11.

Congressional Interest and Scope of Assessment

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ORIGINAL CONGRESSIONAL REQUEST

This report is in response to a request from the Senate Commerce Committee in 1975 and since reaffirmed by the Subcommittee on Science, Technology, and Space Of the Senate Committee On Commerce, Science, and Transportation. This report also responds to interest expressed by the House Committee on Science and Technology and several other House and Senate committees concerned with conservation of natural resources in the U.S. domestic economy.

This report focuses on one major aspect of resource conservation, namely, the conservation of materials—and more specifically metals— through reduced waste in the materials cycle.

Following the congressional request, this report addresses:

- the kinds and amounts of materials wastage,
- techniques or technical options for reducing wastage,
- technical and institutional impediments to applying these techniques.

At the time this study was requested, the then recent (1973-74) shortages of many materials and the threat of future shortages were of particular concern to the Nation. Thus, emphasis in this study was placed on identifying conservation options that can improve materials availability—that is, the degree to which materials can be acquired on a timely basis.

DEFINITION OF MATERIALS WASTE AND CONSERVATION

Waste has two connotations: 1) residual material left over from processing, manufacture, and use; and 2) useless or unnecessary consumption, that is, materials use for which there is no adequate justification. The first definition of waste is precise in that it refers to specific losses that could be recovered if there is sufficient economic justification. The second definition is judgmental and depends on the conditions and incentives under which consumption takes place.

For example, under the conditions of an embargo on imported copper, it might be considered wasteful to use copper for plumbing since substitutes are available. On the other hand, during conditions of oversupply, it might be considered wasteful *not* to use copper.

In addition to changing conditions, there are changing incentives. Thus, for products containing excess metal, it may be the judgment of the manufacturer that the cost of waste is less than the cost of its elimination. But if there are sufficient economic, social, or political incentives, in many instances the excess metal can be removed. Here, the incentives, rather than the material scarcity, drive the elimination of unnecessary consumption.

Since the conditions and the consequences of consumption are difficult to define, the approach chosen in this study was to document losses from the materials cycle or losses that result from excess material in the cycle. The primary question then becomes: where are the losses that could be avoided should the need for conservation arise?

In traditional thinking, conservation has, like waste, two connotations: reducing usage as a response to an immediate or current shortage, or reducing usage to ensure that future needs will be adequately satisfied. In both cases, the concern is with the adequacy of supply, although the timing is different (short v. long term). Studies of conservation traditionally have almost always dealt with the long-term mineral supply and demand condition.

The definition of conservation used in this report is a more general one: reduced usage of resources as a response to either short-term supply interruption or long-term depletion. The important aspect of this definition is that the reduced usage be for some "cause" or to meet some societal objective. It is these "causes" or objectives that distinguish reduced usage for conservation from reduced usage due to normal supply/demand fluctuations.

SCOPE OF THE ASSESSMENT

The context of this assessment is illustrated in figure 11,

Materials availability is subject to short-term threats and conditions and long-term depletion for which some response, either public or private, is required. Possible short-term threats and conditions include:

- chronic lack of capacity,
- import dependency,
- energy shortages,
- cyclical materials shortages,
- environmental restrictions,
- international cartel actions,
- deteriorating U.S. balance of payments, and
- escalating U.S. inflation.

These threats and conditions are discussed in more detail in chapter VII.

As shown in figure 11, a variety of strategies are available to cope with materials availability problems, not all of which are materials strategies. One materials strategy is conservation. Others include, for example, stockpiling and expanded domestic production. A variety of options are available to conserve materials (substitution, recycling, use of less metal in product design etc.). For convenience, these options may be classified as those that reduce the losses from the materials cycle (e.g., reduce wastes) or those that reduce the amount of material in the cycle (e.g., reduce the excess material designed into products or unnecessary inventories).

While materials availability is the concern in this study, it is only one of several that can motivate conservation. Other concerns might include the equity of world distribution of resources or the environmental impact of materials consumption. These are not considered as objectives in this assessment.

In addition, while technical options for conserving materials receive major attention, public policies for implementing these options are given only preliminary consideration Finally, this report does not assess the impacts of either the technical or implementation options on the economy, energy conservation, environmental quality, employment, and the like.

SELECTION OF MATERIALS FOR DETAILED STUDY

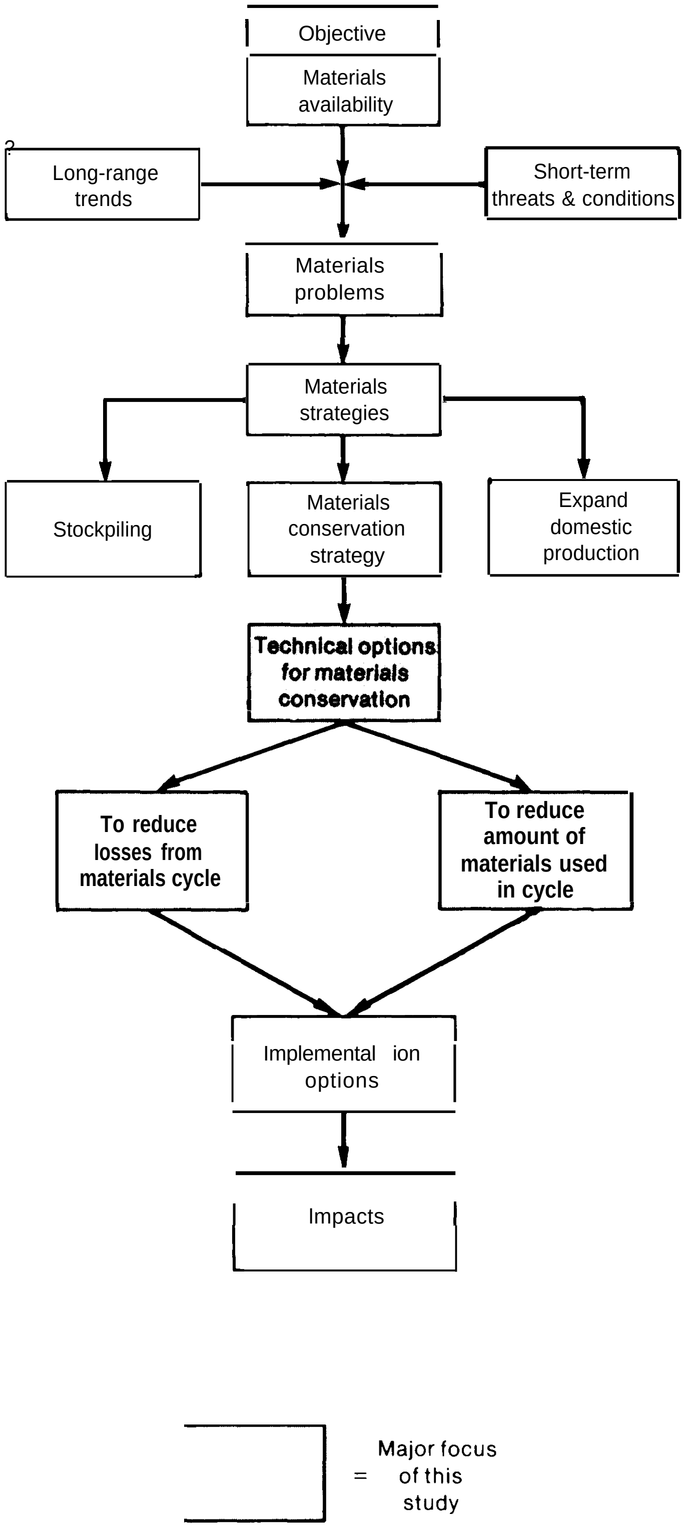
Literally hundreds of materials could be examined in an assessment of materials conservation. Two criteria were used for selecting the specific materials to be analyzed in this assessment: 1) economic and strategic criticality and 2) the nature of the materials and their usage. In the last several years, five major reports have been published dealing with supplies and uses of critical materials. Each of these reports developed a list of critical materials, as summarized in table 1.

In addition to criticality, a variety of characteristics relating to each material were examined: volume, price, import dependence, ease with which the metal is won from its ores, and the nature of its uses.

On the basis of these characteristics, eight metals were selected: chromium, manganese, nickel, platinum group, aluminum, copper, tungsten, and iron and steel. This selection represents a reasonable sample of metals that are commercially important.

For example, iron and steel, aluminum, and copper are basic metals to which minor amounts of alloying elements are sometimes added. Manganese and chromium, on the other hand, are used primarily for their properties as alloying elements

Figure 11 .—Context of Assessment



SOURCE: OTA

in other basic metals. Nickel and tungsten are used both as basic metals in nonferrous alloys and as alloying elements in other basic metals. Platinum-group metals are representative of precious metals. With respect to the way metal products are used in articles of manufacture, at one end of the spectrum are iron, copper, and aluminum. These often are major elements in finished products, and thus are readily salvageable. Precious metals and tungsten, on the other hand, are often embodied in small components of end products, and salvage is more difficult.

Other materials might well have been considered, such as chemicals, food wood, industrial gases, paper, rubber, textiles, ceramics, and plastics. However, in the context of materials availability, metals represent the most critical materials.

Table 1 .—Critical Materials

Materials	Dyckman[a]	SRI[b]	Army War College[c]	Battened	Stockpile[e]	Metals selected
Petroleum	X					
Chromium	X	X	X	X	X	•
Manganese	X	X	X	X	X	•
Titanium.	x					
Nickel.	X	X	X	X	X	•
Platinum group	X	X	X		X	•
Aluminum	X	X	X	X	X	•
Columbium	X			X		
Antimony.	X	X				
Cobalt	X	X	X	X	X	
Thorium	x					
Vanadium	X				X	
Copper.	x					•
Mica	x					
Florine	X					
Graphite.	X					
Tungsten	X	X	X	X	X	•
Asbestos	X				X	
Tin	X	X	X	X	X	
Mercury	X	X		X		
Titanium.	X			X		
Tantalum	X				X	
Magnesium ... , ...				X		
Iron.				X		•

[a]Edward J Dykman, "Review of Government and Industry Studies on Materials Supply and Shortages, " in Syrnposium of *Critical Materials, Proceedings,* U S Department of Defense, Dec 16, 1974

[b]Mark D. Levine, *Department of Defense Materials Consumption and the Impacf of Material and Energy Resource Shortages,* November 1975, prepared by Stanford Research Institute and available from U S. Department of Commerce, NTIS #AD-A018-613.

[c]U.S. Army War College, A *Study of Critical Materials,* May 1976.

[d]A.M. Hall, *A Survey of Technical Actlvities and Research Opportunitie Affecting* the *Supply of Metallic Structural Materials,* September 1974, prepared by Battelle, Inc and available from NTIS # PB 246106.

[e]National Materials Advisory Board, A Screening for *Potentially Critical Materials for the National Stockpile, 1977* NMAB 329.

SOURCE: OTA, based on reports cited above.