STATE OF ILLINOIS

DWIGHT H. GREEN, Governor

INTERPRETATION OF SOAP SAVINGS DATA

By
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IN 1933 H. W. Hudson of the University of Illinois reported his findings on the subject of water quality and soap consumption (1, 2). This work has often been termed the best available study of the cost of hard water and will probably remain so for some time to come. It seems pertinent, however, to interpret this report in the light of the cost trend since 1930, when Hudson's data were collected. The dollar value of soap waste, for example, has been affected by changes in the cost of soap, as indicated by the average wholesale cost indexes for soap and soap products (Table 1).

The indexes (based on 1930 = 100) were reported monthly for each of the years 1933, 1939 and 1946. Since there was practically no monthly variation for any of the items in 1933 and 1939 and in the first ten months of 1946, only the average for these periods is tabulated.

An over-all picture of soap production is given by Table 2, which presents soap sales statistics based on the reports of 70 manufacturers who make 90 per cent of all the soap and glycerine in the United States. The deliveries in pounds are indicated for 1940-46.

It is also of interest to note the trend in the types of soap manufactured, as indicated by U.S. Census of Manufacturers statistics. Table 3 shows a higher production of yellow laundry soap in a depression year and a marked increase in granulated, powdered and sprayed soaps even in depression years, as well as a steady rise in the production of bar toilet soaps. Bar toilet soap production increased 26 per cent—and all soap production increased 12 per cent—from the boom year of 1929 to the less prosperous year of 1939, although the population increase was only 7.4 per cent.

These figures provide some room for speculation. The increase in bar toilet soap production may be an indication of greater national cleanliness. Consideration must also be given to the ever increasing population served by public water supplies. Statistics are not available for every year, but in 1925, 634 *filter* plants could provide 5,000 mgd. of water and in 1940, 5,372 *treatment* plants produced more than 7,000 mgd. (3).. The population served by *softening* plants in 1924 was 2,000,000 and in 1941 had reached 11,500,000 (4).

Synthetics

Complete data are not available on the current production of synthetics, or "soapless soaps," but estimates have varied from 125-150 million pounds in 1946 to 250 million pounds in 1947 (compared with 100 million in 1941 and zero in 1928). A 1 billion-pound production is expected within the next

few years and eventually 5 billion pounds may be reached.

This growth does not mean that soap will be entirely replaced, for industry will require the major portion of synthetics for duties that soaps are unable to perform. It is significant, however, that the major soap makers now market products containing synthetics in part or completely. A glance at Table 3 indicates that the bar soaps

anticipated for that portion of soap consumption which is replaced by synthetics.

Soap Cost Increases

Although the data cited are not strictly comparable, it is apparent from the average wholesale price indexes in Table 1 that the average cost of soap products toward the end of 1946 had increased by about 80 per cent over

TABLE 1

Average Wholesale Cost Indexes for Soap and Soap Products*

Type of Soap	Cost Index (1930 = 100)					
	Date					
	1926	1933	1939	Jan.-Oct. 1946	Nov. 1946	Dec. 1946
Powdered and granulated						
Bulk	118	65.5	90.8	136	224	270
Package	108.6	86.5	100.0	114	150	170
Toilet (bar)	106.1	75.1	79.5	92.3	118	131
Wash Powder						
Bulk	100.0	80.2	65.5	97.8	159.5	171.8
Package	86.0	73.4	71.0	76.5	96.6	119.6
Chips and flakes						
Bulk	102.8	60.6	85.7	125.5	218	256
Package	107.9	63.3	71.5	116	159	186
Cleanser (package)	103.1	87.9	92.3	100.8	103	104.4
Laundry (bar)						
White	107.9	76.1	89.7	112.2	144	155
Yellow	96.7	69.1	83.8	118.4	153	166
Textile (bulk)	107.9	66.5	90.4	144.1	219	252

* U.S. Bureau of Labor Statistics.

constitute less than 50 per cent of the soap production for 1937 and 1939. It is not difficult to imagine that synthetics could replace approximately 50 per cent of the present soap sales.

Because no prediction in the field of synthetics could possibly be valid at this time, the remainder of this paper will ignore the subject. It should be noted, however, that since synthetics are as effective in hard as in soft water, *no savings due to softening can be*

the 1930 figure. It appears quite likely that the cost will remain high or rise still more. This increase means that the annual cost of soap per capita for each of the four municipalities in Hudson's report must be multiplied by an appropriate factor (Table 4). As a result, the value of soap savings at the end of 1946 would be equivalent to 1.8 times that indicated in 1930.

The net savings by using water of zero hardness would not be greatly

different from those obtained by softening to 45 ppm. hardness. No reasonable extrapolation of the data in Table 4 can indicate the annual per capita consumption of soap to be much less than 25 lb. for zero hardness water, making possible an additional saving of, at most, 90¢ per capita. This conclusion is in accord with many observations in the literature (2, 5) and is further corroborated by H. M. Ol-

TABLE 2

Soap Sales and Deliveries*

Year	Soap Sales† $1,000,000 units	Soap Deliveries 1,000,000,000- lb. units
1921	218.7	
1923	253.2	
1925	254.4	
1927	264.0	
1929	258.0	
1931	214.3	
1933	156.0	
1935	202.1	
1936	228.6	
1937	248.6	
1938	256.7	
1939	269.9	
1940	259.2	2.65
1941	326.1	3.12
1942	364.0	2.91
1943	373.6	2.81
1944	442.8	3.27
1945	405.1	2.86
1946	388.4	2.32

* Industry Surveys in 1947. Standard & Poor's Corp., New York.
† Made and sold in the U.S.; liquid soaps not included.

son's article in this JOURNAL (*see* p. 30%), which corrects a misinterpretation of previous statements made by him on this point.

Municipal Softening Costs

The cost of municipal softening (or hardness reduction) involves (1) fixed charges on construction and (2) operating costs, including expenditures for chemicals, power, supplies, labor and superintendence.

The cost of chemicals may be from 25 to 75 per cent of the total annual cost. It is of interest to note that, although construction costs are about 1.7 times the 1939 level (6) and about 2.0 times the 1930 level, the average wholesale prices for chemicals have varied only slightly for the years 1933, 1939 and 1946 (Table 5).

This relationship is of particular advantage for large treatment plants,

TABLE 3

Soap Production*

Type of Soap	Production 1,000.000-lb. units Year		
	1929	1937	1939
Toilet (bar)	324	360	409
Laundry (bar)			
White	914	489	661
Yellow	550	633	579
Granulated, powdered, sprayed	337	743	893
Chips and flakes	388	490	418
Washing and scouring powders, cleansers	505	409	426
Shaving sticks, liquid soap, soap stock	50	48	60

* U.S. Census of Manufacturers. These data are not comparable with the soap sales d-ta in Table 2.

where only a minimum of additional construction is necessary for conversion to a softening plant.

Home Softener Costs

Home-owned softeners in 1930 were estimated (1) to cost $7.77 per capita per year. Present costs are not greatly different because of lower upkeep and frequently greater efficiency.

In Champaign-Urbana, Ill., the present possible soap saving is equivalent to

$3.92 per capita per year. A family of four spends $6.75 to $13.50 per capita annually for serviced water softeners, depending on the quantity and degree of soft water desired. Soap savings pay 30-60 per cent of this cost. Savings through increased longevity of washable clothes and linens provide for another 10-20 per cent.

Considering the high cost of plumbing fixtures, hot water heaters and plumbers' charges, the annual per capita savings resulting from the prevention 'of the deterioration of domestic plumbing by the use of soft water can-

$2.55 per capita. Actually, for the past 20 years the annual per capita consumption has varied from 55 to 80 gpd. Since the average home owner uses approximately 25-35 gpd. per capita, he would thus pay only 65—90¢ per capita per year, or much less than the present-day soap waste alone. Serviced softeners and home softeners would require regeneration only one-third as frequently as at present. The charge per regeneration, however, would be somewhat greater because of the greater proportion of the cost which must be attributed to capital outlay.

TABLE 4

Annual per Capita Cost of Soap in Four Cities

City	Total Hardness of Water Supply *ppm.*	Annual per Capita Soap Consumption *lb.*	Annual per Capita Cost of Soap $	
			Year	
			1930	1947
Superior, Wis.	45	29.23	3.75	6.75
Bloomington, Ill.	70	32.13	4.48	8.06
Urbana-Champaign, Ill.	298	39.89	5.93	10.67
Chicago Heights, Ill.	555	45.78	7.50'	13.50

not be neglected. Savings in fuel for heating water have been estimated to be 25 per cent of the fuel used for this purpose, or 57¢ per capita annually. Obviously, a much greater annual saving would be effected for hotels, industries and institutions.

Through home-owned and serviced softeners, the convenience of soft water is obtained practically free of charge.

If Champaign-Urbana were to be supplied with municipally softened water, it has been estimated that the water rates would be increased by about 7¢ per 1,000 gal. With a per capita consumption of 100 gpd., this involves an annual rate increase of

The annual rural and urban soap waste in Illinois was at one time calculated to be $8,600,000. For municipalities of 10,000 population or more (totalling 4,750,000 people in 1930) the possible soap saving was $4,000,-000.

TABLE 5

Average Wholesale Prices for Chemicals*

Date	Lime per Ton $	Soda Ash per 100 lb. $	Salt per Ton $
1933		1.20	6.79
1939	7.00	1.05	7.20
Jan.–Oct. 1946	7.00	1.06	9.70
Nov. 1946	7.00	1.14	9.70
Dec. 1946	7.00	1.20	9.70

* U. S. Bureau of Labor Statistics.

Exclusive of the Lake Michigan supplies, $1,740,000 could be saved in soap consumption by 1,160,000 people in cities of 10,000 population or more. For all urban supplies other than from Lake Michigan, $3,060,000 could be saved by 1,820,000 consumers. At the present cost of soap and with the 1940 population, possible soap savings for the whole state now total $16,000,000 annually.

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