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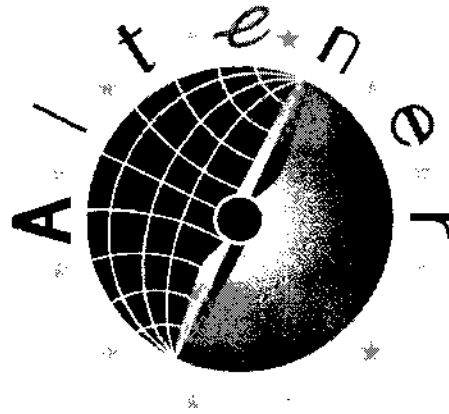
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eines funktionierenden Wärmemarktes im  
großvolumigen Wohnbau.



ENERGIE  
VERWERTUNGSAGENTUR



## **Projektbericht**

# **BIOHEAT**

**Markteinführung von Biomasseheizungen im verdichteten  
Wohnbau und bei öffentlichen Gebäuden**

**Altener 4.1030/Z/00-163/2000**

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# 1 Überblick

Die im Rahmen des Projekts BIOHEAT durchgeführte Analyse kommt zu einem klaren Schluss: mit modernen Pellet- und Hackgutkesseln kann Wärme mit einem Maß an Komfort, Effizienz und Wirtschaftlichkeit bereitgestellt werden, das sie in ganz Europa zu einer realistischen Alternative zu fossilen Heizsystemen macht. Wie die Entwicklung in einer Reihe von am Projekt beteiligten Länder zeigt, ist eine dynamische Markteinführung auf der Basis des bestehenden technologischen Standards und innerhalb der gegebenen wirtschaftlichen Rahmenbedingungen möglich. Hackgut und Pellets sind in allen Teilnehmerländern deutlich billiger als herkömmliche Brennstoffe, und die Gesamtheizkosten mit Hackgut, die auf der Basis einer 100 kW Modellanlage zur Beheizung einer Wohnhausanlage errechnet wurden, wären – mit Ausnahme von Griechenland – in allen Teilnehmerländern wettbewerbsfähig.

Warum hat eine dynamische Markterschließung bislang erst in einigen wenigen Ländern stattgefunden? Der Mangel an Informationen über die neuesten Entwicklungen im Bereich der vollautomatischen Holzbeheizung stellt eines der größten Hemmnisse für eine Marktentwicklung dar. Das Projekt BIOHEAT konnte durch die Verbreitung von Informationen – in Form zahlreicher Publikationen, zielgruppenspezifischer Broschüren und einer Website ([www.bioheat.info](http://www.bioheat.info)) – einen wesentlichen Beitrag zur Überwindung dieser Barriere leisten.

Dies allein wird jedoch nicht ausreichen, um die Marktentwicklung anzukurbeln. Die Analyse hat eine Reihe anderer, zum Teil komplexer Hindernisse ergeben, die es ebenfalls zu überwinden gilt, um das volle Potenzial von Biomasseheizungen auszuschöpfen. In diesem Zusammenhang ist bemerkenswert, dass nicht länger Defizite bei Forschung und Entwicklung das Haupthindernis für die Markteinführung darstellen, sondern ein Mangel an Ressourcen, um bestehende Markthindernisse überwinden zu können.

Die Möglichkeit, sich persönlich vom tatsächlichen Funktionieren von Biomasseheizungen überzeugen zu können, ist eine grundlegende Voraussetzung für Entscheidungsträger, bevor diese der Umsetzung eines Projekts zustimmen. In einigen Teilnehmerländern fehlt es immer noch an erfolgreichen Vorzeigeprojekten, welche die Möglichkeit zur persönlichen Erfahrung bieten: Bioenergie funktioniert! Demonstrationsanlagen mit hohem Bekanntheitsgrad bieten darüber hinaus die Möglichkeit für kostengünstiges Marketing, da sie gewöhnlich großes – und kostenloses – Medieninteresse auf sich ziehen, besonders wenn professionelle Kommunikationsstrategien zum Einsatz kommen. Dies ist besonders in jenen Ländern wichtig, wo Holz als Heizmaterial noch immer einen relativ schlechten Ruf hat. Die Umsetzung von Modellprojekten auf dem neuesten Stand der Technik hat daher oberste Priorität.

Gegenwärtig stellt auch die Brennstoffversorgung in vielen Ländern ein bedeutendes Hindernis dar. In jenen Ländern, die ein dynamisches Marktwachstum aufweisen, war die Einführung von Holzpellets der wichtigste Faktor bei der Entwicklung des Bioenergiemarktes, und zwar sowohl für größere Objekte als auch für Einfamilienhäuser. Dies führt zu dem Schluss, dass die Schaffung eines EU-weiten Marktes für Pellets, der die wettbewerbsfähige Versorgung aller Verbraucher mit qualitativ hochwertigen Pellets ohne geografische Einschränkungen ermöglicht, ein weiterer vorrangiger Faktor ist.

Die Nutzung neuer Technologien gilt immer als riskant und ist aufgrund des Mangels an einschlägigen Erfahrungen mit erheblichen zusätzlichen Transaktionskosten verbunden. Auch wenn die Beheizung mit Holzbrennstoffen grundsätzlich wettbewerbsfähig ist, bedarf

es daher finanzieller Anreize, um das Risiko und die höheren Transaktionskosten während der ersten Jahre der Marktentwicklung wertzumachen.

Regulative Maßnahmen sind im Hinblick auf eine Reihe von Fragen erforderlich. Ein harmonisiertes Paket strikter, aber vertretbarer Emissionsgrenzwerte könnte ein ausgewogenes Umfeld für moderne Technologien schaffen, die sowohl unter übermäßig strengen Emissionsauflagen (wie zum Beispiel in den Niederlanden) als auch unter fehlenden Emissionsbegrenzungen leiden, da solche qualitativ minderwertigen Produkten auf dem Markt Vorschub leisten die das negativen Image von Holzfeuerungen als umweltverschmutzende und ineffiziente Technologie bestätigen.

Im Zuge der Untersuchungen wurde eine Reihe staatlicher Bestimmungen eruiert, die ebenfalls unnötige Hindernissen für den Einsatz von Holzbrennstoffen schaffen. Diese Bestimmungen betreffen die Behandlung von Holzbrennstoffen als Abfallstoffe, Bauvorschriften, unverhältnismäßige feuerpolizeiliche Auflagen, usw.

Für eine Marktentwicklung bedarf es jedoch auch neuer Bestimmungen und Normen zur Qualitätssicherung und reibungslosen Markteinführung. Solche Bestimmungen müssen Qualitätsstandards sowohl für die Brennstoffe also auch für die Heizanlagen enthalten, aber auch Normen für Serviceleistungen wie Transport, Sicherheitsmaßnahmen, technische Vorgaben für Lagerräume, usw. Derartige Regelungen sind äußerst wichtig, da das Versagen jedes einzelnen Elements in der Technologie- und Dienstleistungskette zu schwerwiegenden Rückschlägen führen kann. Die jüngsten Erfahrungen mit vorübergehenden Versorgungsengpässen in einigen skandinavischen Ländern deuten darauf hin, dass möglicherweise die Einführung von Mindestvorgaben für die Brennstofflagerung durch Pelletproduzenten oder die Schaffung staatlicher Mechanismen zur Finanzierung von Lagerkapazitäten ähnlich jener für Heizöl erforderlich sein könnten.

Die Ausbildung von Fachkräften ist eine weitere wichtige Voraussetzung für eine erfolgreiche Marktentwicklung. Seien es Architekten, Konsulenten, Installateure oder andere relevante Fachkräfte: Ein Unternehmer, der mit der neuen Technologie nicht vertraut ist, wird seinen Kunden von der Entscheidung für die neue, „riskante“ Variante abraten, weil er fürchtet, Fehler zu machen oder auf unerwartete Probleme zu stoßen. Die an diese Zielgruppe gerichtete Broschüre ist sicher ein erster Schritt in die richtige Richtung. Detailliertere Informationen werden jedoch folgen müssen.

Es ist offensichtlich, dass komplexe und weitreichende Maßnahmen nötig sind, um die vorhandenen Hindernisse zu überwinden. Andere erfolgreiche Beispiele für die Einführung neuer Technologien deuten darauf hin, dass mit der Marktentwicklung betraute Institutionen bei der Bewältigung dieser Hindernisse mitunter eine zentrale Rolle spielen. Die Einbindung von Energiedienstleistungsunternehmen kann eine weitere effiziente Methode zur Marktentwicklung sein, wenn entsprechende Anreize geboten werden.

In den meisten Teilnehmerländern zeigt die Erfahrung, dass kommerzielle Akteure auf dem Gebiet der konventionellen Energieversorgung in starke Konkurrenz zur Bioenergie treten, sobald diese auf dem Markt auftritt. Wenn nicht politische Rahmenbedingungen geschaffen werden, die etablierte Energieunternehmen zum Eintritt in den Markt für Wärmeerzeugung aus erneuerbarer Energie motivieren, könnte sich die Entwicklung dieses Marktes als langsam und schwierig erweisen.

Bislang haben sich die politischen Maßnahmen der Mitgliedstaaten hinsichtlich erneuerbarer Energieträger (EE) auf den Markt für die Stromerzeugung durch erneuerbare Energieträger konzentriert, nicht zuletzt deshalb, weil die Europäische Kommission diesem Markt besonderes Augenmerk gewidmet hat. Für die Umsetzung von politischen Maßnahmen auf

nationaler Ebene zur Förderung des Marktes für Wärmeerzeugung auf der Grundlage erneuerbarer Energieträger wird die Kommission die Initiative ergreifen müssen.

Dies könnte einerseits dadurch geschehen, dass sie in ihrem Programm Intelligente Energie für Europa das Augenmerk verstärkt auf die Entwicklung dieses Marktes richtet, andererseits wird es aber auch nötig sein, eine politische Initiative zu ergreifen. Eine solche Initiative könnte eine Mitteilung an den Rat und das Europäische Parlament sein, in der eine Strategie zur Förderung des Einsatzes von Wärmegewinnung aus erneuerbarer Energie vorgestellt wird, oder der Vorschlag einer Richtlinie zur Wärmeerzeugung aus erneuerbarer Energie, die den Mitgliedstaaten indikative Ziele vorgibt und ihnen vorschreibt, diesbezügliche Hindernisse zu beseitigen und über den Fortschritt bei der Erreichung dieser Ziele periodisch zu berichten. Auch die Umsetzung von harmonisierten Rahmenbedingungen für die Stromerzeugung durch erneuerbare Energieträger könnte auch eine Möglichkeit bieten, den Markt für Wärmegewinnung auf der Grundlage erneuerbarer Energieträger zu fördern, indem den Mitgliedstaaten gestattet wird, einen Teil ihrer Verpflichtungen hinsichtlich der Stromerzeugung durch erneuerbare Energieträger durch die nachweisliche Lieferung von Wärme aus erneuerbarer Energie zu erfüllen.



## 2 Zusammenfassung der Ergebnisse

### 2.1 Gegenwärtige Marktsituation von Biomasseheizungen im verdichteten Wohnbau

Das Projekt BIOHEAT begann mit einer Orientierungsphase auf der Basis von 15 Interviews mit verschiedenen relevanten Akteuren in jedem Teilnehmerland. Unter anderem war das Ziel dieser Phase, ein klares Bild der derzeitigen Marktsituation zu ermitteln. Die Ergebnisse zeigten große Unterschiede in den 10 Teilnehmerländern auf. Insgesamt konnten vier typische Marktsituationen unterschieden werden:

**„schlafende Märkte“** – Märkte mit Entwicklungspotenzial, die bisher kaum eine Entwicklung im Bereich der modernen Holzbeheizung erfahren haben. Griechenland und Spanien fallen in diese Kategorie. Nur in wenigen Fällen wird Holz zur Beheizung größerer Objekte verwendet, üblicherweise unter Einsatz von veralteten Anlagen. In diesen Ländern wurde der Frage des Einsatzes von Biomasse zur Heizzwecken auf politischer Ebene nur geringe Priorität beigemessen, obwohl in beiden Ländern der Einsatz von Brennholz historisch gesehen durchaus relevant ist. Beide Länder verfügen über ein relativ großes Potenzial hinsichtlich der Nutzung von Holz oder landwirtschaftlichen Nebenprodukten (Olivenkerne, Stroh, usw.). In Spanien ist der Markt etwas weiter entwickelt; mancherorts sind Erfolge zu verzeichnen, und es existiert eine Holzpelletproduktion, die einen kleinen Nischenmarkt von Pelletheizungen versorgt.

**„Märkte in einem frühen Entwicklungsstadium“** – In diesen Märkten gibt es eine bedeutende Anzahl von Projekten, die Holz zur Beheizung verwenden und moderne Technologien zum Einsatz bringen. Dennoch ist die Verwendung von Holzbrennstoffen in diesen Ländern noch sehr ungewöhnlich und wenig bekannt. Portugal, Frankreich, Norwegen und Italien gehören dieser Gruppe an. In diesen Ländern kann eine signifikante Marktentwicklung noch nicht als selbstverständlich betrachtet werden, da weiterhin viele Hindernisse existieren, welche die Holzbeheizung von größeren Objekten zu einem Randphänomen machen. In all diesen Ländern werden in einer oder mehreren Produktionsanlagen Pellets hergestellt, in manchen Fällen erst seit kurzem. Das Interesse am Einsatz von Holzbrennstoffen steigt, und politische Entscheidungsträger haben verschiedene Initiativen zur Entwicklung des Marktes für Wärmeerzeugung durch Holz gestartet.

**„dynamisch wachsende Märkte“** – In diesen Märkten hat der Einsatz von Holzbrennstoffen jene Schwelle überschritten, an der der Markt eine Entwicklung aufgreift und sich diese, ausgehend von Einzelprojekten auf regionaler Ebene, auf dem gesamten Markt verbreitet. Diese Schwelle wird gewöhnlich erreicht, wenn bestimmte technische Rahmenbedingungen erfüllt sind. Dazu gehören ausgebildete Fachkräfte, ein funktionierendes System zur Brennstoffversorgung, eine solide Technologie und etablierte Systeme zur Qualitätssicherung entlang der gesamten Dienstleistungs- und Produktkette, die für den erfolgreichen Einsatz der Technologie erforderlich sind. Derzeit ist dies in Schweden, Österreich und Dänemark der Fall. In Dänemark ist das Potenzial für ein weiteres Marktwachstum relativ gering, da Fernwärme und Erdgas den größten Teil des Wärmemarktes versorgen und rechtlich vor Wettbewerb geschützt sind. Aus diesem Grund könnte Dänemark auch zum vierten Markttyp gezählt werden:

**„Märkte mit begrenzten Wachstumsperspektiven“** – Die Niederlande (und eventuell Dänemark) gehören dieser Gruppe an. Die Niederlande haben keine bedeutenden Biomasseressourcen, verfügen aber über ein voll entwickeltes Erdgassystem, das beinahe den gesamten Wärmemarkt versorgt. Folglich gibt es in bestehenden Gebäuden nicht genügend Platz für Biomasseanlagen und Lagerräume. Darüber hinaus sind die Emissionsgrenzwerte so streng gesetzt, dass Biomassekessel sehr teure und derzeit nicht einmal verfügbare Rauchgasreinigungssysteme benötigen würden. Daher ist das Potenzial für eine bedeutende Marktentwicklung in den Niederlanden eher gering.

Die Tatsache, dass Holzbeheizungssysteme in einigen Ländern eine dynamische Markteinführung erleben, beweist, dass die Technologie für eine umfassende Verbreitung bereit ist. Die Zeitspanne bis zum Marktdurchbruch war in Schweden, Dänemark und Österreich relativ kurz – innerhalb von 5 Jahren wuchsen die Märkte von fast Null auf eine beachtliche Größe an, nachdem eine voll funktionstüchtige Technologie eingeführt worden war und finanzielle Anreize gegeben wurden (Energiesteuern in Dänemark und Schweden, Förderungen in Österreich).

BIOHEAT hat für die Nutzung von Holz am Wärmemarkt einen wichtigen Impuls gegeben und könnte in einigen am Projekt beteiligten Ländern eine relevante Marktentwicklung auslösen. Dies allerdings nur dann, wenn weitere Förderungsmaßnahmen gesetzt werden und dem Einsatz von erneuerbarer Energie auf dem Wärmemarkt mehr politisches Interesse zuteil wird, als dies in der Vergangenheit der Fall war.

## **2.2 Hindernisse für die Einführung von Holzbeheizungssystemen in Ländern mit keiner oder nur geringer Verbreitung**

Da die wirtschaftlichen Rahmenbedingungen durchaus günstiger als erwartet sind, ist es offensichtlich, dass relevante nichtökonomische Hindernisse für die Verbreitung der neuen Technologie bestehen müssen. Die erste Phase des Projekts BIOHEAT war auch der Analyse dieser Barrieren gewidmet. Der folgende Abschnitt gibt einen Überblick über die wichtigsten Hindernisse.

Der **grundsätzliche Mangel an Information** über die neue Technologie ist ein generelles Hindernis in allen Teilnehmerländern (mit der möglichen Ausnahme von Schweden), ein Umstand, dem – so glauben wir – im Rahmen des Projekts BIOHEAT erfolgreich Rechnung getragen wurde. Wenn niemand weiß, dass es praktikable Lösungen für den Einsatz von Biomasse zur Beheizung im verdichteten Wohnbau gibt, dann ist klarerweise auch keine Markteinführung möglich.

Das **Fehlen eines gesicherten Systems zur Brennstoffversorgung** ist in allen Ländern, die bisher keine weitreichende Marktentwicklung erfahren haben, ein zentrales Hindernis. Dieser Versorgungsmangel ist mit der fehlenden Nachfrage nach solchen Brennstoffen verbunden – die fehlende Nachfrage wiederum erklärt sich durch die nicht gesicherte Versorgung. Es handelt sich hier um das typische Henne–Ei Problem der Bioenergie. Die Versorgung kann ohne Nachfrage nicht gesichert werden, aber eine Nachfrage kann nicht entstehen, solange die zuverlässige Versorgung nicht gesichert ist.

In Österreich, Schweden und Dänemark haben Pellets zur Lösung dieses Problems geführt. Pellets können ohne größere Kosten über weite Strecken transportiert werden und ermöglichen daher die kostengünstige Versorgung eines relativ großen Gebiets mit einem standardisierten Brennstoff.

Das **negative Image von Holz als Brennstoff** ist ebenfalls ein generelles Problem. Gegenwärtig gilt Holz eher als der Brennstoff „unterentwickelter“ ländlicher Regionen. Es ist

bekannt, dass Holzfeuer beträchtliche Rauchentwicklung verursachen. Außerdem ist das Vorurteil weit verbreitet, dass Holz ein teurer Brennstoff sei. Es ist schwierig, diese Vorurteile auszuräumen. Mit ihren gegenüber Stückholz sehr unterschiedlichen und positiven Eigenschaften (weich, glatt, angenehmer Geruch) könnten Pellets eine Möglichkeit bieten, Holzbrennstoffen ein gänzlich neues Image zu geben. Die **mangelnde Verfügbarkeit moderner Kessel** ist besonders in noch unterentwickelten Märkten ein wichtiges Hindernis. Unternehmen, die diese Technologien anbieten, konzentrieren sich derzeit auf die dynamischen Märkte und haben bisher nicht versucht, andere weniger entwickelte Märkte zu erschließen.

Wo Informationen, Brennstoffe und Qualitätsprodukte einmal erhältlich sind, stellt der **Mangel an Fachkräften** das nächste Hindernis dar. Architekten, Planer, Installateure und verwandte Berufsgruppen müssen wissen, wie ein Holzbeheizungssystem richtig zu planen und zu installieren ist. Die häufigsten technischen Probleme in Zusammenhang mit diesen Systemen werden nicht durch mangelhafte Produkte verursacht, sondern entstehen aus Fehlern im Zuge der Installation oder während des Betriebs.

Eine sehr effektive Möglichkeit zur Überwindung diverser Hindernisse liegt in der Etablierung von **Energiedienstleistungsunternehmen**, die die Verantwortung für die Planung, Finanzierung, Errichtung und den Betrieb der Holzheizungssysteme übernehmen. Wenn solchen Unternehmen Anreize geboten werden und Starthilfe zur Verfügung gestellt wird, können sie zu einem wichtigen Antriebsfaktor bei der Durchsetzung von Holzheizungen auf dem Markt werden. Mit Ausnahme von Schweden, Dänemark und Österreich gibt es derzeit in den meisten Teilnehmerländern keine derartigen Energiedienstleister. Es ist bemerkenswert, dass es in Schweden und Dänemark große Energieunternehmen wie STATOIL und Shell sind, die große Erfolge bei der Vermarktung des Konzepts von Energiedienstleistungen auf der Basis von Holzpellets erzielen.

Demgegenüber kam es in vielen anderen Ländern schon in den ersten Phasen der Marktentwicklung zu einem **starken Wettbewerb mit Energieunternehmen aus den Bereichen Öl oder Gas** die versuchten den Markteintritt von erneuerbaren Energieträgern zu verhindern.

In manchen Ländern, etwa Portugal und Frankreich, bestehen steuerliche Nachteile beim Einsatz von Biomasse zur Beheizung. Andere Hindernisse ergeben sich z.B. aus übermäßig strikten Emissionsgrenzwerten, unverhältnismäßigen feuerpolizeilichen Auflagen, usw.

Es ist offensichtlich, dass angesichts des komplexen Geflechts der zuvor beschriebenen Hindernisse ein umfassender Ansatz erforderlich ist, um ein dynamisches, selbsttragendes Marktwachstum zu ermöglichen. Voraussetzung für einen solchen ganzheitlichen Ansatz ist ein politischer Engagement für die Entwicklung dieses Marktes, der derzeit in den meisten Teilnehmerländern kaum existent oder nur schwach entwickelt ist.

## **2.3 Hindernisse in Ländern mit dynamischer Marktentwicklung**

Sogar in Ländern mit weit fortgeschrittener Marktentwicklung, wie Österreich, Dänemark oder Schweden, gibt es noch immer eine Reihe von Hindernissen, die das Marktwachstum verlangsamen.

Der **Mangel an Informationen und persönlichen Erfahrungswerten** stellt noch immer ein Hindernis dar. Obwohl bereits eine beachtliche Anzahl von Projekten umgesetzt wurde, sind diese auf nationaler Ebene kaum bekannt. Das Projekt BIOHEAT wird durch eine Vielzahl von Publikationen und Broschüren, die an alle wichtigen Akteure versendet werden, wesentlich zur Beseitigung dieses Hindernisses beitragen. Dennoch - von einer Innovation

zu hören oder zu lesen, hat eine völlig andere Wirkung, als sie persönlich zu sehen und mit jenen Personen zu sprechen, die sie nutzen. Die im Rahmen dieses Projekts organisierten Exkursionen sollten genau diese Möglichkeit bieten – ihr Erfolg war jedoch begrenzt. Die Exkursionen weckten nur das Interesse weniger Teilnehmer, und zwei internationale Exkursionen mussten aus Mangel an Interessenten abgesagt werden.

Holzheizanlagen weisen deutlich **höhere Investitionskosten** und niedrigere Betriebskosten auf. Dies kann zu **Finanzierungsschwierigkeiten** und anderen Problemen führen. Beispielsweise können **divergierende Interessen von Investoren und Nutzern** auftreten, da die einen höhere Kosten tragen müssen damit die anderen in den Genuss von Einsparungen kommen. Darüber hinaus gilt im Immobiliengeschäft das Interesse der Kunden oft mehr dem Preis der Wohnung als den künftigen Heizkosten. Wird eine Pelletheizung einmal als Standardausstattung für „hochwertige“ Wohnungen angesehen, ändert sich diese Situation natürlich.

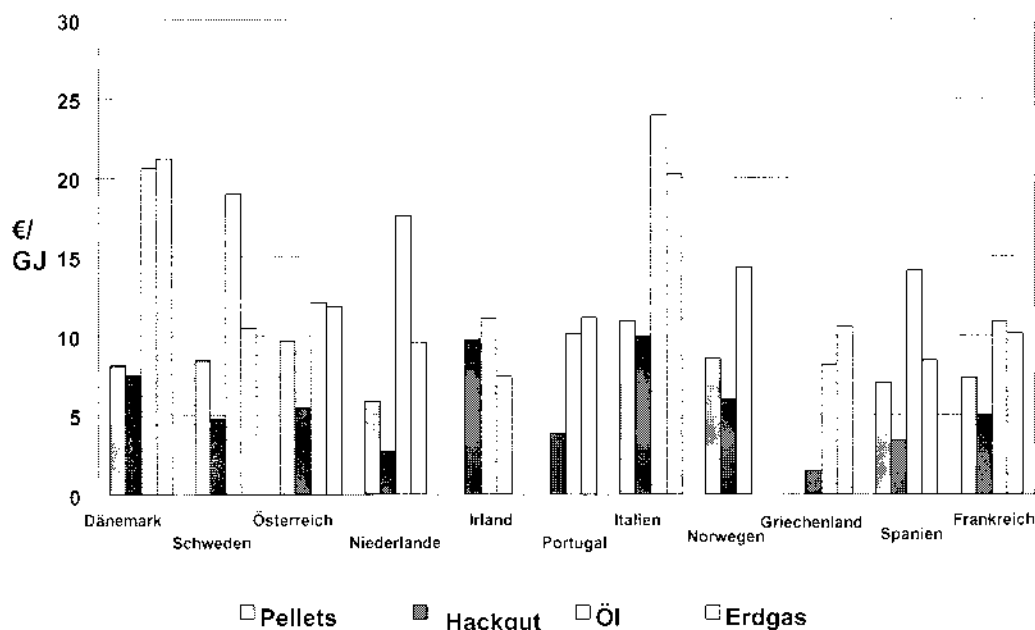
Aufgrund einer stagnierenden oder sogar rückläufigen Gesamtnachfrage nach Brennstoffen auf dem Wärmemarkt (verursacht durch eine Steigerung der Energieeffizienz) könnte die Konkurrenz durch **Erdgas und Heizöl** noch stärker werden, sobald sich Pellets zu einem wichtigen Konkurrenzfaktor entwickeln. Der Heizöl- und Erdgassektor kann ungleich mehr Ressourcen auf Marketingaktivitäten verwenden als der noch junge Bioenergiesektor. Der Wettbewerb kann auch in punktuell signifikanten Preissenkungen Ausdruck finden, wenn ein Bioenergieprojekt zur Diskussion steht. Es ist schwer vorstellbar, dass es der Bioenergie in einem derartigen Wettbewerbsumfeld gelingen wird, rasche Fortschritte zu machen, solange diese konkurrierenden Kräfte nicht ihre Stoßrichtung ändern und sich an der Einführung erneuerbarer Energie beteiligen. Der Markteintritt von Shell und STATOIL ist ein viel versprechender Schritt in diese Richtung, stellt auf europäischer Ebene aber immer noch die Ausnahme dar.

Obwohl es gelungen ist, einen funktionierenden Brennstoffmarkt zu etablieren, kam es in einigen Ländern im Winter 2001/2002 bei Pellets zu vorübergehenden Versorgungsengpässen. Diese entstanden, weil die Marktnachfrage unterschätzt worden war und sich die Sägeindustrie der Notwendigkeit, ausreichende Lagerkapazitäten bereitzustellen, nicht in ausreichendem Maße bewusst war. Versorgungsschwierigkeiten und starke Preissteigerungen hatten massive Auswirkungen auf das Konsumentenvertrauen und führten zu deutlichen Absatzeinbrüchen.

## 2.4 Die Wirtschaftlichkeit von Holzbrennstoffen

Viele am Projekt beteiligte Partner zeigten sich von der Erkenntnis überrascht, dass Biobrennstoffe in ihren Heimatländern tatsächlich billiger sind als herkömmliche Brennstoffe. Aufgrund der komplizierten Umrechnungsfaktoren gestaltet sich der Preisvergleich zwischen Biobrennstoffen und herkömmlichen Brennstoffen schwierig, was allgemein den Eindruck vermittelt, dass sie teurer seien.

Um die Kostenfrage zu klären, wurde von allen Partnern eine ursprünglich im Antrag nicht vorgesehene Erhebung von Kostendaten auf Grundlage von genau festgelegten Rahmenbedingungen durchgeführt, um einen aussagekräftigen Vergleich zu ermöglichen. Die Ergebnisse dieser Recherchen sind in der folgenden Grafik dargestellt, die die Brennstoffpreise in allen Teilnehmerländern vergleicht:



**Abbildung 1:** Brennstoffpreise zur Raumbeheizung, Stand: Juni 2001, ermittelt im Rahmen des Projekts BIOHEAT. Preise inkl. MWSt. bei einem Jahresverbrauch von 900 GJ. Ausreichend für einen 100 kW-Kessel.

Abbildung 1 zeigt, dass **Biobrennstoffe in allen Teilnehmerländern deutlich billiger als herkömmliche Brennstoffe** sind. Natürlich variieren die Preise deutlich von Land zu Land, was von der Steuersituation, der Marktlage und anderen Faktoren abhängt. Beachtenswert ist, dass Holzbrennstoffe in jenen Ländern am billigsten sind, in denen sie nicht zur Energiegewinnung verwendet werden, sondern als zu entsorgender „Abfall“ gelten, oder wo (beinahe) ein Nachfragemonopol herrscht (üblicherweise Hersteller von Pressspanplatten oder die Papier- und Zellstoffindustrie).

Die Tatsache, dass Holzbrennstoffe billiger sind, bedingt nicht automatisch ihre Wettbewerbsfähigkeit, da die Investitionskosten für eine Biomasse-Anlage deutlich höher sind. Auch spielt das Klima eine Rolle, da ein erhöhter Wärmeenergieverbrauch die Wirtschaftlichkeit von Holzheizanlagen verbessert. Aus diesem Grund wurde eine 100 kW-Anlage als Referenzmodell herangezogen, um die Wettbewerbsfähigkeit der Holzheizung unter verschiedenen nationalen Gegebenheiten zu vergleichen.

Bei dieser Modellanlage handelt es sich um eine moderne österreichische Hackguthheizung im Ort Nestelbach, mit der eine Wohnhausanlage mit insgesamt 20 Wohnungen beheizt wird. Der Hackgutmessel verfügt über eine automatische Raumaustragung, eine automatische Reinigung der Wärmeaustauscher und eine automatische Fehlermeldung per SMS an den Betreiber im Fall von Betriebsstörungen. Der Kessel hat einen Wirkungsgrad von ungefähr 90% und CO-Emissionen von ungefähr 100 mg/m<sup>3</sup>. Er kann sowohl mit Hackgut als auch mit Pellets betrieben werden. Der Kessel befindet sich im Heizraum einer der Wohnhausanlagen, der für eine Ölheizanlage vorgesehen war. Anstelle des Öltanks wurde unterirdisch neben dem Gebäude ein Betonlagerraum für Hackgut errichtet. Bilder und eine genaue Beschreibung des Projekts befinden sich auf der Website [www.bioheat.info](http://www.bioheat.info).

Um die Wettbewerbsfähigkeit von Holzbrennstoffen in den Teilnehmerländern zu vergleichen, wurden die Kostendaten dieser Modellanlage als fix angenommen. Ebenso wurden die Kostendaten für einen dazu in Konkurrenz stehenden ölbefeuerten Kessel nach österreichischen Bedingungen als fix angenommen. Eine umfassende Kostenberechnung der Heizkosten nach VDI 2067 wurde für alle am Projekt beteiligten Länder durchgeführt. Bei

dieser Berechnung ging man von einer gleich hohen Investition aus, Brennstoffkosten und klimatische Bedingungen wurden jedoch länderspezifisch angepasst.

Natürlich können die klimatischen Gegebenheiten in manchen Ländern sehr unterschiedlich sein. In diesem Fall wurden die klimatisch kälteren Regionen des betreffenden Landes ausgewählt.

Die Ergebnisse werden in den Abbildungen 2 und 3 dargestellt. Um zu verdeutlichen, dass die Preise immer einer gewissen Fluktuation unterliegen, werden die Heizkosten auf Basis von Holzbrennstoffen in den verschiedenen Ländern als Kreis und nicht als Punkt dargestellt. Der Vergleichspreis ist der nationale Preis von Heizöl (=100%). Die Grafiken zeigen die Heizkosten auf Holzbrennstoffbasis als Prozentsatz der Heizkosten auf Heizölbasis. Die Kosten wurden ohne Förderungen berechnet.

### Vergleich der Gesamtheizkosten mit Hackgut und Heizöl

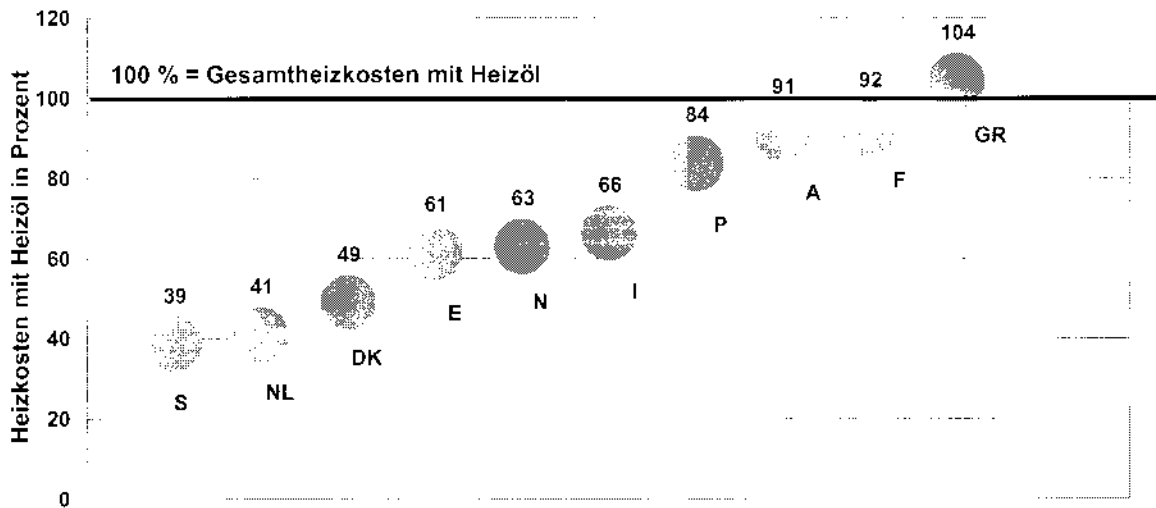


Abbildung 2

### Vergleich der Gesamtheizkosten mit Holzpellets und Heizöl

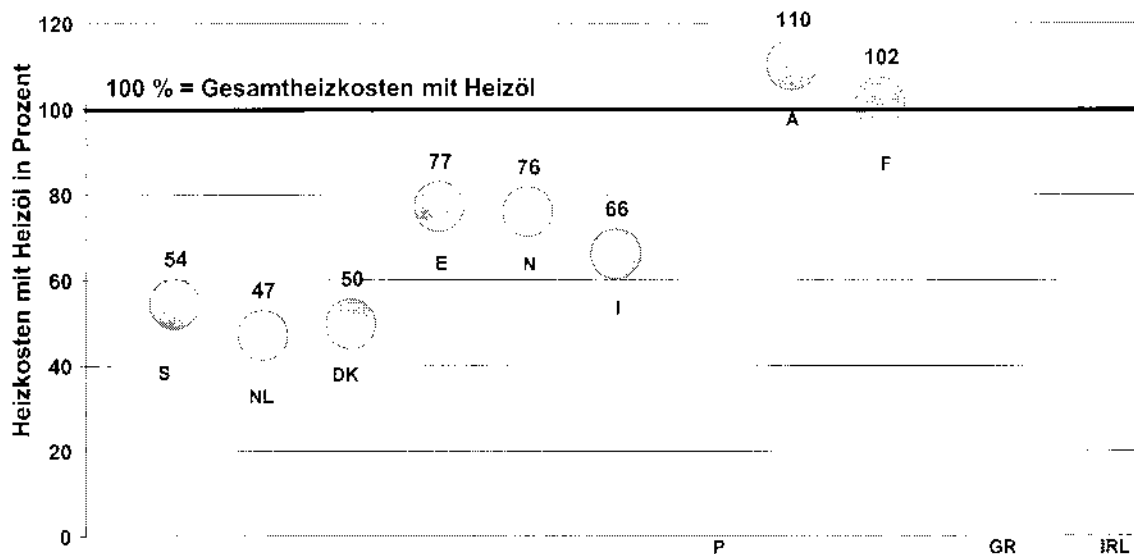


Abbildung 3

Die Ergebnisse zeigen, dass Hackgut in allen Ländern mit Ausnahme von Griechenland und wettbewerbsfähig ist. Die beste Wettbewerbssituation besteht in Schweden und Dänemark, also in Ländern, die überaus hohe Energiesteuern aufweisen, und in den Niederlanden. Hier ergibt sich die Wettbewerbsfähigkeit aus den sehr niedrigen Brennstoffpreisen, da Holznebenprodukte in den Niederlanden als Abfall gelten.

Obwohl die Heizkosten auf Pellet-Basis generell etwas höher ausfallen, sind sie dennoch in den meisten Ländern voll wettbewerbsfähig. Paradoxerweise ist die Konkurrenzfähigkeit in Österreich, wo die Verbreitung von Pellet-Heizanlagen besonders erfolgreich war, am geringsten. Um diesem Mangel an Wettbewerbsfähigkeit gegenzusteuern, stehen Förderungen zur Verfügung, die üblicherweise 30% der Investitionskosten ausmachen. Bei einem derartigen Förderbetrag entstehen bei der pelletbefeuerten 100 kW-Anlage ungefähr dieselben Heizkosten wie bei einer Ölheizung.

Zwei Ergebnisse dieses Wirtschaftlichkeitsvergleichs sind bemerkenswert:

- 1) Die Beheizung größerer Gebäude mit Biomasse kann in ganz Europa wettbewerbsfähig sein!
- 2) Die Marktdurchdringung wird nicht notwendigerweise von wirtschaftlicher Wettbewerbsfähigkeit allein bestimmt. Andere Faktoren – etwa Zugang zu Technologien, Brennstoffversorgung, Image oder Förderpolitiken – können selbst dann zu einer dynamischen Markteinführung führen, wenn der wirtschaftliche Nutzen begrenzt ist.

## **2.5 Beiträge des Projekts BIOHEAT zur Marktentwicklung in Europa**

Phase 1 des Projekts widmete sich der Analyse der Marktlage und der Hindernisse für den Einsatz von holzbefeuerten Heizanlagen in den Teilnehmerländern. Diese Phase war sehr aufschlussreich und zeichnete ein deutliches Bild der zur Belegung dieser Märkte erforderlichen Maßnahmen. Die Ergebnisse wurden in den vorstehenden Abschnitten präsentiert. Sie bestätigen, dass die Hauptziele des Projekts gut gewählt waren. Diese Ziele bestanden darin, Informationen über moderne Technologien zur Holzbeheizung auf breiter Ebene zugänglich zu machen und sich auf das Marktsegment verdichteter Wohnbau zu konzentrieren. Tatsächlich bestand in den meisten Teilnehmerländern ein grundlegendes Informationsdefizit, und das gewählte Marktsegment erwies sich als in ganz Europa wirtschaftlich interessant.

Die Phasen 2 und 3 galten der Erarbeitung und Verbreitung von Informationsmaterialien. Das Hauptaugenmerk richtete sich hier auf die Erstellung von Informationsbroschüren. Zwei Broschüren waren auf die wichtigsten Märkte ausgerichtet – öffentliche Gebäude und Wohnhausanlagen. Diese Broschüren wurden in großen Mengen innerhalb der Zielgruppen in den Teilnehmerländern verbreitet. Gemeinden, Wohnbauträger und Wohnbaugenossenschaften, Architekten und viele andere relevante Berufsgruppen erhielten solche Broschüren, die den Zweck hatten, das Augenmerk dieser Akteure auf das Thema zu lenken, indem verschiedene wichtige Fragen angesprochen wurden:

- Warum ist die Beheizung mit Holz eine interessante Option?
- Beispiele erfolgreicher Projekte
- Informationen über Wirtschaftlichkeit und Umweltauswirkungen
- Anregungen für die Entwicklung eines erfolgreichen Projekts

Eine dritte Broschüre widmete sich den wichtigsten technischen Informationen und soll es Planern, Architekten und Bauträgern ermöglichen soll, sich die bestehenden Erfahrungen zu Nutzen zu machen.

Es zeigte sich, dass die Erstellung der Broschüren mit ihren länderspezifischen Versionen deutlich mehr Ressourcen in Anspruch nahm als ursprünglich angenommen. Um höchste Qualität im Hinblick auf Inhalt und Gestaltung zu gewährleisten, war ein großer Aufwand erforderlich.

Eine weitere Maßnahme zur Verbreitung von Informationen war die Veröffentlichung von Artikeln in bestimmten, an die relevanten Zielgruppen gerichteten Fachzeitschriften. Auch diese Maßnahme erwies sich mit einer Vielzahl von Veröffentlichungen in allen Teilnehmerländern als überaus erfolgreich.

Politische Handlungsoptionen wurden in zwei Workshops mit Vertretern der Europäischen Kommission diskutiert.

Phase 4 zielte darauf ab, interessierte Personen und Organisationen in der Anlaufphase von Projekten zu unterstützen. Die zu diesem Zweck organisierten Seminare waren durchaus erfolgreich. Sie stießen auf reges Interesse und die Anzahl der Teilnehmer, die die einzelnen Veranstaltungen besuchten, betrug bis zu 100 Personen und mehr. In einigen Fällen hatte dies eine umfassende Berichterstattung in Fernsehen, Radio und Printmedien zur Folge. Die anderen für diese Phase geplanten Aktivitäten waren weniger erfolgreich. Leider bestand die Europäische Kommission in der Verhandlungsphase des Vertrags auf einer Verkürzung der Laufzeit von zwei Jahren auf 1,5 Jahre. Üblicherweise liegt ein beträchtlicher Zeitraum zwischen der Verbreitung von Informationsmaterialien und der Entscheidung der Akteure in den Zielgruppen über die Teilnahme an einem Pilotprojekt. Deshalb bestand während der Laufzeit des Projekts sehr wenig Nachfrage nach Unterstützung in der Anlaufphase. Einige Exkursionen mussten aufgrund fehlenden Interesses abgesagt werden, und nur wenige Einzelpersonen und Institutionen machten von den eingerichteten Telefonhotlines Gebrauch. Glücklicherweise werden die meisten am Projekt beteiligten Organisationen auch nach Projektabschluss diese Art von Unterstützung mit Hilfe anderer Finanzierungsquellen anbieten.

## 2.6 Schlussfolgerungen

Wie die Entwicklungen in einigen Teilnehmerländern zeigen, ist ein technologischer Entwicklungsstand erreicht, der eine dynamische Markteinführung möglich macht. **Die mit modernen Pellet- und Hackgutkesseln erzeugte Wärme erreicht ein Maß an Komfort, Effizienz und Wirtschaftlichkeit, das sie in ganz Europa zu einer realistischen Alternative zu fossilen Brennstoffen macht.** Dies gilt besonders für den in dieser Studie untersuchten Markt – Heizsysteme in großen Gebäuden. In einer Reihe von Ländern hat auch der Markt für pelletbefeuerte Heizanlagen für Einfamilienhäuser oder Fernwärmesysteme – von Kleinanlagen zur Beheizung einiger benachbarter Häuser bis zu Großanlagen im 100 MW-Bereich – eine erfreuliche Entwicklung genommen.

**Das diesbezüglich bestehende Informationsdefizit wurde als eines der Haupthindernisse für die Markterschließung ermittelt.** Durch gezielte Maßnahmen zur Verbreitung von Informationen – diverse Publikationen, zielgruppenspezifische Broschüren und eine umfassende Website – konnte das **Projekt BIOHEAT einen wesentlichen Beitrag zur Überwindung dieses Hindernisses leisten.** Das allein wird jedoch nicht ausreichen, um die Marktentwicklung anzukurbeln. **Die Analyse hat eine Reihe anderer, komplexer**



**Hindernisse ergeben, die es ebenfalls zu überwinden gilt**, um das volle Potenzial von Biomasseheizungen auszuschöpfen.

In diesem Zusammenhang ist bemerkenswert, dass **nicht länger Defizite bei Forschung und Entwicklung das Haupthindernis für eine Markteinführung darstellt**, sondern vielmehr ein Mangel an Ressourcen zur Überwindung dieser Hindernisse. Die EU-Kommission hat sowohl im Grünbuch für Energieversorgungssicherheit als auch in ihren Anstrengungen zur Erreichung des Kyoto-Zieles die Bedeutung einer zügigen Markteinführung von erneuerbaren Energieträgern zum Ausdruck gebracht. In diesem Bereich scheint eine **deutliche Diskrepanz zwischen den Mitteln, die für die Forschung und Entwicklung** von möglicherweise erst in Jahrzehnten einsatzbereiten Technologien bereitgestellt werden, **und den Ressourcen zu bestehen, die der Marktentwicklung von Technologien dienen**, welche sich schon heute auf dem Markt befinden und die Nutzung von Biomasse mit einem Wirkungsgrad von mehr als 90% ermöglichen.

Die folgenden Probleme müssen gelöst werden, um eine groß angelegte Markteinführung zu ermöglichen:

Gegenwärtig stellt die **Brennstoffversorgung** in vielen Ländern ein bedeutendes Hindernis dar – in Ländern mit dynamischem Marktwachstum war die Einführung von Holzpellets der wichtigste Faktor bei der Entwicklung des Bioenergiemarktes, und zwar sowohl für größere Objekte als auch für Einfamilienhäuser. Dies führt zu dem Schluss, dass die Schaffung eines **EU-weiten Marktes für Pellets**, der die wettbewerbsfähige Versorgung aller Verbraucher mit qualitativ hochwertigen Pellets ohne geografische Einschränkungen ermöglicht, oberste Priorität hat.

Die Möglichkeit, sich persönlich vom tatsächlichen Funktionieren von Biomasseheizungen überzeugen zu können, ist eine grundlegende Voraussetzung für Entscheidungsträger, bevor diese der Umsetzung eines Projekts zustimmen. In einigen Teilnehmerländern **fehlt es immer noch an erfolgreichen Vorzeigeprojekten**, welche die Möglichkeit zur persönlichen Erfahrung bieten: Bioenergie funktioniert! Demonstrationsanlagen mit hohem Bekanntheitsgrad bieten darüber hinaus die Möglichkeit für kostengünstiges Marketing, da sie gewöhnlich großes – und kostenloses – Medieninteresse auf sich ziehen, besonders wenn professionelle Kommunikationsstrategien zum Einsatz kommen. Dies ist besonders in jenen Ländern wichtig, wo Holz als Heizmaterial noch immer einen relativ schlechten Ruf hat. Die Umsetzung von Modellprojekten auf dem neuesten Stand der Technik ist daher ein weiterer Punkt mit oberster Priorität.

**Öffentliche Gebäude** sind besonders gut als Modellprojekte geeignet – BIOHEAT II – die Fortsetzung des gegenständlichen Projekts - wird sich auf dieses Marktsegment konzentrieren. Es bedarf jedoch politischen Engagements, um die inhärente Unbeweglichkeit administrativer Strukturen zu überwinden.

Die Nutzung neuer Technologien wird immer als riskant angesehen und ist aufgrund des Mangels an einschlägigen Erfahrungen mit erheblichen zusätzlichen Transaktionskosten verbunden. Auch wenn die Beheizung mit Holzbrennstoffen grundsätzlich wettbewerbsfähig ist, bedarf es daher **finanzieller Anreize, um das Risiko und die höheren Transaktionskosten** während der ersten Jahre der Marktentwicklung **wettzumachen**. Die in zwei Teilnehmerländern beobachtete steuerliche Benachteiligung von Bioenergie muss ausgeräumt werden.

**Regulative Maßnahmen** sind im Hinblick auf eine Reihe von Fragen erforderlich. Ein harmonisiertes Paket **strikter, aber vertretbarer Emissionsgrenzwerte** könnte ein ausgewogenes Umfeld für moderne Technologien schaffen, die sowohl unter übermäßig strengen Emissionsauflagen (wie zum Beispiel in den Niederlanden) als auch unter

fehlenden Emissionsbegrenzungen leiden, wodurch auch qualitativ minderwertige Produkte auf dem Markt zugelassen werden die dem negativen Image von Holzheizungen als umweltverschmutzende und ineffiziente Technologie Vorschub leisten.

Im Zuge der Untersuchungen wurde eine Reihe staatlicher Bestimmungen eruiert, die ebenfalls eine **erhebliche Anzahl von unangemessenen Hindernissen** für den Einsatz von Holzbrennstoffen schaffen. Diese Bestimmungen betreffen die Behandlung von Holzbrennstoffen als Abfallstoffe, Bauvorschriften, unverhältnismäßige feuerpolizeiliche Auflagen, usw.

Für eine Marktentwicklung bedarf es jedoch auch **neuer Bestimmungen und Normen zur Qualitätssicherung und reibungslosen Markteinführung**. Solche Bestimmungen müssen Qualitätsstandards sowohl für Brennstoffe also auch für Heizanlagen enthalten, aber auch Normen für Serviceleistungen wie Transport, Sicherheitsmaßnahmen, technische Vorgaben für Lagerräume, usw. Derartige Regelungen sind äußerst wichtig, da das Versagen jedes wichtigen Elements in der Technologie- oder Dienstleistungskette zu schwerwiegenden Rückschlägen führen kann, was wiederum ein nur schwer zu behebendes negatives Image der neuen Technologie zur Folge hätte. Die jüngsten Erfahrungen bei vorübergehenden Versorgungsengpässen in einigen skandinavischen Ländern deuten darauf hin, dass möglicherweise die Einführung von Mindestvorgaben für die Brennstofflagerung von Pelletproduzenten oder die Schaffung staatlicher Mechanismen zur Finanzierung von Lagerkapazitäten ähnlich jener für Heizöl erforderlich sein werden.

Die **Ausbildung von Fachkräften** ist eine weitere wichtige Voraussetzung für eine erfolgreiche Marktentwicklung. Seien es Architekten, Consultants, Installateure oder andere relevante Fachkräfte: Ein Unternehmer, der mit der neuen Technologie nicht vertraut ist, wird seinen Kunden von der Entscheidung für die neue, „riskante“ Variante abraten, weil er fürchtet, Fehler zu machen oder auf unerwartete Probleme zu stoßen. Die an diese Zielgruppe ausgegebene Broschüre ist sicher ein erster Schritt in die richtige Richtung. Detailliertere Informationen werden jedoch folgen müssen.

Es ist offensichtlich, dass komplexe und weitreichende Maßnahmen nötig sind, um die vorhandenen Hindernisse zu überwinden. Andere erfolgreiche Beispiele für die Einführung neuer Technologien deuten darauf hin, dass **mit der Marktentwicklung betraute Institutionen** bei der Bewältigung dieser Hindernisse mitunter eine zentrale Rolle spielen. Politische Entscheidungsträger sollten diese Möglichkeit in ihre Bemühungen, diesen Markt zu entwickeln, mit einbeziehen.

**Energiedienstleistungsunternehmen** können ebenfalls entscheidend zur Marktentwicklung beitragen. Entsprechende Anreize für derartige Unternehmen können dazu dienen, die aufgrund von fehlenden Fachkräften und nicht risikobereiten Investoren entstandenen Hindernisse abzubauen. In den meisten Teilnehmerländern zeigt jedoch die Erfahrung, dass kommerzielle Akteure auf dem Gebiet der konventionellen Energieversorgung in starke Konkurrenz zur Bioenergie treten, sobald diese auf dem Markt auftritt. **Wenn nicht politische Rahmenbedingungen geschaffen werden, die Energieunternehmen zum Eintritt in den Markt für Wärmeerzeugung aus erneuerbarer Energie motivieren, könnte sich die Entwicklung dieses Marktes als langsam und schwierig erweisen.**

Bislang haben sich die politischen Maßnahmen der Mitgliedstaaten hinsichtlich erneuerbarer Energieträger (EE) auf den Markt für Stromerzeugung durch EE konzentriert, nicht zuletzt deshalb, weil die Europäische Kommission diesem Markt besonderes Augenmerk geschenkt hat. Für die Umsetzung von politischen Maßnahmen auf nationaler Ebene zur Förderung des Marktes für Wärmeerzeugung auf der Grundlage erneuerbarer Energieträger **wird die Kommission die Initiative ergreifen müssen.**

## 2.7 Mögliche politische Maßnahmen der Europäischen Kommission

In der Folge werden vier mögliche politische Maßnahmen diskutiert, die ein unterschiedlich intensives politisches Engagement für die Entwicklung des Marktes der Wärmeerzeugung aus erneuerbaren Energieträgern im Allgemeinen und die Entwicklung des Marktes für Wärmeerzeugung durch Biomasse im Besonderen voraussetzen:

### **Option 1: Besonderes Augenmerk auf die Entwicklung des Wärmemarktes im Rahmen des Programms „Intelligente Energie für Europa“ (IEE) – zusätzliche Mittel für die Marktentwicklung**

Dieses Programm würde eine adäquate Basis für Maßnahmen zur Überwindung zahlreicher Markthindernisse bieten, die in den vorangegangenen Abschnitten diskutiert wurden. Es wurde jedoch bereits darauf hingewiesen, dass politisches Engagement auf nationaler Ebene eine wichtige Voraussetzung für eine umfassende Marktentwicklung darstellt. Dies wird wahrscheinlich nicht allein durch die Umsetzung von Option 1 zu erreichen sein.

Die finanziellen Mittel für das IEE-Programm sind im Vergleich zu den für das 6. Rahmenprogramm verfügbaren Mitteln sehr gering. Mittelfristig sollte die Kommission die überaus ungleiche Verteilung von Ressourcen für Maßnahmen, die sich direkt auf die Markteinführung erneuerbarer Energiequellen auswirken, im Vergleich zu solchen für die Forschung im Bereich von Technologien, die noch weit von einer Markteinführung entfernt sind, überdenken.

### **Option 2: Mitteilung an den Rat und an das Europäische Parlament über eine gemeinsame Strategie zur Förderung des Einsatzes von Wärmegewinnung aus erneuerbarer Energie**

Eine solche Mitteilung ließe sich dadurch begründen, dass ungefähr 50% der Primärenergie in Europa in die Beheizung von Gebäuden und in Wärme für industrielle Anwendungen fließt. Zusätzlich ist im Vergleich zur Stromerzeugung aus erneuerbaren Energiequellen (EE) die Erzeugung von Wärme aus EE deutlich billiger. Die Mitteilung könnte die derzeitigen Hindernisse für die Entwicklung von Wärme aus EE wie Biomasse, Solarenergie, Umgebungswärme oder Geothermie beschreiben und die Grundzüge einer umfassenden Strategie zu deren Überwindung und zur Entwicklung des Marktes darstellen.

Angesichts des Fehlens spezifischer politischer Maßnahmen in den meisten Mitgliedsländern wäre eine Mitteilung ein erster, relativ einfacher Schritt, um das Interesse der Mitgliedstaaten auf die Möglichkeiten des Marktes für Wärme aus EE zu lenken. Gesteigertes Interesse im Hinblick auf Wärme aus EE könnte das Augenmerk der Mitgliedstaaten auf die neuen Technologien und das große Potenzial dieses Marktes richten und den Weg für eine Richtlinie in diesem Bereich ebnen, was sich derzeit aufgrund der vielen Missverständnisse in Bezug auf Technologien und Marktpotenzial in diesem Sektor noch schwierig gestalten könnte.

Eine Mitteilung wäre jedoch als Maßnahme nicht gewichtig genug, um das Interesse großer Energieunternehmen an diesem Markt zu wecken, und würde lediglich eine graduelle Steigerung des Engagements der Kommission andeuten.

### **Option 3: Vorbereitung einer Richtlinie zur Förderung der Wärmeerzeugung aus EE**

Eine Richtlinie über die Erzeugung von Wärme aus EE könnte indikative Ziele für den Einsatz von erneuerbarer Energie auf dem Wärmemarkt vorschlagen und die Mitgliedstaaten dazu auffordern, Hindernisse abzubauen und Bericht darüber abzulegen, welche Maßnahmen zur Erreichung dieser Ziele gesetzt werden. Die Verpflichtungen könnten an

Energieunternehmen auf dem Wärmemarkt übertragen werden – besonders an Öl- und Gasunternehmen. Diese könnten über Wärmemengenzähler an Biomassekesseln, Sonnenkollektoren oder Wärmepumpen die Lieferung von bestimmten Mengen von Wärme aus erneuerbaren Energiequellen nachweisen.

Da der Erlass einer Richtlinie natürlich eine weit gewichtigere Maßnahme als eine Mitteilung wäre, würde dadurch deutlich mehr Aufmerksamkeit auf die Thematik der Erzeugung von Wärme aus EE gelenkt werden. Angesichts des derzeitigen Informationsdefizits könnten daraus allerdings auch beträchtliche Kontroversen entstehen. Eine Richtlinie wäre eine angemessene Maßnahme, um das kommerzielle Interesse von Energieunternehmen an der Aufnahme von Energiedienstleistungen im Bereich Wärme aus EE in ihre Angebotspalette zu wecken. Wie schon erwähnt, könnte sich die Verfügbarkeit solcher Dienstleistungen als sehr viel versprechender Schritt für die Entwicklung dieses Marktes erweisen.

#### **Option 4: Nutzung der Möglichkeit einer Harmonisierung der für die Stromerzeugung aus erneuerbaren Energiequellen bestehenden Regelungen zur Schaffung von Anreizen für die Entwicklung des Marktes für Wärme aus erneuerbaren Energieträgern**

Wenn ein harmonisiertes System für die Erzeugung von Strom aus EE in Europa auf Quoten für erneuerbare Energie basieren würde, könnte man Energieversorgungsunternehmen erlauben, einen Teil ihrer daraus resultierenden Verpflichtungen durch die Lieferung von Wärme aus EE zu erfüllen. Eine solche Regelung wäre in verschiedener Hinsicht interessant:

- Wie jüngste Studien zeigen (Projekt PRETIR), werden sich in den meisten Mitgliedstaaten große Probleme bei der Erreichung der indikativen Ziele der Richtlinie zur Förderung der Stromerzeugung aus EE ergeben.
- Die dezentrale Nutzung von Wärme aus erneuerbaren Energieträgern ist leichter zu organisieren als die Versorgung großer zentraler Kraftwerke.
- Der Wirkungsgrad der Nutzung von Biomasse in kleinen Heizanlagen kann bis zu 90% erreichen, während der Wirkungsgrad bei der Stromerzeugung aus Biomasse in großen Kondensationskraftwerken unter 40% liegt.
- Die Kosten für die Bereitstellung erneuerbarer Energie sind auf dem Wärmemarkt deutlich niedriger – auch wenn beispielsweise 2 kWh Wärme aus EE nötig wären, um eine Verpflichtung von 1 kWh Strom aus EE zu erfüllen könnten erhebliche Kosten eingespart werden.
- Eine solche Maßnahme könnte den Wärmemarkt ohne den Einsatz zusätzlicher öffentlicher Mittel und mit deutlichen Ressourceneinsparungen beleben und insbesondere zur Etablierung eines attraktiven Marktes für Energiedienstleistungen führen. So könnte sich in verschiedener Hinsicht eine Win-Win-Situation ergeben.

Ähnliche Maßnahmen wurden in einigen US-Bundesstaaten getroffen und werden auch in Norwegen in Betracht gezogen.



ENERGIE  
VERWERTUNGSAGENTUR



## Final Report

# BIOHEAT

Promoting Biomass heating in large  
buildings and blocks

Altener 4.1030/Z/00-163/2000

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# Content

<b>1</b>	<b>Executive summary</b> .....	<b>1</b>
<b>2</b>	<b>Summary of results</b> .....	<b>3</b>
2.1	The present situation of biomass use for heating large buildings .....	3
2.2	Barriers for wood heating in countries with no or limited diffusion .....	4
2.3	Barriers in countries with dynamic market development .....	5
2.4	The economics of wood heating .....	6
2.5	Contributions of the BIOHEAT project to market developments in Europe .....	9
2.6	Conclusions .....	10
2.7	Policy options for the European Commission .....	12
<b>3</b>	<b>Overview of activities – comparison with contractual obligations</b> .....	<b>15</b>
3.1	Introduction to the project .....	15
3.2	Completion of contractual obligations .....	16
<b>4</b>	<b>Wood heating systems for large buildings: status, barriers for market development and strategies for the future</b> .....	<b>18</b>
4.1	Austria .....	18
4.2	Denmark .....	27
4.3	France .....	33
4.4	Greece .....	42
4.5	Italy .....	55
4.6	Netherlands .....	62
4.7	Norway .....	71
4.8	Portugal .....	79
4.9	Spain .....	82
4.10	Sweden .....	97
<b>5</b>	<b>Promotion and dissemination activities in each participating country</b> .....	<b>103</b>
5.1	Austria .....	103
5.2	Denmark .....	104
5.3	France .....	107
5.4	Greece .....	109
5.5	Italy .....	113
5.6	Netherlands .....	118
5.7	Norway .....	121
5.8	Portugal .....	123
5.9	Spain .....	125
5.10	Sweden .....	129
<b>6</b>	<b>Reflections on the project</b> .....	<b>133</b>
6.1	Positive aspects of the project .....	133
6.2	Problems in the project .....	133
6.3	Lessons learned .....	134
<b>7</b>	<b>ANNEXES</b> .....	<b>135</b>



# 1 Executive summary

The analysis performed within the BIOHEAT project conveys one clear message: modern pellet and woodchip boilers provide heat at a level of comfort, efficiency and economics that make it a viable alternative to fossil fuels throughout Europe. As developments in a number of participating countries show, dynamic market take off is possible with the level of technology achieved and within the given economic framework conditions. Wood chips and pellets are significantly cheaper than conventional fuels in all participating countries and total heating costs calculated on the basis of a model plant heating 20 flats in a residential block would be competitive in all participating countries with the exception of Greece.

Why does dynamic market deployment take place only in a few selected countries yet? The lack of information on state of the art automatic wood heating has been identified as a major barrier for market development. The BIOHEAT project has contributed much to removing this barrier by disseminating information via numerous publications, targeted brochures and a website ([www.bioheat.info](http://www.bioheat.info)).

However, this by itself will not suffice to kick off market development, as a complex set of other barriers has been identified that also need to be addressed to realise the full potential of heating with biomass. It is noteworthy that research is no more the constraining factor for market deployment, but the availability of resources to remove these different barriers.

Personal experience that biomass heating actually works is an essential precondition for decision makers before they decide to realise a project. In several participating countries there is still a serious lack of successful demonstration projects that can provide this personal experience: bioenergy works! High profile demonstration plants can also be a means of cost effective marketing as they usually attract much media attention that need not be paid for, especially if professional communication strategies are applied. This is particularly important in those countries where wood heating still has a very poor image. Thus realising state of art demonstration projects is a top priority.

Fuel supply is another key barrier in many countries at present - in those countries showing dynamic market growth the introduction of wood pellets has been the key driving force both for the bioenergy market for large buildings and for single family houses. This leads to the conclusion that the establishment of an EU pellet market that is able to deliver high quality pellets competitively to any user without geographic restrictions is another issue of top-priority.

Applying new technology is always considered risky and related to considerable additional transaction costs due to non-standard procedures. Thus, even if wood heating is competitive nominally, it needs financial incentives to compensate for risk and higher transaction costs during the first years of market development.

A number of issues ask for regulatory action. A harmonised set of strict but reasonable emission limits could create a level playing field for state of art technologies that suffer both from excessively stringent emission regulations (as e.g. in the Netherlands) and from a lack of emission regulations, which allow very poor products to compete and sustain the image of wood heating as polluting and inefficient technology.

In the course of investigations a number of national regulations were identified that also create various unreasonable barriers for the use of wood fuels. These regulations regard the treatment of wood fuels as wastes, building codes, unreasonable fire safety requirements etc.

However market deployment also calls for new regulations and standards to ensure quality and allow smooth market introduction. Such standards need to be established both for fuel qualities and boiler qualities but also for services such as transport, security measures, technical requirements for storage rooms etc. The importance for such regulations is substantial as failure of any important element in the technology or service chain can lead to severe setbacks and create a negative image of the new technology that is very difficult to reverse. The recent experiences with temporary supply shortages in some Nordic countries point towards the potential need to implement minimum requirements for fuel storage for pellet producers or the establishment of national systems for financing storage similar to those that have been implemented for oil.

Training of professionals is another fundamental precondition for successful market development. No matter if it is architects, consultants, installers or other related professionals: a contractor not acquainted with the new technology will give his customers the advice to avoid selection of the new "risky" option because he is afraid of making mistakes or meeting unexpected problems. The brochure distributed to this target group is certainly a useful first step. But more in-depth information will have to follow.

It is obvious that complex and extensive measures are necessary to overcome the existing barriers. Other successful cases of technology introduction suggest that institutions dedicated to manage market development can play a key role in overcoming these barriers. Energy service companies can be another effective way of developing the market if suitable incentives are implemented.

Experience in the majority of participating countries shows that commercial actors in conventional energy enter in sharp competition with bioenergy as soon as it appears in the market. Unless political frame conditions are implemented that create motivations for energy companies to enter the renewable heat market, the development of this market could be slow and difficult.

So far RES policies of member states have been focussed on the renewable electricity market, last but not least due to the focus the European Commission has given to this market. To implement national policies supporting the development of the renewable-based heating market, it will be necessary for the Commission to take the initiative.

It could do so by putting more emphasis on the development of this market in the Intelligent Energy for Europe programme and by taking a political initiative. Such an initiative could be a communication to the Council and the European Parliament announcing a community strategy for promoting the use of renewable heat or the proposal of a directive on renewable heat stating indicative targets for member states and requiring them to remove relevant barriers and report on progress in achieving the targets. Finally, the implementation of a harmonised renewable electricity framework could also offer an opportunity for developing the renewable heat market by allowing member states to meet parts of their renewable electricity obligations by certified deliveries of renewable heat.

## 2 Summary of results

### 2.1 The present situation of biomass use for heating large buildings

The BIOHEAT project started with an orientation phase based on 15 interviews with various relevant actors in every participating country. Inter alia, this phase aimed to obtain a clear picture of the present market situation. The result of the investigations showed that the situation in the 10 participating countries differs greatly. Nevertheless four typical market situations were distinguished in the participating countries:

**“dormant markets”** – markets with a significant potential that have hardly seen any development in the field of modern wood heating so far. Greece and Spain can be considered to belong to this category. Only very few examples exist where wood is used to heat large buildings, usually with semimodern equipment. In these countries policy-makers have given low priority to the issue of using biomass for heating purposes, even though in both countries traditional use of firewood is quite relevant. In both countries the potential for using wood or agricultural residues such as olive pits, straw, etc. is rather large. In Spain the market is somewhat more developed, featuring some local success stories and a wood pellet production that serves a small niche market of pellet stoves.

**“markets in an early stage of development”** – in these markets there is a significant number of projects relying on wood heating and applying modern technologies. Using wood fuels is still very unusual and hardly known in these countries, however. Portugal, France, Norway and Italy belong in this group. In these countries significant market development cannot be taken for granted yet as many barriers exist that make wood heating in large buildings a marginal phenomenon. In all of these countries pellet production exists or has recently been started in one or several plants. Interest in using wood fuel is growing and policy makers have taken some initiatives to develop the wood heating market.

**“markets on a self-sustained growth path”** – in these markets the use of wood fuels has exceeded the threshold at which market forces pick up a development and carry it from regional isolated examples towards diffusion into the general market. This threshold is usually achieved when a “technology support system” is in place. Elements of this “support system” are skilled professionals, a developed fuel supply system, sound technology and established systems of quality assurance along the whole chain of services and products necessary to make the technology work. At present Sweden, Austria and Denmark are in this position. In Denmark the potential for further market growth is rather low, however, as district heating and natural gas supply the largest part of the heating market and are legally protected from competition. For this reason, Denmark could also be seen as belonging to the fourth type of markets:

**“markets with limited perspectives for growth”** – the Netherlands (and maybe Denmark) belong to this group, which has no significant biomass resources and a fully developed natural gas system that serves almost the entire heating market. Consequently there is no space for biomass boilers and fuel storage in existing buildings. In addition, emission limits are so strict that biomass boilers would need very expensive and presently

not even available flue gas cleaning systems. Thus the potential for significant market development is quite low in the Netherlands.

The fact that wood heating has seen a dynamic market introduction in several countries proves that the technology is ready for widespread dissemination. The time spans of market break-through were rather short in Sweden, Denmark and Austria – within 5 years markets were able to grow from almost zero to a reasonable size as a fully functional technology was introduced and financial incentives were in place (energy taxes in Denmark and Sweden, subsidies in Austria).

This fact is rather encouraging and we believe BIOHEAT will have a relevant impact by triggering a significant market development in several countries participating in the project, provided that other supportive measures are implemented and more political attention is paid to the use of renewable energy in the heating market than in the past.

## 2.2 Barriers for wood heating in countries with no or limited diffusion

Given the reasonable economic situation, it is obvious that significant other barriers must exist that inhibit technology diffusion. The first phase of the BIOHEAT project was also dedicated to analysing these barriers. The following section gives an overview of the most relevant barriers identified.

The **fundamental lack of knowledge** regarding the new technology is a universal barrier in all participating countries except maybe Sweden, which has been – as we believe – effectively addressed by the BIOHEAT project. If nobody knows that there are viable solutions for using biomass to heat large buildings, obviously the technology cannot be introduced on the market.

The **lack of an established system of fuel supply** is a universal and very significant barrier in all countries that have not seen significant market development so far. This lack of supply is linked to the lack of demand for such fuels and vice versa. This is the typical chicken-and-egg problem of bioenergy: supply cannot be established without demand and demand cannot be created without reliable supply in place.

In Austria, Sweden and Denmark, pellets were the “enabling technology” that made it possible to overcome this dilemma. Pellets can be transported over larger distances without excessive costs, thus making it possible to supply a standardised fuel in a reasonably large area without very high costs.

The **poor image of wood as a fuel** is also a general problem. At present, wood tends to be the fuel of “underdeveloped” rural regions. Everybody is aware that wood fires create considerable smoke. Besides – as mentioned above – it is an accepted prejudice that wood is an expensive fuel. It is difficult to overcome these views. With their very different and pleasant properties (soft, smooth, pleasant smell) pellets could be a way to create a completely new image of wood heating. The issue of smoke requires demonstration – modern biomass boilers do not produce any visible smoke. It is essential that the first demonstration plants apply state-of-the-art technology to contribute to overcome this poor image and create a completely new image of wood heating associated with environmentally friendly, economic high-tech appliances.

The **lack of information on and access to state-of-the-art technology** is a relevant barrier particularly in dormant markets. Companies offering state-of-the-art technology at present focus on the dynamic markets and have not yet tried to enter and develop dormant markets. It needs dedicated action to bring companies to these new markets.

Once information, fuels and good products are available, the **lack of skilled professionals** is the next barrier. Architects, consultants, installers and other related professionals must understand how to properly plan and set up a wood heating system. The most frequent technical problems with these systems are not caused by deficient products but by mistakes in the process of setting-up or operation.

A very effective way to remove the barriers that exist for wood heating are **energy service companies** that build, own and operate the respective wood heating system. If incentives and start-up support for such companies are available, they can be an important driving force. At present such companies do not exist in most participating countries, except for Sweden, Denmark and Austria. It is noteworthy that in Sweden and Denmark, it is large energy companies such as STATOIL and Shell that are very successful in marketing the concept of providing energy services on a wood pellets-basis.

Even at a very early stage of market development, **heavy competition from energy companies marketing oil or gas** has been experienced in many cases. Obviously these companies want to prevent the market entry of renewables from the very beginning.

In some countries such as Portugal and France, tax disincentives exist for the use of biomass for heating. Other barriers are regulatory barriers, such as exaggerated emission limits, unreasonable fire protection regulations, etc.

It is obvious that the complex set of barriers described above needs a comprehensive approach to stimulate dynamic self-sustained market growth. A precondition for such a comprehensive approach is the political commitment to develop this market which at present hardly exists (or is rather weak) in most participating countries.

### 2.3 Barriers in countries with dynamic market development

Even in countries with advanced market development, such as Austria, Denmark or Sweden, a number of barriers still exists that slow down market growth.

**Lack of information and personal experience** still plays a role as a barrier. Even though a considerable number of projects has been realised, on a national scale these are hardly known. With numerous publications and large numbers of brochures mailed to all relevant actors, the BIOHEAT project will contribute substantially to remove this barrier. However, „seeing is believing“, as the saying goes. Reading or hearing about an innovation has a completely different impact on people from seeing it personally and talking to the people who use it. The field trips organised in the course of this project aimed at achieving this objective – their success was limited, however. The field trips offered failed to attract many participants and two international field trips had to be cancelled due to lack of participants.

Wood heating systems are characterised by significantly **higher investment costs** and lower running costs. This can create **financing problems** and other problems such as an **investor/user dilemma**: the investor pays more, the user pays less if a biomass system is implemented. In addition, in the housing business customers often pay more attention

to the costs of the flat than to the future heating costs. Once a pellet heating system is considered a standard feature of "high value" flats, this situation changes, of course.

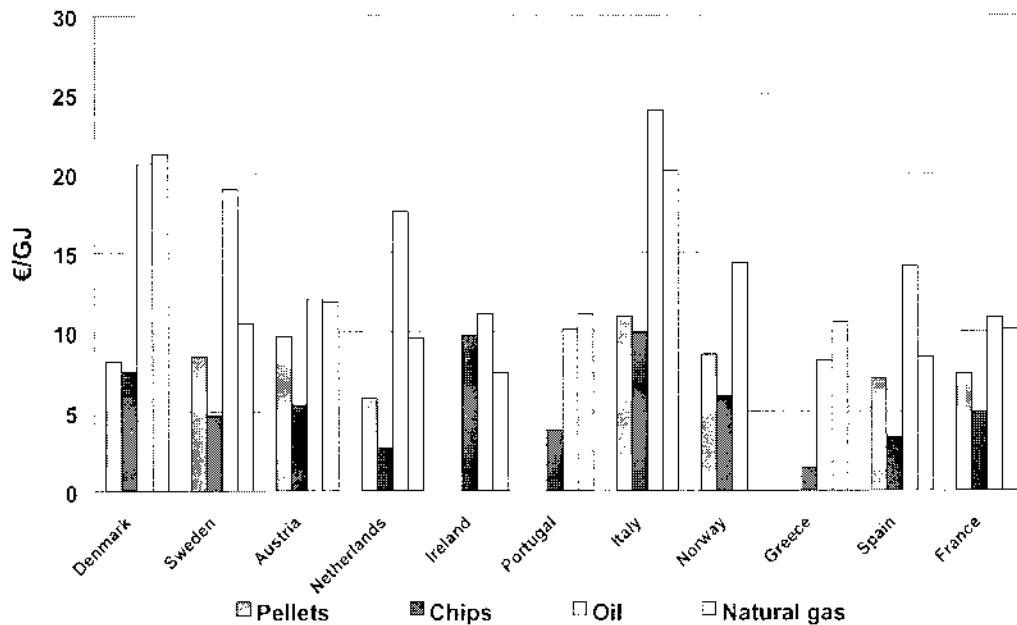
Due to stagnating and even decreasing overall demand (caused by efficiency gains) for fuels in the heating market, **competition from natural gas and from fuel oil** may become even more fierce, as pellets become a relevant competitor. The oil and gas sector is able to spend infinitely more on public relations than the young bioenergy sector. Competition can be also expressed by sharp rebates if a bioenergy project is competing. It is hard to imagine that bioenergy can make rapid progress against such strong forces unless these forces change direction and become part of introducing renewable energy. The entry of Shell and STATOIL in this market is an encouraging sign in this direction, but still an exception on the European scale.

While a working fuel market has been established, in the winter 2001/2002 temporary pellet shortages occurred in several countries. These shortages were caused by an underestimation of market demand and a lack of awareness in the sawmill industry of the necessity to provide sufficient storage capacity. Supply shortages and sharp price increases have profoundly affected consumer confidence and led to significant drops in sales.

## 2.4 The economics of wood heating

It came as a real surprise to many participating partners to find out that biofuels were actually cheaper in their country than conventional fuels. Due to the complicated conversion factors prices cannot be easily compared between biofuels and conventional fuels leading to the general perception that they are more expensive.

To clarify the cost situation a survey initially not planned in the proposal was carried out by all partners based on carefully selected conditions to make a meaningful comparison possible. The results of the survey are depicted in the following figure comparing fuel prices in all participating countries:



**Figure 1:** Prices of fuels for space heating as of June 2001 as gathered in the Bioheat project. Prices are incl. VAT for an annual consumption of 900 GJ. This suffices for a 100 kW boiler.

Figure 1 shows that **biofuels are significantly cheaper than conventional fuels in all participating countries**. Of course there are considerable variations of prices from country to country, depending on taxation, market situation and other factors. It is noteworthy that wood fuels are cheapest in countries where they are not used for energy thus constituting „waste“ that is hard to get rid off or for which (almost) a demand monopoly exists (typically particle board manufacturers or pulp and paper manufacturers).

The fuel being cheaper does not necessarily mean that wood fuels are competitive, as the investment costs for a biomass boiler are significantly higher. Also climate plays a roll, as increasing heat consumption improves the economics of wood heating systems. For this reason a plant of 100 kW was used as a reference model to compare the competitiveness of wood heating under different national conditions.

This model plant is a modern Austrian woodchip-fired plant in the village of Nestelbach that heats 3 small residential blocks (20 flats in total). The woodchip boiler is equipped with automatic fuel feeding, automatic heat exchanger cleaning and an automatic alarm function that sends an SMS to the plant owner in case of operational problems. The boiler has an efficiency of around 90% and CO emissions of around 100mg/m<sup>3</sup>. (Compared to 50% efficiency and 20.000 mg/m<sup>3</sup> of old fashioned wood-fired boilers). It can be operated both with woodchips and pellets. This boiler is located in the heating room of one of the blocks that was prepared for an oil-fired boiler. Instead of the oil tank, a concrete woodchip storage was built underground right next to the building. Pictures and a detailed description of the project are accessible at [www.bioheat.info](http://www.bioheat.info).

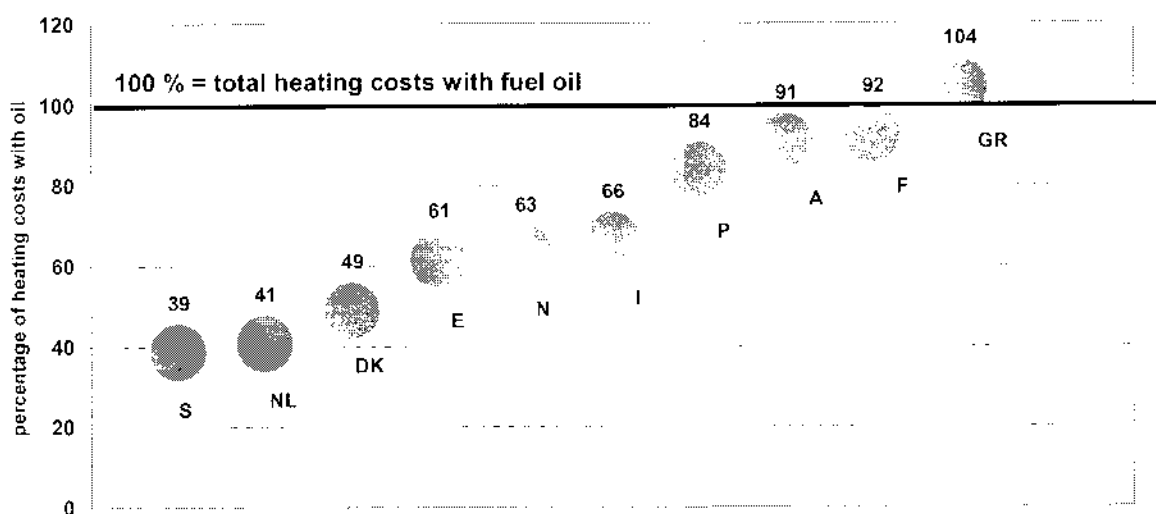
To compare the competitiveness of wood fuels in the participating countries, the cost data for this model plant were taken as fixed. Similarly, the cost data for a competing oil-fired boiler assumed under Austrian conditions were considered to be fixed. A full cost calculation of heat prices was made, based on the VDI 2067 standard, for all participating

countries that assumed the same investment but nationally adapted fuel prices and climatic conditions.

Of course in some countries climate conditions can vary considerably. In this case we selected those parts of the country with colder climate.

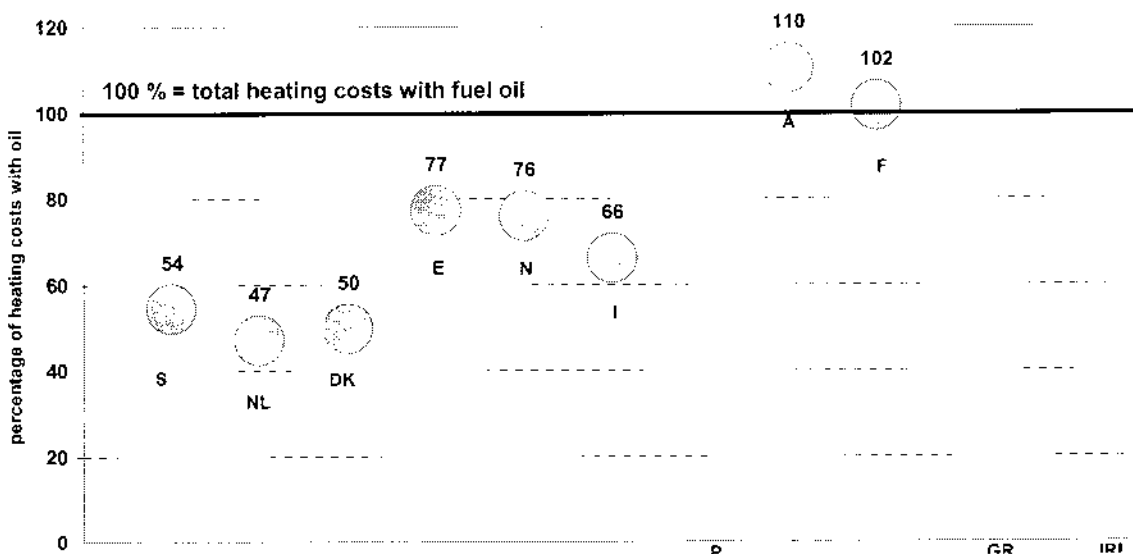
The results are shown in Figure 2 and Figure 3. To indicate that prices will always have a certain bandwidth the heating price based on wood fuels in the different countries is symbolised as a circle rather than a point. The reference price is the national price for fuel oil considered as 100%. The Figures show the costs of wood fuel-based heating as a percentage of fuel oil-based heating costs. Costs are calculated without subsidies.

**Comparison of total heating costs with wood chips and fuel oil**



**Figure 2**

**Comparison of total heating costs with wood pellets and fuel oil**



**Figure 3**



The result shows that woodchips are competitive in all countries except Greece and Ireland. The best competitive situation exists in Sweden and Denmark, which both have considerably high energy taxes, and in the Netherlands. In this case, competitiveness is based on very low fuel costs, as wood residues are presently considered waste in the Netherlands.

While pellet-based heating costs are generally somewhat higher, they are still fully competitive in the majority of countries. Paradoxically, competitiveness is poorest in Austria, where the dissemination of pellet heating was exceptionally successful. To compensate for this lack of competitiveness, subsidies are available which typically amount to 30% of investment costs. With this amount of subsidy, the pellet-fired 100 kW plant incurs about same heating costs as an oil plant.

Two results of this economic comparison are remarkable:

- 1) Heating large buildings with biomass can be competitive throughout Europe!
- 2) Market penetration is not necessarily determined by economic competitiveness. Other factors, such as the availability of technologies, fuel supply, image and supportive policies, can lead to a dynamic market take-off even if the economic benefit is limited.

## **2.5 Contributions of the BIOHEAT project to market developments in Europe**

Phase 1 of the project was dedicated to analysing the market situation and the barriers to wood heating in the participating countries. This phase was very instructive and revealed a clear picture of what needs to be done to get this market going. The results are presented above. The analysis carried out during this phase confirmed that the main targets of the project were well chosen. These targets were to make information on state-of-the-art wood heating technologies widely available and to focus on the market segment of large buildings. Indeed, a fundamental lack of information existed in most participating countries and the selected market segment proved to be economically interesting throughout Europe.

Phase 2 and 3 were dedicated to the production and dissemination of information. The main effort of these phases was dedicated to the production of information brochures. Two brochures addressed the most relevant markets – public buildings and residential blocks. These brochures have been distributed in significant numbers throughout the participating countries. They have been sent to municipalities, housing developers and housing associations, architects and many other related professionals. They try to attract the attention of these actors to the topic by addressing several relevant issues:

- Why is wood heating an interesting option?
- Examples of successful projects.
- Information about economics and environmental impact
- Suggestions on how to develop a successful project.

A third brochure was dedicated to communicate the most important technical issues – also a fundamental contribution to allow consultants, architects and contractors to take advantage of the extensive experience existing in Austria, Denmark and Sweden, which collaborated in designing this brochure. This brochure could be very valuable in ensuring

that the pilot projects that will be carried out in the next few years are based on reasonable concepts and avoid the most common mistakes.

It turned out that the development of the brochures and their country-specific adaptation required significantly more resources than previously assumed. Considerable efforts were made to ensure an excellent quality of the materials both regarding content and design.

Another information-spreading activity was the publication of articles in selected journals addressing the relevant target groups. This activity was also highly successful with large numbers of publications in all participating countries.

The policy conclusions were discussed in two dedicated meetings with the Commission.

Phase 4 was intended to offer start-up support for interested persons and organisations. The scheduled seminars were quite successful. They met with considerable interest and up to 100 persons and more attended the events; in several cases these included considerable media coverage in TV, radio and newspapers. The other activities planned in this phase were less successful. Unfortunately, during the negotiation phase of the contract, the European Commission insisted to reduce the contract's running time from two years to 1.5 years. Usually a considerable time lag lies between the dissemination of information and the decision of actors in the target groups to engage in a pilot project. Consequently, there was very little demand for support in the start-up phase during the running time of the project. Some field trips had to be cancelled due to lack of interest, and few persons and institutions used the telephone hotlines that had been set up. Fortunately, most organisations participating in the project will continue to offer this kind of support after the end of the project based on national funding.

## 2.6 Conclusions

As developments in several participating countries show, dynamic market take off is possible with the level of technology achieved. **Modern pellet and woodchip boilers provide heat at a level of comfort, efficiency and economics that make it a viable alternative to fossil fuels throughout Europe.** This applies particularly to the market investigated in this study – the heating of large buildings. In a number of countries also the market of pellet-fired boilers for single family houses or district heating systems all the way from micro systems serving a few neighbouring houses to large scale systems in the 100 MW range has seen encouraging development trends.

**The lack of information on this fact has been identified as a major barrier for technology deployment. The BIOHEAT project has contributed much to removing this barrier** by disseminating information via numerous publications, targeted brochures and an extensive website. However, this by itself will not suffice to kick off market development, **as a complex set of barriers has been identified that also need to be addressed** to realise the full potential of heating with biomass.

It is noteworthy that **research is no more the constraining factor for market deployment**, but the availability of resources to remove these different barriers. The EU Commission has expressed a high urgency to accelerated market deployment of RES both in the green book on energy security and in its efforts to meet the Kyoto commitment. In this view there seems to be **a significant mismatch between the amounts of funds dedicated to R&D on technologies that might take decades to develop and resources**

**dedicated to market development** of technologies that are available today and allow biomass use with more than 90% efficiency.

The issues that need to be solved to achieve full scale market deployment are the following:

**Fuel supply** is a key barrier in many countries at present - in those countries showing dynamic market growth it has been the introduction of pellets that has driven both the bioenergy market for large buildings and for single family houses. This leads to the conclusion that the establishment of an **EU pellet market** that is able to deliver high quality pellets competitively to any user without geographic restrictions is an issue of top-priority.

Personal experience that biomass heating actually works is an essential precondition for decision makers before they decide to realise a project. In several participating countries there is still a serious **lack of successful demonstration projects** that can provide this personal experience: bioenergy works! High profile demonstration plants can also be a means of very cost effective marketing as they usually attract much media attention that need not be paid for, especially if professional communication strategies are applied. This is particularly important in those countries where wood heating still has a very poor image. Thus realising state of art demonstration projects is a second top priority.

**Public buildings** are particularly suitable for such demonstration projects – BIOHEAT II will focus on this market segment. However, a political commitment is fundamental for overcoming the natural inertia of administrative structures.

Applying new technology is always considered risky and related to considerable additional transaction costs due to non-standards procedures. Thus, even if wood heating is competitive nominally, it needs **financial incentives to compensate for risk and higher transaction costs** during the first years of market development. Obviously fiscal discrimination of bioenergy identified in two participating countries must be removed.

A number of issues ask for **regulatory action**. A harmonised set of **strict but reasonable emission limits** could create a level playing field for state of art technologies that suffer both from excessively stringent emission regulations (as e.g. in the Netherlands) and from a lack of emission regulations, which allow very poor products to compete and sustain the image of wood heating as polluting and inefficient technology.

In the course of investigations a number of national regulations were identified that also create **various unreasonable barriers** for the use of wood fuels. These regulations regard the treatment of wood fuels as wastes, building codes, unreasonable fire safety requirements etc.

However market deployment also calls for **new regulations and standards to ensure quality and allow smooth market introduction**. Such standards need to be established both for fuel qualities and boiler qualities but also for services such as transport, security measures, technical requirements for storage rooms etc. The importance for such regulations is substantial as failure of any important element in the technology or service chain can lead to severe setbacks and create a negative image of the new technology that is very difficult to reverse. The recent experiences with temporary supply shortages in some Nordic countries point towards the potential need to implement minimum requirements for fuel storage for pellet producers or the establishment of national systems for financing storage similar to those that have been implemented for oil.

**Training of professionals** is another fundamental precondition for successful market development. No matter if it is architects, consultants, installers or other related professionals: a contractor not acquainted with the new technology will give his customers the advice to avoid selection of the new "risky" option because he is afraid of making mistakes or meeting unexpected problems. The brochure distributed to this target group is certainly a useful first step. But more in-depth information will have to follow.

It is obvious that complex and extensive measures are necessary to overcome the existing barriers. Other successful cases of technology introduction suggest that **institutions dedicated to manage market development** can play a key role in overcoming these barriers. Policy makers should consider this option when engaging in dedicated efforts to develop this market.

**Energy service companies** can be very effective in developing the market. Suitable incentives for such companies can be a way of overcoming the barriers created by untrained professionals and risk adverse investors. However, experience in the majority of participating countries shows that commercial actors in conventional energy enter in sharp competition with bioenergy as soon as it appears in the market. **Unless political frame conditions are implemented that create motivations for energy companies to enter the renewable heat market, the development of this market could be slow and difficult.**

So far RES policies of member states have been focussed on the renewable electricity market, last but not least due to the focus the European Commission has given to this market. To implement national policies supporting the development of the renewable-based heating market, **it will be necessary for the Commission to take the initiative.**

## 2.7 Policy options for the European Commission

Four different policy options will be discussed, that correspond to different levels of political emphasis on the development of the renewable heat market in general and the market for heat from biomass in particular.

### **Option 1: put particular emphasis on the development of the heat market within the "Intelligent energy for Europe" program – increase funds for market development**

This program would be an adequate basis to address many of the market barriers discussed in the previous sections. It has been pointed out, however, that national political commitment will be an important condition for stimulating significant market development. This commitment will probably not be affected by realising option 1 alone.

The financial funds available for the IEE program are very small compared to the funds for the 6th framework program. From a medium term perspective the Commission might want to reconsider the gross disparity of resources for measures with direct benefit to market introduction of RES compared to research on technologies still far from market introduction.

### **Option 2: issue a communication to the Council and the European Parliament announcing a community strategy for promoting the use of renewable heat**

Such a communication could be justified by the fact that about 50% of primary energy use in Europe is dedicated to supplying heat for buildings and industrial applications. Also, compared to renewable electricity production, renewable heat production is a significantly

cheaper renewable energy option. The communication could describe the present barriers for developing renewable heat (RES H) as heat from biomass, solar energy, ambient heat or geothermal energy and could lay out elements of a comprehensive strategy for overcoming these barriers and developing the market.

Given the absence of dedicated policies in most member countries a communication would be a first comparatively easy step to draw the attention of member states to the opportunities in the RES H market. An increased attention to RES H could open the eyes of member states to the advanced technologies and vast potentials in this market and could make them more ready to accept a directive on the subject than at present as many misconceptions exist with regard to technologies and market potential in this sector.

A communication would not be a sufficiently strong measure to create interest of large energy businesses in this market however and suggest a slow stepping up of engagement of the Commission.

### **Option 3: enter into the process of issuing a directive on RES H**

A directive on RES H could propose indicative targets for the use of renewable energy in the heat market and ask member states to remove barriers and report on measures taken to ensure that the targets are met. The obligations could be passed on to energy companies serving the heat market – particularly oil and gas companies. These could prove the delivery of certain amounts of renewable heat by certified heat meters located behind biomass boilers, solar collectors or heat pumps.

As the attempt to issue a directive is obviously a much stronger measure than a communication it would draw significantly more attention to the issue of RES H. Given the present lack of information it could, however, also give rise to considerable controversies. A directive would be a suitable measure to create commercial interest among energy companies towards offering energy services with renewable heat. As mentioned before the availability of such services could be a very promising approach towards developing this market.

### **Option 4: use the opportunity of harmonising the renewable electricity regimes in Europe to introduce incentives for developing the renewable heat market**

In case a harmonised regime for renewable electricity (RES E) in Europe was based on portfolio standards for utilities, provisions could be made allowing utilities to meet parts of their obligations by certified deliveries of renewable heat. Such a provision would be interesting from several points of views:

- As recent studies suggest (PRETIR project) serious problems in meeting the indicative targets of the RES E directive will occur in the majority of member states
- Decentralised use of renewable heat can be easier to organise than supply of large scale centralised power plants
- Efficiency of biomass use in small heat applications can approach 90% while efficiency of electricity production from biomass in large condensing power plants is below 40%.
- Costs for achieving a certain share of renewable energy use are significantly lower in the heat market – even if e.g. 2 kWh of renewable heat would be needed to replace to obligation of 1 kWh of renewable electricity.

- Such a provision could stimulate market kick off in the heat market without any additional need for public funds and with considerable net savings of resources. It would create a win-win situation from different points of view and establish a highly attractive market for energy services offering renewable heat

Similar provisions have been made in some US states that have issued renewable energy portfolio standards and are also considered in Norway.

## **3 Overview of activities – comparison with contractual obligations**

### **3.1 Introduction to the project**

#### **3.1.1 Scope of the project**

The Campaign for take off initiated by the European Community has proposed the goal to introduce 2000 MWth of biomass heating systems in blocks of flats till 2003. The BIOHEAT project was designed to support the achievement of this goal.

Scope of the project was to develop the market for biomass heating systems in the power range of 50 - 800 kW in 10 European countries. In the course of the project housing associations, developers, planners and communities were informed about the option to heat larger buildings with biomass. In addition to detailed target group oriented information, direct support for the start-up phase of pilot projects was planned.

#### **3.1.2 Project phases**

##### **Phase 1: Orientation**

In this phase interviews were conducted with representatives of relevant target groups such as developers, planners, architects, community representatives and various interest organisations. These interviews should both create interest in the subject and reveal the perceived barriers for implementing biomass heating systems in large buildings. They should also help to identify appropriate channels of information that could be used to disseminate information on the new technical options to use wood fuels in this market segment.

##### **Phase 2: Preparation of information**

3 series of publications in relevant professional media were prepared, translated and adapted for all participating countries. In addition 3 brochures were produced that covered the information needs of developers, planners and communities respectively.

A seminar designed to cover all relevant issues was prepared to inform professionals on best practices in implementing wood based heating systems.

##### **Phase 3: Information dissemination**

In this phase publishing activities and the dissemination of the brochures took place. In addition a website was established that allows easy access to relevant information.

##### **Phase 4: Support of projects in the start-up phase**

Developers or communities that wanted to engage in pilot projects should receive direct support in this phase. This should include both national and international field trips to interesting projects, training seminars for professionals and a telephone hot line for further information offering also economic assessments of pilot projects.

## 3.2 Completion of contractual obligations

**Phase 1** of the project was finished as foreseen in the contract. Some partners conducted more interviews, some slightly less than expected. In total 145 interviews were documented (150 interviews were required). The actual number of persons contacted exceeded this number considerably, however.

**Phase 2** dedicated to the preparation of information was also completed as foreseen in the contract.

The three articles were prepared by the designated partners and adopted by the other partners for their national audiences.

Master copies for three brochures addressing developers, municipalities and consultants were edited and adapted by the partners to their national needs. Only the French partners decided to adapt the concept to their needs by publishing 2 brochure and a set of several 2 page project descriptions, ending at a similar volume of published material.

The resources for preparing the seminar and the brochure for consultants were merged and used to create a very detailed technical brochure of approx. 30 pages that could be used both for the seminars and for wider dissemination as brochure.

Field trips were prepared both on a national scale and on an international scale.

Policy recommendations were edited and presented to the Commission by the coordinator in March 26, 2002 and at the final project meeting in Brussels in September 18, 2002.

**Phase 3** dedicated to information dissemination was completed as foreseen in the contract with one exception: the Greek brochures have not been printed yet and will be submitted directly to the Commission after printing in January 2003.

More than 70 publications based on the articles prepared in phase 3 were published in the participating countries and are documented in chapter 4 and the annex.

The brochures were printed and disseminated as foreseen to a wide variety of relevant audiences as documented in detail in chapter 4.

**Phase 4** was considered to offer support for organisations and persons interested in realising projects. The contractual obligations were fulfilled. 22 Seminars were offered in all participating countries, twice the required amount, some seminars took place after the project was terminated however (in Portugal and Greece). Seminars were in many cases combined with field trips. From the scheduled 3 international field trips two had to be cancelled due to lack of participants. One field trip, that took place just after the first world pellet conference in Stockholm attracted 37 participants from 11 countries however. The telephone hot lines were announced and established. However the response was limited due to the short time span between information dissemination and the closing of the project. However, all participating institutions will stay involved in the topic and offer continued support. The software tool to calculate economic comparisons was developed and is downloadable from the BIOHEAT website.

The website [www.bioheat.info](http://www.bioheat.info) was established and is online offering information on the BIOHEAT project and on heating with wood in large buildings in 10 languages.

All scheduled project meetings took place. The kick off meeting was held in Vienna May 9-12, 2001 and included a field trip to three projects and a boiler manufacturer. The midterm



meeting was held in Amsterdam from November 21-25, 2001. The final meeting took place in Brussels from September 16-18, 2002.

A summary of the project for the CORDIS database has been sent to the Commission. The obligatory update for CORDIS on project progress was submitted together with the interim report.

## 4 Wood heating systems for large buildings: status, barriers for market development and strategies for the future

### 4.1 Austria

#### 4.1.1 General preconditions for increased the use of biomass for heating large buildings

##### 4.1.1.1 Present situation for heating large buildings with wood

The use of biomass for heating large buildings shows a very encouraging trend. A survey conducted by the E.V.A. in 2001 among all developers of residential buildings in Austria shows that the number of such projects has been increasing significantly.

Number of wood heated residential buildings in Austria

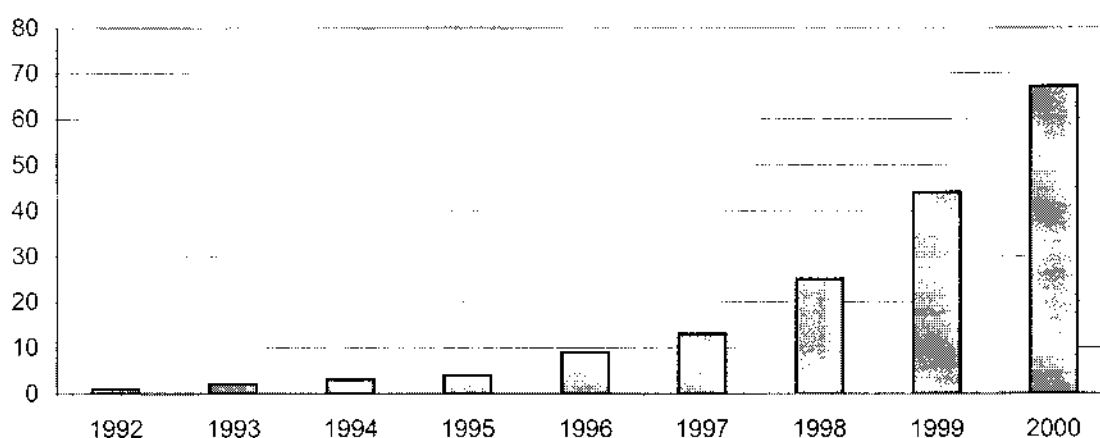
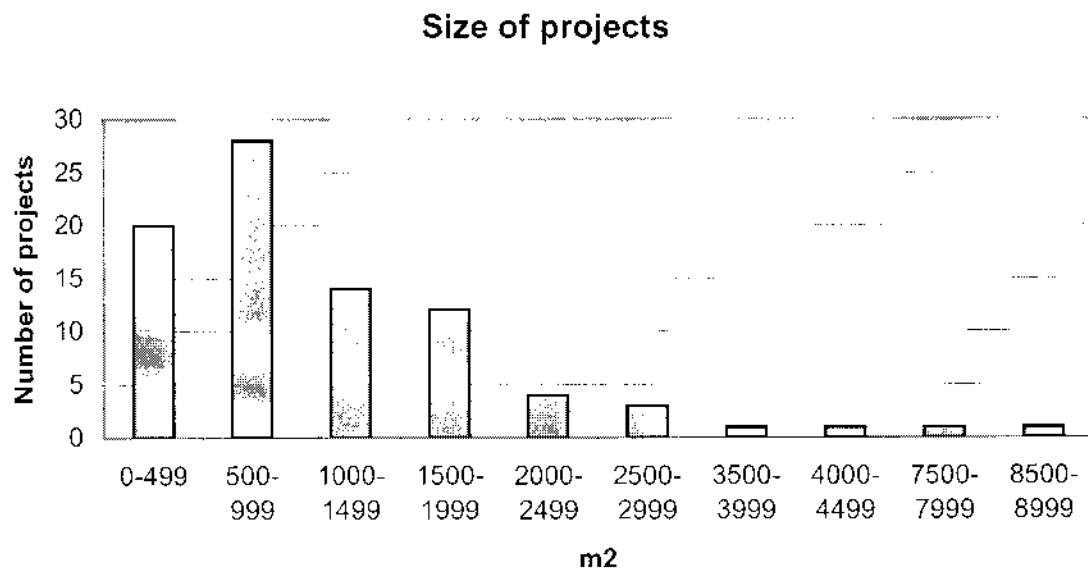


Figure 4

These projects were realised by 40 different developers. Two thirds of the projects are blocks of flats, about one third consists of rows of houses. Most projects are small, with 500-2,000 square metres of living space. This reflects the general trend in Austria to build smaller residential blocks. As Figure 3 shows, also larger projects with up to 9,000 square metres have been heated with biomass. There are no technical obstacles to heat larger buildings with wood – at the contrary: the larger the development, the more economic is the use of biomass.



**Figure 5**

70% of the projects use pellets as fuel, only 30% woodchips. This is to some extent due to the fact that in the province of Salzburg, where most projects were implemented, there are no woodchip suppliers (usually farmers), while pellets are available everywhere and significantly easier to handle.

Telephone interviews with the developers revealed that 70% of the wood heated projects also use solar thermal energy for hot water preparation (and also heating). In addition, 70% also had enhanced thermal insulation. The combination of different technologies to achieve residential buildings sustainable in the full sense of the word was to a large degree stimulated by the smart subsidy policy of the provincial government of Salzburg, which will be described in the next section.

Developers were also asked to specify problems they had with running the boilers. The most frequent problems appeared in the first year of operation, when the persons in charge forgot to order pellets or to remove the ashes from the boiler or were not acquainted with the boiler controls. In two cases, problems were caused by wet woodchips. In total, 10 cases of minor problems were reported, none of which was difficult or expensive to solve.

A major problem identified in the survey was oversizing of the boilers – 50% of all boilers in low energy houses were more than twice the size than necessary. Planners seem to ignore that better insulated houses have a lower heat load. There is also a significant lack of know-how with regard to the dimensioning of solar thermal systems.

The E.V.A. survey also investigated the use of biomass in public buildings. The result showed that in 2001, 129 public buildings were heated with biomass. 32 were federal buildings, 33 provincial buildings and 64 municipal buildings. The majority of federal and provincial buildings heated with wood are the buildings of road maintenance centres that have plenty of woodchips from trimming the road sides. The other wood-heated buildings were predominantly schools and town halls. The contribution of biomass was 0.7% of total fuel demand for federal and provincial buildings and 2.8% for municipal buildings – a very

poor score given the political commitment for increasing the use of renewable energy and achieving the Kyoto target.

#### 4.1.1.2 Financial incentives for heating large buildings with wood

Incentives from subsidies for residential buildings

Subsidies for the construction of residential buildings are substantial in Austria and amount to a total of EUR 2.5 billion annually. An agreement between the federal government and the provincial governments on measures for achieving the Kyoto goal provides that provincial governments, which are responsible for these subsidies, take measures to ensure that subsidies contribute to achieving the Kyoto target. Most provinces have adjusted their subsidy systems in the meantime. Typically buildings with high insulation standards and using renewable energy receive considerably higher subsidies than conventional buildings.

Figure 5 shows the subsidy scheme for the province of Salzburg, which played a pioneering role by introducing the new subsidy regime in 1994. The subsidy rises as higher levels of efficiency and use of renewable energy sources (RES) are implemented. The rise in subsidies is higher than the additional costs caused by increasing efficiency and using RES. As a consequence, the market share of biomass (mostly pellets) and solar energy has been rising to more than 60% over the last few years since the introduction of the subsidy.

### Residential subsidy model of Salzburg every step = 15€/m<sup>2</sup> additional subsidy

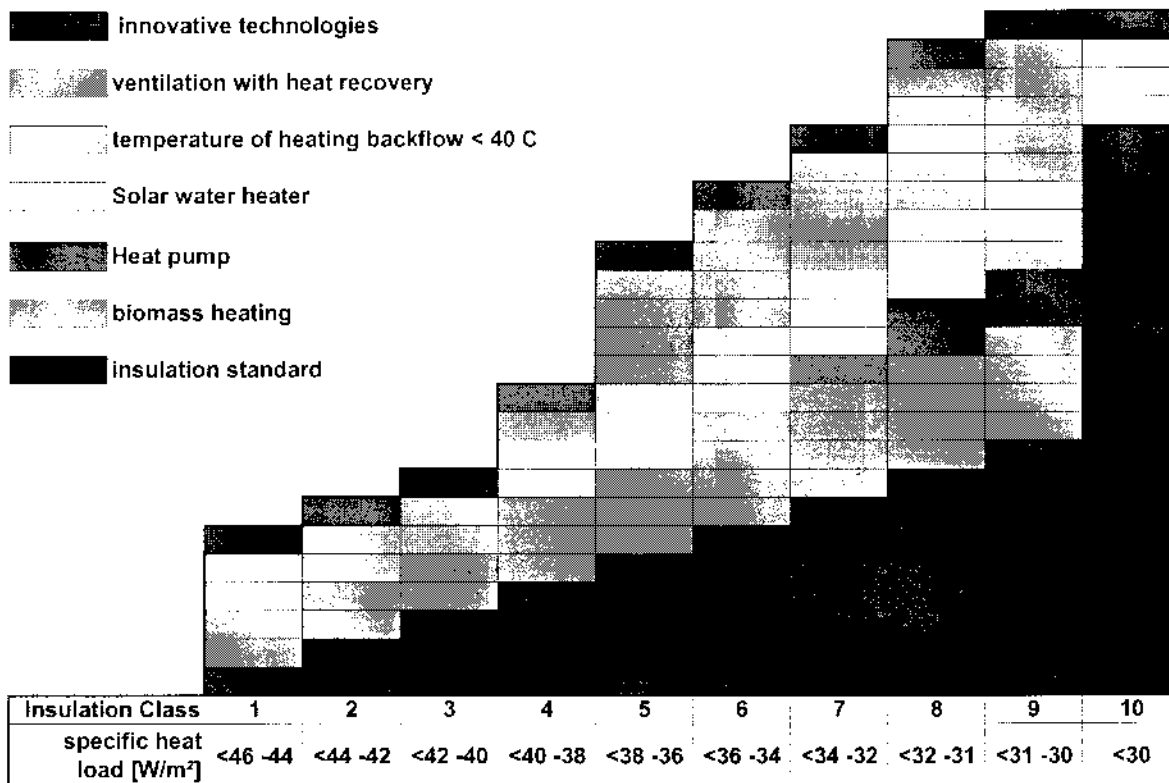
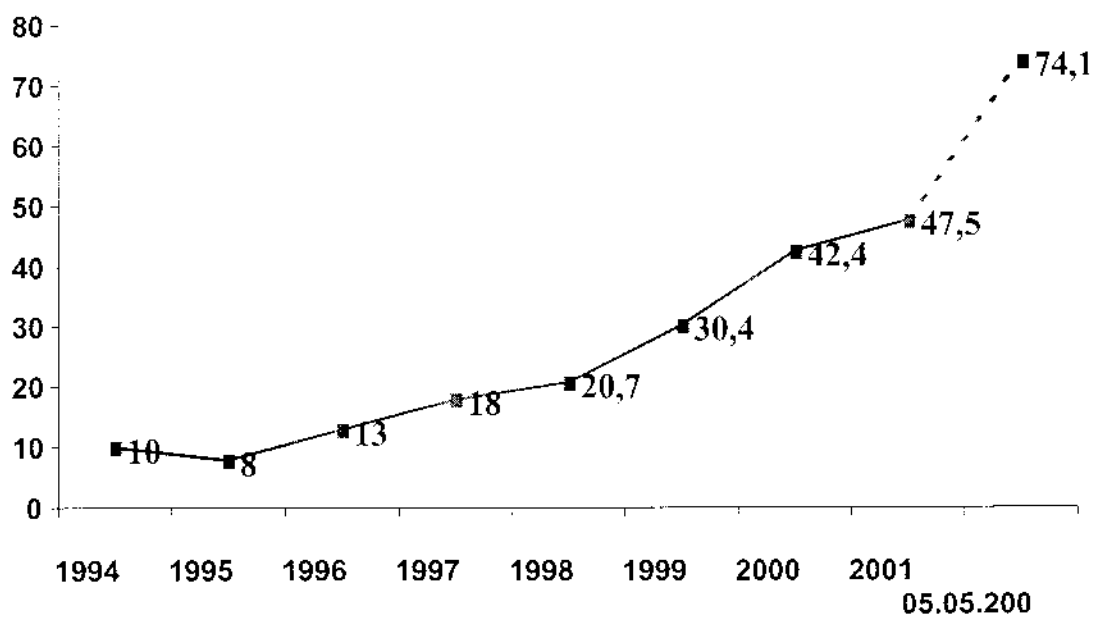


Figure 6

An interesting aspect of this approach is that it does not necessarily require additional funds: conditions can be attached to existing subsidies that reduce the subsidies if certain targets are not met. The province of Styria has recently issued the provision that no subsidies are given to single family houses at all if they do not use renewable energy for heating.

It should be mentioned, however, that – even with very strong incentives in place – developers in Salzburg initially rather preferred to lose money than to adapt their concepts. In the interviews conducted during phase 1 of the project, these developers confessed that the strong personal commitment of the responsible government official, who personally persuaded them to take advantage of the new opportunities, was the main reason why they finally tried to change construction habits. First, they carried out pilot projects and as these worked, new standards evolved that took full advantage of the financial incentives. Slowly the market also became accustomed to the new features and some developers said that in the meantime they would have difficulties selling conventional projects. Figure 7 shows the learning process that took place. Wood heating in the meantime is the standard solution. This fact is very encouraging, because it shows that the technology is obviously ready for the market and can be implemented rapidly, once the right incentives are in place.



**Figure 7:** Percentage of subsidized newly established living area heated with biomass in Salzburg

Other provinces that followed later in establishing more or less similar schemes also experienced that developers were reluctant to adapt their concepts. Local success depended very much on the support and active information the developers received in integrating the new concepts. Two seminars including field trips were offered in the course of the BIOHEAT project in those provinces that had most recently changed their subsidy system (Lower Austria, Burgenland) – in some cases causing severe conflicts between

the government on the one hand and developers and the construction industry on the other.

#### **4.1.1.3 Climate conditions**

In Austria, heating degree days vary between 3,200 in Burgenland and 4,300 in alpine regions. The fact that peaks of rather low temperatures are possible in winter leads to fewer full load hours than in countries with maritime climate, as the boilers need to be designed to cover much higher peak loads than average loads. Another influencing factor is the type of building: schools have around 1,400-1,700 full load hours as they are used only during parts of the day. Residential buildings have around 1,600-2,000 full load hours. Hospitals have a particularly high heat demand, coming to 2,200-2,700 hours of full load operation if correctly dimensioned.

#### **4.1.2 Barriers to wood heating in large buildings in Austria**

##### **Lack of information and personal experience**

During the conception phase of the BIOHEAT project, an interview was conducted with a prominent "green" architect. It turned out that he was not aware of the possibility of using wood to heat large buildings. Even though a considerable number of projects has been implemented, these remain largely unknown. The BIOHEAT project, with numerous publications and large numbers of brochures mailed to all relevant actors in the country, will clearly remove this barrier.

However, „seeing is believing“, as the saying goes. Reading or hearing about an innovation has a completely different impact on people from seeing it personally and talking to the people who use it. The field trips organised in the course of this project aimed at achieving this objective – their success was limited, however, as the field trips offered failed to attract many participants. It may be necessary to bring the technology to the people. Many boiler producers have mobile boilers whose actual operation can be demonstrated on trade fairs. Such units could be brought to annual conferences of real estate owners or other target groups. Innovative approaches are needed to speed up this part of the dissemination process.

##### **Inertia of persons and organisations**

Humans have a strong tendency to stick to behaviour that has worked in the past. This is a substantial barrier against any type of innovation and obviously also one for wood heating. When it comes to putting the first pilot projects into practice successfully, it is always a few innovative persons that make things go. To start dissemination, it is important to locate and motivate these persons.

Another related barrier is the inertia of organisations. Every change in running business creates additional transaction costs. Wood heating affects existing business relationships. Most developers cooperate with specific planners. If the developer becomes interested in wood heating he either selects one of the few experienced planners and thus creates a conflict with „his“ planner, or he sticks with this partner, thus risking an unsuccessful experiment (however, most planners do not want to make their lives more difficult and would try to persuade the developer to avoid that risk).

Austrian housing associations typically also run a department that manages the houses they have built. This department can be very concerned about the impact a wood heating system might have on maintenance or about possible conflicts with the residents in case the new system does not work properly. So they would oppose such projects.

### **Lack of energy service companies**

Outsourcing heating systems is an attractive solution for developers, as that leaves them having nothing to do with operating and maintaining the plant. Moreover, the need not invest in the heating system. It is a good chance to introduce biomass heating. The contractor is responsible for planning, financing, building and operating the plant. This way, professional know-how can be built up rapidly and many barriers to dissemination, such as lack of know-how, risk aversion, concerns regarding operation problems, conflicts with existing commercial partners, etc., can be overcome.

The interviews revealed a serious lack of companies offering such energy services. Only at a regional level, in Styria, and due to the activities of a dedicated agency, the Regionalenergie Steiermark, farmers receive support in setting up their own small contracting business. Most recently, supply seems to be improving. New companies have entered the market and are starting to market their services – maybe to some extent as a consequence of a conference organised by the E.V.A. dealing with the growing market for biomass-based energy services.

In contrast to Scandinavian countries, where big players in energy such as Shell and STATOIL, have entered this business, major players in Austria, such as the OMV, Austria's dominating oil company, have so far preferred to enter into sharp competition instead of taking advantage of the new opportunity. This is certainly a disadvantage for disseminating the new technology and raises the question of how to motivate major energy companies to offer renewable energy services. Obviously the only way is to either create obligations or offer significant economic benefits.

### **Investor/user dilemma**

Wood heating systems require higher investment costs and lower running costs. If the investor is not the user, there is a clear disincentive for implementing this technology, even if it is fully economic. In addition, customers in the housing business often pay more attention to the costs of a flat than to the future heating costs. Once a pellet heating system is considered a standard feature of "high value" flats, this situation changes, of course.

The investor user dilemma also applies to many public buildings, as all federal buildings have been sold and leased back. The new owner is not interested in investing more than necessary.

### **Financing**

Financing is a particular problem for municipalities. A possibility to bypass the investment cost problem is to arrange a leasing contract for the biomass boiler. As such arrangements have not existed in Austria so far, a workshop for responsible managers of boiler producers and representatives from the financial sector was conducted in the course of the BIOHEAT project in March 2002. In the meantime, a framework agreement on the leasing of biomass boilers has been signed between boiler producers and a leasing company offering very good financing conditions.

### **Competition from conventional fuels**

Due to stagnating and even decreasing overall demand (caused by efficiency gains) for fuels in the heating market, competition from natural gas and from fuel oil may become even more fierce, as pellets become a relevant competitor. The oil and gas sector is able to spend infinitely more on public relations than the young bioenergy sector. Competition can be also expressed by sharp rebates if a bioenergy project is competing. It is hard to imagine that bioenergy can make rapid progress against such strong forces unless these forces change direction and become part of introducing renewable energy.

### **Ambivalent policies**

While official statements are fully in line with an increased use of bioenergy and the commitment to the Kyoto obligations, in practice, different factors may play a significant role, such as the traditionally close connection between major utilities or energy companies and politics, departmental thinking in administration or party politics. These factors can shape political decisions and lead to counterproductive statements and actions. A recent survey conducted by the E.V.A. revealed that only 0.5% of federal public buildings use wood heating systems (in contrast to about 15% of households which use wood as their main heating material).

### **Decreasing construction of new buildings and lack of incentives for using bioenergy in existing buildings**

The building market in Austria is slowly approaching saturation. The annual figure of newly constructed flats is decreasing slowly and consequently, the market for new boilers is also decreasing. It is difficult to expand in a contracting market. A vast market for biomass boilers could be created in the segment of existing buildings. However, there are no equally effective financial incentives for old buildings as there are for new buildings. Also, replacing existing systems with biomass-based systems tends to be more difficult due to space restrictions.

### **Wood fuel market**

Compared to many other countries participating in the BIOHEAT project, the wood fuel market in Austria is significantly better organised. Pellets are available across the country and the logistics and service quality are excellent.

However, pellets are almost as expensive as fuel oil. Production is concentrated in less than 10 large sawmills which keep prices up. Competition from abroad is still weak as transport costs are significant (no access to the sea) and quality standards for pellets for domestic use are much higher than for the internationally traded pellets for power plants.

High quality woodchips that can also be used in large buildings are significantly cheaper than pellets. However dry woodchips are available only locally. Woodchips need four times more space per unit of energy than pellets and are consequently less suitable for transport over greater distances, which impedes the establishment of supply structures offering universal delivery.

The recently approved law on renewable electricity will lead to the construction of large biomass power plants. As fuel supply for these plants will need to be based to a large extent on woodchips, it can be expected that improved supply structures will be established, which could have positive side effects on the fuel supply for the heat market.



### **Experienced planners and installers**

Several interviews revealed that planners and installers are generally reluctant regarding wood heating systems because they have no experience with these systems. Also developers would need information on experienced planners. To some extent boiler manufacturers make up for this problem by offering extensive support. Often it is the manufacturer that plans the boiler, boiler room and fuel storage.

The most typical mistake in planning is the gross overdimensioning of boilers. A survey the E.V.A. conducted revealed, that 50% of wood boilers in residential blocks had more than twice the required capacity. Other frequent mistakes regard the shunt system that lifts the temperature of water entering the boiler to prevent corrosion, the power control and appropriate integration of hot water storage, solar thermal systems and systems with additional boilers. Thus, the brochure for planners will fill an important gap.

### **Operation and maintenance**

An automatic wood heating boiler needs more attention than an oil or gas system. The boiler needs to be cleaned, ashes have to be removed periodically, the refuelling needs to be organised and different maintenance works (like greasing certain parts periodically) are required. Concerns on who should be responsible for these activities are a serious barrier – even if fears regarding the actual amount of work necessary seem exaggerated.

A high degree of boiler automation including automatic cleaning and ash removal can help to overcome these concerns. Most of the interviewed developers reported that in the first year of boiler operation a number of failures occurred due to operational mistakes. Typically, the responsible persons forgot to empty the ash bin, to clean the heat exchanger surfaces or to order new pellets in time. These problems show that the adequate and repeated training of persons responsible for boiler operation is very important. Frequently problems also occurred with boiler parameter settings – the complicated, menu-based, computerised controls are difficult to handle for inexperienced persons. Some manufacturers offer boiler settings with remote control via modem, which is another service that could make market penetration easier.

### **4.1.3 Economics of heating large buildings with biomass in Austria**

A recent survey among 12 large buildings heated with biomass was conducted by Regionalenergie Steiermark, a consultant specialised in supporting farmers to set up small energy service companies. The results of this survey are shown in Figure 9. The boiler and feeding system account for about 50% of the overall costs. The second major contribution are construction costs, usually for the fuel storage outside the building. If sufficient space was available within the building, these costs would be much lower. Figure 11 shows the specific investment costs of the projects investigated by Regionalenergie. The variation is considerable. Between 100 kW and 200 kW, specific investment costs tend to rise as production shows a trend from compact boilers typical for domestic use to individually constructed boilers typical for the wood industry.

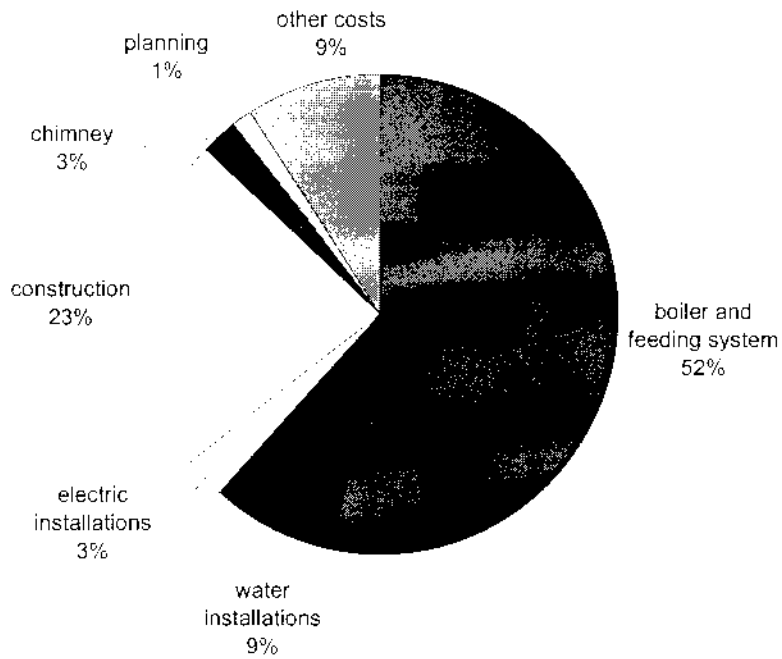


Figure 8

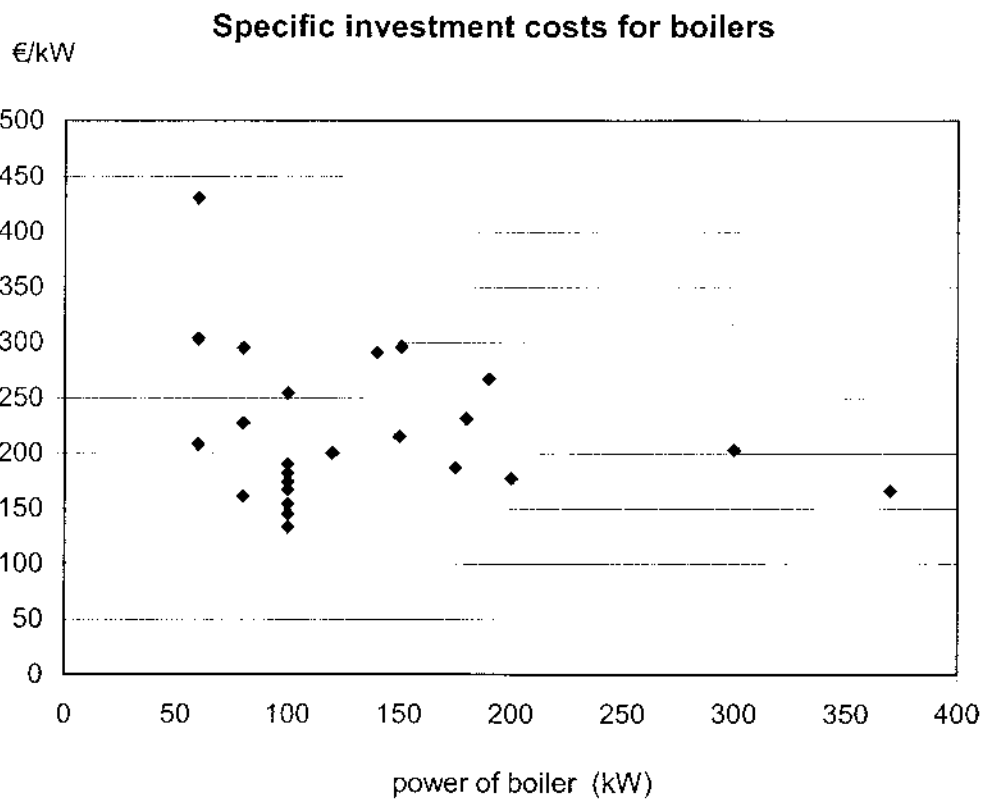


Figure 9

	unit	Woodchips	Pellets	Fuel oil	Natural gas
Boiler costs	[€]	17.500,00	17.500,00	5.800,00	6.600,00
Installation costs	[€]	4.400,00	4.400,00	3.000,00	3.000,00
Building costs	[€]	22.000,00	15.000,00	13.000,00	10.000,00
<b>Total Investment</b>	<b>[€]</b>	<b>43.900,00</b>	<b>36.900,00</b>	<b>21.800,00</b>	<b>19.600,00</b>
<i>Investment minus subsidy</i>	[€]	30.730,00	25.830,00	21.800,00	19.600,00
Annuity	[€/a]	2.313,58	2.002,70	1.592,00	1.471,41
<b>Capital costs</b>	<b>[€/a]</b>	<b>2.313,58</b>	<b>2.002,70</b>	<b>1.592,00</b>	<b>1.471,41</b>
Fuel costs	[€/a]	3.923,53	6.781,57	8.182,31	8.560,06
Electricity cost for boiler operation	[€/a]	60,00	60,00	50,00	50,00
<b>Demand related costs</b>	<b>[€/a]</b>	<b>3.983,53</b>	<b>6.841,57</b>	<b>8.232,31</b>	<b>8.610,06</b>
Repair costs	[€/a]	329,00	294,00	153,00	146,00
Personel costs	[€/a]	960,00	750,00	0,00	0,00
Chimney cleaner	[€/a]	250,00	250,00	200,00	150,00
Service contract	[€/a]	400,00	400,00	200,00	200,00
Insurance, other costs	[€/a]	250,00	200,00	100,00	100,00
<b>Operation related costs &amp; other costs</b>	<b>[€/a]</b>	<b>2.189,00</b>	<b>1.894,00</b>	<b>653,00</b>	<b>596,00</b>
<b>Total annual costs</b>	<b>[€/a]</b>	<b>8.486</b>	<b>10.738</b>	<b>10.477</b>	<b>10.677</b>
<b>Total costs per MWh</b>	<b>[€/MWh]</b>	<b>53,0</b>	<b>67,1</b>	<b>65,5</b>	<b>66,7</b>

**Figure 10**

Figure 10 shows the economics of a 100 kW plant heating a residential block with 20 flats in Nestelbach, also described in the Austrian brochure for developers. Boiler costs are about average and building costs are somewhat higher than average as a separate concrete underground storage for woodchips had to be built outside the building. The calculation is based on 30% subsidy on investment. With this amount of subsidy, a pellet system would be slightly more expensive and the woodchip system would be about 20% cheaper than an oil or gas heating system.

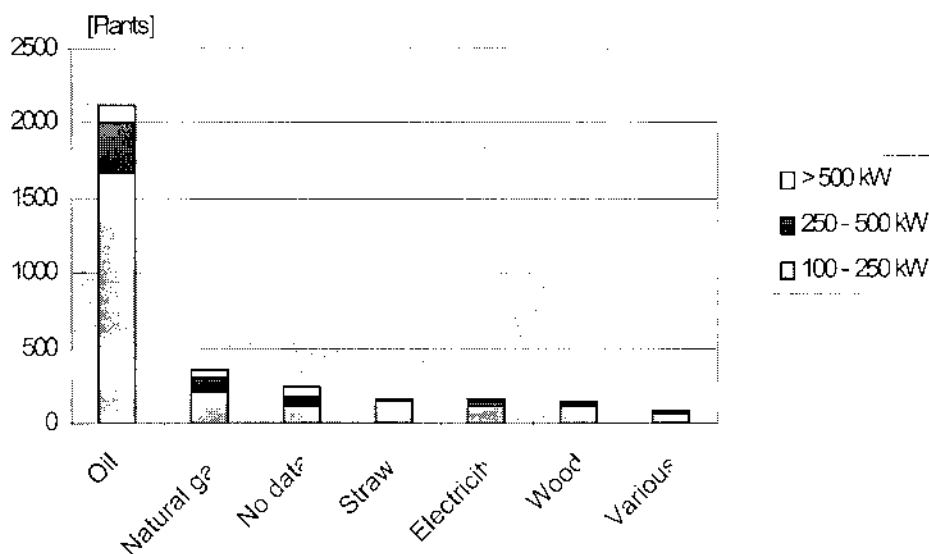
## 4.2 Denmark

### 4.2.1 General preconditions for an increased use of biomass for heating large buildings

#### 4.2.1.1 Present energy use for heating large buildings

District heating is very common, covering more than half of the heat demand in the country. Many district heating systems use biomass fuel, therefore the majority of large buildings is already supplied with biomass heat.

The present demand for heating in large buildings outside of natural gas and district heating networks in Denmark is app. 7 PJ; the majority of these are heated with oil today.



**Figure 11:** Number of large buildings outside district heating and natural gas areas. Survey by dk-TEKNIK in cooperation with Danish Energy Agency, department of statistics, April 2001.

Small-scale systems using wood pellets and woodchips have been very successful in the last 5 years, reaching a total number of installations of more than 12,000.

For the past 15 years, a very competitive price ratio regarding wood fuel and oil has existed in Denmark. Especially in the past 2 years, with high oil prices and a more mature market (infrastructure, organisation, quality) for wood pellets, this has generated a rapid development of stoker-fired wood heating systems.

#### 4.2.1.2 Climate: heating degree days and typical full load hours of heating systems in relevant regions

Having a relatively cold climate, the number of degree-days in Denmark is on average app. 3,000. There are no substantial regional differences within the country.

Typical equivalent full load hours for Danish climatic conditions are app. 3,800 hours, depending mainly on the ratio between heat demand for hot water and pipeline losses versus heat demand for heating up buildings. The figure represents the number of hours a boiler having a capacity exactly matching the winter peak demand would run to supply the annual heat demand. In practical conditions, boilers are smaller or bigger than this, resulting in different full load hours.

#### 4.2.1.3 Existing experiences with wood-heated buildings

Wood heating with wood pellets and woodchips is quite common in both large-scale systems (district heating) and small-scale systems (individual houses with stoker-fired boilers). Large buildings are also to a large extent already supplied by renewable energy systems.

Infrastructure and organisation exists for supply of wood fuels, equipment can be supplied from a number of reliable fuel suppliers (see lists in appendices).

In general, the wood heating systems operate with only minor problems, and generally the technology has a good reputation in Denmark. Approximately 200 wood-fired boilers in buildings with a heat demand of more than 100 kW are in operation in Denmark.

During the last 8 years, dk-TEKNIK has participated in three Danish projects on the identification of barriers for converting existing oil-heated large buildings and blocks to biomass – and on the development and implementation of tools to overcome them. Part of the BIOHEAT project was to share these experiences with other countries.

#### **4.2.1.4 Most relevant market segments identified for wood heating in large buildings**

Initially the Danish efforts in the BIOHEAT project focused on wood heating in new buildings. During the interview phase, however, it became clear that relatively few new buildings are erected every year. A detailed study of the issue was carried out and showed that potential new large buildings available to wood heating only accounted for app. 20 locations a year, while the majority (10 times more) of new buildings are erected in areas with existing public supply systems.

Thus, the project identified existing buildings as the most promising market segment, but also pointed to new buildings as having potential, and further pointed to industrial and business buildings as a potential market.

#### **4.2.2 Barriers to wood heating**

Barrier: Monopoly markets for natural gas and district heating

A key barrier to the development of biomass heating in new buildings is that new buildings within areas supplied by public systems for natural gas or district heating must be connected to these systems. The potential for heating new buildings with biomass could be more than 4 times as high if it was permitted to use biomass in natural gas areas.

Barrier: few new buildings

An assessment has shown that the number of new buildings in areas outside of densely populated areas with existing public supply systems is low. Within the last 2 ½ years, only 18, or app. 10%, of 192 new large buildings constructed in Denmark are located outside of areas with an existing public supply system. A recent survey estimates the number of existing oil-heated large buildings outside of district heating and natural gas areas at 2,100 – or more than 100 times the potential for wood-heated new buildings. Therefore, existing large buildings would be the most promising market.

On a long-term basis, however, new buildings both in open areas and within areas supplied with natural gas should be potential for supply with biomass heating. Thus, an effort to remove the barriers for biomass heating in these areas is highly relevant, but will only have an effect in the long term.

Barrier: Environmental issues for buildings focus on other issues

Standards and recommendations to be taken into account for new buildings might consider saving heat by insulation and other “green” measures very important, while the heating sources for the buildings are hardly ever considered. An example is the guide to “environmentally responsible senior co-housing” issued by the advisor “Boligtrivsel i Centrum”, which on many occasions provides advice for new buildings for elderly people.

This barrier can be overcome by informing any kind of issuer of such standards and recommendations of the importance of the choice of heat supply for the environmental impact of the building during its lifetime.

Barrier: Actors afraid of risks

The key actors - the experts, consultants, architects, installers etc. - are not interested in taking risks. It is a technology they do not have expertise with, and they avoid it in order not to lose money or prestige. This is a barrier that has to be broken down if the professional set-up is not to work against biomass heating. One consultant suggested courses in the installation and operation of biomass heating systems as a means to acquiring the necessary expertise. Several stress that successful case stories are essential for illustrating the new technology and its advantages.

Barrier: Lack of awareness among key actors

Many key actors are not aware of the options to integrate wood heating in new buildings.

Barrier: Investment limited by municipalities

Special financial arrangements apply to quite a few new initiatives for new apartment buildings. In such cases, the government and the municipality take over the major part of the investment, when in return the apartments can be reserved for specific parts of the population. In these cases, there is either a fixed limit for the investment per square meter or a strong urge in the local councils to keep investments on as low a level as possible.

This leaves room for only the cheapest possible heat supply system, and only legislation sets the lower limits for the quality of the building both in terms of materials, but especially in terms of environmentally friendly applications.

This barrier can be overcome in two ways. Legislation can set new standards concerning heat supply (e.g. "must use renewable energy"). Or the local council (political level) can be convinced that the added investment in biomass heating actually pays quite well, both money-wise for the municipality which is involved in financing, but also adds a green image to the local society.

Barrier: Financing is difficult in public service

In several cases illustrated in these interviews and earlier, it was stressed that it is difficult to finance even highly feasible biomass projects within the operational budget in e.g. a municipality or county administration. Resources are allocated to daily problems, investments kept as low as possible.

This barrier is best overcome by intensive information to local politicians and administrative personnel on the economic advantages of biomass heating. Other means could be improved financing schemes for green investments or a more open mind towards new financing schemes, such as the BOOT systems offered by e.g. Shell or VE-Group.

#### **4.2.3 Economics of wood heating under national circumstances**

An example calculation is presented here, based on the economic calculation model developed in the BIOHEAT project.

The case in point is a comparison of heating costs for a wood pellet boiler versus an oil fired boiler in a building with an annual heat demand corresponding to 45,000 litres of oil. Such a building can be supplied by a 100 kW wood pellet boiler using a total of app. 100

tons of wood pellets a year. The heating costs per unit of heating (one MWh) is about 30 percent lower for wood heating, even after considering the higher capital cost associated with the investment.

	<b>Pellets</b>	<b>Oil</b>	
Investment costs			
Boiler	48,000	20,000	[EUR]
Installation	6,700	2,700	[EUR]
Construction	10,000	6,700	[EUR]
<b>Total investment</b>	<b>64,700</b>	<b>29,400</b>	<b>[EUR]</b>
<b>Total capital costs</b>	<b>5,403</b>	<b>2,404</b>	<b>[EUR/a]</b>
Fuel costs	17,482	32,547	[EUR/a]
Electricity costs	550	270	[EUR/a]
<b>Demand related costs</b>	<b>18,032</b>	<b>32,817</b>	<b>[EUR/a]</b>
Repair costs boiler	480	200	[EUR/a]
Repair costs installation	67	27	[EUR/a]
Repair costs building	50	34	[EUR/a]
Personnel costs	2,080	845	[EUR/a]
Chimney cleaner	250	200	[EUR/a]
<b>Operation related costs</b>	<b>2,927</b>	<b>1,306</b>	<b>[EUR/a]</b>
<b>Total costs per year</b>	<b>26,363</b>	<b>36,527</b>	<b>[EUR/a]</b>
<b>Total costs per MWh</b>	<b>69</b>	<b>95</b>	<b>[EUR/MWh]</b>

The economic risk in wood-fired heating lies, first of all, in the insecurity of future energy prices. Wood pellet prices might go up as in the last year or so, where increasing demand has led to higher prices. Also, oil prices might fall, or other competing fuels (coal, straw, electricity) might be cheaply available, undermining the advantageous economy in wood heating.

#### **4.2.4 Perspectives for the future development of wood heating in large buildings**

With current energy prices and the current developed market for biomass fuel, a continued development of wood-based heating in large buildings is foreseen. However, the number of potential buildings is limited, so one should not exaggerate the market volume.

The current government in Denmark does not support the development of renewable energy in general to the same extent as the former government. Thus, support for investments, support for development, demonstration and research has vanished or been drastically reduced during the last year. With less political support, less information etc.

the market development will be slower. However, there has been no change in the basic economic condition: wood fuels is still much cheaper than oil or gas.

The liberal attitude of the new government might lead to new markets for wood fuels opening within areas covered by natural gas pipeline systems. A free competition in these areas will be advantageous for wood fuels (40-50% the price of natural gas).

Finally, markets in industrial and business buildings are expected to increase.

#### **4.2.5 The role of BIOHEAT – lessons learned**

The information phase of the BIOHEAT project collected important information on the current barriers for wood energy development, including the lack of know-how among key actors and policy makers.

Also, we learned that the market in large buildings lies mainly within existing buildings, as the number of new buildings in areas outside of existing supply systems is limited.

The campaign part of the project has reached a large part of market actors, consultants and decision makers, and the BIOHEAT project as such has definitely helped raise awareness of the wood-heating option.

It is estimated that the BIOHEAT project has, as an added effect, initiated approximately 5 new wood-fired heating plants in large buildings in Denmark within a 2-year period.

#### **4.2.6 Policy recommendations**

Policy recommendations were prepared as part of the assessment of barriers in phase 1 and communicated to the national authorities with the interim report, through formal and informal conversations with policy makers and through a series of articles.

Recommendations associated with the individual barriers are addressed in the paragraph on barriers above.

The most interesting option would be if the BIOHEAT project could help the government and the municipalities to open up the natural gas market. It would have a significant impact and boost the market if biomass heating was allowed in natural gas areas.

In general, political support is needed. This covers the legislation framework and economic and tax framework as well as a personal commitment from government and municipalities.

Increased international cooperation on experiences, dissemination and follow-up on wood heating has proven beneficial to the project. This should certainly be continued and strengthened, possibly as a co-operation network on wood heating dissemination, organised in a similar way as the national Danish Centre for Biomass Technology.



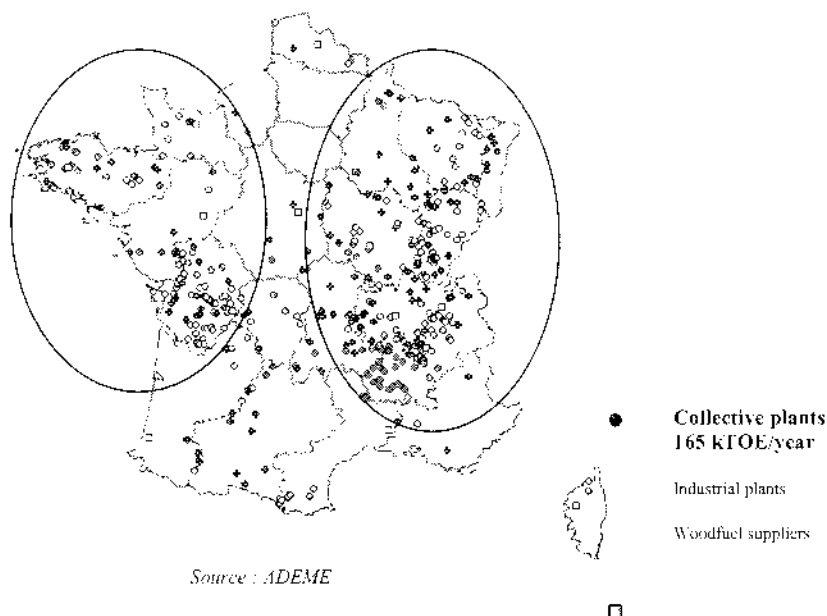
## 4.3 France

### 4.3.1 General preconditions for an increased use of biomass for heating large buildings

#### 4.3.1.1 Present status of heating large buildings with wood energy

Although the French forest is one of the biggest forests in Europe and unexploited wood resources amount to approximately 39 million m<sup>3</sup>, wood for heating purposes represents only 9 million TOE/year (4% of the total energy consumption). The largest part concerns domestic use (logs) and only 165 kTOE/year are used in the 600 collective heating plants (situation at the end of 2001).

As shown below, the development of wood-fuelled collective plants is not homogeneous in France.



**Figure 12**

Due to different climatic conditions and a varying availability of forest resources, the number of wood-fuelled plants is more significant in the eastern than in the western part of the French territory. In the eastern part a large-scale development of collective wood heating plants has taken place on account of a great number of favourable conditions: important thermal needs (with heating degree days from 3,601 to 2,500), a longer winter period, large forests, proximity of Swiss, German and Austrian manufacturers of wood boilers. The collective plants in the western part, mainly situated at the Atlantic coast (with heating degree days in the range of 2,000 to 2,600), are less important but have shown an increase within the last 5 years.

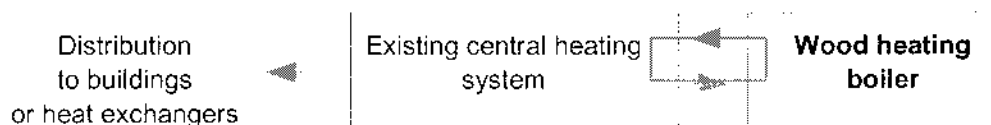
#### 4.3.1.2 Most relevant market segments identified for wood heating in large buildings

Wood-fuelled plants for small and medium projects (less than 800 kW) concerning large buildings in collective housing and tertiary buildings are to be found in various sectors:

- municipal buildings: swimming pools, primary schools, sports halls, city halls, private and public hospitals, old people's homes, secondary schools,...
- collective housing: residences, blocks of flats
- tertiary housing: offices, CAT (centre of assistance by work for handicapped personnel),
- individual housing: farmhouses, little private buildings,...

Two different groups of projects can be distinguished concerning small and medium heating plants:

- Heating plant dedicated to one building
  - Building already equipped with central heating system  
This case relates to collective housing and public buildings such as schools, swimming pools, hospitals, offices, retirement houses ...

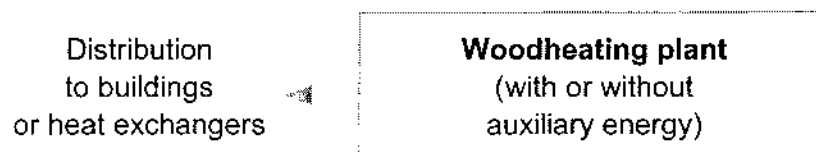


Advantages:

- limited investment costs;
- small distribution network between the two heating systems

Disadvantages:

- a higher or lower degree of difficulties for integration according to available space.
- New heating system



Advantages:

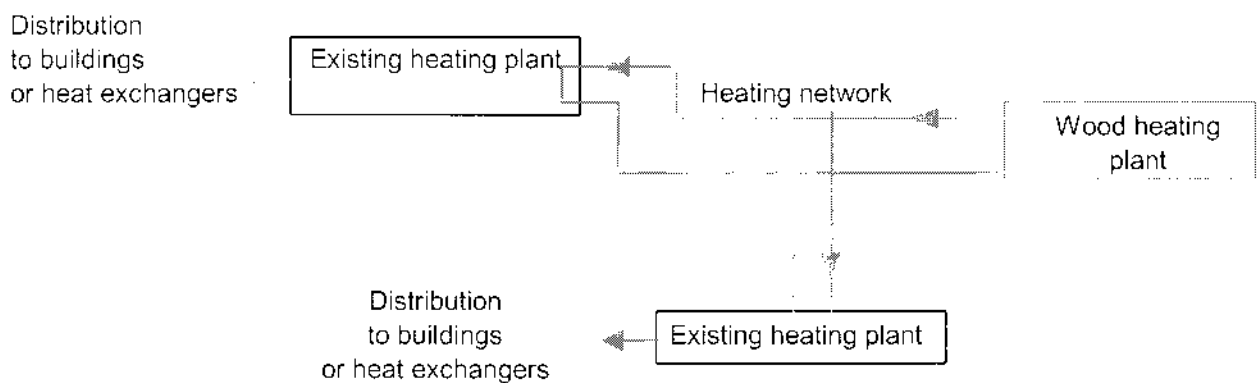
- conception of wood heating plant from the beginning of project;
- simultaneous conception of both wood and auxiliary heating devices, which enables technical, architectural and cost optimisation.

- Heating networks

In this case the wood project includes network creation through the implementation of isolated pipes for heat distribution.

From a legal point of view, we can distinguish two different cases:

- The pipes network provides heat for buildings owned by a single contracting authority (town's buildings, houses or flats belonging to a single housing association ...). This situation is equivalent to a dedicated heating plant.
- The pipes network provides heat for several distinct clients from public organisations and the private sector, which is equivalent to a public service for energy supply (also called "district heating network").



Advantages:

- easiness of integration of the wood-fuelled plant;
- use of existing heating systems turned into heat exchangers and possibility to centralise auxiliary energy;
- interest in joining several partners for a common project.

Disadvantages:

- higher investment costs due to heating network creation.

### 4.3.2 Barriers to wood heating

During the first phase of BIOHEAT, the main barriers to woodfuel development were pointed out in 14 interviews with major actors concerned with wood heating:

	Institution	Kind of actor
1	ADEME : France's Environmental and Energy Management Agency in Low-Normandy	POLITICAL
2	Conseil régional de Basse-Normandie (Regional council in Low-Normandy)	POLITICAL - DEVELOPER
3	La Ferté-Macé Municipality	POLITICAL - DEVELOPER
4	Saint-Hilaire du Harcouët's hospital	DEVELOPER
5	ARO-HLM - Housing companies regional association	DEVELOPER
6	OPAC du Calvados - Public housing company	DEVELOPER
7	B.E.T. Hauguel and associates - Engineering office	ENGINEER
8	Architects Union	ARCHITECT
9	Biocombustibles SA - Woodfuel supply company	BIOMASS SUPPLIER
10	S.E.B. - Woodfuel supply company	BIOMASS SUPPLIER
11	DALKIA - Energy service company	ENERGY COMPANY
12	ELYO - Energy service company	ENERGY COMPANY
13	AMORCE - Local and regional communities national association	POLITICAL
14	SINERG - Financing company	FINANCING

Wood is now accepted as a form of modern energy. Nevertheless the development of heating plants is rather slow due to the French energy policy as well as several fiscal and regulatory aspects.

#### 4.3.2.1 Sociological barriers

For woodfuel development in the housing and services sector spreading the relevant information to the contracting authorities is of essential importance. Actually, from now on profitability will be reached with the financial support granted by the authorities for investments, nevertheless architects, engineering companies, installers and local authorities will concentrate on conventional fossil energies because of their lack of knowledge concerning woodfuel solutions. The image of wood too often remains archaic because of insufficient communication about operational and exemplary wood-fuelled heating plants.

#### 4.3.2.2 Fragility of woodfuel supply

Woodfuel supply is generally considered as one of the main obstacles to setting up a wood-fuelled heating plant by communities, developers or energy service companies:

- Local woodfuel suppliers are not organised systematically;
- Weakness in the guarantees concerning quality, quantity, prices.

Due to the slow current development of wood-fuelled plants in France, the managers of supply companies regard woodfuel activity as a subsidiary activity and consider it necessary that their companies develop other valorisation possibilities for wood residues (animals' litter, organic soil production).

#### **4.3.2.3 Competition with conventional energies**

Woodfuel projects are often confronted with extremely strong competition from Gaz de France which shows a very aggressive commercial policy to keep woodfuels out of the market.

#### **4.3.2.4 A disadvantageous fiscal system**

Economic interests of woodfuel projects are also restricted by two major fiscal rules concerning:

- Woodfuel:

Since 1997, the purchase of wood as a fuel has been subject to the reduced VAT rate (5.5%) in the following cases:

- accommodation and habitation (houses or flats, retirement homes, hospitals...);
- public buildings (schools, swimming pools...).

But this rule excludes the sales of heat produced from wood, which is the usual case for large buildings and an obligation for district heating networks.

Woodfuel promoters have for many years demanded a reduced VAT rate on woodfuel and on energy produced from wood proportional to the wood consumed.

Many projects, especially those including district heating networks, suffer from this discrimination which does not seem justified in terms of energy and economic efficiency.

- Subscription to energy supply:

The VAT rate is regarded as another disadvantage by woodfuel promoters. Heat from a district heating network, as well as electricity or natural gas, is listed in two parts on the invoice:

- one fixed part (subscription) corresponding to investment and maintenance costs;
- one variable part proportional to the consumed energy, which corresponds to fuel costs.

Since 1999, the subscription part for electricity and natural gas has had a VAT rate of 5.5%, whereas the subscription part for a district heating network (fuelled with wood or not) has been 19.6%. This situation also seems to be contrary to any efficient energy policy, especially when district heating networks are fuelled by renewable energy sources.

On these two questions (VAT on wood energy and VAT on subscription for district heating networks) the position of the French Ministry of Finance contradicts the vote of the French Parliament.

#### 4.3.2.5 An insufficient regulatory framework

The lack of clear rules concerning woodfuel also penalises projects. Actually the association of all waste woods (pallets, crates...) with treated and dangerous products obliges to deep flue gas treatment and blocks several projects as early as their conception.

#### 4.3.3 Economics of wood heating under national circumstances

The following table shows the comparison of full costs for a specific project with 250 kW heat load.

Position	Unit	Wood chips	Pellets	Fuel oil	Natural gas
<b>Investment costs</b>					
Boiler	[€]	100.000,00		36.200,00	36.200,00
Installation	[€]				
Construction	[€]	55.000,00		25.000,00	25.000,00
<i>Total investment</i>	[€]	155.000,00	0,00	61.200,00	61.200,00
Applicable for subsidy	[%]	100,0		0,0	0,0
Subsidy	[%]	50,0		0,0	0,0
<i>Investment minus subsidy</i>	[€]	77.500,00	0,00	61.200,00	61.200,00
<b>Capital costs</b>					
Boiler	[€/a]	4.359,23	#DIV/0!	3.156,08	3.156,08
Installation	[€/a]	0,00	#DIV/0!	0,00	0,00
Construction	[€/a]	1.744,72	#DIV/0!	1.586,11	1.586,11
<i>Total capital costs</i>	[€/a]	6.103,95	#DIV/0!	4.742,19	4.742,19
<b>Demand related costs</b>					
Fuel costs	[€/a]	7.684,13	0,00	18.522,46	17.112,26
Electricity costs	[€/a]	550,00		330,00	330,00
<i>Total demand related costs</i>	[€/a]	8.234,13	0,00	18.852,46	17.442,26
<b>Operation related costs</b>					
Repair costs boiler	[€/a]	1.000,00	0,00	362,00	362,00
Repair costs Installation	[€/a]	0,00	0,00	0,00	0,00
Repair costs building	[€/a]	275,00	0,00	125,00	125,00
Personel costs	[€/a]	1.830,00		450,00	450,00
Chimney cleaner	[€/a]				
Service contract	[€/a]	2.700,00		1.400,00	1.400,00
<i>Total operation related costs</i>	[€/a]	5.805,00	0,00	2.337,00	2.337,00
<b>Other Costs</b>					
Insurance	[€/a]				
<i>Other costs</i>	[€/a]	0,00	0,00	0,00	0,00
<b>Total costs per year</b>	[€/a]	20.143,08	#DIV/0!	25.931,65	24.521,45
<b>Total costs per MWh</b>	[€/MWh]	53,7	#DIV/0!	69,2	65,4

It shows that with the available subsidy of 50% wood chips are fully cost competitive. Pellets are hardly available in France and were not considered in this example. At a subsidy rate of 15% the cost of heat from wood fuel would be exactly the same as from gas. It should be noted, that the specific investment costs (including installation) of the 250 kW boiler with 400 €/kW were rather high compared with 220€/kW for a 100 kW boiler in the Austrian example of Nestlebach. It points to market imperfections in this young business.

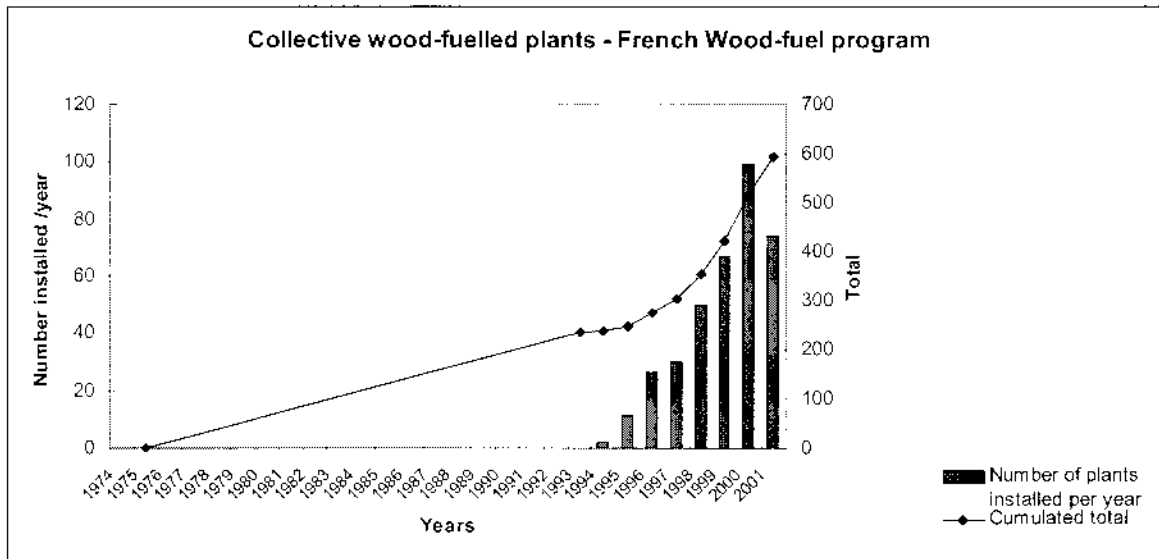
#### **4.3.4 Perspectives for the future development of wood heating in large buildings**

The French woodfuel policy is developed on the basis of a national programme called "Woodfuel and local development", which was launched in 1994 and renewed in 2000 for a 6-year period. This programme is managed by ADEME (French Agency for Environment and Energy Management) and also supported by local structures. It aims at developing wood-fuelled collective plants and especially collective district heating for the housing and services sectors.

Subsidies are allocated for feasibility studies and technical assistance to contracting authorities for construction, follow-up measures and the operation of heating plants. They also include animation whose objective is to identify projects and to organise communication through networks in the wood and energy sectors and with contracting authorities.

The objective of the woodfuel programme is to promote the creation of 1,000 new heating plants (600 for the collective sector and 400 for the industry sector; it represents about 350 MW) in the period from 2000 to 2006. During the last three years (1999-2001) 240 collective wood-fuelled plants were installed within the framework of this programme (among which 214 plants have a small to medium power rate (less than 1 MW)).

As illustrated below, since 1994 the annual growth of collective wood-fuelled plants installed within the framework of the woodfuel programme showed considerable growth and has now reached a rate of 80 plants/year, a rate close to the growth expected by ADEME (100 plants/year).



**Figure 13:** Remark : the exact development between 1975 and 1993 is not available, the curve is obtained assuming there were very few collective wood-fuelled plants before the oil crisis.

ADEME's statistics also show that half of the small to medium plants installed do not have a district heating network.

Considering these ratios and assuming that the growth rate will stay constant, it can be expected that 300 wood-fuelled plants for collective housing and tertiary buildings will be realised within the framework of the French woodfuel programme from 2000-2006, .

One of the future perspectives for medium wood-fuelled plants concerns rural cities (small to medium towns from 500 to 3,000 inhabitants). Estimating that the energy demand of 80% of these towns is sufficient to install a dedicated woodfuel plant (with or without a small-scale heating network), the potential for medium wood-fuelled plants in France could reach 10,000.

The French woodfuel programme's objectives represent only 3% of this market potential, which allows for major capabilities of extension in the woodfuel market, depending strongly on international events which influence petrol prices and on specific measures which will have to be taken by the French government and the European Commission to promote the use of renewable energies.

To reach a higher rate of progression concerning wood-fuelled plants, communication and promotion activities for wood energy must be based on the four principal motivations of local decision-makers:

- The economic interest, which may result from the woodfuel project, and fuel price stability for the period of equipment amortisation;
- Regional planning and local development linked to woodfuel development, especially in bocage areas, where agriculture is to be diversified, and in populated areas, where a search for new activities has been pursued. The cultivation of hedges and wooded areas also constitutes a tool for resources and pollution management,
- Environmental thoughts which gain importance in industrialised areas where wood wastes are dumped or burnt in the open air; the creation of wood-fuelled heating



plants provides local authorities with the possibility to contribute to the reduction of greenhouse gas emission;

- The search for new valorisation solutions encourages industries and local communities to implement wood-fuelled heating plants, as pulp mills have quite reduced their consumption of wood products.

#### **4.3.5 The role of BIOHEAT**

The various tasks carried out in the BIOHEAT project have improved BIOMASSE NORMANDIE's know-how:

- Firstly in France: through the analysis of experience gained in three French regions (Poitou-Charentes, Bourgogne and Rhône-Alpes), which have developed woodfuel in small collective buildings or in small district heating networks for rural municipalities. Many visits and meetings with plants' owners and promoting organisations have facilitated the collection of technical and financial data on the successful realisation of many woodfuel projects. All this information was synthesised to realise the second series of articles.
- Secondly in Europe: the exchange of information between the individual partners and the confrontation of various points of view and behaviours concerning wood heating were strongly instructive and enabled the participating countries to benefit from successful or unfruitful experiences.

Moreover, the BIOHEAT project has raised and synthesised all the major barriers against the development of woodfuel for heating large buildings. The work done to produce this synthesis, the information brochures and the one-day seminar have initiated a working network for woodfuel communication, grouping indispensable partners to succeed in developing wood energy: policy makers in municipalities, health services and social housing, territorial technicians and engineers, heating companies, boiler manufacturers and wood suppliers.

During the BIOHEAT project, BIOMASSE NORMANDIE also carried out four feasibility studies for public buildings, social housing and a farmhouse (50 kW to 300 kW). One of them has turned into a success in the Perche Regional Natural Park in Lower Normandy, which will have a 300 kW wood boiler operating in October 2003, using 125 tons/year.

#### **4.3.6 Policy recommendations**

In France, a large-scale development of wood-fuelled plants can only be achieved by higher competitiveness of wood energy compared to fossil fuels. This can be obtained by:

- maintaining the European subsidies for the kick-off of wood-projects,
- making legislative changes:
- the reduction of the VAT rate on both woodfuels and energy produced from renewables, through the modification of the H Annex from the sixth Council Directive (77/388/EEC) on VAT, thus allowing to apply reduced VAT on heat, as it is already done for natural gas and electricity.
- the introduction of a new Directive: the implementation of a "heat directive" similar to the 2001/77/EC Directive on electricity to promote heat produced from renewable

energy sources. This "heat directive", acting as a new tool combined with other existing directives, would be an efficient way to reach the White Paper's objectives.

- the improvement in regulatory rules concerning quality and standardisation of woodfuels.

These improvements should be supported by the Commission to insure rules harmonisation within the European countries.

The Commission should also continue to carry out complementary actions in technological and know-how transfers and wide communication from advanced to less experienced countries.

## **4.4 Greece**

### **4.4.1 General preconditions for an increased use of biomass for the heating of large buildings**

#### **4.4.1.1 Present biomass utilisation as energy source in Greece**

In Greece in 1996 the biomass consumed chiefly in the household sector and in wood processing plants, amounted to 890 ktoe. The larger share of this quantity, 700 ktoe, was accounted for by burning of firewood in the household sector and the consumption of residues from the processing of wood by industry.

Today, the chief applications of biomass as an energy source include:

- heating of greenhouses
- heating of buildings by using biomass in individual stoves and central boilers
- production of heating for drying in cotton gins
- production of energy in factories
- district heating

Greece possesses important agricultural and forestry residues for the production of energy. More specifically, the agricultural residues available for this purpose from cereals, maize, cotton, tobacco, sunflowers, pruning, vines and wood pith amount annually to 7,5 Mts or approximately 3 Mtoe, while forestry residues may amount to 2,7 Mts or approximately 1 Mtoe.

The favourable climatic conditions prevailing in Greece result in a great variety of residues and high yields from the energy crops in question. This large variety of existing (agricultural and forestry residues) and new (perennial and annual energy crops) biomass raw materials points to an immediate need for investigation at laboratory level, of their physico-chemical properties and their classification of fuels.

At the same time, the wide range of biomass raw materials existing in Greece and the strictly local character of production and sale add to the difficulties of developing the necessary methodologies for the evaluation of the exploitable potential of biomass,

technically and economically. The development of such methodologies is regarded as a critical factor in the utilisation of the domestic biomass potential.

#### Production of Energy from Renewable Energy Sources, 1998

Source	ktoe
Biomass	907,000
Wind	6,300
Small hydro plants (<10 MW)	12,500
Large hydro plants (>10 MW)	308,500
Photovoltaics	0,013
Solar thermal	119,000
Geothermal energy	2,500
<b>TOTAL</b>	<b>1.355,813</b>

Source: Ministry of Development, CRES

#### 4.4.1.2 Importance of wood – solid biofuels as a source of energy

The total share of biomass as primary energy, is presently estimated at 1 Mtoe/year and can for the short term be considered more or less stable as the two opposing major tendencies balance each other out.

- negative trend: gradual decrease in the use of traditional bioenergy (fuelwood)
- positive trend: slow growth of new bioenergy applications (agro-industrial residues)

With respect to the form of biofuels used in Greece we should note that more than 95% of the above defined contribution is in the form of solid biofuels, which are mostly (by more than 90%) used for energy production without any type of refining or upgrading. The only other type of biofuel with some use worth mentioning is biogas.

In contrast to most European countries, forest-derived woody biomass does not represent the dominant type of solid biofuel within the present bioenergy use in Greece. As we can easily see in the following approximate categorisation Greek bioenergy is mainly based on agriculture-derived sources (in percent of total primary bioenergy contribution):

**Biofuels used in Greece**

TYPE	%	ktoe/year	trend
Fuelwood from forests	40	400	-
Fuelwood from tree crops	30	300	+
Agro-industrial residues	20	200	++
Charcoal, forest-derived	3	30	--
Charcoal, agriculture-derived	3	30	--
Other (biogas etc)	4	40	+
<b>TOTALS</b>	<b>100</b>	<b>1,000</b>	<b>+/-</b>

Source: NTUA, Dept of Chemical Engineering

The main type of bioenergy use in Greece is still the traditional, rural one, i.e., for space heating in farm-houses, equivalent to 2-3 kW thermal energy per house, requiring 2-3 t of solid biomass/year (fresh amounts of forest or tree crop-derived wood). This form experiences long term slow decline, following corresponding socio-economic changes in rural areas.

This is followed in importance by the use of agro-industrial residues - such as olive pits, cotton-gin wastes, fruit-processing wastes, etc – mainly for process heat generation at agro and cottage industries, based on the utilisation of their own wastes and residues. On the other hand, the option of bioelectricity is only starting to be considered by Greek Companies.

#### 4.4.1.3 The utilisation of biomass for space heating in Greece

While in northern European countries winters are cold and long leading to an average use of 1.3 TOE/dwelling (1997 ) the corresponding value is 0.1 TOE/dwelling in Greece, a southern country with low demands in space heating. It is worth mentioning that the energy consumption of electrical appliances, lighting and air conditioning amounts to 18% of the total energy balance (CRES, 1997). Furthermore, the share of centrally heated dwellings is 35.5% in which oil is the major fuel. The remainder (64%) of single thermal systems is split up into 25% for oil, 12% for electricity and 18% for wood-fuel.

Taking into account the aforementioned issues, it is evident how significant the socio-economic aspects of conventional fuels used for space heating such as expenses for fossil fuel imports, energy dependency as well as the reduction of household budgets are. Furthermore, the direct and indirect environmental impact (greenhouse gas emissions that the residential sector together with the services sector contributes to amounts to 10% of the total annual CO<sub>2</sub> emissions) cannot be disregarded [4].

The utilisation of biomass, a neutral energy source to the Greenhouse Phenomenon for space heating is not very well known except in the case of woodfuels used in isolated and mountainous settlements. In Greece there are several applications small scale and mainly in the residential sector that exploit olive pits, fruit kernels etc. These applications occur in agricultural areas where biomass potential, end-user price, logistics issues and fuel quality favour the implementation of such schemes.

The contribution of woodfuels to the energy produced from biomass amounts to 77%. . This corresponds to more than 65% of the total share of RES in the energy balance of Greece.

#### 4.4.1.4 Climate: heating degree days and typical full load hours of heating system in relevant regions

In order to see an integral picture of the typical demands in the various Greek regions, please refer to the following tables:

- Characteristics winter climate of major Greek cities (table I)
- Limits of the annual energy demand for heating/cooling in buildings (table II)
- Structure of households (table III)
- Space heating equipment (table IV)
- Water heating equipment (table V)
- Cooking equipment (table VI)

Tables III-VI are base on data of the National Statistical Service of Greece (1997). This household energy consumption data is being presented through:

- the structure of households
- (persons, dwelling, tenure, type, age, insulation, area, etc.)
- the space heating equipment
- (type of space heating equipment, fuel type, production, etc)
- the water heating equipment
- (type of water heating equipment, fuel type, etc.)
- cooking equipment
- (type of cooking equipment, fuel type, etc.)

#### STRUCTURE OF HOUSEHOLDS

	Number	Percentage %
Total number of households	3.602.956	100,0
of which :		
1 persons / household	669.951	18,6
2 persons / household	1.043.842	29,0
3 persons / household	728.079	20,2
4 persons / household	809.360	22,5
5 persons or more	351.724	9,8

Total number of dwellings	3.997.045	100,0
of which: main	3.602.956	90,1
secondary	394.089	9,9

Type of tenure		
owned dwellings	2.815.764	78,2
rented dwellings	787.192	21,8

Housing type		
single houses	1.701.971	47,2
flats	1.900.985	52,8

Distribution of dwelling by age		
Construction period		
Before 1945-47	316.256	8,8
45-47 to 73-75	1.909.360	53,0
After 1973-75	1.377.340	38,2

Availability of insulation (in %)		
No insulation	77	
Loft/roof insulation	16	
Cavity wall insulation	12	
Floor insulation	6	
Double glazing	8	

Average floor area (in m2) per household 82

### SPACE HEATING EQUIPMENT

Dwellings without heating system 28.079 0,8

Dwellings with non-central heating system	1.532.512	42,5
by fuel type		
Fuel/gas oil	543.350	15,1

Natural gas	0	0,0
Electricity	365.517	10,1
Solid fuels	23.153	0,6
Wood	599.015	16,6
LPG	143.842	4,0

District Heating		
Other or mixed	493	0.0

by type of equipment		
Cooking equipment	1.119.704	31,1
Stove	114.778	3,2
Fireplace	158.621	4,4

Dwellings with central heating system	2.042.365	56,7
by fuel type		
Fuel/gas oil	1.980.788	55,0
Natural gas	2.956	0,1
Electricity	22.660	0,6
Solid fuels	20.197	0,6
Wood	19.212	0,5
LPG	1.970	0,1
District Heating		
Other	0	0,0

Type of production		
Individual	675.369	18,7
Central	1.366.995	37,9
Distinct heating	0	0,0

Dwellings with additional heating equipment	782.759	21,7
by fuel type		
Fuel/gas oil	27.586	0,8

Natural gas	0	0,0
Electricity	508.867	14,1
Solid fuels	7.389	0,2
Wood	196.552	5,5
LPG	84.729	2,4
Other or mixed	6.404	0,2

**WATER HEATING EQUIPMENT**

Dwellings without water heating equipment	213.300	5,9
Dwellings with w.h. equipment not connected		
to central heating	3.335.468	92,6
By fuel type		
Natural gas	493	0,0
Electricity	3.116.256	86,5
LPG	16.749	0,5
Solar	801.970	22,3
Other	2.686	0,1

Dwellings with w.h. equipment connected		
to central heating	453.695	12,6
By fuel type		
Fuel/gas oil	435.468	12,1
Natural gas	985	0,0
Electricity	985	0,0
Solid fuels	9.360	0,3
Wood	4.926	0,1
LPG	1.970	0,1

**COOKING EQUIPMENT (principal)**

Dwellings without cooking equipment	18.227	0,5
Dwellings with cooking equipment	3.584.729	99,5



By fuel type		
Natural gas	493	0,0
Electricity	3.084.729	85,6
LPG	836.453	23,2
Wood	185.222	5,1
Gas & Electricity	0	0,0

#### 4.4.1.5 Experience with wood heated buildings

Some of these experiences are included in this report. Additional examples are included in the maxi brochures.

#### 4.4.1.6 Hotel Adrion

Hotel Adrion is located in Iraklio (Crete Island), B' category (according to Greek Hospitality Standards) and its capacity is 65 rooms. A biomass system for space heating and hot water was installed exploiting olive pits in 1985.

The operation period of the biomass system is from the middle of November to the middle of April depending on climatic conditions. Its established thermal capacity is 250 kW (there are two burners; 100 kW and 50 kW) and is supplied with an average amount of olive stones of 150 t/year (data from last three years) and a gate price of almost EUR 44 /t.

The material is considered high quality – its moisture content ranges from 10 to 20%, the heating value from 18 to 19 MJ/kg and ash 2-5%. The material is delivered in the beginning of October to the storage from where a mechanical fuel feeding system supplies the burner.

The flue gas passes through a removal system that is equipped with a mechanical dust remover (cyclone) before it is released into the atmosphere. Odour emissions are seldom remarked in the surrounding areas as the burner maintenance is carried out in regular intervals.

The economic availability of the application is currently taking into account oil prices and the prices of conventional burners. The problems that must be considered in order to plan new appliances is the need of service personnel and daily burner maintenance and varying biomass availability.

#### 4.4.1.7 The Holy Coenobium in Ormilía Chalkidiki (S. Greece)

The biomass application set up in 1987 exploits woodfuel extracted by the forest management of Castanea forest stands that grow in the surrounding area of Chalkidiki (Northern Greece) mountains.

Its established thermal power is 1 x 10<sup>6</sup> Kcal/h and covers the space heating demands of the guestrooms and the Coenobium private areas (in total 25,000 m<sup>2</sup>) as well as hot water (kitchen, laundry etc.). One hundred and twenty nuns lead a secluded life in The Holy

Coenobium of the Annunciation. Additionally, a few thousand of believers visit the Holy Coenobium every year.

The burner operates five months per year consuming 300 – 500 kg/h woodfuel. The woodfuel quality characteristics are: 30 – 40% moisture (stored at uncover area – see photo), its diameter is 15 – 25 cm and length 30 cm. They are supplied mechanically via two silos (total capacity 30 m<sup>3</sup>) to the burner.

The operational cost of the biomass plant amounts to EUR 11,800 per year (excluding the unpaid work of nuns for cleaning up and operating the burner). In the framework of the Operational Program, “Competitiveness” (jointly co-funded by the EU and the Greek Government) the Coenobium submitted a proposal for a new burner (almost 2 x 10<sup>6</sup> kcal/h) and retrofitting procedures such as envelope isolation, replacement of pipe network and so on.

**4.4.1.8 Wood stoves – A typical application in Greece**

Wood stoves create an elegant corner in the lounge and at the same time take advantage of the energy content of the firewood. They can heat the whole house economically.

Wood stoves can include a water heat exchanger connected with the central heating system .

TECHNICAL CHARACTERISTICS	
Thermal value (kcal/h)	20-25
Gauge (cm)	Width 76-90 Height 82 Depth 60
Cross section	F 30
Water entrance-output	1 1/12”
Constructive material	St 37-2
Smokestack’s height (cm)	25-30x25-30

Source: Boiler Industry “UNION”

This way of heating is not suitable for large buildings or blocks due to its small thermal value (max 25.000 cal/h). In single family houses this method of heating seems very convenient, in some cases it is used as the only way of heating. Some industries have long experience in the subject (15 years).

The basic mechanism of thermal transfer is radiation.

1. Boiler
2. Fireplace
3. Filling
4. Open drum of expansion
5. Safety piping

6. Triode valve
7. Circulator
8. Central heating

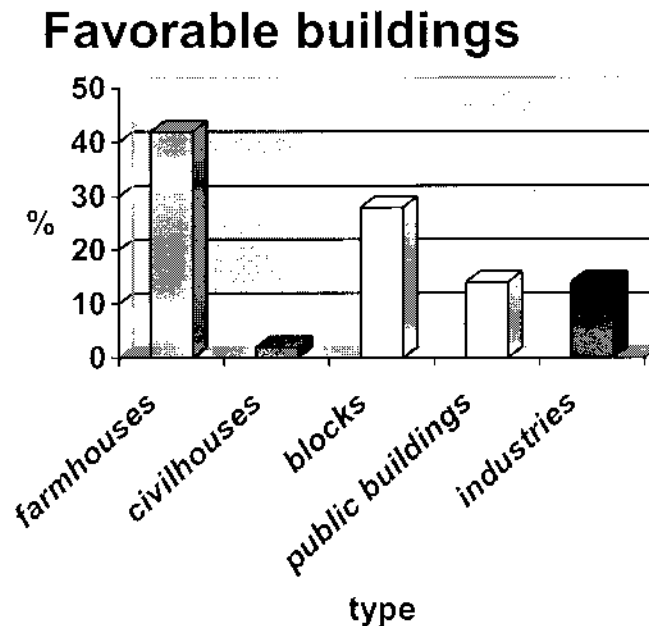


Figure 14

#### 4.4.1.9 Most relevant market segments identified for wood heating in large buildings

Based on the project scheduling a specific questionnaire was developed (a sample can be seen in the annex i). The following persons were interviewed:

- I. Mr N. Mouzakis, end user
- II. Mr G. Xilias, developer
- III. Mr P. Charitos, developer
- IV. Mr K. Tzanos, technology provider
- V. Mr C. Katoudis, boiler constructor
- VI. Mr T. Sietos, developer
- VII. Mr N. Filippopoulos, developer/ boiler constructor
- VIII. Thermodynamiki SA, heating industry
- IX. VIET SA, energy fireplaces constructor
- X. Mrs Pantzou, heating equipment company
- XI. Mr Kiparissis, heating equipment company

- XII. Mr Ladoukakis, heating equipment company
- XIII. Ms M. Christou, President of the Hellenic Biomass Association
- XIV. Mr S. Toukouzianis, end user
- XV. Mr I. Samaras, constructor
- XVI. Mr. N. Fokas, constructor

The results of these interviews are presented in annex i.

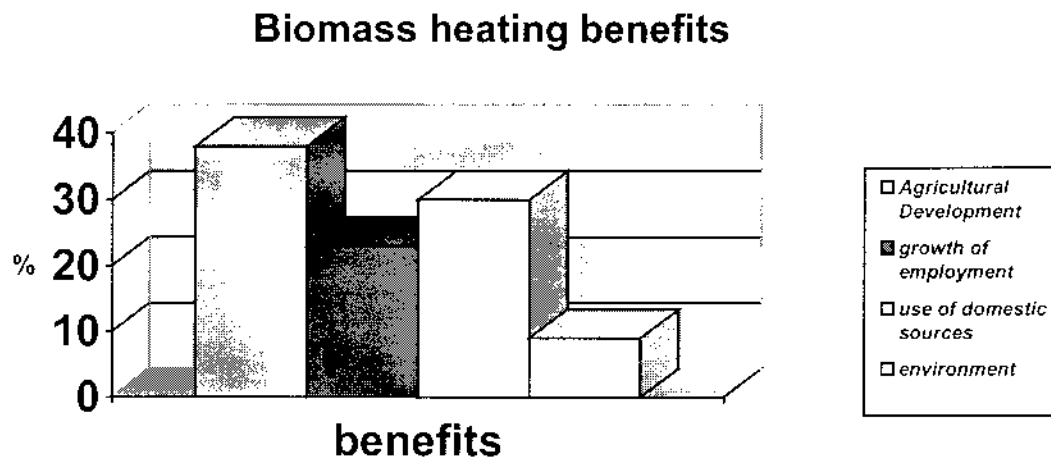


Figure 15

#### 4.4.2 Economics of wood heating under national circumstances

Based on the excel spreadsheet the energy cost for Greece seems to be as follows:

Woodchips:	EUR 1.47 per GJ
Heating oil:	EUR 8.15 per GJ
Natural gas:	EUR 10.6 per GJ
LPJ:	EUR 11.19 per GJ
Electricity for heating:	EUR 22.67 per GJ.

The following examples present the saving, which will be achieved in various cases:

case	Zone	Surface (m <sup>2</sup> )	Intervention	Annual saving potential (EUR)
1-2 floor domestic building	D (north)	150	Replacement of electricity for heating with woodchips*	1500
Medium building 3-4 floors	A (south)	500	Replacement of heating oil with woodchips*	420
Large building 8 floors	C (central)	1000	Replacement of LPG with woodchips*	3150

- we preferred woodchips indicatively since woodpellets have no defined price in Greece

#### 4.4.3 Perspectives for the future development of wood heating in large buildings

Based on the interviews the main obstacles for the deployment of the use of solid biofuels in Greece consist in the following:

- Resource:
  - Availability, seasonable patterns of generation
  - Collection, storage and handling aspects
- Technical:
  - Maturity of certain conversion technologies (e.g.: gasification)
  - Role of inorganic constituents (e.g.: ash melting)
  - Difficulties during use, such as cleaning, dust, lack of technical support
- Economic:
  - High initial capital required
  - High interest rates
  - Lack of venture-risk-capital firms
  - Payback period
  - The immaturity of the market
  - The rising prices of diesel the previous period
- Communication:
  - Lack of information
- low environmental awareness

- Management
  - The reluctance of state stakeholders to invest in biomass applications
  - The lack of an administrative authority in the area of wood fuel supply

#### **4.4.4 The role of BIOHEAT – lessons learned**

#### **4.4.5 Policy recommendations**

The Greek biofuels policy has as main priorities :

- development of networks for collection and management of solid wastes
- estimation of biomass potential
- standardisation of biofuels
- mixed combustion with lignite
- development of production/management schemes of energy crops
- development of pilot applications

Based on the results of the review as well as the discussions during the seminars the suggested priorities for a long term (sustainable) market development are:

- information to the end users concerning economic benefits
- introduction of tax rebates for biomass use
- energy training for constructors
- provision of a complete energy service support (design, installation, operation, maintenance)
- solution of crucial biomass problems, such as supply and management
- increase of availability and competitiveness of the raw material
- realisation of relevant pilot applications to all heating ranges
- strengthening of the environmental sensitisation

Information for the technological development of biomass to researchers and constructors

**PELLETS ARE AN ABSOLUTELY NEW PRODUCT FOR GREECE.  
A LOT OF WORK HAS TO BE DONE TO DEVELOP THE MARKET**

## 4.5 Italy

### 4.5.1 General preconditions for increased use of biomass for heating large buildings

Thanks to the current fiscal situation (high fossil fuel taxation) in Italy the economic conditions favour the increased use of biomass for heating large buildings; nevertheless it is fundamental for the development of this market to organise a well structured biomass supply chain from the wood to the final user. Italy is characterised by a holographic structure that makes this country rich in poor woods which are very difficult to manage because of hydrogeologic issues as well.

#### 4.5.1.1 Present energy use for heating large buildings

At present the energy portfolio used for the heating of buildings is mainly made up by Natural Gas and LPG (about 70% of the market) and heating oil (about 19%). The remainder of 11% is covered by electricity and wood.

During the last 20 years Natural Gas has substituted heating oil and coal thanks to the development of an extensive natural gas distribution grid that reaches the most remote areas of the country.

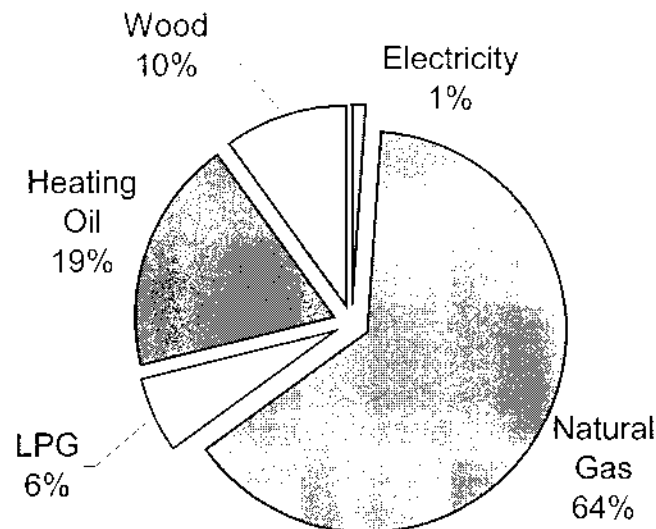


Figure 16: Residential heating energy in Italy

#### 4.5.1.2 Climate: heating degree days and typical full load hours of heating system in relevant regions

Italy is characterised by hugely different climate conditions due to its geographical position in the Mediterranean sea and its extension from North towards South. In fact in Northern

Italy the climate is continental with severe winters and hot summers while in the South the climate is mild in both seasons.

Between these two macro-areas there is the Appennini mountainous chain characterised by short cold rainy winters.

It should be underlined that Italian climatic conditions are not favourable for biomass heating systems which need high full load hours. In fact in the North, for a few days of the year, the temperature can fall some degrees below zero with high moisture and then the design of a heating plant must provide for these conditions (design temperature = -10/-15 °C) comparable with heating systems designed for Central/Northern Europe even though these systems are operated in average for only 4/5 months per year. In consequence plants are largely oversized (high investment cost) and have a low charge factor.

This situation is not favourable to the promotion of these systems but it is largely compensated by very favourable fiscal conditions.

In details the degree days are the following:

Mountain area: ~2500-3200

Coastal area: ~1100-1800

Padana plain: ~2200-2400

#### **4.5.1.3 Experience with wood heated buildings**

In Italy biomass is traditionally used for household heating. Nowadays the biomass contribution to the national energy demand is about 4-5 MTOE corresponding to 16-20 Mton/year of wood.

This figure was established in a recent ENEA (1999) survey. It should be stressed that most of the wood consumption is related to small heating devices (old stoves and fireplaces) characterised by low efficiency; as a result its heating potential in Italy for energy is considerably higher.

It is fundamental to improve the availability of modern combustion devices that make better use of this huge energy potential.

Finding out data on wood consumption for energetic proposes (household heating) in Italy is extremely complicated because reliable data are not available.

In Italy there are several wood heated large buildings operated by means of district heating and by single plants. These plants are mainly located in the North and in the Centre of Italy. Nevertheless there are non-official data on the number of BIOHEAT range plants. From a raw estimation there could be some hundred devices in operation.

#### **4.5.1.4 Most relevant market segments identified for wood heating in large buildings**

The market is not yet mature enough but there are some interesting market niches, mainly places the natural gas grid does not reach. These depend on local entrepreneurs, local boiler/wood fuel producers, wood waste residues' availability, local subsidies etc. It is not yet clear which niches will develop in an open market.



Besides there is a starting market in the bioheat range size for small local district heating in the coldest regions due to specific very cold region incentives: small grids connecting the public buildings and some private houses

#### **4.5.2 Barriers for wood heating**

The main barriers for the promotion of wood heating systems in Italy are the following :

1. Insufficient and inadequate regulatory framework
2. Lack of information on new wood heating systems
3. Lack of a well organised supply of wood fuel
4. Low competitiveness of these systems compared to traditional ones
5. High diffusion of natural gas network
6. Economic risk

##### **Insufficient and inadequate regulatory framework**

Almost all the relevant actors interviewed indicated the inadequate regulatory framework as the main barrier. There is a lack of a clear legislation regarding:

Atmospheric emissions

Solid waste and wood fuels regulations

Fire safety regulations

A specific and clear regulatory framework for this kind and size of boilers is lacking.

In March 2002 a President of the Ministry Decree clarified the distinction between woodfuels and wood waste residues but some problems related to the application of this law still exist

There are also some problems with fire safety regulations: often it is impossible to obtain a permit for a woodfuel storage place. The fire safety authorisation procedure should be simplified and harmonised. At present it is complex and varies from province to province.

Finally in order to solve the problems of woodfuel quality standardisation it is necessary to establish a norm for woodfuel characteristics.

Only with new clear legislation on the subject could the biomass heating market grow significantly.

##### **Lack of information on new wood heating systems**

Consumers, developers and installers showed a general interest in wood heating systems but also a considerable lack of basic information.

This lack of information has been addressed by the BIOHEAT project but should be should be complemented by further information campaigns and the development of pilot projects.

The woodfuel and wood boiler retailers could play an important role as information multipliers and promoters of these technologies. [It could be useful to promote information campaigns or similar initiatives]

A key action is to inform the relevant actors that wood heating systems are competitive and reliable and it is important to show them well designed heating plants.

Another big problem is that often the developers do not know how to design wood heating plants, thus making big mistakes. Therefore it is necessary to teach them by organising specific technical seminars and courses, how wood boiler plants should be designed (i.e. underlining the importance of hot water storage tanks).

Another problem occurs when local authorities do not have the technical tools or the know-how for evaluating the fitness and the economics of different heating technologies: it is fundamental to provide the municipal officers with the appropriate tools (software, handbooks, seminars...) to evaluate the best options.

#### **Lack of a well organised woodfuel supply**

Energy service companies, developers and consumers are worried about the fragility and unreliability of woodfuel supply, the standardisation of woodfuel quality and price stability. It is necessary to improve the efficiency of the whole wood chain (collection /transport /delivery) and cut prices. A solution could be to promote woodfuel locally, close to the end users in order to reduce transport costs and to benefit also from positive external effects like wood cleaning and occupational issues.

#### **Low competitiveness (cost effectiveness) of these systems compared to traditional ones**

Wood heating systems are competitive only in some particular niche conditions. At present wood heating systems are too expensive if compared to gas boilers, even if the operational costs of wood boilers are lower. Their cost effectiveness could be increased by an expansion of the market in this difficult start up phase.

A major issue is the high investment cost: it is necessary to cut down boiler prices and develop new subsidy systems similar to the ones for large district heating.

Municipalities and local administrations could play an important role in the start up phase and should:

- promote wood heating as a public interest action
- involve the relevant umbrella organisations in lobbying actions.

#### **Lack of space for boiler and fuel storage**

Wood heating boilers are larger than gas ones and it is difficult to find the proper space for wood storage and boilers especially in old buildings. Furthermore, several relevant operators stressed the importance of energy service companies in the promotion of these systems. The start up of new ESCO should be stimulated with a specific subsidy policy.

#### **High diffusion of natural gas network**

Another barrier is the natural gas network that has always been strongly subsidised with incentives even where it was not economical and not necessary (i.e. isolated small mountain villages). It is difficult to propose wood heating systems where the connection to the gas network already exists: gas boilers are 4 times cheaper even if the operational cost of a wood boiler is lower. It is difficult to convince consumers to choose the wood heating option when 10 years ago they were persuaded to think that natural gas was the best option.

### Cultural mismatch of biomass district heating

For years the single family central heating system has been promoted and now it is very difficult to convince consumers to switch to wood district heating.

### Economic risk

Developers and installers prefer to design and propose only traditional gas boilers because they consider it a risk to invest in new wood heating technologies that they do not know very well. This barrier could be easily broken down by organising specific designing courses and pilot project field trips.

### Preliminary policy recommendations

In Italy there is now a new solid fuels directive that could help in the promotion of wood heating. This new legislative tools should be improved and corrected (too restrictive emission limits related to small devices, olive husk issue).

Furthermore it is desirable to create a new subsidy scheme specific for these plant sizes, similar to the district heating supporting system and also for wood management. Italian woods are difficult to manage and it is still too expensive to use forestry wood for pellet production. Nowadays pellets are produced from industrial wood residues (sawmill, furniture industry etc), but if the market of wood heating starts up it will be necessary to produce pellets from forest wood.

### 4.5.3 Economics of wood heating under national circumstances

The following figures were obtained from the BIOHEAT calculation model using Italian climate and market conditions with NO SUBSIDIES for wood heating systems.

Investment cost:

	Unit	chips	Pellets	Gasoil	Natural gas
<b>Investment costs</b>					
Boiler	[EUR]	10,000.00	10,000.00	4,000.00	3,000.00
Installation	[EUR]	2,500.00	2,500.00	1,500.00	1,500.00
Construction	[EUR]	10,000.00	8,500.00	4,500.00	4,000.00
<i>Total investment</i>	[EUR]	22,500.00	21,000.00	10,000.00	8,500.00
Applicable for subsidy	[%]	100.0	100.0	0.0	0.0
Subsidy	[%]	0.0	0.0	0.0	0.0
<i>Investment minus subsidy</i>	[EUR]	22,500.00	21,000.00	10,000.00	8,500.00

Due to the low full charge load of Italian plants (< 3000 h/y), low end boilers are used when there are no specific subsidies. Otherwise there is not pay back. That is why investment costs are considerably lower than in Central European plants.

Fuel cost:

		<b>Chips</b> [EUR / kg]	<b>Pellets</b> [EUR / kg]	<b>Gasoil</b> [EUR / Liter]	<b>Natural gas</b> [EUR / m <sup>3</sup> ]
<b>Costs per unit</b>		<b>0.100</b>	<b>0.150</b>	<b>0.830</b>	<b>0.630</b>
	EUR/ m <sup>3</sup>	21.88	100.00		

Results:

<b>kWt</b> <b>h</b>	<b>h/year</b>		<b>Chips</b>	<b>Pellets</b>	<b>Gasoil</b>	<b>Natural gas</b>
<b>100</b>	<b>1500</b>	<b>Total annual cost</b> <b>[EUR/y]</b>	8,28	8,959	16,259	12,752
		<b>Total cost MWh</b> <b>[EUR/MWh]</b>	55	59.7	108.4	85.0
<b>100</b>	<b>3000</b>	<b>Total annual cost</b> <b>[EUR/y]</b>	13,26	15,071	31,226	24,415
		<b>Total cost MWh</b> <b>[EUR/MWh]</b>	44	50.2	104.1	81.4
<b>400</b>	<b>1500</b>	<b>Total annual cost</b> <b>[EUR/y]</b>	23,23	27,296	61,162	47,740
		<b>Total cost MWh</b> <b>[EUR/MWh]</b>	38	45.5	101.9	79.6
<b>400</b>	<b>3000</b>	<b>Total annual cost</b> <b>[EUR/y]</b>	43,16	51,745	121,032	94,391
		<b>Total cost MWh</b> <b>[EUR/MWh]</b>	36	43.1	100.9	78.7

As outlined before investment costs for plants that normally operate for less than 3000 h/y are rather high.

Nevertheless it should be underlined that the heating market for household heating put in evidence the competitiveness (cost effectiveness) of ligno-cellulosic biomass versus fossil fuels that are heavily taxed.

At present the thermal kWh from biomass is about half compared to fossil fuels (natural gas and gasoil).

In addition there are public subsidies (on the capital cost and on the heat supplied from district heating) that make the investment more affordable in the coldest area some regions.

In Italy there is a market only for economic boilers or for discounted (regional incentive) imported technology devices (as in Trentino Alto Adige)

#### **4.5.4 Perspectives for the future development of wood heating in large buildings**

In Italy the distribution of house typologies is concentrated on individual single family houses or in cities large condominium buildings not suitable for wood heating.

In the agricultural mountain regions it is also not common to have large countryside buildings like in Continental Europe. That is why there are not so many "bioheat size" large buildings, but some small district heating community plants that constitute the potential for the development of wood heating (schools, hospitals, hostels etc)

Nevertheless from the politician's point of view is better to develop larger district heating plants (> 1 MWth), for "visibility" and "critical mass" issues.

#### **4.5.5 The role of BIOHEAT –lessons learned**

The BIOHEAT project has played a key role in addressing the lack of information on wood heating. Good information material was produced (articles and brochures) with positive feedback.

Besides in the framework of the project a precise survey to the current state of the Italian wood heating situation has been carried out collecting all the useful information.

Furthermore important contacts with relevant actors of the wood heating chain have been established.

With this project we discovered that there is a huge potential for the Italian wood heating market and since now the legislative framework is more definite the start up will be easier.

Finally the project gave us the possibility to compare the Italian situation with other European countries in order to share experiences.

#### **4.5.6 Policy recommendations**

In Italy a stronger political attention to Biomass issues is necessary: better co-ordination between the competent Ministries and a tuning of the new legislation on solid fuels.

In Europe:

Legislative European harmonisation is necessary without destroying the cheaper boiler technology that helps to keep the investment costs low.

It is necessary to create incentives for R/D programs on forest management in order to lower the cost of forestry woodfuels; in fact Italian woods are difficult to operate because of hydro-geological difficulties.

## **4.6 Netherlands**

### **4.6.1 General preconditions for an increased use of biomass for heating large buildings**

#### **4.6.1.1 Present energy use for heating large buildings**

Biomass-based block heating systems as defined in the BIOHEAT project have not yet been introduced in the Netherlands. In the 60's, coal was substituted as a heating fuel by relatively cheap and clean natural gas from domestic sources in nearly all parts of the Netherlands. It is said that the natural gas distribution system needs to be operated for several more decades in order to recover the large investment of the distribution system.

Nearly all large buildings are therefore heated with a centrally located natural gas-fired boiler. In some large cities, all buildings in the area are connected to a district heating network. Other fuels that are used in relatively small quantities for heating systems are fuel oil (on the Netherlands army bases), as well as propane on a number of farms.

A practical consequence of the wide availability of natural gas is the fact that, in contrast to many other European countries, most of the new Dutch buildings do not include a large boiler room with storage space for fuels (such as heating oil). This is a barrier in cases where replacing a natural gas-fired boiler with a woodchip or pellet-fired boiler in an existing building is under consideration.

Although the prices of wood pellets and woodchips are relatively low as well, the typical payback period of 8-10 years for a wood-fired system is usually considered too long for a technology that lacks a track record for space heating in the Netherlands. In addition, Dutch people have lost affiliation with handling solid fuels for space heating since the replacement of coal by natural gas in the 60's.

#### **4.6.1.2 Climate: heating degree days and typical full load hours of heating system in relevant regions**

As the Netherlands are relatively small as a country, there is hardly any geographic influence on the number of heating days. The normal number of heating days, related to an average room temperature of 18°C, amounts to 3,092. This is about average for the whole of Europe. The annual temperature distribution curve is provided below.

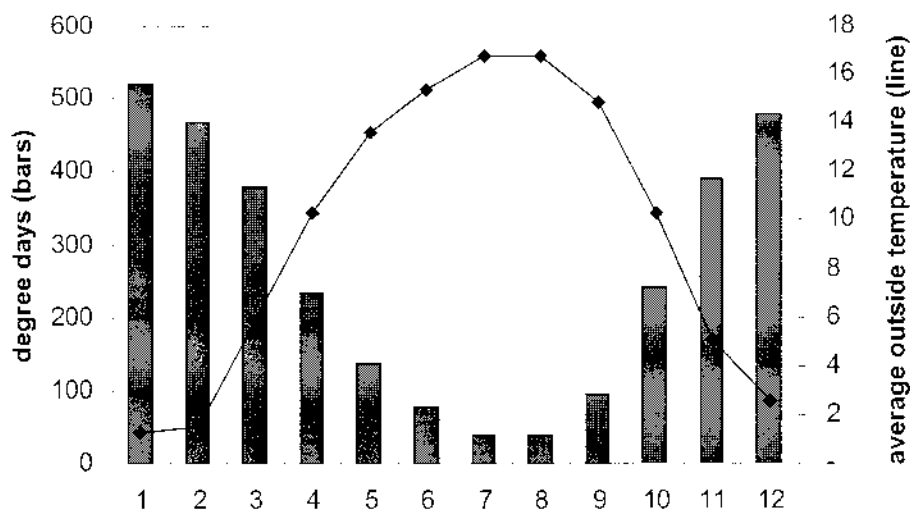


Figure 17

This temperature profile corresponds to 2,290 full load hours for a boiler that is designed to cover the maximum heat demand at the minimum outdoor temperature of  $-18^{\circ}\text{C}$ . A biomass boiler is typically dimensioned at 60% of the peak demand, in which case it can be operated for 4,160 full-load hours.

#### 4.6.1.3 Existing experiences with wood heated buildings

There are approximately 1,050 wood heating systems between 100 and 5,000 kWth in operation in the wood-processing industries. The total installed capacity here amounts to some 320 MWth. Yet, the main reason for such companies to invest in a wood-fired boiler is not to produce heat but to get rid of the wood waste in a financially sound manner. Since there is an existing market for wood-fired boilers, there are several dealers that could also supply wood heating systems that use commercially available woodchips and wood pellets (the target application under BIOHEAT).

A few companies have recently decided to invest in an automatic fired wood pellet or woodchip combustion system for block heating. Examples of such systems are:

- A recreation castle on a rural estate. A woodchip-fired boiler system (Köb, 350 kW) with heat buffers was installed in 2002. Woodchips are obtained from the rural estate.
- A 30 kW pellet combustion system at Labee, one of the two Dutch producers of wood pellets.

#### 4.6.1.4 Most relevant market segments identified for wood heating in large buildings

If environmental taxes on natural gas increase, wood combustion may become a more attractive alternative for space heating in some cases. Wood prices are still rather low, as shown in **Figure 1: Prices of fuels for space heating as of June 2001 as gathered in the Bioheat project. Prices are incl. VAT for an annual consumption of 900 GJ. This suffices for a 100 kW boiler.** But it needs to be realised that the demand for pellets and woodchips is yet only starting. Studies have shown that the domestic availability of wood fuels is

insufficient to meet the ambitious targets for bio-energy that are derived from the formulated policy objectives for renewable energy in 2020 [1].

Coal power plants in particular are expected to have a large impact on the future price of wood fuels, since they will be major consumers. In this situation, one may expect that the price of wood fuels will go up as well, up to a level that equals that of the price of imported wood fuels. At present, all wood pellets produced in the Netherlands are exported because of the low domestic demand for pellets.

In the Netherlands, the net tariff for natural gas depends on the amount of gas consumed. This is mainly caused by the regulatory energy tax (REB) that is particularly high for the first cubic meters of gas, as shown in the below table.

Tariff structure for natural gas in the Netherlands

Annual consumption (m3/year)	0 – 5.000	5.000 - 170.000	170.000 – 1.000.000	>1.000.000
Tariff ex REB, ex VAT (EUR/m3)	0,230	0,230	0,230	0,230
REB (EUR/m3)	0,124	0,058	0,011	-
Total ex VAT (EUR/m3)	0,354	0,288	0,241	0,230

Source: Energiemonitor, 2001-1, Centraal Bureau voor de Statistiek, 2001

When substituting wood fuels for natural gas, fuel savings are particularly high for small consumers. But at the same time, small wood combustion installations are more expensive than larger installations. The REB-tax benefit is largest for small private consumers that share a large wood combustion installation for block heating. The figure below provides an indication of the payback period for a company that supplies heat to individual consumers at the same price as they would normally pay when using natural gas.

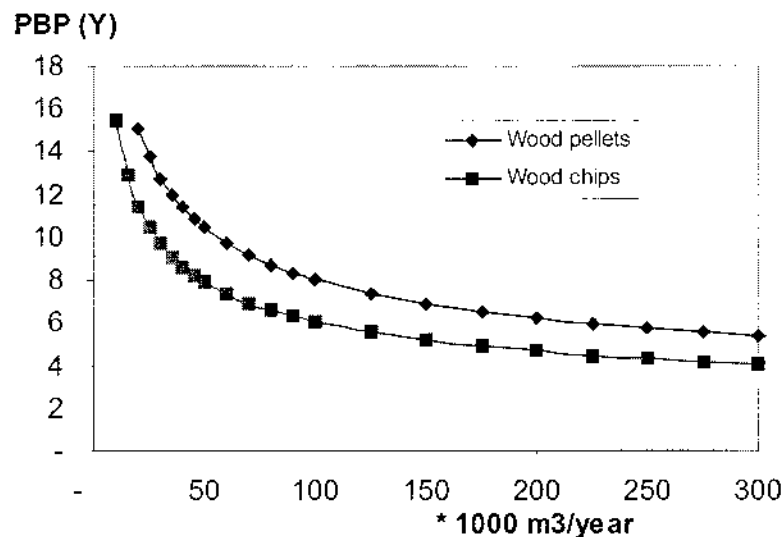


Figure 18: Indicative payback periods (in years) for a company-owned wood fired heating system in the Netherlands at which the heat is supplied to individual customers that pay

1 Ministerie van Economische Zaken, Derde Energienota, 1995



the same price for heat as they would normally pay for natural gas. Assumed is an average consumption of 3,000 m<sup>3</sup>/year of natural gas per final consumer (X-axis shows variation up to 100 consumers). The assumed fuel prices are: woodchips: EUR 35 /ton, wood pellets: EUR 75 /ton.

Government organisations such as municipalities and the army often already avail themselves of woodchips as a result of the maintenance of forested areas, while the demands on the payback period are usually more acceptable (< 8 years) than for the commercial sector (< 3 years).

Churches and several non-profit organizations are partially exempted from REB payment, therefore fuel savings are lower for such organisations when they consider switching to a wood heating system. Further, the buildings used by such organisations are often used for a limited number of hours per week, which increases the capital cost component in the heat costs for a wood-fired heating system.

The most relevant market segments that can therefore be identified are

- Apartment buildings that may share a common wood combustion installation
- Buildings owned by municipalities and other government organisations such as the army that already avail themselves of woodchips.

#### **4.6.2 Barriers to wood heating**

Various barriers exist that slow down the implementation of wood-fired block heating systems. The most important barriers are mentioned below.

##### **4.6.2.1 Lack of awareness**

Firstly, there is a general lack of awareness, in both potential investors as well as municipalities, of the options that may exist for wood-fired heating systems. This barrier was addressed in several ways under the BIOHEAT project.

##### **4.6.2.2 Uncertainty in availability of affordable fuels**

Since no wood-fired block heating systems are in existence in the Netherlands as of yet, there is also hardly any infrastructure for the supply of wood pellets or chips to small consumers. Until recently, there was only one company in the Netherlands that supplied wood pellets. Since autumn 2001, a second one has started to produce wood pellets for fuel. The dependency on single suppliers is still high and long term supply of wood pellets cannot be guaranteed. As the demand is still low, local prices for wood pellets are also relatively low. It can be expected, however, that the local prices will rapidly increase to the international level at which wood pellets are traded.

For woodchips, there is also uncertainty about the supply, especially about the price. Especially low-grade woodchips are now being composted against a negative price (gate-fee). Dry and clean chips that are suitable for small-scale combustion installations are more expensive, but still cheap as compared to neighbouring countries. However, the demand for clean woodchips is growing fast, which will increase the prices in the future. With current payback periods of approx. 10 years, the risks of scarcity and price increase can be reasons not to invest in a wood-fired installation.

#### 4.6.2.3 No affiliation with fuel handling

Since the massive substitution of coal as a heating fuel with natural gas in the 60's, the Dutch have lost affiliation with fuel handling for heating purposes. A major consequence is that existing new buildings do not provide sufficient space for a storage room for pellets.

In the Netherlands, it is common for a project developer to build an office building or apartment building before the users are known. However, if the project developer considers the use of a wood heating system, the risk of negative reactions from potential users of the building (caused by a lack of affiliation and awareness) may lead to a decision not to proceed with this option.

#### 4.6.2.4 Hardly any reference sites

In the Netherlands, the option of wood heating is still new. There are hardly any reference sites available in the country that demonstrate that a wood heating system can be operated successfully.

Commercial risks of a first installation are perceived as high, although the technology has proven to be mature in other countries. As a result, the start-up costs of the first installation are high, since it may take a lot of time and money to convince the various parties involved in the establishment of an installation of the positive impacts of the project. It is therefore necessary to make subsidies available to cover the high initial costs as well as the commercial risks associated with the first project(s). This will demonstrate the operation and be a good reference to others.

#### 4.6.2.5 Tightening emission limits

The tightening emission limits to be imposed after 2007 are a major barrier for biomass heating systems. The Ministry of Housing, Spatial Planning and the Environment has issued a new framework for emission limits from bio-energy installations which is much stricter than the current limits in both the Netherlands and other European countries, and therefore strongly affects the feasibility of small-scale wood combustion installations in particular. The limits that after 2007, will apply for small combustion installations up to 5 MWth using clean biomass, producing only heat, are shown below:

Component	mg/m <sup>3</sup> at 6% O <sub>2</sub>
NO <sub>x</sub> (thermal eff. < 85%)	100
(thermal eff. > 85%)	200
SO <sub>2</sub>	200
Dust	20

The influence of the new emission limits on the feasibility of wood heating systems was a major issue of discussion at the Dutch BIOHEAT workshop. While some producers were confident that new technologies can be developed to allow for the cost effective operation of such systems under the new emission guideline, others were very pessimistic. TNO performed a study on this issue in 2000, the outcome of which was that the average investment for a 500 kW installation in the wood processing industry would increase by at

least 50% as a result of the need for an electrostatic or bag filter in addition to SNCR, resulting in an increase in the payback period from 4 to 8 years.

#### **4.6.2.6 Environmental permits**

Municipalities are responsible for issuing permits for wood fired installations. Since there is no experience yet with the use of wood-fired block heating systems in the built environment, municipalities may prefer to be 'on the safe side' with their requirements on emissions, visual impact, fuel specifications and other cost determining factors and already impose the new emission limits. The latter decision results in a considerable increase in the investment, which will most likely slow down or even block the initiative.

As this barrier was identified early in the BIOHEAT project, TNO decided to pay more attention to this issue by extending the brochure for municipalities and organising a separate seminar for municipalities in addition to the contractually obligatory technical seminar. In the brochures, a clear comparison of the emissions resulting from the combustion of wood and the combustion of natural gas was drawn. Based on reactions from the market to the information material produced it can be concluded that natural gas is commonly considered a clean fuel, while worries exist on the emissions of wood combustion. This is most likely caused by confusion with fireplaces which do indeed cause smoke emissions and smell nuisance as a result of the inadequate combustion quality. This issue is particularly important for municipalities and the environmental NGO's.

Regretfully, hardly any municipalities were interested in participating in the seminar, therefore it was decided to combine both seminars. At this event, an invited municipality representative explained in his presentation that, when deciding on the emission limit to be imposed, one should always balance CO<sub>2</sub> benefits against other emissions. In this regard, the local policy of the municipality with regard to renewable energy plays an important role.

#### **4.6.3 Economics of wood heating under national circumstances**

A calculation has been made for a situation where a natural gas boiler of 100 kW is currently used with an annual consumption of 17,500 m<sup>3</sup> natural gas. The data applies to Dutch conditions, assuming that the new emission limits, imposed after 2007, already apply.

The data in this table is purely indicative, as the exact costs will heavily depend on the chosen type of installation, the peak capacity, contracts with fuel suppliers, the layout of the building, etc. In these calculations, we have included the existing fiscal incentives of EIA and VAMIL as an investment subsidy, the latest news, however, is that the VAMIL incentive may be applied in the future.

Indication of the costs of a wood-fired heating system, as compared with natural gas

	Unit	Woodchips	Wood pellets	Natural gas
Costs of the boiler (100 kW)	EUR	44.000	44.000	5.000
Installation costs	EUR	6.500	6.500	3.000
Construction costs	EUR	23.000	16.000	10.000
Total investment	EUR	73.500	66.500	18.000
Net investment after EIA/Vamil	EUR	57.330	51.870	18.000
<b>Annualised costs</b>				
Capital costs (interest + depreciation)	EUR/year	5.459	5.031	1.605
Demand related costs	EUR/year	2.498	4.245	7.917
<i>Fuel</i>	EUR/year	2.438	4.185	7.867
<i>Electricity used</i>	EUR/year	60	60	50
Others	EUR/year	2.480	2.185	580
<i>Maintenance</i>	EUR/year	620	585	130
<i>Personal costs</i>	EUR/year	960	750	0
<i>Chimney sweeper</i>	EUR/year	250	250	150
<i>Service contract</i>	EUR/year	400	400	200
<i>Insurance and other costs</i>	EUR/year	250	200	100
Total annualised costs	EUR/year	10.438	11.462	10.104
Total costs per GJ delivered heat	EUR/GJ	14,5	15,9	14,0

Notes:

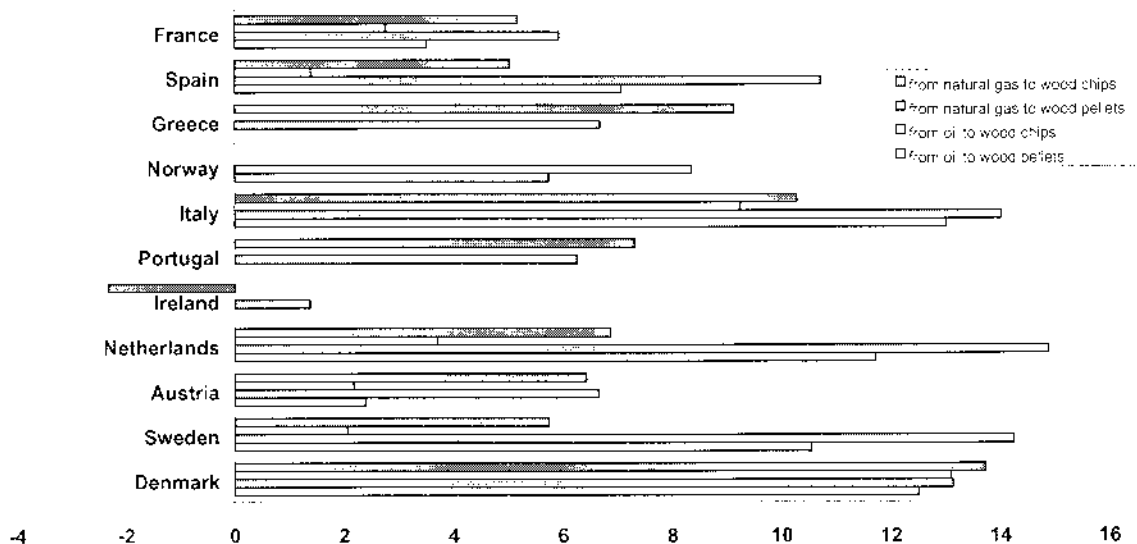
- The fuel prices assumed here are: wood pellets: EUR 80 /ton, woodchips EUR 35 /ton, natural gas EUR 0.35 /m<sup>3</sup>.
- It has been assumed that the new emission limits to be applied after 2007 are imposed. As a result, a cloth filter has been included in the investment, although this technology is hardly available on this scale (projected costs at least EUR 15,000 for this scale) yet. Under the current emission limits, no flue gas cleaning is needed in addition to a commonly used multi-cyclone.

#### 4.6.4 Perspectives for future development of wood heating in large buildings

In the Netherlands, the difference in fuel prices between commonly used natural gas and wood pellets or woodchips is approx. EUR 4-7 per GJ. Fuel oil is hardly used in the Netherlands. As this difference is similar to the countries where wood-fired block heating systems are introduced very rapidly (such as Austria, Sweden, see below figure), one

could conclude that this difference in price should in principle be large enough to obtain an acceptable payback period if the installation would required the same investment.

#### Fuel savings when switching from fossil fuels to woodfuels (Euro / GJ)



**Figure 19:** Savings in fuel costs (in Euro per GJ) in case of a 100 kW boiler, for different European countries.

However, it needs to be mentioned that in the countries where the market introduction of wood heating has been successful so far, wood typically replaces fuel oil. In the Netherlands, wood will typically replace natural gas, which is considered a much more convenient fuel than fuel oil for a few reasons:

- A natural gas-fired boiler is less expensive and more compact than an oil-fired boiler
- Natural gas is very easy to handle and requires no fuel storage space
- Natural gas causes less emissions than fuel oil

Another important factor if estimating the potential for wood-fired block heating systems is the maturity of the fuel market. At present, only a relatively limited amount of woodchips and wood pellets are domestically consumed, which results in a relatively low fuel price. However it has been shown that there is insufficient biomass available in the country to meet the government targets for renewable energy. This will undoubtedly result in an increase in fuel prices. Being an internationally traded commodity, it can be expected that, if demand increases significantly, the price of wood pellets will settle at the international price level of at least EUR 10 /GJ, which implies that the price benefit will be completely lost.

#### 4.6.5 The role of BIOHEAT – lessons learned

The participation of the Netherlands in the BIOHEAT project was beneficial in the sense that it provided more insight into niches in the market and existing barriers for the development of wood-fired heating systems in the Netherlands. A general conclusion is that market conditions are less favourable than in other countries, since:

- there is hardly any hands-on experience with wood-fired heating systems. The Dutch have lost affiliation with handling solid fuel for heating purposes.
- the market for wood fuels is not yet developed, leading to uncertainties about future availability and prices of wood fuels. The entrepreneurs that did invest in a wood-fired heating system use woodchips or pellets they produce themselves.
- the emission limits imposed are usually more stringent than in other countries.

It is argued by some that the relatively high population density of the Netherlands (466 per km<sup>2</sup> against e.g. 126 per km<sup>2</sup> in Denmark or 98 per km<sup>2</sup> in Austria) automatically results in a limited availability of fresh wood fuels per capita and an increased need for the imposition of strong emission limits, as more people are exposed to the emissions.

The BIOHEAT project has certainly created awareness of the different options available. Although this has not yet led to demonstrable projects, there are a number of potential leads that will be further examined. Earlier knowledge dissemination projects have shown that it usually takes a number of years after the first idea before an installation is realised. For example, the woodchip-fired heating system that was recently installed in a recreation hotel was the direct result of a field trip to Denmark, organised by TNO in 1999.

#### **4.6.6 Policy recommendations**

The following national policy recommendations are made, based on experience gained in the Netherlands.

##### **Affordable flue gas cleaning systems should become available**

A major factor that will have a negative influence on the feasibility of wood-fired block heating systems will be the effectuation of new emission limits to be imposed after 2007 for new wood-fired heating systems. While a multi-cyclone is sufficient to meet the current emission standards, a low-NO<sub>x</sub> burning installation (if not with SNCR), combined with a cloth filter for dust removal will be required after 2007.

Both potential investors and the boiler manufacturing industry feel uncertain about the fact whether it will remain financially feasible to establish wood-fired heating systems after 2007. It is necessary to support research and development work to enable the market introduction of cost-effective flue gas cleaning systems.

##### **Stable government policies are required**

Considering the payback period of wood-fired heating systems and the dependency on government incentives such as tax incentives or subsidies, it is important that potential investors can expect stable government policies. In this perspective, one-time subsidies may be more attractive for investors than fiscal incentives.

At the time of finalization of the BIOHEAT project, the energy tax structure was under large-scale revision, though it was not yet known what changes would be implemented.

##### **Renewable heat should be treated equal to renewable electricity in the fiscal system.**

At the time period the BIOHEAT project was done, there was an imbalance in the partial redistribution of REB taxes to renewable energy producers. Considerable tax-redistribution incentives were provided to suppliers of renewable electricity, while heat from renewable sources was excluded from this. At the time of closure of the BIOHEAT

project, the government decided to fully remove the tax-redistribution incentive for renewable energy, thereby also removing the imbalance.

#### **First-mover subsidies are needed**

From interviews with potential investors it can be concluded that there is a large perceived risk to the establishment of the first wood-fired heating systems. It is therefore recommended that first-mover subsidies are made available to the first investors in order to enable demonstration.

For the European Commission, a number of recommendations can be made that would be beneficial to the market introduction of wood-fired heating systems:

- Stimulate measures that promote international trade in wood fuels in order to improve availability
- Harmonize energy tax structures and emission limits
- Promote R&D on affordable small-scale flue gas cleaning equipment

## **4.7 Norway**

### **4.7.1 Present energy use for the heating of large buildings**

#### **4.7.2 Energy trends in Norway till 2000**

Since the 1940s and 50s the most prominent energy carriers for heating purposes in the Norwegian building sector have been electricity and heating oil. This includes both private houses and commercial buildings. In more recent years however, substantial changes in the Norwegian energy market have taken place. Especially the consumption of heating oil has been reduced considerably, a reduction of 68% in the period from 1979 to 2000. There are several reasons for this, such as increased taxes and market prices for both heating oil and electricity as well as unstable supply of electricity from Norwegian power plants.

Until 1995 Norway has been self-supplied with hydro-electricity, which has led to the fact that electricity is the major energy carrier for heating purposes. This is the reason why Norway's heating habits are quite different to other countries. Only 20% of the existing houses in Norway have installed water based heating systems, while 80% have electrical heating-elements. Since 1995 the electricity supply from Norwegian power plants has been unstable, due to years of insufficient rain for filling up the water reserves and a lack of investment in further capacity. This has led to considerable imports of electricity mainly from Danish power plants, based on the burning of coal.

#### **4.7.3 Ratification of the Kyoto protocol**

In ratifying the Kyoto protocol the industrialised countries commit themselves to reducing the emissions of greenhouse gases by 5% of 1990 levels in the period of 2008 to 2012. Similar requirements for the EU-countries are a reduction of 8%.

Norway has ratified the Kyoto protocol and is allowed to have an increase in greenhouse gases from 1990 to 2012 by 1%. This means that Norway's limit is a maximum of 250 million tons of CO<sub>2</sub> equivalents within the 5 year-period of 2008-2012.

#### **4.7.4 Energy policy initiatives in Norway**

The Norwegian government has recently concluded a number of activities and directives to ensure that the requirements of the Kyoto protocol are met. The official Klimameldingen concludes with the following actions:

- Reduction of the consumption of heating oil by 25% in 2008 compared to the average of the period 1996-2000. (This 25% reduction will be achieved in 2002).
- National quota systems for products and industries not yet burdened with excise duties. (for instance the energy intensive industries).
- Taxation in favour of renewable energy (for example biofuels).
- Increased research on CO<sub>2</sub> free gas fired power plants.
- Establishment of strategies
  - for ensuring that all new buildings must have energy systems based on hot water. Legislation must be changed (Plan- og Bygningsloven) in order to obtain a higher level of energy flexibility.
  - for converting from heating oil to renewable energies (for example biofuels) in existing buildings.

The government has established an official Energy centre in Norway, ENOVA, which has an amount of NOK 450 mill (Euro 60 mill) available for subsidies dedicated to renewable energy initiatives.

#### **4.7.5 Green certificates**

Another task of the governmental Klimamelding is to establish Green certificates, which will be effective in phasing in new renewable energy sources. The government has discussed the possibility that such legislation-certificates can force the suppliers of electricity and heating oil to deliver a certain share of their energy as renewable energy. If they do not produce renewable energy, they have to buy it on the free market. This way renewable energy producers have a second income, selling energy as well as certificates. It is unlikely that these certificates will be introduced within the next two to three years.

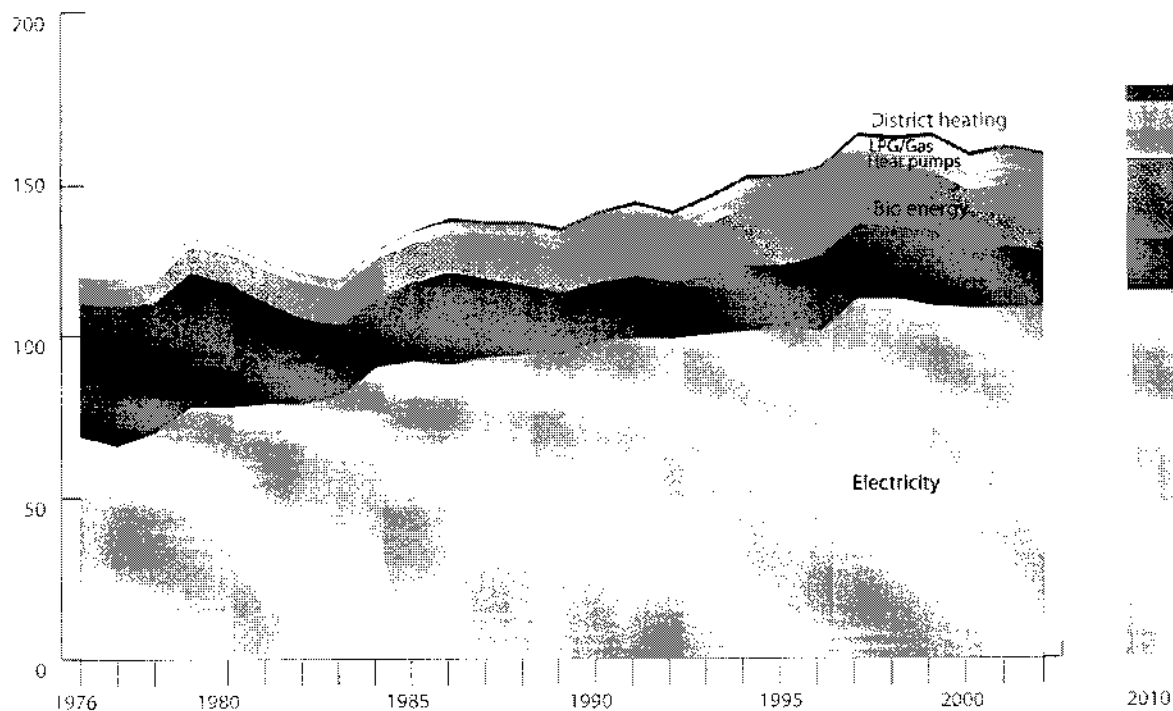
#### **4.7.6 Effects on the Norwegian market for the heating of buildings**

These structural market changes have led to increased use of renewable energy resources, such as heat pumps and bio energy (woodpellets), as well as gas (LPG). As a consequence the use of heating oil and electricity for heating purposes has decreased.

A growing share of newly built houses and buildings will have energy systems based on heating by hot water. In the 1st Quarter of 2002 37.9% of newly built houses in Norway were equipped with water based heating systems, an increase of 9.4% five years ago (1st Quarter 1997).



These facts will lead to the following development on the Norwegian market for the heating of buildings:



**Figure 20**

The market for bioenergy indicated in the diagram is mainly energy from wood being burnt in fireplaces in private houses in periods with cold weather.

Woodpellets are a fairly new energy source in Norway for heating purposes in private houses and large buildings and blocks. Woodpellets were used for the first time in 1996, and from a modest start the total Norwegian consumption amounted to 20,000 tons in 2002. There are two major suppliers of woodpellets in Norway (Statoil and Hydro/Texaco) and 3 minor ones who cover this market.

In addition app. 30,000 tons of woodchips are used in Norway, mainly in the agricultural industry.

The rest of the market for bioenergy is wood being burnt in fireplaces in private homes. This is additional heating to electricity and this consumption amounted to app. 350,000 tons in 2002.

#### **4.7.7 Statoils activities in these new energy markets**

As a response to the changed market conditions Statoil offers long-term energy partner contracts supplying thermal energy for buildings in addition to the oil business. Based on renewable energy (bioenergy and heat pumps) in combination with conventional energy carriers (heating oil, gas and electricity) warm water heating, tap water and cooling are produced and sold as end products to the customer. In addition electricity is supplied for lighting and electrical equipment and gas (LPG) for cooking and other uses.

Statoils business concept is to plan, design, build, own and operate the energy production facilities supplying the customers buildings. In addition to the wholesale of thermal energy

Statoil offers surveillance and energy and environmental reporting. More traditional sales of all energy carriers are also offered.

The overall goal is that Statoils customers receive one invoice for their total energy consumption, where running costs and maintenance are included in the kWh prices. The energy delivery is based on long term contracts (10-15 years) where Statoil matches the customers best alternative energy production, usually heating oil or electricity. Statoil also guarantees for the delivery of the chosen energy carriers.

Statoil has established and co-owns two production plants for biofuel (woodpellets) with an total annual capacity of 30,000 tonnes. As of November 2002 Statoil supplies renewable energy (bioenergy and heat pumps) to 20 customers (schools, retirement homes, living blocks, exhibition centres etc.), all having converted from heating oil and electricity.

#### 4.7.8 Climate in Norway.

Due to the climate in Norway heating systems for private houses and flats will have to run continuously during the whole year because of the heating of tap water during summer. The Norwegian definition of "the heating season" is the period from October 1st to March 31st.

During the last 6 last years the average temperatures within these intervals in relevant regions have been:

	1996	1997	1998	1999	2000	2001
<b>Oslo</b>	-1.4	+0.5	+0.8	+0.6	+2.9	-0.4
<b>Stavanger</b>	+2.5	+4.2	+4.4	+4.7	+5.5	+3.5
<b>Bergen</b>	+2,7	+3.9	+4.0	+4.5	+5.5	+3.6
<b>Trondheim</b>	-0.8	+0.9	+0.8	+0.4	+2.2	-0.2
<b>Tromsø</b>	-1.6	-1.9	-2.5	-1.5	-0.8	-2.3

All temperatures in degrees Celsius.

Typically, heating systems in Norway have an average of "full load hours" of 3.000 hours per year, valid for all regions.

#### 4.7.9 Experience with wood-heated buildings

As indicated above, the experience with wood heated buildings is very poor. Market studies confirm this.

Statoil had several omnibus surveys carried out with questions of which energy resources private persons and professional actors were able to name without any help from the interviewer. The results for 2001 are as follows:

	Professionals	Private
Electricity	96%	98%
Heating Oil	80%	72%
Heating pumps	31%	17%
Gas (LPG)	16%	16%
Wood	13%	73%
Sun	8%	11%
Woodpellets	7%	2%
Wind	3%	4%
Waves	2%	1%

After this initial question, a question was included which energy resources the respondents mentioned were on the delivery program of Statoil in Norway:

	Professionals	Private
Heating Oil	98%	79%
Gas (LPG)	90%	61%
Electricity	77%	45%
Heating pumps	37%	13%
Woodpellets	23%	9%

The results of these tables show that woodpellets are a little known energy source in Norway, and it is obvious that it is of greatest importance that the BIOHEAT-Project is carried out in Norway.

#### 4.7.10 Most relevant market segments identified for wood heating in large buildings

The use of woodpellets in Norway is, as mentioned earlier, a very new energy source. Up to now app. 30 large buildings have installed heating systems with woodpellets as energy source. The most interesting and promising market segments for the suppliers of woodpellets are:

- Public buildings
- Schools
- Retirement homes
- Hospitals

- Living blocks (flats)
- Groups of private houses
- Exhibition centres

#### **4.7.11 Barriers for wood heating**

A survey among decision makers within organisations of the woodpellets industries was carried out in order to focus on the barriers for heating with woodpellets. The major barriers to the diffusion of woodpellets in Norway are the following:

- the price for electricity has been very low in Norway since 1950, and even if woodpellets in 2002 are the cheapest energy source, people think that electricity is the most competitive and efficient of the energy sources.
- lack of information about
  - new wood heating systems.
  - the cost of woodpellets compared to other energy sources.
- the professional actors in the energy markets in Norway (consultants, plumbers, carpenters etc.) have insufficient knowledge of woodpellets as an energy source.
- lack of well organised supply of woodpellets. The production facilities are at present situated in two regions covering a limited part of the country. The logistics of wood pellet delivery systems is insufficient. This means long transportation routes and maybe unstable deliveries.
- investments in a heating system using woodpellets are higher than for other energy systems.
- storage of woodpellets requires larger storage facilities than heating oil and gas (LPG). The tank of pellets is three times as big as an oil tank (with similar energy content).
- heating systems using woodpellets are noisier than other heating systems.
- dust is produced when woodpellets are delivered into the tank.
- pollution by CO, Nox and dust.
- due to the fact that energy systems using woodpellets in Norway are very new and young, woodpellets are met with some reluctance.

#### **4.7.12 Economics of wood heating from a national perspective**

The profitability of using wood heating is determined by investment, which is generally higher, and running costs which are generally lower than for conventional heating systems based on other energy sources. Investments and running costs in the following model are based on Norwegian conditions during the summer 2002. In Norway it is also possible to obtain subsidies from the local communities when building energy systems are based on woodpellets.

Heating systems for prod. of 150 MWh	Woodchips (NOK)	Woodpellets (NOK)	Heating oil (NOK)	Electricity (NOK)
Boiler	130.000	130.000	43.500	25.000
Installation	33.000	33.000	22.500	10.000
Investments related to buildings	165.000	112.500	97.500	0
Total investment	328.000	275.500	163.500	35.000
Investment including subsidies	229.600	192.850	163.500	35.000
Calculation costs (annuity)	17.286	14.519	12.309	2.635
<b>Capital costs</b>	<b>17.286</b>	<b>14.519</b>	<b>12.309</b>	<b>2.635</b>
Fuel costs (energy)	22.500	33.000	52.500	60.000
<b>Variable costs</b>	<b>22.500</b>	<b>33.000</b>	<b>52.500</b>	<b>60.000</b>
Misc. consumer products	2.467	2.205	1.140	0
Running costs	7.200	5.625	0	0
Maintenance	3.000	3.000	1.500	1.500
<b>Other costs</b>	<b>12.667</b>	<b>10.830</b>	<b>2.640</b>	<b>1.500</b>
<b>Total costs per year</b>	<b>52.453</b>	<b>58.349</b>	<b>67.449</b>	<b>64.135</b>
<b>Total costs in Øre per kWh</b>	<b>0,35</b>	<b>0,39</b>	<b>0,45</b>	<b>0,43</b>

(1Euro = 7,8 NOK)

Heating systems based on heating oil and electricity are very reliable with almost no manual operation necessary. Because of that running costs are estimated to NOK 5.625 for woodpellets and NOK 7.200 for chips (based on Norwegian conditions), while heating oil and electricity have no such running costs.

The graphs below show that the price for purchasing wood heating is very competitive compared to heating oil and electricity as per summer 2002.

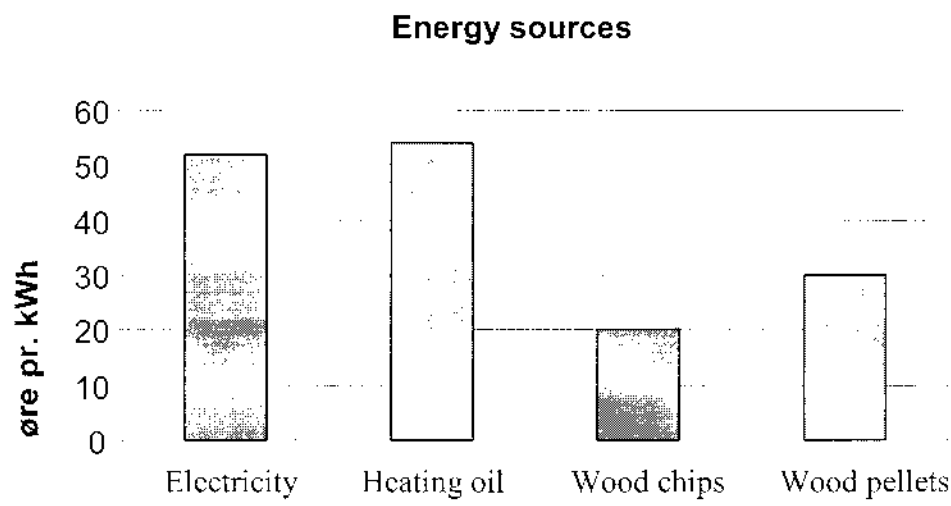


Figure 21

#### 4.7.13 Perspectives for the future development of wood heating in large buildings

The conditions on the Norwegian energy market are changing, mostly due to the fact that

- prices for electricity are expected to continue to rise in the future, both for private households and larger buildings.
- the government has set a target that renewable energy sources, such as
- Woodpellets
- Heating pumps
- will be preferred in the coming 10 years. This is due to the conclusions from the Kyoto Protocol and their impact on Norway.

This will mean a considerable growth in the Norwegian market for woodpellets in the period until 2012, especially in large buildings. The market for bioheat is under these circumstances estimated to grow from 19 TWh in 2002 to 28 TWh in 2010. This growth by 9 TWh in this period is expected to be covered by woodpellets, which means a consumption of app. 200.000 tons of woodpellets in 2010.

1% of new private houses built yearly are expected to have woodpellets as main energy source in 2005 compared to 0% in 2002. For large buildings the share is expected to grow from 1% in 2002 to 4% in 2005. Towards 2010 these figures are expected to increase rapidly, for large buildings to 8-10%.

#### 4.7.14 The role of BIOHEAT – Lessons learned

As the Norwegian participant in the BIOHEAT-project Statoil has learned much from all the contacts established within this project, especially on how to start the information

process to convince all parties in the Norwegian energy market of the advantages of wood fuel compared to other conventional energy sources.

#### **4.7.15 Policy recommendations**

In "Klimameldingen" of April 2002 the Norwegian government announced that the consumption of heating oil in Norway should be reduced by 25% until 2012 and be replaced by renewable energies, such as heat pumps and woodpellets.

According to this Statoil will continue to give relevant information about woodpellets:

- description of heating systems based on woodpellets
- prices of such heating systems
- prices of woodpellets compared to other conventional energy sources
- consequences for the environment when converting to woodpellets
- advantages of woodpellets

to all defined target groups, such as:

- architects
- plumbers
- carpenters
- energy consultants
- companies within the most relevant market segments
- politicians
- environmental organisations

By providing

- information brochures
- articles in magazines and newspapers
- seminars
- field trips

## **4.8 Portugal**

### **4.8.1 General preconditions for an increased use of biomass for the heating of large buildings**

In Portugal heating with biomass is still quite traditional in rural areas of the country, where it is easier and cheap to arrange this fuel.

In individual houses and public buildings such as schools, old age homes, etc, it is frequent to find examples of biomass use for space heating, cooking, and also for hot water.

Although biomass is used extensively energetic systems with low efficiency are frequent.

Recent statistics issued by the Portuguese Directorate General for Energy (DGE) show that 0.54 million toe of wood were consumed in 1999 by the domestic sector in small and medium size projects for heating systems, cooking and hot water.

At the beginning of the 1990ies, with the support of the VALOREN program, some municipalities installed hundreds of biomass appliances in public buildings like elementary schools located in rural areas which are already in use today. In these buildings we typically find two distinct heating systems: smaller ones with single stoves (heat load between 5 and 10kW) and bigger ones with small biomass boilers (40 to 100kW) for central heating systems.

Aside from logs, woodchips, forest residues (tops and branches) and briquettes agricultural biomass is also being used for heating. Systems running with agricultural biomass like olive residues, almond shells or pruned vine twigs are used in some buildings and swimming pools.

Due to the mild climatic conditions, heating degree days in Portugal are only 1000 to 2000.

#### **4.8.2 Barriers to wood heating**

During the first phase of BIOHEAT, different types of actors were contacted and interviewed in order to help understand the situation of the sector and create interest in the subject, namely local authorities at municipal level, regional and municipal energy and environmental agencies, project developers (consultants), woodfuel suppliers, environmental NGOs, forest associations, interested planners and architects.

The most important barriers for the development of solid biomass heating systems in large buildings and blocks are:

- Lack of know-how, experience and information
- Fear of innovation (project developers, planners, local politicians)
- Biomass market: there is no solid production / consumption chain for forest residues, briquettes and pellets
- Existence of unsuccessful examples: some biomass heating systems have been replaced by other fuel systems like natural gas
- Biomass handling : in general biomass fuels are considered to be more difficult to handle than other fuels
- Discriminatory fiscal regulations: presently the VAT rate for biomass is higher than for other kinds of energy sources (19% against 5% for natural gas and electricity)



- Markets of gas and oil heating systems, as well as air-conditioners were growing faster than the wood heating market.

### 4.8.3 Economics of wood heating under national circumstances

The following example of a comparison of heating costs is based on a typical building located in central Portugal, average annual temperatures ranging from 12.5°C to 16°C, a level of heating degree-days less than 1500 and a heat load 100kW.

The data, i.e. technical data, investment, operation and maintenance used in this calculation is based on Austrian experience related to wood heating in large buildings and blocks, but adjusted to Portuguese circumstances on fuel costs and heat demand.

	unit	Woodchips	Pellets	Fuel oil	Natural gas
Boiler costs	[EUR]	17.500,00	17.500,00	5.800,00	6.600,00
Installation costs	[EUR]	4.400,00	4.400,00	3.000,00	3.000,00
Building costs	[EUR]	22.000,00	15.000,00	13.000,00	10.000,00
<b>Total Investment</b>	<b>[EUR]</b>	<b>43.900,00</b>	<b>36.900,00</b>	<b>21.800,00</b>	<b>19.600,00</b>
<i>Investment minus subsidy</i>	<i>[EUR]</i>	<i>30.730,00</i>	<i>25.830,00</i>	<i>21.800,00</i>	<i>19.600,00</i>
Annuity	[EUR/a]	2.313,58	2.002,70	1.592,00	1.471,41
<b>Capital costs</b>	<b>[EUR/a]</b>	<b>2.313,58</b>	<b>2.002,70</b>	<b>1.592,00</b>	<b>1.471,41</b>
Fuel costs	[EUR/a]	2.519,39	5.523,27	6.716,73	8.241,42
Electricity cost for boiler operation	[EUR/a]	60,00	60,00	50,00	50,00
<b>Demand related costs</b>	<b>[EUR/a]</b>	<b>2.579,39</b>	<b>5.583,27</b>	<b>6.766,73</b>	<b>8.291,42</b>
Repair costs	[EUR/a]	329,00	294,00	153,00	146,00
Personnel costs	[EUR/a]	960,00	750,00	0,00	0,00
Chimney cleaner	[EUR/a]	250,00	250,00	200,00	150,00
Service contract	[EUR/a]	400,00	400,00	200,00	200,00
Insurance, other costs	[EUR/a]	250,00	200,00	100,00	100,00
<b>Operation related costs &amp; other costs</b>	<b>[EUR/a]</b>	<b>2.189,00</b>	<b>1.894,00</b>	<b>653,00</b>	<b>596,00</b>
<b>Total annual costs</b>	<b>[EUR/a]</b>	<b>7.082</b>	<b>9.480</b>	<b>9.012</b>	<b>10.359</b>
<b>Total costs per MWh</b>	<b>[EUR/MWh]</b>	<b>47,2</b>	<b>63,2</b>	<b>60,1</b>	<b>69,1</b>

### 4.8.4 Perspectives for the future development of wood heating in large buildings

Although it will not be easy to introduce this technology in Portugal in large buildings and blocks we do expect, particularly at municipal level and with the collaboration and effort of the regional energy and environmental agencies that some existing conventional boilers can be changed to biomass and that some biomass heating systems can be installed in new buildings, especially if we can demonstrate the economic and environmental benefits of the use of this technology.

The starting up of two projects for heating with biomass (forest residues) in two municipal buildings in the North of Portugal, Vale do Lima region, is already a good sign for the future.

However, in order to achieve long term impact on market development it is still essential to overcome the main barriers, namely it will be necessary to:

- Encourage projects starting up by providing information and technical assistance
- Disseminate information on successful pilot-projects
- Create the basis to guarantee a continuous biofuel supply
- Establish political measures to improve the financial and fiscal incentives

#### **4.8.5 The role of BIOHEAT – lessons learned**

At national level we think the project has aroused the interest in biomass heating systems of some important actors. However, it is still too early for evaluating the impact of the project, namely the feedback of the dissemination actions which are still ongoing.

The future development of wood heating in large buildings could depend a lot on the success of pilot-projects that could arise as a consequence of the activities developed in the BIOHEAT I and in the future BIOHEAT II.

#### **4.8.6 Policy recommendations**

Insofar as policy suggestions addressed by the European Union in order to increase the number and the quality of biomass heating systems in large buildings and blocks in Portugal are concerned, we can underline as main topics:

- Encouraging national governments to develop the biomass heat market and establishing political measures to improve the financial and fiscal incentives
- Increasing international co-operation on experience, dissemination, follow-up on wood heating, etc
- Supporting the development of high quality technologies for biomass heating plants including technologies to burn agricultural wastes
- Define quality standards for biomass (including wastes of agricultural industry).

### **4.9 Spain**

#### **4.9.1 General preconditions for an increased use of biomass for heating large buildings**

The Promotion Plan for Renewable Energies in Spain (1999 - 2010) foresees that 70% of the renewable energy objective stated will be covered by biomass.

The biomass applications in the Promotion Plan are divided in thermal applications, with an objective of 900,000 ktoe/year (850,000 ktoe in industrial applications and 50,000 ktoe in domestic uses), and electricity applications, with an objective of 5,100,000 ktoe/year.

At the end of 1998, the biomass consumption in thermal applications was divided in 1,994,324 toe for domestic uses, most of them traditional uses, and 1,304,846 toe for industrial applications and others. At the end of 2001, the contribution of biomass to domestic uses was similar to that of 1998, and amounted to 1,356,981 toe for industrial applications .

#### **4.9.1.1 Present biomass use for heating**

The current biomass heating uses are traditional domestic or industrial uses.

The present market situation for biomass heating in Spain can be described as follows:

Small-scale uses (< 50 kW): There is a constant growing market in rural areas and second homes. More than 10,000 pellet stoves were installed, but only 40 installations, were supported with Regional Agencies funds; the rest were financed independently. There may be more that have not been registered.

District Heating Plants: There are 3 plants with a total of 9,000 kW installed. This market is growing slowly.

Medium-size plants (> 50 kW): More than 30 plants in operation using almond shells and grape residues. Most of them replace old coal boilers of blocks in Zaragoza (20 plants and 10 more in design). In Madrid, the capital of Spain, there are some old biomass boilers in blocks, but now the first two plants with modern technology for biomass combustion are in operation. There are also some plants that uses forest residues and agricultural residues in different locations in Spain. There are more than 5,000 kW installed. Bioclimatic architecture is a new growing market for biomass thermal applications. There is a change from the industrial use of olive oil wastes to domestic use.

#### **4.9.1.2 Climate: heating degree days and typical full load hours of heating system in relevant regions**

Climatic conditions for designing a heating plant in Spain could be divided in 5 regions regarding heating degree-days:

Atlántica: the region that covers the North of Spain, influenced by the Atlantic Ocean.

Continental: the region inside the country not influenced by the seas and with high differences in temperature between winter and summer.

Sur: the region that covers the South of Spain. This region is defined by its high temperatures in the summer, little rain and also partly influenced by the Atlantic Ocean and the Mediterranean Sea.

Mediterránea: the region that covers the East of Spain just near the Mediterranean Sea. This region is influenced by the Mediterranean Sea, with hot temperatures in the summer, little rain, except at the end of summer where there are a lot of storms with floods.

España insular: This region includes only the Balear Islands, near the last region (Mediterránea). These islands are in the Mediterranean Sea and their climatic conditions are similar to the Mediterránea region, they are, however, islands.

There is also another region, Canarias (the islands near Africa), where heating is unnecessary.

The next table includes the heating degree-days for the different regions described:

	<b>Atlántica</b>	<b>Continental</b>	<b>Sur</b>	<b>Mediterránea</b>	<b>España insular</b>
January	226,3	365,8	170,5	192,2	139,5
February	176,4	308,0	114,8	151,2	120,4
March	167,4	288,3	58,9	120,9	105,4
April	138,0	222,0	0,0	63,0	51,0
May	68,2	108,5	0,0	0,0	0,0
June	0,0	0,0	0,0	0,0	0,0
July	0,0	0,0	0,0	0,0	0,0
August	0,0	0,0	0,0	0,0	0,0
September	0,0	0,0	0,0	0,0	0,0
October	27,9	117,8	0,0	0,0	0,0
November	126,0	267,0	63,0	75,0	18,0
December	189,1	359,6	164,3	164,3	99,2
<b>Annual average</b>	<b>93,3</b>	<b>169,8</b>	<b>47,6</b>	<b>63,9</b>	<b>44,5</b>
<b>TOTAL</b>	<b>1,119,3</b>	<b>2,037,0</b>	<b>571,5</b>	<b>766,6</b>	<b>533,5</b>

The typical full load hours of heating systems, including central water heating systems, are evaluated for different areas than the regions of the degree-days. These areas are:

Zona A: In this region there is not need of heating systems.

Zona B: includes the provinces of Badajoz, Barcelona, Castellón, Córdoba, Ceuta, Huelva, Murcia, Palma de Mallorca, Santander, Sevilla, Tarragona, Valencia.

Zona C: includes the provinces of Bilbao, Cáceres, La Coruña, Girona, Gijón, Granada, Jaén, Lleida, Orense, Oviedo, Pontevedra, San Sebastián, Toledo, Zaragoza.

Zona D: includes the provinces of Albacete, Ciudad Real, Guadalajara, Huesca, Logroño, Lugo, Madrid, Palencia, Pamplona, Salamanca, Valladolid, Vitoria, Zamora.

Zona E: includes the provinces of Ávila, Burgos, Cuenca, León Segovia, Soria, Teruel.

The typical full load hours of heating system for the regions described are as follows:

	<b>Zona B</b>	<b>Zona C</b>	<b>Zona D</b>	<b>Zona E</b>
Minimum	778	1.105	1.159	1.480
Medium	1.017	1.351	1.409	1.749
Maximum	1.256	1.597	1.659	2.019

#### 4.9.1.3 Existing experiences with wood-heated buildings

There are a number of different experiences with biomass-heated buildings in Spain. There is a wide range of conditions for these plants, so the experiences in the North of Spain have different preliminary conditions and different cost investments and fuel costs than in the South. Also, the biofuels used are different.

##### North-East of Spain:

Nature Centre for Sustainable Development, "Les Planes de Son", built in 2001. The owner is the foundation "Fundació Territori i Paisatge" of Caixa Catalunya. It is located in the municipality of Son (Alt Àneu, Pallars Sobirà) in the Pirenee of Lerida.

This building has a capacity for 92 persons living in it. There is also a laboratory, a documentation centre, a library, a planetary, an astronomical observatory and an auditorium for 200 persons.

This building is integrated in the landscape and uses some different renewable energy technologies: solar thermal, photovoltaics and biomass.

There is a 30 m<sup>3</sup> subterranean silo for the biomass supply and the boiler is a LS – 150 of 175 kW capacity. The building is heated by underfloor heating and the biomass boiler is combined with a solar thermal installation.

The biomass used is 50,000 kg of wood residue chips supplied by two local sawmills.

The investment costs are EUR 90,670.95 (Silo, EUR 52,945.42; boiler and other, EUR 37,725.53). The annual biomass cost is EUR 3,146/year.

##### North-West of Spain:

There are more than 30 plants in operation using almond shells and grape residues. Most of them replace old coal boilers of blocks in Zaragoza (a major city in Spain).

In this city, the coal supply company BioEbro, S.L. has changed its business from coal supply for heating to biomass supply. Now they cover all phases for the construction of a biomass plant. They design the plant, install it and also offer to the customer the services of biomass supply, operation and maintenance.

Using agreements with biomass boiler manufacturers, they have introduced different options. They can fit an old coal boiler with a new biomass burner, replace the coal boiler with a conventional boiler adapted to burn biomass or install a new biomass boiler.

To promote these plants, the company has used a specific type of financing through the price of the biomass supply.

The range of capacity in these plants varies from 90 kW to 400 kW. The biomass fuels used are almond shells or grape residues (good cheap fuels with a high Low Heat Value).

An example of these plants is the heating plant in the block of 40, Corona de Aragón Street in Zaragoza. There are 16 flats on 8 floors that used to be heated with an old coal boiler. In 2001, the company replaced the old boiler with a Lasián HKN biomass 172 kW boiler including a Biosystem 250 kW burner. The fuel used is almond shell.

The investment costs were EUR 28,981 (old boiler replacement, EUR 448; boiler, EUR 10,400, biomass burner, EUR 2,750; chimney, EUR 450; hydraulic installation, EUR 2,625, electricity installation, EUR 2,166; control system, EUR 1,800; feeding system,

EUR 560; biomass silo, EUR 620; air supply system and extraction system, EUR 447; insulation, EUR 955, installation works, EUR 4,400; legalisation of the plant EUR 1,360).

The fuel supply costs are EUR 5,000/year for a consumption of 40,000 kg per year. The total operation costs are EUR 7,000/year (maintenance EUR 1,000, electricity costs EUR 100, biomass fuel costs EUR 5,000 and other costs EUR 900).

#### **South of Spain:**

During the years 1999 and 2000, the Quesada city council introduced the use of renewable energies with local sources in the municipality. The application was realised in the heating and hot water production systems of two schools.

The schools have three study centres of 400 m<sup>2</sup> each, and a shared space with offices and the dining room.

The plant includes three boilers, one TCN 255, 296 kW biomass boiler for the dining room, and two more TCN - H 150, 174 kW biomass boilers for the rest of the schools. The specific biomass burners were manufactured by a local company which also installed the plant. The plant is divided in two independent installations with subterranean silos of 5,000 kg each. The specific biomass burners are manufactured to use olive oil production residues ("orujillo").

The annual biofuel consumption is 145 t. Because of the seasonal production of the olive oil residues it is necessary to store biomass in order to supply biofuel throughout the winter.

The total investment cost of each installation amounts to EUR 21,050. The total operation costs of each installation are EUR 6,320/year.

#### **South of Spain:**

Use of biomass heating in a rural tourist centre in Montoro (Córdoba). This plant was installed in 2000, in the "Cortijo La Colorá" rural tourist centre. It is a typical Spanish rural house complex called "cortijo", from the 18th century, transformed to tourist's services.

A FAC - 2896, 291 kW, biomass boiler uses woodchips from olive trimmings for the heating and hot water production for the different installations of the centre, including 12 tourist houses (50 persons).

The boiler was manufactured by a local company, and the biofuel consumption of 69 t/year is also supplied by local dealers.

The annual fuel costs amount to EUR 3,312/year, and the total investment costs were EUR 19,834 (installation, EUR 10,819; boiler, EUR 5,410; silo, EUR 2,104; other, EUR 301).

#### **4.9.1.4 Most relevant market segments identified for wood heating in large buildings**

The most relevant market segments in Spain were found as a result of the interviews according to the different groups of actors:

Government level: A Plan for Renewable Energies in Spain was developed by the government, and the most important energy incorporated in the Plan is biomass. The main target of biomass is power generation, but there is a Promotion Plan to finance

biomass projects (Línea ICO – IDAE) which includes biomass for domestic heating. It could be interesting to promote the use of biomass in public buildings, but there are important barriers, such as the fact that there are only a few biomass dealers and there is no biomass market in Spain. The high investment costs for biomass plants are another barrier.

Local authorities: There is an increased interest in biomass applications in municipalities, but they needed technological information. The BIOHEAT dissemination activities have addressed this lack of information effectively. There are environmentally friendly municipalities that have a special interest in this type of renewable energy use. There is national legislation and also regional legislations regarding the emissions for heating systems, but biomass emissions are cited in only one region. There are opportunities for these technologies in new construction projects and in municipal buildings. Local emissions targets of municipalities could be a barrier. There is a lack of demonstration projects with state of the art technologies.

Umbrella organisations (developers and housing co-operatives): There was not enough information about biomass technologies before the BIOHEAT project. The traditional heating system is a natural gas boiler or an electrical heating system. Only a few developers know about new biomass domestic heating uses (those working in bioclimatic architecture). The feeling is that investment costs are high and supply is a problem. There are new construction possibilities because the prospects for bioclimatic construction are very good.

Technical professionals association: There is an interest in biomass applications, but there was a lack of technological information and information about biomass dealers. The main barriers were the lack of technological information and the expansion of natural gas use.

Farmers and forest owners: At the moment, except for traditional firewood production, biomass production does not play a part in the income of forest producers. Demand for wood chips is non-existent, nor do facilities exist that consume this product. The consumption of forest wastes is reduced to fire wood from oak and eucalyptus for domestic use and for small artisan industries like bakeries or restaurants. Only the wood industries, specially the manufacturing industry of boards and pulp industry, takes advantage of its own wastes, and so do companies in the ceramics sector. A market exists in little villages (schools, ...) in rural areas.

Forest industry associations: The main part of the industry remainders and wastes are not used for combustion, but to manufacture other wood industry products. When they are used for combustion, it is usually for their own use, and small quantities are sold as biofuels. There is an increasing interest in biofuels at a European level and at the Spanish level too. In this sense, Spain created the Committee of Normalisation CTN164 of AENOR (AENOR is the Spanish entity to establish technical standards) for Solid Biofuels. A network of wood reclaim companies are in charge of evaluating by-products according to legal demands. Some of these reclaim companies are associated with ASERMA (Spanish Association of Wood Reclaim Companies). The main barrier in this case is that the use of by-products as biofuels could pose a problem for the supply of raw materials for some industries of the forestry sector that use these by-products.

Environmental NGOs: There is an interest in biomass, but there are concerns regarding a potential overexploitation of forests, of loss of nutrients in the soil, of turning land into a desert, and preference is given to the utilisation in the forest industries.

Association of installers: There is an increased interest in biomass, but the energy companies play an important role in the heating market and they promote their own fuels and systems (natural gas, propane, electricity systems, ...).

Boiler manufacturers: Biomass heating systems focus on industrial uses and some traditional heating uses. Biomass heating systems could be interesting in small municipalities, removed from conventional fuel distribution. A critical point is transport costs, if the plan is to promote biomass in areas further away from the place of production, it would be necessary to act on this point, or the option would become nonviable.

#### **4.9.2 Barriers to wood heating**

The main barriers for a market expansion of biomass thermal uses in Spain that have been identified in the interviews during the first phase of the project are:

- There is no biomass market in Spain. Only a few dealers can supply biomass for heating.
- There are no regulations about biomass as fuel. There are no regulations for the quality of biomass products, normalisation tests for biofuels, etc.
- The investment costs of the plants are too high.
- Further development of the technology is necessary.
- The NGOs fear that the use of biomass will turn the land into a desert.
- Only a few developers knew biomass thermal uses.
- There was a lack of technical information.
- There was a lack of information about biomass boiler suppliers.
- There was a lack of information about emissions.
- There was a lack of biomass dealers or information about resources.
- The expansion of natural gas heating poses a great barrier for biomass expansion.
- The best uses for biomass in some regions of Spain are in the forest industries.

With the extensive information activities BIOHEAT has thus addressed some of the most important barriers to biomass use in the heat market in Spain.

#### **4.9.3 Economics of wood heating under national circumstances**

Examples:

Biomass Heating plant in a Nature Centre for Sustainable Development in Lérida (North East of Spain).

Description: Biomass heating and hot water production plant in a Nature Centre combined with solar thermal collectors. It is supplied with wood residues from two sawmills near the



plant. Because it is possible to use natural gas, the comparison is done between biomass and natural gas.

Interest rate: 6.5% (% p.a. nominal value)

Basic data:

Basic data	time of use	annuity factor [%]	annual repair costs (%)
Boiler	20	9,1	1,0
Installations	20	9,1	1,0
Construction	50	6,8	0,5

Final energy demand:

Heat load: 175 kW.

Full power operation: 1,200 h/year.

Final energy demand: 210,000 kWh/year.

Fuel comparison between the real fuel (wood industrial residues) and natural gas.

Fuel price	Wood residues [EUR/kg]	Natural gas [EUR/m <sup>3</sup> ]
Costs per unit (VAT included)	0,073	0,302
Fuel demand	Woodchips [kg/y]	Natural gas [m <sup>3</sup> /y]
Estimated annual demand	54.495	25.917

Heat costs comparison between the two different plants.

Position	Unit	Woodchips	Natural gas
<b>Investment costs</b>			
Boiler	[EUR]	<b>35.725,53</b>	<b>18.506,41</b>
Installation	[EUR]	<b>3.500,00</b>	<b>3.500,00</b>
Construction	[EUR]	<b>51.445,42</b>	<b>10.00,00</b>
<i>Total investment</i>	<i>[EUR]</i>	<i>90.670,95</i>	<i>32.006,41</i>
Applicable for subsidy	[%]	<b>100,0</b>	<b>0,0</b>
Subsidy	[%]	<b>30,0</b>	<b>0,0</b>
<i>Investment minus subsidy</i>			
Capital costs	[EUR]	63.469,66	32.006,41
Boiler	[EUR/y]	2.269,62	1.679,58
Installation	[EUR/y]	222,35	317,65
Construction	[EUR/y]	2.445,70	679,14
<i>Total capital costs</i>	<i>[EUR/y]</i>	<i>4.937,68</i>	<i>2.676,36</i>
Demand related costs			
Fuel costs	[EUR/y]	3.977,44	7.836,73
Electricity costs	[EUR/y]	<b>100,00</b>	<b>60,00</b>
<i>Total demand related costs</i>	<i>[EUR/y]</i>	<i>4.077,44</i>	<i>7.896,73</i>
Operation related costs			
Repair costs boiler	[EUR/y]	357,26	185,06
Repair costs Installation	[EUR/y]	35,00	35,00
Repair costs building	[EUR/y]	257,23	50,00
Service contract	[EUR/y]	<b>1.000,00</b>	<b>500,00</b>
<i>Total operation related costs</i>	<i>[EUR/y]</i>	<i>1.649,48</i>	<i>770,06</i>
<i>Other Costs</i>			
Insurance	[EUR/y]	<b>250,00</b>	<b>100,00</b>
<i>Other costs</i>	<i>[EUR/y]</i>	<i>250,00</i>	<i>100,00</i>
<b>Total costs per year</b>	<b>[EUR/y]</b>	<b>10.914,60</b>	<b>11.443,15</b>
<b>Total costs per MWh</b>	<b>[EUR/MWh]</b>	<b>52,0</b>	<b>54,5</b>

Biomass heating plant in a block in Zaragoza (North-east of Spain).

Description: Biomass heating plant in a block. It is supplied with almond shells from a local dealer. The supplier of the biomass is also a corporation of the enterprises that installed the plant, supply the biomass and provide operation and maintenance. The almond shells

are bought from local industries. The block contains 16 flats on 8 floors. Because there is a natural gas grid in Zaragoza, the comparison is done between biomass and natural gas (most of the plans in this city are replacing old systems with natural gas).

Interest rate: 6.5% (% p.a. nominal value)

Basic data:

Basic data	time of use	annuity factor [%]	annual repair costs (%)
Boiler	20	9,1	1,0
Installations	20	9,1	1,0
Construction	50	6,8	0,5

Final energy demand:

Heat load: 172 kW.

Full power operation: 900 h/year.

Final energy demand: 154,800 kWh/year.

Fuel comparison between the real fuel (agro-industrial residues) and natural gas.

Fuel price	Agro-industrial residues [EUR/kg]	Natural gas [EUR/m <sup>3</sup> ]
Costs per unit (VAT included)	0,145	0,316
Fuel demand	Agro-industrial residues [kg/y]	Natural gas [m <sup>3</sup> /y]
Estimated annual demand	40.171	19.105

Heat costs comparison between the two different plants.

Position	Unit	Agro-industrial residues	Natural gas
<b>Investment costs</b>			
Boiler	[EUR]	23.961,00	18.506,41
Installation	[EUR]	4.400,00	3.500,00
Construction	[EUR]	620,00	10.000,00
<i>Total investment</i>	<i>[EUR]</i>	<i>28.981,00</i>	<i>32.006,41</i>
Applicable for subsidy	[%]	100,0	0,0
Subsidy	[%]	30,0	0,0
<i>Investment minus subsidy</i>	<i>[EUR]</i>	<i>20.286,70</i>	<i>32.006,41</i>
<i>Capital costs</i>			
Boiler	[EUR/y]	1.522,23	1.679,58
Installation	[EUR/y]	279,53	317,65
Construction	[EUR/y]	29,47	679,14
<i>Total capital costs</i>	<i>[EUR/y]</i>	<i>1.831,23</i>	<i>2.676,36</i>
<i>Demand related costs</i>			
Fuel costs	[EUR/y]	5.824,74	6.035,86
Electricity costs	[EUR/y]	100,00	60,00
<i>Total demand related costs</i>	<i>[EUR/y]</i>	<i>5.924,74</i>	<i>6.095,86</i>
<i>Operation related costs</i>			
Repair costs boiler	[EUR/y]	239,61	185,06
Repair costs Installation	[EUR/y]	44,00	35,00
Repair costs building	[EUR/y]	3,10	50,00
Service contract	[EUR/y]	1.000,00	500,00
<i>Total operation related costs</i>	<i>[EUR/y]</i>	<i>1.286,71</i>	<i>770,06</i>
<i>Other Costs</i>			
Insurance	[EUR/y]	250,00	100,00
<i>Other costs</i>	<i>[EUR/y]</i>	<i>250,00</i>	<i>100,00</i>
<b>Total costs per year</b>	<b>[EUR/y]</b>	<b>9.292,68</b>	<b>9.642,28</b>
<b>Total costs per MWh</b>	<b>[EUR/MWh]</b>	<b>60,0</b>	<b>62,3</b>

Biomass Heating plant in a School in Quesada, Jaén (South of Spain).

Description: One of the three plants for heating and hot water production in two schools in Quesada (Jaén). It is supplied with olive oil residues from local industries. A general surface storage facility allows for distributing the biomass (that is produced in a few

months) throughout the year. This storage facility is not included in the analysis. Because there is no natural gas grid, the comparison in this example is done between biomass and gas-oil (the old plant that was replaced was a gas-oil plant).

Interest rate: 6.5% (% p.a. nominal value)

Basic data:

Basic data	time of use	annuity factor [%]	annual repair costs (%)
Boiler	20	9,1	1,0
Installations	20	9,1	1,0
Construction	50	6,8	0,5

Final energy demand:

Heat load: 174 kW.

Full power operation: 1,047 h/year.

Final energy demand: 154,800 kWh/year.

Fuel comparison between the real fuel (olive oil residues) and fuel oil.

Fuel price	Olive oil residues [EUR/kg]	Fuel oil [EUR/m <sup>3</sup> ]
Costs per unit (VAT included)	0,051	0,516
Fuel demand	Olive oil residues [kg/y]	Fuel oil [m <sup>3</sup> /y]
Estimated annual demand	45.993	22.723

Heat costs comparison between the two different plants.

<b>Position</b>	<b>Unit</b>	<b>Olive oil residues</b>	<b>Fuel oil</b>
<b>Investment costs</b>			
Boiler	[EUR]	<b>14.550,00</b>	<b>20.115,66</b>
Installation	[EUR]	<b>3.500,00</b>	<b>3.500,00</b>
Construction	[EUR]	<b>3.000,00</b>	<b>4.000,00</b>
<i>Total investment</i>	<i>[EUR]</i>	<i>21.050,00</i>	<i>27.615,66</i>
Applicable for subsidy	[%]	<b>100,0</b>	<b>0,0</b>
Subsidy	[%]	<b>30,0</b>	<b>0,0</b>
<i>Investment minus subsidy</i>	<i>[EUR]</i>	<i>14.735,00</i>	<i>27.615,66</i>
<b>Capital costs</b>			
Boiler	[EUR/y]	924,35	1.825,62
Installation	[EUR/y]	222,35	317,65
Construction	[EUR/y]	147,62	271,66
<i>Total capital costs</i>	<i>[EUR/y]</i>	<i>1.289,33</i>	<i>2.414,93</i>
<b>Demand related costs</b>			
Fuel costs	[EUR/y]	2.324,01	11.698,24
Electricity costs	[EUR/y]	<b>100,00</b>	<b>60,00</b>
<i>Total demand related costs</i>	<i>[EUR/y]</i>	<i>2.424,01</i>	<i>11.758,24</i>
<b>Operation related costs</b>			
Repair costs boiler	[EUR/y]	145,50	201,16
Repair costs Installation	[EUR/y]	35,00	35,00
Repair costs building	[EUR/y]	15,00	20,00
Service contract	[EUR/y]	<b>1.000,00</b>	<b>500,00</b>
<i>Total operation related costs</i>	<i>[EUR/y]</i>	<i>1.195,50</i>	<i>756,16</i>
<b>Other Costs</b>			
Insurance	[EUR/y]	<b>250,00</b>	<b>100,00</b>
<i>Other costs</i>	<i>[EUR/y]</i>	<i>250,00</i>	<i>100,00</i>
<b>Total costs per year</b>	<b>[EUR/y]</b>	<b>5.158,83</b>	<b>15.029,32</b>
<b>Total costs per MWh</b>	<b>[EUR/MWh]</b>	<b>28,3</b>	<b>82,5</b>

#### **4.9.4 Perspectives for the future development of wood heating in large buildings**

Looking at the present market situation for biomass heating in Spain in its different possibilities, we can expect the following perspectives for the future:

There is a growing market in the replacement of old coal boilers with biomass boilers in large cities and also in rural places. The biomass fuel sources will be agro-industrial residues (almond shells, grape residues, olive oil residues,...) and forest industry residues.

Bioclimatic architecture is a new trend and could present a good chance to develop pilot projects using biomass heating.

There is a change from the industrial use of olive oil wastes to domestic use in the South of Spain.

The use of biomass heating in rural tourist centres could be another market possibility.

In Spain, the realisation of combined biomass and solar thermal plants for heating will be an interesting option for all building applications.

#### **4.9.5 The role of BIOHEAT – lessons learned**

The BIOHEAT project has been an important tool for the promotion of biomass heating on the Spanish market. The reasons are:

- During this project, IDAE has contacted the different dealers of biomass and informed them about the possibilities of investment and support programmes existing in Spain. Also, IDAE has put the different dealers in contact with each other to establish ways of co-operation to develop the biomass market in Spain.
- IDAE has contacted the National Association for Normalisation (AENOR) and is working with different laboratories and research centres to develop regulations for the definition and normalisation of biomass fuels. This work is carried out in co-operation with CEN standards.
- IDAE has put different boiler manufacturers in contact with each other to establish ways of collaboration for developing biomass combustion technologies in Spain.
- The BIOHEAT project, using articles and personal contacts, has disseminated information about the environmental benefits of biomass.
- The BIOHEAT project has contacted different developers' associations to inform them about biomass and its thermal uses. BIOHEAT's web-site, interviews, articles, brochures and seminars have contributed to the dissemination of information.
- The seminars, field trip, articles published and brochures disseminated have provided technical information to municipalities, planners and developers. Also, IDAE has included a special conference about biomass thermal uses in its list of events. These activities have also been used to provide information about biomass boiler suppliers, emissions and biomass dealers or resources.
- The planners' brochure includes a specific chapter on the combined use of biomass and solar thermal collectors. This question is important in Spain because of the great solar resources existing in this country.

#### 4.9.6 Policy recommendations

IDAE is the public business entity entrusted with "direct government action related to energy consumers". The main function of IDAE is to promote energy efficiency and the rational use of energy in Spain, as well as the diversification of energy sources and the promotion of renewable energy within the guidelines formulated by the Ministry through:

- dissemination,
- technical assistance,
- development of innovation projects.

As IDAE is involved in the BIOHEAT project, all the Spanish national conclusions and recommendations are assumed for the relevant decision-makers of IDAE.

The national Spanish recommendations of the BIOHEAT project include:

- Realisation of pilot projects. The main objectives will be public buildings and new constructions.
- Introduction of the use of biomass heating in bio-climatic architecture concepts (following the success with the use of solar thermal energy). This action is being carried out with the seminar for planners in co-operation with the National Association for Future Housing (ANAVIF).
- Reduction of investment costs. This action is being carried out with the ICO-IDAE programme (friendly finance programme) and the different support structures of the Renewable Energy Regional Agencies. There are also specific regional programmes to promote the thermal application of biomass and local programmes to replace old coal boilers.
- Development of the Spanish biomass market. IDAE is collaborating with some research centres and laboratories to achieve normalised tests to evaluate the quality of the different types of Spanish biomass fuels.

At the same time as the BIOHEAT project, IDAE organised a National Biomass Group with the Renewable Energy Regional Agencies of Spain to discuss solutions and to promote the biomass market in Spain (heat market and electricity market). During the meetings of this Group, IDAE informed the Regional Agencies about the development of the BIOHEAT project.

Some of these regional agencies have their own programmes for the development of biomass heating applications.

The Spanish recommendations of BIOHEAT project on the EU level include:

- European information campaign about biomass. (types, technologies, uses, emissions, suppliers,...) not only for the relevant actors, but for the whole population (the final customer must know what biomass fuels are).
- To finish, edit and diffuse the CEN standards for biomass fuels. Quality standards for biomass (including wastes from the agricultural industry) will define the new market.
- To realise pilot projects. The main objectives will be public buildings and new constructions.



- To introduce the use of biomass heating in bioclimatic architecture concepts (following the success with the use of solar thermal energy).
- To reduce investment costs and to develop specific financial support programmes for investments.
- To develop high-quality technologies for biomass heating plants, including technologies to burn agricultural wastes.
- To promote the transfer of technology and experiences between boiler manufacturers, installers and biomass dealers in the different countries of the EU.
- To promote combined solar thermal and biomass plants in the Southern countries.
- To encourage national governments to develop the biomass heating market.

## **4.10 Sweden**

### **4.10.1 General preconditions for an increased use of biomass for heating large buildings**

During the last 20 years, the use of biofuels has increased dramatically in Sweden and now accounts for 16.5 percent of the total energy supply.

Sweden offers good opportunities for increasing the use of biomass. Forests cover more than half of Sweden. During the past century the standing volume of wood has more than doubled. The highly productive agriculture also creates opportunities to grow energy crops on some of the arable land. There is also a potential to increase the use of peat and waste for incineration in the district heating system.

Today, Sweden utilises only a minor part of the natural resources that could be used to produce energy in a sustainable manner.

During the year 2000, a total of 97 TWh (349 PJ) was supplied by biofuels, around 88 TWh of which came from the forest, if we include black liquor from the forest industry. The forest opens up opportunities to extract considerably more raw material for energy, first and foremost as residues from forestry.

The extraction of wood fuels could be increased from around 45 to 120 TWh. With 120 TWh wood fuel and around 40 TWh black liquor from the forest industry's pulp processing, it would be possible for forest fuels to supply Sweden with much more fuel.

The amounts actually available are one thing, whereas the assessment of what may realistically be used in 20 years time is another. A number of factors influence the situation, e.g. price and profitability, political decisions, global developments.

SVEBIO assesses that we can use around 160 TWh biofuels in 2020. Thereby, biofuels will be able to supply around 30 percent of Sweden's energy requirements within two decades.

Therefore, the prospects for an increased use of biofuel are bright in Sweden.

#### 4.10.1.1 Present energy use for heating large buildings

In Sweden, the use of wood fuels for boilers providing heating for large buildings and blocks has rapidly increased during the last few years. As an example, the pellet quantity delivered to heating plants in 2001 was 112,000 tons, an increase by 300 percent compared to 1999.

Companies manufacturing pellet burners have installed 800 pellet burners ranging from 25 to 300 kW during the years 1996-2001. The number of installations has increased dramatically during recent years. The manufacturers forecast that they will install 300 burners in the year 2002.

Some companies in Sweden also market pellet boilers and woodchip boilers. Unfortunately, there are no sales statistics available for these kinds of boilers in this range. However, the number of installations of these boilers has also increased rapidly during recent years.

Below are two charts which show the present use for heating in multi-dwelling buildings and non-residential premises.

<b>Heating of multi-dwelling buildings in 2000</b>	
<b>Heating system</b>	<b>TWh</b>
Own oil boiler	2,6
*District heating system	22,3
Electricity	1,3
Other (biomass)	0,2
Heating pump	0,2
Natural gas	0,3
Oil + heating pump	0,4
District heating system + heating pump	0,7
Oil + electricity	0,4

Source: Statistics Sweden

Heating of non-residential premises in 2001	
Heating system	TWh
Own oil boiler	2,0
*District heating system	10,8
Electricity	1,8
Other (biomass)	0,3
Heating pump	0,1
Natural gas	0,3
Heating pump in different	
Combinations	1,2
Oil + electricity	1,1

Source: Statistics Sweden

\* One has to keep in mind that biofuels are the largest fuel sector in district heating systems. Biofuel makes up more than 50 percent of fuel supplied to district heating systems in Sweden.

#### 4.10.1.2 Climate: heating degree days and typical full load hours of heating systems in relevant regions

Heating degree days differ to a large degree between the northern and the southern part of Sweden. In the northern part of Sweden, they amount to around 6,800, and in the southern part to around 3,100. With regard to population distribution in Sweden, the average lies around 3,800.

Typical full load hours in Sweden are 4,000 hours.

#### 4.10.1.3 Existing experiences with wood-heated buildings

The increased use of biomass in Sweden during the last decade has brought about a development of combustion technology for small scale heat boilers and burners for large buildings. The experience also shows in the interviews carried out. There were no special views on the technology and the security of biomass supply. Statements in the interviews claim that the equipment is reliable.

However, it should be noted that these interviews were carried out before last winter. This winter, there were problems in getting a sufficient supply of biomass in some districts in Sweden. That was the first time this happened in Sweden. The problem, however, is not a long-term shortage in biomass. Rather, it is a question of planning. A minor increase in demand was forecasted, but it became much higher than anticipated, causing delivery problems. Should this occurs again, it may injure confidence in a secure supply of biomass

The producers and consumers of biomass suppose they will be better able to estimate the demand for biomass this winter. They don't think that biomass will again be in short supply this coming winter.

#### **4.10.1.4 Most relevant market segments identified for wood heating in large buildings**

Converting non-residential premises and multi-dwelling buildings from oil to biomass is a large market in Sweden. District heating systems are quite common, and the majority of the large buildings in the cities are in some form connected to such a heat distribution system. There are, however, a number of large population centres with a partial extension of district heating networks. These are the relevant market segments in Sweden.

#### **4.10.2 Barriers to wood heating**

Svebio has carry trough 17 interviews with relevant actors in the course of the project. What follows is a summary of views regarding different kinds of barriers:

- The industry sector doesn't pay energy tax and has a big discount on carbon dioxide tax. The industry is consequently not very interested in converting their premises to biomass.
- Some are worried about taxes on biomass.
- Some are worried about noise and dust generated by the plant.
- Some are worried about increasing transport traffic in residential areas.
- The tenant-owners' societies feel positively towards biomass plants, "but not in my garden".
- Long-term energy taxes or stable subsidies are important. That has not always been the case in Sweden.
- There is a lack of entrepreneurs/enterprises who would like to be responsible for a whole project in this range.
- In some municipalities financing may a problem. "There is no scope in a tight budget for a project like this."
- In some cases it is difficult to find a person in the municipalities, who would take responsibility for the operation of the plant.
- Some are worried about increasing prices of pellets/woodchips.
- The plumbers are an important group. There is a lack of plumbers with experience.
- Sometimes tenders are too complicated for plumbers/retailers (10-15 pages).
- In some cases, a lack of storage space may be a problem.

It is important to emphasise that the barriers mentioned above appeared only in some of the interviews. Consequently, they do not represent a general opinion among all interviewed.

#### 4.10.3 Economics of wood heating under national circumstances

Fuel	Pellets	Pellets	chips	Oil(Eo1)	
Thermal power	2	0.5	2.0	2.0	MW
Investment	270	320	320	65	EUR/kW
Investment	540	160	645	1,200	KEURO
Full load hours	4,000	4,000	4,000	4,000	hour
Heat production	8,000	2,000	8,000	8,000	MWh/year
Fuel price	25	25	15	50	EUR/MWh
Efficiency	85%	85%	80%	90%	
Management and maintenance	2.0%	2.0%	3.0%	1.0%	of investment
Economic life	20	20	20	20	year
	5%	5%	5%	5%	interest
Investment costs	43,100	12,900	51,700	10,300	EUR/year
Management and maintenance	10,800	3,200	19,400	1,300	EUR/year
Fuel costs	232,800	58,200	150,000	439,700	EUR/year
<b>Total costs</b>	<b>286,700</b>	<b>74,300</b>	<b>221,100</b>	<b>451,300</b>	<b>EUR/year</b>
<b>Total costs</b>	<b>36</b>	<b>37</b>	<b>28</b>	<b>56</b>	<b>EUR/produced MWh</b>

The economic calculation above is just a rough example. Experience from Sweden has shown that the costs vary a lot, if follow ups are carried out afterwards.

#### 4.10.4 Perspectives for the future development of wood heating in large buildings

Statistics Sweden have collected some information; their reports EN 16 SM 0102 and EN 16 SM 0203 give general information about heating in large buildings.

According to report EN 16 SM 0102, district heating is the dominating heating system in multi-dwelling buildings and, during 2000, was used for heating in 75 percent of the total heated area. This is about the same percentage as in 1999.

Oil was used for the heating of about 2.6 TWh (7% of the heated area) in 2000, which is a decrease of about one percentage point compared to the previous year. The use of electricity and the combination of oil and electricity should be added to these numbers.

The use of oil and electricity amounts to 4.3 TWh. This sector offers potential for pellets and woodchips in multi-dwelling buildings.

EN 16 SM 0203 provides energy statistics for non-residential premises in 2001. The dominating heating system in those premises is a district heating system, 56 percent of the surface area is heated that way. Oil is used for heating in 2.0 TWh (9 percent) of the

surface area and about the same area is heated by electricity only. Combinations of different heating systems are common. The use of biomass is 0.4 TWh.

The use of oil and electricity is around 4.9 TWh and again offers potential for pellets and woodchips in non-residential premises.

It must be kept in mind that biofuel is the largest fuel in district heating. The supply of biofuel to district heating systems amounts to more than 50 percent in Sweden.

To sum up, the potential for biomass in multi-dwelling buildings and non-residential premises lies around 9.2 TWh.

#### **4.10.5 The role of BIOHEAT – lessons learned**

The brochures were edited by one partner for all participant countries and translated by the partners into their national languages. The partners also had to make amendments to the national conditions in respective countries, which may sound like a good and efficient way to work to save money and time.

Making amendments, however, proved to be much more work than was estimated in the budget. In retrospect, it has become clear that the need for information is quite different in different EU member states. It is better to create a common framework in the beginning. The participants in the project can then produce their own information material in order to suit the information lacking in the country.

SVEBIO met with positive reactions when we disseminated the brochures. The municipalities especially appreciated the information. They own many large buildings in the community and can act as a driving force and also be a good practical example for others in the community. SVEBIO considers the municipalities to be a key group.

The participants of the national field trip also appreciated the initiative to arrange a tour of a municipality with practical experience.

#### **Policy recommendations**

Many of the barriers can be overcome by information, education and by showing different successful cases. The most important groups to inform are municipalities, tenant-owners' societies and plumbers.

## **5 Promotion and dissemination activities in each participating country**

### **5.1 Austria**

#### **5.1.1 Targeted articles**

The Austrian approach to publish targeted articles was based on an extensive review of relevant media. 40 primarily professional magazines were identified as relevant. In a second step these media were contacted to find out in which issues a related topical focus was planned. Then the publishers were contacted before the relevant issues and publications could be placed very easily and successfully. 17 Articles covering the subject of heating with wood fuels were published during the course of the project. The media covered a wide range of actors: architects, developers, municipalities, environmental professionals, professionals from wood industry and installers. Most articles were slightly different, to accommodate the interests of the target group.

#### **5.1.2 Information Brochure**

The information brochures were produced in considerably larger numbers of copies than foreseen. The full colour 12 page brochure for municipalities was printed in 17.000 copies, the brochure for developers 12.000 copies and the brochure for planners 9.000 copies.

The dissemination was arranged in close co-operation with existing interest associations to improve the reception of the brochures.

#### **5.1.3 Seminars**

Two seminars were realised. One seminar in the provincial parliament of lower Austria in St. Pölten on October 19, 2002, attracting about 70 persons including 12 persons from municipalities, 15 from housing associations, 11 from biomass heating co-operatives, 11 architects and 19 from other backgrounds. A field trip was offered after the seminar. TV was present and articles on the event were published in newspapers also. A second workshop was arranged on November 28, 2002 in Eisenstadt addressing actors in the province of Burgenland. About 25 persons attended the workshop, a fieldtrip was made after the end of the workshop.

#### **5.1.4 Field Trips**

2 national field trips were included in the seminars as described above. An international workshop was announced in the bioheat website and by the partners. However the fieldtrip had to be cancelled due to lack of participants.

### **5.1.5 Telephone hot line**

Telephone advice started almost with the beginning of the project. E.V.A. is a well known national institution attracting calls even without promotion. Out of various telephone inquiries 4 cases received an extended personal advice. These cases were:

Administrative building of the 7th district of Vienna: the first "green" district major was interested in establishing a pellet heating system. The building was inspected, all relevant questions were discussed. Upon request from the city government E.V.A. calculated a life cycle analysis comparing the cases of oil heating, gas heating, wood heating and district heating. The results were used in the brochures of the BIOHEAT project and were quite encouraging. However, as the district heating company learned about the project they made an excellent offer to connect the building to district heat – so the decision was taken to use district heat.

A similar fate occurred to the second project – the house of the green party: 2 meetings were held there including hearings with boiler manufacturers. A project would have been possible but again the district heating company made an excellent offer to connect the house to the grid.

Mischek Bau – one of the largest developers of residential projects in Vienna became interested in the issue and called E.V.A.. Mischek has a record of environmental projects including solar water heating, high insulation standards, ecological building materials etc. They considered to build a pellet heating system in a project just in the planing phase at the periphery of Vienna. Two meetings were held to discuss all questions. A heat service company co-operating with Mischek attended the meeting and performed first feasibility calculations. As the project was delayed due to other reasons, in fall 2002 Mischek considered to establish a pellet heating system in a different project.

A fourth project in Vienna was promoted by a private developer – a lecturer for ecological building at the Danube University of Krems. The project was discussed in several meetings. It is an old building that will be restored. The decision has been taken to install the pellet heating system in the meanwhile and construction works will take place in 2003.

Besides these individual cases, which were very useful to understand the questions of developers to design the information brochures accordingly, the telephone hotline was announced via the bioheat website.

## **5.2 Denmark**

### **5.2.1 Targeted articles**

For all 3 articles, a Danish version was prepared based on the international versions. For the third of the three articles (mostly covering the hotline), dk-TEKNIK prepared the international version and distributed this to the other 9 partners.

The 3 series of articles including variant version prepared for specific media has resulted in a total of 12 printed articles.

The first and second series of articles were distributed to selected professional magazines. The first was printed in two publications (copies enclosed), the second in one. The third one followed the issue and distribution of brochures to the target groups, and



was issued as a press release to 8 selected media. So far it has been printed or is planned for printing in 4 media: VVS & EI-Horisont, October 2002 (copy enclosed -target group: installers), MiljøHorisont (planned for printing December 2002 or later - target group: environmental planners), Byggeteknik (planned for printing November 2002 - target group: developers, construction companies, engineering companies), Tidsskriftet Skoven (planned for printing December 2002 - target group: Foresters, wood industry and wood fuel suppliers).

Further the web-based calculation-tool for biomass heating installations "beregning-biokedel" on <http://beregningbiokedel.dk-teknik.dk> has been reported in 7 media: Dansk Bioenergi (nr. 64), Fjernvarmen September 2002, VVS & EI -Horisont October 2002, Byggeteknik, Tidsskriftet Skoven, Vedvarende Energi & Miljø December 2002 and MiljøHorisont.

### 5.2.2 Information Brochures

A national version of all three brochures was prepared. This task proved to be much more time consuming, than assumed when the project was planned. This was partly due to more national adoptions needed, partly due to the number of pages rising far above the expected figure.

In the second project meeting it was decided, that the second brochure for planners and consultants should be combined with the printed seminar material to be prepared for the seminars. dk-TEKNIK therefore put a similar effort into the production of the international version of this brochure, which this way became more comprehensive and useful as a planning tool.

The first brochure (for municipalities) was sent to all municipalities and counties in Denmark, addressed personally to the person responsible for the development of energy within the municipality. Total: 263 direct mailings. Further it has been distributed to other contacts and in the meetings and seminars mentioned above. Printed copies: 2000.

The second brochure (for consultants) is produced as "print on demand" in Xerox quality and office style binding. This was chosen because the brochure due to the combined effort with the training material grew to a total of 26 pages from the assumed 8 pages. An offer to order the report for free was sent to consulting engineers, planners, architects, energy consultancy offices etc. Total: 107 direct mailings. Printed copies (so far): 500.

The third brochure (for developers) was sent to a more broad target group in companies, organisations, authorities etc. involved in energy issues and project development. Total 168 direct mailings. Printed copies: 2000.

### 5.2.3 Seminars

For the use of all partners, dk-TEKNIK prepared a programme outline, and participated in preparation of the combined consultant brochure and seminar material. This outline and technical material were used by the other countries as a model for the national seminars.

For the national seminar in Denmark, a series of a total of 4 events were prepared: 3 seminars/training courses were prepared in the dk-TEKNIK training course programme for autumn 2002. These covered 3 different issues connected to the use of wood for heating in large buildings: Apart from the recipients mentioned above for the brochures, the seminar/training course programme was sent to 1626 dk-TEKNIK customers.

Seminar/training course on the correct choice of fuels: 'Brændselsskift - Hvornår og hvordan' 7 October 2002 in dk-TEKNIK training centre in Søborg, Denmark. This seminar/training course had to be cancelled due to too few participants, which was probably caused by too late announcement. It is being announced again for completion 4 February 2003.

Seminar/training course on wood pellets quality and markets: 'Træpiller – Kvalitet og marked' 19. November 2002 in dk-TEKNIK training centre in Søborg, Denmark.

Seminar on biomass energy supply in industry: 'Biobrændsler i virksomhedens energiforsyning' 22. October 2002 in dk-TEKNIK training centre in Søborg, Denmark

Further, a national wood pellet seminar was planned and performed 26 September 2002 in Vejle, Denmark as a joint effort between the BIOHEAT project, a national project and dk-TEKNIK. The seminar included wood pellet manufacturers and dealers, equipment manufacturers, consultants and developers. 115 participants.

#### **5.2.4 Field Trips**

The national and international field trips were combined into one common event. The programme included visits to 2 schools using wood pellets as a fuel, a visit at a wood pellet manufacturing facility and a mini-seminar to allow the participants to have time for questions and answers. The activities were planned in central Jutland, Denmark on 27 September 2002.

International invitations were sent by e-mail to app. 100 persons (and forwarded from many of these) and app. 200 contacts by snail-mail. National invitations were sent to a total of 600 persons. The field trip was cancelled due to too few participants, mainly because of late announcement and the date being very close to the large wood pellets event in Sweden in September 2002.

#### **5.2.5 Telephone hot line**

The hot line was operational from 1 September 2002 when the brochures and invitations were sent out. Further the hotline was also announced in article nr. 3, which was published in the same period, on dk-TEKNIK and BIOHEAT homepages and in seminars and conferences. Similar services has been provided in dk-TEKNIK during the whole project period as part of activities performed in Centre for Biomass Technology, and in praxis, the services has been available to the target group during the whole project period.

The Austrian partner EVA prepared a calculation model, and dk-TEKNIK performed quality control on this and prepared introductory text to it. Further dk-TEKNIK developed for internal funds a national Danish calculation model, where also heat demand distribution, choice of boiler capacity and formulas for investment costs were included. This model was used in the Danish hot line.

A total of 4 clients used the hotline after 1 September 2002 (phone calls before this is accounted for as activities in Centre for Biomass Technology). One of these - a municipality - expect to build 3 or 4 units, and of the other 3, one is likely to be built.

After the project finish a continued activity on the hotline is expected. If financing of such services under the Centre for Biomass Technology is continued, the services will be similar to the ones under the BIOHEAT project. Without this funding, services will be

limited to mailing brochures, referring to information and contacts and offering consultancy on a fee basis.

## 5.3 France

### 5.3.1 Press articles

The series of articles were sent to thirty magazines or/and newspapers of the local and professional press.

Articles were published in the following magazines:

- "*Le Bois International*": weekly magazine featuring articles about the wood sector (dealing with topics from forest exploitation and sawmills to woodwork for furniture and carpentry); since 1992 a special periodical on woodfuel "*Les Cahiers du Bois-énergie*" is included quarterly in the magazine. "*Le Bois International*" is printed in 15,000 copies.
- "*Chaud Froid Plomberie*": monthly magazine for HVAC professionals (12,000 copies).
- "*Environnement & Technique*": technical and professional monthly magazine featuring articles about the environment sector and dealing with the valorisation of biomass (8,200 copies).
- "*Energie Plus*" – bimonthly magazine from ATEE (2,400 copies), featuring news and technical articles on energy and environment (also available on the Internet [www.atee.fr](http://www.atee.fr)).
- "*Recyclage et Récupération*", weekly magazine distributed to 3,000 subscribers (municipalities, policy makers, industrials,...), (in progress).
- Local press: "*L'agriculteur Normand*" (19,800 copies monthly), "*Ouest France*" (800,000 copies daily), "*L'Acteur rural*" – monthly letter distributed to 500 subscribers (mainly municipalities).

### 5.3.2 Information brochures

Brochures for developers and municipalities:

- "**Bois-énergie une chaleur durable pour l'habitat et le tertiaire**" "Woodfuel: sustainable heat for housing and services sectors".
- Booklet with 8 double-sided coloured pages (1,000 copies)
- "**6 leaflets describing successful cases in France**"  
6 double-sided coloured leaflets – (1,000 copies each).

Brochures for consultants and heating services:

- "**Chaufferies bois de petite et moyenne puissance dans l'habitat et la tertiaire: guide technique**" - "Small and medium wood-fuelled heating plants – Technical guide"  
40 pages – 1,000 copies.

Dissemination of brochures:

The brochures are distributed through:

- the seminar and field trips (October 21/22, 2002): 150 copies,
- regional agency of ADEME in Lower Normandy: 100 copies,
- national and regional energy agencies of ADEME: 250 copies,
- specific mailing through the professional networks represented at the seminar: 300 copies
  - ATTF: French association of the town and municipal technicians, --
  - AITF: French association of the town and municipal engineers,
  - AMORCE: French association of heating network contracting authorities, —
  - ATEE: technical association for energetic efficiency,
  - AMF: French association of mayors, —
  - AICVF: French association of HVAC engineers,
  - FG3E: National federation of heating companies
  - FNB: National federation for wood,
- woodfuel operators of the French woodfuel catalogue (available on the ADEME and BIOMASSE NORMANDIE web sites): 150 copies, —
- 50 copies left for further dissemination. —

### 5.3.3 Seminar

The seminar took place in Saint-Hilaire-du-Harcouët, a town with 4,368 inhabitants located in the south of Lower Normandy. In cooperation with ADEME and the regional council of Lower Normandy the seminar addressed the municipalities, policy makers, organisations or companies from the energy and wood sectors, the social housing and health services, and the woodfuel-promoting organisations. 4,000 invitations were sent out with the help of eight professional associations which displayed the information through their networks. —

The one-day programme included:

- Morning session: "**Why choosing wood-energy?**", with lectures from BIOMASSE NORMANDIE, OPAC du Calvados (social housing organisation) and AMORCE (association of heating networks) and a panel discussion with developers and wood energy promoters. —
- Afternoon session: "**Technical aspects of wood-fuelled plants**", with lectures on two successful cases and on environmental studies concerning atmospheric emissions and a panel discussion with woodfuel suppliers and heating services companies. (For the detailed programme see Annex 7.1.6)

A hundred people took part in this seminar (see Annex). Many participants expressed their appreciation of the lectures, which had dealt with all the aspects of a woodfuel

project: from the necessity to have a secure supply of woodfuel to the different technical and legal constraints depending on the nature of the contracting authority (public or private buildings).

### **5.3.4 Field trips**

The field trips were organised within the framework of the seminar, as the hospital located in Saint-Hilaire-du-Harcouët inaugurated its new wood-fuelled heating plant.

The installation is composed of a 1,5 MW wood –boiler, which heats the hospital (capacity of 200 beds) and two secondary schools (through a distribution network of 800 meters) and burns 1,800 tons of woodchips and bark in one year.

About 100 people attended the visits which had been planned for two days (October 21-22, 2002).

During the visits the regional TV France 3 recorded a 3-minute report for the regional evening news. Articles were also published in the local press (see Annex).

### **5.3.5 Telephone hotline**

The dissemination of information concerning the BIOHEAT programme, the brochures and the seminar was also carried out by means of the telephone hotline, which was established in March 2002 and addresses small municipalities, farmers and private persons. From March to October 2002 this service received about 15 to 20 phone calls concerning small and medium wood heating plants for the housing and services sectors. One of these contacts has resulted in a successful feasibility study concerning a 300-kW boiler, which will start operating at the end of 2003.

BIOMASSE NORMANDIE will continue phone assistance and communication activities for small and medium woodfuel projects through this hotline service.

## **5.4 Greece**

### **5.4.1 Targeted articles**

The journals selected were the technical ones, the most popular in their sector in Greece. These were:

- **TECHNIKA**: the major technical journal in Greece appropriate for Engineers and technicians
- **KTIRIO**: for engineers, constructors in the building sector
- **THERMOYDRAYLIKOS**: the major professional journal of plumbers and heating/cooling installers

An article was published in each one. The results of the reports, as well as the maxibrochures will be a new material for publication. This means that these publications will be increased in the next 12 months.

In parallel the relevant information exists in the CRES' web page (including a link to the [www.bioheat.info](http://www.bioheat.info))

### 5.4.2 Information Brochure

The front page of the 3 brochures is included (1500 copies each one). This material will be disseminated through CRES' channels (on request after a press release, during technical visits, in exhibitions/ conferences, etc) and during the technical meetings with planners, local authorities, as well as other big potential users.

### 5.4.3 Seminar

Due to the limited available budget for external expenses and travels, we decided to promote the aims of the project with seminars with the following characteristics:

- (i) local authorities with problematic biomass waste management
- (ii) population increase
- (iii) working distance very close to Athens
- (iv) small groups per municipality to be informed- discussion at the end of the Seminar

The procedure is under development although the project has been finished and will be continued for the next 12 months.

Details of the seminars are as follows.

Date	04-12-01
Location	Municipality of Rafina
Program	15:00 Welcome by Major Mr A. Kechagioglou 15:30 Introduction on the biofuel potential applications – the Bioheat project, Dr T. Tsoutsos, CRES 16:00 Energy applications in Local Authorities, Mr K. Iliopoulos, CRES 16:30 Presentation of the activities of the Technical Service, Mr V. Skrekas, Municipality of Rafina 17:00 Roundtable discussion – follow up 18:30 End of the Seminar
Target group	Major and the technical staff of the municipality
Number of participants	8
Commends	The municipality is a metropolitanical centre in the east of Attica. With the port of Lavrion will be the alternative great port of Attica (the first is Piraeus). As a result of this technology transfer the municipality has submitted two proposals

	for funding in the Ministry of Interior and in the Ministry of Agriculture to exploit their biomass residues (chips and briquettes)
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Date	24-01-02
Location	Municipality of Spata
Program	13:00 Welcome by Major Mr A. Tountas 13:30 Introduction on the biofuel potential applications – the Bioheat project, Dr T. Tsoutsos, CRES 14:00 Energy applications in Local Authorities, Mr K. Iliopoulos, CRES 14:30 Roundtable discussion – follow up 16:00 End of the Seminar
Target group	Major and the technical staff of the municipality
Number of participants	8
Commends	The municipality is very close to the new airport and has to face two challenges: <ul style="list-style-type: none"><li>(i) the tremendous increase of its population, as well the need for new public/social buildings</li><li>(ii) the construction of a new technology park called ACROPOLIS in an area of 0.4 km<sup>2</sup>, the needs of which is planned to be covered by new energy sources</li></ul>

Date	05-03-02
Location	CRES
Program	13:00 Welcome by Mr K. Tigas, CRES 13:30 Introduction on the energy problem of the Municipality of Artemis, Major Mr V. Tyrakis 14:00 Introduction on the biofuel potential applications – the Bioheat project, Dr T.

	<p>Tsoutsos, CRES</p> <p>14:30 Biofuel technologies, Mr I. Eleftheriadis, CRES</p> <p>15:00 Energy applications in Local Authorities, Mr K. Iliopoulos, CRES</p> <p>15:30 Roundtable discussion – follow up</p> <p>16:30 End of the Seminar</p>
Target group	Major and the technical staff of the municipality
Number of participants	12
Commends	<p>The municipality has major seasonal problems during Spring and Summer, since it is in the east side of Attica (close to the sea). Their major problem is to exploit their huge waste residues from the houses.</p> <p>The upgrading of biomass in the form of pellets and briquettes could be a solution.</p>

#### 5.4.4 Field Trips

locations visited, date, number of people, who attended and reactions

locations	Date	Number of people	Person	commends
Boiler constructor "H ENOSI", Kilkis	September 2001	2	A. Hatziathanasiou	5% of the boilers are for olive kernels, 5% for wood, 80% oil, 10% LPG a significant Greek constructor
Holy Coenobium, Ormelia	May 2001	2	A. Hatziathanasiou	Wood end user (300-500 kg/h) Maintenance : 4 million Drs/year
Mouzakis, domestic bulding, Kifissia	September 2001	2	A. Hatziathanasiou	Wood end user (10 kg/h)
Hotel Atrion, Crete	May 2001	2	A. Hatziathanasiou,	It uses olive oil pits since



			L. Garvill	1985 Thermal capacity 250 kW
Milia, Crete island	February 2002	1	T. Tsoutsos	A remote an energy autonomous village, using wood district heating to cover its needs

### 5.4.5 Telephone hot line

As a follow up of the articles we received several number of phone calls (Mr Mavrogiannis was responsible to answer). The success of this story means that it needs to be strengthened.

In the hotline we gave information on the economic advantages, on the existing web page, and on the forthcoming publications

After the end of the project we will continue to supply information (it is among CRES' scopes).

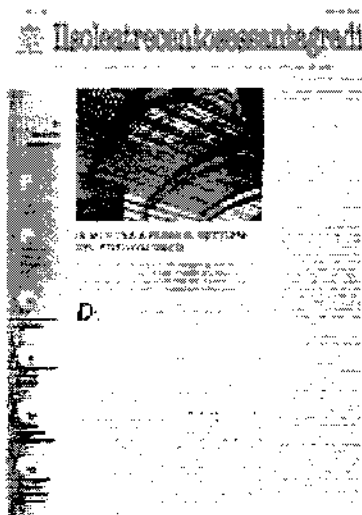
## 5.5 Italy

### 5.5.1 Targeted articles

During the dissemination phase of the project 6 articles were produced and published.

After an intensive survey of the relevant magazines and newsletters, five media were selected.

**ISES newsletter: Il sole a 365 gradi:**



<http://www.ilsolea360gradi.it/>

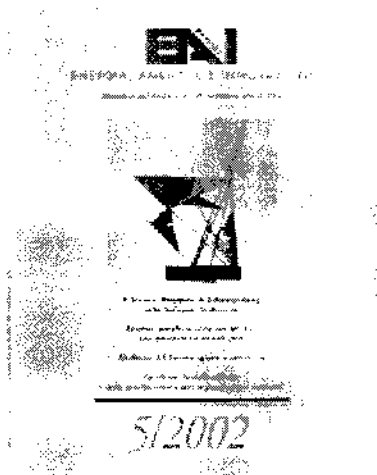
This is a 16-page, monthly newsletter of ISES ITALY, a section of the International Solar Energy Society and provides information on renewable energy: photovoltaic, solar thermal, wind energy, biomass, solar architecture, marine currents, etc, as well as news on projects, policies and events in the field of solar energy in Italy, Europe and world-wide.

Published since 1994 over 13,000 copies reached the various regions of Italy as well as some international sites. With over 70 distribution points in Italy it is circulated among a broad spectrum of professionals and organisations: Members of ISES ITALY, mass media, public authorities and institutions, municipalities and local utilities, companies, manufacturers, architects, engineers, professionals, installers, research centres, banks, schools, universities, environmental and consumers' associations, etc.

In September 2002 n. 8 magazine published the article "BIOHEAT: an European project with ENEA for the promotion of wood heating" (one page).

In this article there is a short description of the projects, information on the brochures and how to request them and information on the activated hotline.

**IEA: Innovazione Energia Ambiente (ENEA Magazine):**



<http://www.enea.it/com/ingl/>

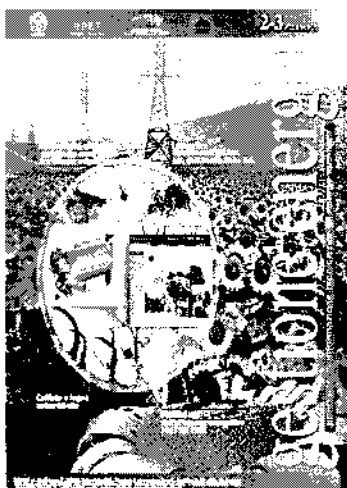
This two-monthly house-organ provides information on the latest topics on news on energy, technology and the environment. It is a showcase of ENEA's studies and researches, presenting also experts' articles of general and special interest in the fields of energy, technology and the environment.

The journal features:

- Highlights: with official and institutional documents of ENEA's interest
- Open space: with articles by leading personalities on the latest scientific, technological and economic topics
- Studies and research: with in-depth reviews of general and special interest
- Technical notes: with short articles on ENEA's initiatives
- News: news from the World, the European Union, Italy and ENEA. Notes on upcoming events and noteworthy publications

In the 4/2002 July/August Magazine a technical note (one page) on the project and the brochures was published: " Wood heating of blocks and big buildings: the European project BIOHEAT"

## GESTIONE ENERGIA: The Italian Energy manager magazine



[http://www.fire-italia.it/gestione\\_energia/caldaie\\_legna.pdf](http://www.fire-italia.it/gestione_energia/caldaie_legna.pdf)

Gestione Energia is a two-monthly magazine providing technical information to Italian energy managers.

This magazine is distributed in 5000 copies around Italy.

In the 4/2002 July/August Magazine an 8 page article on wood heating was published:

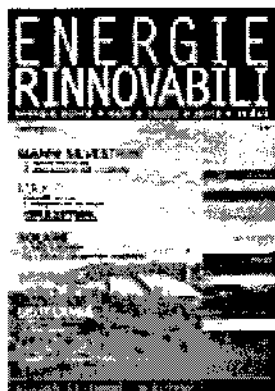
"New automatic wood boilers: a silent revolution". In this article there is a complete exhaustive description of biomass heating systems, some examples of successful installations and environmental and economic benefits.

It is possible to download this article from:

[http://www.fire-italia.it/gestione\\_energia/caldaie\\_legna.pdf](http://www.fire-italia.it/gestione_energia/caldaie_legna.pdf)

In the same magazine (4/2002 July/August) in the information note section there is another article (one page) specific for the launch of the brochures with their availability.

## ENERGIERINNOVABILI:



<http://www.artechenergia.it/>

Energie Rinnovabili is a two-monthly magazine on all renewable energy technologies distributed in 10,000 copies. The main target groups are: plants installers, designers, public administrations, engineering companies, energy managers etc.

In the January 2003 n.1 magazine will contain the article: "New technologies for wood heating". In this article detailed information on the project, on the brochures and the hot line are provided.

Staffetta Quotidiana - Italian

# **STAFFETTA NEWS**

## **Oil gas and power in Italy**

EDITOR Stefano De111 C0111

<http://staffetanews.staffettaonline.com/>

Since 1933, Staffetta Quotidiana has offered total coverage of the Italian energy industry. Currently Staffetta Quotidiana, an independent daily newspaper, publishes more than 7,000 authoritative reports yearly regarding oil, oil products, natural gas, electricity, renewable energy sources, energy conservation and the environment. The paper tracks energy policies, regulatory and normative changes, Italian and foreign markets, price trends, company activities and strategies, as well as publishing documents and studies, along with commentary from editors, policy makers and industry operators.

Staffetta Quotidiana's readers include public and private operators, corporate executives, members of the Italian government, local authorities, governmental and non-governmental organisations, public regulators, trade unions and business organisations, banks, universities, research centres and journalists.

The BIOHEAT Italian brochure was reviewed with a specific article the 12 October weekly summary magazine.

### **Feed back**

We received several emails of people that read the articles and requested the brochures (about 100 mails).

Several contacts and in seminars and fairs.

### **5.5.2 Information Brochure**

Three different brochures have been designed and published:

- Woodfuels: sustainable heat for residential buildings
- Woodfuels: sustainable heat for public buildings
- Heating big buildings with woodfuels

A digital copy can be downloaded from [www.bioheat.info](http://www.bioheat.info) and:

[http://www.enea.it/com/web/pubblicazioni/Comb\\_legn1.pdf](http://www.enea.it/com/web/pubblicazioni/Comb_legn1.pdf)

[http://www.enea.it/com/web/pubblicazioni/Comb\\_legn2.pdf](http://www.enea.it/com/web/pubblicazioni/Comb_legn2.pdf)

[http://www.enea.it/com/web/pubblicazioni/Comb\\_legn3.pdf](http://www.enea.it/com/web/pubblicazioni/Comb_legn3.pdf)

The three publications were printed in 5000 copies each and have been distributed by mailing and during seminars and fairs.

The publication was designed following the BIOHEAT guide-lines, therefore considerable adjustments to the Italian heating market were implemented.

Distribution started at the end of September and is already in progress.

A mailing list was prepared considering all the institutions and persons contacted during the interview phase and all the other relevant actors and institutions.

Special consideration was given to all the institutions that could help the spread of information like Associations, Regions, Italian Thermo-technical Committee, Universities, NGOs etc.

More than 1000 copies were distributed during specific fairs related to energy issues:

#### **Modena**

(17-19 October): EXPOENERGIA <http://www.senaf.it/expoenergy/home.htm/>  
Brochure distribution (200 each)

#### **Rimini**

(6-9 November): RICICLA ENERGIA <http://www.ricicla.it/it/energia/index.asp>  
Seminar on Wood heating; Brochure distribution (300 each)

#### **Milano**

(11 November): Energy manager course  
Brochure distribution (50 each)

#### **Sesta Godano**

(29 November) BIOHEAT Seminar  
Seminar on BIOHEAT project  
Brochure distribution (80 each).

### **5.5.3 Seminar**

Three seminars were organised:

#### **CINGOLI (Macerata)**

June 6- "Wood heating of buildings"  
About 60 participants: installers, Municipality delegates, plumbers, designers

#### **Rimini: in the frame of the energy fair RICICLA ENERGIA**

November 7-"New wood heating systems: a challenge for the ESCO's"  
About 200 participants: energy managers, installers, local energy operators, ESCO's delegates etc.

#### **Sesta Godano (La Spezia)**

November 29-"BIOHEAT: a European project for wood heating promotion"  
About 80 participants: local authorities and municipalities delegates, installers, wood operators, energy managers and NGO's delegates

A couple of other seminars and field trips will be performed in the in 2003 in the framework of the institutional mission of ENEA Renewable Energy Section: Arezzo (Tuscany) and Cuneo (Piemonte).

### **5.5.4 Field Trips**

In partnership with CTI field trips were carried out.

25-26 October: visit of Sondalo and Tirano wood district heating plants and of a wood boiler that supplies a farmer close to Lodi

About 50 participants: energy managers, professionals, community delegates, private energy operators

### 5.5.5 Telephone hotline

Organisation of a call centre:

A new telephone number was activated in ENEA ( +390630483482) and the service of buffering the telephone call was outsourced to a co-participating company : one secretary from 8 to 18h, 5 days per week.

The hotline activation was announced in articles, during fairs, seminars and by e-mail.

We received several calls of people asking for general information and the mailing of the brochures.

The list of the calls is updated day by day.

## 5.6 Netherlands

### 5.6.1 Targeted articles

In the Netherlands, press releases have been sent to 22 different magazines and newspapers. These were selected based on the result of interviews held in the initial phase of the project. In the magazines that were contacted, a total of nine articles have appeared, varying in length from an announcement of the BIOHEAT seminar to a series of full colour articles of multiple pages. Below, an overview is given of all articles published:

Magazines contacted:	Target group	Article appeared:
Bouwennu	Project developers	No
Cobouw	Project developers	No
Duurzaam Bouwen	Project developers	No
Duurzame Energie	Project developers, consultants	No
Energieconsulent	Consultants	Yes, full colour article
Energietechniek	Consultants, installers	No
Installatietechniek en ondernemen	Installers	No
Houtwereld	Wood processing industry	Yes, full colour article
IPO Milieuwerk	Provincial government	No
Milieumagazine	General on environment	No
Nieuwsbrief Duurzaam Bouwen	Project developers	No
Aedes	Housing corporations	No
ROM Magazine	Municipalities	No
Stromen	Energy sector, consultants	Yes, announcement on BIOHEAT seminar (see annex)
Sustainable building	Project developers	No
Houtwereld	Wood processing industry	Yes, article with photographs
TNO Duurzaam Nieuws	Industry, government	Yes, project description and announcement of seminar (see annex)
Utilities	Project developers, consultants	No
Verwarming en Ventilatie	Installers	Yes, two detailed articles (see annex)

Magazines contacted:	Target group	Article appeared:
VNG Magazine Energiemanagement.net	Municipalities Project developers, consultants, energy sector	No Yes, article on popular website on energy-related items
Hout en toelevering	Wood processing industries	Yes, article on Bioheat seminar and article on wood fired heating systems

In the series of articles, reference was made to the BIOHEAT information package of three brochures, as well as the seminar, field trips and the telephone hotline.

A number of readers of the above magazines have contacted TNO for more general information on wood fired heating systems or with specific questions on the feasibility in certain cases. A few examples of reactions are provided below:

1. The municipality of Barneveld contacted TNO to advise on the environmental performance of an old wood furnace that is used for space heating.
2. The municipality of Groningen contacted TNO to get more on the immissions of biomass heating plants and the health effects of ash handling.
3. After an initial telephone conversation with TNO, the Ministry of Defense has started to consider to use wood combustion systems to heat a number of barracks of the army. On several locations, the Netherlands army already avails of large quantities of wood chips (originating from maintenance of the partly forested shooting ranges), that are currently already supplied for a relatively low price as biofuel to a power plant.

In future as well, TNO will continue to provide support to potential investors that are considering to start a wood fired heating plant.

### 5.6.2 Information Brochure

Three information brochures were developed for distribution in the Netherlands:

- A full colour 16 page brochure for municipalities that describes different aspects of the option and the role municipalities can take in the promotion of such systems. Around 550 of the 1000 copies printed have been distributed by TNO to all municipalities in the Netherlands, together with an invitation to participate in a special seminar for municipalities. An additional 50 copies were sent to other target groups on request. 50 more copies were distributed at the Bioheat workshop.
- A 16 page full colour brochure has been produced for project developers and consultants that describes the option of wood heating. Similarly to the brochure for municipalities, this brochure was distributed together with an invitation for a dedicated bioheat seminar for project developers. From the total edition of 1000 copies, 375 organisations in the Netherlands have received a copy from TNO by direct mail. Another 100 copies were sent on request or taken at the Bioheat workshop
- A 46 page full colour brochure with a more detailed description of the technology, considerations for design, dimensioning, etc. This brochure was printed in an edition of 250 copies, of which around 100 copies have already been distributed by direct mail and on request.

The availability of the above brochures and reports was also announced in several magazines in the Netherlands, which has led to a significant interest in addition to the persons directly mailed. Several people order all of the above reports.

All reports are also available online at the BIOHEAT website. Copies are enclosed in the annex of this report.

### **5.6.3 Seminar**

Since it was already experienced within the BIOHEAT project that municipalities play an important role in the realisation of wood fired heating systems, it was decided to organise a separate seminar for municipalities in addition to the seminar for installers, project developers etc. The designed programme of the seminar for municipalities was similar to the one for technicians, however it also included a presentation of one municipality on the consequences of imposing too strict emission guidelines on wood fired heating systems.

360 persons were directly invited to participate in the seminar for project developers, installers and other technicians which was planned for October 23. Another 590 persons (a.o. all municipalities in the Netherlands) were directly invited to the seminar for municipalities, planned for October 24. In addition, both workshops were announced in several magazines.

However, while 50 persons registered for the first seminar, only 5 persons from municipalities registered for the additional seminar. It was therefore decided to combine both seminars for October 23.

The seminar was attended by 50 delegates, representing project developers, installers, consultants, fuel suppliers, suppliers of equipment, energy companies and municipalities. It was received very positively. The program was comprised of the following presentations:

- 1) A general presentation on the use of biomass for energy, and why wood heating can be an attractive option in large buildings in the Netherlands (by Jaap Koppejan, TNO)
- 2) Technical aspects of wood fired heating systems for large buildings, design considerations. (by Petra de Boer, TNO)
- 3) Developments in the market for wood pellets and the availability of wood pellets (by Barend Labee, Wood Flame)
- 4) Details of the wood firing technology, options for storage, firing and flue gas cleaning (by Gerrit Meiners, Fröling Germany)
- 5) Considerations in the issuing of environmental permits (by Theo Hettinga, Municipality of Apeldoorn)

Although wood fired heating systems are new to the Netherlands, it was clear that the workshop convinced participants about the maturity of the technology and the acceptable environmental impact. It was agreed that a typical payback period of 8-10 years would be too long for many parties, however in some cases this may be acceptable.

During the workshop there was significant discussion around the impact of the new emission guideline on the cost-effectiveness of biomass heating systems. It was commonly agreed that particularly the relatively small combustion units targeted under BIOHEAT will be affected. Additional research and development work needs to be done in



the area of flue gas cleaning in order to keep small scale biomass combustion financially attractive. This topic was already identified as a major barrier for market introduction in a previous phase of BIOHEAT.

#### **5.6.4 Field Trips**

The Bioheat seminar was combined with a field trip to pellet producer Wood Flame. At this location, 80 ktons of wood pellets are produced. All 50 participants at the workshop also attended the field trip. Besides a tour through the company site, an operating pellet boiler was demonstrated. At this site, boiler producer Fröling from Germany demonstrated the construction details of a modern pellet boiler, using a special demonstration model.

The field trip was received very positively. It proved that both the production and use of wood pellets can be regarded as a fully developed alternative for natural gas in the Netherlands.

#### **5.6.5 Telephone hotline**

TNO is already commonly known at a large audience for the availability of knowledge on biomass combustion. From 1996 to 2001, the Dutch Biomass Information Centre was located at TNO.

The telephone hotline was announced in a number of articles, as well as the brochures produced. In spite of this, the number of calls received was limited to approximately 20. About 10 calls were related to issues described in the brochures (such as environmental impact and costs of equipment), 5 callers were seriously interested in implementation, while another 5 were interested in the results of the seminar held. In addition, potential projects that were provided with information in the BIOHEAT project are:

- Two housing associations
- A rural school
- A recreation centre
- An office building
- A greenhouse complex
- Army barracks

TNO will be continuing to provide information towards the different target groups in the Netherlands. There is still contact with a number of entrepreneurs who are considering to invest in wood fired heating systems. Further, the Dutch Information Centre for Renewable Energy will be provided by TNO with key information on the technology option, including the information material developed.

### **5.7 Norway**

#### **5.7.1 Targeted articles**

Statoil has published a number of articles about renewable energy and especially wood pellets. The following magazines and newspapers have been used:

- Byggenytt, August 2000.
- Byggenytt, September 2001.
- Byggeindustrien, September 2001.
- Stavanger Aftenblad, October 2001.
- VVS-Aktuelt, February 2002.
- ENØK-Posten, Akershus, April 2002.
- Aftenposten, 8 articles in the period 1999-2002.

The response to those articles has been limited, actually rather poor. This is due to the lack of knowledge and information about wood pellets as one of the most prosperous energy sources within the next 10 years.

### **5.7.2 Information Brochures**

Statoil has produced 3 information brochures about wood pellets:

- Wood pellets in public buildings.
- Wood pellets in larger buildings.
- Information about wood pellets for consultants.

The brochures are finished as originals and will be printed during December 2002. The distribution to the defined targetgroups will take place in January 2003.

Statoil has, in addition to 3 mentioned brochures, produced 4 brochures (total 2.000 copies) with relevant information about wood pellets, which have been distributed to our defined targetgroups.

### **5.7.3 Seminars**

Statoil has yearly arranged 4-6 seminars for the most interesting companies within our defined targetgroup with 5-7 participants on each seminar. The participants has been chosen out dependant of interest in building an energy system based on wood pellets as energy source. These seminars are always combined with field trips to buildings with such energy systems to learn how it works. Often we also arrange field trips to our production facilities in Brumundal.

In addition representatives from Statoil have given presentation on different seminars and courses on several occasions.

In connection with some of the seminars Statoil also have presented wood pellets on an exhibition stand. We have participated on the following exhibitions:

- "ENØK-Oslo" in Oslo in November 2000.
- "Environment Conference - UN" in Haag, December 2000.
- "Energimessen" in Oslo in September 2001.
- "Synergy123" in Stavanger in October 2001.
- "Varmemessen 2002" in Oslo in February 2002.

- "Sustainable Building 2002" in Oslo in September 2002.

The response of the exhibitions have been very limited.

#### **5.7.4 Field trips**

Have exclusively been arranged in connection with seminars, see 4.7.3. Seminars (above).

#### **5.7.5 Telephone hot line**

There has been no need for such a "Telephone hot line" till now. When "the real information period" starts in January 2003 Statoil will establish a "Telephone hot line".

### **5.8 Portugal**

#### **5.8.1 Targeted articles**

The articles written by the partners of Austria, Sweden and Denmark were translated and adapted to the Portuguese reality.

Despite expectations of wider distribution of these articles in future magazines and events, the articles disseminated until now are:

- One article was published in "Boletim da APPBG", an environmental magazine read mainly by an academic audience interested in environmental issues. This magazine was published on June 2002, 1500 copies.
- One article was distributed in the seminar "Valorização de Resíduos em Concelhos do Baixo Vouga e Baixo Mondego" on September 30th 2002. The event was attended by about 150 people, a target group of BIOHEAT project such as technicians of municipalities, forest associations, industries based on forest products, environmental organisations, regional energy agencies, etc.
- One article was distributed in the seminar "Valorização de Resíduos em Concelhos da Cova da Beira e Beira Interior" on October 29th 2002. The event was attended by about 100 people, a target group of BIOHEAT project such as technicians of municipalities, forest associations, industries based on forest products, environmental organisations, regional energy agencies, etc.

Copies of these articles are annexed to this report.

#### **5.8.2 Information Brochure**

According to the work programme, three different brochures addressed to municipalities, project developers and consultants were produced during the project.

These brochures were translated, adapted to national context and designed in CBE.

1000 copies of each brochure were printed to be distributed in seminars and mailed to important national actors, who are the target group of the respective brochure.

Concerning this project task we were able to observe that the initial time estimation to produce the brochures was too short which generated a significant delay in the finalisation of this task.

Copies of these brochures are annexed to this report and available for download from the project web site.

### 5.8.3 Seminar and Field trip

Despite the fact that the seminar and field trip were prepared during the time schedule of the project the realisation of these tasks was postponed to December 10th due to external reasons, such as the weather conditions required for a visit to a heating system and also because some invited speakers were not available.

The main target groups for this event are heating systems' planners, regional energy agencies, technicians and students.

The programme for this one day course and field trip will be as follows:

9.20	OPENING SESSION	GIL PATRÃO, CBE
9.30	<i>Presentation of BIOHEAT project</i>	Teresa Almeida, CBE
	<b>BIOMASS AS FUEL</b>	
10.00	Forest biomass characteristics	Joana Carinhas, CBE
10.30	Physical and chemical parameters to control	Maria Carlos, CBE
11.00	Harvesting, transport and chipping of forest residues	Manuela Ferraz, CBE
11.30	Coffee break	
	<b>BIOMASS AND ENVIRONMENT</b>	
11.45	Sustainability of forest and the use of forest residues for heating buildings	DGF
12.15	Forest harvesting and biomass	João Fernandes, COTF
12.45	Environmental concerns of biomass use	Filomena Lobo, Instituto dos Resíduos
13.15	Lunch	
	<b>BIOMASS FOR ENERGY</b>	
15.00	Biomass boilers – technical characteristics, operation and maintenance, costs,	Alexandre Ferreira, Torres & Belo
15.45	Biomass boilers – technical characteristics, operation and maintenance, costs,	Torres Andrade, Morisa
16.30	Biomass boilers – technical characteristics, operation and maintenance, costs,	Joaquim Branco, Ventil,
17.15	Briquettes and pellets production	H. Ribeiro & Veríssimo
18.00	<b>Visit to CBE pilot installation of briquettes production and biomass heating system</b>	

Concerning the expectations for this event we believe that the seminar will have an audience of around 50 persons. This estimation is based on previous seminars organised by CBE focused on similar subjects. In Portugal events related to the use of biomass for

energy organised by our institution have been very well received by the public, due to real interest in this topic and the lack of information felt in general.

#### **5.8.4 Telephone hotline**

On BIOHEAT project the telephone hotline should offer support to companies in early project stage, including preliminary assessment of economic feasibility and information regarding available subsidies, regulations, technical concepts, fuel suppliers, etc.

Offering advice by telephone on biomass issues is a frequent task of CBE – Biomass Centre for Energy. In general, we receive an average of 4-5 calls per month from persons interested in information on biomass characteristics, examples of use, fuel availability and suppliers, etc.

The telephone line available to obtain information on biomass heating systems, is published in brochures and articles in BIOHEAT context.

### **5.9 Spain**

#### **5.9.1 Targeted articles**

The articles of BIOHEAT project have been published in a total of 7 magazines and in the web and we expect that will be published in two more.

The list and the description of the magazines that published the articles are:

##### **LIBE. LA INDUSTRIA DE BIENES DE EQUIPO.**

Address: C/ Hermosilla, 75 – 1ª 13, 28001 Madrid.

Description: Monthly review

Target group: Equipment manufacturers.

##### **CARTA LOCAL. Revista de la Federación Española de Municipios y Provincias.**

Address: C/ Nuncio, 8., 28005 Madrid

Description: Monthly review.

Target group: Municipalities of Spain.

Number of copies: 19.000

##### **Cuadernos de Administración Local.**

Address: C/ Nuncio, 8., 28005 Madrid

Description: Monthly review.

Target group: Municipalities of Spain.

Number of copies: 9.000

**CONAIF 90.**

Address: C/ Antracita, 7., 28045 Madrid

Description: Monthly review.

Target group: Installers, plumbers and installation companies of gas, heating and others.

Number of copies: 17.000

**Madera y mueble en formación.**

Address: C/ Sagasta, 24., 28004 Madrid

Description: 4 numbers per year.

Target group: Forest Industry.

Number of copies: 10.000

**Noticias de climatización y refrigeración.**

**Internal bulletin of the Association ATECYR (Asociación Técnica Española de Climatización y Refrigeración)**

Address: This bulletin is printed by the Review "El Instalador". Industrias Gráficas El Instalador.

Description: 6 numbers per year.

Target group: Installers and installation companies of heating cooling and other.

Number of copies: 1.100

**O MONTE.**

Address: C/ Rúa do Vilar, 33, 1º., 15705 Santiago de Compostela

Description: 4 numbers per year.

Target group: Forest Owners and Farmers of the region of Galicia.

Number of copies: 3.000

**EL BOSQUE de Asturias.**

Address: C/ Cardenal Cienfuegos, 2. Escalera 1, 1º., 33007 Oviedo

Description: 4 numbers per year.

Target group: Forest Owners and Farmers and Forest Industries of the region of Asturias.

Number of copies: 3.000

**MONTES.**

**The articles will be published but they are not published yet.**

Address: C/ Cristobal Bordiú, 19 –21, 2º D., 28003 Madrid

Description: 4 numbers per year.

Target group: Forest Engineers of Spain.

Number of copies: 5.500

### **MONTAJES E INSTALACIONES.**

**The articles will be published but they are not published yet.**

Address: Editorial Alción, S.A., Edificio ECU, C/ Medea, 4., 28037 Madrid

Description: It has an edition of 11 numbers per year.

Target group: Planers, engineers, installers and companies in the building an engineering sectors.

Number of copies: 5.400

### **ENERGÍA.**

**The articles will be published but they are not published yet.**

Address:

INGENIERÍA QUÍMICA, S.A., Edificio ECU, C/ Medea, 4., 28037 Madrid

Description: It has an edition 6 numbers per year.

Target group: Planers, engineers, installers and companies in the building an engineering sectors.

Number of copies: 4.500

### **5.9.2 Information Brochure**

#### **Municipalities:**

Number of copies: 3.000

Dissemination: They were distributed as documentation in the seminars. They were distributed to the actors contacted in the BIOHEAT project and some of them in institutional diffusion. They rest will be distribute with a mailing to municipalities.

#### **Developers:**

Number of copies: 2.000

Dissemination: They were distributed as documentation in the seminars. They were distributed to the actors contacted in the BIOHEAT project and some of them in institutional diffusion. They rest will be distribute with a mailing to developers.

#### **Planners:**

Number of copies: 2.000

Dissemination: They were distributed as documentation in the seminars. They were distributed to the actors contacted in the BIOHEAT project and some of them in institutional diffusion. They rest will be distribute with a mailing.

### 5.9.3 Seminar

IDAE has realised two seminars to promote the use of biomass heating in blocks and buildings.

Seminar: **“Curso práctico sobre Instalaciones de Calefacciones alimentadas con Biomasa en Edificios y Bloques de Viviendas”**.

This seminar was realised in co-operation with the Forest Engineer Association with the following characteristics:

Date: 30/10/2002

Location: Colegio de Ingenieros de Montes, C/ Cristobal Boudiú 19 – 21, 2º D., 28003 Madrid.

Program: The program is attached in the following pages.

Target group: Forest engineers, forest actors (owners, industry, etc.), students, other actors involved (planners, installers, boilers manufacturers, etc.).

Promotion Media: The Forest Engineers Association sent the programme to all its members and also included it in the web of the association. IDAE sent the programme to all the actors contacted during the BIOHEAT project.

Number of participants: The seminar had a restricted number of participants (because of the size of the seminar room) of 35 persons. It was full and a lot of people can't assist because the number of request was higher than 35.

Other activities included in the seminar: During the afternoon and evening of the seminar's day it was offered the field trip, and the participants visited two plants in Madrid (described in the next chapter "Field Trips").

Reactions to the seminar: The seminar had a high qualification from the participants and from the speakers. It allowed the meeting of different actors involved in the biomass heating (planners, boiler manufacturers, biomass suppliers, customers, etc.) and also it was a very good media to give information about the biomass and this type of plants.

Seminar **“Uso de la biomasa en la calefacción de edificios y bloques de viviendas”**.

This seminar was realised in co-operation with the Association for the Housing of the Future (ANAVIF) with the following characteristics:

Date: 20/11/2002

Location: Centre Cultural Bancaixa, Pza. de Tetuán 23, Valencia

Program: The program is attached in the following pages.

Target group: Planners, housing development actors (developers, housing associations, etc.), students, other actors involved (installers, boilers manufacturers, etc.).

Promotion Media: ANAVIF sent the programme to all its members and also included it in the web of the association. IDAE sent the programme to all the actors contacted during the BIOHEAT project. It was published articles and advertisements in newspapers before the seminar to promote it. IDAE contacted with a regional TV "Canal 9" and the national TV "Tele 5" to come to the seminar. The two TVs realised interviews to some speakers (Christian Rakos and Luis García) and included them in their news programmes with



some imagines of the seminar. Also one radio channel came to the seminar and realised interviews to the speakers that were included in its news programmes. Reporters of different newspapers came to the seminar and published articles about it after the seminar.

Number of participants: 123 persons.

Reactions to the seminar: When the seminar finishes some people contacted IDAE looking for information about the biomass market and its applications. The days after the seminar some newspapers published articles about it and the use of biomass for heating buildings and blocks. Two television channels (one national TV, "Tele 5", and other regional TV, "Canal 9") included interviews of the speakers and pictures of the seminar in its programmes. One radio channel included interviews of the speakers in its programmes.

## **5.10 Sweden**

### **5.10.1 Targeted articles**

One article has been published in the periodicals: Energimagasinet, VVS Forum, Bioenergi and Bioenergy International.

Energimagasinet: Seven editions per year. The number of copies are 4 000. Target groups are district heating companies, manufactures of equipment in the energy sector, producers of biomass, consultants and others. For further information [www.energimagasinet.com](http://www.energimagasinet.com)

VVS Forum: Eleven editions per year. The number of copies are 15 700. The periodical target groups are plumbers. For further information [www.vvsi.se](http://www.vvsi.se)

Bioenergi: Sex editions per year. The number of copies are 3 000. The periodical target groups are companies in the biomass sector. For further information [www.novator.se](http://www.novator.se)

Bioenergy International is a new periodical. It is published in co-operation with AEBIOM, European Biomass Association. The number of copies are 8 000. It is distributed to the members of the bioenergy associations in Europe. The articles is also published on the site [www.bioenergyinternational.com](http://www.bioenergyinternational.com)

The reaction of the articles has been positive. Many have called and discussed the topics in the articles. They have also ordered brochures and some have announced that they would like to participate in the seminar.

### **5.10.2 Information Brochure**

The brochure "Wood fuels – sustainable heat for public buildings" is printed in 3 000 copies.

The brochure "Wood fuels – for residential buildings" is printed in 3 000 copies.

The brochure "Heating large buildings with wood fuels" is printed in 1 000 copies.

Brochures have been disseminated to The Tenant-owners Association, Swedish Boiler and Burner Association, The Plumbers Association, The Swedish Association of Local Authorities, The National Association of Swedish Architects, The Swedish Construction

Federation, Federation of Swedish Farmers and in Swedish Bioenergy Associations network. Brochures have also been disseminating to participants in the seminar.

SVEBIO disseminated in the first step around 10-20 copies of each brochure to the associations. The associations have then possibility to order more when they send information to their members or arrange conference/seminars. SVEBIO think it is a good and efficient way to disseminate the brochures. SVEBIO really tried to avoid that the brochures just will be storage at some of the associations.

They have order brochures, so it has been no problem to disseminate them to the target groups. At the moment we have disseminate a majority of the brochures. The order keep on coming so the brochures will soon be out of stock. The respond has been very positive SVEBIO will also disseminate the brochures as PDF-flie.

Please find attached copy of each brochure.

### **5.10.3 Seminar**

SVEBIO arranged one seminar in co-operation with The Swedish Association of Local Authorities and the municipality of Kristianstad. The seminar took place on 30 September, 2002 in the city Kristianstad. SVEBIO bought a register of addresses from The Swedish Association of Local Authorities. Invitations were sent to around 1 300 civil servants in municipalities in Sweden.

The municipality of Kristianstad is an example of communities having made real efforts to replace oil by pellets for the heating of public buildings.

The municipality of Kristianstad issued a policy for environment and energy to reach the goal of no fossil fuels. This was a success and the municipality was awarded an EU prize for the best provincial community energy policy and also an honourable mention in the national competition for best ecological community.

In Kristianstad 43 boilers in public building systems have been converted to pellets firing and these conversions have been carried through outside the district heating system. The plants lie within the range of 50 – 350 kW. The conversion was mainly achieved by replacing oil burners by pellet burners. By doing this about 1000 m<sup>3</sup> of oil have been replaced by 2 100 ton pellets meaning a reduction of carbon dioxide emissions of almost 3000 tons a year.

The idea was to arrange a seminar in Kristianstad, because of the experience and knowledge in the municipality. Civil servants at the municipality, who have been involved in the projects, did keep lectures. The participants had the opportunity to listen to lectures about the biomass market in Sweden, possible subsidies, experience from the different converting project, purchasing of equipment, grid or not grid and about particle emission from biomass combustion.

The number of participants was 21. It was a disappointment, but those who attended the seminar were really interested. Many of them had project in progress or were really interested to start a project. Since the group was not so big it also became a good opportunity to exchange experience among the participants. It was quite many who called before the seminar and said that the programme is interesting. But they did not have afford to visit the seminar. It is problem when you try to invite civil servants in municipalities. The municipalities often have lack of money.

The seminar was received positive. Many of the participants expressed that it was a good idea to “convey real experience from the municipality to the participants”.

#### 5.10.4 Field Trips

SVEBIO has carry through one international field trip and one national field trip.

**The international field trip** was arranged in conjunction with the “The First World Conference on Pellets. SVEBIO also invited people from Sweden to this field trip. The field trip took place on 5-6 September 2002. The number of participants were 37. The participants were from 11 different countries. The reactions from the them were positive. They especially appreciated the wide range in the programme. Forssjö Bruk (pellet producers) had assembled all manufactures of pellet equipment. The reaction of this initiative was very positive. Some of the participants thought they spend too much time in the bus.

Locations visited at the international field trip:

FORSSJÖ BRUK leases and manages the Ericssberg estates in the municipality of Katrineholm. In addition to forestry, farming and estate management, the company also runs a sawmill and a wood pellet production plant. The biomass plant that we visited was taken into operation in 1995 and is integrated with the sawmill, where heat is used for drying timber and sawdust for wood-pellet production. The production capacity is about 45 000 tons per year.

The participants had opportunities to meet with representatives of the following areas of technology: Pellet production, plastic wrapping (16 kg), combustion, biomass drying, hot water production and distribution.

THE HÄSSELBY POWER PLANT owned by Fortum Power and Heat AB is situated by the shore of Lake Mälaren and is the first co-generation power plant in Stockholm. The plant is connected to one of Stockholm’s district heating networks and operates three 100 MW boilers. The fuel, mainly wood-pellets, is delivered by ship to large automatic storages at the quay.

SAHLINS ECOTEC demonstrated a 200 kW boiler converted to pellet burning for use in a moderate-size facility. This kind of pellet burner installation is a cost-efficient and common solution in Sweden. 800 pellet burners in the range of 25- 300 kW have been installed in Sweden.

At the SP SWEDISH NATIONAL TESTING AND RESEARCH INSTITUTE the visit focused on testing pellet burners and stoves. The participants were able to view their modern test laboratories and hear more about their latest research projects, for example particle emission from biomass combustion. They also received information about the Swedish system for quality certification and quality control of small burners, boilers and stoves for pellets, the so called P-mark testing system.

BORÅS ENERGI showed a a medium size 1.75 MW automatically operated pellet boiler integrated into a residential area.

**The national field** trip took place in conjunction with seminar in the municipality of Kristianstad on 30 September. The number of participants was 21 from. The majority was from municipalities.

The municipality of Kristianstad was host for this field trip. In Kristianstad 43 boilers in public building systems have been converted to pellets firing and these conversions have

been carried through outside the district heating system. The plants lie within the range of 50 – 350 kW.

The participants had the opportunity to visit two oil boilers at two different schools (Nosaby and Kulltorp), which had been converted to pellet: The size of this two plants was 250 kW and 200 kW.

The participants thought it was very interesting to see the plants and also to learn about the municipality's experience.

#### **5.10.5 Telephone hot line**

The telephone hot line was announced in the articles, by the website, e-mail, conferences, seminar We have received phone calls. SVEBIO will continue offer advice and support after the project is finished

## 6 Reflections on the project

This chapter presents reflections from the participants collected by a brainstorming session during the final workshop of the project. These reflections are open and uncensored and are presented to give the reader an opportunity to learn from mistakes made and problems encountered.

### 6.1 Positive aspects of the project

The following **general aspects** of the project were particularly appreciated by the participants:

- Clear focus of the project
- Appropriate timing
- International contacts and exchange of experiences
- The orientation phase was particularly useful

Positive aspects regarding the **results** of the project were:

- The project has contributed significantly to raise awareness
- It has improved the insight of the participants into the market potential and the barriers that need to be tackled
- The approach to learn from successful countries to avoid mistakes was very useful
- The website is a powerful tool to provide updated information to the target groups

### 6.2 Problems in the project

Internal communication between the 10 partners was unsatisfactory. The main points criticised were:

- No rules had been set up for communication
- Emails from the co-ordinator or other participants were frequently not answered or answered with large delay
- Changing persons responsible for the project led to information gaps and communication failure
- There should have been at least one more meeting during the productive phase

Another problem was the variation of the quality of contributions from the participants. One reason for this fact might have been the lack of sharply defined standards for the contributions.

Brochure production was another issue: the time needed to design and produce the brochures was grossly underestimated in the resource calculations. As a consequence the master copies provided by the co-ordinator came significantly delayed. In addition the national adaptations took longer than expected. As a consequence the brochure were disseminated close to the end of the project.

Unfortunately the Commission insisted in reducing the running time of the project. As a consequence of increased time for information production and decreased running time the idea of giving start up support to persons reacting on the information activities did not materialise.

The contribution of the Commission to the budget was only 33%. This low contribution was another serious problem for several partners.

### **6.3 Lessons learned**

Fundamental preconditions for successful project management are sufficient resources both regarding time and finances. If timing is not realistic discipline to meet deadlines will deteriorate. If resources are too low there will be a lack of engagement.

Management of the project must be strict in several ways: sharp discipline regarding deadlines, clear and commonly agreed rules for communication and sharply defined requirements for deliverables are necessary to ensure a homogenous quality of contributions.

To improve internal communication and give all partners a feeling for what is going on a regularly issued project newsletter might be useful, that gives monthly accounts on what has actually been done by each of the partners.

## 7 ANNEXES

Annex A	Information brochure for developers
Annex B	Information brochure for municipalities
Annex C	Information brochure for consultants and heat service companies
Annex D	Targeted publications
Annex E	Seminar material

All the annexes are enclosed separately to this report.