NAEMI Biomass & Business Training Workshop

May 15-19, 2006 Oxford Suites

Spokane, Washington.

U.S.A.

John Olsen

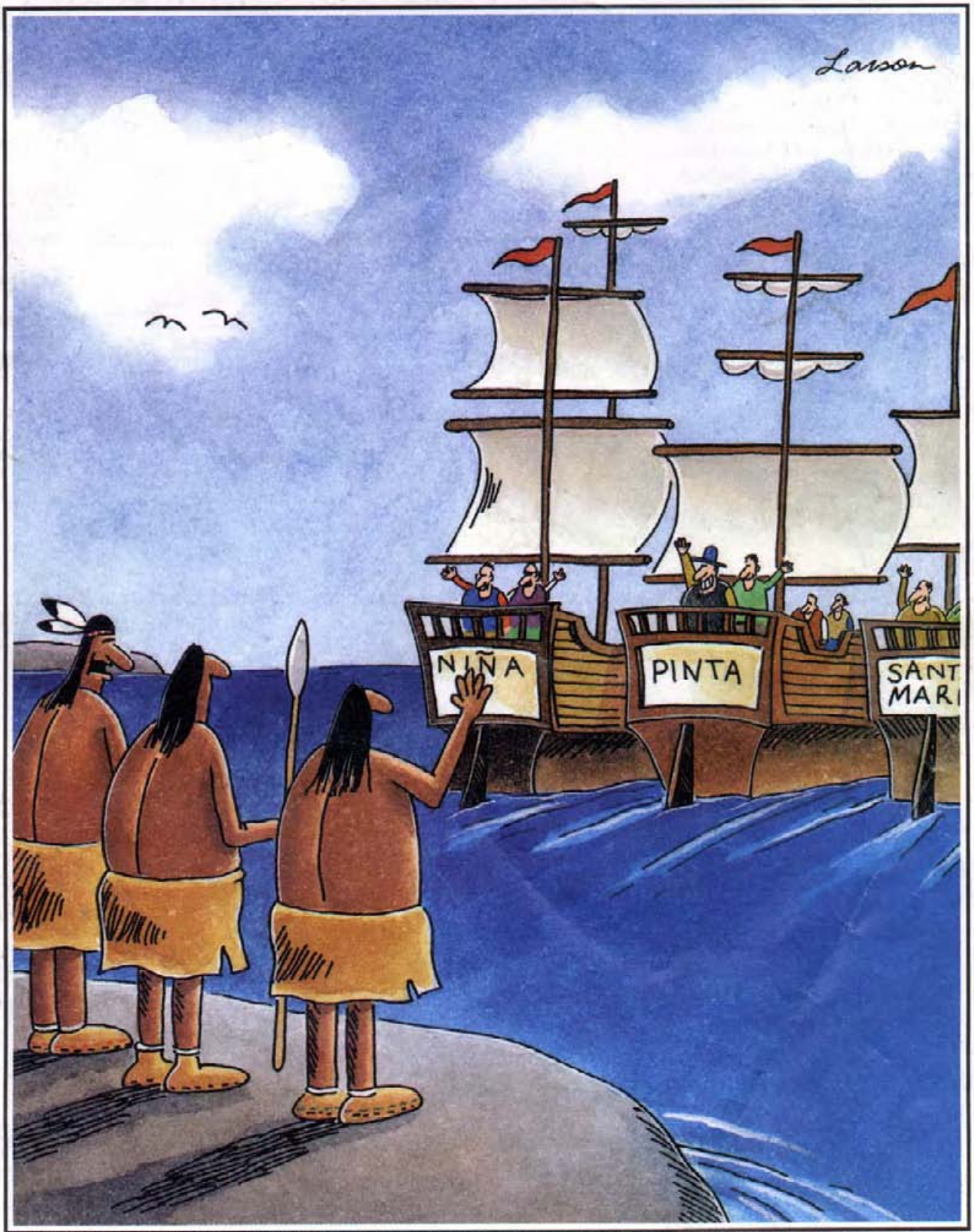
Cree Industries

200 – 100 Park Royal South.

West Vancouver, B.C.

CANADA

cree@dowco.com



Did you detect something ominous in the way they said "See ya later?"

cree@dowco.com

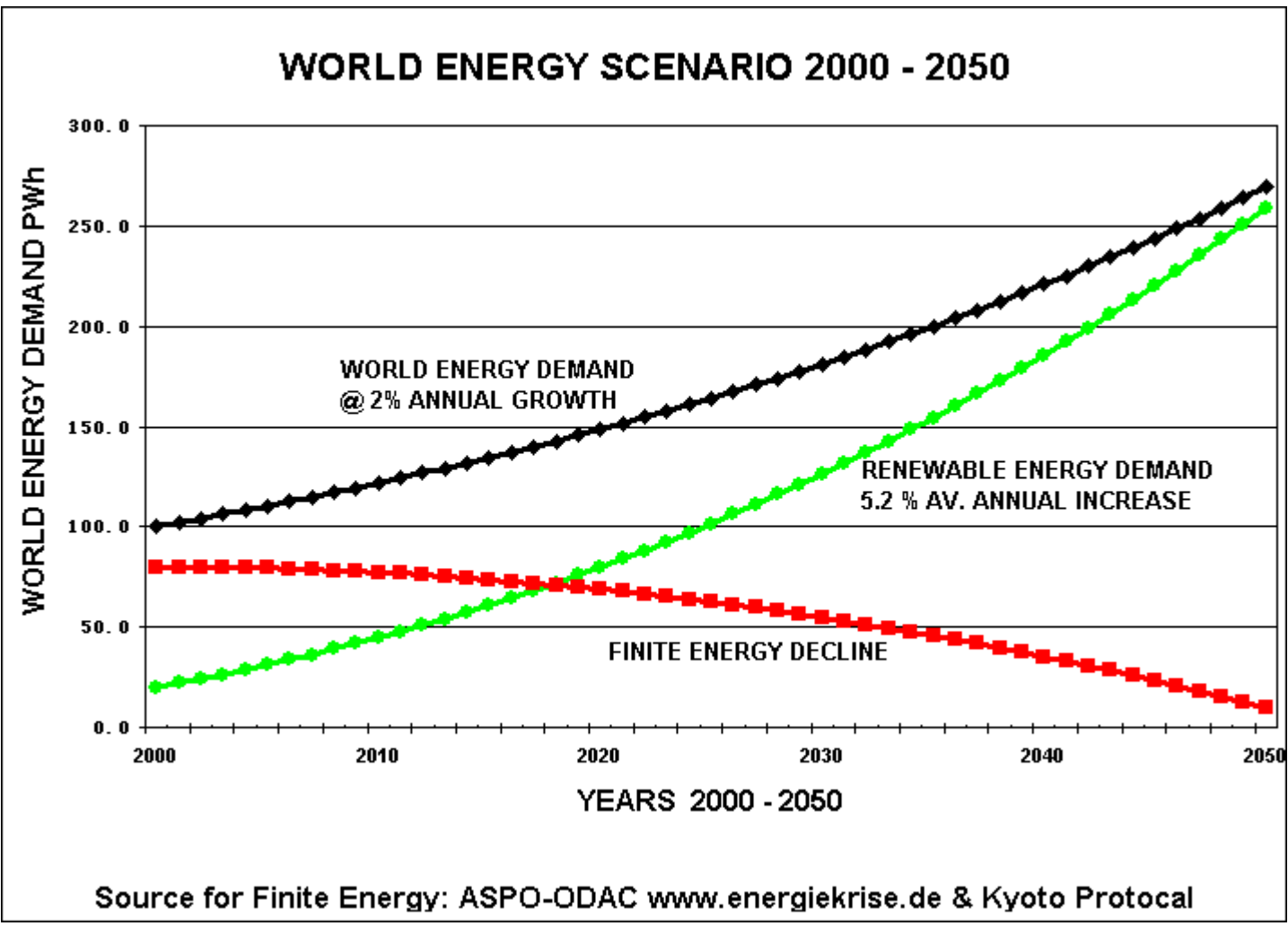
My name is John Olsen, and I am a member of the Peguis 1st nation, Manitoba, Canada.

Thank you for allowing me this opportunity to present this brief overview, of extruding Biomass into a solid fuel, utilizing the SHIMADA extruder.

I believe, that producing smokeless fuel, used for heat and cooking, will provide an interesting and lucrative future, to Tribes, and Bands, across North America.

Providing year-round employment and establish an industrial base for future generations, involving us all, in a renewal resource.

cree@dowco.com



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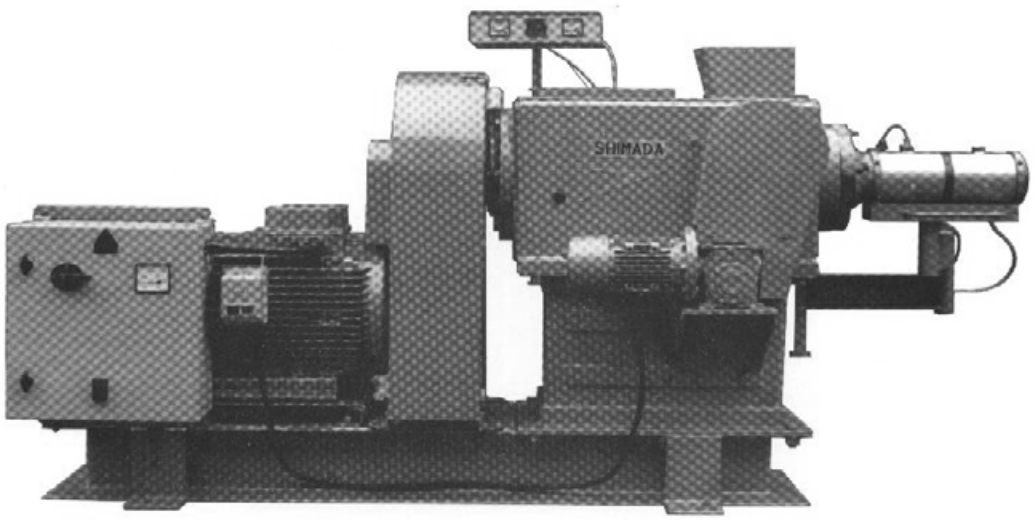
BIOMASS EXTRUDED into SOLID FUEL



The SHIMADA

A proven machine over 1500 in use

Worldwide

40 years in operation

John Olsen

cree@dowco.com

The **HEATLOG®**

cree@dowco.com

The SHIMADA

460 volts, 3 phase power, add dry sawdust,

and Logs will be extruded

cree@dowco.com

cree@dowco.com

cree@dowco.com

cree@dowco.com

The HEATLOG®

After Logs cool they can be easily packaged.

cree@dowco.com

cree@dowco.com

The SHIMADA Screw

cree@dowco.com

HEATLOG®

Winter Fuel

Octagonal

10" long,

2 ¼" wide,

½" center hole

SIZZLERS ®

Summer Fuel

For charcoal type

Barbecues

HEATLOG®

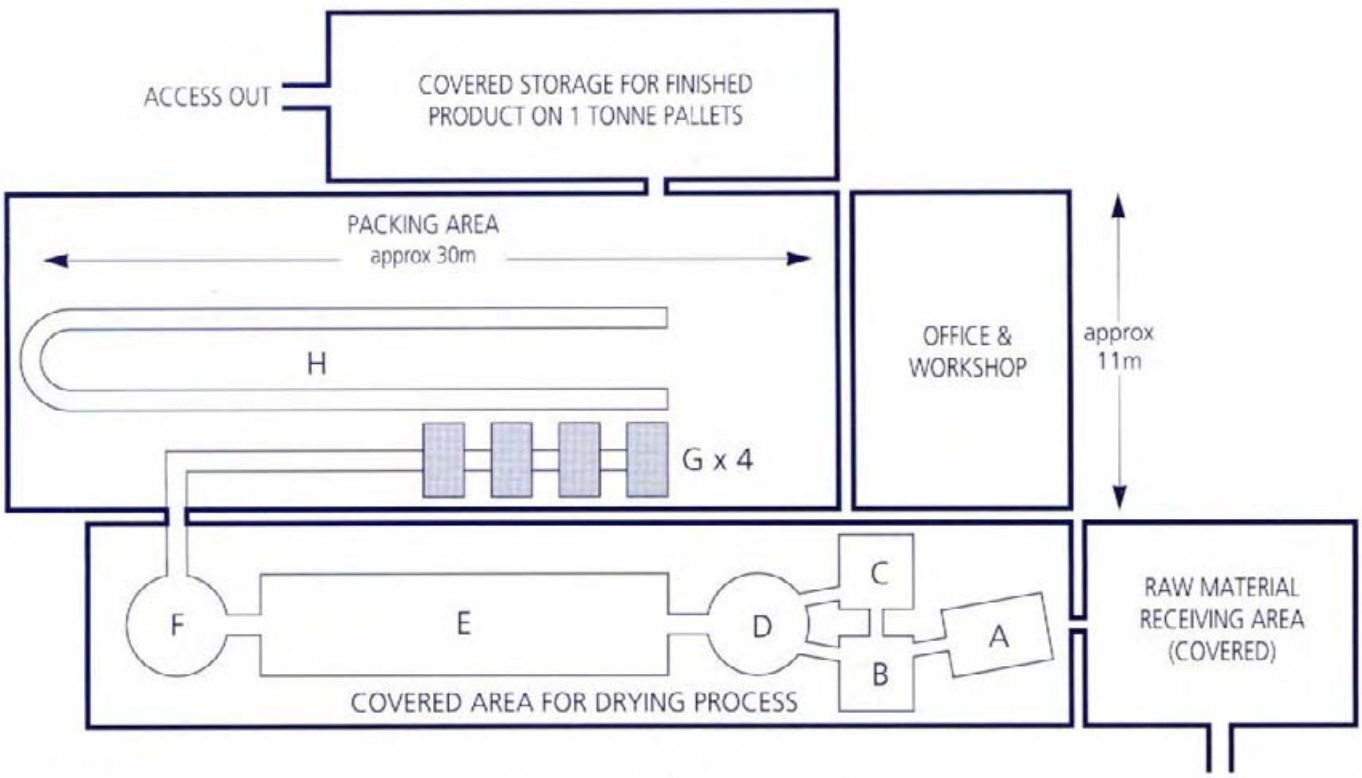
Cooling

Banding in 12 packs

Pallets ready for shipment

typical factory layout

The **HEATLOG®**



A V BIN > flow to
B SCREEN >
C HAMMERMILL >
D WET BIN >
E DRIER >
F DRY BIN >
G EXTRUDER PRESSES >
H CONVEYOR BELTS (COOLING)

HEIGHT OF MAIN BUILDINGS
5-6 METRES
DRYING AREA
10 METRES

HEATLOG®

Wood Characteristics

Softwoods	BTU / lb
Cyprus Western Red	9700
Cyprus yellow	9900
Douglas Fir	9200
Fir Balsam	8616
Fir (unspecified)	8300
Hemlock Western	8500
Larch Western	8530
Pine Jack	8500
Pine Lodgepole	8600
Pine ponderosa	9100
Spruce Sitka	8100
Spruce white	8500
Hardwoods	
Alder red	8000
Aspen trembling	8610
Birch white	9340
Cottonwood black	8800
Maple broadleaf	8400
Poplar (unspecified)	8615

Canada has a real problem, where a small beetle is killing the pine forests of British Columbia, to the tune of 1 Billion 200 million cubic metres, dead to date.

With 7 pellet production mills in operation, a huge industry is racing to produce biomass pellets, for the insatiable needs, of the European community. I understand that the production is sold out for the next 4 years.

The extruded log "Heatlog", is really a big pellet with a central hole, which can be used in any wood burning fireplace, stove, boiler or barbecue burner.

cree@dowco.com

In a screw extruder, the rotating screw takes the material from the top hopper, through the barrel, and compacts it against a die which forces a build-up of a pressure gradient along the screw.
During this process the biomass is forced into intimate and substantially sliding contact with the barrel walls. This also causes frictional effects due to shearing and working of biomass.
The combined effects of the friction caused at the barrel wall, the heat due to internal friction in the material and high rotational speed (approx 660 rpm) of the screw cause an increase in temperature in the closed system which helps in heating the biomass.
Then it is forced through the extrusion die, where the briquette with the required shape is formed.
At this stage just before entering the die, the pressure exerted is maximum.
At the compression zone, the biomass material becomes relatively soft due to high temperature (200-250 °C). In the process, due to loss of elasticity, it is pressed into void spaces and as a result, the area of interparticle contact increases.
When the particles come together they form local bridges which selectively support and dissipate the applied pressure.

cree@dowco.com

Interlocking of particles may also occur.
The moisture gets evaporated to steam at this stage and helps in moistening the biomass.
The biomass gets further compressed in the tapering die to form the briquette.
In this section, removal of steam and compaction take place simultaneously; the pressure exerted transmits throughout the material giving uniform pressure, and therefore, uniform density throughout the briquette.
The speed of densification determines the relative importance of the various binding mechanisms.
The aim of compaction is to bring the smaller particles closer so that the forces acting between them become stronger which subsequently provides more strength to the densified bulk material.
Effect of moisture… The percentage of moisture in the feed biomass to extruder machine is a very critical factor. When the feed moisture content is 8-10 %, the briquettes will have 6-8% moisture.
At this moisture content, the briquettes are strong and free of cracks and the briquetting process is smooth.
The shiny surface is caused by partial plasticizing of the lignin in the wood due to high pressure and the evaporation of terpenes during the production process. Making the handling of the finished "Heatlog", very clean, and easy to use by the consumer.

cree@dowco.com

Excel file **for example only, E&OE**

Cree Industries			
Cost approximate for discussions only			
U.S.A. $ dollars			
hours per day	**10**	**year 1**	**year 2**
days per year	**220**	**220**	**220**
total hours year (d)	**2200.00**	**2200**	**2200**
1/2 tonne hour (d) divided by 2)	**1100.00**	**1100**	**1100**
number of machines	**1**	**USA $**	**USA $**
cost of one SHIMADA	**$74,000**		
	machine to buy	**$74,000.00**	**$0.00**
delivered dry 8% moisture content sawdust	**per ton**	**$30.00**	**$30.00**
Factory labour 2 men	**per ton**	**$38.47**	**$38.47**
Factory rent	**per ton**	**$2.79**	**$2.79**
Factory power	**per ton**	**$15.61**	**$15.61**
Factory insurance	**per ton**	**$2.23**	**$2.23**
Factory maintenance	**per ton**	**$2.79**	**$2.79**
Factory packaging	**per ton**	**$22.97**	**$22.97**
Factory total (a)	**per ton**	**$114.86**	**$114.86**
Number of Heatlogs 2 lb's each (b)	**per ton**	**1,000**	**1,200**
Factory Produces	**tons per year**	**1,100.00**	**1,100.00**
One Heatlog cost to produce	**(a) divided by (b)**	**$0.1149**	**$0.0957**
One Heatlog Wholesale at 2 times cost	**estimated**	**$0.2297**	**$0.1914**
Factory cost	**per year**	**$200,346.00**	**$126,346.00**
Factory wholesale	**per year**	**$252,692.00**	**$252,692.00**
GROSS profit	**per year**	**$52,346.00**	**$126,346.00**
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cree@dowco.com

Moving sawdust

cree@dowco.com

BIOMASS

Heatlogs can be made from a variety of biomass materials, such as: Sawdust, Sugar Cane residues, Rice Husks, Palm Oil residues, Sunflower husks, Coconut husks, Olive Pits, etc.

FEEDSTOCK

Drying and/or grinding of the biomass may be needed to prepare the feedstock to specification. Moisture content of the raw material must be between 4 - 8 %. Average particle size of the raw material must be between 2 - 6 mm (can include 20% fine particle dust).

HEATLOG®

Dense 1.25 tonnes per cubic metre and does not expand at all when burning leaving low ash content.
At no time are any additives, waxes or foreign bodies introduced.
Heatlogs are made by extruding biomass under pressure. Bonding is accomplished by utilising the natural lignins in the biomass and the heat generated by extrusion.

<u>BIOMASS is</u>

68 - 83% carbohydrates.
15 - 30% lignin (a polyphenol).
3 -7% extractives.

The SHIMADA extruder

Length 77”
Width 30”
Height 52”
Weight 2227 lbs
Power 60 hp
Revolutions 660 rpm

PRODUCTION

1102 lbs hour

Please contact
John Olsen
cree@dowco.com

More than a third of humanity, 2.4 billion people, burn biomass (wood, crop residues, charcoal and dung) for cooking and heating.

When coal is included a total of 3 billion people half the world's population cook with solid fuel.

In Agenda 21 the United Nations,

and its member states, have strongly endorsed the goal of sustainable development, which implies meeting the needs of the present without compromising the ability of future generations to meet their needs.

Energy produced, and used in ways, that support human development, over the long term, in all its social, economic, and environmental dimensions, is what is meant by the term

SUSTANABLE ENERGY

Source; United Nations World Energy Assessment

cree@dowco.com

Potential Source of Raw Material

Characteristics of waste wood from different source

Generally wood briquettes are composed of dry or dried wood waste, mainly shavings and sawdust from timber processing and manufacturing operations, which has been mechanically compressed together.

Hard or soft woods can be used alike; it is the cellulose that is burnt, so in reality any cellulose material can be used.

cree@dowco.com

Other organic materials could also be considered for processing.

This could be in the form of paper or cardboard, or moving away from waste we could consider other crops grown as biomass such as Miscanthus or residue from flax or Hemp processing.

Some recommendations have pointed towards fragranced briquettes, where briquettes are impregnated with some form of chemical, such as vanilla, so they release a subtle fragrance whilst burning.

cree@dowco.com

The Potential for Wood Briquettes

The use of wood as a fuel is favored environmentally as it does not contribute to net greenhouse gases emissions, as the carbon released during burning is merely that which was fixed as the tree grew.

According to British BioGen (2001), "densified wood fuels such as Pellets and Briquettes are ultimately likely to be the predominant bio fuels in UK domestic heating markets".

Sweden is quoted as an example where pellets sales have risen from virtually nothing in 1990 to over 800,000 tonnes annually today.

cree@dowco.com

The use of solid recovered fuels is consistent with the promotion of the waste hierarchy in Europe. They offer a local and environmentally-friendly alternative to importing highly polluting fossil fuels, and their use is expected to increase significantly.

Currently Europe's main policy targets on energy are:

1. Meeting Kyoto objectives (through an 8-per cent reduction in CO_2 emissions between 2008 and 2012 compared to 1990)

2. Doubling the share of renewable energy sources (from 6 to 12% of gross inland energy consumption)

3. Improving energy efficiency (an increase of 18 per cent by 2010, compared to 1995)

4. Maintaining security of supply.

cree@dowco.com

Energy cannot be created or destroyed, but it can be converted from one form to another.

Energy also can be measured in joules.

Joules sounds exactly like the word jewels, as in diamonds and emeralds.

A thousand joules is equal to a British thermal unit.

1,000 joules = 1 Btu

exajoule = quintillion (10^18) joules

The term "joule" is named after an English scientist James Prescott Joule who lived from 1818 to 1889.

He discovered that heat is a type of energy.

cree@dowco.com

Every hour, enough sunlight energy reaches the Earth to meet the world's energy demand for a whole year.--- U.S. Department of Energy ---

The amount of energy from the Sun that reaches the Earth annually is 4×10^{18} Joules.

4×10^{18} Joules/ Year ÷ 365 Days/Year = 1×10^{16} Joules/ Day ÷ 24 Hours/ Day = 4×10^{14} Joules/ Hour

The amount of energy consumed annually by the world's population is about 3×10^{14} Joules.

cree@dowco.com

Renewable Energy sources supply 14 percent of the total World Energy demand.

The supply is dominated by traditional biomass used for cooking and heating, especially in rural areas and developing countries.

cree@dowco.com

Energy Security

means the availability of Energy at all times, in various forms in sufficient quantities, at affordable prices.

These conditions must prevail over the long term, if Energy is to contribute to sustainable development.

cree@dowco.com

The oldest human energy technology, the home cooking fire, persists as the most prevalent fuel-using technology in the World.

For most of the World's population, the home cooking fire, accounts for most direct energy demand.

cree@dowco.com

The world's population has increased explosively over the past 100 years.

"It took the world population millions of years to reach the first billion, then 123 years to get to the second, 33 years to the third, 14 years to the fourth, 13 years to the fifth billion" (Sen,1994).

Additions to the population have been unprecedented:"Between 1980 and 1990, the number of people on earth grew by about 923 million,

Crop residues, consist of a wide variety of materials, many of which do not have much value as fertilizer or soil conditioner. Indeed, in some cases disposal becomes a serious problem if these residues are not gathered for fuel. In these cases the usual practice is to burn the residues in place on the fields, with consequent pollution implications.

In Canada and some Northern States, it has been suggested that the Flax stubble be extruded into "Heatlogs", because the annual burn of this in the field, blankets the prairie cities in smoke.

cree@dowco.com

Renewable energy sources can meet many times the present world energy demand, so their potential is enormous. They can enhance diversity in energy supply markets, secure long-term sustainable energy supplies, and reduce local and global atmospheric emissions. They can also provide commercially attractive options to meet specific needs for energy services (particularly in developing countries and rural areas), create new employment opportunities, and offer possibilities for local manufacturing of equipment.

Annual
Global
Primary production
of
Biomatter
220 Billion Oven Dry Tonnes
Or
4500 Exajoules

Ref http://www.un.org/Pubs/textbook/e00149.htm

cree@dowco.com

The world derives about 11 percent of its energy from biomass.

In developing countries biomass is the most important energy source, accounting for about 35 percent of the total .

(In the largest developing countries, China and India, biomass accounts for 19 percent and 42 percent of the primary energy supply mix.)

But in the world's poorest countries, biomass accounts for up to 90 percent of the energy supply, mostly in traditional or noncommercial forms.

This explains why biomass is often perceived as a fuel of the past—one that will be left behind as countries industrialize and their technological base develops.

But biomass resources are abundant in most parts of the world, and various commercially available conversion technologies could transform current traditional and low-tech uses of biomass to modern energy.

cree@dowco.com

Biomass is a rather simple term for all organic material that stems from plants trees, and crops. Biomass sources are therefore diverse, including organic waste streams, agricultural and forestry residues, as well as crops grown to produce heat, fuels, and electricity (energy plantations). Biomass contributes significantly to the world's energy supply—probably accounting (9–13 percent of the world's energy supply. Its largest contribution to energy consumption—on average between a third and a fifth—is found in developing countries. Compare that with 3 percent in industrialized countries

cree@dowco.com

Technologies for biomass fuel upgrading (into pellets or briquettes,) are advancing, and the development of dedicated energy crops will also improve fuel standardization.

For biomass to become a major fuel, energy crops and plantations will have to become a significant land-use category.

Land requirements will depend on energy crop yields, water availability, and the efficiency of biomass conversion to usable fuels.

cree@dowco.com

Sweden is probably the world leader in creating a working biomass market. Its use of biomass for energy purposes—domestic heating with advanced heating systems, district heating, and combined heat and power generation—has increased 4–5-fold in the past 10 years. And the average costs of biomass have come down considerably. Swedish forests have met this growing demand with ease. The growing contribution of biomass has been combined with a big increase in the number of companies supplying wood and wood products and in the number of parties using biomass. As a result, competition has led to lower prices, combined with innovation and more efficient biomass supply systems. Some 14,000 hectares in short rotation willow plantations have been established. Sweden also imports some biomass, which make up only a small part of the total supply but keep prices low. Sweden plans to increase the 20 percent share of biomass in the total primary energy supply to 40 percent in 2020, largely by extending and improving the use of residues from production forests and wood processing industries.

TABLE 11.1. PRIMARY ENERGY CONSUMPTION BY REGION, 1987 AND 1997 (EXAJOULES)

Region	1987	1997	Total increase	Annual percentage increase
United States and Canada	86	101	15	1.7
Europe	74	76	2	0.2
Former Soviet Union	58	38	–20	–4.1
South and Central America (including Mexico)	15	20	5	3.4
Middle East	10	15	5	4.6
Africa	8	11	3	3.0
Asia and Pacific (including Japan)	64	101	37	4.8
Total	**315**	**362**	**47**	**1.5**

Note: Converted at the rate of 1 billion tonne of oil equivalent energy = 43.2 exajoules.

Source: BP, 1998.

cree@dowco.com

cree@dowco.com