UR 1946/6-29

REPORT ON PEAT, LIGNITE AND BROWN COAL DEPOSITS ON KING IS.

Carbonaceous deposits of three types occur on King Island : -

(a) Brown coal of Miocene age in thin seams.

(b) Immature lignite of quaternary age under sand dunes.

(c) Peat swamps belonging to the present cycle of sedimentation.

Of these the only deposit which can be considered as a potential industrial or domestic fuel is the peat deposit known locally as Pearson's Swamp.

Brown Coal on R.H. Hooper's Property

Brown coal was first reported on King Island in 1930 by Mr. R.H. Hooper who struck a thin seam while sinking a well on his property in the Sea Elephant River district (King Island 27/17). A sample was sent to the Department of Mines where it was identified as lignite.

The writer visited the well on January 18th, 1946, and arranged for it to be pumped out. The well is timbered to the bottom, which was obscured by eighteen inches of muck. This was cleaned out and the brown coal found as reported at the bottom. The following section was measured downwards below the timber: -

Lignite	4"
White Clay	6"
Carbonaceous sandstone	1"
Lignite	6"
Carbonaceous sandstone	1"
Clay with pyritic nodules	3"
White clay	6"
	2' 3"

The top of the lignite is 19'9" below the windlass. The series dips approximately S 20^{0}W at 3^{0}. Sample 5C16 was collected across both seams, exclusive of the separating band.

The Chief Chemist of the Department of Mines gives the following proximate analysis of sample 10C16 :-

Moisture at 105^{0}C	13.0 %
Volatile combustible matter	34.5
Fixed carbon	33.9
Ash	18.6
Sulphur	0.62
Calorific value	7990 B.T.Us. per. lb.

What is probably the same seam occurs at a similar depth in a well on Mr. Richard's property adjacent to Mr. Hooper's.

These brown coal seams are much too thin to be of any commercial value. They are probably of Miocene age, and appear to belong to the same basin as a number of occurrences of polyzoal limestone on King Island. The limestone appears to form the base of the Miocene basin, so it is probable that a bore put down on Hooper's or Richard's property would pass through the limestone before entering the older Palaeozoic rocks. Owing to the rarity of outcrops on King Island, evidence on which to determine the boundaries of this basin is very fragmentary.

The limestone outcrops prominently on a block in the name of M. Keys (King Island 14/19) on the foreshore of Sea Elephant Bay near the mouth of Blowhole Creek about four miles north of Naracoopa. At this point several samples were collected and the following section was measured :-

Hard bryozoal limestone 7'	Sample 6C16
Friable bryozoal limestone 1'	" 6C20
Impure concretionary limestone and marl, with pelecypods, echinoids, and bryozoa 3'	Samples 6C17, 6C18, 6C19.

The series is sub-horizontal.

Similar limestone also occurs in the upper part of the Sea Elephant Valley between the Frazer and Pegarah roads on Mrs. Adams' 36 acre block in the name of Misson (King Island 12/3.) Samples 5C1 and 5C15 were collected from this locality.

I have informed by Mrs. Adams that similar limestone occurs in Punchbowl Creek, a tributary of Sea Elephant River, and was struck in a well on A.E. Brown's block (King Island 10/18).

It has also been reported by Debeham* to occur on the creek flowing into the marsh connected to Seal Lake, and is shown on his map. According to Debenham, a thickness of about twenty feet only is visible, dipping slightly to the west. The length of outcrop is only about forty feet, the rest being hidden under sand and detritus. The upper strata are composed of fine broken shell sand, very hard and very cemented, and the lower of coarse fragmental material with complete shells and pebbles of schists and quartzites of the early Palaeozoic rocks.

From the distribution of the limestone outcrops it is apparent that there is a shallow but fairly extensive basin of Miocene sediments with thin brown coal seams in the Sea Elephant Valley, and a smaller independent basin in the south of the island. Thicker seams of brown coal than those so far seen might occur in the basin and could be prospected for by shallow drilling, but the coal is not of sufficient quality to warrant underground mining.

Reported Brown Coal near Lake Martha Lavinnia

A report had been received that material resembling brown coal had been seen several years ago by Chas. Button in the vicinity of Lake Martha Lavinna. Mr. Button kindly agreed to accompany me to the spot. At the point on the east of Penny's Lagoon and south-east of Lake Martha Lavinnia, we found the material previously seen by Mr. Button. It is an immature lignite, formed by

*Debenham: "Notes on the Geology of King Is., Bass Straits." Proc. Roy. Soc. N.S.W. 1910.

the burial of a Quaternary peat deposit by encroaching sand dunes. It now occurs at the base of the dunes and is being dissected by the sea. The deposit extends along the coast for about half a mile, and lenses out in each direction and is replaced by "coffee rock." Most of the peat is of very poor quality, and even the best of it is poor, and with its present overburden is of no commercial value. A sample (2C3) detached from this deposit by the waves and washed up on the beach, collected on a previous visit was examined by the Chief Chemist of the Department who reported that it contains 11.40% moisture and 34.30% ash.

Peat Deposits

Several peat deposits of Quaternary age occur in the northern half of King Island. They are in order of size :-

Egg Lagoon
South-East Lagoon
Reedy Lake
Pearson's Swamp
An area behind Sea Elephant Bay on
L.Livingstone's block (King Island 27/11)
A small area on Camp Creek near Currie

All these deposits were formed in the recent past through the blockage of drainage by moving sand hills, which resulted in the formation of lagoons. The subsequent dense growth of aquatic plants accumulated as peat. The only deposit which offers any prospect as a source of fuel is Pearson's Swamp.

Peat at Egg Lagoon.

Egg Lagoon has an area of about four and a half square miles, and following artificial drainage has become the most valuable stretch of pastoral land on the island. True peat only occurs in a limited area in the western part of the basin. Table 1 shows a series of analyses of the peat and soil of Egg Lagoon. Three of these were collected by the writer and analysed in the laboratory of the Department. The others were collected by Stevens and Hosking and analysed in the C.S.I.R. laboratories, and described in Bulletin No. 70 of the C.S.I.R. The samples were taken along the centre of the lagoon, at varying distance from the main road. The positions of the samples are shown on the map accompanying this report.

At 16 chains from the main road, the peat is fourteen inches deep and has 46.5% of ash. At 45 chains from the main road it is over 8 feet deep and averages 42.8% of ash. The ash content is less in the deeper layers. At 115 chains from the road the peat is not developed, but the surface soil is quite peaty. The ash content of the Egg Lagoon deposit is too high to be considered of value as commercial fuel.

A good deal of the ash is in the form of fine powdery calcium carbonate, which increases in some places to nearly 50% in the layers below the peat. Gypsum is also present in the loams below the peat.

The soils which come to the surface towards the eastern half of the lagoon are older than the peat and probably extend at depth beneath it. Marine shells were shown to me by Mr. Haines collected at a depth of 16 feet from the southern part of H.B. Holland's block (King

Debenham: "Notes on the Geology of King Is., Bass Straits." Proc. Roy. Soc. N.S.W. 1910.

Island 34/42) about 2½ miles east of the main road. Bones of Diprotodonts and other marsupials were found during the cutting of the drainage canal on J. Haine's 500 acre block (King Island 34/18) at a point about 148 chains east of the main road. These fossils are all older than the peat deposit.

South East Lagoon

South-east lagoon does not contain true peat although the surface soil is a peaty loam. The following succession is reported by Stevens and Hosking.

Depth in Inches	0-8	8-41	41-80
Moisture %	3.0	3.2	3.3
Combustible matter %	5.3	6.1	3.4
Ash %	91.7	90.7	93.3
Colour	Black	Dark Grey	Grey
Description	Peaty loam	Sandy loam	Sand

Reedy Lake

There is no peat in this swamp although the top foot contains a good deal of humus. Stevens and Hosking report that the brown subsoil loam changes to a sandy clay with depth and at 65 inches a lignitic layer is encountered. No analysis of this material is avaiable, but it is analogous in its occurance to the peaty lignite east of Lake Martha Lavinnia and Penny's Lagoon, which has already been described. It does not offer any commercial prospect as a possible fuel.

Livingstone's Block

Low grade peat occurs behind Sea Elephant Bay on L. Livingstone's block (King Island 27/11). A hand bore showed the following succession : -

Sandy peat	4"
Sand	1' 3"
Peaty sand	2' 11"
Hard pan	9"
Sandy peat	2' 9"
Peaty sand	3' 6"
	11' 6"
Water table at	3' 6"

This peat is of no commercial importance.

Camp Creek near Currie

There is a small basin of low grade brown peat on Camp Creek in the northern part of the Currie town area. It is reported by Stevens and Hosking to contain only 33% organic matter. Even if it were of better grade the deposit is too small to be of any consequence, and it is serving a more economic function in its present utilisation as a market garden than it ever could as a fuel source.

PEARSON'S SWAMP PEAT DEPOSIT

General

Location

Pearson's Swamp is the name locally given to a marsh 445 acres in extent lying on the following purchased sections:-

Peat Analyses from Egg Lagoon.

Distance from Main Road	16 Chains		45 Chains			115 Chains		230 Chains			
Sample Number	2259	2260	1C1/A	1C1/B	1C1/C	2250	2251	2252	2253	1154	2255
Depth in Inches	0-14	14-45	0-52	52-78	78-96	0-16	16-45	0-7	7-24	24-66	66-80
Moisture %	16.9	7.1	9.16	11.10	12.48	9.0	3.0	7.8	4.3	2.9	4.2
Combustible Matter %	47.6	17.2	40.22	48.90	65.38	15.4	4.6	14.8	6.7	2.8	3.5
Ash %	46.5	84.7	50.62	42.00	21.24	85.6	92.4	78.4	89.0	94.3	92.3
Description	Black calcareous peat	Dark greyish yellow calcareous soil	Black peat	Black peat	Brown peaty loam	Black peaty loam	Grey-yellow loam	Black peaty loam	Black loam	Grey sandy loam with $CaCO_3$+ gypsum	Grey sandy loam with $CaCO_3$- gypsum

Lot	Acres	Survey Plan	Original Purchaser
23567	207.0. 0	8/17	E.G. Miller
17567	106.1. 0	19/3	do.
17770	106.1. 0	8/17	A.E. Evans
23670	212.3.25	8/20	do.
23669	213.0.39	8/18	J. Barclay
17856	106.1. 0	18/19	do.
17771	106.2. 0	18/16	T.A. Lewis
23612	213.2. 0	8/19	A. McDonald

The property is now owned by A.J. Pearson, and is managed by P.C. Clemons of Loorana, via Currie, King Is.

Access

The swamp is approximately 12 miles north of Currie, and may be reached by following the main Egg Lagoon Road from Currie to a point about a mile beyond the Pass River bridge, where there is branch road with gate and cattle ramp leading west into Tatham's property. A motor vehicle can pass with difficulty and at about three quarters of a mile from the main road, a panel through the fence and buckthorn hedge leads north to the edge of the swamp. There is an alternative access by leaving the main road about a furlong further north where there is a panel in the fence leading directly into Pearson's property. A track passable with difficulty by motor vehicles leads from this panel to the edge of the swamp.

Vegetation

Most of the surface of the swamp is open and devoid of trees and covered by light growth of sedges and reeds. But about 50 acres of the deepest part of the swamp carries a dense growth of titree, (Melaleuca aricifolia).

Natural Drainage

The entire area of the swamp was originally a waterlogged basin of internal drainage, the overflow running westward across the A. Evan's 106 acre lot 17770 into Bungaree Creek.

Artificial Drainage

Attempts have been made to drain the swamp and convert it to good pasture land by cutting a drain in the vicinity of the natural overfolow into Bungaree Creek and digging a radiating system of drainage ditches across the surface of the bog. This work met with only limited success, because the main outlet drain struck granite and hence appreciable deepening was not possible except at unwarranted expense, and accordingly the water level was not lowered sufficiently to improve the pasture over the main surface of the swamp. However, a marginal fringe of the swamp was improved and now carries an appreciable cover of pasture grasses.

Geology

The bedrock in the district about Pearson's Swamp is porphyritic granite. The granite outcrops on the four low ridges that rise like low islands in the north eastern end of the swamp, also round the south eastern end of the swamp in the vicinity of bores Q13, R13, M10, L9 and K9. It is also found at the western end of the swamp between bores E14 and E15.

The hills which hem in the swamp on the west are wind blown sand hills, which have been fixed by vegetation for some hundreds of years.

The peat deposit completely fills what was originally a freshwater lagoon similar to the numerous other lagoons along the west coast of King Island. Its depth varies from zero round the margins to over twelve feet in the deepest parts. Approximate depth lines of the peat over the surface of the swamp are shown on the attached plan. The surface layers of the peat are black and well humified. Below this is a zone of fibrous raw peat - reddish brown in colour, with a strong ripe odour of H_2S mixed with fruity esters. In this raw peat the fibres and tissues of the original peat are easily distinguished by the eye but are easily broken.

The bottom of the peat is always well defined, and is underlain by grey gritty sand. Between the sand and the peat there is often a few inches of gritty or sandy peat. Tree stumps are absent from the main peat section but stumps and roots, decomposed to the sectility of chesse occur frequently in the basal six to twelve inches of the peat. These are the remains of trees which were growing in the area when it was first flooded.

Origin of Peat Swamp

At the end of the Pleistocene period the sea level about King Island stood about 20 feet higher than at present. At this stage marine mollusecs were living in estuaries at the eastern end of what is now Egg Lagoon, and shells collected from there have been shown to me by Mr. Haines. At the same time a small coastal drainage creek flowed across the site which is now Pearson's Swamp, but it did not flow along the course of the present overflow from the swamp but rather on the course indicated in blue on the plan herewith where the present depth of peat is greatest. The valley floor and the low ridges were all granite and were thickly timbered with eucalypts.

About 5,000 years after the end of the Pleistocene (according to Browne*) there was a general retreat of the sea by about 12 to 20 feet to its present level, probably caused by a slight refrigeration of the entire earth which increased the amount of water locked up in the polar ice caps and high altitude snowfields. This retreat of the sea left bare extensive sandy beaches all round the coast of King Island. The strong westerlies which are so prevalent on King Islands quickly got to work on the unprotected beach sand, and in the next few years extensive sand dunes were built up and commenced to roll inland, damming the mouths of all the small coastal streams. That is why we find a belt of sand hill country about two miles wide all along the west coast of King Island, with a series of freshwater lagoons at the inland edge of the sand hill country. The same sort of thing happenen on the east coast but not so markedly because the easterly winds are not so prevalent as the westerlies, so the sand hill belt where present on this coast is not so wide.

The little creek which drained the area now occupied by Pearson's Swamp was completely barred by the sand hills which straddled the valley at the south-east end. Water gathered to a maximum depth of about fifteen feet and covered

Browne, W.R.: "An Attempted Post-Tertiary Chronology for Australia." Presidential Address. Proc. Linn. Soc. of N.S.W., lxx, 1-2, 1945.

an area of 370 acres, until it was able to spill over the granite ridges on the north-west side which was now the lowest part of the basin rim. In this way Pearson's Lagoon came into being.

Considerable changes in the vegetation followed. Hardy colonising plants took in the sand hills and so bound their surface and protected them from being driven further by the wind. A considerable area of flat land to the north and east of the new lagoon became waterlogged because of the damming of the drainage and the ensuing rise of the water table. The standing timber died, and its place was taken by titree (Melaleuca squamea) which spread across these flats. The big trees on the flooded area of course died out, and were replaced by a dense growth of subaqueous water grass, with sedges round the margin and freshwater algae. The plants grew so prolifically in the lagoon that soon the water was chocked with them and their remains accumulated on the bottom. This process started about 4,000 years ago and has been going on steadily ever since. The accumulating water plants gathered on the bottom as peat which to-day has reached a maximum depth of over twelve feet, and in a dry season is quite firm enough to walk upon.

The stumps of the original vegetation still occur at the bottom of the peat and fragments of the wood brought up by the drill have been examined by Dr. H.D. Gordon of the Botany Department, University of Tasmania. Dr. Gordon reports that, "The wood from the bottom is that of a dicotyledon. Its structure is not very well preserved but shows considerable resemblance to certain species of Eucalyptus, and I think it probably belongs to that genus." Dr. Gordon also examined some fibrous material from the peat of one of the marginal bores and reports as follows :- "The other material consists of persisting strands of fibres of a plant, the surrounding soft tissue having decayed. This reminded me of <u>Triglochin procera</u>, the fibres of which are similarly left exposed in present day marshes in Tasmania. Comparison of sections showed a general similarity, but differences in detail, so that I think the material is not <u>Triglochin</u> but may well be a plant of similar habitat. <u>Triglochin</u> is common in fresh or slightly brackish water and marshes in Tasmania, and the lagoon behind the sand dunes at Howrah Beach, Bellerive might be a suggestive example.

Associated with this fibrous material were plentiful cell-walls of various Desmids. These microscopic algae are confined to fresh water, except for a single species recorded from brackish water, and can be accepted as good evidence that this material was deposited in fresh water, not necessarily of any depth, as Desmids are abundant in the wet soil and on the surface of peat bogs."

<u>Soils</u>

A report on the soils of King Island has been prepared by Stevens and Hosking of the C.S.I.R., and published as Bulletin 70 of the Council. The soil types in the vicinity of Pearson's Swamp are the peat itself, the Nugara sandy loam, the Yambacoona sand and the Currie sand.

The peat is too waterlogged to be useful pasture, in its present state and even after drainage it is more acid (pH 5.5 - 5.8) than other peat areas such as Egg Lagoon (pH 6.8 - 7.8) which have become excellent pasture after drainage and fodder cultivation. The Pearson's Swamp peat would need a heavy lime treatment in addition to drainage.

The Currie sand is the dune sandhill country to the south west, which blocked the drainage and caused the swamp. The soil is rich in lime and grows a good pasture but is deficient in certain trace elements which causes serious deficiency diseases in stock confined to these areas.

The Yambacoona sand is an original soil which antedates the formation of the lagoon, and occurs on the low ridges which were not overrun by the advancing sand hills, and which were high enough not to be waterlogged by the rise in water table which followed the blockage of the drainage by the sand hills. In the vicinity of Pearson's Swamp the areas of Yambacoona sand are all underlain directly by granite. This soil offers fair pasture but seems to be associated with some deficiencies. The original eucalypt vegetation on these low ridges has long since been killed out by bush fires.

The Nugara sand is also an original soil, and occupies those areas which became waterlogged when the drainage was blocked by the advancing sand hills, but which were not actually flooded by the lagoons which developed following the blockage of the drainage. The rise of the water table killed out the then existing eucalypt trees, and now the whole area is occupied by stunted titree. In its present state this country is practically useless for pasture.

Quantity of Peat Available

Pearson's Swamp has an area of approximately 370 acres. The depth of peat varies over this area from zero to over 12 feet. In order to make an accurate measurement of the quantity of peat present it would be necessary to bore the swamp at each corner of a five chain grid over the entire area. This was not possible in the time available because field work was restricted according to instructions to a fornight which included the general reconnaissance of the island for other peat and brown coal deposits. However, forty bore holes were put down with a post hole digger capable of boring to twelve feet, and samples were collected from each of these bores. The bores were plotted on the plan submitted herewith on the scale of 10 chains to the inch. Depth contours to the bottom of the peat were then sketched in,consistent with the bore hole data extrapolating in accordance with the geological history and origin of the deposit. The reliability of these contours and of the quanitity estimate based on them would have been considerably improved by an extra week of boring.

A table of estimated acreage within each depth contour, and estimated volume is set out on the plan.

According to Odell and Hood*, it is fair to assume that an acre of peat land will yield 200 tons of air-dried peat pet foot of depth of peat in the bog.

The tonnages within each depth contour are set out in Table 11. (P.T.O.) From this it is seen that the total quantity of peat in the bog is about 420,000 tons. But using mechanised diggers it might not be economic to work peat less than say three inches in depth. The quanitity of peat in area 3 feet and more deep in according to the table about 376,000 tons. The shallower peat could easily be worked by the primitive method of spading the wet peat and spreading it as turfs upon the surface of the ground to dry as has been

Odell and Hood: "Possibilities for the Commercial Utilization of Peat". U.S. Geological Survey Bulletin 253

TABLE 11

	Acres	Volume of air dried peat in acre feet	Tons of air dried peat	Progressive Total
Within 12' Contour	33.7	404.4	80,880	80,880 tons 12'deep and over
Between 11' and 12' Contours	19.3	221.9	44,390	125,270 " 11' " " "
" 10' " 11' "	11.0	115.5	23,100	148,370 " 10' " " "
" 9' " 10' "	12.4	117.8	23,560	171,930 " 9' " " "
" 8' " 9' "	15.7	133.4	26,690	198,620 " 8' " " "
" 7' " 8' "	27.3	204.7	40,950	239,570 " 7' " " "
" 6' " 7' "	26.9	174.8	34,970	274,540 " 6' " " "
" 5' " 6' "	31.7	174.3	34,870	309,410 " 5' " " "
" 4' " 5' "	34.2	153.9	30,780	340,190 " 4' " " "
" 3' " 4' "	51.6	180.6	36,120	276,310 " 3' " " "
" 2' " 3' "	40.0	100.0	20,000	396,310 " 2' " " "
" 0' " 2' "	136.2	136.2	27,240	423,550 tons total in the swamp.

practised in many parts of Europe for many centuries, but would not be economic for industrial purposes.

It is necessary at this stage to form an opinion as to whether the quantity of peat in this bog is sufficient to form the source of fuel for an electric power scheme for King Island.

The present population of King Island is approximately 1,500. It is essentially a pastoral community with an important scheelite mine at Grassy. Apart from the mine, power demands would be primarily for domestic purposes, light farm power for milking machines etc., and for one or two butter and processing factories.

On this basis the peak power demand is not likely to exceed 1,000 horse power, and the average consumption taken over 24 hours per day, for all days of the year would probably be less than 200 horse power.

The calorific value of the moisture free peat is approximately 7,500 B.T.Us. per pound. Hence if the peat is air dried to 25% moisture its heating value would be 5,620 B.T.Us.per pound. But about 4.5% of this heat would be used in driving out the moisture so the heat actually available for steam raising would be about 5,367 B.T.Us. per pound.

If a furnace is designed to burn the peat with 50% efficiency and the efficiency of the steam engine is taken at 20% and of the generator at 90%, the overall thermal efficiency in converting the heat available in the peat to electric power would be 9%.

Hence the heat obtainable as power from the peat = 9% of 5,367 B.T.Us. per lb.
= 483 B.T.Us. per pound.

Now one B.T.U. per minute = 0.023 H.P.

Hence 200 H.P. $= \frac{200,000}{23}$ B.T.Us. Per minute.

$= \frac{200,000}{23} \times 1440$ B.T.Us. per day.

Hence the tonnage of peat required to generate 200H.P. is

$$\frac{200,000 \times 1440}{23 \times 483 \times 2240} \text{ tons per day.}$$

= 12 tons per day approximately

Hence to generate 200 horsepower continuously approximately 12 tons of air dried peat 25% moisture would be burnt per day. This is equivalent to 4380 tons per year, so that on the above assumptions the Pearson's Swamp deposit taking only those parts of the swamp over three feet deep, would last the King Island community approximately 83 years. If peat two feet deep and over can be worked economically, the supply would last 90 years on the foregoing basis. Hence it would seem that the quantity of peat available is sufficient to warrant investigation of other aspects of the problem.

Quality

Analyses

Forty four samples of the peat from Pearson's

TABLE 111

Field Number of Sample	Chem.Lab. Reg. No.	Depth of Peat	Volatile Carbon-aceous Matter	Fixed Carbon	Ash	Sulphur	Calorific Value B.T.U./lb.
C10	120	12'	56.6	21.4	22.0	1.98	7750
C11	121	8'11"	55.2	21.7	23.1	4.04	7700
C12	122	6'11"	52.2	22.0	25.8	3.64	7420
D13	123	3'	52.2	21.4	26.3	6.29	7290
D14	124	1'11"	56.5	22.8	20.7	1.93	7950
E14	125	1'6"	54.6	24.5	20.9	1.57	7820
F14	126	2'6"	56.6	21.6	21.8	1.76	7550
F15	127	1'6"	49.6	20.5	29.9	1.32	6890
G15	128	3'9"	54.9	27.7	17.4	2.38	8070
H15	129	5'9"	50.9	26.5	22.6	3.14	7380
I15	130	12'	51.8	26.7	21.5	3.61	7390
J15	131	12'	49.7	25.7	24.6	4.13	7180
K10	132	4'2"	58.5	17.9	23.6	3.83	7890
K15	133	11'	52.0	26.4	21.6	4.40	7430
L10	134	2'6"	61.0	0.4	38.6	6.98	6090
L13	135	11'6"	52.6	23.8	23.6	4.47	7640
L14	136	7'	51.0	24.9	24.1	3.65	7100
L15	137	8'3"	51.5	25.8	22.7	4.28	7390
M11	138	3'9"	62.2	20.0	17.8	3.36	8720
M12	139	8'	49.5	18.9	31.6	5.37	6740
M13	140	7'6"	60.8	23.0	16.2	3.77	8750
M14	141	7'	52.0	23.1	24.9	3.16	7350
M15	142	5'10"	50.5	22.3	27.2	3.48	7110
N15	143	3'	52.9	25.4	21.7	2.19	7600
O15	144	2'	53.9	25.7	20.4	1.55	7590
P14	145	4'8"	55.9	26.2	17.9	2.56	8220
P15	146	2'	56.1	28.0	15.9	1.95	8020
Q15	147	4'9"	56.0	27.4	16.6	3.58	8250
R15	148	4'3"	55.6	25.5	18.9	2.45	8150
5C2/A	548	0'-1' (8')			18.65		
5C2/B	549	1'-2' (8')			19.15		
5C2/C	550	2'-3' (8')			28.13		
5C2/D	551	3'-4' (8')			26.29		
5C2/E	552	4'-5' (8')			35.24		
5C2/F	553	5'-6' (8')			31.45		
5C2/G	554	6'-7' (8')			15.49		
5C2/H	555	7'-8' (8')			29.9		
5C3	556	6' 6"	52.9	25.4	21.8	4.2	7658
5C4	557	4'	49.8	23.0	27.25	2.7	6475
5C6	558	4' 8"			23.46		
5C8	559	5'	53.5	24.7	21.8	3.8	7011
5C10	560	5'			29.92		
5C12	561	0'-3' (4')	54.9	25.13	19.94	1.67	8194
5C13	562	3'-4' (4')	59.0	25.8	15.2	2.6	8603

Swamp have been examined by the Chief Chemist, at the Mines Department Laboratory, Launceston.

Results of these analyses are set out in Table 111. Locations of all samples are shown on the attached map on the scale 10 chains equals one inch. All analyses are calculated to a moisture free basis in order to avoid differences due to unequal drying. Thirty four of the analyses represent average samples from surface to the bottom of the peat at the points indicated. The depths to bottom are shown in the table and on the map. In order to check any variation of grade in depth, eight samples, 5C2/A to 5C2/H respectively, were collected in the same hole, each sample representing one foot of depth. Similarly samples 5C12 and 5C13 are both collected from a single hole, the former representing the black humified peat which forms the upper three feet of the deposit, and the latter representing the reddish immature peat which underlies the black peat.

The foregoing spot analyses have been classified in Table 1V according to the depth and tonnage of peat they represent. Thus the mean analysis of the 92 acres of the bog which is over 8 feet deep and which contains 198,000 tons of peat is 52.43% volatile combustible matter, 27.24% fixed carbon, 23.11% ash, and 3.82% sulphur, and has a calorific value (dried) of 7458 B.T. Us. per pound, and so on for the other depths given in the table. If the minimum working depth of the deposit is 2', the total reserve is approximately 396,000 tons having on mean alayses 53.2% volatile combustible matter, 25.9% fixed carbon, 23.18% ash, 3.52% sulphur and having a calorific value of 7512 B.T.Us per pound.

Moisture Content

The peat when freshly removed from the bog contains a very high percentage of water, probably over 80%. This water is not merely mechanically present - it is in a colloid like association with the peat and cannot be removed easily by mechanical means and does not come out readily on drying.

A number of samples were air dried to constant weight in the laboratory in order to determine to what level the moisture content would fall under such conditions, with the following results :-

Sample 5C2/A	13.28%	residual moisture after air drying.
5C2/B	12.58	
5C2/C	12.56	
5C2/D	13.50	
5C2/E	12.96	
5C2/F	14.84	
5C2/G	12.34	
5C2/H	11.18	
5C3	13.82	
5C4	12.44	
5C6	12.29	
5C8	11.58	
5C10	10.42	
5C12	11.76	
5C13	10.38	

These results are considered normal for peats elsewhere in the world.

Sulphure Content

The sulphur content is unusually high and must be

TABLE 1V

	Acres	Tons	Volatiles %	Fixed Carbon %	Ash %	Su %	Calorific Value B.T.Us./lb.
Over 12' deep	33.7	80,880	52.7	24.6	22.7	3.24	7440
Over 11' deep	53.0	125,270	52.5	28.1	22.67	3.67	7472
Over 10' deep	64.0	148,370	52.5	28.1	22.67	3.67	7472
Over 9' deep	76.4	171,930	52.5	28.1	22.67	3.67	7472
Over 8' deep	92.1	198,620	52.43	27.24	23.11	3.82	7458
Over 7' deep	119.4	239,570	52.62	27.2	22.87	3.77	7504
Over 6' deep	146.3	274,540	52.57	26.55	23.24	3.63	7494
Over 5' deep	178.0	309,410	52.46	26.32	23.47	3.61	7457
Over 4' deep	212.2	340,190	52.76	26.16	23.23	3.54	7485
Over 3' deep	263.8	376,310	53.01	26.25	23.01	3.54	7522
Over 2' deep	303.8	396,310	53.20	25.90	23.18	3.52	7512
Whole Swamp	340.0	423,550	53.22	25.69	23.22	3.30	7514
First grade N. American Peat			68.3	20.9	10.8	-	8490
First grade N. American Peat			67.9	24.9	7.2	-	9662
Box Firewood			74.34	22.57	3.09	-	8241
Gelliondale Brown coal briquettes(Vic.)			49.21	43.29	7.38	-	10158
Yallourn brown coal briquettes (Vic.)			51.52	46.44	2.05	-	11046

Note.

All above fuels recalculated to moisture free basis. As fired, box firewood contains about 13% moisture, Gelliondale briquettes 14.6% Yallourn briquettes 13%. The Pearson's Swamp peat could be air dried to 13% but to save drying time it would probably be more economic to fire it at 25% moisture.

regarded as an undesirable feature. The sulphur is present probably partly as H_2S and partly as ferrous sulphide. In either case this will produce SO_2 in the furnace which in a moist fuel of this type forms sulphurous acid (H_2SO_3) which will corrode the furnace and flues and lead to short life to grates and metal stacks, etc. An appreciable proportion of the sulphur may, however, be present as gypsum, in which form it would be less harmful and would merely act as an inert filling in the ash.

Ash

The ash content is very high but the volatiles are also high so there is no doubt that the fuel would burn readily and once ignited would burn completely with little or no unconsumed fuel in the ash. But special continuous feed grates would need to be designed to suit this high ash fuel, and removal of ash would need to be automatic. No analyses of the ash have been made and this question needs investigation before any large scale use of the fuel is planned. The high sulphur and the colour of the ash where the peat has caught fire on the bog suggest a high iron content which in turn suggests that the ash is likely to slag and clinker.

Analyses by Stevens and Hosking (C.S.I.R. Bulletin 70, p. 32) show the mechanical composition of a sample from between the 3' and 4' depth contours to be :-

	0" - 11"	11" - 45"
Course sand	5.2%	9.7%
Fine sand	4.8	8.5
Silt	3.9	5.65
Clay	6.1	4.7
	20.0%	28.1%

Partial chemical examination of the same samples show :-

Loss on acid treatment (HC1)	6.0%	10.9%	(details below)
$CaCO_3$	Nil.	Nil.	
Nitrogen	2.29	1.03	
P_2O_5	0.40	0.17	
K_2O	1.54	0.17	

The acid soluble fraction had the following composition:-

CaO	1.14%	1.88%
MgO	0.97	0.71
K_2O	0.15	0.18
Fe_2O_3	2.00	2.26
Al_2O_3	2.83	3.73
Mn_3O_4	0.004	0.003
P_2O_5	0.41	0.18
TiO_2	Nil.	Nil.

All of the above analyses have been re-calculated to a moisture free basis.

The Chief Chemist reported that qualitative examination of sample L10 shows the presence of calcium sulphate and vanning revealed a small amount of a mineral which is probably iron sulphide. However, sample L10 is right on the margin of the bog and probably contains wind and water-borne contamination and so cannot be regarded as in any way typical of the deposit.

The report of calcium sulphate is interesting and lines up with reports by Stevens and Hosking (C.S.I.R. Bulletin 70, pp. 30-32) of other swamp soils on King Island with considerable developments of gypsum in the lower layers often present in quite large crystals. Such precipitation of gypsum implies a period of greater aridity than at present in the not far distant past, when these marshlands dried out completely in drought periods.

Further analysis and fusibility tests of the ash from a composite sample from the area within the three foot depth contour have been requested from the Chief Chemist and will be appended to this report when received.

Calorific Value

The average calorific value (7522 B.T.Us. per pound for moisture free peat) is rather lower than best overseas peats, and is also somewhat lower than Victorian brown coal briquettes, However, the difference is largely due to the high ash content, which represents so much inert filling in every pound of fuel.

Conclusion

In view of its high ash, and high sulphur the peat from Pearson's Swamp cannot be considered to be a first grade peat. First grade peats elswhere in the world have ash below 10% and sulphur below 1%. However, there is no doubt that this peat is a practicable fuel even though second grade, and where there is no indigenous competing fuel, and where imported fuels carry an unusually high freight premium, its development might well be economic although uneconomic in areas well supplied with alternative fuels.

Cost of Competing Fuels

Shortage of Indigenous Fuel

King Island is very short of all forms of fuel. Owing to extensive bush fires several years ago, there is very little firewood on the island for steam raising, and even for household cooking purposes the end is not far distant.

High Transport Costs of Competing Fuels

Imported fuels - coal, brown coal, and oil all have to bear unusually high transport costs.

Crude fuel oil for under furnace firing can be landed at King Island at £2.5.0 per drum of 44 gallons (373 lbs.) Heavy diesel oil costs £2.14.0 per drum and distillate £3.10.0 .

Peat Versus Oil Firing

It is instructive to compare the cost of the cheapest oil with peat. Crude oil of calorific value 185,000 B.T.Us. per pound, costs £2¼/373 per pound. King Island peat (25% moisture) has an effective calorific value of 5367 B.T.Us. per pound. Hence if the conversion of peat to steam is 50% efficient as compared with 75% efficiency for crude oil, one ton of peat is equivalent to

$$\frac{5367}{185{,}000} \times \frac{50}{75} \times 2240 \text{ lbs. of oil at } £\frac{9}{4 \times 373} \text{ per lb.}$$

That is one ton of peat makes as much steam as £2.18.10 worth of furnace oil. However, an oil burning plant can be run with less overhead and labour costs than a peat plant. Working on the basis of a plant with a mean load of 200 horse power - oil fuel would cost about £325 per week. If we assume that peat burning power house of this size costs £2,000 a year more to run than an equivalent oil burning power house because of extra labour and more rapid depreciation of furnaces, etc. - then dried peat would need to be produced at £2.10.0 a ton to be equal in costs to an oil fired plant. If dried peat can be produced for less than £2.10.0 per ton it would be more economical than furnace oil, in addition to providing local industry and employment.

Peat Versus Diesel Distillate.

An average diesel burns 0.4 lbs. of fuel per brake horse power hour. In arriving at figures for peat we have included the efficiency of the generator at 90% so the performance for diesels may be taken as 0.44 lbs. of fuel per effective brake horse power hour. In a 200 horse power plant taken as basis of comparison the daily consumption of diesel fuel would be 200 x 24 x 0.44 lbs. which would cost approximately £20. To produce equivalent power from peat requires 12 tons of peat, but the overhead using a peat burning steam plant would be higher than with a diesel plant. If we allow say £2,000 a year for the difference in overhead, (£5.10.0 per day) then the cost of 12 tons of peat must be less than £14.10.0 if it is to compete with dieselene. In other words peat must be mined, dried to 25% moisture and delivered to the power house at less than 24/- per ton. If the difference in overhead is nore than allowed for above, the maximum competitive price of peat would be correspondingly less.

Producer Gas Plants Using Peat.

Investigations conducted by the United States Bureau of Mines (Bulletin No. 13) indicate that peat is a very suitable fuel for use in producer gas plants, and if efficient scrubbers are included to clean the gas, quite satisfactory results can be obtained, and in fact, many such power plants based on peat are operating in Europe.

Tests indicate that 3 to 4 lbs. of peat are required per brake horse power hour. Hence if we assume the higher figure for King Island peat, 10 tons of peat per day would be required to yield an average of 200 horse power as electricity continuously. This is a 20% improvement in efficiency on the figures arrived at for a steam plant based on the peat, and on these figures the King Island deposit would last 103 years, and peat costing £1.12.0 per ton would compete with dieselene, even allowing for much greater overhead costs.

A producer gas power plant offers the following advantages :-

(1) The peat would only need to be aid dried to 30% moisture, because addition of steam is otherwise necessary to produce the optimum producer gas and there is no point in drying water out of the peat and adding it again with the air blast. This represents a considerable

saving of drying time because the rate of drying falls off rapidly with decreased moisture content and as many days are required to dry the peat from 30% to 20% moisture as are required to dry it from 90% to30%.

(2) More economical in use of fuel, as pointed out above hence lower cost per horse power.

(3) Avoids high temparature fuel bed so that high ash, high sulphur fuels might be used without clinker troubles. This is not always the case, however, and tests would be necessary to determine this point with this particular fuel.

On the other hand there is much prejudice against producer plants and unless the operators understood the process thoroughly and were sympathetic towards making it work, a theoretically sound and practicable scheme might fail through operator prejudice alone. So this factor should be borne in mind.

Peat as Household Fuel

Air dried peat is in general a satisfactory substitute for wood for household fuel. It ignites easily, and burns with a hot flame, and is clean to handle - not soiling the hands or carpet like coal or coke. It has, however, a distinctive odour when burning which some people find objectionable. It is bulkier than coal and burns out more rapidly so needs frequent stoking.

Although not obtainable in quantity boiler firewood is quoted on King Island at 16/- per 40 ft. ton of about 1,000 lbs. Shorter lenghts for household purposes is dearer. If we assume that the wood has a calorific value of 8500 B.T.Us. per lb., then the cost of firewood per B.T.U. is

$$\frac{16}{1,000 \times 8500} \text{ shillings}$$

Hence a ton of air dried peat yielding 5400 B.T.Us. should be worth

$$\frac{16}{1,000 \times 8500} \times 5,400 \times 2,240 \text{ Shillings.}$$

i.e. £1.5.4 to be of equal heating value to good boiler firewood, and rather more than this in competition with household wood.

Summary of Cost of Competing Fuels

The foregoing discussion is intended to serve as a basis to assess the ceiling price below which air dried peat would need to be produced on King Island if it is to compete with a diesel oil or other alternative fuels. On the assumptions stated the ceiling price of peat for use in steam raising would be 24/- per ton, whereas if the peat were used as producer gas the ceiling competitive price would be 28/- per ton, and to compete with firewood for household purposes a similar figure (25/- to 28/-) per ton is indicated. If peat can be produced for substantially less than these figures it would appear that a peat plant would be more economical as a source of power than a diesel plant.

Winning of Peat Fuel

The processes involved in the winning of peat fuel are :- excavating, macerating, drying, harvesting, and storage. Of these drying is the most difficult and the most costly.

Excavating

The most primitive method used particularly in Europe is spading the peat as sods and laying them on the surface of the bog to dry. Modern plants vary considerably from (1) a floating dredge that travels along the working face with a minimum consumption of power (2) Excavator on caterpillar tracks working from top side of face (3) Steam shovel (4) Dragline and scoop.

A small floating dredge seems to be the most practicable excavator for a waterlogged bog like Pearson's Swamp. To produce an average of 12 tons of air dried peat a day for seven day week, over 600 tons of wet peat would need to be excavated per week so that a dredge capable of digging 20 tons of wet peat per hour would be ample on a single shift basis.

The dredge should be capable of digging in ground varying from 2 feet to 15 feet deep. An efficient control of digging depth would be necessary to ensure that the whole of the usable grade peat was excavated without disturbing the sandy bottom. To achieve this two small continuous samplers should be fitted to the dredge, one working an inch below digging bottom and the other say 4 inches below digging bottom. The samples cut by each sampler should be washed through a screen and the screen oversize pass continuously before the dredge operator. The digging depth could then be constantly regulated so that the upper sampler was always free of sand and the lower sampler always contained sand. In this way the digging bottom would always be within four inches of the bottom of the deposit.

Macerating.

It is usual to macerate the peat before drying because macerated peat shrinks during drying yielding a harder and denser product with less fines. The macerator would be mounted on the excavating dredge.

Drying

Air drying in the open is the only method which could be considered practicable for the King Island deposit. Various methods of artificial drying are discussed in detail in Bulletin No. 253 of the United States Bureau of Mines, but are not thermally economical for a deposit of this type.

The method of air drying by mechanically spreading on the surface of the bog developed in Canada is described in the same publication. The excavator delivers the peat to the macerator which deposits its product on a travelling belt extending 900 feet out onto the surface of the bog. The macerated peat is automatically unloaded from this belt into a spreading device which deposits it on the bog in a uniform layer 12 feet wide 5 inches thick and about 770 feet long. This machine also cuts the spread pulp into blocks 5"x5"x10".

The whole plant - excavator, macerator, conveyor system and spreader - is mounted on caterpillar treads and advances as a unit. After a partial drying period (about 14 days in the climate described) the blocks are turned by hand, and after another drying period are harvested by hand on to conveyor belts.

The foregoing process is too costly to be considered for the King Island deposit. It is uneconomic because of (a) the expensive plant required (b) the extensive use of hand labour in turning and harvesting (c) the drying is slow because of capillary moisture rising from the bog below, and because the peat is dried in blocks 5" thick, whereas drying rates are much higher with thinner sheets. In any case as the bog becomes partly used increasing difficulty would be experienced in finding sufficient flat land to spread the peat on to dry, because Pearson's Swamp is relatively limited in area.

It is therefore suggested that drying would be done more efficiently and more economically by using welded pontoons of light sheet steel as drying platforms. The pontoons would float in the water in the already excavated area, and no harvesting would be necessary because the peat would remain on the pontoons until dry and would be towed directly to the power house loading point at the edge of the bog. By painting two plimsol lines on the barges, the macerated peat would be loaded into the barge until the water was level with the upper plimsol line, then when the lower plimsol line appeared the peat would be dried out to the correct moisture percentage for use. In this way the product would be uniform, with automatic weighing and use of minimum drying time. The empty pontoon would be filled with pulp directly by pipe from the pontoon dredge. The pulp would best be spread on trays say 2" deep and cut like caramel blocks 2" x 2" so drying would be rapid with no capillary moisture from below. Assuming an average weekly consumption of 84 tons of air dried peat, something less than 700 tons of wet peat pulp would be handled per week, hence less than 2,300 cubic yards of drying barge space would be needed, assuming a 14 day drying period. If drying barges were 6' x 12' and had 6 trays each 2" deep, less than 69 barges would be needed - or say 100 barges, allowing for delays in turnabout. The barges would draw about 15" to 18" fully loaded wet and 6" to 9" when air dried. About an acre of water space would be needed to park the barges during drying. Hence working would best be commenced on the shallow peat 2 to 3 feet deep, spreading this on the surface of the bog to dry so that a considerable water surface would be obtained early in the operations. The water level of the bog could be controlled at the present drainage outlet.

<u>Summary</u>

The process outlined above may be summarised as follows :-

The peat is dug by a floating dredge, macerated on the dredge, and delivered as compressed pulp by pipe on to trays on drying pontoons, where it is cut into 2" cubes by disc cutters. The pontoons float on the lagoon for 10 to 14 days and are towed to a loading point where they are loaded by a grab on to a conveyor which takes the peat blocks directs to storage ready for consumption. In this process the peat is not handled manually at any stage of its processing and the cost per ton would be minimum. The following equipment would be necessary :-

(1) Dredge with 20 tons per hour capacity, with macerator.
(2) 100 pontoons about 3 cubic yard capacity each. Suitable equipment for towing pontoons to unloading point.
(3) Grab for unloading the pontoons.
(4) Conveyor to storage point.

Climatic Factors Influencing the Drying of Peat.

King Island has a mild moist climate. The rainfall is well distributed over the year with an average of 211 wet days with an average of 0.169 inches per wet day. The wettest months are May to October. The average relative humidity is high, being about 79% at 9 a.m. and 76% at 3 p.m. Heavy dews are common. Strong winds principally westerlies are characteristic of the island, which lacks high hills and trees to break the wind. Significant meteorological data, which have been furnished by the Director of the Commonwealth Meteorological Bureau are shown in Table V.

Wind.

Wind is one of the most important factors in the drying of peat, and because of the persistent strong winds air drying on King Island would be much more rapid than might be expected in consideration of the moist climate. There are no hills of consequence on King Island and Pearson's Swamp is quite open and completely free from timber over large areas. Investigations elsewhere have shown that obstructions have no effect in reducing wind velocity at a distance greater than about 13 times their height. Hence ridges 150 feet high in the vicinity of Pearson's Swamp would have little or no effect on wind velocity on the swamp at distances 650 yards from the ridge crests, and the titree on the centre of the swamp would not effect wind velocity 200 yards away from them. Hence on the open areas of the swamp wind velocities will be quite unaffected by the surrounding sand ridges and the titree growth.

Humidity.

Humidity is usually relatively high on King Island which would make drying rates slower than they would otherwise be. The average relative humidity is recorded at 79% at 9 a.m. and 76% at 3 p.m. No figures are available for night humidity, but the prevalence of heavy dews on King Island implies that the air is commonly saturated at night, hence drying would not take place at night.

Saturation deficit is a better index of the drying power of the atmosphere. On the basis of the results tabulated, if a particular drying process on King Island takes 10 days in January it will take the following number of days during the other months :-

January	10	days
February	11	"
March	13	"
April	17	"
May	23	"
June	26	"
July	24	"
August	21	"
September	19	"
October	16	"
November	14	"
December	12	"

The disadvantage of the winter would be aggravated

e.g. H.J. Sims, Australian Journal of Science, August 1945, p.19.

TABLE V

Climatological Data at Currie, King Island.

Information supplied by Director, Commonwealth Meteorological Service

	Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Average Max. Temp.	22	67.7	68.9	67.1	62.6	59.2	56.0	55.3	55.7	57.7	60.3	62.8	65.5	61.6
" Min. "	22	53.5	54.9	54.0	51.8	49.4	47.1	45.7	46.0	46.9	47.8	49.2	51.9	49.9
" Mean "	22	60.6	61.9	60.5	57.2	54.3	51.5	50.5	50.8	52.3	54.0	56.0	58.7	55.7
" Rel. Humy.% 9 a.m.	25	72	76	78	81	84	85	84	82	80	78	77	75	79
" " " " 3 p.m.	23	70	72	73	77	81	82	80	79	77	76	74	72	76
" Monthly Saturation Deficit, ins. of Hg, 9 a.m.	23	.154	.135	.121	.092	.068	.059	.063	.072	.079	.098	.114	.126	.098
Estimated Evaporation (ins.)		3.26	2.86	2.57	1.96	1.44	1.25	1.34	1.53	1.67	2.08	2.42	2.67	25.05
Average Rainfall.	34	1.50	1.56	1.66	2.45	3.47	4.00	4.52	4.29	3.45	2.63	2.01	2.17	33.71
" Days of Rain	10	11	11	14	18	20	23	24	23	21	19	14	13	211
Cloud Amount 9 a.m.	26	6.8	6.7	7.1	7.4	7.2	7.3	7.2	7.3	6.8	7.0	6.9	7.0	7.0
" " 3 p.m.	24	6.3	6.1	6.6	7.0	7.3	7.5	7.3	7.1	7.0	6.9	6.7	6.5	6.8
Hours of Sunshine, Hobart.	20	236.5	198.3	199.3	143.7	141.2	118.0	130.3	158.4	172.6	192.2	218.8	218.0	2127.3
Av. Windspeed, Knots, 9 a.m.		10	10	9	8	7	8	8	10	10	9	10	9	9
" " " 3 p.m.		9	10	9	9	8	9	8	11	10	9	9	10	9

Notes

1. No observations of sunshine are made on the Island but the average monthly figures would be only a few percent less than the averages quoted for Hobart.

2. Saturation deficit represents the drying power of the atmosphere and the figures quoted are in inches of Mercury. From these figures, an estimate has been made of the evaporation.

3. The amount of cloud refers to the number of tenths of the sky covered. Ten would be overcast and 0 clear.

by the heavier rainfall during the winter months so that peat already partly dried is wetted again more frequently by rain.

Temparature.

Average maximum temperature at Currie is given as 61.6°F., average minimum temperature is 49.9°F, and average mean temperature is 55.7 F. The average minimum temperature for July, the coldest month, is 45.7°F. and frosts are rare even in winter-time. This is important because the principal factor which prohibits winter drying in the peat lands of the northern hemisphere, is the onset of frosts which disrupt drying peat and causes it to crumble unless the moisture content has fallen below 50%.

Rainfall .

Rainfall is persistent though not heavy on King Island. Rain is not so important a factor in the air drying of peat in the open as might be expected. As peat dries the arrangement of the molecules changes. Although it is hard to dry moisture out of peat, it is equally hard to put moisture back into peat once it has partly dried out. Even if left to soak in water, partly dried or dried peat does not re-absorb moisture rapidly and the water picked up in this way dries out again much more readily than the original water content did. However, the wetting of the drying peat by rain and dew would certainly retard the drying of the upper tray of the drying pontoon, but is doubtful whether it would be worth while placing a flat shelter over the drying pontoon to keep off rain and dew. The principal drying agent is undoubtedly the wind and everything should be arranged for maximum exposure of the drying peat to the wind.

Length of Drying Season.

Peat drying could be carried on on King Island throughout the year, although rate of drying would be less in the winter months. As pointed out above in the large peat plants in the northern hemisphere drying has to be discontinued during the winter because freezing disintegrates the blocks before they have dried enough to resist bad weather. The winter climate on King Island is much milder than in the regions mentioned, and heavy frosts are exceptional and the lagoons never freeze over.

Time Required to Dry Peat to 30% Moisture.

It is rather difficult to predict the length of drying time required to dry peat to 30% moisture on King Island. The period of from 30 to 40 days in the Canadian fields is certainly very much longer than would be required in this case for the following reasons.

(1) The Canadian blocks are 8" x 5" x 5" which is the minimum size suitable for the process used, whereas in the pontoon drying suggested for Pearson's Swamp the peat would be cut into 2" cubes. It costs no more to cut them to the smaller size, but blocks smaller than 5" cubes would not be practicable in the Canadian method. Laboratory experiments show that the drying rate for 2" cubes is less than a quarter of the rate for 8" x 5" x 5" blocks.

(2) The Canadian blocks are spread on the surface of the bog and receive a continuous flow of capillary moisture from below as they dry. In the suggested

process there would be no retarding flow of capillary moisture.

(3) The climate on King Island with its high wind velocities and mild temperature would lead to much faster drying than the Ontario climate. As the temperature drops there is less margin of water vapour between drying air and saturated air. For example air at 52°F. and 70% humidity is capable of absorbing as much moisture as air with only 56% humidity but 10°F. colder. The average temperature for King Island is 55.7°F as compared with 44°F. in Ontario.

In the peat producing area of Russia the mean annual temperature is about 39°F. with a long period of winter freezing when no drying can be attempted. In Denmark where peat is also produced the mean annual temperature is 45°F., and the average relative humidity is 84%. In these countries rate of drying is several times longer than it would be on King Island.

In view of these factors it seems reasonable to expect the length of drying to reach 30% moisture with the suggested King Island process to be from 6 to 9 days, or at most 14 days which is the period allowed for in deciding the number of pontoons required. During the winter the drying rate might be expected to be longer - perhaps 15 to 30 days.

Conclusion

Pearson's Swamp peat is not a first grade peat. It's ash and sulphur content are both uncomfortably high, and clinker troubles are likely. In most regions the exploitation of this deposit would be uneconomic. But economic conditions on King Island are not normal. There is an acute shortage of firewood and there is no other indigenous fuel. Reshipping and local freight costs are high and all imported fuels are at premium prices. In conjunction with these special circumstances, the Pearson's Swamp peat may well prove to be profitably exploitable and supply fuel for an electric power plant for all needs of the island as well as meeting household cooking needs. The quantity of peat is sufficient to meet the demands of the island for fifty years - if not longer.

Suggestions have been offered concerning possible methods of working the deposit. The peat might prove to be a satisfactory fuel for a producer gas power plant or it might be used for raising steam. The decision on which is more practicable is beyond the province of a geologist, and it is suggested that if on the evidence here presented development is considered warranted, a practical fuel engineer or power engineer should be consulted. Such advice might be sought from the Commonwealth Coal Committee or the State Electricity Commission of Victoria, since both these organisations possess specialists in the utilisation of low grade fuels.

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