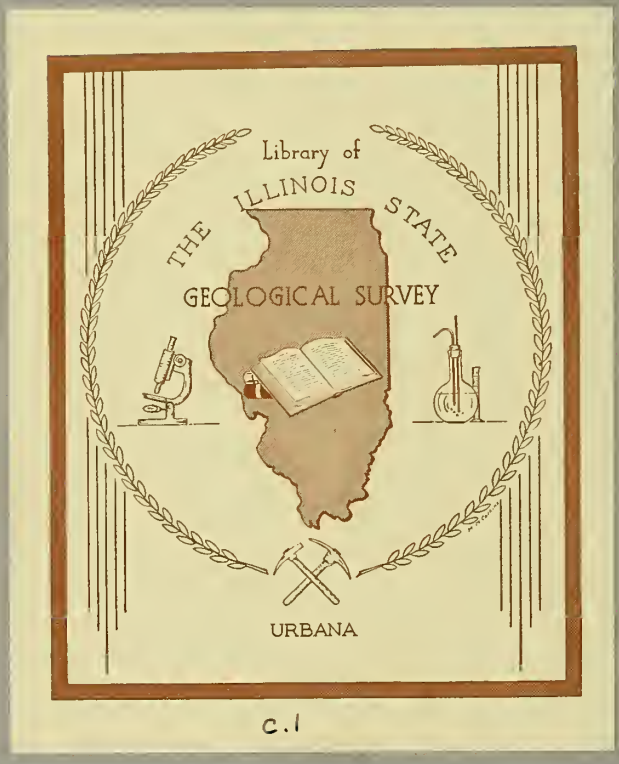

STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
DIVISION OF THE
STATE GEOLOGICAL SURVEY
M. M. LEIGHTON, *Chief*

REPORT OF INVESTIGATIONS—NO. 28

ILLINOIS MINERAL INDUSTRY IN 1932

A Preliminary Statistical Summary and Economic Review

BY

W. H. VOSKUIL and ALMA R. SWEENY

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1933

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Contents

Tables

ILLINOIS MINERAL INDUSTRY IN 1932

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STATISTICAL SUMMARY OF ILLINOIS MINERAL INDUSTRY IN 1932

This preliminary summary of the mineral production in the State of Illinois in 1932 is issued for the information of the State's mineral producers. Figures for 1932 are preliminary and will be revised when complete returns have been received; the figures for 1931 are final (Table 1).

The Mineral industries, in common with all other agencies of production, are passing through a difficult period of readjustment to rapidly changing economic conditions. The emphasis has shifted from production to distribution and marketing. Competition between mineral producing districts and among mineral products themselves has become so keen that the need for accurate measurement of the market has now become a necessity. Markets must be resurveyed so that producers may govern their production schedule in conformity to market demand. A statistical report of production and imports into a market territory is one of the essential elements in analysis of the market and this report is designed to meet this need.

ACKNOWLEDGMENTS

This report is made possible through the cooperation of the United States Bureau of Mines, the United States Bureau of the Census, through the active collection and publication of coal statistics by the Illinois State Department of Mines and Minerals, and through the cooperation of the mineral producers of the State in complying with requests for information.

TABLE 1.—*Preliminary summary of production and value of Illinois minerals, 1931-1932*

Product	1931		1932	
	Tons	Value	Tons	Value
Coal	44,303,295	$75,527,000	31,452,770	$52,211,598
Pig iron	1,727,834	29,178,510	731,872	11,544,298
Clay products	.....	10,585,136	.....	4,314,643
Coke	2,478,984	14,042,457	1,421,753	7,961,817
Cement (barrels)	6,425,909	5,342,446	5,451,383	3,413,078
Sand and gravel (total)	10,297,943	5,209,474	6,126,000	3,265,000
Structural sand	1,416,399	605,400	768,000	385,000
Paving and road-making sand	2,007,844	841,188	1,500,000	540,000
Glass sand	415,766	415,766	399,587	352,139
Molding sand	317,314	240,798	329,114	131,222
Railroad ballast sand	307,929	71,683	25,481	16,192
Cutting, grinding and blast sand	170,752	427,102	101,942	225,589
Engine sand	72,782	38,958	41,259	23,440
Fire or furnace sand	2,684	3,355	[a]	[a]
Other sands	117,215	123,336	52,355	57,369
Paving and road-making gravel	3,568,902	1,671,339	2,038,000	1,085,000
Structural gravel	1,304,299	589,940	742,000	420,000
Railroad ballast gravel	592,797	179,188	119,519	25,979
Other gravel	2,788	1,421	8,743	3,070
Petroleum (barrels)	5,039,000	4,500,000	4,661,000	4,810,000

Product	1931		1932	
	Tons	Value	Tons	Value
Limestone (total)	5,278,170	$3,945,064	2,866,264	$1,798,196
Road metal and concrete	3,648,820	2,454,221	1,711,408	1,217,761
Flux	418,730	344,899	147,917	118,458
Railroad ballast	361,640	241,618	122,564	81,939
Rip-rap	505,070	510,334	128,569	120,799
Agriculture	254,680	228,606	127,779	113,047
Rubble	2,570	4,260	.....	.....
Other uses	86,660	161,126	82,957	140,088
Mineral paints, zinc and lead pigments				
Natural gasoline (gallons)	5,024,000			
Natural gas (M. cu. ft.)	2,130,000	204,000		
Lime (total)	96,105	718,952	62,300	447,179
Building	22,380	182,367	12,000	100,000
Tanneries	6,700	52,910	6,180	47,000
Metallurgy	18,321	125,796	12,016	77,479
Paper mills	2,737	18,498	3,805	22,700
Other uses	45,967	339,381	28,299	200,000
Fluorspar	28,072	468,386	9,615	156,279
Quartz (silica)	56,262	335,219	39,036	219,370
Clay	100,028	200,995	45,045	109,312
Tripoli	12,651	87,481	6,476	91,569
Lead	205	15,170		
Sandstone	44,860	25,364	35,129	24,827
Zinc	.....	.....		

[a]Included in other uses.

COAL

Review of Production

Coal production in Illinois in 1932 fell somewhat below its proportional relation to the national production as compared with the year 1931 (Table 3). The record for the two years in the State and nation is as follows:

Table 2.—*Summary of coal production in 1931 and 1932*

Year	Production		Illinois per cent of total
	United States	Illinois	
1931	382,089,000	44,303,295	11.5
1932	305,667,000	31,452,770	10.3

The rate of production maintained in the State is remarkable in view of the fact that mining in all of the shaft mines ceased on April first pending the negotiation of a new wage scale and was not resumed until late in September, a period of nearly six months (Table 4). Production from January to March and from October to December, 1932—six months of uninterrupted operation—was 25,145,004 tons as compared to 24,653,736 tons for the same months in 1931. In this same period the national coal production was 182,574,000 tons in 1932 as compared to 201,992,000 tons in 1931, a decline of 10 per cent. Thus it would appear that, although the actual output of 1931 was low due to the suspension of mining activities, the actual rate of production indicates that the progressive invasion of eastern coals into the Illinois coal market area has been arrested.

A further examination of the demand for coal since 1929 shows that the long downward trend ceased in June and July, 1932, and that in the following November and December it actually exceeded the output of the previous year.

TABLE 3.—*Coal production by months for United States and Illinois, 1931 and 1932*
(In thousands of net tons)

Month	United States			Illinois		
	1931 Thousands	1932 Thousands	Change from 1931 Per cent	1931 Thousands	1932 Thousands	Change from 1931 Per cent
January	38,949	27,892	−28	4,918	3,851	−22
February	31,737	28,013	−52	3,796	4,185	+10
March	34,226	32,250	−6	4,292	6,011	+40
April	28,777	20,300	−29	3,029	346	−88
May	28,613	18,384	−36	2,949	513	−83
June	29,491	17,749	−40	2,745	595	−78
July	30,103	17,857	−41	2,765	748	−73
August	30,858	22,489	−27	3,300	1,670	−49
September	32,255	26,314	−19	3,353	2,400	−28
October	36,075	32,677	−9	4,043	3,335	−17
November	30,426	30,632	0	3,508	3,673	+0.5
December	30,579	31,110	+0.2	4,097	4,125	+0.3
Total	382,089	305,667	−20	42,793	31,453	−26

TABLE 4.— *Coal production in Illinois*

County	January	February	March	April	May	June
Christian	247,811	270,615	516,433			
Clinton	17,030	17,082	31,956			
Franklin	829,315	991,737	1,342,298			
Fulton	126,854	140,098	181,156	50,338	73,696	68,468
Henry	46,319	47,958	53,228			
Jackson	121,903	123,490	185,118		27,798	38,411
LaSalle	17,687	18,235	22,319		7,519	7,920
Macoupin	359,477	455,620	549,784			
Madison	111,906	103,887	164,139	8,584	37,014	31,818
Marion	35,809	43,045	59,323			
Montgomery	109,828	106,518	196.111			
Peoria	87,084	86,551	99,152			
Perry	269,276	298,338	382,331	55,898	99,331	160,249
Randolph			40,570			
Saline	280,953	260,531	408,990			
Sangamon	315,876	332,990	502,945			
St. Clair	278,459	261,335	367,335	16,642	20,785	22,449
Tazewell	22,977	21,501	31,723			
Vermilion	188,847	202,480	341,818	14,560	19,206	26,117
Washington	27,351	27,827	43,354			
Williamson	172,964	191,854	294,052	2,640	3,960	3,000
Woodford	5,957	4,981	8,015			
Other Counties	177,562	178,237	188,923	197,419	223,574	236,593
Total	3,851,245	4,184,910	6,011,073	346,081	512,883	595,025
Strip Mines	607,517	645,401	792,295	242,228	367,711	458,605
Shaft Mines	3,243,728	3,539,509	5,218,778	103,853	145,172	136,420

[a] Compiled from Monthly Reports, Illinois State Department of Mines and Minerals.

by counties and months for 1932[a]

July	August	September	October	November	December	Total
	98,532	15,834	119,110	222,441	283,667	1,774,443
			15,604	20,360	25,927	127,959
	587,852	946,821	924,785	716,234	795,317	7,064,359
111,261	70,534		73,303	84,293	114,501	1,094,502
			49,806	49,578	53,027	299,916
	116,040	170,788	191,104	150,277	144,065	1,269,903
5,273	13,100	21,605	25,681	22,792	23,152	185,283
15,197				221,156	302,823	1,904,057
30,400	30,955	26,401	72,913	147,629	168,384	934,030
	29,650	56,717	60,584	43,744	45,066	373,938
			36,874	70,808	93,556	613,695
			29,084	83,247	112,008	497,126
238,777	223,342	308,576	348,342	307,344	319,755	3,011,559
			18,755	21,640	25,521	106,486
	107,407	231,361	347,960	353,490	337,001	2,327,693
			89,816	214,478	216,301	1,677,406
39,797	37,105	12,221	191,000	278,890	330,191	1,856,209
			28,474	28,720	31,740	165,135
30,185	89,997	165,389	210,087	188,094	183,246	1,660,026
	29,213		53,509	42,007	41,186	264,447
4,050	135,697	226,420	274,857	241,959	294,414	1,845,867
		6,953	10,705	12,713	14,271	63,595
273,083	169,867	210,468	163,008	146,072	170,330	2,335,136
748,023	1,670,200	2,399,554	3,335,361	3,672,966	4,125,449	31,452,770
580,594	469,027	462,240	646,329	539,321	612,667	6,423,935
167,429	1,201,173	1,937,314	2,689,032	3,133,645	3,512,782	25,028,835

Distribution in 1929-1932

The previous report for 1931[1] analyzed in some detail the distribution and consumption of coal in various sections of the Illinois coal market area and presented a table showing the distribution of Illinois coal. In this report a summary of bituminous coal distribution from all sources for 1929 is included (Table 5).

The detailed distribution figures indicate some of the underlying economic factors which govern coal movements in the Illinois coal market area. These detailed data are available for 1929 only, but the underlying conditions have not changed appreciably. The amount of coal consumed in the Illinois coal market area in 1930, 1931, and 1932, together with the quantity supplied by Illinois, can be approximated by a summation of the quantities of coal moved in by rail and water from competing fields on the east and west (Table 5).

Table 5.—*Summary of coal tonnages available to the Illinois coal market area, 1930, 1931, and 1932* [a]
(In thousands of net tons)

Source of Coal	1930	1931	1932[b]
Illinois production	51,719	44,303	31,453
Production from other states (also consumed in Ill. fuel area)			
Iowa	3,893	3,388	3,430
Kansas	2,430	1,987	1,805
Missouri	3,853	3,621	3,795
North Dakota	1,700	1,519	1,837
Shipments into the area			
By water to Lake Superior docks and "Soo"	13,723	10,172	7,407
By water to Lake Michigan ports	10,056	9,214	7,064
By car ferry across Lake Michigan	1,035	684	676
By rail to Illinois-Indiana	22,930	17,284	14,571
By rail to Northwest	4,260	3,371	3,119
Colorado-South Wyoming shipments eastward	992	636	528
Total approximate supply	116,591	96,105	75,685
Production from nearby states			
Indiana	16,490	14,295	12,400
Western Kentucky	10,915	8,580	9,360
Arkansas	1,533	1,154	1,050

[a] Compiled from Monthly Coal Distribution Reports: U. S. Bureau of Mines.
[b] Preliminary figures.

[1] Voskuil, W. H., and Eich, Alma, Illinois Mineral Industry in 1931: Illinois State Geol. Survey Rept. Inv. No. 25, 1932.

In addition to coal shipments from the Appalachian and Rocky Mountain fields and from the mines of states within the boundaries of the Illinois coal market area, a considerable quantity of coal is shipped into this territory from Indiana. The exact quantity has not been definitely ascertained but coal shipments by railroads representing 95 per cent of the tonnage in 1932 are shown in Table 6.

TABLE 6.—*Shipments of coal from Indiana and western Kentucky into the Illinois coal market area in 1932 (in thousands of tons)*

To	Indiana	From W. Kentucky	Total
Illinois[a]	3,865	2,008	5,873
Wisconsin	305	264	569
Minnesota	124	146	270
Iowa	304	621	925
Missouri[b]	80	714	794
Nebraska[c]	9	39	48
South Dakota, North Dakota, Kansas	3	62	65
Total	4,690	3,854	8,544

[a] Includes Bettendorf, Davenport, and Iowana, Iowa.
[b] Includes Kansas City, Kansas.
[c] Includes Council Bluffs, Iowa.

Tables 7 and 8 give detailed information of coal movement and production by months in 1931 and 1932.

TABLE 7.—*Coal available in the Illinois coal market area, 1931-1932* [a]
(In thousands of tons)

1932 [b] Month	Production by States in the Area				Production of Mid-western states which ship coal into the area		
	Illinois	Iowa	Missouri & Kansas	North Dakota	Indiana	Western Kentucky	Arkansas
January	3,851	374	592	238	1110	713	(not separately available)
February	4,185	390	553	220	1168	685	
March	6,011	407	542	185	1530	775	
April	346	280	294	80	495	548	
May	513	220	280	65	628	656	
June	595	237	322	55	678	642	
July	748	203	322	43	653	755	
August	1,670	225	362	60	710	814	
September	2,400	300	434	139	940	820	
October	3,335	330	602	246	1240	998	
November	3,673	350	635	256	1200	823	
December	4,125	114	1,054	250	1048	1131	
Total [c]	31,452	3,430	5,660	1,837	12,400	9,360	

[a] Data for Illinois from Illinois State Department of Mines and Minerals; data for other states compiled from U. S. Bureau of Mines.
[b] Preliminary figures.
[c] Total by months differs somewhat from annual total in summary table since the U. S. Bureau of Mines has not yet released final monthly figures.

TABLE 8.—*Coal imported into the Illinois coal market area, 1931-1932* [a]

(In thousands of tons)

1931	Lake borne coal arriving at			Rail haul from Appalachian fields to		Colorado-So. Wyoming	Total
	Lake Superior and Soo	Lake Michigan ports	By car-ferry across Lake Michigan	Illinois-Indiana	Northwest	Shipments East	
January			73	2,087	358	86	
February			54	1,553	192	32	
March	347	281	44	1,854	170	43	8,712
April			38	1,312	171	17	
May	955	1,038	54	1,252	237	31	3,567
June	1,337	1,291	62	1,045	237	27	3,999
July	1,599	1,599	67	1,093	307	25	4,690
August	1,923	1,603	80	1,393	393	54	5,446
September	1,669	1,303	79	1,490	386	72	4,999
October	1,620	1,273	76	1,561	379	94	5,003
November	719	820	57	1,252	268	87	3,203
December	3	6	0	1,392	273	68	1,742
Total	10,172	9,214	684	17,284	3,371	636	41,361
1932							
January			96	1,426	281	77	
February			64	1,420	271	57	
March	94	334	63	1,551	255	43	7,061
April			35	860	125	9	
May	468	516	37	723	130	8	1,882
June	869	749	31	669	130	14	2,462
July	937	876	54	768	207	14	2,856
August	1,235	969	69	1,028	312	25	3,638
September	1,375	1,112	69	1,366	371	61	4,354
October	1,341	1,285	88	1,701	415	84	4,914
November	1,088	1,210	70	1,356	285	66	4,075
December[b]	3	13	0	1,357	283	66	1,722
Total	7,410	7,064	676	14,225	3,065	524	32,964

[a] Compiled from Monthly Coal Distribution Reports Nos. 1-16, U. S. Bureau of Mines, August-December, 1931; January-December, 1932; January, 1933.

[b] Estimated on basis of eleven months shipments.

Railway Coal Consumption

Coal consumption by locomotives of Class I railroads in 1932 was about half of that in 1920 and less than 60 per cent that of 1929. The gradual decline in railroad fuel consumption since 1917 is attributed in part to the introduction of fuel oil. This competitor reached a level of about 14.5 million tons in 1924 but since then has shown no further increases.[2] Progressive decline from 1924 to 1929 is accounted for in part by increasing efficiency in locomotive operation. The sharp decline beginning in 1930 and continuing through 1932 is the direct outcome of decreasing freight tonnage of which coal itself is an important item. The extent to which railroads are dependent upon coal traffic is evident from the fact that nearly one-third of revenue freight originating on railroads consists of anthracite, bituminous coal, and coke. Thus in 1930, the total revenue freight tonnage originating on railroads was 1,123,529,915 tons of which 407,937,379, or 36 per cent was coal and coke. Hence a sharp decline in coal tonnage hauled by railroads will result in a decrease in fuel consumption. An examination of Table 9 shows that since 1925 the ratio of coal consumed by locomotives to coal hauled would be between 23 and 25 per cent. A recovery of industrial production with its accompanying effect upon volume of transportation would immediately result in an increase of the railroad fuel market.

Table 9.—*Coal Shipments and railway coal consumption*
(In thousands of net tons)

Year	Coal loaded for shipments [a]	Coal used by locomotives Class I. R. R.'s[b]	Per cent of coal shipments
1917	469,851	138,714	29.4
1918	503,089	137,840	27.4
1919	409,149	122,674	29.8
1920	504,873	131,553	26.1
1921	382,064	110,554	28.9
1922	383,677	115,636	30.1
1923	505,859	134,106	26.5
1924	441,566	119,926	27.1
1925	477,173	119,888	25.1
1926	526,286	124,828	23.7
1927	480,223	117,486	24.4
1928	467,348	113,882	24.4
1929	497,934	112,951	22.5
1930	437,399	97,857	22.4
1931	357,278	81,213	22.7
1932	285,000[c]	66,193	23.0

[a] Annual reports of the U. S. Bureau of Mines.
[b] Annual Report on Fuel for Locomotives, Interstate Commerce Commission Statement M-230.
[c] Estimated for 1932.

[2] Voskuil, W. H., and Eich, Alma, Op. cit., p. 15.

Table 10 shows the total coal delivered to Class I railroads in 1929, and coal delivered by Illinois fields.

TABLE 10.—*Fuel coal delivered to class I railroads by consuming regions, in 1929* [a]
(In net tons)

Region	Total coal delivered[b]	Illinois deliveries
New England	4,098,802	0
Great Lakes	25,093,486	2,595,492
Central eastern	33,167,794	1,820,332
Pocahontas	6,414,000	0
Southern	20,408,906	3,276,008
Northwestern	16,238,843	4,576,962
Central Western	16,307,336	5,615,984
Southwestern	5,593,408	2,025,903
Total	127,322,665	19,910,681

[a] Distribution of Coal Shipments, M. C. D. 8, U. S. Bureau of Mines, March, 1932, page 8.
[b] Includes small quantities of anthracite.

STRIP MINING IN 1932

The production of coal by strip mining showed a slight gain above that of 1931 (Table 11). The output of coal by stripping in Illinois has increased from 1.6 per cent of the total production in 1923 to 14.6 per cent in 1931 and 20.4 per cent in 1932. The rapid increase in percentage in 1932 was occasioned, not by a substantial increase of tonnage by this method but by a decrease in shaft mining for reasons previously discussed.

TABLE 11.—*Strip mined coal in Illinois, 1914-1932* [a]

Year	Output (Tons)	Per cent of total production	Year	Output (Tons)	Per cent of total production
1914	327,487	0.6	1923	1,256,704	1.6
1915	455,195	0.8	1924	2,219,318	3.2
1916	437,863	0.7	1925	3,378,747	5.0
1917	519,944	0.6	1926	3,443,668	4.9
1918	512,428	0.6	1927	2,807,363	6.0
1919	400,640	0.6	1928	4,345,762	7.7
1920	589,540	0.7	1929	5,374,813	8.8
1921	563,168	0.8	1930	6,116,415	11.3
1922	677,513	1.2	1931	6,262,501	14.6
			1932[b]	6,423,935	20.4

[a] Monthly Report of Shipping Mines, Illinois State Dept. of Mines and Minerals.
[b] Preliminary figures.

Number and Output of Mines by Classes

Table 12 shows by classes the number of Illinois coal mines in operation, the total output, and the percentage of the total output of each class from 1924 to 1931 (see Illinois Mineral Industry in 1931 for data for years 1919-1923). The year 1931 showed an increase in the number of mines in classes 3, 4, and 5, particularly in the last class; percentage of production increased and actual output for class 5 mines increased also. Part of the increase in class 5 mines is no doubt accounted for by decreased coal output and a consequent dropping of mines from one class to a lower class. The increase in number of operating mines in a year of decreased production may be related to the trend of hauling coal from mine to market by truck.

TABLE 12.—*Number and output of coal mines, by classes, 1924-1931* [a]

Year	Class 1A (more than 500,000 tons)	Class 1B (200,000 to 500,000 tons)	Class 2 (100,000 to 200,000 tons)	Class 3 (50,000 to 100,000 tons)	Class 4 (10,000 to 50,000 tons)	Class 5 (less than 10,000 tons)	Total
1924	46	60	59	58	88	177	488
1925	48	48	45	33	73	219	466
1926	48	48	37	39	81	262	515
1927	21	52	52	46	88	286	545
1928	33	50	40	37	65	322	547
1929	43	49	35	34	64	303	528
1930	35	48	31	26	70	298	508
1931	30	43	21	30	68	344	536
PRODUCTION BY CLASSES (In thousands of tons)							
1924	34,357	18,691	3,247	4,361	2,085	582	68,323
1925	40,031	15,144	6,622	2,537	1,875	701	66,909
1926	43,394	14,736	5,573	2,909	2,014	742	69,367
1927	15,313	17,214	7,684	3,475	2,372	789	46,848
1928	28,029	16,718	6,039	2,724	1,547	892	55,948
1929	34,830	16,130	5,033	2,330	1,523	812	60,658
1930	28,642	16,256	4,324	1,802	1,865	863	53,731
1931	22,750	14,000	2,920	2,040	1,640	953	44,303
PERCENTAGE OF OUTPUT BY CLASSES							
1924	50.3	27.4	12.1	6.4	3.0	0.8	100
1925	59.8	22.6	9.9	3.8	2.8	1.1	100
1926	62.6	21.2	8.0	4.2	2.9	1.1	100
1927	32.7	36.7	16.4	7.4	5.1	1.7	100
1928	50.1	29.9	10.8	4.9	2.7	1.6	100
1929	57.4	26.6	8.3	3.9	2.5	1.3	100
1930	53.3	30.2	8.0	3.4	3.5	1.6	100
1931	51.3	31.6	6.6	4.6	3.7	2.2	100

[a] Data from Mineral Resources of the United States, Part II, Nonmetals: U. S. Bureau of Mines, annual reports.

Fuel Briquets

Fuel briquets supply only a small part of the fuel used for domestic purposes. It should be noted however, that two-thirds of the fuel briquets used in United States are marketed in the Illinois coal market area (Table 13).

Table 13.—*Fuel briquets consumed for domestic fuel in the Illinois coal market area in 1931 and 1932* [a]
(In net tons)

State	1931	1932
Illinois	7,918	5,474
Wisconsin	77,907	65,872
Minnesota	200,583	137,292
Iowa	23,843	18,310
Missouri	4,271	3,005
North Dakota	52,288	43,915
South Dakota	39,490	29,999
Nebraska	16,975	8,245
Kansas	10,033	6,262
Total	433,308	318,374
Total for United States	688,258	485,288

[a] Weekly Coal Report 821, U. S. Bureau of Mines, Washington, D. C., April 8, 1932, p. 3.

Retail Prices of Domestic Coal

Trends in retail prices of domestic fuels in selected cities of the Illinois coal market area are given in Table 14.

Table 14.—*Average retail prices of coal in selected cities, 1913 and 1929 to 1932* [a]

Chicago

1913

Month	Anthracite Stove	Anthracite Chestnut	High Vol.	Bituminous Low Vol.	Run-of-mine
January	$ 8.00	$ 8.25			$ 4.97
July	7.80	8.05			4.65
1928					
January	16.95	16.46	8.66	11.85	8.25
July	16.25	15.95	7.96	10.35	7.50
1929					
January	16.80	16.45	8.20	11.85	8.25
July	16.55	16.10	7.74	10.35	7.50
1930					
January	16.85	16.40	8.53	12.32	8.25
July	16.38	15.93	7.78	10.29	7.75
1931					
January	16.40	16.30	8.09	11.89	8.00
July	16.25	16.25	7.54	10.36	7.23
1932					
January	16.73	16.73	7.92	11.41	7.48
July	15.30	15.05	7.53	9.22	6.95

Peoria

Bituminous coal, prepared sizes

Month	1928	1929	1930	1931	1932
January	7.10	6.90	6.75	6.43	6.12
July	6.52	6.49	6.27	6.13	6.10

Springfield

Bituminous coal, prepared sizes

January	4.44	4.24	4.34	4.34	4.34
July	4.44	4.34	4.34	4.37	4.39

(continued on page 22)

St. Louis

Month	Anthracite Stove	Anthracite Chestnut		Bituminous
1928				
January	16.90	16.45		7.02
July	16.40	16.15		5.95
1929				
January	16.75	16.45		6.40
July	16.45	16.20		6.28
1930				
January	16.70	16.45		6.75
July	16.25	16.00		6.00
1931				
January	16.23	15.98		6.40
July	16.47	16.47		5.51
1932				
January	16.41	16.47		5.73
July	14.72	14.72		5.16

Minneapolis

Month			Bituminous High Vol.	Bituminous Low Vol.
1928				
January	18.15	17.70	10.96	13.75
July	17.95	17.65	10.94	13.50
1929				
January	18.28	17.90	10.90	13.50
July	18.00	17.60	10.41	13.24
1930				
January	18.30	17.85	10.56	13.65
July	17.75	17.30	10.26	13.14
1931				
January	16.90	16.90	9.85	12.63
July	17.61	17.61	9.91	12.34
1932				
January	18.05	18.05	9.87	12.54
July	16.75	16.50	9.62	11.87

[a]Monthly Labor Review, U. S. Department of Labor.

Influence of Competitive Fuels and Water Power

Coal shares the energy market with fuel oil, natural gas, and water power. Of these fuel oil is the most important factor in the Illinois coal market area, natural gas has made rapid increases since 1930, and water power is a minor but not unimportant factor.

Fuel Oil Consumption

The extent to which fuel oil shares the energy market in the states supplied by Illinois coal is shown in Table 15.

TABLE 15.—*Fuel oil consumption in the Illinois coal market area, 1926-1931* [a]
(In barrels of 42 U. S. gallons)

State	1926	1927	1928	1929	1930	1931[b]
Illinois	8,992,051	11,445,021	14,127,611	13,257,751	12,807,413	11,133,114
Wisconsin	1,101,141	1,411,161	1,474,385	1,640,396	1,573,051	1,396,406
Minnesota	979,585	1,404,070	1,478,911	1,548,860	1,664,264	1,764,881
Iowa	666,153	659,790	786,897	881,970	1,123,053	960,481
Missouri	5,146,747	5,296,509	4,516,311	4,750,722	4,489,736	4,222,271
North Dakota	40,182	25,070	63,202	109,655	128,201	105,077
South Dakota	121,909	106,046	130,332	154,290	166,702	205,450
Total	17,047,768	20,347,667	22,577,639	22,343,644	21,952,420	19,787,680
Coal equivalent (in tons)[c]	4,050,000	4,835,000	5,370,000	5,710,000	5,225,000	4,700,000
Nebraska	748,547	670,586	637,193	810,027	852,022	801,890
Kansas	5,164,216	4,815,814	5,653,993	5,717,494	4,661,937	5,437,761
Grand Total	22,960,531	25,834,067	28,868,825	28,871,165	27,466,379	26,027,331
Coal equivalent (in tons)[c]	5,450,000	6,150,000	6,870,000	6,871,000	6,550,000	6,180,000

[a] Swanson, E. B., National Survey of Fuel Oil Distribution, 1927, 1928, 1929, 1930, and 1931. Annual reports of the U. S. Bureau of Mines.
[b] Preliminary.
[c] Fuel oil converted into coal equivalent on a basis of 4.2 barrels of oil to a ton of coal.

Natural Gas in the Illinois Coal Market Area

The importation of natural gas into Illinois began in 1929 when 156,000,000 cubic feet were received from northern Louisiana. Since that year three major pipe lines have been laid from outside gas fields to various Illinois cities. The East St. Louis and St. Louis district is supplied by the gas from the Monroe field in northern Louisiana; several cities in central Illinois[3] receive gas by long distance pipe-line from the Hugoton field in southwestern Kansas; Chicago receives gas over a distance of 900 miles from the Amarillo field in the Texas Panhandle. A fourth gas line from the Amarillo and Hugoton fields supplies cities in eastern Nebraska, western and central Iowa, and southern Minnesota. The increase of gas importation into these states since 1929 is shown in Table 16.

Table 16.—*Natural gas imported into the Illinois coal market area*
(In thousands of cubic feet.)

From	1928	1929	1930	1931
Illinois				
Kansas	0	0	0	26,000
Louisiana	0	156,000	6,712,000	7,553,000
Missouri	0	0	0	175,000
Texas	0	0	0	4,166,000
Total	0	156,000	6,712,000	11,920,000
Missouri				
Kansas	9,406,000	14,635,000	20,284,000	3,033,000
Louisiana	0	133,000	5,464,000	5,406,000
Oklahoma	0	0	0	5,447,000
Texas	0	0	0	9,217,000
Total	9,406,000	14,768,000	25,748,000	23,103,000
Iowa				
Kansas	0	0	8,000	1,795,000
Texas	0	0	0	1,727,000
Total	0	0	8,000	3,522,000
Nebraska				
Kansas	0	0	1,098,000	2,802,000
Oklahoma	0	0	0	31,000
Texas	0	0	0	1,837,000
Wyoming	0	0	0	147,000
Total	0	0	1,098,000	5,817,000
Grand Total	9,406,000	14,924,000	33,666,000	43,362,000

[3]Jacksonville, Peoria, Bloomington, Decatur, Urbana, Champaign, Danville.

Consumption of gas in the states comprising the Illinois coal market area for the years 1928 to 1931 is shown in Table 17.

TABLE 17.—*Consumption of natural gas in the Illinois coal market area, 1928-1931*
(In millions of cubic feet)

	1928	1929	1930	1931
Illinois	3,051	3,139	9,602	14,050
Minnesota	0	0	0	0
Iowa	0	0	0	3,522
Missouri	9,766	15,078	26,122	24,261
South Dakota	214	1,717	2,905	2,803
Nebraska	0	0	1,098	4,817
Kansas	72,761	75,476	75,635	65,609
Total	85,792	95,410	115,362	115,062
Total without Kansas	13,031	19,934	39,727	49,453
Approximate coal equivalent (exclusive of Kansas) in tons[a]	521,240	797,360	1,389,080	1,978,120

[a]One ton of coal is considered as equivalent to 25,000 cubic feet of natural gas.

The significant changes in natural gas consumption, insofar as they affect the competitive position of coal, are the recent increases in Illinois, Iowa, Nebraska, and Missouri. Completion of the gas line from the Monroe field in Louisiana to the St. Louis district in 1929 resulted in a rapid increase in the use of natural gas for industrial purposes in both Missouri and Illinois while domestic consumption also registered substantial increases. Completion of the long distance lines from the Texas Panhandle to Indianapolis and Chicago in 1931 further increased the consumption of natural gas in Chicago and in cities of central Illinois. The coal market was also seriously affected by the introduction of gas into the principal cities of eastern Nebraska, western Iowa and southern Minnesota.

The gas supply of South Dakota is obtained from Montana and is used entirely in the western part of the State and, consequently, does not effect the market for Illinois coal. Similarly gas consumption in Kansas and western Missouri results mainly in the displacement of fuel oil and local coal supplies.

HYDRO-ELECTRIC POWER

Water power is not an important factor in the power supply of the Upper Mississippi Valley States. Practically all water power installations are engaged in the production of public utility electric power although some hydraulic power plants are used in the wood pulp

industries of Wisconsin. This aggregate power output is so small as to be negligible. In the electric utility industry, the relative importance of hydro-electric power is declining. Reduced electric power consumption in the last three years apparently affected hydro-electric plants to a greater extent than fuel burning stations. The relative position of each of the energy producing groups is shown in Table 18

TABLE 18.—*Production of electricity in Illinois coal market area, 1920-1932*[a]
(In thousands of kilowatt hours)

Year	Total	By fuels	By water	Per cent by water
1920	7,182,420	5,368,314	1,814,106	25.3
1921	7,108,313	5,369,900	1,738,413	23.4
1922	8,144,956	6,406,061	1,738,895	21.4
1923	9,311,784	7,491,982	1,819,802	19.5
1924	10,029,389	7,907,654	2,121,735	21.2
1925	11,065,384	8,933,023	2,132,361	19.3
1926	12,338,116	9,728,642	2,609,474	21.4
1927	13,096,212	10,247,584	2,848,628	21.8
1928	14,197,809	11,123,433	3,074,376	21.7
1929	15,320,316	12,505,881	2,814,435	18.5
1930	14,992,163	12,458,105	2,534,058	17.5
1931	14,199,152	11,827,399	2,371,753	16.7
1932	12,813,766	10,174,462	2,639,304	20.6

[a] Compiled from the annual and monthly reports of the U. S. Geological Survey, Division of Power Resources. Comprises the states of Illinois, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas.

PETROLEUM

PRODUCTION AND DEVELOPMENT IN ILLINOIS IN 1931 AND 1932[4]

The last detailed discussion of petroleum production and development in Illinois covered the period 1929 and 1930,[5] and since the detailed data regarding drilling in 1931 were not included in the statistical summary for that year they are included here.

Production of petroleum in 1932 was 4,661,000 barrels, a decrease of 378,000 barrels from the previous year. This decrease is largely due to artificial curtailment of production during the latter half of 1932, for if the production for that period had been the same as for the first half of 1932 when there was no curtailment the total production for the year would have been 5,212,000 barrels which exceeds the production for 1931 (5,039,000 barrels).

If the amount and period of curtailment during 1932 had been the same as for 1931, namely 25 per cent for 5 months, the amount produced would have been 4,678,000 barrels, and indicates a decline of 7 per cent, on a basis of equal curtailment. This compares with a decline from 1930 to 1931 of 10 per cent on a similar basis.

[4] Prepared by Alfred H. Bell, Illinois State Geological Survey.
[5] Bell, A. H. and Benson, E. T., Petroleum developments in Illinois in 1929 and 1930, Illinois State Geol. Survey Press Bulletin Series Illinois Petroleum No. 20, July 11, 1931, pp. 8-16.

TABLE 19.—*Price of crude oil in Illinois during 1932*

Period From To	No. of days	Price (Per barrel)
Jan. 1 — April 10	101	$0.90
Apr. 11 — Dec. 15	249	1.10
Dec. 16 — Dec. 31	16	0.87
	366	$1.032

TABLE 20.—*Production, price, and value of crude oil in Illinois in 1930-1932*

Year	Production of crude oil Barrels	Ave. Price for year	Value	
			Calculated	Given By Bureau of Mines
1930	5,736,000	$1.616	$9,250,000	$9,100,000
1931	5,023,000	0.852	4,280,000	4,500,000
1932	4,661,000	1.032	4,810,000	

TABLE 21.—*Proration in Illinois fields during 1932*

Percentage of normal Production	Period	Production actual M. bbls.	Production potential M. bbls.
100	5½ months	2404	2404
90	3½ months	1381	1536
60	3 months	876	1460
		4661	5400

The results of drilling, by counties, in 1931 and 1932 are shown in Table 23. Owing to the low prices of crude oil and the decreased demand during these years very little drilling was done in the producing fields and the greater part consisted of scattered wildcat tests.

Eight of the wells drilled in Crawford County in 1932 were in the area 3 to 4 miles east of Flatrock which was discovered in 1930.[6] Of the 8, 4 were oil producers with initial daily productions of 10 to 30 barrels and the remaining 4 were dry holes.

The scattered wildcat tests in Illinois in 1931 and 1932 are tabulated in Table 22.

[6] Bell and Benson. Op. cit., p. 12

TABLE 22.—*Wildcat wells drilled in Illinois in 1931 and 1932*

County	Part of Sec.	Sec.	T	R	Company	Farm	No.	T. D.	Lowest horizon penetrated
					Completed 1931				
Hancock	NE NE NE	13	4N	9W	Kosana Oil Co.	Kircher	1	1078	"Trenton"
Henry	Cen.NE NE	20	17N	1E	Geneseo Oil & Gas Co.	S. Shafer	1	750	"Trenton"
Kankakee	SW SW SW	27	30N	11W	H. B. Snyder & Co.	Mason	1	1000	"Trenton"
Monroe	SE NE SE	22	1S	10W	Wesner et al	L. Gross	1	537	"Trenton"
Montgomery	NE NE NE	17	9N	3W	Miller et al	Miller	1	800	Pennsylvanian
Montgomery	NE NW NW	16	9N	3W	Myers, Miller et al	Miller	2	1145	Lower Miss.
Perry	SE SW NE	24	5S	3W	Ohio Oil Co.	Roe	1	1433	Chester
Sangamon	SE NE NW	30	15N	7W	Midland Oil Co.	Geo. Horn	1	500	Lower Miss.
Williamson	NE SW SW	29	9S	1E	Wiswell, Kieth, et al	J. B. North	1	1320	Chester
					Completed 1932				
Adams	NE NW SW	10	2N	7W	Geo. C. Newland	Chas. Hobson		972	St. Peter
Adams	SW NE NE	2	1N	9W	Walmar Oil Co.	Homer Bradford		720	St. Peter
Coles	NE NW NW	21	11N	9E	Old Homestead Oil & Gas	W. A. Smith		1003	Pennsylvanian
Hancock	NE SE SE	13	4N	9W	Walmar Oil Co.	Mitze	1	935	"Trenton"
Hancock	NW SW NW	8	3N	8W	Walmar Oil Co.	Miller	1	1361	Prairie du Chien
Jackson	NW NE NW	13	10S	1W	Big Four Oil & Gas Co.	Otis Fox	1	2690	Lower Miss.
Jefferson	NW NW SE	24	4S	2E	Phillips Petroleum Co.	Moss	1	2928	Lower Miss.
Monroe	NW	23	1S	10W	Webster Oil & Gas	A. Harmes	1	664	"Trenton"
Montgomery	SW SE SW	9	9N	3W	DeWitt & Miller	Wm. House	1	975	Pennsylvanian
St. Clair	SE SW NE	33	1N	9W	T. J. Collins	C. Waelti	1	1265	"Trenton"
St. Clair	SE SE NE	18	2N	7W	Johnson Oil Co.	E. H. Smiley	1	850	Lower Miss.
St. Clair	SE NE SE	28	1N	8W	Kane & Pollack	Stolberg	1	1137	Lower Miss.
St. Clair	SE SW NE	13	1S	9W	Acona Natural Gas Co.	T. Stutz	1	1491	"Trenton"
Shelby	NE NW NW	3	11N	6E	A. J. Holderman et al	W. O. Storm	1	1202	Pennsylvanian
Wabash	SW SE SW	1	1S	13W	Forman & Miller	O. O. Ginther		2621	Lower Miss.
White	NE SE NE	22	3S	10E	Mann & Huber	J. Higginson		1454	

Drilling or shut down Dec. 31, 1932; not reported completed

Clinton			SE	27	1N	5W	Voss et al	M. Breiner	1	210	Pennsylvanian
Bond		SE	SW	18	6N	3W	Ashby et al	J. G. Stanton	1	1022	Chester
Bond		NE	SE	22	5N	4W	Ashby et al	M. F. File	1	926	Chester
Boone			NW	27	43N	4E	J. B. Myers et al	Hogan	1	816	St. Peter
Coles		SE	NW	27	12N	8E	Kline et al	Hildreth	1	900	Pennsylvanian
DeKalb		NE	SE	35	41N	5E	Paul Schulte et al	E. Wyman	1	935	St. Peter
Jasper		SE	NW	7	6N	9E	Richard Eke	Ross Klier	1	1433	Pennsylvanian
Johnson	NW	SE	SE	6	13S	4E	A. P. Cummins	C. E. Deans	1	180	Chester
Richland	SE	SW	SW	28	4N	14W	P. E. Hill	P. Kocher	1	2120	Pennsylvanian
Rock Island	SW	SW	SE	8	17N	1E	Roweder, Battles et al	Christianson		2894	Mt. Simon
Shelby		NW	NW	4	11N	6W	A. J. Holderman et al	R. Lemons	1	1045	Pennsylvanian

TABLE 23.—*Results of drilling in Illinois in 1931 and 1932*

County	1931						1932					
					Initial Production						Initial Production	
	Completed	Dry	Gas	Oil	Oil bbls.	Gas M. cu. ft.	Completed	Dry	Gas	Oil	Oil bbls.	Gas M. cu. ft.
Adams							2	2	–	–	–	–
Bond	1	0	1	0	0	?	4	2	2	–	–	2000
Boone	1	1	0	0	0	0	–	–	–	–	–	–
Clark	–	–	–	–	–	–	2	1	–	1	2	–
Clinton	2	2	–	–	–	–	–	–	–	–	–	–
Coles	–	–	–	–	–	–	1	1	–	–	–	–
Crawford	13	6	–	7	72	–	17	10	0	7	91	–
Cumberland	1	1	–	–	–	–	–	–	–	–	–	–
Effingham	1	1	–	–	–	–	–	–	–	–	–	–
Hancock	1	1	–	–	–	–	2	2	–	–	–	–
Henry	1	1	–	–	–	–	–	–	–	–	–	–
Jackson	–	–	–	–	–	–	1	1	–	–	–	–
Jefferson	–	–	–	–	–	–	1	1	–	–	–	–
Kankakee	1	1	–	–	–	–	–	–	–	–	–	–
Lawrence	–	–	–	–	–	–	2	1	–	1	2	–
Madison	1	0	0	1	2	–	–	–	–	–	–	–
Macoupin	7	4	1	2	8	300	–	–	–	–	–	–
Marion	1	0	0	1	15	–	1	0	0	1	5	–
Monroe	4	3	0	1	?	–	1	1	0	0	0	0
Montgomery	2	2	0	0	0	0	1	1	0	0	0	0
Morgan	0	–	–	–	–	–	6	0	6	0	0	2092
Perry	1	1	0	0	0	0	0	–	–	–	–	–
St. Clair	10	7	0	3	11	–	4	4	–	–	–	–
Sangamon	1	1	0	0	0	0	0	–	–	–	–	–
Shelby	0	0	0	0	0	0	1	1	–	–	–	–
Wabash	3	1	0	2	8	0	5	4	0	1	2	–
White	0	–	–	–	–	–	1	1	–	–	–	–
Williamson	1	1	–	–	–	–	–	–	–	–	–	–
Total	53	34	2	17	116	300+	52	33	8	11	102	4092

The Ohio Oil Company Roe well No. 1 in sec. 24 T.5 S., R.3 W., Perry County, which finished near the base of the Chester series, was located on the Pinckneyville anticline which had previously been recommended for testing.[7]

The Wesner et al L. Gross well No. 1, sec. 22, T. 1 S., R. 10 W., and the Webster Oil and Gas Co. A. Harmes well No. 1, sec. 23, T. 1 S., R. 10 W., were located near the axis of the Waterloo anticline but there was no indication of local closure.

The Phillips Petroleum Co. and A. J. Nason test on the Moss farm in sec. 24, T. 4 S., R. 2 E., was located on an anticline revealed by coal borings.

The Johnson Oil Refining Company's E. H. Smiley well No. 1 in sec. 18, T. 2 N., R. 7 W., was located on a slight anticline or "terrace" in coal No. 6 which had been previously mapped.[8]

None of the rest of the test wells listed were drilled on known favorable structures.

The decrease in drilling in Illinois during the years following 1929 is shown in Table 24. The increase from 1928 to 1929 was due to the discovery late in 1928 of the Dupo field which was largely drilled up in 1929 and 1930.

TABLE 24.—*Total wells drilled in Illinois, 1928-1932*

Year	Completions	Dry	Gas	Oil	Initial production	
					Oil (barrels)	Gas (M. cu. Ft.)
1928	145	58	8	79	1840	data not available
1929	433	101	18	313	16030	4588
1930	253	119	14	120	3134	8242
1931	53	34	2	17	116	300+
1932	52	33	8	11	102	4092
Total	936	345	50	540	21222	17222

FACTORS INFLUENCING THE MARKET FOR CRUDE PETROLEUM

The crude petroleum industry of Illinois is directly affected by the economic condition of the oil industry in the United States, which is, in turn, subject to world wide influences. Relative conditions of supply and demand since 1927 is shown in Table 26, page 36. Until 1929

[7] Bell, A. H., Ball, C. G., and McCabe, L. C., Geology of the Pinkneyville and Jamestown areas, Perry County, Illinois: Illinois State Geol. Survey, Illinois Petroleum No. 19, April 11, 1931, p. 15.

[8] Udden, J. A. and Shaw, E. W., Description of the Belleville and Breese quadrangles, U. S. G. S. Geologic folio No. 195, the Belleville-Breese folio, 1915.

Blatchley, R. S., Illinois oil resources, Ill. State Geol. Survey Bull. 16, 1910, pp. 89 and 167.

Shaw, E. W., The Carlyle oil field and surrounding territory, Ill. State Geol. Survey Bull. 20, 1915, p. 64.

new supply was exceeding demand and stocks of crude and refined products, already large, were increasing. The situation was further aggravated by a decrease in net exports beginning in 1928 and continuing through 1932. Recent legislation taxing the imports of oil and the steady growth of refineries in European nations who draw their oil supplies from Venezuela probably point to a permanent decline in export trade which more than offsets the curtailed imports.

Although there is lack of unanimity among the members of the industry as to the cause of price reductions of crude oil that occurred late in 1932, many factors are recognized as having contributed to the downward revisions. Among these are the large stocks of gasoline which were 50,000,000 barrels on December 31, 1932. Gasoline prices are far more sensitive to excess stocks than to any other influence. One reason is that the industry receives most of its money from the sale of gasoline. As a result, when a refiner has to obtain additional funds for any purpose, he attempts to dispose of his gasoline at a price generally below the market. Consequently, as long as gasoline stocks are large, any stability in price is virtually out of the question.

The practice in the industry to maintain its refining activities as near to capacity as possible regardless of the condition of the market for the refined product, is another factor tending to keep the market not only unsettled but also generally at low levels. The legal problem of restricting operations precludes any concerted action along this line.

The unsettled price structure, moreover, is not affected solely by the current statistical position of the industry. Present prices and the probable future trend must be examined in the light of conditions now existing in the national oil industry. The relation between supply and demand, the arbiter of price in a competitive system, has been subjected to unusual mal-adjustments in the oil industry. The chief factors that may be enumerated are:

(1) The existence of large known underground reserves and held-in production.

(2) Efforts of leading oil companies to reduce stocks above ground.

(3) Increasing percentages of gasoline recovery from crude oil.

(4) Declining rate of consumption increase.

(5) Discovery and exploitation of unusually large and cheaply developed pools.

TREND OF DEMAND FOR GASOLINE

Gasoline consumption in the United States increased at a rate of from 30 to 35 million barrels annually until 1929. Following that year, there was an abrupt change in the curve of demand with the result

that there were virtually no increases in 1930 and 1931 and a decrease of about 10 per cent in 1932 (Table 25). Relatively the market for refined oil products has not suffered as severely as other important groups of industrial commodities. When the demand for industrial commodities again turns upward the demand for gasoline may be expected to follow the trend and recover the lost markets occuring in 1932. Nevertheless, the rate of increase existing before 1929 can hardly be anticipated and a conservative estimate of continued consumption at the 1929 level for the immediate future years will be assumed in analyzing the conditions of petroleum supply.

TABLE 25.—*Gasoline demand, 1925-1932* [a]

	Barrels	Per cent increase over previous years
1925	233,865,000	
1926	264,391,000	18
1927	299,818,000	13
1928	332,033,000	10
1929	375,999,000	13
1930	394,800,000	5
1931	403,418,000	2
1932	377,403,000	−6

[a] American Petroleum Institute.

CONDITIONS OF SUPPLY

Beyond the bare figures of annual crude oil supply, account must be taken of several far reaching changes which are temporarily disturbing the profitable relationship of a balanced demand and supply. The discovery of large reserves of oil in widely separated oil-producing states and in localities hitherto regarded as unfavorable to oil has dispelled the fear, for several years at least, of a crude oil shortage. As a consequence of this change of sentiment, leading oil companies undertook to reduce the large stocks of crude oil held on tank farms of refiners and pipe line companies, now no longer regarded as necessary, and to apply the same policy to stocks of gasoline. The result of this policy was, in effect, to increase the available supply of crude by adding to current production the unneeded and stored-up surplus. Concurrent with the inauguration of this policy was the discovery, within a short period of time of several prolific pools with high initial production in the wells and enormous potential production.

The existence of these large underground reserves, even though the fields were not completely drilled, created a state of mind which placed them in the same category as stocks above ground with consequent demoralization of the price structure. The oil public, temporarily

at least, failed to recognize the fact that the rate at which these potential resources could be brought to the surface is limited by the critical rate of production per well and the number of wells drilled into the pool.

Meanwhile, the increased recovery of gasoline from crude oil by means of the cracking process tended to increase the available supply of gasoline at a faster rate than the demand for crude petroleum. Under the old "straight-run" methods of refining, with a production of 18 per cent of gasoline from a barrel of crude oil, it would have taken more than twice the amount of crude oil actually refined in 1932 to have produced this output of gasoline. By means of the cracking process, the yield of gasoline has been increased to 42 per cent in 1930[9] and by treatment of all of the gas and fuel oil this percentage could be raised to 60 or more. Further development of "cracking" would cut heavily into the annual requirements of crude oil.

The price structure since 1930 has been further affected by prolific production from flush pools, notably East Texas, Oklahoma City, and Kettleman Hills. The rapid succession of the discovery and exploitation of these pools contributed so heavily to the crude oil supply that the price fell to unheard of low levels. This low price of oil, fixed by the low cost of production at the prolific flush pools, jeopardized the profits of all the wells having a settled production, the small stripper wells and the higher-cost pumping wells. This condition was particularly aggravated by the fact that several large pools of unusually large volume came into production in quick succession. Noteworthy of mention among these prolific pools are Kettleman Hills, Oklahoma City, East Texas, Yates, and Conroe.

SIGNIFICANCE OF THE DEMAND AND SUPPLY FACTORS

The significance of the events of the past few years in oil history lies in the fact that the several separate and unrelated factors in the conditions of supply followed each other so quickly that it was impossible to effect an adjustment to demand. What, then, may be expected in the future? Although accurate prediction in the ever-changing panorama of oil is impossible, nevertheless certain trends may be indicated. The reduction of crude stocks above ground and of refined products is a temporary contributing factor to the existing threat of over supply, and its influence will be removed when this program is accomplished. Similarly, the constant threat to the market of large proved underground reserves will diminish as these supplies are drawn upon and as the realization dawns upon the oil producers that the critical rate of production limits their rate of availability. The extent of proved underground reserves may be considered abnormal.

[9]Hopkins, G. R., Petroleum refinery statistics in 1930: U. S. Bureau of Mines Bull. 367, p. 98, 1932.

The rapid succession of discovery of such pools as East Texas and Oklahoma City may not occur again and with their eventual decline, the diminished proven reserves will not be sufficient to menace the price structure.

Increasing percentages of gasoline recovery from crude oil is probably a trend of a more permanent nature, and the rate of change is not rapid enough to cause serious dislocations, by itself, in the relation between supply and demand.

Attempts to control the supply of new oil has been mainly by proration. While this expedient may have been temporarily beneficial, it now threatens to become an aggravating factor in the producing branch of the industry, and needs a radical revision of method. Proration, as now administered, puts a premium on drilling activities. The allowable output of a producer now depends on the potential production built up. Consequently he continues drilling, although he is allowed to produce in some fields only a small part of the capacity of the completed well. The result is that all producers are operating at a small percentage of capacity. For flush pools this may, nevertheless, mean profitable operation even at low prices but for the settled production of the smaller wells, this policy is ruinous.

The statistical position of the oil industry from 1927 to 1931 is shown in Table 26. Domestic demand has exceeded supply in 1930 and 1931 with a consequent reduction of stocks in those years. Declining importance of international trade in petroleum is shown in the dwindling net exports of oil products.

The serious predicament of the 350,000 small wells of settled production in the country and the necessity for their preservation was recognized by Judge C. B. Ames, President of the American Petroleum Institute, in an analysis published in the quarterly bulletin of the Institute. According to Judge Ames, stability could be brought into the oil industry by the cooperation of only three or four states. He states that:

"A sound conservation policy must, in the public interest, include these factors: (a) preservation of the 350,000 small wells of settled production; (b) very drastic limitations on new pools which will discourage wildcatting under present conditions; and (c) the limitation of existing flush pools to the requirements of the market. These conditions require the cooperation of only three or four states. Is it not possible for these states and the industry to so cooperate as to remove distress production to make possible the preservation of old wells by a price which will pay the cost of pumping and to stabilize the industry on a basis of sound conservation?"[10]

[10] Reprinted in Oil Weekly, January 30, 1933, p. 68.

TABLE 26.—*Summarized statistical position of the petroleum industry, 1927-1931* [a]
(Thousands of barrels of 42 U. S. gallons)

	1927	1928	1929	1930	1931
Total new supply[b]	1,014,084	1,038,166	1,169,633	1,058,949	981,252
Total demand[c]	943,981	1,015,384	1,102,027	1,082,949	1,025,497
Domestic supply[d]	872,999	983,717	1,007,376	902,450	856,737
Domestic demand[e]	802,946	860,935	939,770	926,450	900,982
Gasoline consumption	299,878	332,033	375,999	394,800	403,418
Exports					
Crude	15,844	18,966	26,374	23,705	25,546
Refined products	125,191	135,483	135,883	132,794	98,969
Imports					
Crude	58,383	79,767	78,915	62,129	47,250
Refined products	13,353	11,790	29,794	43,489	38,832
Foreign trade balance					
Excess of crude imports	42,539	50,801	52,541	38,424	21,704
Excess of refined exports	111,838	123,693	106,089	89,305	60,137
Net exports of oil products	69,299	72,892	53,548	50,881	38,433

[a] Data from the annual statistical reports of the U. S. Bureau of Mines.
[b] Source of production of domestic crude, natural gasoline, benzol, and crude and refined imports.
[c] Total new supply plus or minus decrease or increase in stocks.
[d] Total new supply less exports.
[e] Total demand less exports.

TABLE 27.—*Crude oil and motor fuel, 1929-1931*
(Thousands of barrels of 42 U. S. gallons)

	1929	1930	1931
Crude oil			
Domestic production	1,007,323	898,011	851,031
Imports	78,933	62,129	47,250
Exports	26,401	23,705	25,535
Change in stocks [a]	+35,816	−19,636	−40,963
Apparent consumption	1,024,045	956,071	913,709
Average daily consumption	2,805	2,609	2,503
Total refinable stocks on hand, Dec. 31[b]	431,518	411,882	370,919
Motor fuel			
Domestic Production	439,393	440,728	437,735
Natural Gasoline production			
Benzol production			
Imports	8,834	16,927	13,621
Exports	62,059	65,575	45,716
Change in stocks	+10,119	−2,720	+1,779
Apparent consumption	376,099	394,800	403,861
Stocks on hand, December 31	43,261	40,541	42,320

[a] Lamp, August 1932, p. 2.
[b] Annual petroleum statement, No. 94 U. S. Bureau of Mines.

BUILDING MATERIALS

Survey of Construction

A number of non-metallic mineral materials are used largely in building construction and the demand for them fluctuates with the varying activities of the building industry. Among these are clay products, cement, structural sand, structural gravel, glass sand, and lime. The market outlook for these materials is therefore governed more or less by a common set of factors, hence their trend in production and consumption will be considered together.

Trends in output of building materials and in building permits issued for the years 1920-1932 are given in Table 28. Activity in the building industry, which reached its highest levels in the years 1924-1927, is almost paralleled by activity in each of the building materials here listed. Each of these disposes of a part of its product in markets other than the building industry but the latter is the most important outlet. For example, the peak of cement consumption occurring in 1928 is a result partly of extensive road building as well as building construction. Glass sand, also, enters such uses as autombile plate glass, pressed table ware, glass containers, etc. Nevertheless, the large proportion of these materials directly or indirectly entering into the construction of homes, offices, public buildings and industrial structures tends to make them more or less dependent upon the extent of building activity.

The building record, as disclosed by this table, is distinctive in its relation to other types of industrial activity. While such industries as coal mining, oil production, automobile manufacture, industrial and agricultural machinery output have fluctuated from year to year and all have declined severely since 1929, none has experienced so wide an amplitude of activity as the building industry and those raw material industries closely associated with it in the period from 1920-1932. The rapid expansion of building from 1920 to 1925-26 followed as a consequence of the restricted building program during the war and the rise of the nation out of the depression of 1921. The equally rapid decline after 1926 indicated the ending of the building shortage accumulated during the war and post-war years. The industries which had expanded to meet the unusual building demand now were weighed down with excess capacity, surplus equipment, and a larger personnel than could possibly be employed. The exisiting crisis in which the building and associated industries are the severest sufferers was making itself felt as early as 1927. Sustained production in other lines of industry into late 1929 merely concealed somewhat the substantial decline in building for two prior years.

TABLE 28.—*Output of selected Illinois building materials compared with trend of building permits, 1920-1932*

Year	[a] Building permits value, 354 cities in U. S. (Thousands)	[c] Value of clay products, Illinois	[d] Cement consumption bbls., Illinois	[d] Structural sand production in tons, Illinois	[d] Structural gravel Illinois, tons	[d] Glass sand production in tons, Illinois	[d] Lime
1920	$1,675,277	$26,138,419	7,407,388	2,211,776	1,702,631	714,353	35,103
1921	1,916,437	19,041,182	6,366,563	2,015,749	1,272,413	259,889	25,404
1922	2,888,082	26,784,263	9,667,741	2,330,647	1,448,316	488,641	44,632
1923	3,536,737	34,218,987	12,237,478	3,548,297	2,259,994	481,328	49,584
1924	3,702,135	33,591,368	13,328,219	3,255,710	2,382,599	642,009	44,587
1925	4,393,364	36,763,980	14,404,947	3,429,381	2,236,895	709,029	50,588
1926	4,121,965	37,030,004	14,066,500	4,001,642	2,721,005	610,234	57,969
1927	3,651,036	34,346,886	14,832,550	4,194,993	2,598,191	629,268	63,550
1928	3,500,730	32,026,885	17,683,269	4,630,189	3,182,255	658,036	65,701
1929	3,096,839	27,391,068	13,490,520	4,011,481	3,401,945	552,539	51,476
1930	1,776,623	19,972,156	10,979,816	2,685,313	1,947,176	489,824	31,535
1931	1,212,196	10,585,136	7,773,157	1,889,757	1,290,073	416,066	18,683
1932	417,541[b]	3,937,951	5,798,195	(e)	(e)	(e)	(e)

[a] Engineering News-Record, February 4, 1932, p. 161.
[b] Engineering News-Record, February 2, 1933, p. 147.
[c] U. S. Bureau of Mines and Bureau of the Census.
[d] Annual mineral statistical reports of the U. S. Bureau of Mines.
[e] Data not available.

Stagnant conditions in the construction industry were intensified by the general industrial debacle in 1929. Falling commodity prices and real estate values effectively discouraged any building activity. Loss of employment and the general undermining of employment security further depressed the desire or the ability of individuals to build. Drop in industrial activity put a stop to plant and office construction. The general lowering of price levels and incomes brought about further mal-adjustments between the cost of construction and ability to pay.

This rapid survey of the past is of interest only insofar as it may be used to interpret the future. Builders, building tradesmen, and dealers in building raw materials are eager to forecast as far as possible the future trend. Is the building industry a closed chapter or is the present a quiescent period preceding renewed building activity? And if building will be renewed in the future, what will be the trends—in types of buildings, in materials, and in cost of homes.

Present Condition of Buildings

The need of renewed building activity cannot be doubted while existing structures are obsolete. Obsolescence is particularly prevalent in domestic housing where change and the adoption of modern improvements in building has been slowest. Proof of the existence of obsolescence necessitates a statement of essentials of a modern house as conceived to be a standard of comfort and desirability and a comparison of this with present day structures. Such a modern house would possess the elements of permanence, both with regard to the materials of construction and its protective coating and decorative features; it would be equipped with a modern heating plant and plumbing equipment; it would be thoroughly insulated against a loss of heat. Construction has ceased to be merely the mechanics of laying up walls if they are of stone or bricks or the plastering of walls and the laying of floors of wood. The next decade may not be one of vast construction enterprises, for quite the contrary appears highly probable, but it will be one of development along lines directed by foresighted planners, who are now solving the problems to overcome weakness brought to light in reports covering the rapid deterioration of ill-chosen materials, or failures due to faulty methods or haste on the part of the workman. The intensive interest displayed by producers of and dealers in coal, fuel oil, and natural gas in demonstrating the heating possibilities of various kinds of heat installations raises this element in house operation to a more scientific level. Insulation in old houses as well as in new construction has demonstrated its practicability and is proving an aid in regulating house temperatures.

Conditions That Must Be Met To Revive A Building Industry

The conditions that must be met in order to revive a building industry are intimately related to the present economic difficulties. The construction and associated raw material industries are peculiarly interested in social stability and permanence of employment. As long as unemployment or the possibility of unemployment prevails, it will be difficult to persuade persons to undertake the construction of homes even though the want and desire exists. Moreover, along with reasonable stability of employment is an assurance of the continued value of the investment in a home and the soundness of property values. When these are subject to the uncertainty of drastic deflation, the prospective house owner is hesitant in committing himself to a long time investment. The restoration of economic health by the slow process of readjustment to new economic conditions and the restoration of employment and purchasing power must precede any extensive building developments.

The second condition that must be met in reviving the building activity of the next decade is an understanding of the wants of the prospective home owner and an adjustment of the building industry to fill these wants. While these have been discussed in an analysis of the elements of a modern house, they may now be briefly summarized as follows:

(1) A lower cost home than was prevalent in the decade just closed.

(2) A well-constructed house of well chosen materials designed to give durability.

(3) A modern heating plant designed to increase convenience of operation and, at the same time, reduce fuel costs.

(4) Insulation.

The range of cost of house construction in the past has been so high as to exclude a large group of workers with moderate incomes. The general reduction in income level has increased this number. It is among this large group now occupying obsolete homes that an opportunity to supply modern houses exists and for whom a low cost home embodying the modern features of comfort, durability, and heat economy must be designed. An indication of the size of the market in the lower price range in homes is shown in Table 29.

TABLE 29.—*Value of owned homes (except farms) in Illinois* [a]

Home valuation	Number	Per cent
Under $1000	37,033	4.8
$1000—1500	36,146	4.7
1500—2000	32,568	4.2
2000—3000	69,369	9.0
3000—5000	141,756	18.5
5000—7500	170,542	22.2
7500—10,000	100,887	13.1
10,000—15,000	94,847	12.3
15,000—20,000	33,963	4.3
20,000 and over	34,929	4.4
not specified	13,506	1.8
Total	765,546	
Median value $5,867		

[a] Population Bulletin, 1930. Families, Illinois, Fifteenth Census of the United States, Table 7, page 9, 1932.

PROPOSALS THAT ARE BEING ADVANCED TO MEET MODERN CONDITIONS

Plans and proposals to meet the new conditions and new demands upon the building industry have not been wanting. Activities in this direction have ranged all the way from government aid in home financing to the design of factory built houses manufactured by mass production methods.

The various aids and proposals may be summarized as follows:

(1) Establishment of aids for financing home building.

(2) Creation of employment through an extensive public works building program.

(3) Design of new types of homes and of house building materials, such as steel houses—combination steel and glass houses—light weight brick materials, etc.

(4) Improvement of the comfort features of a house through the installation of automatic heating equipment and the use of heat insulating materials and better interior surfacing materials.

The record building program following the World War failed to develop a type or system of construction which offers comfort in a low-priced home. Indications now point to a trend back to the single home. The Government program for aid to home builders may do much to make small homes more accessible by reducing the heavy financing costs and by helping to eliminate the dishonest speculative builders. One estimate places recent average financing and promotion costs for home building at 27 per cent, with land and improvements averaging 21 per cent, leaving only 52 per cent for the home itself.

It is generally recognized that first cost and cost of maintenance are far too high in most cases, making home ownership impossible for families having a moderate income. Antiquated and inefficient methods of construction are still the rule. While progress in manufacturing and transportation industries has been rapid and has achieved to a remarkable extent low cost, convenience, and luxury, the dwelling has been an exception to the rule that the advancing years bring increased output of labor per day. Too many houses have been built of poor materials by poor workmanship. Deterioration is so rapid that it is impossible to pay for the house as rapidly as it depreciates in value.

The solution of the small house building problem from a technological point of view which is also satisfactory from an architectural standpoint depends entirely upon the materials to be used and the method of construction.

Significant developments of the year have been the progress made in reenforced brick work, use of enamelled steel sheets for outer wall surfaces, light-weight bricks, increasing interest in insulating materials, and the use of steel frames and sheet steel in house construction.

Recent developments in the field of masonry consists of brick or tile reenforced with steel. Apparently, strength and other properties equal to those obtained in reenforced concrete can be obtained. Reenforced brick structure is not confined to outer walls but is also suitable for floors and inner partitions. Methods have been worked out for manufacturing reenforced brick panels which are then assembled in the building. Although there is little doubt that reenforced brick work, such as these panels, will have advantages for many engineering structures, their use in small houses is less certain and will depend, very greatly, upon the cost.

Metals have been used for structural work in place of wood frames and the year 1932 witnessed the extension of steel as a material for outer walls and inside partitions. Experimental houses employing enamelled steel sheets have been erected. The publicity which the steel house has received has been accompanied by statements of the possiblity of factory fabrication of house and radical reductions in cost. There is, however, no adequate evidence to support the belief that substantially lower costs can be effected through the use of this material. Factory fabrication possess advantages only when mass production methods can be employed which in turn implies a well-organized selling organization similar, for example, to automobile agencies. Another difficulty that must be overcome is the problem of adapting mass production methods to the desire for individuality and distinctiveness in the home. Above all this is the necessity of overcoming public reluctance in adopting the steel house before a market can be created which will

warrant production on a commercial scale. The merits of a steel house and its ability to meet competitive materials will probably be determined only after a relatively long experimental period has elapsed.

The manufacturers of clay building materials cannot, however, be contented to remain in the restricted high price home building market. Whether or not the proposed steel house is to develop into a competitor of wood for the low priced field, the clay products house must find ways and means to supply the lower income brackets if it is to have a substantial share of building in the future. This is especially true since the fall of price levels since 1929 and the consequent reduction of incomes by workers.

No clear cut proposals have as yet come forward to meet this problem. The reinforced brick structure, which has received much study since 1931 and 1932, has opened potential market for brick in certain types of structures. Its value as a means of reducing costs of small house construction has not yet been demonstrated. Brick finds itself on firm ground as a material capable of pleasing architectural appearance and flexibility of house design. It has as yet no competition from radically new materials. It is primarily a question of whether the low income group of workers must be content to continue to dwell in old, obsolete structures erected in the past generation or whether brick and clay block or tile can offer them a comfortable house within their means.

CLAY PRODUCTS

Relation of Construction Activity to Demand for Clay Products

The value of clay products in 1932 was $4,314,643 as compared with $10,585,136 in 1931. This severe decline is of course directly related to conditions in the building industry.

The relation of construction to productive activity in other lines is indicated in a report of the National Bureau of Economic Research.[11] An analysis of the figures of production shows that products entering into "capital equipment" in 1932 totaled but 36 per cent that of 1927. "Consumption" goods may be divided into "durable", "semi-durable," and "non-durable." "Durable" goods produced in 1932 were 34 per cent of those produced in 1927, "semi-durable" were 75 per cent, and "non-durable" were 89 per cent. These figures illustrate the way in which the country has limited its purchases to commodities supplying the day-to-day needs and also the extreme elasticity in the demand for "durable" commodities.

"Construction" work may be split into three classes—residences, non-residential buildings, and public works. In 1932, building of residences was only 15 per cent, non-residential building was 25 per

[11] National Bureau of Economic Research, Bull. 45.

cent, and "public works" and utilities building was 52 per cent of the 1927 total. The extreme elasticity of demand for this class of product, as illustrated by these figures, has a great bearing upon the matter of employment. It is manifest that the remedy for unemployment—as distinguished from temporary relief—will depend upon the speed with which normal "construction" activities can be resumed.

Production of principal clay products in Illinois in 1932 is shown in Table 30.

TABLE 30.—*Production of clay products by classes in 1932*

Area	Quantity (Thousands)	Value	Stocks on hand (Thousands)
Common Brick			
Chicago area (Lake and Cook counties)	23,957	$171,668	64,535
Northern Illinois (Bureau, Fulton, LaSalle, Livingston, and Tazewell counties)	7,357	65,701	7,856
Central and western Illinois (Henry, Sangamon, and Macon counties)	4,290	41,507	2,778
East St. Louis district (Madison, Macoupin, St. Clair, and Greene counties)	4,753	55,372	2,799
Eastern and Southern Illinois (Fayette, Iroquois, Saline, and Vermilion counties)	3,430	29,736	3,795
TOTAL	43,787	363,984	81,763
	Quantity	Value	Stocks December 31
Other Products (Entire State)			
Face brick, thousands	29,442	$ 378,454.00	51,073
Hollow building tile, tons	38,095	123,172.31	50,792
Vitrified brick, thousands			
Paving	27,892	552,835.30	12,094
Other	5,689	62,868.96	7,993
Drain tile (tons)	20,270	95,927.65	123,190
Other clay products[a]		927,378.19	
Pottery		1,837,022.65	
TOTAL		4,341,643.06	

[a] Fireclay products, terra cotta, refractory cement, raw clay, silica brick, cement, hollow brick, sewer pipe, wall coping, flue lining, chimney pipe, enameled brick, haydite, etc.

The present status of the clay products industry, especially that of structural clay products whose output has decreased most, must be examined in the light of statistics of production, shipments, and stocks of material on hand. For this purpose the data on production and

stocks, gathered by the State Geological Survey, and the monthly shipments from a group of selected plants reporting to the U. S. Department of Commerce, are compared.[12] Thus in 1932, 52 plants produced 43,787,000 common bricks, and stocks on hand as of December 31, 1932, were 81,763,000. An average of 34 representative plants shipped a total of 56,452,000 common bricks, and stocks declined from 107,533,000 in December, 1931, to 69,778,000 at the end of December, 1932 (Table 31). Face brick inventories decreased only slightly, as indicated from the reports of 16 representative plants in December, 1931, and of 17 plants in December, 1932. Evidently more than a year's supply of finished materials is on hand at the existing rate of market demand but stocks would not be excessive if moderate building activity were resumed.

TABLE 31.—*Summary of structural clay products industry in 1932*

	Common Brick (Thousands)	Face Brick (Thousands)	Hollow building tile (Tons)
Production	43,787 (52 plants)	29,442 (24 plants)	38,095 (28 producers)
Shipments, 1932	56,452 (34 producers)	32,633 (19 producers)	30,999 (16 producers)
Stocks, Dec. 31, 1931	107,533	41,866	73,053
Stocks, Dec. 31, 1932	69,778	40,028	45,282
Decrease	− 37,755	− 1,838	− 27,771
Stocks as reported by all producers	81,763	51,073	50,792

IMMEDIATE PROBLEMS OF THE STRUCTURAL CLAY PRODUCTS INDUSTRIES

The problems of the brick industry from 1920 to 1926 were those of production. Building activities and the demand for structural clay products were expanding at a rapid rate. The building peak of 1926-27, however, was followed by a period of decline that shifted the problem from one of production to one of distribution and marketing. The immediate problem is the readjustment of production and stocks into closer coordination with actual market demand.

The figures of shipments and stocks for 1932, together with the general figures for clay products output and building activity from 1920 to 1932, may be regarded as a statistical barometer of the market condition and the relation of the producers to the market. Inventories need be still further decreased if production is to be economical. The dollars-and-cents value of keeping inventories close to market demand may be illustrated as follows, using the 1932 figures of the 34 companies reporting on manufacture of common bricks:

[12] Structural Clay Products: Monthly release from Bureau of the Census, Department of Commerce, Washington, D. C.

If a price of $8.00 per thousand at the yard is assumed, the stock on December 31, 1931 (107,533,000 bricks), was worth 107,533 x $8 or $860,264, the annual interest charge on which, at 6 per cent would be $51,616. A year later when stocks were reduced to 69,778,000 bricks, the value was $558,224, a decrease of $302,040, and the interest charges would be $33,493 or a decrease of $18,123 for the group of producers.

Control of production for the purpose of maintaining inventories at a moderate level, however, requires a further refinement of statistical reports to cover separately each important marketing district, if a producer is to have an accurate picture of conditions of supply and demand in his particular locality. In Illinois, for example, certain more or less well defined market districts, such as the Chicago area, the St. Louis district, the Peoria market, the Springfield market, and the Danville market ought to have statistics of both shipments and production separately tabulated and reported.

For such districts as Chicago and St. Louis, where the market is supplied by several brick plants in adjoining states, it would be helpful if total statistics of production and shipments in the local market were collected by a local manufactuers' organization and the data made available to each of the members.

In the St. Louis district, for example, there were in 1929, 18 clay products plants in St. Louis city and county and 13 in the counties comprising the St. Louis district in Illinois. To get a complete picture of the statistical position of the industry in this local market, total monthly production and inventory statistics of all plants should be available by cooperative agreement among the manufacturers in this area. By no other means can the costly policy of piling up inventories be curtailed and brought under control.

Future Problems of the Brick Industry

Apart from the immediate problem of inventory control, the structural clay products industries are facing certain changing conditions in the building industry which must be anticipated and carefully studied so that the proper readjustments can be made within the industry to meet the new outlook and the new needs.

Although an accurate or detailed forecast cannot be made, nevertheless certain trends are discernible and serve as guide posts to the characteristics of building activity in the coming decade. Among the items to be considered are:

(1) Trends of construction in major classes of buildings, i. e., residential, public, industrial, office, etc.

(2) Changes in building construction which will require new types of materials.

(3) New materials needed to meet the modern demands for comfort and convenience in buildings, especially in residences.

The next decade will probably witness the greatest activity in the residential building class. The market for other classes of buildings such as office buildings, industrial plants, and public buildings is either saturated or in excess of needs for the present and immediate future. Two factors, however, indicate the need of more active residential construction with the return of more prosperous conditions. They are (1) obsolescence of present structures, and (2) the movement of population away from congested metropolitan areas and the need to provide new residences in suburban areas and in smaller cities.

The brick industry must also take cognizance of the fact that the trend is toward lower cost residences. With the decline of lumber supply becoming apparent, the opportunity for filling the low-cost house market is open to brick manufacturers if reduction in the cost of financing and constructing a house can be accomplished. No other material has been offered that has conclusively demonstrated the possibility of building a low-cost house although sheet-steel manufacturers have attempted to do so. Clay products such as light weight bricks, porous brick, nail block, brick panels, and brick veneer have been designed to meet the problem of lower cost but it is still too early to determine their usefulness and acceptability by the public. Clay products manufacturers cannot, however, afford to relax their efforts in finding a means for the practical solution of this problem.

The use of steel frame work, made either from rolled structural shapes or tubular pieces, welded into a frame, and enclosed with structural clay products seems to be gaining favor as a type of building possessing durability and absence of shrinkage and being proof against fire and against vermin accumulation. Cooperation between brick manufacturers and builders is essential in solving the structural problem in the design of a building of this type.

Activity in the design and testing of reinforced brick structures in 1931 and 1932 has demonstrated the practicalness and economy of this type of masonry for various kinds of construction. This opens for brick utilization a field which has hitherto been occupied by other materials and every effort should be made to present the merits of this type of construction to the building industry.

New materials which add to the comfort and cleanliness of a house such as insulating materials, glass or porcelain enamel for interior finishing, tile for flooring, and sound-proofing materials are receiving more critical attention than hitherto and their relation to structural clay products demands further study. The position that brick is to

occupy in the building activities of the next decade will be affected to a considerable degree by foresight in anticipating the developments of the immediate future.

TABLE 32.—*Shipments of common brick, face brick, and hollow building tile in Illinois in 1932*

Month	Common Brick			Face Brick			Hollow Tile		
	Plants reporting	Shipments (In thousands)	Stock on hand at end of month (In thousands)	Plants reporting	Shipments (In thousands)	Stock on hand at end of month (In thousands)	Plants reporting	Shipments (In thousands)	Stock on hand at end of month (In thousands)
Jan.	34	3,455	106,293	19	2,043	44,126	16	3,386	73,284
Feb.	39	4,214	104,810	22	2,053	52,634	19	3,069	69,296
Mar.	37	3,702	101,744	20	2,410	48,576	17	2,614	71,094
Apr.	38	6,456	95,500	22	4,406	59,247	17	3,793	68,429
May	36	6,688	93,754	19	3,346	46,652	15	3,488	66,236
June	33	5,316	86,715	18	3,615	41,502	15	2,765	68,172
July	34	5,488	86,016	19	2,978	42,726	16	2,899	60,711
Aug.	34	5,639	83,166	19	3,146	41,244	15	2,978	52,254
Sept.	32	4,622	79,449	18	3,184	49,658	15	2,978	52,055
Oct.	33	5,224	77,477	18	3,163	41,258	15	1,795	56,206
Nov.	30	3,454	73,780	15	1,515	35,858	14	735	45,612
Dec.	32	2,194	69,778	17	774	40,028	14	499	45,282
Total		56,452						32,633	

GLASS SAND

RESOURCES

Illinois glass sand is obtainable mainly from the outcrops of St. Peter sandstone in LaSalle, Kendall, Ogle, and Calhoun counties. The value of this sand for glass-making purposes rests upon freedom from impurities, especially iron. Illinois ranks first in the production and value of glass sand which it ships in considerable quantities to glass making centers in other states. Although figures on the movements of glass sand from state to state are not available, some data on comparative figures of production and consumption of glass sand in Illinois and its two principal competing glass making states—Indiana and Ohio—indicate that a considerable importation of glass sand into the latter states is necessary. On the other hand the excess of production over consumption in Illinois shows its position as a sand supplying state over a wide area.

Relation of Output to Industrial Activity

The trend of glass sand production must be related to the output of glass products and future possible demand for glass sand based upon estimated trends in the output of the several types of glass products. Table 33 gives the output of glass sand, in tons, in Illinois and for the United States as a whole, and the value of output of glass products for a period covering 1899 to 1931. Particular attention should be called to the performance of building glass materials. With the exception of the relatively small item of wire glass, all the items under building glass, i. e., plate glass, window glass, and cathedral glass, show their maximum output occuring in the years 1923 and 1925. This corresponds with the period of greatest activity in building as shown in a previous table. On the other hand the production of glass sand in the period from 1927 to 1931 when building activity declined severely was partly sustained by the continued growth until 1931, of pressed glass and glass container products. This is in part a reflection of the increased use of glass in production of commercial food preserving industry and also the increase of home packing since 1929.

The outlook for glass sand consumption in the immediate future is conditioned largely upon a revival of the building industry and an expansion in automobile output, the largest single plate glass consumer. The extremely low ebb of automobile output in 1931 and 1932 noticeably affected the output of plate glass. A moderate revival in this industry is anticipated in 1933. While curtailment in glass manufacture was most pronounced in the window and plate glass industries, the pressed and blown glass and the glass container industry have also shown losses in 1931.

The decreased use of glass products in the established branches of the industry has served as a stimulus to research in new products and in new uses for glass. Then new products, while varied in nature, are still in the developmental stage, and have not yet become commercially significant. Among those of interest are glass bricks,[13] doubled glazed windows, glasses for interior wall finishing, and vitreous enamel steel products.

The problems that are foremost in the glass sand industry, as in all other industries, is that of markets and distribution. The future probable trend of the glass sand market must be based upon a measurement of the market for glass products. This in turn involves a study of the trends of production in those industries which are the principal consumers of glass, i. e., the building industry, automobile manufacture, commercial food preserving industries, and tableware products.

[13] Ceramic Industry, November, 1932, p. 242.

TABLE 33.—*Output of glass sand in the United States and Illinois, and output in value of glass products, for specified census years* [a]

Year	In tons Output of glass sand		Value of glass manufacture							
	U. S.	Illinois	Plate glass	Window glass	Cathedral and obscured glass	Wire glass	Pressed and blown glass	Glass Containers	Other glass	Total
1899 . .				$10,879	$ 732		$17,076	$21,677		$ 56,540
1904 . .	858,719	219,784	$ 7,978	11,611	972		21,956	33,631		79,607
1909 . .	1,104,451	224,381	12,205	11,743	1,359		27,398	36,018		92,095
1914 . .	1,619,649	339,551	14,733	17,495	2,417	$1,591	30,279	51,959		123,085
1919 . .	1,827,409	521,286	33,348	41,101	4,300	2,906	70,748	94,670		261,884
1921 . .	1,280,359	259,889	37,261	24,026	2,547	3,316	55,718	85,743	$1,694	210,413
1923 . .	2,034,958	481,328	66,103	42,623	5,114	5,534	77,279	107,231	1,885	306,269
1925 . .	2,334,921	709,029	57,207	37,525	6,916	5,810	72,086	100,301	6,133	286,482
1927 . .	2,171,693	629,268	44,258	26,814	5,092	4,377	76,657	114,380	4,752	276,129
1929 . .	2,219,677	552,539	50,192	25,962	5,256	5,992	85,549	126,765	5,110	299,719
1931 . .		416,366	26,111	10,397	2,364	1,800	56,291	100,079	6,341	207,045

[a] Annual Reports of the U. S. Bureau of Mines and the Bureau of the Census.

Glass Manufacture in Illinois

Although the leading state in glass sand production, Illinois ranks fifth as a manufacturer of glass products. Moreover, the sand deposits of the state are near to the large markets of Chicago, the cities of eastern Wisconsin, and those on the inland waterways to the south. Nevertheless, the curious anomaly exists of a state exporting a valuable raw material and re-importing it in the form of manufactured commodities made by fuel and labor in other states.

A few statistics will show you the general picture of the areas of glass production, glass consumption, and glass transportation.

Table 34.—*Glass sand produced and consumed in and exported from Illinois*
(In tons)

Year	Production[a]	Consumption[b]	Excess of production over consumption
1925	709,029	143,959	565,070
1927	629,268	198,249	431,019
1929	552,539	208,157	244,382

a From annual reports of the U. S. Bureau of Mines, Mineral Resources of the U. S.
b Data from the Biennial Census of Manufactures.

These figures show that from one-half to two-thirds of Illinois glass sand is shipped out of the State for manufacture elsewhere.

Table 35.—*Glass production of leading states*
(In thousands)

	1925	1927	1929
Pennsylvania	$84,961	$78,671	$81,050
W. Virginia	47,884	44,161	48,384
Ohio	35,036	33,938	39,309
Indiana	36,200	35,308	34,490
Illinois	16,590	21,478	22,938
New York	17,621	16,150	17,857
New Jersey	15,903	15,667	16,283
U. S.	$295,959	$282,394	$303,818

A comparison of the above tables shows that although Illinois ranks first in production of glass sand, it stands fifth in production of glass. This, in itself, may not be uneconomic, if the conditions of production or the location of consuming centers favors the location of glass factories elsewhere.

CONDITIONS OF PRODUCTION

The reasons for plant location, in the order of their importance are as follows: availability of fuel, sand, skilled labor, and markets. Considering the first two which are directly related to production, the introduction of natural gas into northern Illinois now puts this district on an equal footing with Indiana, Ohio, Pennsylvania, and West Virginia insofar as fuel supply is concerned. Moreover, if producer gas or fuel oil is to be used instead of natural gas, conditions are still favorable for glass plant location in north central Illinois. A study of comparative fuel costs shows that $4.50 is equal to fuel oil at $0.028 a gallon and natural gas at $0.19. Coal is available from mines in nearby northern counties and should be available at less than $4.50 and fuel oil is available from the refineries of the Chicago district at Wood River station near Alton, Illinois. Combine favorable fuel supplies with an unusually well situated supply of first class glass sand and it becomes apparent that production conditions are as favorable in northern Illinois as elsewhere.

MARKETS

The markets for glass in the order of quantity in 1929 were as shown in Table 36.

TABLE 36.—*Glass products marketed in 1929* [a]

Window glass	402 million sq. ft.
Plate glass	149 million sq. ft.
Wire glass	44 million sq. ft.
Cathedral glass	34 million sq. ft.
Glass, pressed tableware	23 million dozen
Glass, food containers	14 million dozen

[a] Data from the 15th Census of Manufactures.

This represents about 75 per cent of the value of all glass products and, moreover, consists of products whose distribution is closely related either to construction or to population distribution. Although exact figures on the shipments of glass and glass products are not available, it is evident that a considerable movement of glass to Chicago and its adjacent markets from eastern glass centers occurs, largely from West Virginia, Indiana, and Ohio, according to the Tariff Commission. Thus in 1929 glass shipments to important centers were as shown in Table 37.

TABLE 37.—*Glass shipments in 1929*[a]

To	Pounds	
Chicago	35,560,000	
Detroit	25,701,000	
St. Louis	14,199,000	
Pittsburgh	9,329,000	
Minneapolis & St. Paul	8,642,000	
Cleveland	8,397,000	
Other	163,237,000	
Total	265,065,000	62.5 per cent of U. S. total.

[a] Report to the President on Cylinder, Crown, and Sheet glass, Report No. 33, Second Series, U. S. Tariff Commission, 1932, p. 10. Shipments shown in the table above were ascertained by the Tariff Commission for concerns producing about 85 per cent of the total output.

The important cities of Chicago, St. Louis, Milwaukee, and St. Paul-Minneapolis, not to mention the smaller cities of eastern Wisconsin and northern Illinois, constitute a favorable marketing area for a northern Illinois glass industry and the opportunity now seems to be open to grasp these markets.

A factor that is not often considered in the outlet of a raw material such as glass sand is the wide fluctuation in demand that may occur from year to year which cannot be explained entirely upon the fluctuations in output of finished products. Such is the case of Illinois glass sand in 1925 and 1929. Excess of production over local consumption, i. e., shipments to points outside of the state, was 565,070 tons in 1925 and 244,382 in 1929, or less than half the 1925 figure, whereas value of glass products showed little change. This may be explained by changes in purchases by glass plants from one source of sand to another and it subjects sand quarries remote from glass plants to the constant possibility of a wide range of market outlets from year to year. This condition would be considerably improved by a closer relationship between glass plant and quarry.

LIME

Sales of lime in 1932 were 1,956,000 tons, a drop of 751,614 tons from the previous year, reflecting the low ebb of building activity.

Table 38 gives a perspective of the industry in Illinois and neighboring states since 1920. This table gives production, by uses, for Illinois, and total production in three adjoining states that are important as lime producers; consumption in Illinois; and exports from Indiana, Missouri, and Wisconsin.

TABLE 38.—*Lime produced and consumed in*
(Short

Uses	1920	1921	1922	1923	1924
Building	35,103	25,404	44,632	49,584	44,587
Paper mills	7,183	8,905	14,706	13,542	12,217
Tanneries	(a)	5,339	5,899	(a)	(a)
Metallurgy	15,866	(a)	1,199	(a)	(a)
Other chemical	20,952	16,187	18,989	20,797	19,625
Total Illinois	87,903	58,222	85,425	92,633	89,132
Used in adjacent states and U. S., total					
Total Wisconsin	144,590	124,078	189,558	227,549	235,030
Total Indiana	134,672	90,542	113,246	126,296	116,927
Total Missouri	209,113	159,194	203,984	246,326	243,465
Total U. S.	3,570,141	2,532,153	3,639,617	4,076,243	4,072,000
Illinois consumption					
Sales	87,903	58,222	85,425	92,633	89,132
Shipments out of State	25,078	20,823	28,586	33,136	31,238
Imports into State	172,587	133,302	223,628	214,136	302,142
Consumption	235,412	170,701	280,467	273,633	360,036
Exports from adjacent states					
Indiana	83,285	52,376	61,205	73,177	66,263
Iowa	(a)	(a)	(a)	(a)	(a)
Missouri	154,565	103,145	134,858	166,543	165,710
Wisconsin	77,329	77,085	130,262	77,057	177,527
Excess of exports over imports in adjacent states					
Indiana	38,771	18,566	12,345	21,469	6,189
Missouri	121,645	93,711	109,310	136,806	139,752
Wisconsin	32,716	43,187	84,931	31,390	127,896
Total excess	193,132	155,464	206,586	189,665	273,837

[a]Figures not separately available.

and exported from Illinois and adjacent states
tons)

1925	1926	1927	1928	1929	1930	1931	1932
50,588	57,969	63,550	65,701	51,476	31,535	18,683	(a)
10,689	9,953	11,996	10,884	9,210	5,926	2,737	(a)
4,111	4,835	7,423	6,645	6,887	6,977	6,700	(a)
9,185	7,510	3,617	4,734	5,782	4,126	5,157	(a)
21,444	22,913	29,217	27,559	56,027	41,145	38,041	(a)
96,066	103,180	115,803	115,523	119,382	89,709	71,317	76,000
244,903	216,414	197,667	163,965	130,902	64,989	42,621	31,000
127,878	126,005	116,171	107,209	116,795	87,965	81,925	64,000
273,348	263,467	267,776	303,014	316,579	265,771	224,416	180,000
4,580,823	4,560,398	4,414,932	4,458,412	4,269,768	3,387,880	2,707,614	1,905,000
				119,382	89,709	96,105	(a)
				50,159	44,051	43,597	(a)
				254,173	137,934	92,780	(a)
				323,396	183,690	145,288	(a)
				75,740	52,604	49,864	(a)
				(a)	(a)	(a)	(a)
				233,827	194,099	170,771	(a)
				276,198	27,839	12,253	(a)
				12,443	8,253	5,632	(a)
				219,169	184,155	152,623	(a)
				6,760	—35,534	—39,327	(a)
				238,372	156,874	118,928	(a)

An examination of the production records of each of these states since 1920 shows that Illinois gained about 35 per cent from 1920 to 1929, Missouri gained about 50 per cent, and Indiana declined slightly. Wisconsin showed a rapid rise in production until 1925 and an equally rapid decline so that 1929 was below the 1920 level and, in 1931, production in this state had declined more severely than in its neighbors. During this same period (1920-1929) increase in the United States was 20 per cent. A further examination of the table of detailed uses shows that the building industry is the largest single user, but that aggregate consumption by the several chemical industries exceeds all others. Of particular interest is the item "other chemical uses." This includes such items as alcohol manufacture and dehydration, alkali manufacture, bleaching materials, insecticides, oil and fat manufacture, glue, paint, sand-lime brick, sewage and garbage purification, soap, water purification, fillers, etc. Consumption has consistently increased and this appears to be in keeping with the widening application of chemical processes in industry.

The dependence of Illinois upon outside states for the major part of its lime requirements is also disclosed by this table. Imports varying from 65 per cent to 85 per cent of total consumption are shown in the years for which data are available. Although details of lime shipments from state to state are not available, it seems probable that the main shipments come from the lime producing plants in the eastern counties of Missouri. This state has a considerable excess of exports over imports and the plants are favorably located with reference to the chemical and metallurgical industries of East St. Louis.

The Chicago market probably draws to a considerable extent from the lime plants of eastern Wisconsin and to a lesser extent from Indiana. Convenient transportation facilities and the existence of high-calcium limestone deposits in these states account for this large interstate shipment. Lime producers in Illinois are located in Adams, Cass, and Rock Island counties.

PORTLAND CEMENT

Portland cement production was 5,451,383 barrels in 1932 valued at $3,413,078. This was a decline of 15 per cent in quantity and 36 per cent in value from the previous year for which figures are 6,425,909 barrels valued at $5,342,446.

TABLE 39.—*Portland cement consumption in Illinois, 1930-1932*
(In barrels)

Month	1930	1931	1932	Per cent decline from 1931
January	182,347	195,146	103,901	47
February	356,200	227,023	108,880	52
March	379,453	279,530	118,689	58
April	694,367	717,468	335,544	53
May	1,038,904	882,739	703,571	20
June	1,212,319	1,069,134	815,496	24
July	1,495,891	1,054,935	923,612	13
August	1,604,378	1,063,517	867,859	18
September	1,704,696	975,734	779,476	20
October	1,586,016	856,580	694,410	19
November	655,302	406,836	272,348	33
December	247,845	193,244	99,279	48
Total	11,157,718	7,921,936	5,823,065	27

Prices continued to decline in the early part of 1932 but recovered in August to the level of late 1931 (Table 40).

TABLE 40.—*Portland cement prices in Chicago, 1930-1932*[a]
(Per barrel)

Month	1930	1931	1932
January	$2.20	$2.20	$1.55
February	2.20	2.20	1.55
March	2.20	2.10	1.55
April	2.20	2.10	1.55
May	2.20	1.95	1.35
June	2.20	1.95	1.53
July	2.20	1.95	1.95
August	2.20	1.95	1.95
September	2.20	1.95	1.95
October	2.20	1.95	1.95
November	2.20	1.95	1.95
December	2.20	1.65	1.95

[a] Engineering News-Record, monthly reports.

The market area for Illinois cement will be enlarged by the opening of the Illinois Waterway. One cement manufacturer has recently constructed a barge terminal at Peru, Illinois, using specially designed

barges to carry cement in bulk. The river route of water-borne cement is to be extended from Memphis, the present terminal, to Vicksburg, an increase of 350 miles. This new, longer route would permit the company to serve more easily the river cities in the lower Mississippi region as well as to effect a substantial saving by the use of its own equipment. Points that are served along the Peru to Vicksburg route include St. Louis, Cape Girardeau and Memphis.

FLUORSPAR

The fluorspar industry continued at a low ebb in 1932 in keeping with industrial stagnation in the metallurgical, ceramic, and chemical industries. Fluorspar shipped from Illinois mines in 1930 to 1932 is shown in Table 41.

TABLE 41.—*Fluorspar shipped from Illinois mines, 1930-1932*

Year	Production (Tons)	Value	Average
1930	44,134	$936,473	$18.95
1931	28,072	468,386	16.69
1932	9,615	156,279	16.25
	Kentucky output		
1932	14,975	225,052	15.28

The uses of fluorspar in 1932 are shown in Table 42.

TABLE 42.—*Uses of fluorspar in 1932*[a]

Use	Short tons	Value	
		Total	Average
Steel	18,881	$228,933	$12.13
Foundry	524	7,636	14.57
Glass	3,596	101,765	28.30
Enamel and vitrolite	1,261	36,318	28.60
Hydrofluoric acid and derivatives	738	14,603	19.79
Miscellaneous	226	2,691	11.91
Exported	25	553	22.12
Total	25,251	$392,499	$15.54

[a] Mineral Market Reports No. 187, U. S. Bureau of Mines, April 7, 1933.

The mineral fluorspar is unique in that deposits are restricted in number and it is one of the few commercial minerals containing a large percentage of the element fluorine. Significant world production is limited to Canada, France, Germany, Great Britain, Spain, and the United States. Domestic production is confined largely to Illinois and Kentucky where 95 per cent of the mineral is obtained. The other

producing centers are too far away to be competitors. Fluorspar has a comparatively low melting point, which makes it an extremely useful flux, either in the glass industry, where it lowers the melting point of the glass, or in the open-hearth steel industry where it effects a very appreciable lowering of temperature required for smelting.

The restricted geographical distribution of the mineral in the United States is shown in the table of production. Since 1905, Illinois has produced 61.5 per cent of the total, Kentucky has produced 30.5 per cent of the total and the remainder is distributed among the states of Arizona, Colorado, Nevada, New Hampshire, New Mexico, Tennessee, and Washington. The relation among the leading producers during the last five years, 1927-1931, is shown in Table 43.

TABLE 43.—*Total fluorspar production in Illinois, Kentucky, and other states, 1927-1931*

	Production	Per cent
Illinois	251,105	45.8
Kentucky	260,712	47.5
Others	36,991	6.7
Total	548,808	100.0

Kentucky has gained at the expense of Illinois. The remaining states have also declined relatively. Aside from the restricted distribution of the domestic resources, the United States imports a substantial part of its supplies mainly from Germany, France, Spain, and the Union of South Africa. The extent of importation of foreign ores is shown in Table 44. With the exception of the war years, the tendency of percentage of imports has been upward. For the 20-year period from 1911 to 1931, total apparent consumption has been 3,414,227 tons of which 685,692 tons or 20 per cent has been imported.

Of the total annual consumption of fluorspar, from 75 to 80 per cent is used in the manufacture of open hearth steel. Fluctuations in steel production therefore exert the controlling influence in the ups and downs of the fluorspar industry. The inter-relation between these two industries is shown in the Table of open-hearth steel production and fluorspar consumption. (In order to eliminate to some extent the abrupt changes from year to year, a table based on a three-year moving average has been prepared.) An exact correlation between steel production and fluorspar consumption does not exist, partly because the quantity of fluorspar per ton of steel is not constant from year to year and partly because the percentage of fluorspar used for other purposes also varies. Nevertheless, the trends in the two commodities are noticeably similar.

The dominant position of steel in the fluorspar market naturally raises the question as to the immediate future of the steel industry. Forecasts for a period of 5 or 10 years are useless because of the complexity of factors affecting the demand for steel. In the immediate years of 1933 and 1934, it is pertinent to make the following observations:

The per capita consumption of steel in the United States in 1930 was 734 pounds, in 1931 it was 462, and in 1932 it was 242 pounds. For the eleven year period 1919-1929, which excludes the war years but includes the depression of 1921, average consumption was 825 pounds. It is evident, therefore, that steel consumption in 1931 had fallen to 56 per cent of the 11-year average and in 1932 to 29 per cent. Prospects for a recovery of this average are based on the assumption that 5,000,000 automobiles, now seven years old or more will be replaced when purchasing power recovers, that rails, locomotives, and freight cars now badly depleted will be purchased when freight-car loadings have returned to a profitable level and when a hoped-for rise in agricultural prices results in a market for agricultural machinery.

The consumption of fluorspar in industries other than open hearth steel is governed more or less by the rate of production of products using fluorspar, e.g., foundry castings, glass ware, and enamel for pottery. An exception may possibly be noted in the case of hydrofluoric acid which consumes from 5 to 10 per cent of the product.

The use of fluorspar as a flux in cement manufacture is being tried in France with apparently favorable results.

"For some time the cement industry, too, has been interested in the use of fluorspar. Only modest experiments have been made in its actual employment, and with the special object of lowering the point of vitrification in rotary kilns. In general, the normal temperature of these kilns is around 1400°C., and the use of 6 per cent of fluorspar would make it possible to lower this temperature to less than 900°—a quite considerable difference, with a great economy of fuel . . . . . and a certain lowering of power costs. Also, cements with fluorspar never form rings in rotary kilns, which lengthens the life of refractory linings and saves time by reducing to the minimum the stops required."[14]

Fluorspar may be regarded almost entirely as a process material in industrial operations. The market for the mineral, therefore, is determined, under present conditions, by the output of its associated industries. The unique characteristics of this mineral as one of the few important carriers of the element fluorine suggests possibilities of new uses and enlarged markets. Fluorine and its compounds possess properties which find peculiar uses in industry, and, under proper conditions, these uses can be enlarged. The principal obstacles lie in

[14]Adolphe Janin in Le Ciment 37:32, January, 1932.

the difficulty of preparing fluorine compounds in commercial quantities and in handling the products after they have been prepared. These problems should not be regarded as unsolvable, inasmuch as the possibilities of chemical investigation have not been thoroughly explored.

The domestic market must also take cognizance of competition from foreign sources. The present markets for Illinois and Kentucky fluorspar lie mainly in the Mississippi Valley and Great Lakes region. In Pittsburgh, Wheeling and other eastern points the market is divided with foreign spar. In Buffalo and the eastern seaboard foreign fluorspar dominates the market, and will probably continue to do so. Replacement of foreign spar in the interior steel centers offers possibilities in view of the changing aspects of the transportation system. The fluorspar mines of southern Illinois are now accessible to the steel plants of northern and southern Ohio and the Pittsburgh district by water transportation over the Ohio River and the Illinois Waterway. The possibilities of barge shipments to Ironton, Wheeling and Pittsburgh over the Ohio River and to Chicago, Detroit, and Cleveland via the Illinois Waterway and the Great Lakes should be thoroughly investigated.

TABLE 44.—*Fluorspar imports, production, apparent consumption, and amounts used in the production of open-hearth steel*

Date	Imports	Production	Apparent Consumption	Open-Hearth Steel production, 000 gross tons	Import Percentage
1911	32,764	87,048	119,812	15,599	27.4
1912	26,176	116,545	142,721	20,781	18.3
1913	22,682	115,580	138,262	21,600	16.4
1914	10,205	95,116	105,321	17,175	9.7
1915	7,167	136,941	144,108	23,679	5.0
1916	13,323	155,735	169,058	31,415	7.8
1917	13,616	218,828	232,444	34,149	5.8
1918	12,572	263,817	276,389	37,459	4.5
1919	6,943	138,290	145,233	26,949	4.8
1920	24,612	186,778	211,390	32,672	11.7
1921	6,229	34,960	41,189	15,590	15.1
1922	33,108	141,596	174,704	29,309	19.0
1923	42,226	121,188	163,414	35,900	25.8
1924	51,043	124,979	176,022	31,577	28.0
1925	48,700	113,669	162,369	38,034	30.0
1926	75,671	128,657	204,328	40,678	37.0
1927	71,515	112,546	184,061	38,068	38.9
1928	47,183	140,490	187,673	44,114	25.2
1929	54,345	146,439	200,784	48,353	27.1
1930	64,903	95,849	160,752	35,049	40.4
1931	20,709	53,484	74,193	21,800[a]	27.9
1932	13,236	25,251	38,489	13,000	34.4

[a] Estimate.

TABLE 45.—*Production of sand and gravel and limestone in Illinois by districts, 1930-1932.*

SAND AND GRAVEL

District No. (Fig. 1, p. 66)	1930		1931		1932	
	Tons	Value	Tons	Value	Tons	Value
STRUCTURAL SAND						
I	1,131,123	614,771[a]	206,173	118,066	(b)	(b)
II	531,944	142,711	471,170	122,174	311,128	141,579
III	478,438	166,827	276,244	89,899	155,795	65,440
IV	346,842	216,719	360,727	211,905	184,914	84,930
V	228,750[a]	135,035[a]	122,638[a]	76,274[a]	57,051[a]	27,184[a]
VI	41,730	23,174	28,916	16,414	10,736	5,437
Total	2,758,827	1,299,237	1,465,868	634,732	719,624	324,570
PAVING AND ROADMAKING SAND						
I	146,247	84,947	75,292	49,331	(b)	(b)
II	1,470,719	361,972	1,013,952	365,448	460,732	169,667
III	415,301	171,091	240,645	83,527	256,876	83,819
IV	441,871	312,774	360,727	211,905	423,699	171,531
V	251,135[a]	174,233[a]	203,603[a]	114,758[a]	159,793[a]	62,135[a]
VI	182,087	87,896	175,785	90,029	155,158	57,378
Total	907,360	1,192,913	2,070,004	914,998	1,456,258	544,530
STRUCTURAL GRAVEL						
I	201,685	80,058	(a)	(a)	(b)	(b)
II	796,528	345,482	709,795	231,973	529,138	191,474
III	510,721	265,121	248,489	129,285	199,222	100,363
IV	373,010	248,259	299,893	178,622	216,369	121,451
V	(a)	(a)	(a)	(a)	(a)	(a)
VI	65,232	42,792	36,653	20,728	54,721	34,124
Total	1,947,476	981,712	1,294,830	560,608	999,450	447,412

a Includes structural gravel.
b Concealed in total; less than three producers.

a Includes paving and roadmaking gravel.
b Concealed in total; less than three producers.

a Included in structural sand.
b Concealed in total; less than three producers.

PAVING AND ROADMAKING GRAVEL

I	87,124	31,555	40,897	22,048	(b)	(b)
II	2,579,345	947,587	2,233,264	1,012,105	1,506,676	564,048
III	1,149,513	461,285	633,904	283,932	569,640	275,225
IV	750,636	414,854	487,719	257,072	463,254	217,246
V	(a)	(a)	(a)	(a)	(a)	(a)
VI	297,340	207,081	169,194	93,242	84,424	35,449
Total	4,863,958	2,062,362	3,564,978	1,668,399	2,623,994	1,091,968

a Included in paving and roadmaking sand.
b Concealed in total; less than three producers.

OTHER SAND AND GRAVEL

I	1,609,608	691,921	(a)	(a)	(a)	(a)
II	7,203	4,062	65,720	7,250	(a)	(a)
III	1,551,846	1,617,447	926,730	1,175,972	681,717	759,022
IV	16,584	9,296	25,480	19,537	36,293	17,879
V	(a)	(a)	(a)	(a)	16,025	8,780
VI	70,623	47,176	50,468	33,177	17,308	11,126
Total	3,255,864	2,369,902	1,068,398	1,235,936	751,343	796,807

a Concealed in total; less than three producers.

RAILROAD BALLAST SAND AND GRAVEL

Preliminary Figures

I	496,694[a]	78,329[a]	245,269[a]	41,776[a]	(b)	(b)
II	849,304	292,095	289,687	128,031	140,919	42,408
III	61,908	8,931	103,456	11,839	31,000	17,200
IV	268,060	81,610	262,314	69,225	92,127	16,430
V	.....	.....	.....	.....	.....	.....
VI	(a)	(a)	(a)	(a)	(b)	(b)
Total	1,675,966	460,965	900,726	250,871	264,046	76,038

a Districts I and VI combined.
b Concealed in total; less than three producers.

TOTAL SAND AND GRAVEL

I	3,622,445	1,562,165	566,035	231,653		
II	6,242,694	2,096,509	4,783,598	1,866,981	2,984,263	1,012,742
III	4,172,106	2,823,259	2,429,468	1,774,454	2,029,847	2,327,776
IV	2,227,467	1,211,426	1,698,624	877,396	1,357,945	624,421
V	426,333	256,860	345,241	200,632	232,869	98,098
VI	707,648	427,935	474,977	258,358	338,699	149,639
Ill.	17,398,693	8,382,025	10,297,943	5,209,474	7,391,623	4,392,676

TABLE 45.—(Continued)

LIMESTONE

District No. (Fig. 1, p. 66)	1930		1931		1932	
	Tons	Value	Tons	Value	Tons	Value
ROAD METAL AND CONCRETE						
I	2,800,682	1,780,406	1,905,483	1,130,453	545,287	275,984
II	786,727	636,466	839,215	589,321	503,263	343,576
III	94,646	102,850	82,878	74,810	79,303	69,122
IV	49,783	68,806	45,000	61,620	56,306	70,659
V	790,214	672,479	655,394	316,259	348,299	256,569
VI	115,342	94,024	120,850	91,013	185,950	157,472
Total	4,637,394	3,355,031	3,648,820	2,263,476	1,718,408	1,173,382
RAILROAD BALLAST						
I	175,910	122,159	132,175	85,247	50,944	29,456
II	162,173	113,537	123,015	91,064	58,833	41,719
III	.....	.....	.....	.....	.....	.....
IV	.....	.....	.....	.....	.....	.....
V	133,168	99,024	101,847	61,587	38,517	34,364
VI	(a)	(a)	(a)	(a)	(a)	(a)
Total	471,251	334,720	357,037	237,898	148,294	105,539
AGRICULTURAL LIMESTONE						
I	325,485	148,517	45,203	20,438	16,549	10,351
II	232,722	184,927	73,209	58,350	15,026	11,275
III	5,400	9,200	3,900	6,325	8,560	7,318
IV	39,080	66,551	14,115	24,330	13,880	18,161
V	216,204	285,334	101,020	102,514	64,320	56,122
VI	49,535	46,256	17,237	16,649	7,944	8,000
Total	868,426	745,785	254,684	228,606	126,279	111,227

a Concealed in total; less than three producers.

FLUX

I	411,564	317,163	318,089	231,252	87,064	52,304
II	.....	.....	.....	.....	.....	.....
III	.....	.....	.....	.....	.....	.....
IV	407	741	(a)	(a)	887	1,013
V	192,924	219,930	100,495	113,403	(b)	(b)
VI	.....	.....	.....	.....	.....	.....
Total	604,895	537,834	418,584	344,655	87,951	53,317

a Concealed in total; less than three producers.
b Districts IV and V combined.

RUBBLE AND RIP RAP

I	436,868	427,073	418,265	416,417	20,875	22,625
II	30,217	21,140	5,986	6,750	23,544[b]	24,754[b]
III	.....	.....	.....	.....	.....	.....
IV	58,593	60,253	1,493	2,018	(b)	(b)
V	203,702	182,054	78,904	84,909	53,150	45,420
VI	(a)	(a)	(a)	(a)	(b)	(b)
Total	729,380	690,520	504,648	510,094	97,569	92,799

a Concealed in total; less than three producers.
b Districts II, IV and VI combined.

MISCELLANEOUS

I	74,998[a]	56,127[a]	25,933	60,339	24,114	54,055
II	(a)	(a)	33,266[b]	24,874[b]	23,769	25,325
III	(a)	(a)	(b)	(b)	.....	.....
IV	17,889	49,424	10,334	29,792	3,171	9,861
V	35,983	54,889	17,102	46,121	3,160	9,562
VI	.....	.....	(b)	(b)	(c)	(c)
Total	128,870	160,440	86,635	161,126	54,214	98,803

a Districts I, II, and III combined.
b Districts II, III, and VI combined.
c Concealed in total; less than three producers.

TOTAL LIMESTONE

I	4,208,749	2,831,215	2,845,168	1,944,146	1,292,751	491,093
II	1,224,407	974,796	1,060,641	810,858	207,733	427,447
III	102,046	119,066	86,828	81,160	87,863	76,439
IV	165,669	245,924	70,837	117,569	82,275	117,645
V	1,572,190	1,513,705	833,809	681,703	589,492	508,052
VI	265,531	224,373	159,687	125,358	207,790	177,520
Ill.	7,538,810	5,909,089	5,278,173	3,945,064	2,467,904	1,798,196

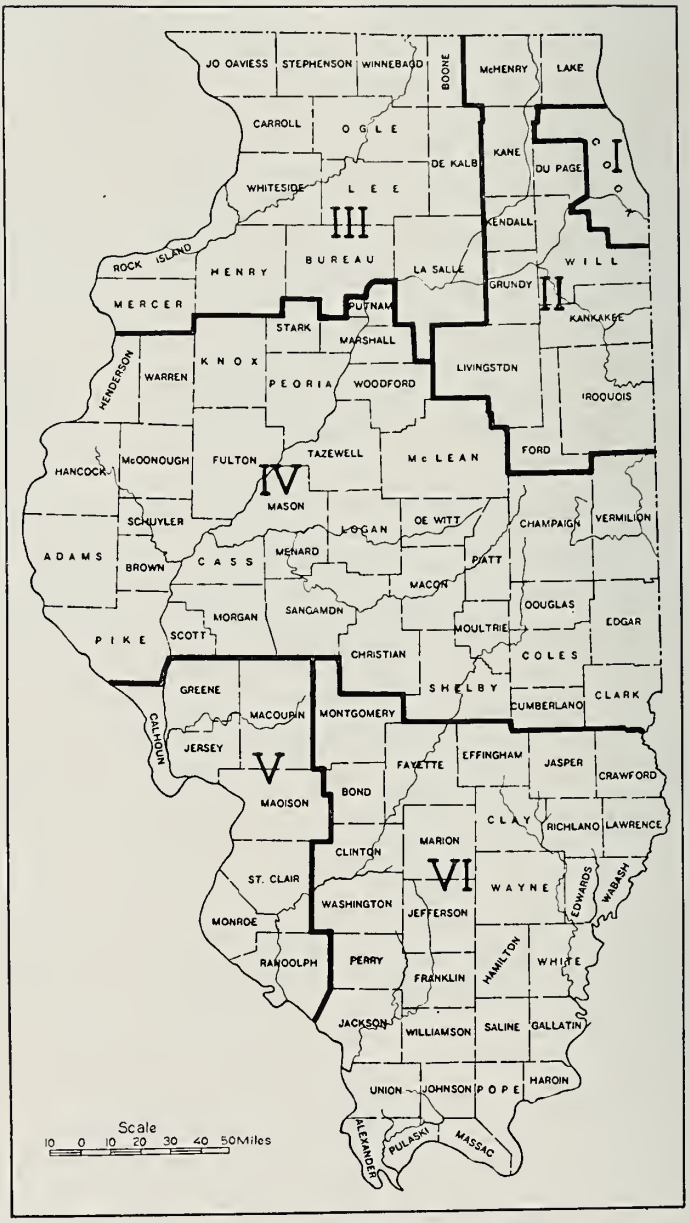

FIG. 1.—Index map of Illinois showing location of districts according to which production of sand and gravel and limestone (Table 45) is given.