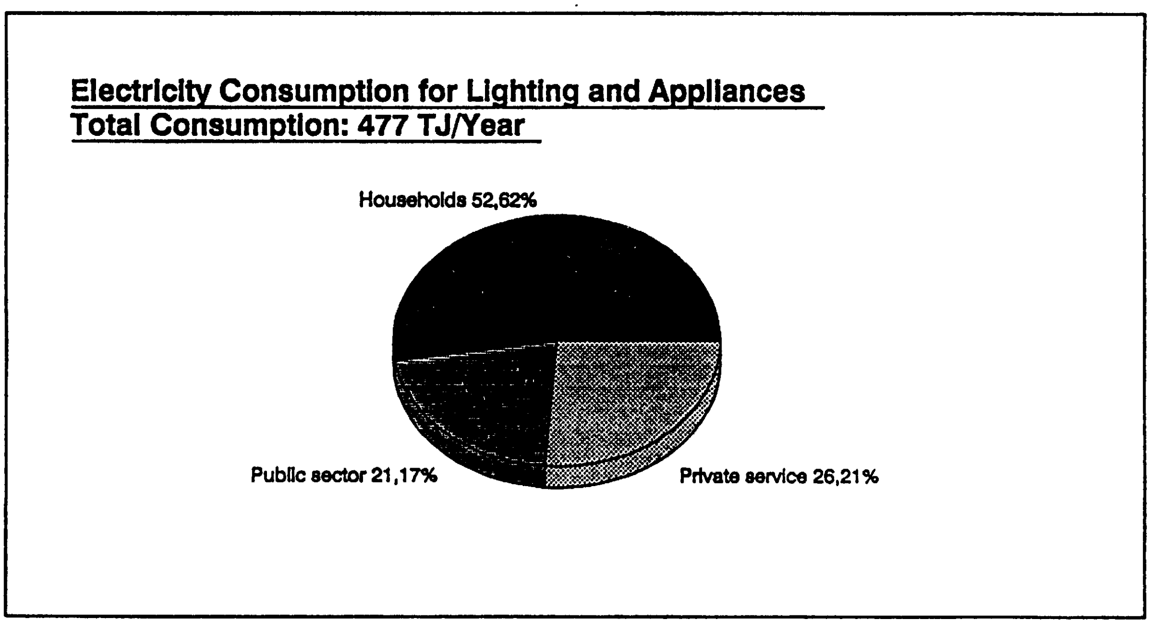

Electricity Consumption for Lighting and Appliances
Total Consumption: 477 TJ/Year
Households 52,62%
Public sector 21,17%
Private service 26,21%

Fig. 3

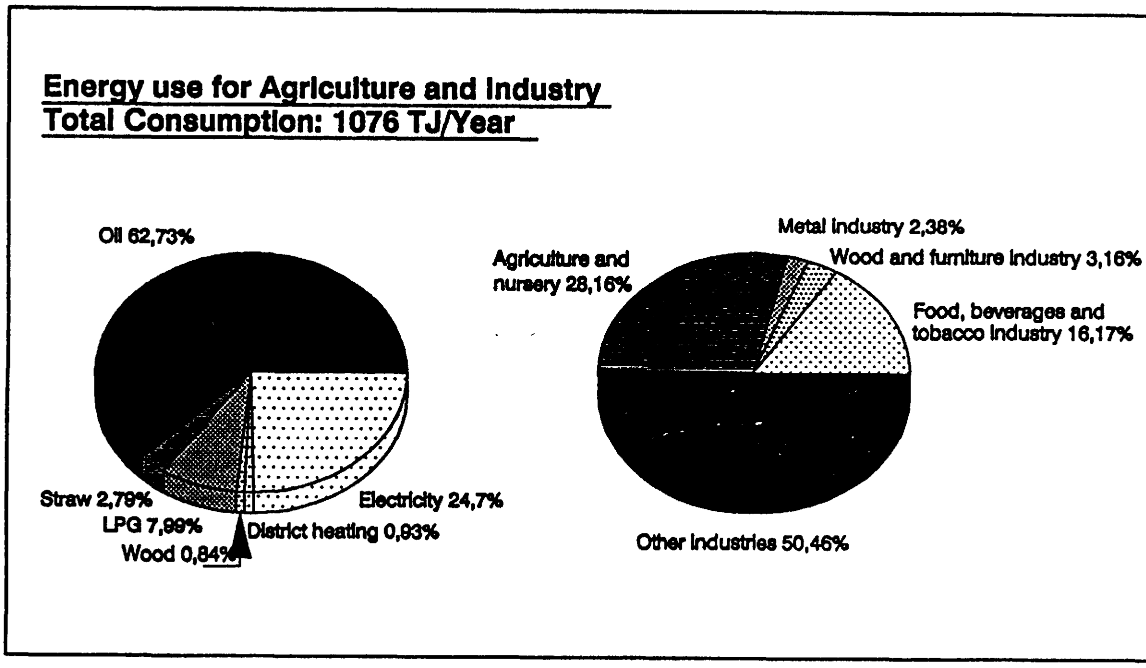


Fig. 4

	Total resource TJ	Available for energy purposes TJ
Straw[1]	1.620	750
Wood	-	150-250
Waste[2]	318	160
Biogas	297	166
Wind	145	77
Solar (heat production)	-	200-660
Solar (photovoltaic plants)	-	120

[1] The amount of straw is shown for a normal year. The amount can vary widely from one year to another.

[2] The amount is calculated by using a heating value of 8.5 GJ/ton

Table 5 Local energy resources on Bornholm

TABLE 6.

Energyprices in Denmark 1.11.1990.

	Net-price,	Energy-tax,	Added Tax,	Total consumer price in DKK	$	£	Drachmer
Gasoil per 1.000 liters							
Private households	2.212 kr.	1.760 kr.	874 kr.	4.846 kr.	848,69	432,29	128.872
Industries	2.212 kr.	0	0	2.212 kr.	387,39	197,32	58.752
Heavy fuel per ton							
Industries	1.445 kr.	0	0	1.445 kr.	253,06	128,90	38.380
Petrol per liter							
98 octane	2,36 kr.	2,90 kr.	1,49 kr.	6,75 kr.	1,18	0,60	179
92 -	2,38 kr.	2,25 kr.	1,30 kr.	5,93 kr.	1,04	0,53	158
95 -	2,44 kr.	2,25 kr.	1,32 kr.	6,01 kr.	1,05	0,54	160
Dieseloil per liter	2,10 kr.	1,76 kr.	1,09 kr.	4,95 kr.	0,87	0,44	131
Electricity per kWh							
Private households	0,49 kr.	0,33 kr.	0,18kr.	1,00 kr.	0,18	0,09	27
Industries	0,49 kr.	0	0	0,49 kr.	0,08	0,04	13

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY PLAN
FOR MADEIRA AUTONOMOUS REGION

Jose Manuel Melim Mendes
CEEETA

1. GENERAL INFORMATIONS ABOUT THE REGION

The archipelago of Madeira is situated in the North Atlantic, midway between the 15° 51' and 17° 16' meridians longitude west from Greenwich. Porto Santo is the northest most part of the archipelago and the Selvagens group the southest, therefore colser to the Canarias archipelago and to the African continent.

Madeira is 500 miles away from the mainland Portugal and also from Santa Maira's island, in the Azorian archipelago.

The demographic distribution is mainly characterised by an irregular territorial concentration and a high average population density: in 1986, there were 338,2 inhabitants per square kilometer in the whole area and 346,9 in both the inhabited islands. In the same year, Madeira had 359,4 inhabitants per square kilometer, while Porto Santo had 177,2 inhabitants per square kilometer, while Porto Santo had 117,2 inhabitants per square kilometer.

The evolution was the following:

1970 - 251,135 inhabitants
1981 - 252.763
1986 - 269,500

The total terrestrial area of the Archipelago is 796,77 square kilometers, according to the Geographic and Cadastral Institute (delegation in Madeira), and is divided into four areas:

Madeira	736,75 Km^2
Porto Santo	42,17 Km^2
Desertas	14,23 Km^2
Selvagens	3,62 Km^2

From the available statistical data, concerning the regional economic accounts, we can only analise the period from 1976 to 1980. In this last year, the GDPmp (Gross Domestic Product - market prices) was 18,1 billion escudos, with a per capita tax of about 71 thousand escudos, this is about 57% from that of the mainland, and an average productivity (GDPmp per active inhabitant) of about 200 thousand escudos (68% that of the mainland).

In this period of 1976-1980, the average structure of the GDPmp was the following

Farming, Fishing and Mining	23,6%
Manufacturing Industry	11,3%
Electricity, Gas and Water	0,6%
Public Works and Building Industry	7,8%
Public Admistration, Education and Health	18,8%
Commerce, Restaurants, Hotels and Transports,etc.	37,9%
	100,0%

The Tertiary sector has an important weight with 56,7% of the GDPmp, followed by the agriculture sector with 23.6% and the industry sector with 19.7%. Such division shows clearly the fragility of the industrial sector in this sector

When comparing the GDPmp sectors division (1976-80), with that of the active population (1981), we can conclude the services sector is the one presenting the highest workforce productivity rate:

GDP SECTORS DIVISION (1976-80) AND ACTIVITIES
OF THE ACTIVE POPULATION (%)

Sectors of activity	Participation in GDP (%)	Activities of the active population (%)
Primary	23.6	22,1
Secondary	19.7	34.5
Tertiary	56,7	43,5

2. SHORT DESCRIPTION OF THE ENERGY SECTOR OF THE REGION

In 1986, the total consumption of primary energy was 132.773 toe. The consummed total of final energy was 106.916 toe.

- The MAR heavily depends on oil subproducts to satisfy its energetic needs, 83.5% of which are an expensive part of the regional imports. The present favourable situation of the international oil market, does not change the vulnerability of MAR, since MAR totally depends on foreign imports of oil.

The internal resources presently having some projection on the regional energy balance are forestry biomass (12.7%) and water energy (3.1%). Although there exists already a small number of facilities, their contribution is very small in relation to the existing potential of other renewable forms of energy, that in 1986 still presented a very small share of the existing potential.

Concerning the energy consumption by sectors, the data show that the Household/Tertiary (51.4%) and the Transports (41.5%) are, in terms of Final Energy, the largest energy consummers in the MAR, while Industry and Building (6.5%) and Primary (< 1%) still represent a small share.

The high penetration (26.9%) of firewood and vegetal remainders in the Household/Tertiary sector should be stressed. If we consider only the Household sector, the penetration reaches 42.3%. This conclusion was obtained in inquiries on energy consumption in the Household sector of MAR and is one of the first contributions of the present work to a better diagnosis and understanding of MAR's energy system.

Production, transport and distribution of electrical energy is presently provided by a public company - Electrical Company of Madeira. Regarding oil subproducts, the Portuguese Sheel holds the whole of the strategic reception and storage facilities, but the distribution is made by several different operators. In Porto Santo, the reception and storage belongs to +Petrogal.

In what concerns the price policy for oil subproducts, the prices are equal to those practiced in the mainland, a situation that provokes a decrease of tax revenues in the local budget due to costs of sea transport. Prices of electrical energy are much higher than the ones practised in the mainland, since, in this case, the adopted policy works with real prices for an electrical production system with scale uneconomies towards the mainland, and has no interconnections to allow keeping resources derived from the network interconnection.

3.1 ENERGY ECONOMY ISSUES IN THE ISLAND

The high dependency of the Region's energetic system from the oil subproducts is, obviously, a handicap for the local economy. For instance, in 1985, this factor represented 21.9% of the debits of the Trading Balance.

As stated before, the prices for the oil subproducts are equal in the Region and in the Mainland, and this means a grievance for the local budget. In the other hand, as also said before, the cost of electrical energy is higher than in the mainland, which represents an obstacle to the creation and development of certain economical activities in the Region.

3.2

Theorically, the region has significant potential energetic resources, but their precise quantification is not yet known.

At the present level of exploration techniques development, only a minimum part of that energy is being explored, if we except the use of water resources and forestry biomass.

A great variety of actions has been promoted, in order to develop the use of New and Renewable Energy Sources (NRES - FNRE). In spite of the technical and economical restrictions, in the medium term, some of these sources can become an energetic component of major importance.

The new and renewable energy sources, almost inexhaustible, that can be used in the Region, are the following:

- solar energy
- wind energy
- biomass and remainders energy
- tidal energy
- water energy

In Madeira Autonomous Region (MAR), some of these sources have already reached very good results, but we can expect to obtain a higher level of utilization, based in a better avaluation and management of the existing resources, as well as in technological progress.

Presently, the utilization of water resources represents about 22% of the annual production of electrical energy (1986 and 1987), while in 1985 it had represented 31.3%.

Another very important local source of energy, that we often forget about, is biomass. The great majority of the rural population uses firewood as their main source for cooking and domestic waters and home heating. This same source is also often used in the baking industry and wicker works.

The utilization of solar energy through the use of solar collectors has a certain importance, in spite of the discredit originated by some defective instalation and equipment, as well as by its higher costs.

However, the production of heat at low temperatures (less than 100°C) can be profitable in meeting the hot water needs for households and tertiary, as well as some heating needs in farming and in the tourism industry.

Hundreds of facilities are already being used by a great number of people in providing water heating for sanitary purposes and for swimming pools.

In houses, solar energy may be used for central heating, through solar passive systems. There are already some experimental projects in this area.

Another possible use for the thermic solar energy is the heating of greenhouses, mainly in floriculture and horticulture.

Depending on the type of cultura, the total covered area (about 29,7 acres), can contribute with a spare of energy of 600 toe per year.

The Region has some experience in the photovoltaic area, because, since 1983, there is a photovoltaic plant in full operation at Selvagem Grande, that provides electricity to the watchmen' facilities.

The majority of the navy lighthouses all over the Archipelago are feed by photovoltaic systems.

The total potential operating in the Region for signaling systems and isolated houses is calculated in about 3,000 Watt-peak.

Concerning the wind energy, besides the aeolian park located in Porto Santo island, composed of 8 aerogenerators, each of them with a capacity of 300 KW, there are also some planned investments for the instalation of new aeolian parks.

According to the forecasts, the aeolian potential of Madeira island is about 14 GWh per year.

Since the Archipelago began to be inhabited, forestry products and their remainders were the absolute fuels, until the 18 century. Since then, and across the years they have been loosing their relative importance. However, it should be stressed that forest originated biomass is regaining its importance as raw material potential of high interest to produce energy.

Based in recent studies, held within the Regional Energy Plan, a significant part of the rural population uses wood as energy source for cooking and for air and water heating, the wood consumption in the households reaching about 42,000 tons per year. Baking industry, restaurants, paper factories and wicker works consumme about 7,000 tons per year.

A careful avaluation of all aspects inherent to the use of vegetal biomass potentialities in the Region, shows there is a high balance between supply and demand, although its impossible to quantify some important variables of consumption, previously refered. The high possibility of having areas, presently deserted, reforested and the interest shown by the people responsible for those actions, can, eventually, produce an increase on the supply for vegetal biomass in the Region.

The potentialities of domains such as biogas and, in the long term, tidal energy should also be refered and dully avaluated.

There are already some medium-sized farming and cattle raising explorations that may well become a "deposit" for the future production of biogas. Nowadays, the number of possible biogas producers is estimated in 55 explorations.

Tydal energy is a little known and explored source of energy, that represents, however, a potential with interesting characteristics for MAR when compared to other renewable sources of energy. In this domain the following actions need to be developed:

- study of the tydal characteristics of Madeira and Porto Santo;
- development of demonstration projects for the use of tydal energy.

Now, one of the most relevant endogenous energy resource: Hydric energy, that presently represents about 52.9 GWh per year, about a fifth of the total consumption of electricity in MAR.

Its value can be considerably increased, since Madeira Island has a plentiful suplly of water resources. According to recent studies, the hydric potential can be situated between the 170 to 200 GWh per year

A huge underground water table, with a capacity for over 200 millions cubic meters, stores a large part of rain water. The large majority of this water can be found in the northern side of the Island and in the central mountains, while the higher consumption area is the Funchal municipality and surroundings.

The avaluation and correct management of the water resources is extremely important, in order to profit from all the potentialities of this endogenous source of energy - fundamental for the economic development of the region.

Rational Use of Energy

The energy represents a fundamental part on the economy and its development. An undisciplined growth cannot take place, whether on supply or on demand.

MAR, strongly dependent on energy, is characterized by a consumption structure that shows enormous potencialities in the rational use of energy, some of them previously shown.

The Rational Use of Energy (URE - REU), of the existing energetic potential applied at the several economic activities as in small and medium sized companies of the industrial, tertiary sector, including the tourism sector and also households, can contribute significantly for the reduction of our double energy dependency, as well as for a rational use of the endogenous energetic potential.

In the rational use of energy, three main areas can be considered:

- rational production of energy
- energy saving and management
- energy rational consumption

The environment is one of the largest beneficiaries of the Rational Use of Energy, since the energy saving brings smaller consumotions and consequently diminishes the release of pollutants.

The rational production of energy can contribute in an important way, not only to avoid the deterioration of the environment, but as well to eliminate remainders and debris, namely urban, industrial, farming and cattle-raising debris and forestry and wood mills debris.

The Rational Use of Energy that urges to be profited in full by MAR, is a huge unexplored "deposit", and a individually accessible energy source.

According to data concerning specific consumptions of energy, a determined policy for the rational use of energy can lead to a decrease of about 30% of the global needs of energy in MAR, in a period of 15 years.

3.3 ESTIMATIONS FOR ENERGY RELATED EMPLOYEMENT

The energy sector contributes with not more than 1% to the employement of the active population, 2/3 of which is concentrated in the company responsible for the production, transport and distribution of electrical energy in the Region

In absolute value, the number of jobs in the energy sector nears 1500.

4. ENVIRONMENTAL PROBLEMS RELATED TO ENERGY IN THE ISLAND

The environmental impacts caused by the energy system on the region, are small and focused mainly on the transports system and on the production of electrical energy.

To avaluate the environmental incidence of the energy system the releases of five polutants (dust, SOx, NOx, CO and HC) were equated. This polutants are associated to the functioning of the energy system in MAR. These polutants were considered the most significant in global terms and for comparing objectives.

Naturally, other atmospheric polutants may, from time to time, be as important as those adopted, but in a strategic study, as in this case, the use of a larger number of variables would unecessarily burden the study without significant advantages. Other kinds of polutant releases were not considered (water polution, noise), because in the particular case of the energy system, they are much less important than atmospheric releases. Besides, the energy system is largely responsible for the air polution, while its share of, for instance, water polution, is very small and restricted to the big refinement and electric production facilities. No other kinds of environmental incidences depending on site analysis were made, either.

Concerning the releases values, only the electrical energy produced via thermic and the transport system could be quantified, through the application of the release factors adopted by the European Community. Besides, these are the two domains causing the largest part of the atmospheric polutant releases. As an example, the electrical energy production in Victória plant, caused, in 1986, the release of about 170 tons of dust, and an estimated 2.500 tons of SO_2.

An extended study avaluating the releases associated to the energy system settings in MAR, quantifying the global releases and their possible level of concentration or spreading should, in our view, be carried out, in order to prevent possible risk situations, that could endanger the environment quality in MAR, an essential value for the Region.

5. ENERGY PLANS CONCERNING THE REGION AND THEIR IMPLEMENTATION

In 1980, a first integrated work was carried out about the energy sector in Madeira Autonomous Region (MAR), within the cooperation agreement between the Portuguese and the United States governments. This study was carried out to a national level (Portugal/US Cooperative Assessment).

The result of this work was a general view on the energy resources of the region and a projection of future supply.

The local authorities, namely the local Government, have an urgent need to diagnose the regional energy system in an organised and systematic way, and to reflect on the best options to be taken in the energy domain, according to the forecasts about the Region socioeconomic development. Thus, an attempt was made, some years ago, to create the conditions to the elaboration of an Energy Plan for the Region.

After several failed attempts to elaborate the regional energy plan, the conditions for its concretization were finally created within the Regional Energy Plans supported by D.G XVII of the European Community Committee.

PERAM (Energy Plan for Madeira Autonomous Region) was elaborated in one year, having been delivered to the Regional Government in July 1989. Its main objective was to provide the responsibles for the Regional government with the elements and tools necessary to the decision making on regional energy policy. In order to provide to the energy and planning local structures the capabilities to functioned from the work, the work was elaborated to assure the continuity of the energetic planning and the involvement of the representatives of the public and private concerned sectors of MAR. To achieve the mentioned goal, and after a detailed characterization of the region, both physical and socioeconomical, the study carried out the following research:

- Evolution of the energy sector from 1974 to 1986;
- Elaboration of the regional energy balance, in a most extended way, of the reference year (1986);
- Organisation of the existing information synthesis about the energy potential (renewable energies) and about the consumption reduction potential through the Rational Use of Energy ;
- Avaluation of supply evolution from macroeconomic cenaries purpose-built. A detailed analysis of Final Energy supply by different consumme sectors and different uses, served as basis to the selection of options on demand behaviour;
- Optimization of the energy production, manufacturing and distribution system, aiming at satisfying the energy needs induced by socioeconimical development of Madeira Autonomous Region up to the year 2010.

Three macro-economic cenaries to the region and two cenaries of populational growth, up to the year 2010, were elaborated. For each cenary the energy needs of the region associated to each sector were calculated from the needs of useful energy or from the forecasted level of activity.

Its conversion in terms of final energy was made, taking into account the effects of an increased efficiency of energy consumming equipments, as well as different attitudes of decision makers (in both micro and macro level) before the rational use of energy.

After the final energy quantification, several hyphotesis were discussed on the choice of energy alterantives.

In the last phase, settings on the supply system were elaborated, according to specific premises and objectives selected for each hypothesis.

After having examined all possible combinations, four extended work options were choose. For each one of the four selected hypothesis, energy system settings were established. to the years 1990, 1995, 2000, 2005, and 2010.
The impact on local economy and environment for each configuration of the energy system, was analysed.

At last, programs of action and main recommendations were elaborated. in order to implement a more rational energy system in MAR, that would enrich the existing potentialities in the Region.

Following the public debate about the Plan, with the participation of EEC, and due to the weakness of the local government structures responsible for the energy sector, a decision was taken to create a PERAM implementation body, aimed at carrying out in practice the Plan' recommendations, in a two years period.

Meanwhile, the structures of local administration urge to be reorganised, both legislatively and technically, so that the energy sector may proceed to the actions development for the energy future of the region.

6. ENERGY PROJECTS FINANCED OR ABOUT TO BE FINANCED BY THE SEVERAL FINANCIAL TOOLS AND PROGRAMS OF THE COMMUNITY

After Portugal having joined the European Community, in 1986, and resulting from the EEC structural funds financing, a big step was taken in the energy sector, specially in what concerned electrical infrastructures projects. In fact, until 1989, the electrical company of Madeira submitted to the approval of the European Regional Development Fund 13 projects.

On other hand, a big project of the Electrical Company of Madeira obtained financial support from the European Investment Bank. Within the Valoren program, two projects obtained, until now, support (mini-hydric facilities and an eolian park), which will be independent producers of electricity.

Within the energy demonstration program, 2 projects obtained support - an 100 KW photovoltaic station in Porto Santo and an 200 KW aerogenerator in Madeira island.

7. INSTITUTIONAL FRAMEWORK CONCERNING ENERGY

The Archipelago of Madeira is, from a political-administrative point of view, an autonomous region of the Portuguese Republic, with its own governement bodies and legislative and executive autonomy, defined in the Constitution. Therefore, the energy sector depends from the local legislation.

Among the companies working on the sector, there is a local public company, that provides for the production, transport and distribution of the electrical energy in the Region - Electrical Company of Madeira ..

In what concerns oil subproducts, there are two main companies capable of providing the reception and storage - Portuguese Shell, in Madeira island and Petrogal, in Porto Santo island. The market distribution and sale is guaranteed by several operators.

Despite the legislative and executive autonomy above mentioned, there is a good relationship between the local authorities and those of the mainland.

8. ISSUES FOR DISCUSSION

8.1 Energy Supply Issues

The region has a geographical situation, that renders any energy connection to the mainland impossible.

Consequently, the sea transport costs will cause overcosts, scale uneconomies towards the mainland systems, and the unexistence of any backup reserve derived from the interconnection.

This objective facts determine that instead of reasoning in terms of the internal energy market, the economic, financing, price policy and possible subsides issues, should be analysed in terms of the economic and social coherence the European Community wants to implement.

In fact, the overcosts previously mentioned will, if a transparency price policy is adopted and no financial support is given, diminish the regional budget revenues or largely increase the prices for energy consummers.

An important area to study extensibly, and possibly to develop, concerns the renewable energies technology, that can be realistically implemented in the region, and also those technologies which promote energy saving and specially the electrical energy replacement.

Another important aspect related with the energy system in the Region concerns the environmental quality. The high level of touristic vocation, demands a minimum environmental aggression. Although there is no reason for alarm, we can consider that the transport system, specially in Funchal, begins to be a motive of concern, and therefore demanding a strict vigilance of the interface energy/transports.

8.2 Institutional infrastructure

As previously mentioned when speaking of the PERAM implementation body, there are some local weaknesses known by the local authorities, but in a general way, we can consider that the Region has already the necessary technical basis to ensure the adequated energetic development of the region, whether alone or in cooperation with other external organisations.

8.3 Other Issues

A last aspect which should be stressed. is the urgent need for vocational training in specific technical-vocational jobs in the energy domain, that in some areas presents very significative weaknesses in the Region.

TABLE 1

Population and employment in MAR

	1970	1981	1986
Total population (1000 inh.)	251,1	252,8	269,5
Total active population (1000 inh.)	89,1	96,9	126,0
Activity rate (%)	35,5	36,2	46,7
Unemployment rate (%)	6,2	7,5	8,0
Active population per activity sectors (%):			
• Primary	36,0	22,1	22,0
• Secondary	35,0	34,5	34,0
• Tertiary	29,0	43,2	44,0

TABLE 2
GDP extended analysis

	1980		1986 (1)	
	10^6 escudos	%	10^6 escudos	%
Farming	4 863	27,0	12 940	18,6
Minning Industry	159	1,0	9 970	14,3
Manufacturing Industry	1 992	11,0		
Electricity and Water	202	1,1	1 030	1,5
Public works and Building Industry	1 957	10,8	7 450	10,7
Commerce, Hotels and Restaurants	4 081	22,6	16 350	23,4
Transport and Communications	1 431	7,9	8 900	12,7
Banks and Assurances	- 623	- 3,5	- 900	- 1,3
Services rendered to the community and welfar	3 985	22,1	14 000	20,1
GDPmp	18 053	100,0	69 740	100,0

(1) forecasted values

TABLE 3

"Marketable" primary energy consumption

Unit: toe

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Gasolines	8 173	9 032	9 078	9 559	9 705	10 334	11 566	12 070	12 999	13 735	14 239	15 522	16 213
Gasoil	19 691	23 861	28 244	27 127	32 728	37 645	39 732	44 266	42 701	41 561	36 600	33 450	33 018
Kerosene	1 699	1 574	1 540	1 489	1 451	1 358	1 190	873	824	801	807	619	612
Fuel-oil	10 574	10 717	7 104	14 252	11 471	13 354	19 137	20 854	27 454	32 340	38 377	40 243	46 900
LPG	7 372	8 661	9 409	9 975	10 249	10 594	11 805	12 172	12 510	13 259	15 224	13 684	14 158
Total of oil subproducts	47 509	53 845	55 375	62 402	65 604	73 285	83 430	90 235	96 488	101 696	105 247	103 518	110 901
Annual average to growth rate	←			10%		→	←			4,8%			→
Hydro electricity:													
• equivalent to thermic production (1 GWh=234.8 toe)	9 627	10 214	11 411	10 096	11 083	11 036	10 848	9 462	9 228	10 167	12 867	15 098	11 317
• equivalent to consumption (1GWh=86 toe)	3 526	3 741	4 180	3 698	4 059	4 042	3 973	3 466	3 380	3 724	4 713	5 530	4 145
"Marketable" primary energy Total consumption in MAR*	57 136 51 035	64 059 57 586	66 786 59 555	72 498 66 100	76 687 69 663	84 321 77 327	94 278 87 403	99 697 93 701	105 716 99 868	111 863 105 420	118 114 109 960	118 616 109 048	122 218 115 046
Annual average to growth rate	←			8,7%		→	←			4,4%			→

* Taking the equivalent to thermic production for hydroelectricity

TABLE 4

Primary energy consumption, local population and GDPmp in MAR

Unit: toe

	19 76	19 77	19 78	19 79	19 80	19 81	19 82	19 83	19 84	19 85	19 86
Primary energy consumption	59 ,555	66 ,100	69 ,663	77 ,327	87 ,327	93 ,701	99 ,868	110 ,420	110 ,960	110 ,048	120 ,046
Pop. (10^3 inh.)	250 ,9	250 ,2	250 ,4	250 ,1	250 ,0	250 ,8	260 ,4	260 ,5	260 ,8	260 ,7	270 ,5
PIB (10^9 esc.) (1)	46 ,43	53 ,75	56 ,23	57 ,33	65 ,40	n.a. (2)	n.a. (2)	n.a. (2)	n.a. (2)	n.a. (2)	69 ,74 (3)

(1) 1986 prices
(2) non available values
(3) forecasted value

TABLE 5

Oil subproducts imports stake in the trading balance and in the total imports in MAR

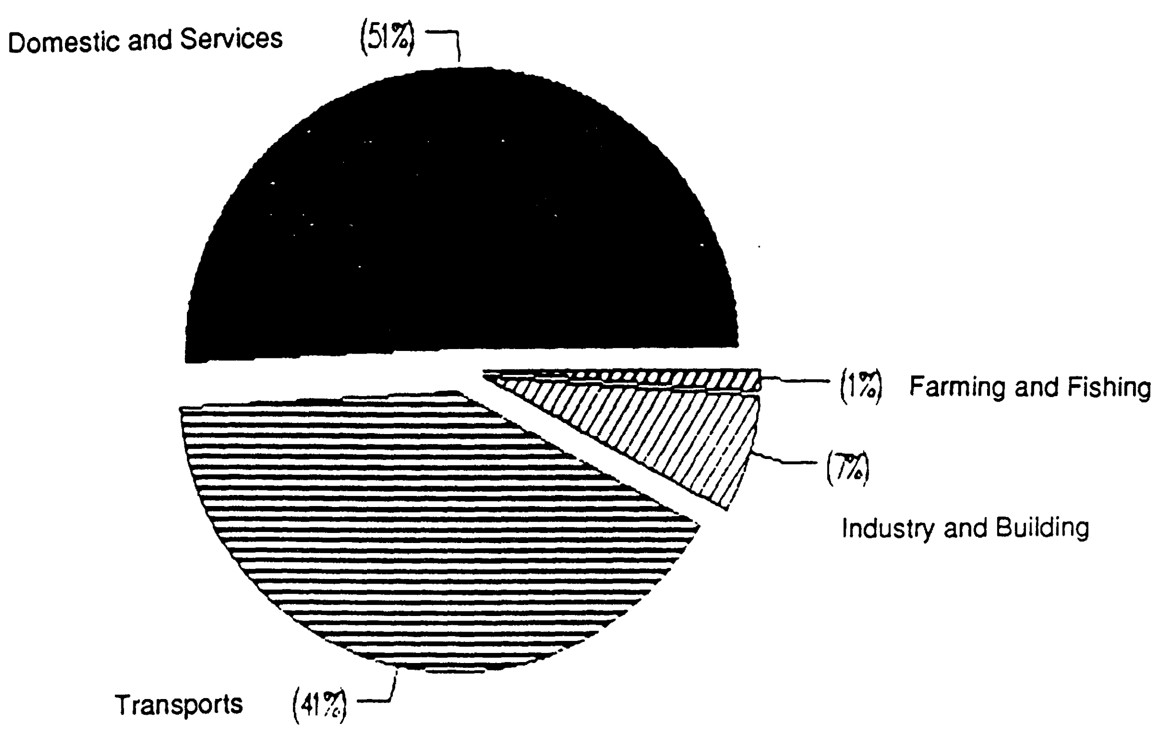
Unit: 1000 Escudos

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Oil imports	309 993	400 255	512 712	811 044	1 404 592	2 006 867	2 453 494	2 860 700	3 613 356	4 953 799	3 205 408
Total imports	3 397 827	5 073 345	6 666 384	9 455 009	12 782 389	17 255 447	21 467 048	25 969 183	26 354 846	32 224 983	41 863 491
Trading balance debits	- 2 425 219	- 3 712 670	- 4 748 902	- 6 964 602	- 9 669 267	- 13 684 227	- 17 445 013	- 20 114 812	- 18 717 935	- 22 575 570	- 30 465 841
1/2	9,1	7,9	7,7	8,6	11,0	11,6	11,4	11,0	13,7	15,4	7,7
1/3	12,8	10,8	10,8	11,6	14,5	14,7	14,1	14,2	19,3	21,9	10,5

Note: The trading balance debits and imports total refer to the Mainland + Azores + Foreign Countries
The oil imports are only for internal consumption (the imports that will be again exported weren't accounted for)

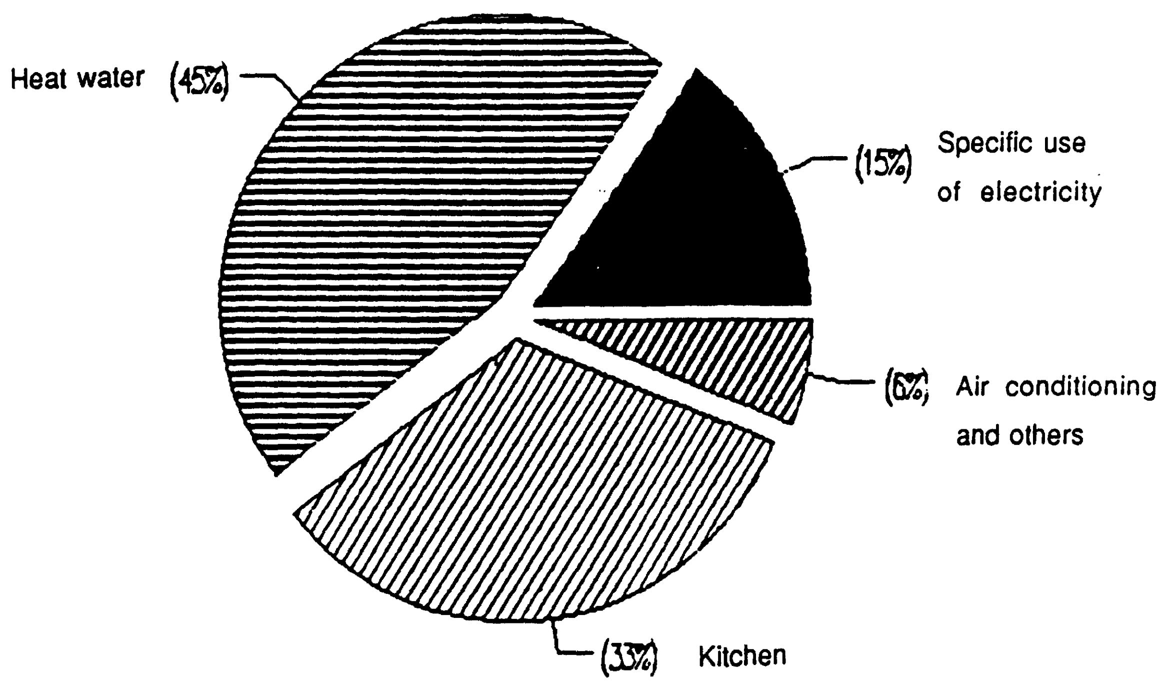
PIE GRAPH 1

Final Energy distribution by consumers sectors
1986



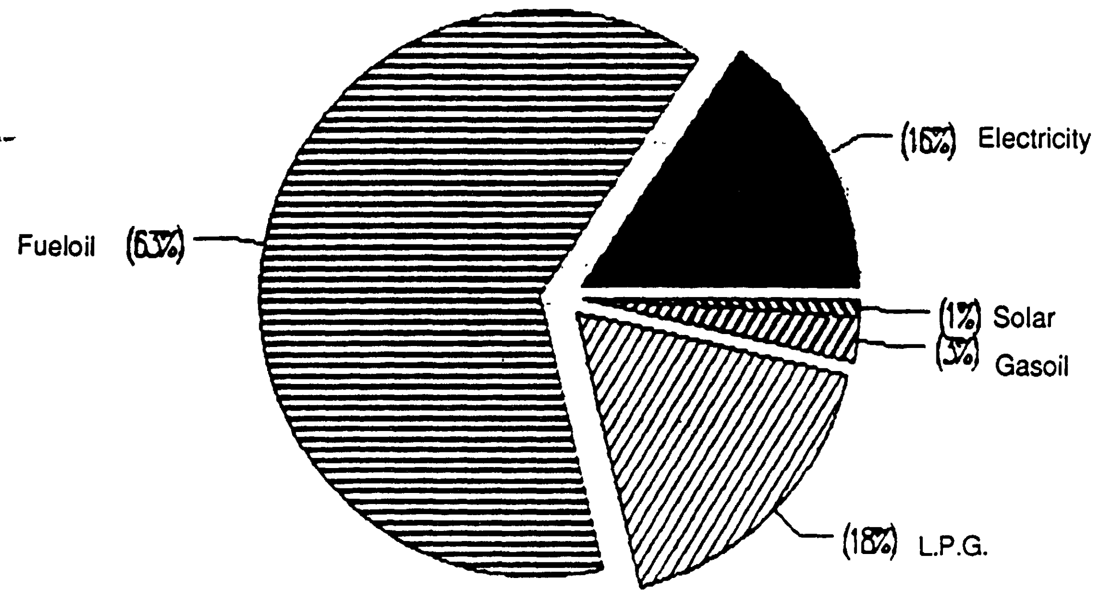
PIE GRAPH 2

Residential Sector
Consumption by Utilization Modules
1986



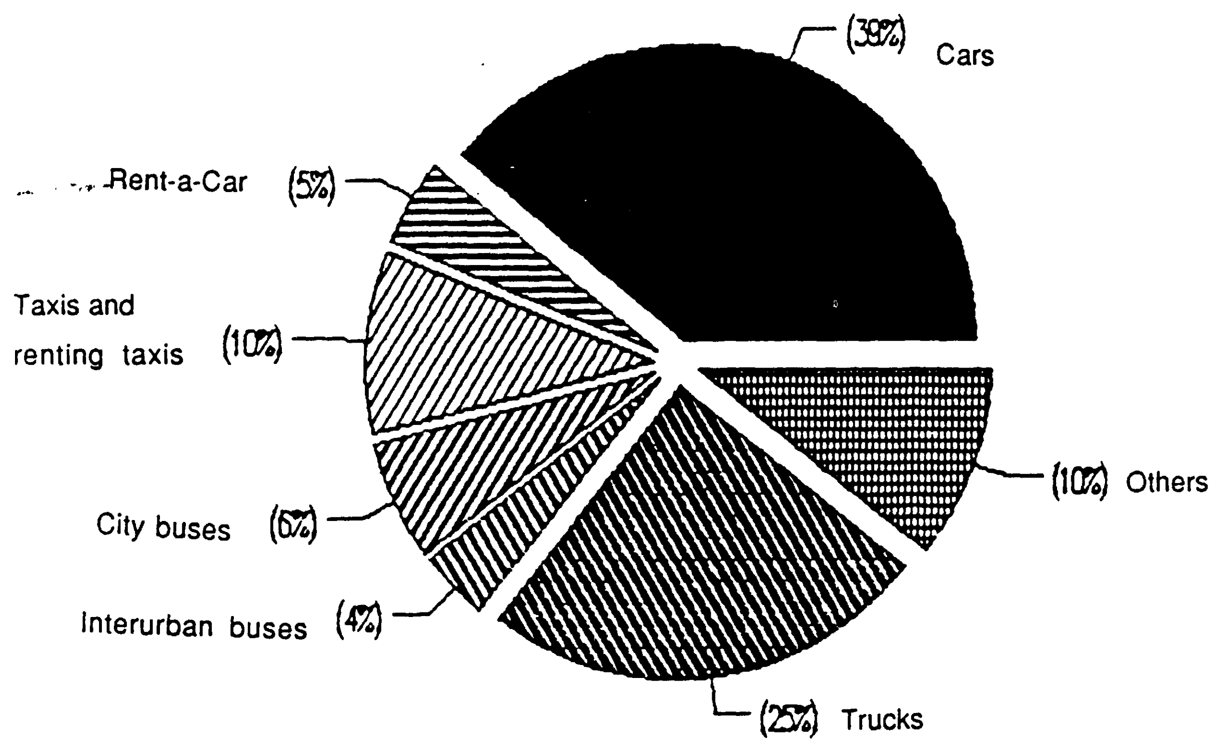
PIE GRAPH 3

Turism Facilities
Final Energy Consumption
1986



PIE GRAPH 4

Transports
Consumption by Utilisation Modules
1986



SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY SITUATION & CHALLENGES IN THE CANARY ISLANDS

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Director for Energy Policy
Cosejeria de Industria y Energia
Gobierno de Canaries

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A.- GENERAL INTRODUCTION OF THE CANARY ISLANDS

1.- Administrative organization

When the Spanish territory was administratively organized in provinces, The Canarian Archipelago, formed by seven islands and some small islets, was divided in two provinces:

Las Palmas (Oriental Islands), formed by Gran Canaria, Fuerteventura and Lanzarote.

Santa Cruz de Tenerife (Occidental Islands), formed by Tenerife, La Palma, La Gomera and El Hierro.

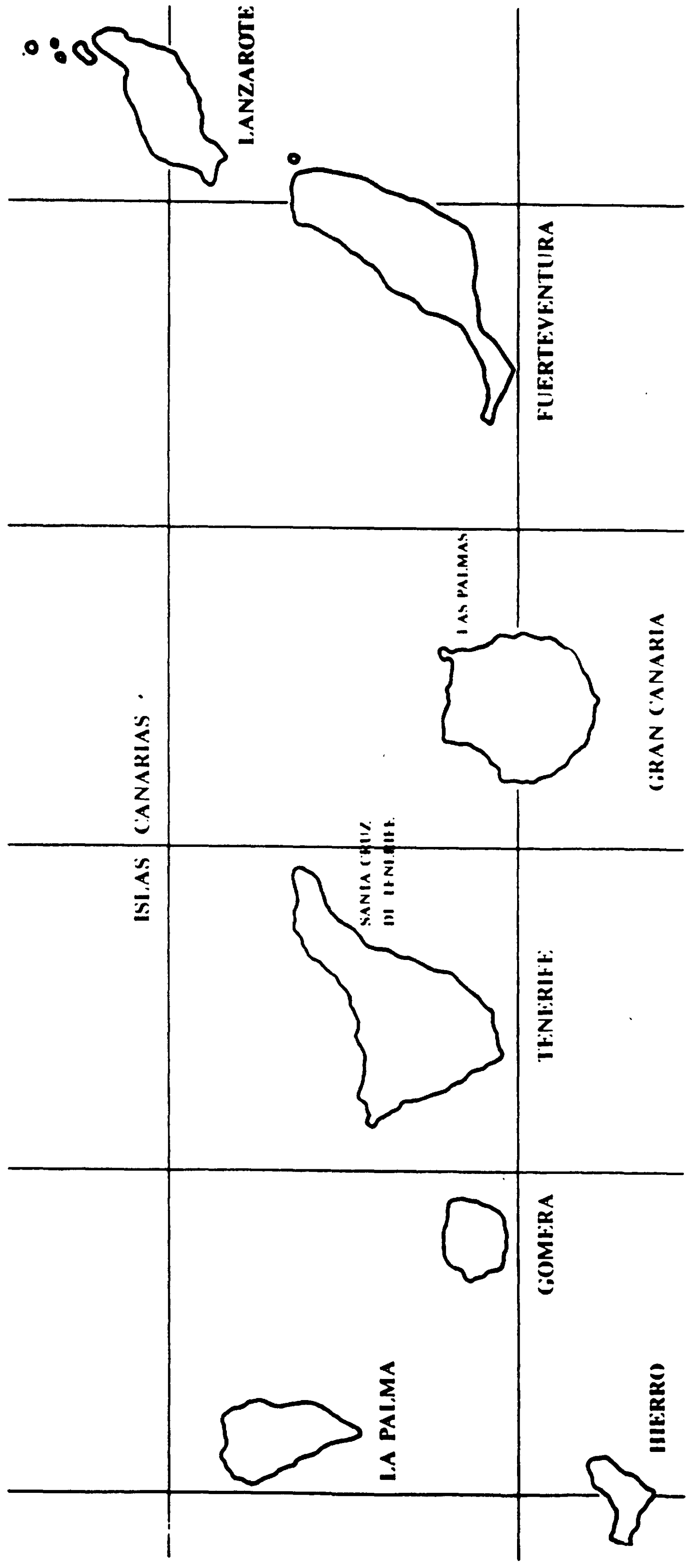
The internal administrative division consist of 87 townships on a surface of 7.456,85 square km, as follows:

Island	Nº Municipality	Surface (km2)	%
Lanzarote	7	861,71	11,6
Fuerteventura	6	1.663,37	22,3
Gran Canaria	21	1.530,77	20,5
Tenerife	31	2.055,02	27,6
Gomera	6	371,07	5,0
La Palma	14	686,07	9,2
Hierro	2	287,04	3,8
TOTAL	87	7.456,85	100,0

The next picture represents the Canarian Archipelago localization with northern end at Punta Musego, 25º 24' 35", and southern end at Punta de los Saltos, 27º 38' 10".

The easterner island is Lanzarote, over the superior paralel. The westerner island is El Hierro, situated in the inferior paralel.

This dispersed geographical structure makes the economies of scale and the influence zone to be very much less profitable than the rest of the national territory, and it has supply problems, mainly in the energy matter, specially in the electric power, due


ISLAS CANARIAS
LANZAROTE
FUERTEVENTURA
LAS PALMAS
GRAN CANARIA
SANTA CRUZ
DE TENERIFE
TENERIFE
GOMERA
LA PALMA
HIERRO

to the interconexion impossibility, so it is necessary to consider separately the installed capacity for production and covering, to guarantee the service continuity.

2.- Demographic factors.

Canary Islands is the Spanish region with major growth in population, based in high birth rate and life expectancy. Actualy, the Canarian population is about 1.600.000, with 87% of which live in the two islands that share the capital cities of the Archipelago, Gran Canaria and Tenerife.

Besides to that, due to the habitat excellent conditions, Canary Islands has an important immigration, that becomes established definitively. This makes the population to grow at a greater intensity.

Population density is double than the Spanish average, which falls into a relative hiper concentration population, having a repercussion on a very important service demand, amongst the water is very much important.

However, it is necesary to point out that the vegetative population growth in the Canary Islands in the last 25 years has experimented a very quick drop similar to the mainland:

NATURAL POPULATION GROWTH

Unit: 1/1000

Years	Canary	Spain
1.965	22,62	12,96
1.971	18,54	10,68
1.977	14,10	10,30
1.982	10,46	6,00
1.984	7,65	4,44

The natural population growth in Canary Islands has the same tendency as the whole Spain. In the Canary Islands, the birth rate passed from 21.368 persons in 1.965 to 10.824 in 1.984, what it means an annual average of minus 3.52%. In Spain, for the same period, it passed from 400.704 persons to 170.274, with an annual average of minus 4.40%.

3.- Water in the Canary Islands.

3.1.- Canary Islands water problems.

Water is a necessary good. Its major or minor abundance will not only lead the region economy, but quality life and public health are strongly connected with it. Its necessity oblige to make a good use, independently of its origin. Canary Islands water problems are defined by its lack of it.

The specific factor in hydraulic resource deficit in the islands is the weather, that is characterized as subtropical, with dry summers. Its mildness is due to trade winds in north latitude, 28-29º, Atlantic Ocean.

Each island presents different climate from the summit to the coast, from the north slope to the south, from one island to another, that makes to vary the average annual rate of rain from 1.000 mm/year on the summit to 100 and 200 mm/year on the coast.

In summary, we can assume that the origin of islands barrenness is its climatology, whose main characteristic are:

- The latitude place the archipelago within trade winds.

- The southern deflection of Gulf Stream - Canarian Stream - and cold water from African coast toward north.

- Africa influence, only 100 km from Fuerteventura.

- The islands height structure that allow different cloud formation, independently.

The soil permeability, depending of different geological structures and age, among others.

In front of this situation, we find some necessities that are fixed by the increasing demographic density, a concentrated population, mainly in the two capital islands, which needs are continuously increasing for a higher living, reaching a consumption of 150 liters of water per inhabitant and day.

Its agriculture, representing about 20% surface, is the economical sector of major water consumption, between 70 to 80% of total, but in the future, due to agriculture production system changes, it is expected a reasonable reduction in water consumption.

In the last few years, the secondary sector has lost its relative importance, to the advantage of tertiary sector, in which tourism has been pointed out as a increasing consumer of hydraulic resources.

In summary, we can affirm that there is an important growing lack of hydraulic resources, and the over exploitation of these, are producing the exhaustion of the reserves, spoiling its quality and the well deepness need are lowering the freatic level in order of 4m per year, in the main islands.

3.2.- Hydraulic balance.

The following table shows hydraulic balance forecast for 1.995:

HYDRAULIC BALANCE (1.995)

Islands	Resources	Demands	Balance
Tenerife	202	222	- 20
La Palma	80	78	+ 2,5
La Gomera	13	11,5	+ 1,5
El Hierro	3,7	3,5	+ 0,2
Gran Canaria	100	174	- 74
Lanzarote	0,6	10,9	- 10,3
Fuerteventura	4,5	9,5	- 5
TOTAL	403,8	509,4	- 105,6

Sources: Regional Hydraulic Plan

From this analysis we can get the following conclusions:

1. Four islands, Tenerife, plus the easterner three, present hydraulic deficits, been specially serious in the last three.

2. On the contrary, La Palma, La Gomera and El Hierro still present certain margin of superavit.

3. The global consumption per inhabitant presents heavy differences, according to the relative weight of agriculture activity, but there are still some important possibilities of rationalization in the western islands, where the water factor is not acting as a constraint.

4. More representative is the ratio in urban consumption, where there is a social deficit not attended in Lanzarote and Fuerteventura islands.

5. Still, more important is the global balance. It can be observed that in the whole of the Canary Islands, they are going to be dependent in 1 of each 5 liters of water to be consumed.

3.3.- Possible options.

To cover the deficit observed, a serie of technical solutions should be arbitrated. These solutions are based in conventional and no conventional systems, that will correspond to three well differentiated steps: water extraction from wells and galleries, waste water depuration and sea water desalination.

a) Water extraction.

With the point of minimally reducing the freatic level lowering, it is necessary that the amount of extracting water from wells and galleries to be kept at actual values.

b) Water depuration.

The following table shows the depuration capacity per island, in service, in construction and in project installations, in service for 1.995.

Unit: m^3/day

Islands	Service	Under Construction	Project	Total
Tenerife	19.100	3.000	1.000	23.100
La Palma	1.000	-	-	1.000
La Gomera	-	-	-	-
El Hierro	1.200	-	-	1.200
Gran Canaria	36.600	6.500	35.900	79.000
Lanzarote	6.000	1.200	-	7.200
Fuerteventura	1.200	300	800	2.300
TOTAL	65.100	11.000	37.700	113.800

c) Sea water desalination

The desalination plants already in existence in Canary Islands, as included in the following table, are very important, located especially in the oriental islands of the Archipelago.

There are both big installations, to satisfy the urban demands, and small installations for residential and tourist areas.

Island	Capacity installed m³/day MSF	RO	VC	Total	Produced Water Hm³/year MSF	RO	VC	TOTAL
Gran Canaria	38.000	76.500	3.700	118.200	9,0	18,2	1,0	28,2
Lanzarote	5.000	11.400	8.500	24.900	1,3	2,9	2,1	6,3
Fuerteventura	-	3.500	12.000	15.000	-	0,9	3,1	4,0

MSF: Multi Stage Flash
RO: Reverse Osmosis
VC: Vapor-Compression

The programmed installations are:

	Capacity to install m³/day	Foresee production Hm³/year
Gran Canaria	28.500	7,3
Lanzarote	18.500	4,7
Fuerteventura	6.500	1,7

Even so, there is a deficit estimated as:

Gran Canaria 28,5 Hm³/year
Tenerife 15,0 Hm³/year

For 1.995 the demand should be covered in the following way:

Unit: Hm³/year

Island	Total Demand	Supply Dumps	Galeries	Wells	Purifying	Desal.
Tenerife	222	2	150	50	5	15
La Palma	78	5	50	25	2	-
La Gomera	11,5	3	8	2	-	-
El Hierro	3,5	-	0,9	2,8	0,1	-
Gran Canaria	174	10	5	85	10	64
Lanzarote	10,9	0,2	-	0,4	1	9,3
Fuerteventura	9,5	1	-	3,5	0,5	4,5
TOTAL	509,4	21,2	213,9	168,7	18,6	92,8

3.4.- Energy demand in the water sector.

Considering the average specific consumption of the different extraction, depuration and desalination systems, it could be estimated the energy demand generated by water sector in 1.995.

ENERGETIC CONSUMPTION IN 1.995

	Extraction		Depuration		Desalination		Total
Island	Q	C	Q	C	Q	C	C
Tenerife	50	50	5	16	15	105	171
La Palma	25	25	2	6,4	-	-	31,4
La Gomera	2	2	-	-	-	-	2
El Hierro	2,8	2,8	0,1	0,3	-	-	3,1
Gran Canaria	85	85	10	32	64	448	565
Lanzarote	0,4	0,4	1	3,2	9,3	65,1	68,7
Fuerteventura	3,5	3,5	0,5	1,6	4,5	31,5	36,6
TOTAL	168,7	168,7	18,6	59,5	92,8	649,6	877,8

Units: Q: in Hm^3
C: Consumption in GWh

Comparing the global electrical energy demand and the consumption of the same in the water sector, referred to 1.995, we can see the great importance that will have this activity in future energy consumption in the Archipelago.

ELECTRICAL ENERGY

	Demand (GWh)	Water consumption (GWh)	%
Tenerife	1.720	171	10
La Palma	124	31,4	25
La Gomera	20	2	10
El Hierro	10	3,1	31
Gran Canaria	2.154	565	26
Lanzarote	374	68,7	18
Fuerteventura	143	36,6	26
	4.545	877,8	19

4.- Economic activities.

The Canary Archipelago productive system has experimented a quick evolution during the last decades with very important changes in its structure and economical activity distribution. Agriculture, that in 1.955 represented 25% of regional input, falls to the actual 3,11%, in profit of the tertiary sector, which has been increasing regularly, till reach 74,41% of the regional total.

The values of agriculture, cattle, fishing, industrial and tertiary sector production and its participation in the total Spanish, is as follows:

	Millions of pc	% Spain
Agricultural production	30.585	1,90
Cattle production	10.574	0,96
Fishing production	19.784	11,12
Industrial production	200.665	2,25
Tertiary sector production	729.880	4,25

Referring to the agricultural production, the three large Canary Islands production, potatoes, bananas and tomatoes, are mainly destined to exportation to the Peninsula and the rest of Europe. Also to be mentioned a fourth cultivation that day by day acquires more meaning, the adorn plants.

Approximately 90% of the exportation market is found in the EEC countries, mainly Holland and United Kingdom.

About cattle, Canary Islands occupy the last position in Spanish regions, from investment point of view. The meat production is scarce and insufficient to supply the Canaries, only 1% of the National total.

Cattle situation is precarious, with a tendency to decrease, but still it represents more than a quarter of the final agricultural production. Cattle decrease should be associated with the reduction of farming and with the rustic exodus, pushed by tourist development.

Future possibilities will depend on competitive prices, the irrigation increases for pasture production and improvements in the structural investments.

Fishing production is very much limited due to the narrow continental platform, originated in the volcanic constitution of the Canary Islands. For that reason there is a dependence to the neighbor continent, specially in the fishing bank water, Canarian - Saharian, under Morocco jurisdiction, in major part, and Mauritania, since 1.975.

The self conscience that West African countries have being reaching about economic values of its water fishing resources, has leaded to the necessity to have to fish farther from coast (to more than 12 miles), besides to have possession of license fishing, to pay fees, and some other severance benefits.

In the secondary sector, the transformation industry in Canary Islands, represents approximately 10,8% of the gross internal product. This participation has being held very stable since some years, remaining well bellow the national average. This represents the lower industrialization level of the Archipelago in comparison to the whole of Spain.

In the last thirty years, the growth of construction activity emphasized over the energetic sector and also, even in minor dimension, the Paper, Graphic Art and Ceramic, Glass and Concrete Industries, activities very much related with the building sector, and a moderate increase in the Food, Drinks and Tobaccos. They are very regressive the Chemical and Textile Industry, and insignificant the Leather, Shoes and Manufacture, Wood and Cork.

Within service sector could be pointed out the economic activities related with tourism. In the last twenty years, the gross added value has increased with a annual average of 8,4%, rate that has to be considered as very high and progressive and the number of employees was multiplied by a factor of 1,55.

Comparatively with the Spanish evolution, Canary Islands has being more progressive, because in 1.969 the touristic sector and similar represented 6,61% of the whole Spain and in 1.989 the 8,83%.

B.- ENERGY SITUATION.

1.- Introduction

To be able to analyze the situation of any kind of economic activity, not only it is necessary to know demand, but also is very important to know the supply parameters.

2.- Energy supply.

The energy supply situation in Canary Islands presents an special configuration due, in the first place, to the absence of fossil fuels and practically inexistence of hydraulic ressources, so it is necessary to carry out very valuable energy imports. This fact, together to the existence of an oil refinery at Tenerife, has driven to nearly total dependency of the petroleum for the energy supply in the Archipelago.

For that, the energy supply of Canary Islands results very much sensible to any interruption or retard in the availability of the necessary primary energy to guarantee suplies, and so call for a diversification of supply.

Maritime communications and strategic storages, appropiately distributed, establish the main base to assure the supply continuities of commercial energy to the users.

So, the final energy offer is limited to petroleum products, plus electric energy, which is equally generated from the same fuel, with a very limited offer of renewable energies.

2.1.- Oil.

Actualy, the primary energy sources comes mainly from petroleum, obtained from Santa Cruz de Tenerife CEPSA refinery. The rest, are imported from the Peninsula, or from foreign companies to supply to the air and maritime traffics.

The authorized refining capacity of CEPSA is 8 million of tons per year, but actually the real capacity is 6.5 million of tons, and in the last few years production has been around 4 million of tons a year. The amount of destilated crude in the last decade has been as follows:

DESTILLATED CRUDE

Year	Production thousands of t.	Capacity Utilization Rate (%)
1.980	5.712,6	87,9
1.981	5.597,6	86,2
1.982	5.086,6	78,3
1.983	5.097,6	78,4
1.984	4.582,0	70,3
1.985	3.993,4	61,3
1.986	4.029,0	66,2
1.987	4.204,2	64,6
1.988	3.267,9	50,8
1.989	3.698,2	56,9

In this table it can be clearly observed the drop in the utilized capacity till 1.985, and afterwards a slight recover. This figure contrasts with the corresponding to the EEC-10 in which the refining capacity excess has passed from 38% in 1.980 to 20% in 1.988. This reduction is mainly due to the European refining capacity decrease.

Oil received in Canary Islands during 1.989 came in a 13,9% from Caribbean zone, in a 20,6% from West Africa, in a 46,7% from the Persian Gulf, in a 11,8% from North Africa, and in a 7,0% from the rest of Europe and other countries, so it represents a very diversify structure limiting supply risks.

In the Canary Islands, beside the descent in quantity of distilled crude, the actual refinery production is sufficient to attend the regional market need, as can be observed:

TENERIFE REFINERY PRODUCTION DURING 1.989

Unit: thousands of t

Products	Production
L.P.G.	73,4
Gasoline	391,2
Kerosene	654,4
G.O.- D.O.	723,6
F.O.	1.303,8
Gas refinery	166,3
Nafta	91,4
Asphalt	163,1
Others	130,8
TOTAL	3.698,2

2.2.- Electric energy.

The electric power production and distribution in Canary Islands is performed by UNELCO (Unión Eléctrica de Canarias S.A.), which was established in April, 1.930 and is integrated in the group of Societies of Electric Energy of the Instituto Nacional de Industria (INI), headed by ENDESA as a titular State share.

The installations of production and distribution of this company, are disseminated among the seven islands of the Archipelago, being the following table the geographic distribution of the power plants:

Type of Plant	Denomination	Power MW.	Location
Thermic	Candelaria	332,20	Tenerife
Hydraulic	El Mulato	0,80	La Palma
Thermic	Los Guinchos	28,67	La Palma
Thermic	San Sebastián	9,14	La Gomera
Thermic	Llanos Blancos	4,39	El Hierro
Thermic	Jinámar	367,60	Gran Canaria
Thermic	Guanarteme	64,74	Gran Canaria
Thermic	Punta Grande	97,51	Lanzarote
Thermic	Las Salinas	30,02	Fuerteventura

Most of the market supply is produced in their own power plants and a small proportion acquired from third parties, essentially the desalination plants from Gran Canaria and Lanzarote.

UNELCO production in 1.989 was 3.292 GWh, 11% higher than the previous year. Total supply to the grid of public distribution, available to the market was 3.186 GWh, 11% increment to 1.988.

The geographic distribution of the electric energy generated in 1.989, is as follow:

Island	Electrical energy production GWh	%
Tenerife	1.269	38,5
La Palma	103	3,1
La Gomera	22	0,7
El Hierro	10	0,3
Gran Canaria	1.498	45,5
Lanzarote	131	4,0
Fuerteventura	259	7,9
TOTAL	3.292	100,0

The total capacity installed at 1.989, was 935 MW, distributed as follows:

Islands	Total Power MW
Tenerife	332,20
La Palma	29,47
La Gomera	9,14
El Hierro	4,39
Gran Canaria	432,34
Lanzarote	97,51
Fuerteventura	30,02
Total Archipelago	935,07

The electrical generating systems uses four different systems, counting with two plants for water desalination.

The percent participation of each system in 1.989:

- Steam turbines 71,5%
- Combustion engines 19,3%
- Gas turbines 9,2%
- Hydraulic turbines 0,1%

2.3.- Renewable energies.

2.3.1.- Eolic and solar energy.

Due to the geographic situation of the Archipelago, and its latitude, the radiation intensity that is received is very much higher to any other point in Europe. Not only the sun hours but the radiation values in the islands are the larger in Spain, emphasized by having very small variations along the year, so it can be said that solar energy presents ideal conditions to be widely used in the Archipelago.

Therefore, in respect to other commercially installed energies, the more developed, at the moment, is the solar capture at low temperature, improved by institutional, subsidies per surface panels installed. However, the quantification of the produced energy by solar panels has to be estimated, through the fuel saving or electric power produced by the installation, and it could be 0.15 tce./square meter year.

In profit of solar energy to be transformed into electric power, the Consejería de Industria y Energía has performed a demonstration campaign with 18 rustic living and 24 points of public light have being electrify, with total installed power pick of 4.780 W.

There are another photo voltaic installations in some places far from the electrical distribution grid, such as head light, buoy, etc.

In eolic energy, the Archipelago is an exceptional zone, not only because its high potential, but its regularity along the year.

These characteristics are fundamentally due to its situation, because the band of high pressure towards 30º north latitude and the band of low pressure in the Ecuador, produce trade winds from N.E., that they are characterized regular and blow with an average speed of 4 m/sec ., being its maximal frequency in summer (about 90%), and minimal in winter (above 50%).

The aerial generators more important installed in Canary Island are:

Place	Island	Municipality	Model	Power Installed in KW.
Los Moriscos	G.Canaria	Ingenio	GA-14S	55
Arinaga	G.Canaria	Agüimes	GA-14S	55
La Aldea	G.Canaria	S. Nicolás	GA-14S	55
Granadilla	Tenerife	Granadilla	MS-2	250
Granadilla	Tenerife	Granadilla	CENEMESA	300
Granadilla	Tenerife	Granadilla	MADE	150
Granadilla	Tenerife	Granadilla	VESTAS	250
Granadilla	Tenerife	Granadilla	ECOTECNIA	150
Granadilla	Tenerife	Granadilla	ECOTECNIA	25
Granadilla	Tenerife	Granadilla	GA-14S	55

The following table gives the equivalent primary energy produced by renewable energies, and its comparison with the internal consumption and the total primary energy in the Archipelago.

RENEWABLE ENERGY CONTRIBUTION IN 1.989

Unit: Thousands of tce

Hydraulic	0,90
Solar	4,30
Eolic	0,30
Total	5,50

% internal consumption	0,20
% primary energy	0,13

As it can be established, the role of these energies, important from the point of view of clean energies and net saving of petroleum imports, have taken very scarce proportion from the energetic point of view, but due to the Archipelago characteristic, it is possible to think it will increase in the future.

2.3.2.- Geothermical energy.

The existence of historical and recent volcanic eruptions, the ample presence of manifested hot water, so the thermic anomaly of "Las Montañas del Fuego" (Lanzarote), make the Canarian Archipelago a chosen research point, since the beginning of thermal exploration in Spain.

The Consejo Superior de Investigaciones Científicas is investigating a zone close to La Montaña de Fuego in Lanzarote to determine the potential focus and its exploitation possibilities. Its origin is in a hot rock at low depth that maintain a natural air circulation entailed to volcanic phenomena, without aqueous fluid feed. The exploitation of this type of layer is in experimental phase and it will be based in pressurized water injection to obtain steam.

In La Palma island it also seems to be a geothermal layer of this type, fed by the volcano Teneguía. To study these structures, as much in Lanzarote as in La Palma, an agreement is going to be signed with EEC upon a proposal named "Project of experimentation and evaluation of the possibilities of exploitation of the dry hot rock at low depth in the islands of Lanzarote and La Palma".

In the Gran Canaria Island some previous studies have being carried out that allow to check the existence of a hot salty fluid in the subsoil in the South East of the island.

In Tenerife island it has been found evidence of the existence of a steam fluid at 300º C. that could be a layer of high entalpy. This zone is close to the Teide and if it confirmed, could be planed its exploitation by conventional geothermic techniques, using the steam to drive turbine generators.

2.3.3.- Biomass.

In the Canary Islands it has been examined the possibility to use the urban solid waste and so that, a study has been carried out to know the quantity and the average calorific power of this kind of waste in the Canarian Community. The estimated production value is 164.000 tons. According to the population and life level, normally the volume of waste increases, so this potential energety is expected to grow in the future.

The estimated humidity is about 57%. There is not influence of season variation in the waste composition. It has been estimated an average calorific power in 3.000 kcal/kg, so the urban waste theoric potential in 1.987 could be 55.000 tce.

The possibility of its use is diverse, and could be used to generate heat, or electricity or both in especially prepared plants, with a relative low cost and as well to produce organic fertilizers, with fermentable material.

3.- Energy demand

3.1.- Actual situation.

The three great markets in wich the Canary Islands could be differentiated had the following behavior in 1.989:

	Millions of tce	%
Internal market	3,2	43
National external market	1,2	16
Foreign external market	3,0	41
Total supplies	7,4	100

Here, the supplies to ships and planes are called "external market".

These figures pointed out the importance of the supply to the exterior foreign transport that represent 41% of total demand In the Canary Islands, whilst in the internal market does not reach 43% of total.

In 1.989 the final internal energy consumption reached 2.8 millions of tce., with a growth of 7.5% over previous year, considerable superior to the registered in the whole of the Spanish energetic system. The sectorial distribution of this consumption was as follows:

National maritime transport	28 %
Domestic use	24 %
Agriculture and fishing	12 %
Construction and Industry	11 %
National aerial transport	10 %
Terrestrial transport	9 %
Trade and services	6 %

These figures pointed out the importance of the sectors of the external national transport (maritime and air) that represent nearly 40% of final energy consumption.

Equally emphasize the importance of the domestic sector (including private cars consumption) and the industry scarcity, in contrast with the participation of this sector in the Spanish energy balance, denoting Canary Islands as low developed and low energy consumption region.

The following table shows the final consumption per type of energy, and manifest the importance of gas-oil as the fuel more utilized by the final consumer:

Gas-oil	42 %
Fuel-oil	17 %
Gasoline	16 %
Electricity	11 %
Kerosene	10 %
L.P.G.	4 %

In comparison with the national average, it is observed a bigger participation of liquid fuels (85% in the Canaries, 63% national), and a minor incidence in gas (4% against 9%). The electricity participation is as well considerable inferior in the Canaries (11% against 18% national), which denote an important delay in the Archipelago electrification.

3.2.- Geographical distribution.

The geographical distribution of fuel supplies in the internal market pointed out to a clear concentration in the bigger islands of Gran Canaria and Tenerife. This characteristic is still accentuated when ships and aeroplanes are considered, due to the strategic importance of the harbours in both capitals.

Next picture shows the situations of each market: internal, national external and foreign exterior.

FUELS SUPPLIES STRUCTURE PER ISLAND

Unit: %

Islands	Total	Internal market	External market: National	External market: Foreign
Gran Canaria	57,8	47,3	61,0	64,5
Tenerife	35,5	38,8	35,7	32,8
Lanzarote	3,8	6,8	2,7	1,9
Fuerteventura	1,6	3,5	0,4	0,8
La Palma	1,0	2,7	0,2	(*)
La Gomera	0,2	0,6	(*)	-
El Hierro	0,1	0,3	(*)	-
Sum	100,0	100,0	100,0	100,0

(*): Inferior quantities to 0,1%

Looking at the per capita consumption, there is great difference from one island to another. The islands with major economic expansion index (Lanzarote and Fuerteventura) had an energy consumption per inhabitant very much higher than the rest, whilst in the islands with more stable structure (La Palma, La Gomera and El Hierro) had a per capita consumption 40% inferior to regional average, including in this case the different share of primary or tourist sectors.

Something similar happened with the energy consumption ratio per unit of gross internal product, with values in Lanzarote and Fuerteventura much higher than the average, whilst in La Palma is too low. The value of this coefficient in La Gomera and El Hierro is, contrary, slightly higher to the regional due to their low economic development level.

For both coefficients, Gran Canaria presents values slightly higher than the average, and Tenerife slightly lower, although if auto consumption of CEPSA refinery had been included, the Tenerife indexes had increase in some way.

3.3.- The electric power demand.

Comparatively with some other markets of our social environment, the electric energy consumption in Canary Island is low. In the expression of consumption per capita, in 1.989, Canary Islands reached the figure of 2.010 kWh per inhabitant, while Spain head 2.960 kWh per inhabitant. Both values are too far away of those registered in the O.E.C.D. countries, which only Greece, Portugal and Turkey have a consumption per capita lower than the Spanish figures.

This low level of electrification is causing a very high growing of the electrical demand, as we can see:

GROSS DEMAND OF ELECTRICAL ENERGY

Years	Gross demand (GWh)	Anual Growing rate %	Consumption per-capita (kWh/inh)
1.972	890	-	730
1.975	1.160	9,2	880
1.980	1.680	7,7	1.170
1.985	2.407	7,5	1.150
1.989	3.292	9,1	2.011

The following table shows the evolution of the geographic distribution of the electric energy demand:

EVOLUTION OF THE GEOGRAPHIC DISTRIBUTION OF THE ELECTRICAL ENERGY DEMAND

Unit: %

Islands	1.972	1.975	1.980	1.985	1.989
Tenerife	39,8	39,0	38,1	39,2	38,5
La Palma	4,5	4,4	4,0	3,5	3,1
La Gomera	0,5	0,5	0,5	0,6	0,7
El Hierro	0,2	0,3	0,3	0,3	0,3
Gran Canaria	51,7	51,8	50,1	47,3	45,5
Lanzarote	2,3	2,8	4,2	5,6	4,0
Fuerteventura	1,0	1,2	2,8	3,5	7,9

The very high increase experimented at Lanzarote and Fuerteventura in the last 15 years came compensated, in the percent distribution, by lower growth in the coefficients in La Palma and Gran Canaria, so, in minor measure in Tenerife.

La Palma, as a consequence of being the electrical system with a lower increase, has passed from the third position in electric demand in 1.975 to occupy the fifth in 1.987.

4.- Canary Islands as a world center of maritime supply

Taking into account the importance of Canary Islands as a center of ships bunkering, as much commercial as fishing, the tourism specific weight and, therefore, the fuel supply for planes, it is interesting to analyze the demand originated by the foreign external transport, that raised in 1.989 to 3,1 millions of tce., equivalent to 71% of the total primary energy demand in the Canary Islands for the rest of energy consumptions, and it duplicate the amount supply to ships and planes of national flag.

The importance of Canary Islands as a world center of supply is undeniable, due to the volume of supply to national and foreign ships that is practically equal to the figure of internal consumption, and is situated in head place at world level, equivalent to centers like Rotterdam or Singapour.

The traffic evolution has unfavorable tendency for Canary Islands, because it is forecasted a gentle but continuous withdrawal of fishing fleets towards African harbours, as well as the stagnation in maritime transit in Canary Islands.

This oblige to a continuous effort to increase the captation level, compensating in this way the minor total traffic. In this point the fuel factor could be an important element, although not the only to get the objective.

This important fuel demand has generated in the main Canarian harbours, copious investment for fuel storage and supply installations and, in last instance, it represents to multiply by two the requirement of demanded energy for the Archipelago.

The evolution of the amount supplies to ships in the Archipelago has been very influenced by exogenous factors, among those could be mentioned the closing and later opening of Suez Channel, the international maritime market drop in the 70 and the decrease of petroleum transport after 1.973 crisis. The world fleets market drop nearly a 30% by consequence of the economical crisis and energy saving policy beginning by O.E.C.D. countries.

The following table include the evolution of total supplies from the Archipelago and its percent distribution:

FUELS SUPPLIES AND DISTRIBUTION BY MARKETS

		Percentual Distribution		
	Total supplies	External market		Internal
Years	(millions of tce)	National	Foreign	Market
1.965	4,3	14	71	15
1.970	6,7	16	66	18
1.975	5,1	17	49	34
1.980	5,9	18	47	35
1.985	6,3	17	46	37
1.989	7,4	17	44	39

The maximum reached in 1.970, with 6,7 millions of tce.,(favorable circumstance due to Suez Channel closing and the energetic crisis had not yet started and their reflecting to the international ship traffic), has not being exceeded till 1.989, and this is fundamentally due to to the push of aeroplanes supplies and the internal energy demand, because the supplies to ships are stabilized or had very moderated growth.

Although the supply to the foreign external sector are in first place along the period, it is observed the change that the consumption structure in the decade 1.965 - 1.975 experimented, as a consequence of the fall, during the firsts 70th years, of the supply to foreign ships and the spectacular development of the internal energetic consumption.

The fuels have been grouped in three categories in the external markets, which participation in supply is as follows:

EXTERNAL MARKETS STRUCTURE BY TYPE OF FUEL

Unit: %

Years	Gas-oil	Fuel-oil	Kerosene
1965	28	69	3
1970	21	74	5
1975	32	51	17
1980	24	59	17
1985	37	47	16
1987	39	42	19

It is observed a despaired tendency among the three fuels, with a very important jump between 1.970 and 1.975, that was justified, on one side by a spectacular increase in kerosene consumptions, as a result of the first Archipelago tourist development.

On the other hand, the fuel oil supplies are reduced to half in five years period, due to Channel Suez reopening and as a consequence of energetic crisis, whereas the gas oil supplies decrease slightly, what does not alter the fact that increase its percent participation, because on the whole, these markets supplies are reduced to 40% during those 5 years.

Since 1.975 it is generaly observed an increased trend in gas-oil and kerosene demand, and decreasing in fuel-oil demand, as for what the difference between gas-oil and fuel-oil supplies were already reduced to three points in 1.987.

5.- Energy prices

Fuels prices for navigation and aviation supplies, as well as the fuel-oil for the internal market are liberalized. Gasolines, gas-oil and LPG prices for the internal market are fixed by the Central Government, in accord with the Canarian Government, and are independent of those prevailing in the rest of the national territory.

It is due principally to that the Canarian oil sector has been developed in a more free way than the rest of the State, without the existence of the oil Monopoly CAMPSA.

On the other hand, the excise tax to the petroleum derivatives is very different in Canary Islands, because here, by now, it is not applied the T.V.A. (added value tax), and that will dispos of an autonomous fiscal system with lower taxes on oil products.

The trend to the future, however, is to liberalize the market and the selling prices, in such a way that the free competitive should be the one to control oil prices.

In relation to the electric rates prevailing in Spain, they establish the same uniformity in all the national territory, for what the electric energy, for the same type of utilization, costs in Canary Islands to the final user the same as any other place of Spain.

These rates are fixed by the Central Government and they are periodically actualized, in function of electrical sector costs evolution. Actualy, within these costs are enclosed determinated concept, as nuclear moratory financing, nuclear waste management, or coal storage, that are strange to the Canarian electrical sector. As well, on the contrary, the Central Government compensate to the exploitation Company for a major cost variability that implicate the absolute dependency of petroleum that must be supported by Canarian electrical power plants.

C. PLANS AND STUDIES PERFORMED ABOUT ENERGY

1.- The Energetic Plan of the Canary Islands (PECAN)

Today, the guidelines of the Energy Policy are laid down in the Energetic Plan of Spain (PEN) 1.983, where the problems of the spanish energetic sector are analyzed, the objectives to correct the mentioned problems are set down, the consumption objectives of energy and supply levels are defined as well as the actions to be done to get the referred objectives.

In the Canary Islands, its planning of energy must be consistent with the principles of the spanish energy policy and the EEC as well, but also must be compatible with other factors like:

a) The Canary singular case of the energy conditions (different energy balances and levels of supply; isolated systems of power generation and storage; etc.)

b) The energy context which caused the Spanish Energy Plan has substantially changed recently and justifies that the objectives and actions expressed there are under review.

For these reasons, the Canary Government took the decision to produce the Energetic Plan for the Canary Islands-1.989 (PECAN), where not only the consistency with the spanish and european policies are considered but also the actual technological and energetic situation as well as the specific and singular canary case already mentioned. This Plan was approved by the Regional Parliament on the 31st January 1990.

2.- Basic Principles of PECAN

The principles considered to make the PECAN are:

<u>Consistency</u>.- The PECAN principles have to be consistent with the objectives and guides of the EEC and spanish energy policies.

<u>Solidarity</u>.- This principle has to be considered in a double sense. On one hand, the guidelines of the PECAN have to be in line with the ones exposed in the energy planning of Spain as well as the EEC. For that reason, the objectives of PEN (spanish Plan) and ECC are continously taken into account.

On the other, the necessity of solidarity must lead to the following points expressed here under:

a) To establish a proper set of conditions in order to guarantee the availability and reasonable costs of all kind of energies in line with the rest of Spain.

b) To establish a set of measures of financial assistance similar to those provided by the Central Spanish Government for the power generation implying an indirect reduction of costs in the energy supply.

c) To avoid situations where the possibility of unbalance in quality and prices between islands do not occur.

Cooperation.- In order to get a perfect coordination between Administration, power companies and individuals, who are the final ones to take decisions.

Flexibility.- Allowing to identify a basic set of capable options so that events caused by unexpected changes as happened in the past may not risk the stability of the energetic system.

3.- The PECAN objectives

The objectives of the PECAN are:

a) General objectives

1.- To guarantee the energy supply of the canary archipelago, so that the future demand could be sufficiently covered, in quality as well as in quantity by supplies and by security storage.

2.- To reduce the level of vulnerability of the supplies, diversifying the supply sources for not depending exclusively on oil.

3.- To promote the rational use of energy, with the purpose of getting better rates of consumption per unity of regional product.

4.- To reduce the energy dependence from abroad, implementing when possible the use of new and renewable energy.

5.- To minimize the energetic production costs from the different productive sectors.

6.- To contribute to the proteccion of enviroment.

7.- To guarantee the supply of energy by a proper legal support to the productive sectors regarding to financial and technical solvency.

b) Instrumental Objectives

1. Power to regulate: To complete the transfer of faculties from Central Government to make possible the fulfilment of the above objectives.

2.- Price Policy: To adjust the price policy to the objectives of the macroeconomic and energy policy.

3.- Institution and Regulation Policy: To regulate the legal aspects of the energy with the reference of the mentioned targets and the specific characteristics of the Canary Archipelago.

This will be especially important in the aspects of generation and supply power, minimum stocks and product specifications.

4.- Technological Policy: To increase the potential of research aside from the adjustment in the fields of new energy resources and specially in renewable energy, in which the Canary Islands have excellent natural conditions.

5.- Credit Policy: To study the viability of the opening of special credit lines, in connection with the Regional or National Credit Institutions. These credit lines should undertake initiatives in fields like energy research and specially in the introduction of renewable energy or energy savings. This policy has to be coordinated with the available financial help from EEC.

D. THE ENERGY AND ENVIRONMENT IN THE CANARY ISLANDS

Energy use has a high impact in environment not only in relation to generation of power but also by all kind of different consumption sectors.

The Goverment of the Canary Island is deeply worried about the growing environmental degradation of the territory of the islands. The Energetic Plan of the Canary Islands (PECAN) has paid special attention to this problem and has proposed an action program which is right now under way. The pollution problems were divided in two categories:

a) Environmental problems directly related to the transformation and use of energy.

- Emissions of SO_2, NO_x, particulates, VOC by big installation of generation and consumption of energy (refineries, electric power plants, industry, etc.)

- Emissions of CO, NO_x and lead compounds by the large number of litte pollutant spots like engines of motor vehicles.

b) Environmental problems non directly connected to the consumption of energy:

- The spilling of oil and petrol products to the sea water because of the operations of ship loading and unloading in the ports.

- A big group made up of pollutants due to the daily human activity.

With regard specifically to the first category of problems the action plan of the Canary Government is the following:

1.- Fuels

Firstly, it has to be pointed out that the actions in this matter are intended not only to the emissions caused by the installations of production but also to the quality of products.

In the first case, and considering the location of the refinery close to an important town, the Government seeks to improve the policy of reducing emissions which has been going under way during these last years, including the provision of an adequate reserve of low sulphure fuels to preclude unfavourable climatic conditions.

As to fuel quality, the EEC regulations will be implemented without significant derogations as far as environment is concerned, specially in everything related to sulphur content in gas-oil for the internal market of the islands as well as lead content in gasoline.

The standards to be met by marine fuels will be the currently applied by the oil industry and the marine transport due to the special characteristics of this market and also because its consumption is made outside the geographical limits of the archipelago.

In gasolines, the availability and the introduction of unleaded petrol should be in line to the evolution of the number of cars. Fiscal incentives have been introduced to enable a more quick implementation. In any case, the EEC Directive is applicable and establishes an standard for the unleaded petrol of 95 RON, since October the first of 1.989, although the regulation control is being carried with a degree of flexibility in the petrol stations to get the precise adjustments in the service equipments.

Besides, the laboratories of the Consejería de Industria y Energía of the Canary Government are intensifying the quality control of the different fuels to assure that all the combustibles marketed meet the legality and all the technical specifications.

Moreover, all this is added to the supervision of emission standards and air quality.

With respect to the automobile sector, the above mentioned Consejería will increase the checking of vehicles on pollutant emissions in its own vehicle technical inspection installations as well as in the private firms of this service. This control will be complemented with inspections in the streets by the local and State Police.

Finally, it will be established a network to gauge the air quality by the Consejería de Industria y Energía itself or by Entities in due form authorized. This network will be set with priority in locations close to big installations of combustion like the refinery, electric power plants or industrial complexes.

2.- Electricity

The Government of the Canary Islands applies in this archipelago the same legislation about pollutant emissions and air quality like any country member of the EEC, not considering the exceptions made to Spain justified by the peculiar conditions of Mainland Spain but not applicable to the Canary Archipelago.

For this reason and for the existing electric power plants, the Consejería de Industria y Energía requires strict fulfilment of the enviromental legislation to achieve the reduction of pollutant emissions provoked by these installations.

The Consejería de Industria y Energía of the Canary Government will demand enviromental studies prior the authorization for the new plants or equipments, and also will subject these permissions to the strict fulfilment of the environmental legislation (enforcing even more constraint conditions when necessary). This Consejería will take a monitoring and continous control of the pollutant emissions from power plants, ambient concentrations and quality of utilized combustibles. The results of this work will be handed to the affected municipalities to keep them informed of the preventive adopted measures.

In this same line, the Consejería de Industria y Energía carries a follow-up of all projects submitted, as much as in the writing phase as in the execution phase, with the aim to control the necessary elements installed to reduce pollution. This task of following-up continues even though the power plants are operating to supervise the quality of combustibles and contamination standards.

E.- LEGISLATIVE FRAMEWORK

The legislative powers of the Regional Government of the Canary Islands stems from the spanish Constitution, the Autonomy Statute of the Canary Is. and the Royal Decree regulating the transfer of competences from the Central to the Regional Government.

The key point in the sharing of responsibilities is the role that Spanish Constitution awards the Central Government of defining "the foundations of the mining and energy legal framework" whilst the Statute of Autonomy of the Canary Is. takes the responsibilities of legal regulations and execution regarding the basic legislation of the State according to the established terms of reference.

Going down to specific aspects, the energy responsibilities of the Regional Governement of the Canary Islands can be splitted in three main areas:

1.- Energy policy.

1.1.- Definition of a specific Energy Plan for the Region.

1.2.- Orientative actions regarding the investments of the Public Companies, specially the electric utilities, operating in the Region.

1.3.- Authorization for construction and operation of new energy producing installations.

1.4.- Creation as proposed in the Regional Energy Plan of a Regional Energy Institute, to centralize and enhance the competences in the energy field and to promote the participation of the Regional Government in the producing companies.

1.5.- Regulation of the operating conditions of the energy producing companies.

1.6.- Specific regulation of energy strategic stocks and crisis measures.

2.- Pricing policy.

2.1.- Propose the oil products prices to the approval by of the Central Government.

2.2.- (This competence can not be extended to electric tariffs where a unified national price exists.).

2.3.- To determine a specific regulatory framework for electric tariffs regarding discontinuity and quality of supply.

2.4.- To determine, through the approval of the Regional Parliament, the level of taxation regarding the oil products (excise tax, as no TVA exists in the region).

2.5.- To establish a compensatory system for distribution cost of oil products between the large and small islands.

3.- Fiscal & economic incentives.

3.1.- Enhancing of rational use of energy through regional or EEC incentives (in that last option, resources have to be channeled mainly through the Central Government).

3.2.- Fostering of new and renewable sources of energy (specially solar and wind) again through direct subsidization.

3.3.- Determine subsidies for critical sectors/activities (LPG for households, fuel for water desalination).

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

LA CORSE, ILE DES ENERGIES NOUVELLES

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SEMINAIRE SUR LES PROBLEMES ENERGETIQUES
DES ILES DE LA COMMUNAUTE EUROPEENNE
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par:
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La CORSE, Ile des Energies Nouvelles

La Corse (a Corsica), 8760 km2, 250 000 habitants, est située à 80 km des côtes italiennes, à 180 km des côtes françaises et à 14 km de la Sardaigne. Ses consommations d'énergie s'élèvent à 650 000 Tonnes Equivalent Pétrole, dont 450 000 Tep pour les usages autres que les transports.
Ce niveau modeste est lié à sa faible population (29 hab/km2) et à sa faible industrialisation.

1/ Une situation de dépendance

La Corse ne dispose d'aucune ressource fossile : ni charbon, ni pétrole, ni gaz naturel.
La seule ressource locale qui ait été mise en valeur est l'hydroélectricité ; mais seulement 4% du potentiel sauvage disponible sur l'Ile a été valorisé de la sorte autour des années 60, alors que la moyenne française atteint un équipement de 26%.
Il en résulte un taux de dépendance énergétique considérable pour la Corse, largement excessif, et qui s'est fait au détriment du développement local.
Cette situation tient pour une part à la trop faible volonté politique locale, en tous cas à mes yeux, et aux yeux du courant d'opinion autonomiste et nationaliste que je représente.
Elle tient surtout au comportement de l'Etat français, et notamment de son agent énergétique EDF (Electricité de France) qui a un monopole d'Etat et qui a toujours traité la Corse à travers ses intérêts propres et non à partir des intérêts économiques de l'Ile.
Ainsi, l'existence d'un potentiel hydroélectrique important est un atout objectif fondamental de la Corse. Dans nos îles méditerranéennes, l'eau est la matière première indispensable à tout développement.
Avec 900 mm de précipitation par an en moyenne, les rivières de l'Ile peuvent être équipées à hauteur de 1000 Gwh, alors que, justement, en 1990, les besoins de l'Ile s'élèvent à environ 1000 Gwh!
Dans ce domaine essentiel, l'Ile pourrait approcher l'autonomie énergétique. En réalité, elle est dépendante à 70%.
Pourtant, chaque barrage hydroélectrique est une réserve d'eau supplémentaire gratuitement ou presque mise à la disposition

de l'agriculture et des autres besoins insulaires (au rang desquels la prévention des incendies n'est pas le moindre), puisque financée par les besoins de la production d'électricité.

Comment expliquer cette carence? Depuis 1970, EDF s'est refusée à procéder à l'équipement hydroélectrique de la Corse. Dans un premier temps, elle a préféré réaliser des centrales diesel au fuel lourd, positionnées dans le créneau de la fourniture de faibles puissances adaptées aux marchés limités, avant d'exporter cette technologie vers les départements d'Outre Mer et d'autres marchés de ce type à travers le monde. Puis, vers 1984, rencontrant une très vive opposition sur l'Ile, confrontée aux effets du nouveau choc pétrolier et à une prévision de surproduction d'électricité d'origine nucléaire en France, EDF a mis sur pied le projet de liaison par câble sous-marin entre l'Italie et la Corse, le câble ICO. La très forte opposition locale a amené EDF à composer et à admettre un programme hydroélectrique de compensation. Mais, très partiel et très étalé dans le temps, traité sans complémentarité avec les autres besoins de l'économie corse, notamment en matière de maîtrise de l'eau, ce programme est très insuffisant. Ce qui est très important pour l'avenir car, une fois le cordon ombilical installé entre l'Ile et le Continent, rien ne sera plus facile que de l'alimenter au fur et à mesure de l'évolution des besoins plutôt que de procéder à la mise en valeur des ressources locales.
Si bien que les potentialités de la Corse soumises au monopole EDF risquent fort de rester inexploitées ad vitam aeternam!

Enfin un nouveau projet déjà très avancé au niveau européen consiste à rattacher la Corse au projet de gazoduc entre l'Italie et la Sardaigne afin d'améliorer la rentabilité de cet investissement très lourd. Probablement ce rattachement a aussi pour but de rendre ce programme éligible aux aides spécifiques européennes pour les programmes de coopération transfrontalière.
Moins contraignant économiquement que l'électricité transportée par câble depuis le Continent qui est un produit final "prêt à consommer" sans aucun espoir de plus-value locale, le gaz présente cependant la même logique de dépendance.
Ainsi l'avenir énergétique de la Corse est placé sous le signe de la dépendance accrue ce qui est à l'opposé des intérêts légitimes de notre peuple qui se voit ainsi privé de la sécurité d'approvisionnement et, surtout, de la mise en valeur des richesses locales.

2/ Un espoir d'alternative : la Corse, île des énergies nouvelles

Située au coeur de la Méditerranée, la Corse bénéficie d'un excellent ensoleillement.
Très montagneuse, elle reçoit des pluies abondantes pour sa latitude, ce qui, en relation avec son relief accidenté, génère de bonnes potentialités hydroélectriques. Son climat, méditerranéen mais bien arrosé (en moyenne 900 mm par an), lui

fait bénéficier d'une couverture végétale importante, souvent dense, de forêts et de maquis.
Sa partie sud, battue par des vents réguliers, bénéficie d'une configuration physique aux abords des bouches de Bonifaziu (Bonifacio), qui en font un des sites éoliens les plus favorables de la Méditerranée.
Les atouts naturels de la Corse en font donc une île propice à la mise en valeur de presque toutes les énergies renouvelables: hydraulique, solaire, biomasse, éolien.
En théorie ses besoins en dehors des consommations du secteur des transports pourraient être largement couverts par son seul potentiel en énergies renouvelables.
En pratique, ce n'est bien sûr pas possible, ne serait-ce qu'en raison d'un parc existant d'installations qu'on ne peut modifier du jour au lendemain, et aussi des contraintes technologiques liées aux énergies nouvelles. Mais il est tout à fait possible de faire en sorte que le taux de couverture des besoins de l'Ile par les énergies renouvelables puisse atteindre un niveau très important, sans commune mesure avec ce qui se rencontre ailleurs, du moins sur le Continent français.
En tout cas, les énergies nouvelles sont le seul espoir d'améliorer l'autonomie énergétique de l'Ile dans le cadre d'une stratégie de développement économique autocentré.
C'est pourquoi un vaste mouvement populaire s'est développé à partir de 1976 dans l'Ile pour, au delà de la protestation contre les choix imposés par Paris, faire prévaloir le développement des énergies renouvelables.
Puis, l'instauration du Statut particulier de la Corse en 1982, qui a donné des compétences nouvelles à l'Assemblée de Corse en ce domaine, et la création simultanée de l'Agence Française pour la Maîtrise de l'Energie en France, ont permis l'émergence d'une politique suivie en faveur de ces énergies, à travers un Fonds Régional institué en 1984-85.

Plusieurs programmes ont alors été lancés :

- sur les minicentrales, avec le soutien de l'Europe, DG XVII dans un premier temps, et, massivement, programme Valoren pour une seconde partie. Cependant des obstacles administratifs ont ralenti et parfois empêché la réalisation des ouvrages programmés.

- le solaire thermique pour l'eau chaude commence à connaître une diffusion sensible dans l'habitat individuel. Même s'il ne concerne encore que 3% du marché concerné (habitat pavillonnaire), le taux de satisfaction enregistré laisse prévoir un bon développement, d'autant qu'il vient d'être décidé une augmentation sensible de l'incitation financière régionale (de 15% à 25% par installation). La pénétration du produit est plus rapide dans les établissements touristiques, particulièrement favorisés par l'adéquation parfaite entre la période de leurs besoins et les apports solaires maximum.

- le solaire photovoltaïque est devenu une pratique généralisée pour l'électrification en site isolé, avec des applications pour l'habitat, le tourisme (gîtes de montagne, éclairage de monuments), les besoins agricoles (pompage), et d'autres encore (signalisation routière en rase campagne, éclairage public, relais de TV, installation de chloration des eaux, etc...).

- la biomasse (bois-énergie) est une priorité, car l'impact économique attendu du développement de cette filière à travers d'autres technologies que l'archaïque cheminée rurale alimentée par bûches est multiple.
Le débouché "énergie" du bois conditionné en plaquettes forestières doit créer à terme un débouché pour les petits bois destinés ailleurs à la trituration et qui restent sans débouchés en Corse à cause de l'absence de papeterie. C'est toute la sylviculture insulaire qui en est pénalisée si bien que nos forêts, pourtant de très belle qualité, sont très mal exploitées.
Le bois-énergie doit aussi favoriser les opérations de démaquisage et de prévention des incendies. Enfin il est une activité complémentaire à l'activité agricole.
La réalisation de chaudières centralisées automatiques à plaquettes se développe à un rythme assez soutenu désormais, atteignant 2000 Tep, 4 ans après le lancement de la filière. Les perspectives de développement sont bonnes.
Pour parvenir à ce résultat, il a été décidé de structurer la filière autour d'un organisme parapublic, une Société d'Economie Mixte, regroupant capitaux privés et publics, dont la vocation est d'être un véritable opérateur énergétique du bois énergie comme le sont, pour les énergies concurrentes, les grandes compagnies pétrolières, Electricité de France ou Gaz de France.

- L'éolien enfin fait l'objet d'études en vue de l'implantation d'une ferme éolienne sur le sud de l'Ile.

Ces réalisations témoignent d'une volonté politique non négligeable en faveur des énergies nouvelles en Corse même si, à mon avis, elle reste très insuffisante.

La vocation de la Corse dans ce domaine des énergies nouvelles me semble très nette, et c'est pour elle un vecteur économique possible pour de multiples activités industrielles et de services qui ne manqueront pas de se développer dans les années à venir puisque le développement des énergies renouvelables est non seulement probable mais obligatoire.
Il faut, en effet, penser aux pays du sud qui aspirent au développement, et qui ne pourront le faire selon le modèle énergétique des pays développés, sauf à accroître la tension sur les ressources fossiles (et donc les risques politiques que cela suppose), et compte-tenu de la crise écologique et de l'effet de serre.
Or dans nos îles du sud de l'Europe, et spécifiquement en Corse où nous disposons de ressources abondantes, nous pouvons être les laboratoires "grandeur nature" de ces technologies; d'autant plus facilement que l'accès de nos îles aux énergies classiques du continent européen sera toujours, quel que soit le moyen choisi, économiquement plus cher, laissant donc de meilleures marges de compétitivité aux autres énergies.

C'est pourquoi je souhaite ardemment que la Corse passe la vitesse supérieure dans ce domaine et devienne rapidement l'Ile des Energies Nouvelles en Europe.
Encore faudrait-il que les programmes énergétiques étatiques ou européens, dictés par les intérêts continentaux représentés par les grands producteurs d'énergie, ne viennent pas étouffer dans l'oeuf ces perspectives encourageantes.
En conclusion, je veux m'adresser à mes collègues élus d'autres îles car nous sommes tous mandataires d'intérêts similaires.
Nos hôtes crétois ont insisté sur l'état de carence qui les menace. C'est bien sûr une priorité absolue.
Mais il est un état tout aussi grave que l'état de carence, c'est l'état de dépendance. Nous devons tout faire pour que nos îles et nos peuples n'en soient pas réduit à ne vivre que par le "cordon ombilical", comme sous transfusion.
Face à la logique macroéconomique des continents, nos économies insulaires sont menacées de mort. Nous devons absolument préserver notre capacité de production autonome, et notamment dans le secteur clef qu'est l'énergie.
Telle est en tous cas la volonté du courant d'opinion que je représente ici aujourd'hui, mais je pense pouvoir parler, sur ce sujet précis, au nom d'une très large majorité des forces vives de la Corse.
Pour nous il s'agit d'une priorité politique. Et, s'il le faut, ce sera un combat politique.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY IN THE SCOTTISH ISLANDS

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ENERGY IN THE SCOTTISH ISLANDS

by

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1 GENERAL INFORMATION

The British Isles lie on the Western seaboard of Europe and stretch from Shetland in the North to the Scilly Isles in the South (Fig. 1). The Scottish Islands lie to the North and West of the rest of the UK and are the most northerly extremity of the EEC. Shetland, Bergen and Leningrad are all approximately 60 degrees north.

It is convenient to consider the Scottish Islands in six groups:

(a) Islands in the Clyde Estuary (Strathclyde Region)
(b) The Inner Hebrides (Strathclyde Region)
(c) The Inner Hebrides (Highland Region)
(d) The Western Isles or Outer Hebrides
(e) The Orkney Islands
(f) The Shetland Islands

Figure 2 shows the geographical locations of these islands.

In Table 1, an estimate is given of the population in each group of islands together with the distance "as the crow flies" to Glasgow. The distance of a given island from the Scottish mainland is not very meaningful. For example, the Island of Skye in Highland Region is less than 1km from the mainland yet it is about 180km from Glasgow "as the crow flies" and about 400km from Glasgow by road.

Three of the groups of islands - the Western Isles, the Orkney Islands and the Shetland Islands - are all self-contained regions of local government. Table 2 provides some information on employment in these regions.

In this century there has been a gradual transition from a subsistence economy based on crofting and fishing to an economy based on fish catching, fish processing, fish farming, tourism, agriculture, textiles, oil and service industries. (Crofting is a Scottish term for part time farming of hereditary small holdings with income supplemented from outside sources.)

The islands tend to have short summers and wet and windy winters. This obviously has a detrimental effect on tourism and limits agriculture.

The topography of the islands varies from rugged mountains through bleak moorland to some good agricultural land.

2 ENERGY SUPPLY AND END USE IN SCOTTISH ISLANDS

2.1 Electricity

Scottish Hydro Electric plc is the successor of the North of Scotland Hydro Electric Board (NOSHEB). When the NOSHEB was created, it was given the responsibility of providing an electricity supply to all who live in the Highlands and Islands of Scotland and who wished to be connected. This responsibility is now deemed to have been completed. In the latter stages of connecting uneconomic consumers assistance was provided by the European Commission.

Initially, electricity was supplied to the islands by the installation of Diesel Generators at strategic locations. In recent years many of the islands have been or are being connected to the electricity distribution grid on the mainland of Scotland. Figure 3 shows some of the island submarine connectors and the location of back-up Diesel Generators, Gas Turbines, Wind Generators and Island Hydro Electric Schemes.

An ERDF grant for the second phase of the Western Isles project has been provided by the EC. A submarine link is being provided from Ardmore in Skye to Beacravik in Harris and Loch Carnan in South Uist.

Table 3 summarises the installed generating capacity (using conventional hydro electric and diesel or gas turbine) in the islands. There is an installed capacity of 125 MW at the oil terminal at Sullom Voe in the Shetlands using gas turbines but as this is not connected to the grid it has not been included in the table.

2.2 Renewable Energy Resources

The European Wind Energy Atlas (Fig. 4) shows that Scotland has the finest wind regime in Europe for generating power. In the islands, Burgar Hill in Orkney has one of the strongest wind regimes in Scotland. It was thus a natural site for testing wind turbines under development.

In the last 10 years about 10 wind generators have been erected on Scottish islands. Table 4 summarises their location, manufacturer, capacity, rotor diameter and approximate date. Many of these projects featured in the Community Demonstration Programme for Wind Energy.

The wind generator at Liniclate School was erected 2 months ago and is now being commissioned. It was designed, before Benbecula was connected to the mainland, to form part of "a stand alone" system with a 160kw diesel generating set.

The small wind generator on North Ronaldsay serves a low energy house which also makes use of solar energy.

The wind generator on Fair Isle was an early success story. A management system based on priority usage has been very successful and the system is popular with local residents.

In Foula there is a more elaborate computer managed system involving a 60 KW aerogenerator, an 18 KW mini hydro system with pumped storage facility and a 23 KW diesel generator as back up if neither wind nor hydro generator is operational.

A prototype wave energy generator has been installed in Islay (Inner Hebrides, Strathclyde) and is now in service.

2.3 Solid Fuels

Peat was the traditional method of space heating on many islands and is still widely used. This was later supplemented by coal which is transported to the larger islands by boat directly from the coalfields which makes it reasonably economic. However transport on from the first island of call makes it more expensive on the smaller islands. Coal sales to the islands are declining against increasing gas sales.

2.4 Gas

With the availability of coal, gas works were established at Rothesay on the island of Bute (1. Clyde Estuary), Millport on the Cumbrae (1. Clyde Estuary), Stornoway in Lewis (4. Western Isles) and elsewhere.

Today, British Gas plc (Scotland) supplies natural gas to the island of Bute and LPG (butane) to Stornoway. The liquid natural gas is conveyed to Rothesay in cryogenic lorries. Safety considerations require British Gas to charter a return trip on the car ferry daily to transport the lorries.

British Gas has withdrawn from the Cumbraes with the agreement of their customers who are now supplied with electricity or bottled LPG which is also delivered to many islands by road haulage using car ferries.

Bottle and bulk gas is available on most islands and is widely used domestically for cooking and portable heaters. Hotels and boarding houses also use it for cooking and in some cases for central heating. There is some industrial use of bottled LPG (Propane).

2.5 Petroleum Products

All of the islands are heavily dependant on petroleum products. Petrol and diesel are used for road transport, agriculture, fishing and for ferry operation. Because of the the climate a larger than usual amount is spent on fuel oil and gas for space heating. Table 5 compares energy prices in the islands with those in Central Scotland.

2.6 Transport

Figure 5 illustrates the main car ferry routes, ferry terminals and airports. Island groups such as the Shetlands have many internal ro-ro ferry services that are not shown. The traffic carried on car ferries shown is summarised in Table 6. Table 7 reviews car ownership and road mileage on the islands. Together these 3 Tables give a cumulative picture of the importance of car ferries in the life of the island communities.

It has sometimes been suggested that ferries in remote areas should be subsidised so that the cost per mile approximates to the cost of driving a car or bus. This does not happen in the Scottish islands. High ferry costs have an impact on some fuel costs on the islands.

Table 1 showed that the average distance from Glasgow to a group of islands varies between 60km and 450km. By land and sea such journeys are slow. The increasing use of aircraft has brought the islands closer to the rest of Europe.

The impact of North Sea Oil on Shetland is illustrated in the large number of "offshore" flights (Table 8). However, the small number of flights to European airports outwith the UK is a reminder of how remote the islands are.

3 ENERGY ECONOMY ISSUES IN SCOTTISH ISLANDS

3.1 High Energy Prices as Obstacles to Development of the Local Economy

During the first half of the twentieth century, the lack of electricity was a handicap to the development of the Scottish islands. Thanks to the work of Scottish Hydro Electric, who subsidised the connection charge to the grid, this handicap has now been removed for the greater part of the island population. Currently new users to the electricity grid are being asked to meet the full connection charge and this is a brake to further development, particularly in the rural communities.

On the whole, British Gas and Scottish Hydro Electric charge the same prices on the islands as on the mainland. However, coal, bottled LPG and petrol are more expensive in the islands, transport costs adding to their selling price. The high price of petroleum products is a real economic development problem. This is ironic given the high volumes of crude oil that pass through Orkney and Shetland.

While energy prices and the availability of energy are always important in economic development, the physical remoteness of the islands is also important. The islands are on the periphery of the EC. Some are 1000km from mainland Europe. This is a different order of magnitude from the distance of any other islands from "the mainland". Transport costs affect both the cost of imports and the difficulty of selling exports at competitive prices.

3.2 Exploitation of Local Energy Resources and of New Energy Technologies as a Means to Economic Development

Scotland has unique natural resources of renewable energy. As Figure 4 shows, Scotland has the finest wind regime in Europe for generating electricity. Table 4 summarises the existing wind energy installations on the islands. Wind generators installed to date are mainly of traditional design.

A case can be made for using the Scottish islands as a natural laboratory for the development of economical wind power. Investment in wind energy development in the last decade of the twentieth century could pave the way for economic use of wind energy in the twenty first century.

The Scottish Development Agency sponsored an appraisal of tidal energy in 1986. This was largely a desk-top exercise, but it points the way to many local schemes which could be viable in the future.

Wave energy development in Scotland received a set back in 1982 when the British Government cut back on funding. There is a growing consensus that this was a mistake which may have arisen through two errors - through underestimating the true cost of nuclear energy and through overestimating the probable cost of wave energy. The UK Department of Energy is reconsidering this at the moment and increased investment in wave energy technology may now be appropriate. Meanwhile, an onshore wave energy device has been installed on the island of Islay (2. Inner Hebrides : Strathclyde). This is now operational.

3.3 Estimations for Energy Related Employment, etc

Table 2 showed that about 5% of the islanders are involved in energy related industry ("manufacturing" + "energy and water"). Much of this employment is oil related in connection with the Sullom Voe oil terminal in Shetland.

4 ENVIRONMENTAL PROBLEMS

(a) Wind Energy

While a few experimental wind generators have been generally welcome, the reaction of environmentalists to a wind farm covering an island has still to be tested.

(b) Tidal Energy

A barrier placed in some of the best sites for tidal energy would interfere with the movement of both fish and sea transport. Provision of a fish ladder and system locks for local fishing boats could be provided with a slight increase in the cost of electricity generated.

(c) Wave Energy

The only installation at present is on a fairly small scale. Larger onshore devices would involve local disruption with the presence of contractors and their equipment. On the other hand, a long line of "Salter Ducks" would have to be sited in such a way that it did not interfere with shipping.

(d) Oil

The exploration for oil, the process of bringing it ashore and trans-shipping it all present hazards to the environment. Spillages are monitored but island beaches are under constant threat. Both Orkney and Shetland have contingency plans to deal with spillage accidents.

5 ENERGY STUDIES AND THEIR IMPLEMENTATION

A Scottish Energy Study is about to be launched with support from the European Commission. This will examine energy usage throughout Scotland. One task is to assess the scope for harnessing renewable sources of energy. The Scottish islands will be involved in this.

Another task is to examine the opportunities for education in energy matters. For example, if a 2MW wind generator is erected on an island, who will service it? How will he/she be trained?

Throughout the Scottish Energy Study each task leader will be looking for practical projects for implementation. The Scottish Development Agency has a track record of implementing such projects. SDA is working closely with the Scottish Office in this Study and has selected a consultant and a steering committee who inspire confidence that this Study will have a practical outcome which will be beneficial for Scotland and for the Scottish islands.

6 ENERGY PROJECTS FINANCED OR ABOUT TO BE FINANCED BY THE EUROPEAN COMMUNITY

Reference has been made above to projects supported under the demonstration scheme. These projects are listed in Table 4

7 INSTITUTIONAL FRAMEWORK CONCERNING ENERGY

(a) The Scottish Office

Part of the UK government machine resides in Edinburgh. The Secretary of State for Scotland and his staff have some responsibility for energy matters. However energy policy is primarily driven by the Secretary of State for Energy and the Department of Energy in London

(b) Island Regions

Three groups of islands - the Western Isles, the Orkney Islands and the Shetland Isles - are units of regional government. Many of local government's powers have been taken over by the UK Central Government in recent years.

(c) The Highlands and Islands Development Board

The HIDB has responsibility for economic and social development in the Highlands & Islands within which island communities have a high priority. The Board has been involved in several projects to research and introduce new energy systems into islands.

(d) The Scottish Development Agency

The Agency has an Energy & Environmental Technologies Division solely devoted to green issues development in which energy plays a major part. Within the Highlands & Islands area, Agency activities are undertaken in close collaboration with the HIDB.

8 ISSUES FOR DISCUSSION

8.1 Energy Supply Issues

(a) Economics

Because of the distances involved, connection of the islands to the electrical grid on the mainland would have been deemed uneconomic by private enterprise. However, in preparation for the privatisation of Scottish Hydro Electric plc, many of the islands have been connected to the mainland distribution system. This involved assistance from the European Commission and the use of Scottish Hydro Electric plc's own resources.

POPULATION & DISTANCE FROM GLASGOW

ISLAND GROUP	POPULATION	DISTANCE FROM GLASGOW km*
IN THE CLYDE ESTUARY	12,900	60
INNER HEBRIDES	17,100	150
WESTERN ISLES	31,000	250
ORKNEY	19,500	310
SHETLAND	22,400	450

* "As the crow flies"

Table 1.

EMPLOYMENT

	WESTERN ISLES	ORKNEY	SHETLAND
LAND AREA sq km	2,900	1,000	1,400
POPULATION	31,000	19,500	22,400
EMPLOYED	8,900	6,000	9,100
in Service Industries	6,500	4,500	6,400
in Manufacturing	1,200	700	1,000
in Construction	700	300	700
in Agriculture & Fishing	300	500	300
in Energy & Water	100	100	800
UNEMPLOYED	2,000	800	600

Table 2.

INSTALLED GENERATING CAPACITY
(Conventional Hydro Electric, Diesel and Gas Turbine)

ISLAND GROUP Sites of Generators	INSTALLED CAPACITY MW	TYPICAL ANNUAL OUTPUT GWh
CONVENTIONAL HYDRO ELECTRIC		
Inner Hebrides, Storr Lochs (Skye)	2.9	7
Western Isles, Chliostair (Harris)	1	3
Western Isles, Gisla (Lewis)	0.5	2
DIESEL AND GAS TURBINE		
Inner Hebrides, Bowmore (Islay)	6.2	0.7 Standby
Inner Hebrides, (Tiree)	1.6	1.4 Standby
Western Isles, Arnish (Lewis)	Gas Turbine 22.0	-
Western Isles, Loch Carnan (Uist)	12.1	38.4
Western Isles, Stornoway (Lewis)	30.3	82.8
Orkney, Kirkwall	34.3	1.6 Standby
Orkney, (Flotta)	Gas Turbine 3.3	0.5 Standby
Shetland, Lerwick "A"	40.7	67.7
Shetland, Lerwick "B"	17.4	82.6
Shetland, Lerwick	Gas Turbine 9.7	-

Table 3.

FUEL PRICE COMPARISON

	MAINLAND PRICES	ISLAND PRICES
4 Star Petrol	44.9p/litre	48.4p/litre
Diesel	40.0p/litre	44.4p/litre
1 Ton Coal	£90	£120.00
15kg Butane Gas	£12.50	£13.35

Table 4.

INSTALLED GENERATING CAPACITY (Wind Generators)

ISLAND GROUP Site of Wind Generators	MANUFACTURER	CAPACITY/ DIAMETER	APPROXIMATE DATE
Western Isles, Liniclate School (Benbecula)	Windharvester	60kW/17m	1989
Orkney, (South Ronaldsay)	IRD	22kW/10m	1980
Orkney, Burgar Hill	WEG	250kW/20m	1983
Orkney, Burgar Hill	Howden	300kW/28m	1983
Orkney, Burgar Hill	WEG	3000kW/60m	1986
Orkney, Kirkwall	Vestas	75kW/17m	1986
Orkney, (North Ronaldsay)	Aerowatt	10kW/7m	1988
Shetland (Fair Isle)	IRD	55kW/15m	1982
Shetland, Scalloway	Vestas	55kW/15m	1983
Shetland, Susetter Hill	Howden	750kW/45m	1988
Shetland (Foula)	Windharvester	60kW/17m	1989

Table 5.

TRAFFIC ON CAR FERRIES

FERRY ROUTE	PASSENGERS thousands	CARS thousands	COMMERCIAL VEHICLES & BUSES thousands
Kennacraig - Islay	95	28	5
Oban - Craignure	436	69	6
Oban - Coll - Tiree	36	6	0.5
Oban - Barra - Lochboisdale	36	8	3
Mallaig - Armadale	114	24	0.3
Kyle - Kyleakin	1,167	366	35
Uig - Tarbert - Lochmaddy	116	33	6
Ullapool - Stornoway	130	26	10
P&O Orkney & Shetland Services	201	38	13
Orkney Islands Shipping Company	100	19	-

Table 6.

CAR OWNERSHIP & ROAD MILEAGE

ISLAND GROUP	VEHICLES LICENSED	PUBLIC ROAD LENGTHS km
WESTERN ISLES	9,960	1,180
ORKNEY	9,740	940
SHETLAND	10,200	900

Table 7.

PASSENGER TRAFFIC TO AND FROM ISLAND AIRPORTS

ISLAND GROUP AIRPORT	to	OTHER SCOTTISH AIRPORTS	OTHER UK AIRPORTS	OTHER EUROPEAN AIRPORTS	UK OFFSHORE
Inner Hebrides	: Islay	20,100	100	-	-
Inner Hebrides	: Tiree	5,600	20	-	-
Western Isles	: Benbecula	29,600	20	-	-
Western Isles	: Stornoway	64,400	150	10	-
Orkney	: Kirkwall	94,700	400	100	60
Shetland	: Sumburgh	196,000	230	1,600	113,000
Shetland	: Unst	49,700	20	3	48,000

Table 8.

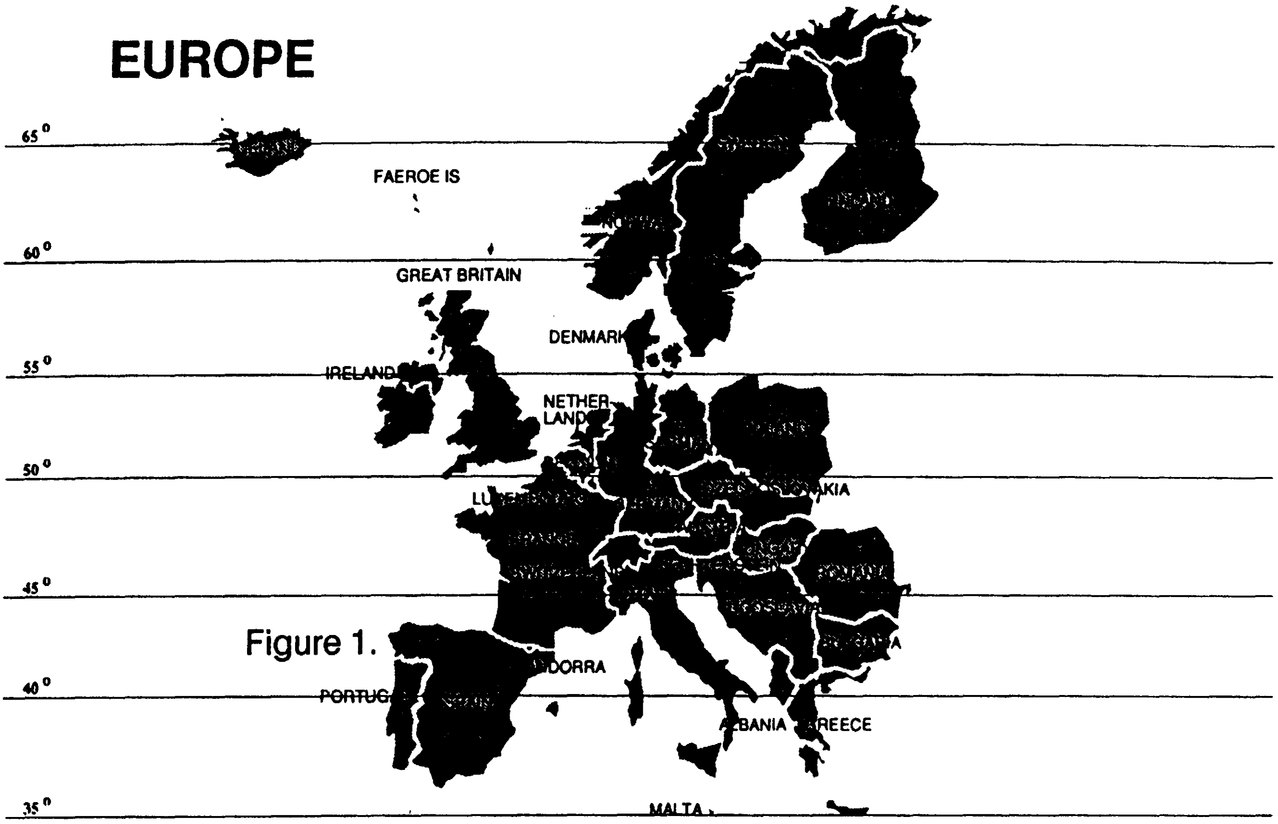

Figure 1.

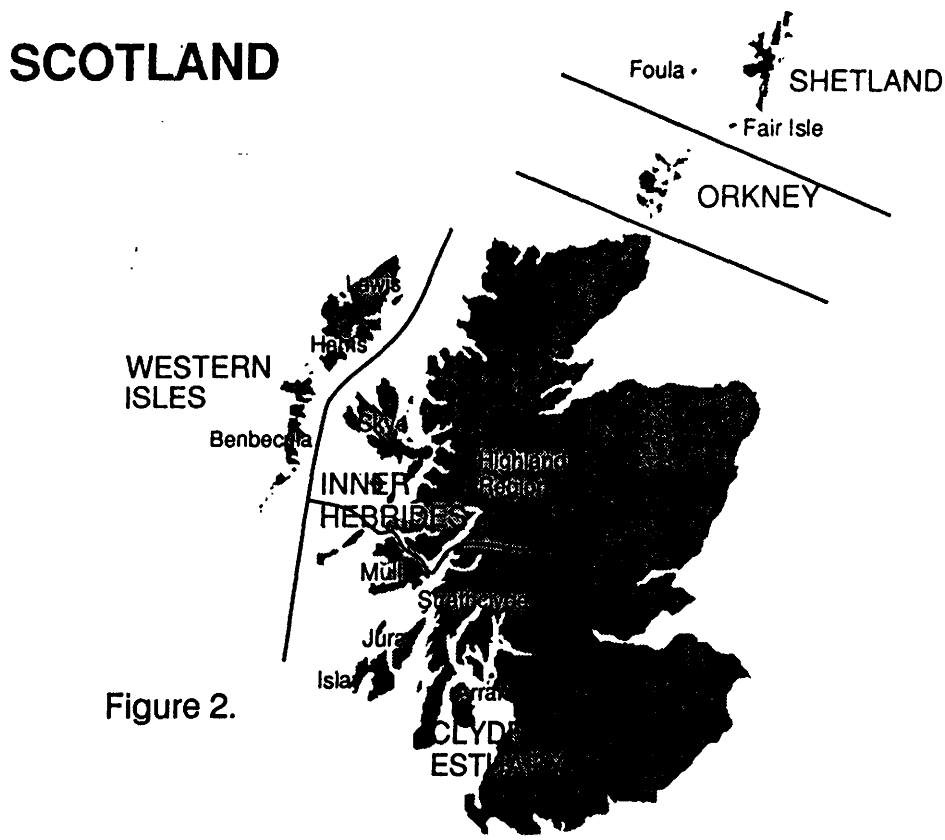

Figure 2.

ELECTRICITY SUPPLIES TO THE ISLANDS

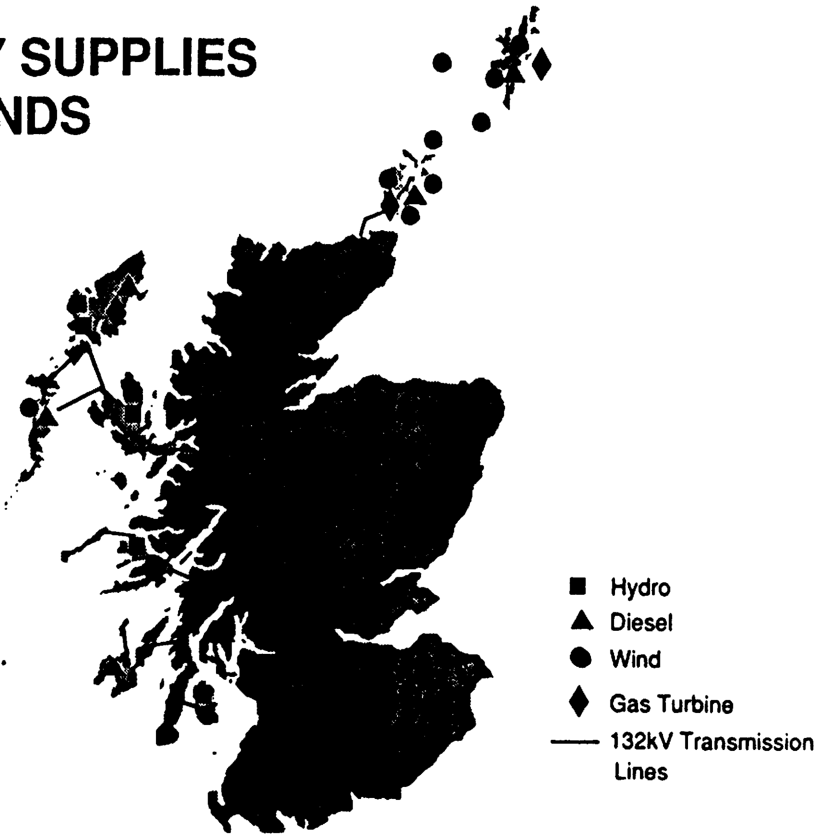

Figure 3.

ISLAND TRANSPORT
Car Ferries and Airports

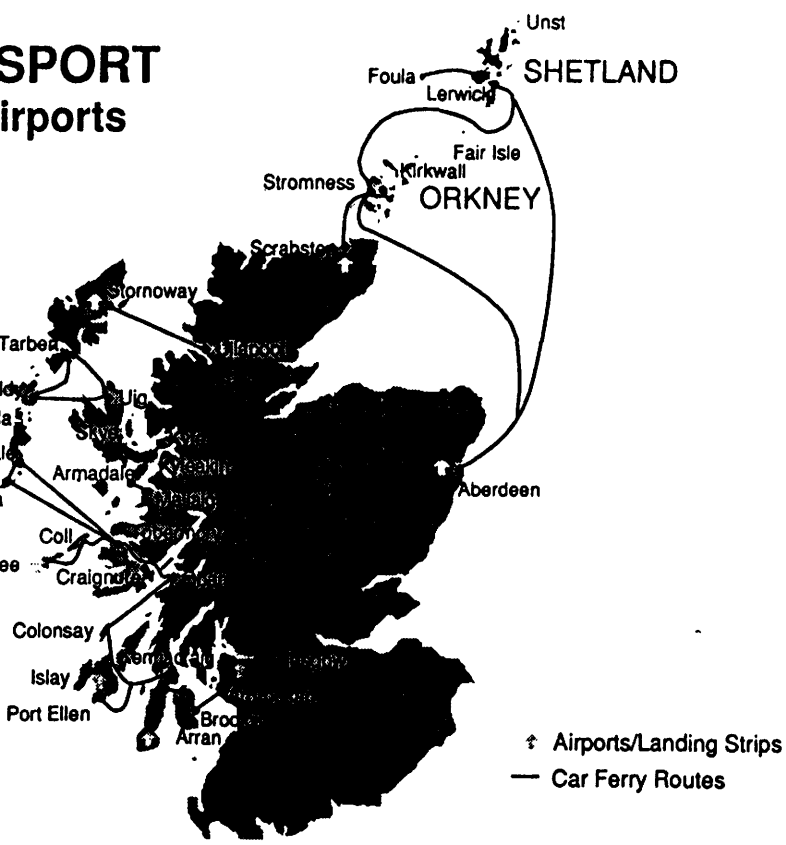

Figure 5.

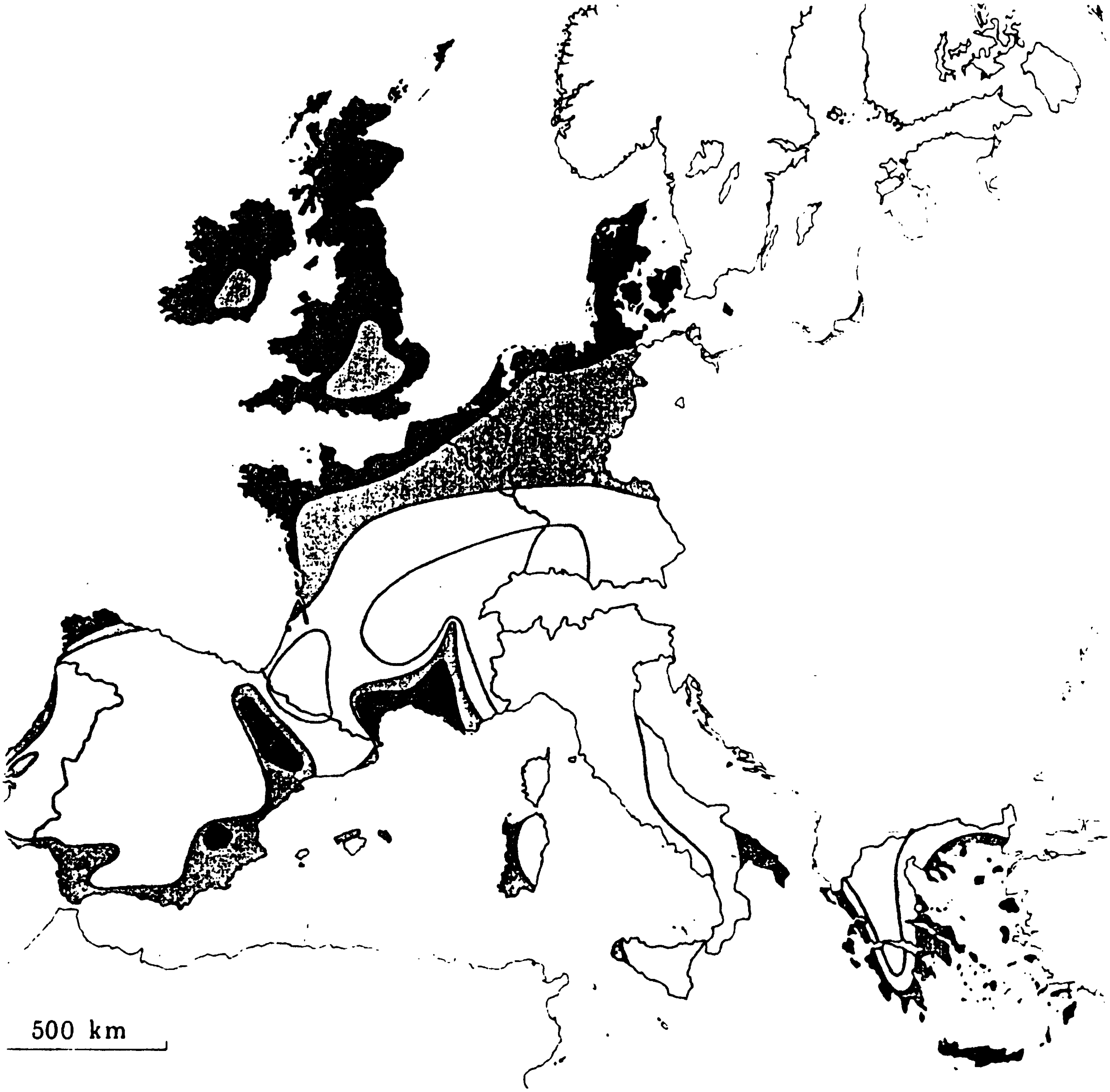

Figure 4.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY IN THE SCOTTISH ISLANDS
PROBLEMS & ISSUES

J. Baster
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Energy Issues in Islands - Crete - 11-13 November 1990
Submission from Orkney, Shetland and the Western Isles Islands Councils

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Energy in the Scottish Islands - Problems and Issues

1. Problems

Energy supply to the Scottish islands is not easy. This tends to be reflected in higher than average prices, especially for petroleum products (often lack of competition between suppliers is as important as additional transport costs - though transport costs become more dominant when supplies have to be double handled from main islands to smaller islands in the archipelago). Likewise, double handling of coal imports tends to raise its price in smaller islands. Gas is imported bottled, since safety regulations rule out bulk road tankers on ferries, thus raising its cost.

As far as electricity is concerned, those islands with a submarine cable connection to the Mainland are on the same footing as consumers on the Mainland (although such cables are expensive to install and replace). Islands too distant for a submarine link (eg Shetland) are dependent on local generation, usually diesel and very expensive. Although protected by the uniform tariff structure, they are vulnerable to any future change in this policy.

The above average cost of petroleum products affects a wide range of industries in the islands, eg farming and fishing, and puts them at a competitive disadvantage compared with their Mainland counterparts.

Ironically, Scottish islands are rich in raw energy resources of wind, tide and waves. Oil terminals on Shetland and Orkney handle tens of millions of tonnes of crude oil, as well as gas, all shipped to Mainland centres for processing.

2. Economic Issues

In the Scottish islands, one of the principal sources of demand for energy is domestic space heating, due to the sub-artic climate. In discussing supply considerations, it is important not to lose sight of the significance of demand reduction measures through better insulation.

Development of local energy resources has generally been complementary to Mainland connections in the Scottish islands, mainly due to the intermittent nature of wind generation. Other potential methods of generation, from tide and waves, would suffer from the same problem. But the islands would be an ideal test bed for technology on renewables, not least because of the extreme wind and sea conditions.

In certain islands, development of peat resources can be a partial substitute for imported energy.

Overall, Mainland connections play a crucial role in energy supply to islands and this seems likely to always be the case. ERDF assistance for installation has been extremely important. The cost of eventual replacement is a matter of concern.

Nevertheless, exploitation of the islands raw energy resources could make an important contribution to their economic development. Ultimately, islands might even become net exporters of energy, in cases where the existence of submarine cables makes this possible.

3. Financing and Pricing Issues

The above average price of petroleum products in the islands is a matter of constant concern to the island authorities. Transport costs are not always the main cause of this, and thus subsidy does not provide a straightforward answer. Lack of competition between suppliers is a real problem and it is not easy to see how this can be remedied.

The uniform electricity tariff is of crucial importance to the islands. Any change in this policy would have disastrous consequences for the islands.

4. Subsidy Issues

Grants to submarine connections have been vital. Grants to developing technologies in renewables - wind, tide and waves - are also crucial if these are to become established. Since the benefits of developing these technologies would be available eventually to all consumers, there is a case for all taxpayers contributing.

The uniform electricity tariff involves a cross-subsidy from Mainland to island consumers at present. Mainland consumers may not be happy with this forever - although they themselves may require subsidy when the eventual cost of decommissioning nuclear plant is included. When this happens, all consumers/taxpayers will probably be required to pay. Thus the principle of cross-subsidy may benefit other groups of consumers apart from the islands in the long run.

5. Environmental Issues

The principal threat to the environment from energy in the Scottish islands comes from the possibility of the storage of high level nuclear waste at Dounreay. Such a development is strongly opposed by all local authorities in the area, as it would threaten tourism and all the primary industries like farming and fishing which are dependent on a clean environment.

The handling of crude oil in Orkney and Shetland is also a threat which both local authorities have taken all possible steps to guard against.

The development of local energy resources has some visual impact but on the present limited scale, this is not negative, and indeed can even be a positive factor. Development on a large scale might be a different matter.

6. Institutional Infrastructure

Since energy supply is dominated by large national and international companies, local authorities in the islands have only a limited current role, and limited expertise, in energy planning. They are perhaps most active in promoting insulation schemes, and in inter-island transport subsidies. However, in different circumstances, they could take on a wider role especially in the three archipelagoes of Orkney, Shetland and the Western Isles, each of which has its own all-purpose authority.

Orkney - Energy Use

1. Liquid Fuel

Whilst the island of Flotta stores and loads onto tankers some 15M tonnes per annum of crude oil, all of this raw energy is exported, and some 27,000 tonnes of refined products are imported. Orkney's highly mechanised agricultural sector, and its fishing and ferry fleets, are heavy users of oil products. Most oil products are imported by coastal tanker. There are no particular problems about this but the oil companies operate a zonal pricing policy which makes oil products more costly in island locations. In addition, the lack of competition between oil companies in a small market place means that consumers do not benefit from rebates available in the centres of population where competition is intense. This is more important than zonal pricing in determining the level of prices in the islands.

More specialised products, such as aviation fuel for the inter-island air service, have to be imported in special barrels and obviously this adds greatly to the expense.

Delivery of liquid fuels to the smaller islands involves additional handling and expense. The cost of carrying liquid fuel tanks (barrels in the case of petrol) and tankers on the inter-island ferry service is paid by Orkney Islands Council.

2. Electricity

For many years, Orkney's electricity was generated in a diesel powered station in Kirkwall. Over the 70's and 80's, the smaller islands, which had previously relied on local generators, were connected to mains supply by submarine cable. In 1983, Orkney was connected to the National Grid by a 40 kilometre submarine cable across the Pentland Firth. The Kirkwall station is maintained on standby to meet peak demand and in case of problems with the cable.

Orkney has some 9,000 consumers and peak demand is around 25MW. Growth is mainly in the domestic heating market and in fact peak demand is at night, from night storage heaters, using low tariff electricity.

In addition to the local generating station, Orkney has 3 large aerogenerators, ranging from 300KW to 3MW. These prototypes have been in operation since 1983 and results are still being evaluated. Several small aerogenerators are in use as well.

The Flotta oil terminal has also installed 9MW of generating capacity using spare gas supplies. To date, supplies from this sources have been irregular.

Whilst local generating capacity is developing, Orkney is highly dependent at present on the National Grid connection. Current replacement cost of this cable, reputedly one of the longest submarine cables laid, is £20M.

Generation at the Kirkwall station from diesel is expensive and a return to this source might threaten the uniform pricing policy.

3. Gas

As in the case of oil, substantial quantities of methane, ethane, propane and butane are exported from the Flotta oil terminal. Distribution of piped gas to consumers in Orkney has not been considered economic (although there was previously a town gas system in the main town, Kirkwall). Bottled gas is re-imported to the islands and this is a costly operation.

4. Solid Fuel

Apart from some limited supplies of peat, which are mainly exploited by hand by householders for their own use, there are no local supplies of solid fuel. Coal is imported in bulk to the islands by coastal shipping. Extra handling costs make supplies to the smaller islands expensive, although one or two of these islands receive direct deliveries by ship at the same price as supplies to the Mainland of Orkney.

ENERGY SITUATION IN SHETLAND

John M. Burgess
Shetland Islands Council

COMMISSION OF THE EUROPEAN COMMUNITIES

SYMPOSIUM

ENERGY ISSUES IN THE E C ISLANDS

November 11-13 1990, Crete, Greece

Energy Situation in Shetland

General Information

The Shetland Islands - or Shetland as it is usually called by its inhabitants - is a group of about 100 islands of which 10 are inhabited and are unconnected by bridges. The total area of Shetland is 1,468 square kilometres and the population is approximately 23,000. The main port on the mainland of Great Britain serving Shetland is Aberdeen, some 338 kilometres distant. The only town in Shetland is Lerwick with a population of some 7,500. It is approximately 1,088 kilometres from Brussels and some 3,000 kilometres from Athens.

The main industries are fish catching, fish processing, fish farming, knitwear, tourism and oil.

Description of Energy Sectors

Since Shetland is so far away from the mainland of the United Kingdom, there is no connection to the electricity grid of Great Britain. All the inhabited islands except 2 are served by an electricity grid system with power coming from a diesel fuelled power station in Lerwick, the capital of Shetland. The generating capacity of the power station is 66.4 megawatts, and normal power output ranges from 10 megawatts to 36 megawatts, depending on the time of day, the season and the weather.

Four inhabited islands in the group remained unconnected to the Shetland grid in 1982. These 4 islands were considered uneconomic to connect to the grid by the electricity generating authority then called the North of Scotland Hydro-Electric Board, and since March 1990 called Scottish Hydro-Electric plc.

Until 1982 the island of Fair Isle had a community electricity supply, powered by 20 kw and 5 kw diesel generators which were very expensive to run. In that year a community scheme was provided with electricity coming from a 60 kw aerogenerator with the diesel generators as back up. Funding for the new scheme came partly from the European Regional Development Fund, partly from Shetland Islands Council and partly from the Highlands and Islands Development Board. The original diesel generators were recently replaced with two new ones of 60 kw total capacity.

Alternative Sources of Energy

In addition to the aero and hydro generators in Foula and Fair Isle, Scottish Hydro-Electric plc recently erected a 750 kw aerogenerator connected to the local grid; it is not yet fully commissioned.

Shetland is one of the windiest places in the world and therefore provides an ideal test bed for wind and wave powered equipment. No local research has been done to date on either wave power - or tidal power which is also abundant. Because of the prevailing high wind speeds and proximity to the sea, the atmosphere is salt-laden and therefore corrosive to metals. This unique combination of factors means that alternative energy equipment which is tested and found satisfactory in Shetland is likely to perform well in any other location.

Shetland also has some very extensive peat deposits which could be further developed. At present local peat is widely used as a domestic fuel, but none is used to generate electricity. A few years ago a proposal by the electricity supplier to establish a peat-fired power station in the island of Yell was shelved because E E C finance was refused. This project could be reconsidered.

E E C Finance

The present electricity generation and distribution systems within Shetland could not have been funded without E R D F grants. Unfortunately, these grants may not be available in future because Hydro-Electric is to be privatised in the near future and will become ineligible for E R D F grant under the present rules. Similarly finance for the replacement of old external ferries to the U K mainland is unavailable because the operator is a private company. This is hampering the provision of ferries best suited to the islands' needs.

In 1983 the Out Skerries were connected by submarine cable funded partly by Shetland Islands Council (£160,000) and the E F C's European Regional Development Fund.

In late 1988 the island of Papa Stour was connected to the grid by means of submarine cable, again partly financed by Shetland Islands Council (£69,000) and the European Regional Development Fund (£252,000 out of a total cost of £506,000). The remaining island of Foula is some 20 miles from the Shetland mainland and is unlikely to be connected to the grid on the basis of present electricity distribution technology.

In 1990, Foula, the last island to be provided with a community electricity scheme, received a supply from an innovative system with electricity coming from a 60 kw aerogenerator, or a 18 kw mini hydro system with pumped storage facility and with 23 kw diesel generator back up if neither the wind or hydro generator is operational.

Funding for this unique system came partly from the E E C (Energy Demonstration Project), partly from the Highlands and Islands Development Board, partly from Shetland Islands Council, and partly from the contractors, Windharvester Limited, who underestimated the cost of the project, and therefore met the shortfall.

Energy pricing by Scottish Hydro-Electric plc is by way of a common tariff throughout its area. Prices for electricity on the islands of Foula and Fair Isle are fixed by the local bodies managing the electricity schemes at levels which cover the running costs plus a contribution to a Sinking Fund which will be used to fund capital expenditure when major items of plant require replacement.

Energy Issues

Shetland is rich in primary energy sources, although ironically these are largely unavailable to the local population. Shetland is a large producer of crude oil with a production of 40 million tonnes in 1989 plus some 730,000 tonnes of butane/propane gas, but none of this production is available to local consumers. Refined products of crude oil eg petrol and diesel have to be imported from refineries on the U K mainland. Propane and butane, although available at the oil terminal, have to be imported from similar sources because there is no loading facility for the products. Importation inevitably adds to the cost of local fuels, compared with those to consumers on the U K mainland. The Sullom Voe Terminal which processes oil and gas has an installed capacity of some 125 mw although normal output is considerably lower; however all electricity produced is used within the terminal, there being no connection to the local grid.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY ISSUES FOR THE WESTERN ISLES OF SCOTLAND

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1 LOCATION AND GEOGRAPHY

The Western Isles Islands Area covers a chain of islands running approximately north-northeast to south-southwest and at its closest about 30 miles and at its furthest about 60 miles from the north-west coast of the mainland of Scotland. This chain, which is populated throughout its length, is approximately 130 miles long (210 km), equivalent to the distance from Inverness to Edinburgh, Milan to Bologna. The total area of the Western Isles amounts to some 300,000 hectares (3,000 km^2) or one-third of the size of Crete. The main islands which make up the Western Isles are, north to south, Lewis, Harris, North Uist, Benbecula, South Uist, Barra. The total population of the Western Isles is at present approximately 31,000 - two-thirds of whom reside in Lewis, the remaining one-third living in Harris, Uist and Barra. The town of Stornoway and its immediate environs has a population in excess of 8,000 persons, accounting for about one quarter of the Western Isles total. The remainder of the population is distributed in much smaller units throughout the islands generally on the coastal fringes and typically in linear crofting townships. The physical geography of the islands varies north to south as well as east to west. The northern half of Lewis consists of a large area of peat moorland. Southern Lewis, together with Harris, makes up the main upland area of the Western Isles. In Uist, the terrain changes from east to west with a prominent mountainous ridge running north to south on the east side and the flatter low-lying machair areas of the west coast bordering the Atlantic. Barra also shows some of the characteristics of Uist, with the high rocky land being to the east and centre of the islands while the west side resembles the Uist machair land.

The climate is greatly affected by the Atlantic Ocean. The warm air from the North Atlantic Drift helps to modify temperature and keeps the islands relatively free from snow and long periods of frost. Rainfall (about 1,000 to 2,000 mm per year) is persistent. One of the main characteristics of the climate of the islands is the wind speeds which are experienced. Severe gales reaching force 12 on the recognised scale of wind velocity (1 - 12) are often experienced in the winter months.

2 ELECTRICITY

The Western Isles is supplied with electricity by the North of Scotland Hydro Electric Board from 'diesel' power stations at Stornoway, Lewis (30mw) and Loch Carnan, South Uist (12mw) and from small hydro-electric power stations at Gisla, Lewis (0.5mw) and Chliostair, Harris (1mw). The Stornoway, Gisla and Chliostair stations serve Lewis and Harris; Loch Carnan serves Uist and Barra - Berneray, Eriskay and Barra being linked to the Uist network by submarine cables. A gas turbine station (22mw) at Arnish, Stornoway, commissioned in 1982, provides standby capacity for the Lewis and Harris network. Most areas receive a three phase supply. The main high voltage network in Lewis has been upgraded to provide spare capacity for areas in which further small scale development is likely to take place.

A small number of properties are still unconnected to a public electricity supply. There are plans to provide supplies in some instances but the contribution required from individual property owners towards the total cost of provision may act as a deterrent.

The most significant development in recent years has been the linking of the mainland national grid to Harris and South Uist with submarine cables from Skye. These links have been completed with EC assistance and also involve considerable lengths of new cabling onshore. When in operation fully, the new cable links will permit the power stations at Stornoway, Arnish and Loch Carnan to be reduced to standby duty except at peak times. Some concern has been expressed locally about the start-up time in the event of a break in the submarine cable and also with respect to the capacity of the submarine cable in relation to peak loads. Nevertheless, the cable link does open the theoretical possibility of power exports to the mainland in the future.

While the economics and logistics of wind generation of the bulk of the islands' electricity needs are presently unfavourable, there has been some interest in the aerogeneration of electricity at a smaller scale. The Western Isles Islands Council has been involved with the installation of a 60 kw wind turbine used in combination with a diesel generator in a new Community School in Benbecula. This latter project attracted a grant of £28,800 from EC DG XV11 as a demonstration project.

The Hydro Board has considered the building of a demonstration peat-fired power station of 3-8mw capacity in Lewis. An evaluation was made of the cost of constructing and staffing a peat-fired station and also of the amount of peat available and the cost of harvesting it. The Board investigated the possibility of EC and other grants which might be available for a demonstration project. However, to date, such a project has not proved feasible.

The sea area off the west coast of the Western Isles has been identified as being the area in the United Kingdom with the greatest potential for the exploitation of wave energy. The technical feasibility of a large scale wave energy project linked to the national grid is still in some doubt, although the submarine cable link to the mainland, recently completed, could be an important asset.

Tidal energy has received little attention either in the Western Isles or at a national level. Research and development work on small scale tidal energy devices has continued in recent years and the Western Isles are considered to be highly suitable for the installation of pilot scale tidal (and low head hydro) devices producing between 10kw-500kw approximately, although no projects have yet been followed through.

3 GAS

Within the Western Isles, only the town of Stornoway has a piped mains gas supply, the gas being produced from liquid butane brought to the Island by sea tanker. Although most of the town is served by the supply, there are no plans to extend the area covered to include the adjacent housing areas of Plasterfield, Manor Farm or Stile Park. The gasworks in Stornoway is classified as a major hazard by the Health and Safety Executive and, as such, restricts certain types of development in its immediate vicinity. Due to restrictions on sea transport, bulk gas is not available on the islands.

4 OIL/COAL/PEAT/BOTTLED GAS

Apart from electricity, oil is the main source of power for industrial and domestic purposes and is imported to the Islands via Stornoway, Loch Carnan and Castlebay by sea tanker and thereafter distributed by road tanker.

There are reserves of oil in the seas around the Hebrides, but, to date, this has not yet been exploited for both technical and economic reasons.

Coal is imported, primarily for domestic use, by puffer through the main seaports.

Peat is an important source of domestic fuel throughout the Islands. Until recently, all peat was hand-won, but over the past few years, some experiments have been carried out into mechanised peat cutting, particularly in Lewis.

Bottled gas is in widespread use throughout the Islands, both for commercial and domestic use.

5 PASSIVE SOLAR ENERGY

The location of the Western Isles at latitude 58° N produces extensive use of active solar devices for water heating or electricity generation. The Western Isles Islands Council has successfully carried out work on passive solar heating of flats and houses. There is scope for further development in this area and also for energy conservation in terms of design.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

EXPERIENCES IN REGIONAL ENERGY PLANNING IN THE GREEK ISLANDS

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SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

EXPERIENCES IN REGIONAL ENERGY PLANNING IN THE GREEK ISLANDS CRETE - LESVOS - CYCLADES

by
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1. REGIONAL ENERGY PLANS

This paper describes Regional Energy Planning activities carried out by the Energy Policy Unit for three Greek Islands complexes namely the Region of Crete, the Prefecture of Lesvos and the Prefecture of Cyclades[1].

The regional energy planning activity in all three plans presents some common characteristics of an organisational, structural and methodological nature. On the organisational front, the plans are financed by the Directorate - General for Energy (DG XVII) of the Commission of the European Communities (CEC), in the context of its Regional Energy Programme. The formulation of the plans is always carried out in close and, as it has been proved, fruitful collaboration with the competent local and regional authorities.

On the other hand, all the three REPs concern island regions of Greece with many common structural characteristics. The studied regions experienced social, demographic and economic decline in the past. Some reversal trends observed in recent years are based on unbalanced growth of only one economic sector, that of tourism. The energy profile of the islands is dominated heavily by oil products, used also for electricity generation at autonomous power stations.

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1 The Cyclades project was carried out in cooperation with LDK - Consultants, Engineers and Planners

On the bright side, the local energy potential, mainly in renewable energies, is significant and, in some cases, greater than the regional energy needs.

The methodology developed and followed in the formulation of the plans presents some common characteristics, too. The diagnosis of the present energy and economic situation supported by on-site sampling surveys is a first step, followed by feasibility analyses of specific technical solutions, consistency checks with the use of integrated energy-economy models and formulation of a coherent Regional Energy Plan with a horizon the year 2000. The REPs are compatible with regional socioeconomic development objectives and with national and Community energy policy objectives. The plans are accompanied by specific organizational, financing and time schedule proposals that will facilitate their implementation.

The experience gained, however, in the path from Cyclades through Lesvòs to Crete has been used constructively and is reflected in the evolution of the form of the REPS and the specific proposals associated with each of them.

2. EVOLUTION IN REGIONAL ENERGY PLANNING

EPU has now developed through its activity in three successive REPs an integrated methodological procedure for regional energy planning. The analytical tool is an integrated modelling system of energy supply, energy demand and energy-economy modules that has been enriched to tackle employment and environmental issues. The planning procedure is supported by institutional, organizational and financial proposals that are of crucial importance for the implementation of Plans.

Perhaps more important is the evolution that characterises the form of the implementation proposals associated with each REP. The classical scenario approach gave way to specific energy intervention programmes and this is turn to integrated operational programmes, thus responding immediately to emerging new financing possibilities for the implementation of Regional Energy Plans in the context of the Flanking Policies of the Community's Structural Funds.

This progressive evolution will become evident in the brief description of the three REPs that follows.

3. REP FOR CYCLADES

The Cyclades is a group of over thirty dispersed islands in the middle of the Aegean Sea. High cost, low reliability and scarcity of energy have contributed to the underdevelopment of the region in the past, yet the region is endowed with renewable energy resources, whose potential is many times greater than the region's energy needs.

Consistent alternative scenarios of energy supply, energy demand and economic growth were developed, using an integrated methodology computerized in the Cyclades Modelling System. Energy, economic, technological, environmental, employment and social implications of each option and scenario are thoroughly examined. The best options that are included in the final Plan were selected with the help of a multicriteria analysis method, taking into account the opinions of the people of Cyclades and its representatives.

The REP for Cyclades is accompanied by three sets of proposals, referring to energy interventions, organizational aspects and time schedule respectively, in order to facilitate its implementation. An Energy Office within the Nomarchia and an Advisory Committee will organize and supervise the implementation of the Plan. The investment interventions will require a total of 20-25 billion Dr85 (about 135-170 MECU) for the 1985-2000 period and are structured in five sectoral application programmes, concerning:

- windgenerators of a total capacity of 3.9-12.2 MW for the production of grid-electricity

- energy-intensive development of the farming and fishery sector, involving mainly heating by low enthalpy geothermal energy of 650-800 hectares of greenhouses and 2 hectares of fish-farming units
- 15 sea water desalination plants of total capacity of 5750 m^3/day in combination with windgenerators and low enthalpy geothermal energy
- energy efficiency measures and solar collector applications in buildings
- other energy applications (e.g. biogas, photovoltaics).

In summary, the methodological aspects of the scenario approach and the integrated energy-economy and multi-criteria analysis was the main feature of the REP for Cyclades.

4. REP FOR LESVOS

The Department of Lesvos, consisting of the islands of Lesvos, Limnos and Agios Efstratios in the northeastern part of the Aegean Sea, possesses the characteristics of underdevelopment. The population is declining, the GDP growth rate is the lowest in Greece and the economy depends heavily on one cultivation, that of olive trees.

The energy picture does not help the situation. Although the contribution of biomass is significant, oil products are the exclusive conventional energy form with a rapidly increasing share and future economic growth will have to rely on them in a business-as-usual development path. However, the region is endowed with a large potential of geothermal, wind and solar energy, whose exploitation could contribute towards the economic development of the region.

The Lesvos Integrated Modelling System (LIMS) ensured the consistency of energy demand, energy supply and economic projections and provided a detailed evaluation of the economic, energy, employment and environmental consequences of the Plan. The REP for Lesvos consists of a set of 4 sectoral energy intervention programmes and a set of specific organizational and financing proposals that will facilitate its implementation. The investment interventions will require a total of 20 billion Dr85 (about 135 MECU) up to the year 2000 and concern:

- intensive cultivations of 125 hectares in greenhouses, aquaculture and drying of farm products, through the exploitation of low enthalpy geothermal energy
- a rational use of energy in buildings programme, promoting the penetration of integrated woodstoves, electric night storage heaters, heat pumps, fluorescent lamps and solar water heaters
- installation of a 0.75 MW geothermal power station, 6.5 MW of grid-connected windgenerators and 1.55 MW of autonomous windgenerators
- exploitation of energy possibilities in the olive oil branch.

An Energy Office within the Nomarchia and the proposed Lesvos Energy Committee will organize and supervise the implementation of the Plan. A promotion campaign has been outlined for the 1st phase of the Plan 1988-1992 with an estimated cost of 227.4 mDr, about half of which could come from Community sources. The main investment effort is expected in the 2nd phase 1993-2000.

In summary, the change in emphasis from methodology to implementation is the evolutionary characteristic of the REP of Lesvos. EPU has promoted the implementation of the major interventions of the Plan. As a result, the establishment of the Polichnitos Geothermal Company, the operation and expansion of geothermal cultivations and the establishment of specific windgenerator applications are now at an advanced stage.

5. REP FOR CRETE

The region of Crete is located in the far southern part of the Aegean Sea and consists mainly of the island of Crete. After a downward trend of population growth in 1961-1971 decade, the trend reverses dramatically in the next decade due to the exploitation of primary and tertiary activities. It indicates an overall index of the intensive development in the region.

The consideration of the past trends and the present situation of the energy and economic regional system leads to the major conclusion that the rapid development of the tertiary and rural sector is followed by high growth rates of energy demand. In parallel, the energy supply of the island is heavily dependent on oil products, which exhibit also penetration rate increasing against traditional energy forms. Furthermore, the extremely rapid development of electricity demand reflects to significant problems on the expansion of power stations. These disturbances attributed to the present growth path should be affected by corrective interventions.

Crete exhibits a considerable potential of renewable energy sources, adequate to contribute to alternative energy supply projects and to support local development. Wind and solar energy, biomass in the form of olive kernel waste, briquettes and firewood and hydroelectricity are available in large, or nevertheless in exploitable, quantities. Possibilities also exist for the more efficient use of energy in buildings, industry and the rural sectors.

The exploitation of regional energy potential and the possibilities for rational energy use interventions inspired the launching of this project for a "Regional Energy Plan for Crete". The main economic development possibilities are parallelly considered and in some cases they could be combined with local energy resources to energy driven growth for the region.

A rather exhaustive prefeasibility investigation was carried out for the appropriateness of energy technologies to be applied to the local energy supply conditions and to the local energy consumptions habits. Emphasis was placed on applications that could lead towards energy security augmentation and energy driven development and that could comply with the specifications of the General Secretariat of the Region of Crete.

The Energy Plan for Crete consists of seven energy intervention programmes, 4 of which are focused on local energy resources exploitation and 3 are dealing with rationalization of energy use. The anticipated development actions in the programmes are integrated within the planning period 1990-2000. More specifically the proposed energy intervention programmes are:

1. Exploitation of local energy resources interventions
   - wind energy applications
   - solar energy applications
   - small hydros
   - biomass applications
2. Rational energy use interventions
   - RUE in buildings
   - RUE in the industrial sector
   - RUE in the rural sector

It is evident that there are common actions between programmes of the two above mentioned classes. Since the Plan has not been yet accepted, the study team preferred to keep the integrated character of each proposed programme. By this way the regional authorities can select to launch a subset of the programmes without any compatibility problems. The proposed Energy Plan incorporates a combination of all the above mentioned interventions. A summary, comprising the main characteristics of the energy intervention programmes for Crete, will follow.

5.1 Wind resource applications

Wind energy production, is wind resource site dependent. For Crete, four basic wind class regions can be distinguished exhibiting annual mean wind speeds from 5.0 to over 9 m/s. WECS are mainly displacing electricity produced by conventional fuels, whereas sometimes they satisfy heating loads. Possible users of WECS should be considered the PPC, local authorities, private self-producers and farmers (windpumps).

The microeconomic analysis depends on the type of the WTG and on the potential investor. The criterion of payback period (PBP) is used for the economic viability evaluation. A discount rate of 5% is considered.

PAYBACK PERIOD (YR)	
Grid connected WTG	8.1 - 24.4
Autonomous WTG	10.9
Windpump	very high

The situation is improved if grants in the range of 30-50% are considered. The prohibitive figures for windpumps are attributed to the subsidized agricultural electricity rates with which the comparison is achieved.

The projected penetration of wind energy in 2000 is planned to be:

PROJECTED PENETRATION OF WECS, 2000		
	Capacity (MW)	Elec. Production (GWH)
Grid-connected WTG	60	180
Autonomous WTG	5	20
Windpumps	6	25
TOTAL	71	225

The overall investment cost of the wind energy programme is estimated to 17.7 bDr89, whereas if information, training, demonstration and other support activities included, the total programme cost is estimated to reach up to 20 bDr89.

5.2 Solar energy applications

Crete exhibits the greatest solar radiation in Greece. The practically exploitable potential concerns the coverage of water heating and space heating in buildings, of heat production in industry, of heating in greenhouses and of electricity production by photovoltaics. The most common appliance is the flat solar collector used already for water heating.

The microeconomic evaluation for Crete's conditions was based on the payback period (PBP) criterion and a discount rate of 5% was considered. Reference values of PBP for typical applications are:

ECONOMIC VIABILITY ASSESSMENT	
	PAYBACK PERIOD (PBP)
Thermosiphonic solar system	4.7 - 7.8 Years
Forced circulation solar heaters	16 - 17 Years
Swimming pool solar heater	9.7 Years
Passive solar	2.5 - 8.5 Years
Photovoltaics	52 - 200 Years

If investment grants were considered then the above values become half for forced circulation solar heating systems and photovoltaics. Generally, the viability of solar devices is satisfactory with the exception of photovoltaics.

The projected solar energy exploitation for 2000 by each application category is presented below:

PROGRAMME OBJECTIVE 2000	
Domestic hot water solar collectors	615 TJ
Forced circulation solar heaters	85 TJ
Swimming pool solar heater	4.5 TJ
Passive solar	2 TJ
TOTAL	706.5 TJ
Photovoltaics 320 KW	310 MWh/YR

The estimated overall cost of the intervention programme is expected to reach 15 bDr 89 from which 13 bDr are required for investments. The anticipated financial support from state and Community resources through grants and subsidies is estimated to about 20% of the total programme cost.

5.3 Hydraulic resource exploitation

A series of studies from different institutions have been carried out for Crete's hydroelectric potential. It is estimated that the technical exploitable hydro electricity in Crete is in the order of 600 GWh corresponding to installed capacity 200 MW. This estimation is based upon preliminary research for many sites at present. A total number of 48 sites are suitable for rapid exploitation contributing to about 180 GWh per year under 60 MW installed capacity. Electricity produced from small hydros will normally substitute diesel oil used in gas turbines. Furthermore, irrigation, town water, aquaculture and other development projects can be combined with electricity production.

A vigourous implementation plan for small hydro projects is proposed to take place by the target year 2000.

SMALL HYDRO IMPLEMENTATION BY 2000	
Hydro capacity	60 MW
Electricity production	178 GWh
Generation cost	
- Grants excluded	5.4 Dr89/KWh
- Grants included	4.1 Dr89/KWh

The estimated overall cost of the intervention programme is estimated to 10.5 bDr89 from which 9.7 bDr will be directed to investments and the rest to information and other activities. The financial support from the state and the Community, under the existing grant regime, is expected to be the half of total required cost.

The main coordination, organizational and information subjects will be undertaken by the General Secretariat of the Region assisted by regional institutions and consultant firms. The main carriers of the investment effort are the PPC and the local authorities.

5.4 Biomass applications

The main renewable energy resource which is exploited at present, is the biomass in the forms of firewood and olive-kernel. Significant possibilities are traced for the exploitation of animal waste, urban waste sewage and industrial wastes.

The prospects of a more intense utilization of biomass waste depends on the resolution of the technical problems associated with the harvesting, the fuel handling and the economic viability of the proposed interventions. Firewood consumption is considered that have reached at a saturation level.

The transportation and storage problem of solid biomass waste may be resolved by densification methods using briquetting technology. Therefore, the proposed programme is concentrated on biomass waste densification techniques and direct combustion, rather than pyrolysis and industrial process techniques, which are still at a demonstration level.

It is estimated that 145 briquetting units could be installed until 2000 based on the olive oil (65), vine (45), carob (15), banana (20) cultivations. The annual biomass agricultural waste which could be processed is accounted to be in order of 180000 tons.

The overall intervention is expected to increase biomass energy consumption by 2103 TJ/year in 2000, which is more than present olive kernel utilization. The estimated overall cost of the intervention programme is in the order of 2.3 bDr89. The major amount corresponds to the projected investment cost, whereas 125 mDr is expected to be directed to information and training activities.

5.5 Rational Use of Energy in buildings

Rational Use of Energy interventions in buildings in Crete are generally classified to:

- good energy housekeeping and energy management
- equipment replacement, addition and system retrofit.

Good energy housekeeping will be based on the diagnostics of short energy audits. Capital expenditures are not required with the exception of specific equipment service cost and minor workhours spent. Actions should be concentrated on specific electricity end-use, space heating and water heating. The implementation of good energy housekeeping techniques in the buildings sector should save 5-10% of the annual final energy consumption.

The microeconomic evaluation of equipment investments stressed out that oil products conservation associated applications have payback periods ranging within 1-7 years. Electricity conservation investments are moderately beneficial with the exception of power factor correction which exhibits considerable profitability.

The objectives for the year 2000, under the assumption that the proposed vigourous RUE programme will be initiated as soon as possible, are:

PROGRAMME OBJECTIVES 2000	
	ENERGY SAVING (TJ/YR)
DOMESTIC	
Good housekeeping	52
Investment intervention	1063
TERTIARY	
Good housekeeping	47
Investment intervention	117
TOTAL	1279

The estimated energy savings correspond to 19% of present final energy consumption in the domestic and tertiary sectors. The overall accounted cost of the proposed intervention is 25 bDr89. The financial support, which is expected to derive from state and Community resources, is estimated to only 2 bDr89.

5.6 Rational Use of Energy in the industrial sector

Energy conservation possibilities in the industrial sector of Crete are examined from the point of view of improving the overall energy system efficiency on the island while aiming toward reduction of oil dependence. Rational Use of Energy (RUE) interventions are dictated by the Small and Medium size of Enterprises (SME) and the conservation possibilities for each sector. However, the proposed activities could be divided into two categories:

- good energy housekeeping
- equipment replacement and system retrofit

Good energy housekeeping includes diagnosis of existing energy situation and opportunities for better management and organization of SMEs. The main activities to be carried out comprise:

- energy audits by which energy system diagnosis and exploitation of energy conservation opportunities are achieved.
- energy management which aims at rational management of energy consumption, economic operation of the system and strict maintenance procedures which do not impede with production volume.
- monitoring and control by which interactive processes are established in order to correct the operation of large systems
- minor equipment replacement where low cost equipment is replaced or added for the improvement of energy consumption.

Three categories of investment interventions are considered:

replacement of worn out equipment the energy efficiency of which has dropped, because of long time use

integration with energy conserving equipment; by the addition of such equipment the overall system energy efficiency is improved.

change over to new energy technologies, where better energy and/or economic operation can be achieved.

The objectives for the year 2000, under the assumption that the proposed vigourous RUE programme will be activated as soon as possible, are:

PROGRAMME OBJECTIVES 2000	
	ENERGY SAVINGS (TJ/YR)
<u>INDUSTRIAL SECTOR</u>	
. Good housekeeping	75
. Investment intervention	291
TOTAL	366

The estimated energy savings figure corresponds to 15% of present final consumption in the region's industry. The overall accounted cost of the proposed intervention is expected in the order of <u>3</u> <u>bDr89</u>. The financial support, which is expected to derive from state and Community resources, is estimated to cover about 40% of total cost or 1.2 bDr89.

5.7 Rationaal Use of Energy in the rural sector

According to the present situation characteristics and the perspectives of rural sector energy consumption, the rational energy use interventions should emphasize on water pumping and the increasing needs for space heating in greenhouses. Concerning water pumping the main effort should be concentrated upon the replacement electrical and gasoline fired waterpumps with windimills. On the other hand, greenhouse heating should be oriented to direct combustion of briquetted biomass waste. Parallelly, good housekeeping and maintenance practices should be generally implemented to existing mobile equipment.

The investment cost of a typical windpump ranges within 650 - 750 KDr89. The payback period remains unattractive under the prevailing electricity tariffs in the rural sector nowadays. However, this subsidization regime is expected to alter, so that windpumps will become competitive. With reference to greenhouse heating, the thermal energy cost of biomass waste briquette is accounted to 1425 Dr89/Gcal in comparison to 2604 Dr89/Gcal for fuel oil, which is the most competitive fuel. It is evident that this intervention is exhibited economically attractive.

It is estimated that the implementation of a vigourous programme for RUE in the rural sector in connection with the aeolic and biomass programmes the following objective could be achieved in the planning period 1990-2000.

PROGRAMME OBJECTIVES 2000		
	ENERGY DISPLACED TJ/YR	CAPACITY
WINDPUMPING	90	6 MW
GREENHOUSE HEATING	1200	5000 STREMMAS
TOTAL	1290	

The conventional energy substitution corresponds to about 80% of present final energy consumption in the rural sector. The overall accounted cost of the proposed programme is in the order of <u>2.95</u> <u>bDr89</u>. The financial support from state and Community resources is expected to cover 50% of total cost or 1.4 bDr89.

5.8 Alternative major energy supply options

The prospective major energy supply options for the island of Crete are rather downgraded in the study because they are not principally influenced by regional authorities. Two major projects, namely electric interconnection with the mainland and LNG supply are considered. The former one is studied by PPC since 1986 and important speculation has been developed on the sizing of the linkage. The LNG perspective is timidly aroused recently and an initial assessment is presented in the study.

5.9 Implementation of the Plan

The construction of a collaboration framework among the involved regional institutions and the local consumers should precede. Towards this goal and generally towards the promotion of the Energy Plan implementation, the General Secretariat of the Region and the forthcoming Prefecture Govrnments should play the predominant role.

Three stages of action should be distinguished promotion; development including design, financing and construction; operation maintenance and management. All the three stages should be successfully coordinated and motivated by the proposed Energy Office.

The Energy Office is expected to be the motivating institution towards the Energy Plan's implementation having the main role of actions supporting the sectoral programmes success. The EO will be placed at the General Secretariat of the Region and keep direct contacts with the Energy Development Offices of the Prefecture Governments. The EO gives advice to the RA on the evolution of the Energy Plan and reestimates the selected programmes to be launched.

The energy investment programmes can be financed from public and European Community resources. The recently launched Regional Operational Programmes of the EC could contribute towards the improvement of energy infrastructure and the expansion of renewable energy supply projects. The possibilities of financing through the Integrated Mediterranean Programmes are rather restricted, as this programme terminates on 31/12/1992. The VALOREN programme could be exploited as it is designed to help some regions in EC with energy economic problems. The Thermie programme could support dissemination and innovatory projects on renewables, rational use of energy and utilization methods of solid fuels.

The Development Law 1262/82 is currently being subject to change by the parliamentary congress. The existing attractive status for energy investments on RUE, renewables and oil substitution is expected to be kept and to be improved, as specific emphasis will be placed on energy environmental implications. The form of third party financing is under speculation to be used for the financing of small medium enterprises initially. However, organizational, financial and lack of experience problems should be relaxed at this stage.

5.10 Summary of results

In order to evaluate the energy, economic, employment and environmental impacts of the Plan, an integrated modelling system was developed and used. The REGional energy PLANning model of CRete (REGPLAN-CR) is a dynamic, annual step, time-forwared set consisting of three modules:

. an economic module based on a dynamic input-output formulation,

. an energy demand module,

. an energy supply module, based on an energy flow diagram representation of the regional energy supply system.

Tow scenarios were composed in order to evaluate the Energy Plan implication. The Reference scenario is used for comparison purposes and assumes a business-as-usual evolution of the Region. The Plan scenario takes into consideration the above mentioned proposed intervention programmes, anticipates additional investments of 54 bDr89 and affects an increase in the average annual growth rate of the gross regional product in the planning period 1990-2000 to 4.84% against 4.70% in the Reference case. A total of 3400 new jobs are created although the proposed interventions are not labour intensive. The average annual population growth is 1.06 against 0.90 in the Reference scenario.

Total final energy demand is expected to reach 69310 TJ in the year 2000 against 70170 TJ in the reference case representing an overall increase of 75% from the 1990 level.

The share of renewables in total energy provisions increases from 15.25% in 1987 to 17.72% in 2000 against a decrease to 8.66% in the reference case.

The overall contribution of renewables in electricity production is estimated to 471.2 GWh, which corresponds to 19.36% of the foreseen electricity production in 2000. The electricity imports through the interconnection cable are accounted for 60.77% of electricity supply in 2000. The contribution of renewables and imports will effect significant oil products savings in electricity generation, which at present is based exclusively on oil products.

The ratio of oil products imports to GDP in the reference case is 27% greater than in the Plan in 2000. This fact stresses that the implementation of the Plan contributes significantly to the reduction of the dependence of regional economic development on oil products.

The implementation of the Plan is expected to lead to an improvement of environmental conditions in the region. Oil substitution in electricity generation and rationalization of energy use are the two main poles for air pollution reduction. Generally, the penetration of renewables is accompanied with positive environmental effects. The disadvantage associated with briquette burning is not expected to cause any significant environmental problem.

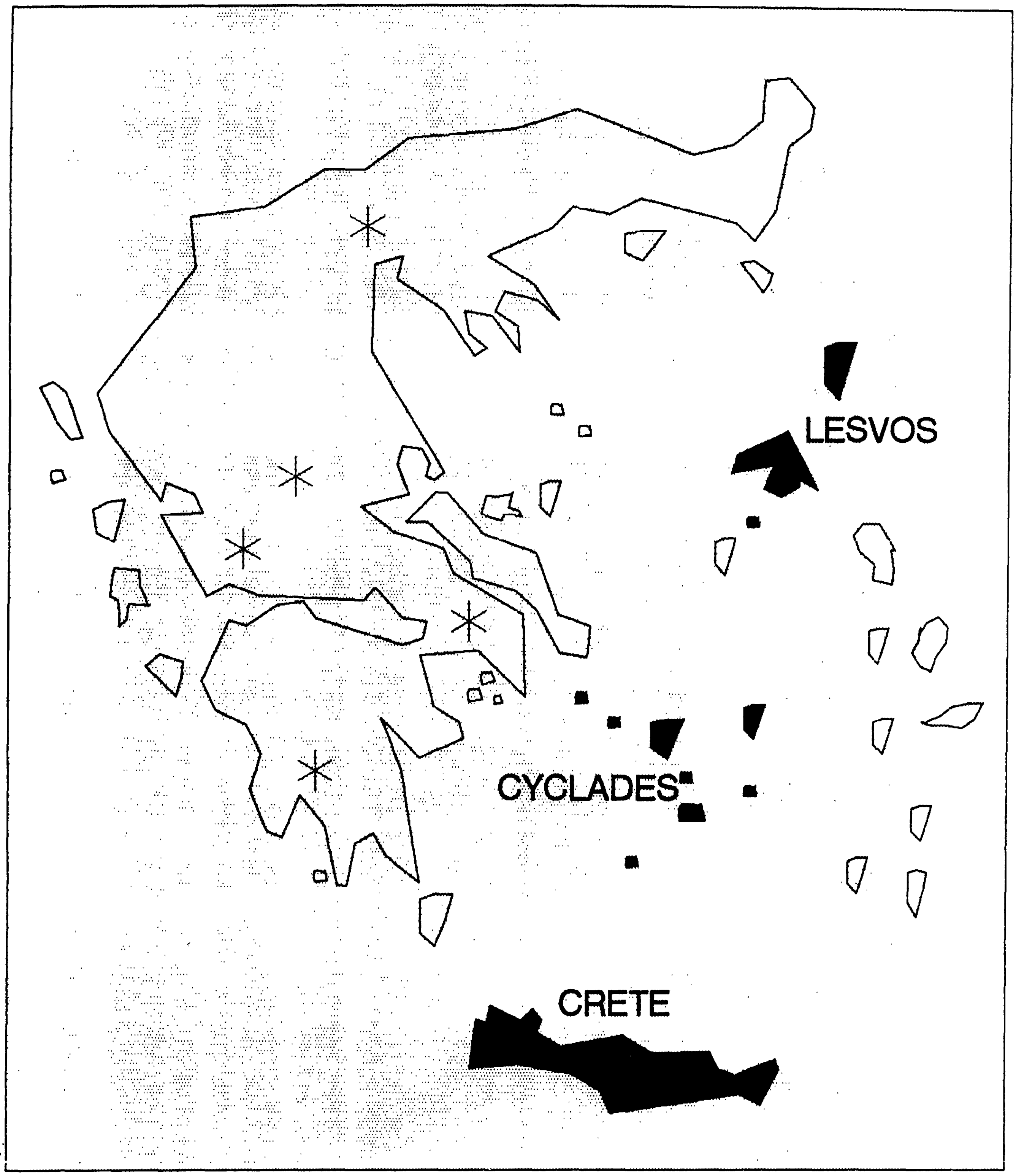
5.11 Concluding remarks

The Energy Plan for Crete is a proposal for local energy resources exploitation that complies with reduction of oil products imports. The Plan is also compatible with energy driven development of the less favoured areas of the region. Hence, the regional socioeconomic and the national and Community energy-economic objectives are targeted.

The Plan is structured in such a way that the implementation phases are facilitated. Seven energy intervention programmes with detailed technicoeconomic description, comprehensive guides, concrete targets and time schedule form the core of the Plan. Responsible bodies are identified and organizational actions are proposed for each activity within each programme as well as for broader activities in the framework of the Plan. Financing sources at regional, national and Community level are examined and specified for each proposed intervention.

The success of the implementation of the Plan rests heavily on the efforts to be put by the responsible regional and local authorities coordinated by the proposed Energy Office and the Development Offices of the Prefecture Governments, in particular, considering the relevant lack of experience in medium- to long-term activities. The responsible authorities should be assisted in their efforts, especially in the initiation phase, by competent bodies in the field.

REGIONAL ENERGY PLANS IN GREECE



EVOLUTION IN REGIONAL ENERGY PLANNING

1. CYCLADES

- Scenario approach with multicriteria analysis
- Integrated energy-economy development at macro level
- Exhaustive list of possible interventions

2. LESVOS

- Specific energy intervention programmes
- Implementation promotion of the major interventions of the Plan
- Analysis at prefeasibility study level

3. CRETE

- Emphasis on the motivation role of reg. authorities
- Prefeasibility analysis on most interesting intervention programmes
- Organizational, financial & technical guides

ELKEPA ACTIVITIES ON ENERGY ISSUES IN GREEK ISLANDS

M. Deligiannakis
Director General ELKEPA

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ELKEPA ACTIVITIES ON ENERGY ISSUES IN GREEK ISLANDS

by
M. Deligiannakis
General Director ELKEPA

It's a pleasure to address this Conference, that takes place in my own hometown and deals with "the Energy Issues in EC Islands".

The energy problem has been one of the most complicated, unresolved and critical issue all over the world. The regulating factors of this issues (e.g. the prices) are characterized by high instability. The traditional sources of energy are not unlimited while their extensive use creates serious ecology problems.

Although the use of energy has become more rational (conservation of energy, substitution of conventional fuels and development of renewable sources of energy like solar, wind, biomass, geothermal etc.) this does not give the essential solution of energy problem. Therefore efforts have to be increased.

In the case of the islands the energy issue has a special dimension in comparison with continental. This speciality is mainly caused by: the increased carrying cost of conventional fuels and products, the high cost of connection of islands grid to the continental one, the strong peak of electric load during the peak period of tourism in islands etc.

On the other hand we must consider the usually rich local energy potential of Greek islands, especially the renewable sources of energy i.e. solar energy, wind potential in most of them, geothermal energy in some of them etc. Consider that solar energy peak coincides with tourist period peak.

Concequently, the exact estimation and exploitation of this energy potential is very important for the local energy need.

Hellenic Productivity Centre (ELKEPA), has developed remarkable activities on the topic of energy, through the Institute for Technological Applications (ITE), (where a specific unit operates in order to promote energy issues) and in the islands through the local offices in Heraclion of Crete, Mitilini of Lesvos and Hania of Crete.

ELKEPA is trying to connect the increase of productivity with the development of energy technology offering the following services.

- Training and specialization programmes.
- Feasibility studies - Surveys.
- Design and installation of Demonstration plants.
- Awareness.

Training - Specialization

ELKEPA organizes and carries out - through ITE and its local offices - training programmes in energy issues in order to develop specialized scientists, who will develop the applications of modern technology, as well as modern processes and methods.

These programmes - whose subjects are based on the local needs and prospects of development - target executives, technicians and unemployed engineers. These programmes combine lectures and practice (the latter of which occupies more than 50% of course time).

Since 1988, 14 programmes attended by 268 persons, have been carried out, in Crete and Aegean Islands, on the following subjects:

Renewable sources and conservation of energy in Industry and Buildings, passive solar systems and bioclimatic Architecture, wind energy, geothermy, application of renewable sources of energy in Agriculture and energy design of greenhouses.

Feasibility Studies - Surveys
ELKEPA though ITE and its regional offices (in islands) carries out feasibility studies, in order to detect applications and products which can be developed by islands production enterprises. ELKEPA also offers consulting services for the solution of concrete local technological issues with the application of advanced energy technology.

Also ELKEPA with the collaboration of trainees of its local offices programmes has carried out 19 surveys on the following energy issues:

- Hot water production systems retrofits in the form of central active solar systems.

- Estimation of energy conservation retrofits potential in existing building envelope.

- Space heating passive solar systems and passive cooling techniques in new buildings.

- Evaluation of wind potential and possibilities of use of wind energy for the small and medium size enterprises in Crete.

- Energy performance study of Greenhouse with various energy sources (solar, geothermal, heat recovery).

- Exploitation of bioenergy in Crete.

  Energy performance study of caw - house.

- Energy performance of hydrodynamic in Crete.

Design & Installation of Demonstration Plants

In the framework of Mediterranean Integrated Programmes ELKEPA through ITE, has undertaken design and install pilot plants in Crete, in the subject of biotechnology.

This project will lead to the design and standardization of special waste treatment plants. These wastes are very common in Crete (olive mills waste, raisin plants waste, solid waste, sludge of municipal waste).

In addition to their treatment these waste can be used for the production of energy.

Awareness

ELKEPA, through ITE and its local offices informs on the importance and the possibilities of energy and advanced technology transfer and applications by organizing lectures, one day seminars, conferences etc.

Recently, ELKEPA has undertaken, through ITE in the framework of Valoren Programme, the creation of a network in order to provide consulting services in energy issues all over the Greece. The first two offices of the network will be in Mitilini and Heraclion.

This network will exploit the databases of ELKEPA and the databases ELKEPA has access to, in order to provide information for technical and economic features of energy systems, devices suppliers, pilot plants, bibliography, special scientists etc.

ELKEPA has even developed specialized gradually enriched libraries in its local offices, equipped with books, journals etc. (in Greek and foreign languages) on energy issues.

ELKEPA in order to contribute to the effort for conservation of energy in Greece has undertaken through ITE the development of a portable energy audit lab, an improved form of the well known energy-bus.

Using this energy-bus we can measure and record energy information. The study of these information will lead to the statement of measures (listed according to their cost) and retrofits of energy conservation.

This portable lab, because of its possibility to move, is perfectly adapted to the islands requirements. This lab is adapted to the form of small and medium size industries and handicrafts which exist in islands.

I wish every success to this conference. ELKEPA is very interested in the conclusion and the proposals of the conference. ELKEPA will do its best for the application of these proposals.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY POLICY ISSUES IN THE AZORES

Prof. Mario Fortuna
Regional Secretary of the Economy
Regional Government of Azores

ENERGY POLICY AND ISSUES IN THE AZORES

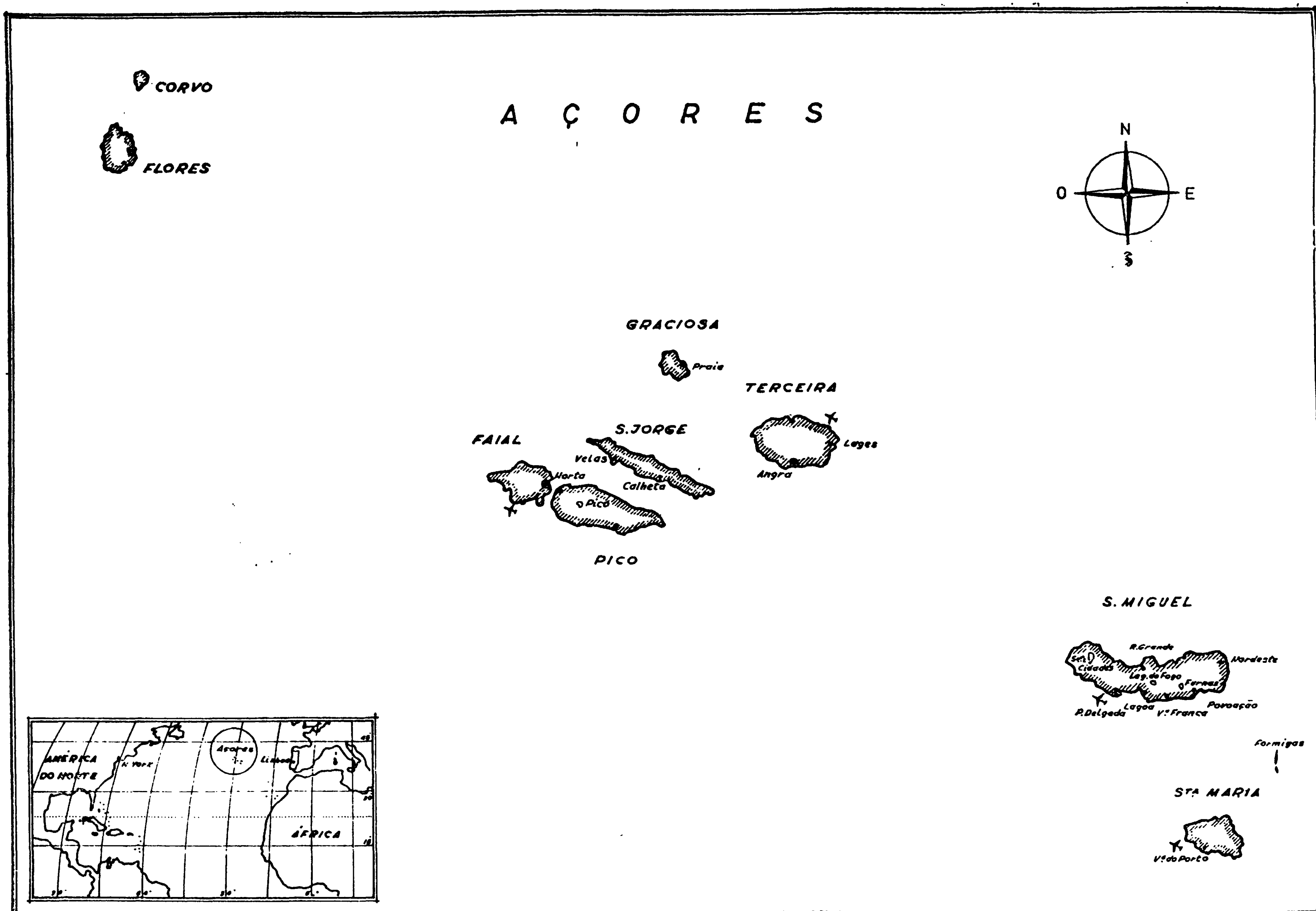
1. GENERAL CHARACTERIZATION OF THE AZORES

The Azores are an autonomous Region of Portugal comprising nine dispersed islands (fig 1) with a total area of 2333 Km2 and a population of about 257000. The archipelago is located one third of the way between continental Portugal and north america. The islands are therefore very isolated from any of the two continents.

In the economy of the Azores the primary sector (agriculture, cattle, raising and fishing) is still of critical importance accounting for about 25% of the employment and 25% of income. The secondary sector is very dependent on the primary sector (dairy, fish processing, cattle feed and agroindustry) and accounts for about 24% of employment and 26% of income. The tertiary a little less than 50% of income. Within the tertiary sector the tourism industry is growing but is still at a fairly undeveloped stage.

The unemployment rate in the islands has been very low for the past few years (well below 5%). This, however, might be associated to a strong emigration to north america and to a low participation rate of women in the labor force (about 35%). Underemployment is also a commom fenomenon in the primary sector.

Per capita income in the Azores stands at 60% the national level. Portugal itself has one of the lowest income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R.Grande
Nordeste
Cidades
Lag.do Fogo
Furnas
Povoação
P.Delgada
Lagoa
Vª Franca
Formigas
Sta MARIA
Vª do Porto
AMÉRICA DO NORTE
N. York
Açores
Lisboa
ÁFRICA

levels of the EEC.

2. THE ENERGY SECTOR IN THE AZORES

The energy sector of the Azores can be best characterized by the energy balance. Figure 2 contains estimated values for 1988, converted to tep's. Endogenous sources account for about 10.8% of the total energy supplyed. The major part of this energy comes from biomass. Hydroelectricity is the second most important source followed by geothermal (at an experimental stage) and wind. In terms of endogenous sources the pictures should change considerably in the near future with the implementation of the industrial stage of geothermal energy production.

From figure 2 one can also conclude that 89,2% of the energy used in the islands comes from imported sources. About one-third of this energy was used for transformation into electricity. The rest was consumed by final users. Fuel-Oil and diesel fuel was the most used type of energy.

On the final demand side one can conclude that biggest use is for transportation and industry as a whole. In the structure of final consumption electricity accounts for 14%, diesel for 36%, fuel-oil for 10%, gasoline for 14% and LNG for 12%. This structure does not differ considerably from the situation in 1982. From 1982 to 1988 total demand grew at an average rate of 3.7%.

Table 1 presents some comparative statistics for the Azores, Portugal and the EEC. One fact that is readily

AZORES

ENERGY BALANCE (ESTIMATES)

VECTOR	PRODUCTION	IMPORT	TRANSFORMATION		FINAL CONSUMATION			
					IND	TRANSP	RES/COM	TOTAL
Hydroelectric	3,9		3,9 → Electricidade	→	3,5		14,6	16,1
Geothermal	0,4		0,4 → Electricidade	→				
Eólic	0,1		0,1 → Electricidade	→				
Other Renewable	15,0			15,0 →	9,0		6,0	15,0
Fuel-oil		50,2	36,8 → Electricidade	13,4 →	13,4			13,4
Diesel Fuel		69,3	21,4 → Electricidade	47,9 →	18,0	29,9		47,9
Gasoline		18,8		18,8 →		18,8		18,8
LNG		16,4		16,4 →			16,4	16,4
Jet Fuel		4,3		4,3 →		4,3		4,3
Petroleum		0,3		0,3 →			0,3	
	19.4	159.3			43.9	53.0	37.3	134.2

evident is the lack of diversity of primary energy sources in the Azores. Of the external dependence of these islands, petroleum products account for 89.1%. For the same years per capita energy consumption in the EEC stood at 3.2 tep's as compared to 1.1 for Portugal and 0.7 for the Azores.

TABLE 1 - Primary Energy By Sources (%)

	EEC avg. (1985)	Portugal (1986)	Azores (1988)
COAL	23.2	11.9	0.0
PETROLEUM PRODUCTS	45.0	63.0	89.2
NATURAL GAS	18.0	0.0	0.0
NUCLEAR	12.0	0.0	0.0
HYDRO/GEOTHERMAL	1.5	15.7	2.4
OTHER	0.3	9.4	8.4
External Dependence	43.3	75.1	89.1
External Dependence on Petroleum	31.6	63.0	89.1

Currently the supply of liquid fuels is made from continental portugal to the islands of S. Miguel and then distributed to the other islands. This transport is made by a small vessel contracted exclusively for this purpose. Two islands, because they do not yet adequate ports receive the fuel in small containers.

Liquefied gas is supplied from the mainland to three islands, bottled and then distributed to the remaining islands.

As is evident this system is very expensive and would raise prices considerably in the smaller islands were it not for the regionally adopted policy of maintaining prices equal in all the islands.

It is the competence of the Regional Government of the Azores to set energy prices. The policy followed has been to tax gasoline and diesel fuel subsidise fuel for the production of electricity as well as liquefied gas. This policy permits a reduction of the impact of insularity both on the lower income consumer and on industry. Of course, this comes at the expense of foregone revenues that could otherwise be channeled to other programs. Prices in the Azores are, due to this policy, slightly lower than prices at the national level but have kept pace with them.

3. THE IMPACT OF ENERGY COSTS IN THE AZOREAN ECONOMY

Because most of the energy consumed in the Azores is imported and because these islands are dispersed, small and far from the continent, costs are very high. In spite of the fact that practiced prices are near the national levels there are costs that the economy bears to maintain them as such. One way the other the end result is than less resources are available for other uses in development programs.

The realization of the impact of the external dependence on energy has led the Government to develop all possible endogenous sources and to create incentives for conservation. This policy has led to investments on research and investments on the use of wind, hydro, geothermal and wave energy. Biogas is also produced by the private sector. The geothermal resources are the most promising at this stage because of the impact they might have. It is estimated that by 1992 this source might account for 60% of all electricity consumed in the biggest island (which accounts for more than 50% of all consumption). The geothermal project is also expected to advance to two other islands.

The geothermal project is expected not only to reduce energy dependence but also to facilitate the appearance of activities that might benefit from the use of the warm water that is produced in the process.

In any scenario, the energy sector and infrastructure in the Azores will always be dificult to administer and expensive. In fact there are nine separate, very small markets which do not permit economies of scale in the production of electricity or in distribution of any of the forms of energy. This, naturally, is reflected in a very negative impact on the development capabilities of these islands and demands that the authorities be continuously alerted to all developments in this sector.

4. ENERGY AND THE ENVIRONMENT

The Azores have not, to now, faced any major environmental problem related to energy production or consumption. As far as biomass is concerned consumption levels have not endangered the necessary equilibrium in forests. Hydroelectric production through the use of generally small creeks have not had any adverse effects that might be registered. The burning of various fuels, because of the islands dispersed nature and the influence of continuous winds have not caused any significant poluting effect. The only concerns that are now expressed refer to the exploration of geothermal sources given than the drilling might affect the water supply and the steam and warm water might affect the ecological ballance at the surface. All of these aspects have, however been taken into consideration in the choice of technology used both for the drilling and for the disposal of the steam and of the warm water.

5. THE AZORES ENERGY PLAN

An energy plan is being elaborated for the Azores to serve as a tool for the setting of policy for the sector. This plan, which is supported financially by the EEC, will seek to identify and simulate the relationships between the economy and the energy sector, taking into consideration the dispersion of the islands and their small size. The model will be fed by a data bank and a simulator will permit the creation of development scenarios and the consequences for energy demand and supply. It will include a macroeconomic module, a module for the energy sector and a sub-module for electricity.

6. COMMUNITY FUNDS AND THE ENERGY SECTOR

Since portugal joined the EEC in 1986, various projects on the energy sector have been contemplated with aid from various programs financed by the Regional Development Fund. These projects have been presented by the local authority for the sector, by the local utility and by the private sector. These projects have contemplated studies, and the production and distribution of electricity. The local electrical utility has also contracted various loans with the European Investment Bank.

7. INSTITUTIONAL FRAMEWORK

Under the portuguese constitution the Azores are an autonomous region with a considerable set of attributions in the definition and execution of economic policy. Energy policy is one area which has been conducted by the Regional Government even though some boundaries are established by the Central Government as far as taxes are concerned. Aside from the brackets established for taxation of some energy sources it has been up to the local authorities to determine price levels, investment policies for the sector, research and diversification policy, administration, etc.

One might say that as far as energy planning and policy the Azores have had a considerable amount of autonomy. Even though some adjustments are being made in the price fixing mechanisms for the various petroleum products it is expected that the Regional Government will maintain the autonomy it now has for the sector. As such the decision-making capacity is not an issue at this point.

8. THE INTERNAL MARKET AND ENERGY SUPPLY OF THE AZORES

The Azores are requesting that the Community support policies to minimize the impact of increased energy costs on economic activity and on the standart of living in the islands. This request is based on the recognition of the need for specific measures to adress the development problems of these islands, on the fact that they will not benefit from most of the impact of the internal market and of the trans-european energy distribution networks and on the policy of social and economic cohesion within the Community. This is, we consider, a central issue both for this region and for the EEC. The region is asking that the Community undertake a specific mesure to eliminate the additional cost of suppllying energy to the various islands.

The Commition has, in this respect, realized that any measure to improve the energy balance of the Azores should, on the one hand concentrate on their endogenous potential and, on the other compensate the additional costs of imported energy products. This can be partially attained by recourse to existing programs such as VALOREN, JOULE, THERMIE or others financed by the Regional Development Fund. The specific characteristics of the Azores demand, however, that additional measures be taken.

The Commition has also considered that it would be acceptable to have state aid finance the additional cost of supplying energy to the islands as well as to have an exceptional fiscal treatment for energy used in the production process.

This is an important development but, as far as the islands are concerned, it is clearly insufficient. On the one hand the solution of the problem is attributed to the home country, on the other the tax exemption or reduction will, in the case of the Azores, come at the expense of the regional budget given the current fiscal setup.

The need for the search of specific solutions for the problems of islands is also highlighted when we come to the analysis of the trans-european networks. In the case of energy the Commision has realized the need to strenghthen the distribution and transportation networks in order to better obtain a well functioning internal markets and economic cohesion. Specific mention has been made of the need to:

- introduce a transportation network of natural gas to Greece and Portugal;
- an maritime pipelines for gas between Ireland, the United Kingdom and France and also between Italy and Corsica and Sardenia;
- connect hand pipelines for gas between Spain and Portugal, on the one hand, and Spain and France on the other;
- improve the network of electricity distribution covering France, Spain and Portugal;
- to establish a network for the transport of electricity between Ireland and the United Kingdom

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY IN GUADELOUPE - FRANCE

M. Frager
Regional Delegate
of French Agency for Energy Management

I - GENERAL INFORMATION

* Guadeloupe archipelago is located in Caribeen Sea, 7000 Kms from continental Europe, and 1700 Kms from central América.

* It is a French Département.

* This archipelago is composed of one main island and five little dépendancies.

* The total population is about 385 000 inhabitants, on 1700 km².

* Main économic activities are tourism, buildings industry, agriculture (sugar cane, bananas, rum).

* We must remark that exportations are only one tenth of importations.

II - ENERGY IN GUADELOUPE

* Energy in Guadeloupe in mainly imported from neighbouring contries : Trinidad, Venezuela, Martinique. ,

* Only 8 percent of the total consumption is produced locally, from renewable energies :

  - géothermal energy
  - solar energy
  - biomass energy

* The total energy consumption comes to 385000 toe, that is to say one ton per inhabitant.

The increasing rate is 7 % per year.

* Electricity represent 30% of this energy :

- 600 Gwh/year
- P max : 100 Mw
- total installed power : 250 MW

- cost price is 3 times the sale price

1,5 F/Kwh ⇓ 0,5 F/Kwh

NB (1) 1 ECU = 7 F

NB (2) : in little islands, cost price is about 3F/kwh (gas-oil).

That is what the national company looses a lot of money in Guadeloupe : about 600 millions francs, almost 100 millions ECU each year.

In view of these elements, our Agency works hard :

1°) to devellop using of efficient energy equipements ;
2°) to devellop renewable energies utilization.

III - ENERGY RESOURCES OF GUADELOUPE

There is no possibility for fossil energies resources. But many possibilities with renewable energies, which are already in exploitation.

The following figures show you the different renewable resources in substitution of electricity, in operation and in position to be in operation next ten years.

	In operation	Next 10 years	TOTAL
- Geothermal	4 MW	10 MW	14 MW
- Solar Thermal	8 MW	18 MW	26 MW
- Photovoltaïc	0,3 MW	1 MW	1,3 MW
- Wind	-	1 MW	1 MW
- Biomass	6,5 MW	-	6,5 MW
- Hydraulic	-	25 MW	25 MW
- Waste	-	3 MW	3 MW
TOTAL	**18,8 MW**	**58 MW**	**76,8 MW**

About the next ten years 58 MW, 20 will be in operation at the end of 1992, because of two hydraulic turbins.

These figures have to be compared to the actuel electric grid maximum power which is 100 MW.

Actually, renewable energies and energy management represent 120 persons' permanent activity.

IV - <u>ENVIRONMENT PROBLEMS</u>

Generally, energy savings generate pollution reduction. For geothermal equipement, it was necessary to take care of sulphur gaz emission.

For hydraulic equipement, negociations with National Office of Forest and National Natural Parc of Guadeloupe have leaded to an agreement for increasing the minimal flow saved in the rivers, in relation to the legal minimum flow.

But hydraulic equipement allows a strong reduction of air pollution, because of saving about 20 000 t of oil, which will not be burnt each year.

Otherwise, we develop, for large air-conditionner systems, utilization of efficient double stage compressors, using R 22 freon instead of R 502, dangerous for ozone layer (Montréal Protocole).

V - PLANIFICATION

Energy politic is built by our Agency, in connection with Regional Council.
Electricity de France is also associated.

Our objectives are :

- control of consumptions
- developping of renewable local energies.

VI - FINANCING CONSIDERATIONS AND INSTITUTIONAL FRAME

Energy management are supported in Guadeloupe by public financing from :

- AFME
- Regional Council
- Europeen Community, through VALOREN programme.

A general agreement was dealt between AFME and Régional Council for five years (1989-1993), and Valoren programme came to intensify financing means necessary to realize the regional programme of energy management.

Others partners, as EDF, Department Council etc ... joined to us.

All the public actions are driven by AFME, in relationship with private operators.

VII - DISCUSSION POINTS

In Guadeloupe, renewable energies are :

- a development pole, generating jobs and reducing importations ;
- a strategic factor because of decreasing dependance towards outside regions and giving a better security in operation.

Valoren programme was a very important support to this development ; it represents :

. 20 millions F from EC for
. 200 millions F of investments.

But we think that energy programmes have to be driven during long periods.

Investments are important, new technologies are long to be efficient, understood, and disseminated, mentality are long to be changed.

That is why we think that it is not the moment to press on brakes.

Valoren programme has contributed to give a strong expansion to renewable energies in Guadeloupe.

Its flexibility was a big asset for its good execution.

As you have seen, with sufficient means, it's possible to change noticeably the energy dependance in this archipelago.

That is why, Guadeloupe Régional Council and AFME are demanding for a VALOREN II programme.

Thank you very much.

Marc FRAGER

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

CHAIRMAN'S SUMMARY & PRESENTATIONS

Dr J. Twidell
Director, Energy Studies Unit
University of Stratchclyde
Glasgow, Scotland

SYMPOSIUM ON ENERGY ISSUES IN E.C. ISLANDS

CHAIRMAN'S SUMMARY AND PRESENTATIONS

by Dr. John Twidell

Director, Energy Studies Unit
University of Strathclyde,
Glasgow, Scotland.

This summary follows the presentations made for the 9 island groups. Further presentations in this symposium will consider the commonality and range of immediate difficulties for the islands, such as the reliance on oil and the consequences of separation from mainland resources. However the purpose here is to take a step back from daily difficulties of island life to consider more fundamental factors.

1. EUROPE TODAY

History will record 1989/90 as unexpected drama. For the third time this century events in mainland Europe have led to continental and hence worldwide political change. The almost complete collapse of traditional communism and the lessening of Soviet dominance have transformed European national groupings. The European Commission must obviously concentrate effort and money on relationships with, and support for, the countries of the previous Eastern Europe. Already a new term is being used - Central Europe. The concept of a continental influence will be encouraged, built upon the traditions and industry of countries having little contact with the sea.

This new requirement to support Central and Eastern European economic reconstruction will be a change of emphasis for the Commission. Previously the strategy had been to strengthen the western and southern boundaries of Europe, most recently by the inclusion of Portugal, Spain and Greece into the Community.

The islands of Europe are predominantly on those western and southern boundaries. There have been most important and successful Community programmes of support from which all the islands have benefited. The changes in Central Europe must necessarily mean that the proportion of financial support coming to the islands is likely to decrease.

With regard to energy, the European Commission has given a lead to the development of local and indigenous sources. The support therefore for renewable energy has been adventurous and stimulating with the Commission's influence for the islands usually being far in advance of that of the national governments. Since renewable energy is best harnessed in rural areas, there was quite properly a bias to projects on islands, especially for wind and photovoltaic energy demonstrations. In such situations fossil fuels are more expensive in real terms than on the mainland, the environment is vigorous and so the economic payback for renewables is the more favourable.

In the former Eastern Europe, conventional fuels are used inefficiently with much environmental pollution. The Commission must now rapidly improve and clean up these systems while maintaining essential industry. This will be an expensive process with the short term requirements offering fewer opportunities for renewables.

In all, the events of 1989/90 will detract attention from the European islands and may well reduce financial support. It is important therefore to argue the case for the islands in a vigorous and coherent manner.

2. THE CASE FOR ISLANDS

For the purposes of this conference, "islands" are island groups with a distinct regional character. Their administration is such to favour local autonomy and a close link of such developments as energy with the need for local employment and the cycling of local cash expenditures. In practice every island has its own distinctiveness of environment, resources and, above all, culture. Such matters appear extremely attractive if life on the islands is well resourced, both to the islanders and to those on the mainland continent. There is a real sense in which the islands to mainland Europe are like the flowers to a garden. Keeping to this analogy, some interesting comparisons can be made with regard to policy for energy supplies and use.

2.1 New varieties

The range of island circumstances, especially with regard to the natural environment and the skills of the people, mean that local resources, and the means to utilize those resources, vary from island to island. For renewable energy this means that certain energy systems are particularly appropriate on some islands and not others. For instance wind turbine generators, small scale hydro power, photovoltaic power, remote location/autonomous systems, biomass utilization, wave power, tidal power and even geothermal sources will never be universally appropriate, but will certainly be appropriate as specific technologies on individual islands.

When a renewable energy system is appropriate on a particular island, it is likely to make a proportionately large contribution on the local scale. Examples are the wind turbines on the small Scottish island of Fair Isle and on Orkney. On the national mainland the same systems would have not been significant and their proportional contribution would have been trivial.

For these and many other reasons, islands are excellent places to harness new proven types of local scale technology. Islands are the places to both foster new varieties and to appreciate them.

2.2 Clean "disease free" areas

In agriculture, islands are important places for breeding and propogation, free from mainland disease or contamination. There is a sense that a similar benefit exists with modern technology, that now has to reach improved standards of environmental acceptability. Islands are places to appreciate the natural environment and to find values absent in the turmoil of mainland living. Thus islanders are quickly conscious of unacceptable pollution or developments which spoil cultural inheritance. For instance there are limits to the installation of diesel fuelled power generation because of fumes and noise. Undersea power supply cables appear beneficial, but they remove local employment and local cash flow.

Renewable energy technologists claim that their technology is largely free from chemical pollution, makes use of local natural resources and thereby fits into the local environment. With their sensitivity for both their environment and their economic wellbeing, islanders are in a good position to judge such claims. Once tried and found acceptable on islands, technologies are likely to move to the mainland as improvements to the general environment.

2.3 Embryo development

What may be called inappropriate, small scale and trivial on the mainland, may be significant on islands. An example is the generation of electricity from photovoltaic "solar cells" to provide autonomous power not linked to a central grid. On an island such a system has to be developed and used to its full potential. All the information has to be present, although the size of the structure and the power may be small.

Such complete, yet small scale, developments on islands can be seen for the mainland as perfect "embryos" which may be thereafter developed. Thus mainland finance can be used to develop the small scale system, with the knowledge that success on the island gives the information for later replication at larger scale. For the island the development has economic value in its own right, and for the mainland there is the gaining of complete experience.

2.4 Dissemination of knowledge and experience.

There is no benefit in producing a successful development unless the information about it is distributed for others to replicate the sucess. Because of the isolation of islands, this information transfer has to be considered carefully. There must be a framework for the information to pass to other islands, and indeed to the mainland. It is for this reason that the initiative of the CEC Directorate General for Energy is welcomed in bringing this European Island forum together. The Directorate's role may be compared to that of the Seed Merchant, who supports the growth of new varieties and then sees to their marketing and distribution with a carefully prepared catalogue of information.

3 SUMMARY

For the islands of Europe, this first energy conference has allowed exchange of information and mutual encouragement that cannot be obtained by each individual island with its own mainland national agencies. The Symposium has allowed a preliminary exchange of information that will hopefully grow into a full exchange of technological and institutional experience. The role of the Directorate will be essential in facilitating such exchanges across the vast distances of ocean that separate Bornholm from Sardinia, an7d Guadalupe from Crete.

John Twidell.

THIRD SESSION

FUTURE ORIENTATION OF EC ACTION

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY PROBLEMS FACING THE EC ISLANDS
(Inventory of issues raised during the previous session)

Prof. H. Baguenier
CEEETA

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

Energy problems facing the EC islands

Inventory of issues raised during the previous session

by
Prof. HENRI BAGUENIER
(CEEETA)

The problems brought up by the energy needs in the Islands of the European Economic Community are specific enough to justify a special approach and treatment. This idea, all of us had before going to Crete, was confirmed by all the speakers based on their own experiences as community or national officers, City Hall representatives, research centres or university research centres membres, or local energy agencies or electrical production and distribution companies. This common idea, that can seem obvious for some, is global enough to comprise approaches which are convergent in a certain aspect and divergent in another, depending on each person's references. That is why, in this first summary attempt (made too shortly after the event) instead of making a rather boring summary of each speech, we are going to group the conclusions (on the identified problems and proposed solutions) in two categories:

I. the convergent solutions
II. the divergent or specific solutions

1. The convergent solutions

• The islands'situation signifies the absence or insufficiency of access to the large energy transport and distribution systems (gas, electricity, oil/oil subproducts...) bringing overcosts to the islands (the smaller the region the higher the overcost - see presentation about the Greek Islands). This first "main idea" was emphasized by Monsieur Senetakis in the opening speech and afterwards retrieved by almost every speaker.

• The islands'situation generates a double condition of dependency on external imports and on oil (frequently only on oil subproducts). This situation weakens the stocks safety not only in case of international crisis, but also in the everyday life of certain small islands (see presentation about the Greek Islands). This external dependency keeps exchanges with the foreign markets permanently unbalanced. The presented figures showed a dependency rate nearing 90% (It is very difficult to compare situations when different energy equivalents are used and non-marketable consumptions are taken into account, specially biomass.) (French example about the electricity equivalence).

• The electricity production, transport and distribution systems are heavily burdened by the absence (impossibility or prohibitive costs) of network interconnections to the mainland or between the different islands in the archipelago (for example, Canary Islands, Azores, Madeira...). To the usual overcosts reasons related to market dimension, we can add the characteristics coming from the electricity demand structure itself. So (for example in Bornholm, Greece, Scottish Islands...) the heavy burden of household and terciary consumption, a direct consequence of the increase of terciary sector's importance in the islands' economies (verified in different stages by all intervenients), shows itself on the load diagramms that vary according to the season, sometimes even on the day. The energy power companies are, therefore, constrained to invest large amounts of money to equip to the peak and sometimes they are not able to satisfy demand (Greek example, small islands of Canary, Azores and Madeira).

• Due to the weight of tourism in the economy of the majority of the islands, the constraints on environment will increasignly decide energy options, thus creating possible new overcosts (for example, the elucidative statement of Bornholm representative).

• All the intervenients emphasized endogenous resources importance and the significant contribution some of them already have (for instance, wood, Lesbos and Madeira; wind, Scottish islands; hydroelectrical, Madeira and Azores...) or could have (hydroelectrical in Corsica) in the future. This almost consensual diagnosis (apparently the PPC representative had some doubts) does not imply a consensus on the choosen actions to undertake (see the divergent opinions between Mr.McKenna and Mr.Melim Mendes on the programm VALOREN and the representative of Guadeloupe). The correlation between emphasis on endogenous potential and its use were equally pointed out by all intervenients.

• The common energy market, CEE and its members want to achieve, can be quite opposite towards the islands'interests. That is why the Comission representatives insisted on the economic and social cohesion and presented the different community support schemes[1]. The other intervenients also pointed out the need for specific support schemes, although differing on organisation and even goals.

• Price and costs problems are top issues. There is a consensus about the existence of such problems, but not in their resolution (territorial continuity principle in the majority of the presented cases for electricity, but overcosts partially supported by consummers in the Portuguese Autonomous Regions; very different taxes on oil subproducts...). Questions on prices and costs cannot, in the majority's opinion, burden consummers. Allow me to point out the unanimous silence surronding the question of who should bear the overcosts to relief consummers of them.

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[1] A representative from the Commission came up with the idea of using the benefits from the transEuropean networks in order to support certain overcosts in the storage on those regions.

• At last a consensus of all present in continuing this debate, a will shown in the proposal of the Canary Islands' representatives at promoting another similar event to be held on their region.

2. Divergent and specific conclusions

Surely none of the intervenients previously assumed that his conclusions could be divergent or specific, thus this analysis cannot be separated from a comparative analysis entirely on the responsibility of the speaker. Naturally, it is easier to found differences between the approaches concerning solutions than concerning the identification of problems.

Our statements will be grouped according to the possible characterisation of an energy policy in an islands' region from:

- an institutional basis
- the objectives
- the methodologies and the courses of action of the energy programms.

• Starting from an institutional basis, the different interventions showed a high variety of situations which (if you permit me a personnal remark) is only implicit in the exposés. The Autonomous Regions of Madeira and Azores have a complete autonomy in what concerns energy policy and the local gouvernments have the control of the local Electrical company. They also set up the prices and taxes, while, for instance, French departments, even when grouped in Regions, have nearly no influence over the supply system or prices (see intervention of Mr. Alfonsi). The French example shows the contradictions, emphasized by some intervenients, between a price system for consummers not reflecting costs and the valorization of the endogenous potential. Crete's example highlights the need for the definition of an institutional support to beggin energy planning. Another institutional aspects were pointed out, as for istance, difficults the economic agents face when trying to valorize local resources (small hydraulics in Corsica).

• The goals on energy policy expressed, implicitly or explicitly, throughout the various exposés, do not differ much. The traditional separation line between giving more importance on demand over supply and vice-versa was refind. That is why the "Bornholm" approach leads to a permanent search for energy effectiveness in order to diminishes the growing needs of supply, while the approach presented by the electrical company of Crete pretends an increase of capacity instead of a temporary elimination of peaks. Speaking of these different approaches, it is convenient to draw the attention on the Commission representatives'positions in giving priority to energy effectiveness and to renewable energies, following the goals defined by the Council. According to some intervenients, the goals in energy policy can be controled by political goals. To exemplify this idea, Mr.Alfonsi presented the problem of interconnection to mainland networks as one of the ways to reduce the potential economy of Corsica. The representative from Guadaloupe showed the contradiction between social concern (not to burden consummers) and the goal of valorizing endogenous potential.

• The planning methodologies and its many ways of implementing energy policies aimed at resolving the presented islands' problems, are extremely different specially because of the various institutional basis and goals, but also because of the variety of tools used to carry out these policies.

The Commission representatives presented the main tools elaborated within the Community energy policy goals and social and economical cohesion, and some of the peakers emphasized the difficulties (Mr.McKenna) felt in the execution of certain programmes (VALOREN), which can be resolved (intervention of Mr.Maniatopoulos and Mr.Gérini) by reforcing promotion and diffusion of new energy techniques and improving assistance to energy planning.

The positive exposés of Madeira, Guadaloupe, Azores, Bornholm and the other negative exposés, showed that the existence of implementation structures, namely communitarian, is essential (The VALOREN results stated by Madeira, Azores and Guadaloupe where local structures exist contrast with the absence of real results in the other eligible islands). The VALOREN[1] example shows quite well that the problem of financing, however important, is not the only one to be solved.

[1] or the demonstration programms (30% of the unused budget).

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

ENERGY SITUATION FOR THE EC ISLANDS NON CONNECTED TO AN ENERGY GRID

J. P. Laude
COWIconsult

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

Progress report of the Study "Energy situation for the EC Islands non connected to an energy grid"

by

COWIconsult, CEEETA and EPU

1. INTRODUCTION

In order to evaluate the effects of the Internal Market within the energy sector in regard to the particular situation of the EC islands, the Task Force for European Integration has recently launched a specific study for those islands which have no possibilities to be connected to an energy grid.

The European Community is aiming to complete an Internal Energy Market for Europe by 1992. This must be done taking into consideration security of energy supply, environmental impacts, and the promotion of new energy technologies.

The goal of having an Internal Energy Market is to reduce energy costs and prices, and increase EC industries' competitiveness worldwide. The energy market will be characterised by greater competition and transparency of costs and prices for those involved in it.

The present means of attaining this goal are varied - reducing those boundaries which prevent utilities engaging in inter-state electricity and gas exchanges; community coordination of national planning, investment, production, and distribution of energy, for example.

With this in mind, the community must face the needs of those EC islands which are not connected physically to mainland energy systems. These islands are characterised by a heavy dependence on oil, higher fuel transport costs from main terminals, higher inter-island distribution costs, diseconomies of small-scale power generation, reduced fuel choice, and a highly uneven demand for daily and seasonal energy. These factors lead to greater energy costs for those islands.

This study considers the extent to which the internal market goal will apply to those islands. It will look at a framework of technological, political and financial solutions to their additional energy cost problems and to the security of supply. It will aim to be applicable to the wide variety of member islands. The solutions put forward will then lead to a range of policy ideas for the European Commission.

2. THE EC-ISLANDS

The strict geographical definition of an island is not applicable for the project goals. We have chosen instead to concentrate our effort on those islands, which are not likely to be affected by the prospects of the internal market.

The lack of connection to a main energy grid, an isolated location from the mainland characterized by long sea transportation distance, and limitation in harbour facilities are some of the important selection criterias used.

Consequently we have not included in the scope of this study the islands close to the shore which are presently connected or will be connected in the near future. Other considerations have also been taken into account, mainly the level of energy dependent economic activities.

A general trend for these EC islands is the reduction of population.

As with preliminary classification criteria we have focused on the following set of economic and energy issues: the more or less isolated character of their economies, as a result of their distance from the mainland; the type of economies developed; and the effects of their geographical situation on their energy situation. Using these criteria, several groups of islands were considered:

- Islands with comparable economic activity level with the mainland and with comparable energy consumption. Most of these islands are close to the shore and connected to an electricity grid. Some have better access to the gas network. These islands will profit in some degree from the predictable benefits of the internal market. For these reasons they will not be included in the scope of this study. As examples we can mention the island of Bornholm (DK), the Sicily (Italy) and the Ionian islands (Greece).

- Islands with a recent economic revival based on tourism for which energy supply is needed for transportation, electricity and greater water supply during the high season. Despite the difficulties of supplies and the additional cost of energy, the important fact in energy matters is the reliability of the supply. This is the most important aspect in maintaining the service level required by tourism. Examples include the Island of Creta, the Canaries and Baleares Islands.

- Islands for which their economy and survival is based on the traditional primary sector, e.g. agriculture, breeding and fishing. Those islands are generally located at long distances from the mainland or other economic poles, which limits the possibility of income from tourism and which is also the reason for the accumulation of several drawbacks. High energy prices, poor competitiveness of export production on the world market, and weakness of trade and cultural relations to the mainland are such problems.

  For these islands economic factors such as energy prices are particularly crucial to the survival of the islands' society. This is because they are dependent on external trade and a rise in energy prices raises production costs, which reduces their competitiveness overseas. Different kinds of subsidies are proposed by the EC to alleviate the effects of these unfavourable conditions. Examples are the archipelago of Azores (Portugal), some smaller and less accessible Greek islands, and the French DOM.

There is another kind of hierarchy among the different islands as a group. Size of local population, differences in economic activities, level of services, and harbour facilities are also important factors at the local level, determining the reliability and the price level of energy supply.

Common for the second and third categories of islands are the following factors:

- high and increasing dependence on oil products to cover current energy needs with electricity relying almost exclusively on just oil (Figure 1 and 2).

- substantial seasonal or daily peaks of demand for energy, resulting from seasonal activities (tourism) or low energy demand during the night due to the absence of a heavy secondary sector.

- substantial higher than national costs for the transportation and storage of oil products as well as for electricity generation (small size of local energy market and dependency of the small islands on a main island)

- low security and reliability of the energy systems.

A list of the islands is presented in table 1.

Corsica and Sardinia are presently connected together and will be in the near future connected to Italy.For that reason they will not be included in the final scope of the study. Some of the Greek islands from Aegan Archipelagos are connected together, making a larger energy system, but still remain in the scope of the study.

The population of the island of the project represent about 7.5 millions people (5,5 millions without Corsica and Sardinia), i.e. about 2% of the population of the Community and the following member countries are represented: France, Greece, (Italy), Portugal, Spain and the United Kingdom.

3. THE CONCERN OF THE INTERNAL MARKET FOR THE ISLANDS

The general objectives concerning the free access and exchange possibilities on the main continental energy grid and the overall coordination of investments are of very little concern because of the specific isolated situation of the islands.

On the other hand the aims dealing with price transparency and harmonization of VAT and other taxes are of great importance for the future energy situation on the islands.

A harmonization of excise taxes and VAT will lead to predictable lower oil prices in the southern member states, which on one hand can be considered as a positive measure for the islands in terms of economic impact, but on the other hand as a more unfavourable measure, because of the possible increase of consumption and thus a delay in the penetration of renewables and energy savings measures.

Transparency of price structure will expose the subsidies and means allocated to the islands' oil and power sector. Transition to a "true price" policy will affect especially the small or stagnant industrial sector on the mainly agricultural islands and the growing tourism sector on the prosperous islands.

Facing the challenges of the internal market for energy, alternative solutions have to be elaborated to alleviate the predictable social and economic drawbacks when and if price transparency and true pricing might be blindly applied.

To reduce the gap of the weight of additional costs three different ways can be explored:

- an enhanced penetration of energy savings technologies to compensate for the lack of cheap energy supplies (Figure 3).

- an enhanced energy promotion of local and renewable energy sources in order to force as many oil products as is economically possible out (Figure 3).

- appropriate transition measures for fuel supply of islands when carrying out harmonization of taxes and VAT applied on fuels.

4. ADDITIONAL COSTS

The distinguishing feature of the energy situation of the EC islands is the extra costs they face in energy supply. There are two main sources of additional costs:

- Transportation, storage and distribution of oil products
- Electricity generation

Oil must be transported from a terminal on the mainland to the islands by ship and be stored before distribution to consumers. This adds between 10 and 20% to costs depending on the distance from mainland and harbour facilities. These additional costs are then increased when the oil is distributed to subsidiary islands. The final cost may be 40% higher than that of the mainland. Such transportation, and the small size of energy markets on islands, lowers the choice of fuels available for energy uses and production, which is also a constraint.

Electricity production differs from that of the mainland in size and range of alternatives. The mainland networks use nuclear, coal, hydro, diesel or gas electricity generation, with power stations reaching up to 4 gigawatts in for example the UK. Islands are limited to diesel generation, and very small-scale hydro or renewable energy generators. The smaller scale of technology raises costs, and contributes to a further difficulty - an uneven shape in the electricity load profile. This means there is a very low "base load" electricity demand, as well as a large peak to demand. This requires capacity which is little used outside peak hours. Island diesel electricity production costs are thus three times that of mainland thermal production, whilst the capital charges and operating expenditures are twice that of mainland diesel production. The cost relations are illustrated in figure 4 and 5.

The example based on the 2 islands of Madeira shows obviously the emphasis of the problem for the subsidiary islands. Porto Santo has an installed capacity of 6.6 MW compared to the main island Madeira (100 MW). The cost difference is about 80 ECU/MWh.

5. TECHNOLOGICAL SOLUTIONS

Because of the very short period of return needed for investments made within the field of energy and electricity savings (ranging from 1 to 2 years on the continent, and likely to be under 1 year on the islands) an enhanced implementation of such measures seems to be particularly appropriate to the case of the islands.

Fuels savings and a possible delay in the installation of new output capacity are the direct benefits of such measures. To conduct an energy savings programme successfully, an organizational and financial structure is needed even more when the recipients are mainly medium and small industries, hotels, and individual consumers.

The other technological way to reduce the physical and economical dependency on oil products is to promote the substitution of oil products by use of local and renewable energy sources and the application of renewable energy technology. Investment level and power production cost is shown in figure 6 and 7.

The most promising renewable energy technologies are presently wind turbines, mini hydroelectricity and thermal conversion of biomass. Though some of these technologies have been commercialized for more than 10 years. The particular conditions of the islands, i.e. their relative isolation and need for successful operation, means implementation must proceed with great caution.

To emphasise the items discussed in this paper, a very rough assessment of the total capacity output of the islands generation system has been simulated.

As an example the additional costs bound to power generation are between 100 to 200 millions ECU/year with reference to the present oil prices. In comparison with this amount a reduction of 30% electricity consumption would result from a total investment of 400~600 million ECU and provide a net benefit of 40-60 ECU/MWh saved, for a saving potential ranging from 1000 to 1500 GWh.

6. SUBSIDIES

There are several different models for subsidies in order to alleviate the islands costs.

The levelling of additional energy costs can be obtained by application of differential rates of VAT and excise duties, which means a corresponding reduction of national or regional budgets and a limitation of other possible development programmes. That is the model applied to fuel supply by the regional Government of Madeira.

The levelling can also be obtained through a so-called jointly common tariff policy with the mainland. In this case the cross subsidising of energy consumption on the island is supported by the large number of consumers on the mainland. This model has been applied by centralized power utilities like EDF in France and the natural Creata utilities. This solution does not place the alternative supply system in a competitive position even though they can propose lower production costs than the actual electricity cost. Furthermore, the practice introduces social and economic distortion between islands from different member countries.

The third possible subsidies source consists of direct participation in investment or operation of an energy system, granted by national and community funding, like the EC Structural Funds and other means allocated through programmes like THERMIE, Save, Valoren, Integrated Mediterranean Programme.

At this stage of the study it is not possible for us to outline the possible practical solutions to be considered, but it might be stressed that a greater effort of coordination and cohesion of the Community actions is needed.

7. SUGGESTED MEASURES

The result of the preliminary considerations made needs to be an economically practical strategy comprising the following elements.

- a comprehensive effort to save energy and electricity and reduce the dependence on oil products.

- a directed but careful investment in the most reliable renewable energy technologies on the most favourable sites, answering the demand for new output capacities.

- an appropriate transition policy for price structures and taxes applied to the energy supply for these islands.

This strategy might be supported by follow-up measures, which already exist, have to be improved or created.

The actions of energy planning engaged on behalf of regional, national or community authorities have to be continued and followed-up during the implementation stage. Experiences from Bornholm (DK) and Madeira (P) show the important role of the "open energy committee", regrouping the main actors involved with and concerned by the energy (local and regional authorities, planning organizations, utilities, trade and industrial representatives, consumers' organizations). These "open energy committees" are able to act as catalysts for new ideas, new technologies and their dissemination. Integration of energy planning and other development planning activities have also to be promoted.

Promotion of the "Energy service" concept to replace the traditional concept of energy supply, constitutes another important action to be developed on the island. Such a concept suggests the possible need to establish a new "energy office" in charge of providing that kind of service.

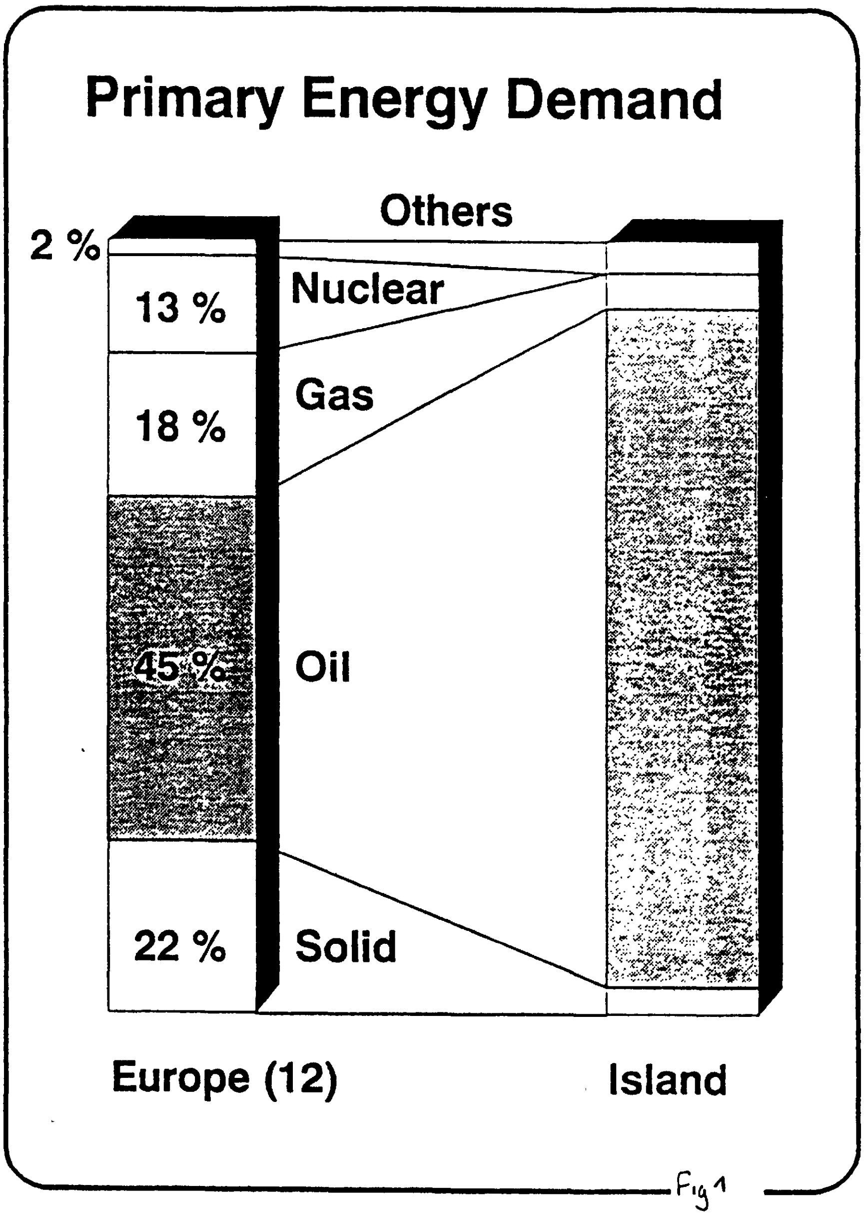
The cohesion and coordination of financial measures applied (e.g tax harmonization, uses of EC-funding, subsidies...) in order to reduce the economic and social distortion between island and mainland and among the islands together is a community task that needs to be fulfilled.

Furthermore, the general on-going Community task for ensuring the quality and reliability of energy equipment has to be improved on the islands through training activities focused on local crafts in order to improve their level of skills using the new technology. Increasing information on successful projects, as proposed by THERMIE programme is an absolute necessity to promote the change in energy systems.

Finally, the need for transparency within the fields of financial engineering and monitoring of the programme te be implemented in the islands, has to be fulfilled.

Name	Mainland	Area in km2	Population	Density inhab./km2
Corsica	France	8,681	240,000	27.6
French Guyanna	France	91,000	73,000	0.8
French Polynesya	France	4,000	150,000	37.5
Guadeloupe	France	1,779	320,000	179.9
Kerguelen Islands	France	6,993	90	0.0
Martinique	France	1,100	328,000	298.2
Mayotte	France	374	54,000	144.4
New Caledonia	France	19,058	145,000	7.6
Reunion	France	2,510	525,000	209.2
St Pierre & Miquelon	France	242	6,700	27.7
Wallis & Futuna	France	255	11,000	43.1
SUB-TOTAL	France	135,992	1,852,790	13.6
Crete	Greece	8,312	502,000	60.4
Northeastern Aegean	Greece	3,827	195,000	51.0
Southern Aegaen	Greece	5,209	234,000	44.9
SUB-TOTAL	Greece	17,348	931,000	53.7
Azores	Portugal	2,335	251,400	107.7
Madeira	Portugal	796	265,000	332.9
SUB-TOTAL	Portugal	3,131	516,400	164.9
Baleares Islands	Spain	5,014	730,000	145.6
Canary Islands	Spain	7,273	1,685,000	231.7
SUB-TOTAL	Spain	12,287	2,415,000	196.5
Br. Indian Ocean Ter	UK	60		0.0
Cayman Island	UK	259	18,300	70.7
Montserrat	UK	103	12,000	116.5
Pitcain	UK	5	65	13.8
Saint Helena	UK	419	6,600	15.8
South Georgia	UK	4,092	20	0.0
Tristan da Cunha	UK	104	300	2.9
Turks and Caicos Isl	UK	430	7,700	17.9
Virgin Islands	UK	153	11,000	71.9
Western Islands	UK, Skotl.	7,280	31,000	4.3
Shetland Islands	UK, Skotl.	1,427	24,000	16.8
Ascencion	UK, St Hel	88	1,350	15.3
SUB-TOTAL	UK	14,420	112,335	7.8
Sardinia	Italy	24,090	1,605,000	66.6
SUB-TOTAL	Italy	24,090	1,605,000	66.6
GRAND TOTAL	EUROPE	207,268	7,432,525	35.9

table 1


Primary Energy Demand
Others
2 %
13 %
Nuclear
18 %
Gas
45 %
Oil
22 %
Solid
Europe (12)
Island
Fig 1

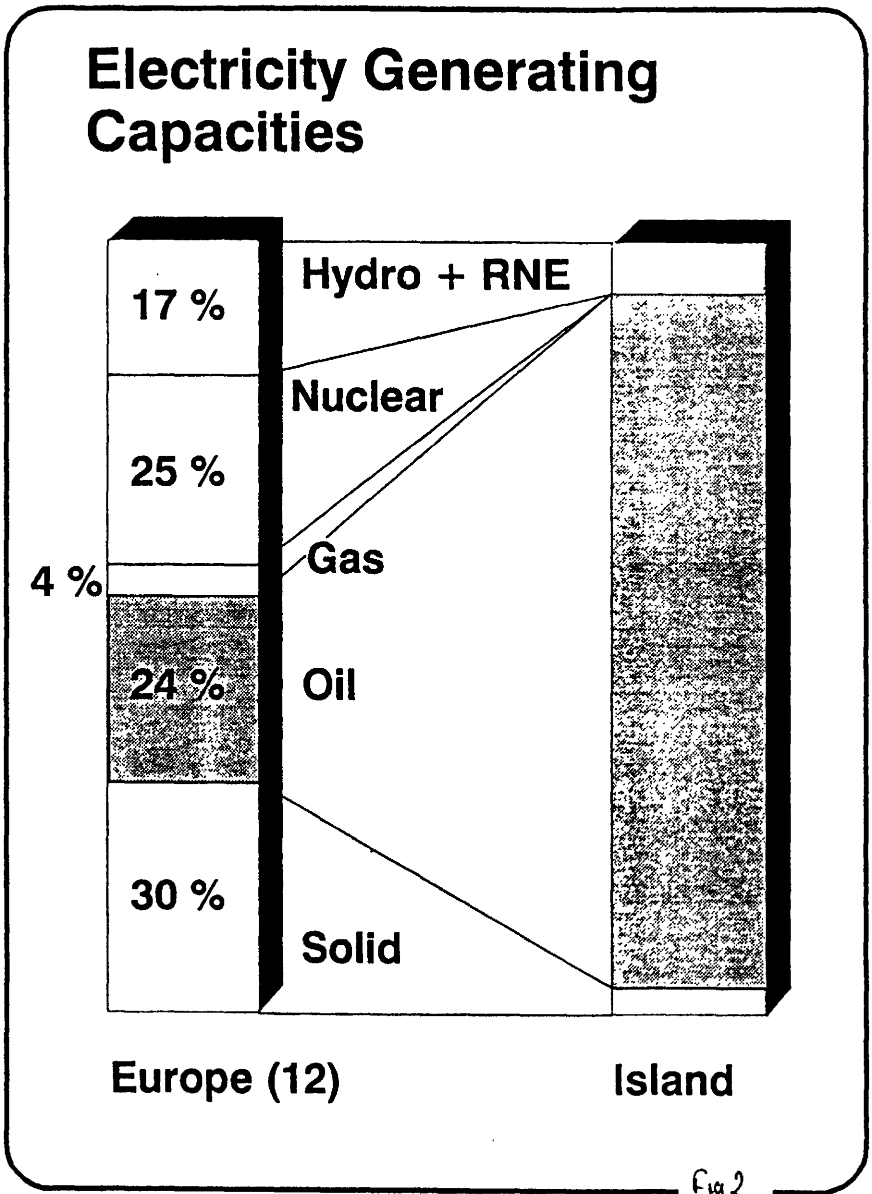
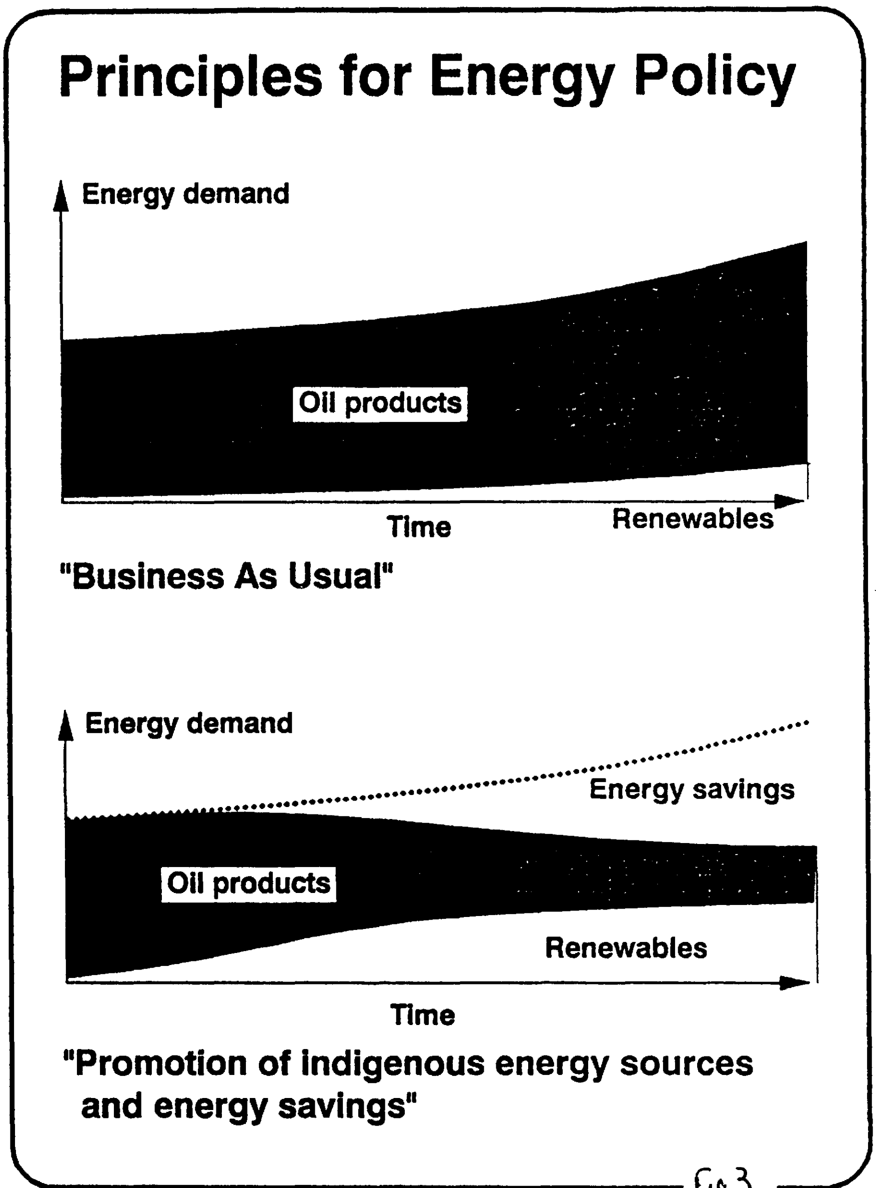

Electricity Generating Capacities
17 %
Hydro + RNE
Nuclear
25 %
4 %
Gas
24 %
Oil
30 %
Solid
Europe (12)
Island

Fig 2


Principles for Energy Policy
Energy demand
Oil products
Time
Renewables
"Business As Usual"
Energy demand
Energy savings
Oil products
Renewables
Time
"Promotion of indigenous energy sources
and energy savings"
Fig3

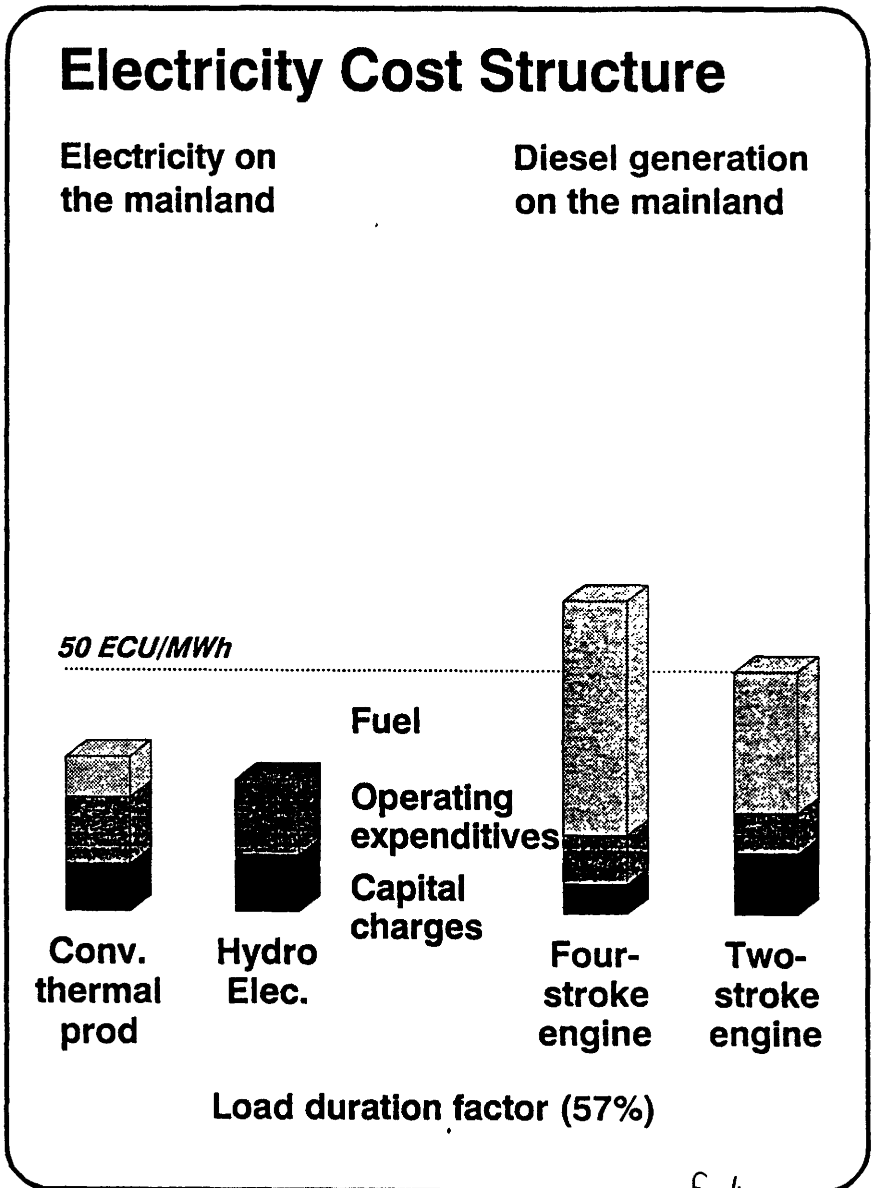
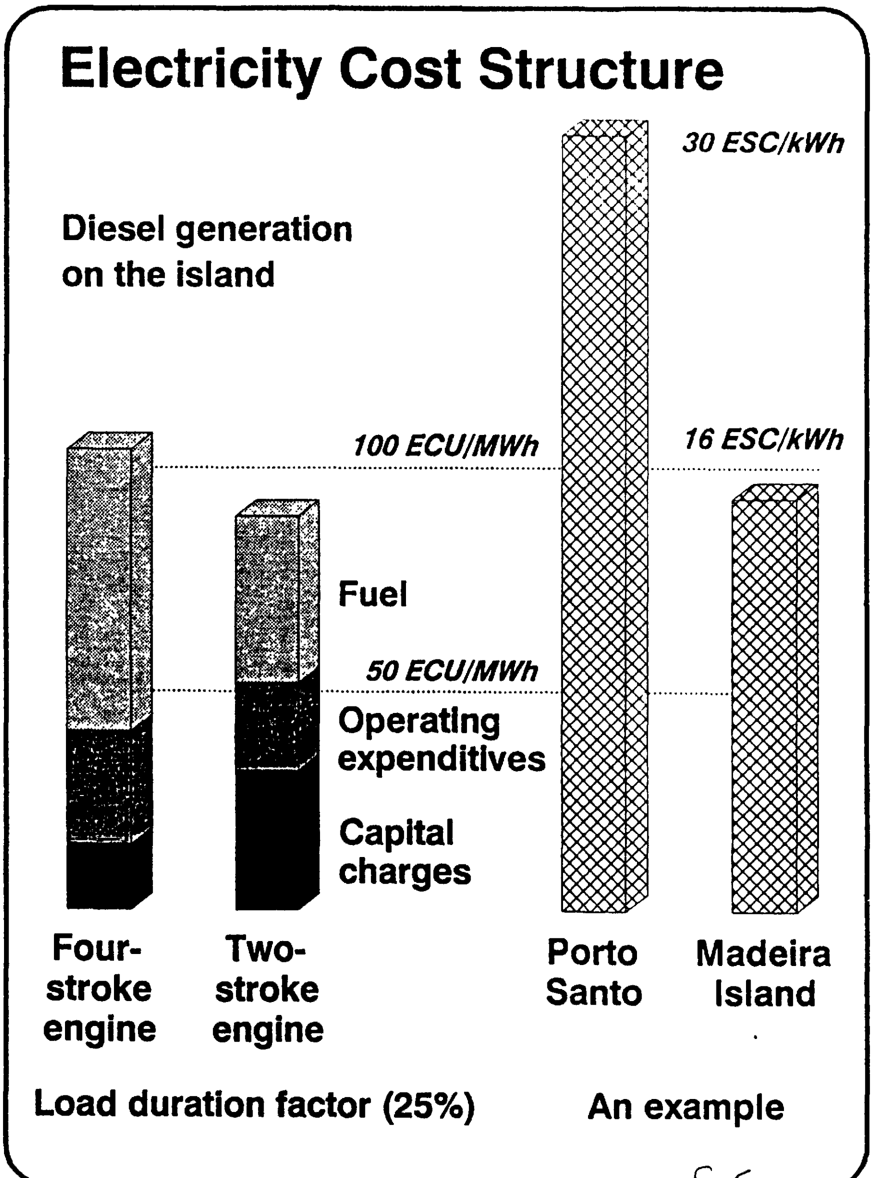
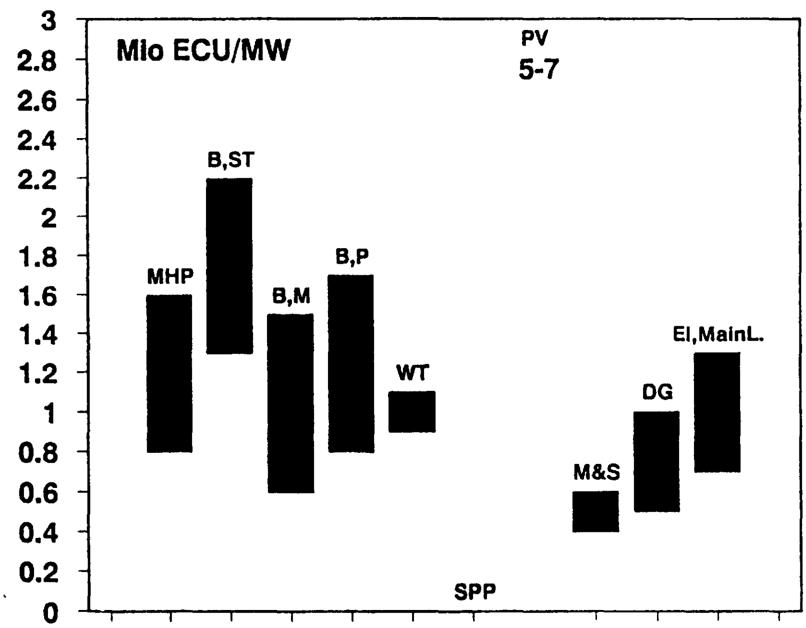

Electricity Cost Structure
Electricity on the mainland
Diesel generation on the mainland
50 ECU/MWh
Fuel
Operating expenditives
Capital charges
Conv. thermal prod
Hydro Elec.
Four-stroke engine
Two-stroke engine
Load duration factor (57%)

Fig 4


Electricity Cost Structure
Diesel generation
on the island
30 ESC/kWh
100 ECU/MWh
16 ESC/kWh
Fuel
50 ECU/MWh
Operating
expenditives
Capital
charges
Four-
stroke
engine
Two-
stroke
engine
Porto
Santo
Madeira
Island
Load duration factor (25%)
An example
Fig 5.

Investment Level Technologies

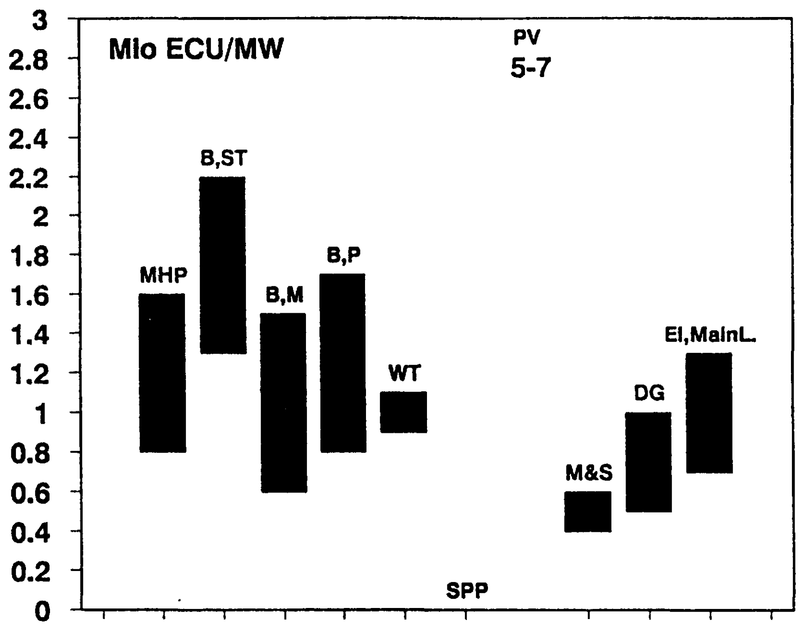


Technologies:

HP, Hydro power
B,ST: Biomass, steam turbine
B,M: Biomass, Methanation
B,P:Biomass, Gasification
WT: Wind turbines
SPP: Solar power plant
PV: Photovoltaics
M&S: Monitoring & savings
DG: Diesel generation
El.,Mainl.: Main power plant

Fig 6

Investment Level Technologies



Technologies:

HP, Hydro power
B,ST: Biomass, steam turbine
B,M: Biomass, Methanation
B,P:Biomass, Gasification
WT: Wind turbines
SPP: Solar power plant
PV: Photovoltaics
M&S: Monitoring & savings
DG: Diesel generation
El.,Mainl.: Main power plant

Fg7

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

DIRECTION OF FUTURE COMMUNITY'S ACTION

I. Galanis
Commission of the European Communities - DG XVII

DIRECTION OF FUTURE COMMUNITY ACTIVITIES

Presentation of the main Commission activities designed to help solve the energy problems of the Community's Islands; some of these are already well defined and are operational while others are being set up or are still in the planning stages.

1. Regional energy programming activities

Continuation of energy programming activities with the emphasis shifting towards new priorities, namely:

- energy planning in the outlying regions and particularly in border areas and on islands;

- feasibility studies with a view to preparing the ground for energy projects and investment;

- energy programming and management in urban areas.

Of these priorities, the first two are of direct relevance to islands and have featured in the past in energy planning studies and, with effect from this year, in feasibility studies. Following the call for proposals launched in 1990, the Commission adopted three feasibility studies concerning islands (out of a total of ten feasibility studies selected). These related to the installation of wind farms on Crete, the application of geothermal energy in agriculture on the island of Lesbos and the saving of energy in air-conditioning systems in the Cyclades.

A budget in the region of ECU 3 million will be available in 1991 for energy programming activities.

The 1991 call for proposals will be launched at the end of this year or in the New Year.

2. Technological development activities in the fields of renewable sources of energy and energy savings, as well as solid fuels and hydrocarbons.

Continuation of technological development activities with a more marked bias towards marketing and the market.

The Thermie programme, which is the successor of the Energy Demonstration and Hydrocarbon Technology programmes and which will cover the period 1990-1994, enables the Commission to provide financial assistance for two types of measures:

- implementation of energy projects in the areas referred to above, including innovative projects, projects which involve the application of tried and tested technologies in a new environment, and specific projects defined by the Commission;
- promotion of the new energy technologies and dissemination of experiments and results.

The Thermie programme gives priority to projects situated in the less-favoured regions, and in particular to those submitted by small and medium-sized enterprises.

A call for proposals for 1991 projects was launched in August and will close on 7 January 1991.

In addition, a network of "focal points" has been set up by the Commission with a view to stepping up its promotion and dissemination activities.

A budget of some ECU 125 million has been earmarked for Thermie projects in 1991.

The Thermie programme, like the demonstration programme which preceded it, is managed by energy sector rather than on a geographical basis. However, this by no means excludes projects carried out on islands; indeed, projects of this kind, as well as projects carried out on the mainland which can be taken over and adapted for islands, make up a significant part of the programme, especially in the renewable energies sector.

3. <u>Activities designed to improve energy efficiency</u>

In October 1990 the Commission adopted the Save programme in a bid to promote energy efficiency in the Community. This programme, which is to run for an initial five-year period, provides the framework for specific measures which the Commision has planned in the following three fields:

. technical assistance measures which will involve first and foremost the laying-down of standards which reflect energy efficiency requirements for buildings, domestic appliances and transport;

. financial measures, in particular the promotion of financing by specialized institutions and organizations which will be ensured a return as a result of the energy savings achieved;

. measures relating to user behaviour, involving information and training in a bid to make businesses more aware of the problems and change consumer habits.

While these incentive measures to ensure efficient use of energy relate to the entire Community, they are nonetheless of importance for the Community's islands.

A new programme along the lines of the Save programme is planned to promote alternative sources of energy.

4. Strengthening of regional energy structures

Whether the aim is to carry out regional energy programming studies, process the results and assist in the planning, setting-up, construction and monitoring of technology projects, to improve the spread of information and the dissemination of the technologies demonstrated, or to set up pilot awareness projects at regional level, the existence and operation of regional energy structures is a growing necessity, regardless of what form they take (regional branches of national bodies or organizations set up by the regional authorities).

Some regions already have their own energy departments, but a large number are still without.

The Commission believes strongly that its activities in the energy sector must be carried out in conjunction with those of the national and regional authorities, as the latter are on the spot and can make a more balanced assessment of the problems involved and the solutions considered.

Discussions are in progress to examine the means to be deployed with a view to the setting-up of regional energy teams and providing back-up for their activities.

These discussions, together with a study which has been launched on this matter, should produce some practical results by the end of 1991.

5. Policy regarding furthest outlying islands and regions

A new policy is gradually being implemented with regard to the Community's furthest outlying islands and regions. It began with the Poseidom programme adopted by the Council in December 1989 (Programme of options specific to the remote and insular nature of the French overseas departments) and is being continued with the preparation of similar programmes for the Azores and Madeira on the one hand and the Canary Islands on the other, the latter having recently opted for full Community membership.

This new approach is designed to enable Community rules and policies to be adapted on an ad hoc basis to take account of and offset the specific handicaps suffered by these islands and regions, namely their low level of economic development, geographical remoteness and distance from the Community market, bearing in mind their traditional links with neighbouring non-member countries.

In this context Madeira and the Azores have asked the Commission to look into ways of offsetting the extra transport costs for energy products coming from the mainland, which are currently met from the islands' regional budgets.

The Commission is keenly aware of this problem and its final decision will take into account all the adaptations and measures which are appropriate to these islands. Indeed, one of the innovative aspects of the programmes concerning the furthest outlying regions is their global approach to problems and solution.

However, the Commission would once again stress the need to step up energy production from locally-based sources, mainly from renewable energy sources, and to make substantial energy savings, in order to ensure that any aid programme which may be adopted does not result in an inflation of subsidies as a result of an increasing consumption of petroleum products.

It should further be pointed out that the adaptations and measures authorized in connection with these programmes are not intended to be applied to all islands, but will be confined to the furthest outlying.

6. Other activities

I would like to draw attention to two other major Commission activities, namely:

. upstream of the activities carried out by DG XVII, the research and development work carried out by DG XII in the context of the Joule programme, some of which directly concerns or has important implications for islands. This is particularly true in the case of development work on renewable sources of energy;

. downstream of DG XVII's activities, the assistance granted to islands by the structural Funds in accordance with the priorities established by the governments (Community support frameworks) and the Commission (Community initiatives), which have already been outlined for us by the representatives of the Directorate-General for Regional Policy.

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SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

SOME SUMMARY COMMENTS & RECOMMENDATIONS

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by

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1. THE PRESENT SITUATION

The purpose of this brief comment is not to abstract the detailed presentations of the general conditions and energy consumption patterns and problems noted in EC islands. This is ably done and presented elsewhere by the raporteur of the meeting. Rather, what is attempted here is an ennumeration and brief elaboration of some basic points for action which seem to be common to all islands.

Let us first examine the basic defining parameters of economic activity and resulting energy demands in these islands. The main sustaining activities of the economies of almost all of the EC islands are **agriculture** and **tourism.** These activities and particularly the latter in conjunction with the limited existing facilities have generated an increase of energy demand of about 3-10% per year, a rate which is expected to remain unaltered in the foreseeable future.

Agricultural activities are mostly distributed and often require energy in isolated areas, far from existing or planned power grids. At the same time, power demand levels are relatively low. Both the nature of this activity and the abilities and proclivities of the people involved mitigate toward the use of renewable energy sources to cover all or part of the energy needs.

The other activity, tourism, also comes with its own particular demands. Foremost among these, is the need for environmentally benign energy supply and utilization but with a close second the strongly uneven distribution of the load level over the year. In many islands the energy demands rise by at least tenfold during the tourist season which is typically the summer.

The main energy consumption is found in the **transportation** sector. Transportation energy needs (and costs, if not subsidized) are high because of the distances and difficulties in transporting people and goods as well as the fuel itself to remote locations and often under adverse weather conditions.

The indigenous energy supply of all the islands represented, and indeed of the vast majority of all EC islands, comprise some form of **renewable** energy source with wind and biomass being the most common.

In addition to stating all the similarities found between the conditions on the EC islands, one should also mention the differences. The most important of these differences are the **size**, the **climate** and the **mix** of needs and capabilities. Thus the size covers the spectrum from a few tens to a million people and from a few to a few hundreds of kilometers while the climate varies from arctic to the tropical with the subsequent opposite heating and cooling requirements.

2. WHAT CAN BE DONE IN THE FUTURE

The problems that were identified in the individual island presentations are many as are possible remedies which in general are better known to the local residents. What is required here is the discerning of energy needs that can and should be addressed by organizations of broad enough interest and scope such as CEC. Further, this needs to be carried out keeping firmly in mind the generally expressed resentment of all island representatives to far-off central government directives which have been composed by bureaucrats with little or no knowledge of local conditions and large estimates of self-importance.

The areas of action can be divided in two, those that are specific and those that cut across many fields. The specific ones are easily identified from the details of the presentations given. They include:

- Efficiency of transportation
- Improved communications to alleviate travel
- Improved off-grid power systems
- Energy-efficient fresh water supply
- Integration of diverse energy sources
- Elimination or reduction of environmental impact of energy production and use

The above list is neither complete nor original. It clearly includes items of concern, now and in the past, to all islands albeit at different degrees of importance to each. It is also a list that is almost self-evident given the details of the presentations of this symposium.

Beyond the specific areas listed above and the ever-present request and possibly well-justified need for more funds, there remains the need for energy planning. Work on this has been carried out for a number of islands and a prime example has been presented in this symposium by Prof. Samouilidis. Still, in my opinion, the results of such work have not been utilized sufficiently in the past and the utilization of the energy policies proposed for the islands remain less than optimal. Many reasons can be found for this which vary from island to island.

There exists though one reason which, in my estimation, is over-riding and has to be discussed further. This reason is the reduced capability of the local authorities to make full use of the results of these energy strategy studies. Implementation is hindered by delays which change the initial conditions of the study, by incorrect or incomplete input data, by lack of funds, by concealed local political and social considerations, and by limited capabilities of local administration.

Such shortcomings at the local level are exacerbated by the difficulties of, on one hand, influencing from afar decision makers of the central administration and, on the other, of having to deal with the local residents and their reaction to possibly unpleasant actions.

3. A MODEST PROPOSAL FOR ACTION BY CEC

Several of the problems mentioned have already been the target of both national and CEC programs. For example, a number of innovative applications of renewable energy sources, mostly wind and solar, have been financed by the Demonstration Program and lately by THERMIE. Additional energy-related projects have been financed by VALOREN while some research aspects of wind turbines, solar collectors, photovoltaic cells and heat exchangers have been investigated with the aid of JOULE grants.

This assistance and interest for energy problems of the islands should be maintained in the future calls for tenders of THERMIE as well as SAVE and ALTENER.

There is need though for a new initiative to address the crucial, in my opinion, problem of local expertise and capabilities. Such an initiative should encompass:

- Training for technical personnel of state and especially municipal authorities charged with energy utilization matters.

- Development and implementation of energy planning tools for use at the local level by local technical personnel on a routine basis.

- Training of maintenance technicians for new energy technologies to be used on islands.

- Collection and reduction of data necessary for rational use of energy and energy production. These data sets should become available to both local authorities and private individuals.

- Exchange of experiences, both successful and unsuccessful along with their evaluation.

The level of this initiative, to actually be effective, remains to be investigated as are additional items to the main ones above. In a fundamental way, they address the question of implementation which still remains the plague of a number of brilliant technological advances.

SYMPOSIUM: ENERGY ISSUES IN EC ISLANDS

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