Chapter VII

ALTERNATIVES TO ECONOMIC STOCKPILING

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The impacts analysis in chapter V indicates that the economic net benefits would be positive for three of the five stockpiling policies and negative for the other two. Certainly for the latter, and to a lesser extent for the former, alternatives must be considered since they might provide net benefits even greater than stockpiling. Moreover, there may be certain overriding considerations which could lead to the conclusion that any or all of these stockpiling policies should not be implemented and that alternative approaches should be taken. These overriding considerations could include adverse social and political impacts, as well as excessive operating costs and the lack of available information.

A complete assessment of economic stockpiling should include a cost/benefit analysis of each alternative and a comparison of the results with the total net benefits of the related stockpiling policies. Such a quantitative analysis was beyond the scope of this assessment, but it would be the proper function of an agency established to implement an economic stockpiling program. What is presented here is a qualitative analysis of three general categories of alternatives to stock piling.

A. REASONS FOR CONSIDERING ALTERNATIVES TO STOCKPILING

Just as economic stockpiling is conceived as primarily a governmental program requiring either direct or indirect industry participation, the emphasis on alternatives is also likely to be in the Government sector, Industry self-interest can be expected to lead to some kinds of protective actions in order to overcome both short- and long-term supply problems. Nevertheless, it could be necessary for the Government to provide some type of incentive for encouraging the improvement of supply capabilities. Similarly, it could be necessary for the Government to mandate use limitations in order to help achieve a balance between supply and demand. In every instance, effective Government-industry cooperation would be essential to achieve the same goals which might be attained by economic stockpiling, Thus, it appears that if future shortages of material are to be avoided, some degree of governmental intervention into the normal marketplace may be required.

While economic stockpiling may be viewed by many as unwarranted intervention in the marketplace, it must be recognized that some intervention is already present in a number of aspects of materials production and distribution. To some degree almost every one of the alternatives described below is already in practice. The concern here is to what extent, if any, there should be broader use of those alternatives which are already in existence and which, if any, ought to be added, In some in-

stances, as in the case of Government assistance to industry to help increase the supply of materials, more than one alternative has been applied simultaneously. Given the various forms of Government intervention already in existence, economic stockpiling could be found to be less a source of market intervention than the introduction of new alternatives or the extension of present ones.

In recent years intervention by Government in the marketplace has not always prevented shortages and, in some cases, may actually have caused shortages, as is alleged in the supply of natural gas, Efforts to enhance the supply of materials has taken such forms as depletion allowances, expensing of development costs, subsidization, favorable tax incentives for investment, and stockpile purchases to initiate or sustain production of certain minerals and materials. Despite these efforts by the Government, some shortages have occurred. What an economic stockpile may do is alleviate the impact of a future shortage of material, provided that particular material is stockpiled in adequate quantity.

The present assessment envisions the use of an economic stockpile to achieve certain social benefits thru the prevention of materials shortages. But since an economic stockpile is an intervention in the marketplace, the social benefits from implementation of a stockpile must be measured against the economic costs and the relative desirability of alternatives to achieve the desired social benefit.

Virtually all the alternatives presented below were mentioned in some of the interviews as being preferable to the 11 stockpiling policies. However, the preference for alternatives was less true with respect to stockpiling policies aimed at overcoming import disruptions than for the other policies,

B. ALTERNATIVE METHODS TO INCREASE SUPPLY

Materials supply could be increased through the following means, each of which is discussed in subsequent order:

- Direct subsidies to producers working marginal resources,
- Tax incentives to encourage production from marginal resources,
- Research and development to increase production from marginal resources or to process substitute materials,
- Tax concessions to favor capital formation and investment in mineral supply,
- Low interest loans and investment guarantees to encourage exploration and production,
- Tariff concessions to raw-material-producing countries,
- Increased recycling of secondary materials, and
- Production from public lands.[1]

[1] S. Victor Radcliffe, in the Henniker Report, lists the following methods of increasing supply;

1. Advances in the understanding of mineral formation and the techniques for exploration, and of plant biochemistry.
2. Creation of new materials or processes that open up new resources (e.g., synthetic polymers, new mining techniques for minerals on land and in the oceans).
3. Improving the physical efficiency of the extraction of resources (e.g., increased energy efficiency in processes for aluminum and steelmaking. or wood products).
4. Develop lower cost alternatives for existing materials (i.e., substitution of materials or systems to provide the same performance or function), including the possibilities for greater use of the more abundant materials, such as manganese and silicon, or of renewable materials, including current organic wastes such as lignin. All other references used from this conference will be cited as Henniker *Report*.

1. Direct Subsidies to Producers Working Marginal Resources

Direct subsidies would provide. for payment to producers in amounts sufficient to cover the difference between costs (including a reasonable rate of return) and market prices for each material involved, Such a program has been used in the past as part of the strategic and critical materials stockpiling program for defense, Under this program, substantial quantities of asbestos, beryl, chromite, columbium, Fluorspar, manganese, mercury, mica, and tungsten were purchased at higher than market prices, This program had the added purpose of supporting domestic production of certain materials in order to maintain the mobilization base, However, much of the material produced was of relatively low quality and was not adequate for defense stockpiling purposes, The program included premium price plans for copper, lead, and zinc in World War II, as well as floor and ceiling contracts during the Korean war.

Although these subsidy programs were directly related to the strategic and critical stockpile, they are examples of Government support which could be provided irrespective of the existence of a stockpile. Two such examples, copper and titanium, are discussed below,

Under Title III of the Stockpiling Act of 1946, provision was made for various methods of capacity expansion of materials, including Government floor-price purchase contracts to stimulate private companies to increase mine production. Under these contracts the Government agreed to purchase specified amounts of output at the guaranteed floor price if the market did not take up these quantities at that price or a higher price.

a. Government Subsidies and Copper.—In 1951 and 1952 the Defense Production Administration approved 10 projects for Government assistance in the production of copper, In most of these projects, a floor price was guaranteed in a long-term purchase contract. Some of these 10 projects also involved accelerated tax amortization, Government loans, or both, as authorized by the Stockpiling Act of 1946. It was estimated at the time that the annual increase in output from the mines opened by these projects would total about 250,000 tons of copper, that about 100,000 tons would be available in 1954, and that the full output would come in by 1955. An additional nine projects were subsequently approved, bringing the total number of projects within that program to 19, and increasing the potential commitment to 1,191,240 tons of copper. However, since copper prices were relatively good during the contract delivery period, the bulk of the output (949,354 tons) was sold to industry and only 231,959 tons were delivered to the Government. Obligations to deliver 9,927 tons to the Government were canceled,

There was also a small program for the maintenance of production at some existing mines which could not produce copper at the Government ceiling price of 24.5 cents per pound for electrolytic copper ($490 per short ton). Contracts were therefore consummated for 30,434 tons at an average subsidy of $127.39 per ton. These contracts were terminated when price regulations were removed from copper in March 1953. Under this program, slightly over half of the contracted amount (16,201 tons) was delivered to the Government.

The program under title III achieved its objective of increasing copper production for the defense program. With the help provided by the subsidies and additional incentives of rapid tax amortization, several copper properties operating today had their inception in this expansion program,

b. Government Subsidies and Titanium.—In the case of titanium, Government assistance has gone through two major phases, The domestic industry had been started in 1950 through Government aid in the form of guaranteed purchase contracts, coupled with loans, loan guarantees, and research contracts, More recently, the collapse of the SST program, in particular, put the

titanium sponge industry in jeopardy in the last half of 1971.

As a result of serious concern on the part of the Office of Emergency Preparedness, Congress, and other interested agencies, a stockpile purchase/buyback program was adopted to support the titanium industry. In January 1972 the GSA was authorized to acquire 7,000 tons of domestically produced titanium sponge from the three existing producers, although the smallest subsequently dropped out of the program. The purchase of this tonnage was to be paid for with other materials excess to the stockpile, in lieu of cash. All the 6,500 tons which were to be supplied by the two other producers have been delivered to the Government. This program helped sustain the titanium industry during the period of uncertainty prior to an upsurge of demand in 1973 and 1974.

c. Future Subsidy Programs.—The future of a direct subsidy program under peacetime conditions would depend upon the willingness of Congress to provide the funds. In order to do so, however, Congress would have to determine that the activation of marginal and submarginal mineral deposits would be in the best interests of the country. Political support in mining areas would have to offset broader concerns about the optimum use of national resources, unless the loss of foreign supplies were to become a fact or a serious threat. If such an incentive as a direct subsidy program were implemented, it would have to be supplemented by an allocation program for distribution to customers and could involve additional costs of upgrading the material to meet consuming industry specifications.

In summary, direct subsidization has worked effectively to initiate production, to develop marginal resources, and to maintain an ailing industry. These programs were frequently joined with stockpiling, but may be extended in lieu of any stockpiling by direct payments rather than by purchase of material.

2. Tax Incentives To Encourage Production From Marginal Resources

Tax adjustments or incentives, such as rapid tax amortization allowances, have been used in the past under the defense program to stimulate capital investment in mining and processing facilities, and have been successful in increasing the mobilization base. Concessions could also be made through selective depletion allowances for low-grade resources,

The National Commission on Materials Policy, in referring to depletion allowances, made the following statement which is presented here in its entirety:

> Although the gamble in exploration is governed by scientifically determined odds, the stakes are so high and the risk so great that it is necessary to take specific action to share the costs to compensate those who take these risks, The primary methods of providing encouragement has been through percentage depletion allowances in tax laws. For the very expensive and highly risky search for oil and gas, charging the first year's drilling costs to expenses rather than to the capital account is also allowed.
>
> Although the equity of depletion allowances is questionable, lawyers and economists have found no other generally acceptable mechanism to cover fairly the risks of developing a mineral reserve.
>
> Depletion allowance is applied to the gross income from the property, which means that an operator must have taxable income above expenses in order to have anything from which to deduct this authorized depletion percentage. Minerals that have been discovered in paying quantities in the ground area capital asset, but as they are produced, that asset is used up. Percentage depletion, therefore, is the best method yet devised to permit a mineral resource owner to recover at least a part of his capital so that it can be used to develop additional mineral deposits, and to provide incentive to potential investors. On the other hand, percentage depletion is of no value whatever to those who take the risk of exploration but find little or nothing, since there must be income above expenses in a tax year in order to receive the depletion deduction.
>
> Because of its speculative nature, exploration cannot be financed by bonds or by bank loans. Funds can come only from those who are willing

to risk a succession of failures in confidence that they will enjoy eventual success.

The traditional means of providing this stimulation has been through the substitution of percentage depletion for cost depreciation in the tax structure and the privilege of charging exploration costs against other income.

This principle has been subject to public attack, but criticism has not produced better alternatives, and in our brief tenure, we have not been able to do better than the critics.[2]

Following that analysis, the National Commission then made the following recommendations:

- ... Congress continue the percentage depletion provisions of our tax laws as a time-tested major incentive to discovery and development of mineral resources. These provisions should not be further reduced unless and until a better incentive system can be developed,
- ... the total cost of mineral exploration be allowed as a tax-deductible item, as intangible oil and gas well drilling costs are today,

As in the case of direct subsidies, the future of tax incentives, including depletion allowance, is uncertain, All such tax concessions would face fiscal problems in light of growing budget deficits and questions of equitability in the tax treatment of various national resources. In the case of petroleum, the depletion allowance of 22 percent was eliminated on March 29, 1975, except for small producers with 2,000 barrels per day output or less, The 22-percent allowance will apply to succeedingly smaller daily outputs each year until 1980, when it will cover producers with 1,000 barrels per day or less. After 1980 the percent allowance on 1,000 barrels per day or less will decline each year until 1984, when it will amount to 15 percent and remain at that figure thereafter. Average annual output in the United States in 1974 was approximately 8,740,000 barrels,

Tax incentives, such as depletion allowance, from goods or marginal resources are a very important means of increasing the supply of materials, but they do not prevent shortages of material due either to suddenly increased demands or unexpected interruptions in the supply of foreign source materials. The question of an adequate supply of materials enhanced by such tax incentives may not lead to the accumulation of a sufficient industrial inventory to alleviate the need for an economic stockpile, On the other hand, too great an extension of subsidies or tax incentives to marginal producers may have the effect of discouraging private investment in good resources. A tax-incentive program for the support of research and development is mentioned in the following section.

3. Research and Development To Increase Production From Marginal Resources or To Process Substitute Materials

Research and development could take various approaches: (1) one financed and operated by the Government, (2) one jointly financed and operated by Government and industry, or (3) one operated by industry under the impetus of a tax incentive, Government grants-in-aid could also be made to research organizations, universities, and companies possessing competence in research,

The potential domestic production of oil from shale and aluminum from nonbauxitic materials stand out as examples in which research and development may in the future increase the United States supply of these basic materials. Such activity could also include technical assistance to foreign producers to help improve their efficiency and broaden their markets.

a. The Importance of Research and Development.—Richard W. Roberts, then Director of the National Bureau of Standards, mentioned five technical options in materials research which can be used alone or in consort to improve materials performance. These options would in general have the ultimate effect of increasing supply: (1) development of new materials, (2) development of new processing techniques, (3) improvement in manufactur-

[2] *Materials Needs and the Environment Today* and Tomorrow, National Commission on Materials Policy, June 1973.

ing and fabrication techniques, (4) improvement in nondestructive evaluation techniques, and (4) improvement in design theories and concepts.[3]

Dr. John Morgan, Jr., Assistant Director of the Bureau of Mines, cites the following five areas which require "accelerated development of new and improved technology and rapid introduction thereof": (1) exploration, (2) mining and petroleum and natural gas products, (3) processing, (4) use, and (5) recovery and recycling.[4]

Julius J. Harwood, Director, Physical Sciences, Scientific Research Staff, Ford Motor Co., suggests a four-part strategy to increase the research and development efforts directed toward "materials substitution, recycling, solid waste disposal and materials processing to provide new sources of materials, reduce scrap generation and increase productive utilization of available materials to offset tight supply and increasing costs of materials. "[5] The four-part strategy encompasses the following points:

(1) Alert, as early as possible, the outside market to any major upward shift in specific materials usage. . . . clearly recognize that 2-to 3-year leadtimes or more may be required for materials producers to effect significant capacity expansion;

(2) The extended leadtimes emphasize the need for establishing early-on, continuous liaison and communication among product planning/engineering, manufacturing and supply activities concerning product assumptions and materials requirements to ensure availability of required materials to support our future vehicle programs;

(3) Maintain periodic updates of availability, supply, and economic projections to establish a monitoring and early warning system; and

(4) Explore feasibility of alternate markets to provide flexibility to compete in shifting materials supply markets,

b. NCMP R&D Recommendations.—The National Commission on Materials Policy (NCMP) made a number of far-reaching recommendations dealing with research in energy and nonenergy materials and related subjects. These recommendations are presented as follows in summary form.[6]

(1) Regarding research on new sources of energy and the environment, NCMP recommended that

., . the Government sponsor a massive research effort to improve the use of fossil fuels and develop new sources of energy, to improve slurry transport of coal, to develop processes of obtaining synthetic oil and gas from coal or from such raw materials as shale and tar sands;

. . . research into fuel cell development be pursued;

,,, greater priority be assigned to efforts to develop the breeder reactor;

. . . research in high-temperature materials be accelerated;

. . . research be undertaken in economical, clean sources of automotive power for private and public transportation;

. . . the Government support extensive R&D on the dynamics of environment ecosystems; and on the impact of major human activities and their effect on human, animal, and plant life. The R&D will emphasize the detection and study of substances in low levels of concentration, and studies of their life cycles and chronic, additive, or delayed effects on public health;

. . . development of additional techniques to repair environmental damage from surface and underground mining and similar activities, and methods for reducing pollutants from various effluents to a more desirable level; and

. . . research and development be supported, with the participation of industry, on alternative efficient technologies that produce materials without undue sacrifice on environmental quality.

., , consideration be given to such measures as:

sHenniker Report.
4Henniker Report.
5Henniker Report.

6NCMP, *Material Needs and the Environment.*

- review of the potentially inhibiting effects of antitrust procedures on joint industry-wide research, e.g., antipollution efforts, and modification of present procedures where appropriate,
- sharing between the Government and industry the costs inherent in demonstrating, at the pilot plant level, promising developments protective of environmental quality, e.g.,hydro-metallurgical processes, formed-coke production methods (bypassing the high-emission coke ovens in coke manufacture), and extension of vacuum technology in extractive metallurgy, cooperative ventures of the Government and industry for developing technologies, exemplified by the wartime synthetic rubber program, by the recent cooperative blast furnace research of the Bureau of Mines, by research into nonpolluting coking methods which is now being undertaken jointly by the Office of Coal Research and industry, and by the current Technology Incentives Programs of the National Science Foundation and the National Bureau of Standards; and

,.. Government support be provided for studies, particularly at universities, which will stimulate rapid development of the geosciences and their application to problems of mineral exploration.

(2) Regarding waste utilization and materials conservation, NCMP recommended that

... the Federal Government cooperate with State and municipal governments and industry in developing technologies for utilizing industrial and urban waste as a source of fuel and raw materials;

... support be offered to universities, private institutions, and industry to further research into development of feedstocks for polymer production from renewable raw materials, and to encourage continued research into extraction of mineral values from low-grade ores; and

... R&D be sponsored on improvements in resistance to corrosion and other degradation; in nondestructive testing methods; in techniques of characterization; in new composites; and on other topics relating to materials effectiveness. This R&D, supported in the past by the Department of Defense, National Aeronautics and Space Administration, and Atomic Energy Commission, should also be pursued by other agencies with materials responsibilities, and should be complemented by efforts to translate knowledge into practice.

(3) Regarding technology research and development and education/training, NCMP recommended that

... the agencies assigned substantial responsibilities in the materials and resources field be instructed and enabled to take steps to build up commensurate research and development to generate new knowledge and technology, and also to enhance the exploitation of available knowledge. Their activities should include:

- in-house research capabilities sufficient to insure adequate support for their entire research and development program;
- appropriate basic research in the physical, biological, social, economic, and political sciences as relevant to materials;
- cooperation between national laboratories and industry, including shared research, personnel, and information;
- sponsorship of coupling programs involving the Government, industry and nonprofit and university laboratories in joint research and development directed at serving national needs; and
- deliberate, explicitly funded efforts on the part of agencies generating new technology to alert the public to the potentials of applying this knowledge and to stimulate its transfer to industrial use.

\\\ a continuing analysis be carried out, Preferably by NSF, of the numbers of graduates to be needed by the materials industries in various specialties, with allowance for sufficient lead time;

.,. support of education and training in the materials field take into account the need to modify those aspects concerned with materials extraction and processing to give them sufficient prominence in the materials engineering curricula; and to incorporate up-to-date knowledge from materials fields and from physical sciences and engineering;

... cooperative efforts be fostered among Federal, State, and local agencies, private industry, and labor for the development of uniform national codes. These standards should be based upon performance requirements designed to increase efficiency in the use of materials, to encourage introduction and acceptance of superior

materials, and to enhance recovery or disposition of materials from worn-out products; and

. . . the Government review present policy with respect to the vesting of patent rights when undertaking joint research with the private sector.

Research and development by industry and/or Government will continue as part of normal operations. The emphasis on particular materials will shift as new developments occur. Direct Government assistance will be' limited by funds and the criticality of particular situations. The fallout of research and development from both industry and Government, including that dealing with defense matters, will accrue to other areas as it has in the past.

4. Low Interest Loans and Investment Guarantees To Encourage Exploration and Production

Actions in the investment area include low interest loans and investment guarantees such as those provided by the Overseas Private Investment Corporation, That agency provides incentives to United States private investors to encourage investments in many developing countries by insuring against losses which might result from social, political, or economic problems in the developing country and by reducing the need for government-to-government lending programs in supplying capital through private investment channels. Other governmental or intragovernmental organizations, such as the Export-Import Bank and the International Bank of Reconstruction and Development, are also sources of capital for the construction and operation of facilities. The National Commission on Materials Policy recommended that the U.S. Government reestablish and adequately fund a financial institution, possibly modeled after the Reconstruction Finance Corporation or the Defense Plant Corporation, which can arrange for low-cost investment capital for industry, if a clear national need can be shown, "[7]

Although the Office of Minerals Exploration in the U.S. Geological Survey (the successor to the Defense Minerals Exploration Administration) exists to provide low-cost loans for minerals exploration, it has ceased making new loans due to a lack of funds. A total of 36 minerals have been covered, mostly for loans of up to 50 percent of exploration costs and some up to 75 percent. At the present time, unexpired contracts exist only in gold and silver. This experience of the Office of Minerals Exploration does not suggest greater Government involvement in granting loans for exploration, but this situation could change if supplies of critical imported materials were to become a threat or an actuality. With further regard to financing problems, NCMP recommended the relaxation of antitrust laws to permit "special industry groups to form joint venture corporations for the production of critical industrial materials under economies of scale that cannot be attained by individual companies, and under conditions that do not restrain trade. "[8]

Low interest loans and investment guarantees are an alternative to stockpiling of scarce domestic resources, recycling, and new technology, i.e., those policies which would not counteract long-term shortages,

5. Tariff Concessions to Countries Producing Raw Materials

Tariff concessions to countries producing raw materials could increase supplies to the United States. However, the effect of these concessions would be limited by the fact that import duties on most materials in which the United States is heavily import dependent are already low or nonexistent. Nevertheless, some favorable developments from the standpoint of improving the overall economic situation in developing countries and from reducing costs to United States consumers could flow from the current tariff and trade negotiations under the General Agreement on Tariffs and Trade (GATT) agreement.

[7] NCMP, *Material Needs and the Environment.*

[8] NCMP, *Material* Needs and the Environment,

The Interior Department, in its report "Critical Materials: Commodity Action Analyses, " March 1975, takes another view on tariffs as a means of increasing supplies. According to the report, higher tariffs would, by raising U.S. prices and costs, presumably encourage increased domestic productive capacity, Given the historical trend toward lower tariffs and the need to compensate through GATT for higher tariffs in one commodity with tariff or trade concessions in another, the probability of higher tariffs seems rather remote.[9]

Tariff concessions as an alternative to stockpiling might be effective if changes are made so as not to penalize imports of raw material or destroy domestic production. As an alternative to stockpiling, these concessions could aid in maintaining foreign supply but could adversely affect domestic production. It is probable that tariff changes are not an alternative to any stockpile policy.

6. Increased Recycling of Secondary Materials

The recovery of secondary materials has the effect of renewing nonrenewable resources. Much of the metal and some of the secondary glass generated in producing plants is reused at the manufacturing site. The recycling industry, with about 8,000 establishments, collects economically recoverable wastes, processes them where necessary, and sells them to consumers of secondary materials. While it is already being carried out on a large scale by established industries, recycling on an increased scale, particularly from municipal waste, could augment the supply of usable materials. Recycling could be stimulated by Government by such actions as direct subsidy payments, tax concessions to producers and/or consumers, research and development in recovery and use technology, adjusted freight rates to provide more comparable rates between recycled and primary materials, and grants to State and local governments to assist in solid waste recovery programs,

Municipal waste recovery has become the subject of much discussion as well as work. Seymour L. Blum, Director, Advanced Program Development, The Mitre Corp., lists the following alternatives for consideration:

- Resource recovery technology, to include
  - front end separation,
  - incineration, and
  - comporting;
- Energy recovery, to include
  - steam,
  - oil pyrolysis,
  - gas pyrolysis, and
  - direct firing;
- Disposal technology, to include
  - land fill, and
  - incineration;
- Collection procedures;
- Transport procedures;
- Storage procedures; and
- Separation economics.[10]

As a means of increasing the recycling of secondary materials, NCMP made the following recommendations:

> ,,. the Federal Government offer loans at low rates of interest to private firms for recovery of resources from municipal waste;
>
> ,,. the Federal Government offer subsidies for solid waste handling to municipal or county efforts to levy user charges that will enable the operations to pay all costs;
>
> ,,. the Federal Government give users (scrap consumers, e.g., steel mills) of materials economic incentives in the form of tax credits for expanded use of recycled materials;
>
> . . . the Federal Government offer tax credit for investments in new plants and equipment specifically geared to the production of marketable products from recycled materials, with 5 year amortization deductions for companies that install ancillary equipment that will allow them to process larger quantities of scrap than at present;

[9] In "Critical Materials: Commodity Action Analysis" (March 1975), p. 2, the Interior Department presents an analysis of materials supply problems for aluminum, chromium, platinum, and palladium and concludes that stockpiling is more cost-effective than either a tariff or a subsidy in most cases, but that a combination of these three options is the overall optimal policy,

[10] Henniker Report.

> ... the Federal Government take the necessary steps to correct the existing freight rate differentials between secondary and primary materials;
>
> ... the Federal Government exercise leadership by using its purchasing power to provide a market for products made from recycled materials;
>
> ,., the Federal Government help reduce the flow of solid waste by establishing, within Federal purchasing departments, performance standards rather than composition standards that discriminate against secondary materials;
>
> ... the Federal Government remove any labeling regulations, unrelated to consumer protection, that discourage consumers from buying products that contain secondary materials;
>
> ... the Federal Government accelerate research and development and technology transfer on resource recovery, especially to encourage recovery of resources in municipal wastes;
>
> ... the amount of solid waste requiring disposition be increasingly reduced where possible by methods of recycling, reuse, and recovery;
>
> ... industry develop and expand technology and markets that will allow for practical use of all bulk waste; and
>
> ... industry dispose of waste, including mine tailings, in a manner to facilitate eventual recovery of valuable resources.[11]

An economic stockpile to aid recycling may be unnecessary if any of the foregoing recommendations are enacted. The problems of recycling are not only economic or technological, but largely arise due to institutional problems between private enterprise and local, State, or Federal Government. A more viable alternative to a national stockpile to aid recycling might be one set up on a local or regional basis with some Federal help in initial financing and organization.

In view of the great interest in the recovery of usable solid materials from municipal waste and the accompanying use of energy materials in that waste, progress in that direction can be expected for the future within the limits of quantity, quality, and costs. A technology assessment on resource recovery, materials recycling and reuse was requested by the House Committee on Science and Technology and is currently being carried out by the Office of Technology Assessment.

7. Role of Public Lands in Increasing Domestic Supply

Much of current production comes from claims originally filed on public land. Access to minerals on public land is increasingly being restricted by policies arising from concern with alternative land use and environmental impact. Supply from public land can logically be considered as a component to various alternatives to stockpiling. Its importance as an issue in itself justifies separate discussions, however. The use of public lands as a means of increasing supply of materials was discussed by NCMP as follows:

> The Government has a responsibility to oversee exploration of mineral resources within public lands. Development of these resources is in the public interest, for they can add substantially to the Nation's reserves. This benefit should be weighed against the negative effects of possible ecological disturbance or insult to the natural environment,
>
> We recognize the need to protect public monuments, unique and irreplaceable natural wonders, and parks. Vast areas of public domain, however, have been so restricted, with their status so uncertain, that the risk of exploration cannot be economically justified by the prospect of success. Without entry to these lands and without assurance of tenure in the event of a discovery, no mining group can calculate the relative costs and benefits which would permit determination of the most effective use of the land. There are indeed numerous examples of places where better use of the land has been made after mineral extraction than was made before,
>
> As the Congress develops the urgently needed legislation governing public lands, we recommend that
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> United States statutes recognize without equivocation that final judgments on the value of publicly owned lands cannot be made until the subsurface has been explored thoroughly, and that the laws assure:

[11] NCMP, *Material Needs and the Environment.*

- land be used in a way that will optimize its future material contribution; and
- in the future when values change, a tract of land may be used for purposes far different from the present.

The exploration of wilderness tracts is likewise discussed in the NCMP report as follows:

> The opposing objectives of protecting wilderness tracts and expanding mineral reserves can be reconciled at their points of difference. Such possibilities include rationale regulation of the movement of aircraft over wilderness areas and the entry of other suitable forms of transportation where they are now prohibited.
>
> The exploration, without evident damage, of pristine tracts is now permitted by Federal land agencies. The need for such regulated exploration was recognized in principle by the Wilderness Law which permitted a period for determining the value of mineral deposits before further access was denied. The failure to provide the U.S. Geological Survey and the Bureau of Mines resource evaluation programs with funds for these explorations has frustrated Government efforts to assess these potentialities. At the same time, private exploration has been prevented by regulations intended for other purposes, Normal prudence prohibits financial entities from spending money where constantly changing regulations could turn an economically sound venture into a losing proposition.

Following that analysis, NCMP recommended that

> ... Congress include, in legislation governing land, permission to explore under regulations which will prevent irreparable damage to the protected areas and hold disturbances to the lowest level possible;
>
> ... Congress provide for:
>
> - the development of mineral properties by private industry where there will be minimal impairment of recreation or biological functions, or where plans are provided in advance to restore or improve original conditions when extraction is terminated;
> - evaluation of the costs and benefits of mining development, by methods such as those used in the environmental impact statements of governmental projects: and
> - strict sanctions against violation of protective regulations.

A technology assessment of constraints and incentives affecting domestic minerals accessibility on public lands is currently being conducted by the Office of Technology Assessment.

C. ALTERNATIVES TO MAINTAIN STABLE LEVELS OF SUPPLY

Maintaining stable levels of supply could involve four principal approaches: (1) inventory management, (z) extended futures markets, (3) standby capacity, and (4) international commodity agreements.

1. Inventory Management[12]

Departures from traditional inventory management patterns in order to provide relative stability at all phases of the business cycle and overcome unusual interruptions in supply could require Government incentives in the form of tax adjustments. Industrial firms, including both producers and consumers of materials, tend to maintain normal working inventories which vary from material to material, depending on such factors as the degree of integration within individual companies, the form of the material, seasonal factors, and assurances of supply sources.

The current Swedish tax system, which permits accelerated writeoffs of inventories to encourage private stockpiling by allowing changing acquisition costs to be spread over long periods of time, has frequently been cited as a pro to type, nongovernment economic

[12] Inventory management in response to indirect incentives, is here treated as an alternative to stockpiling in contrast with the holding of stocks by industry on contract to the Government which is treated as stockpiling in ch. IV,

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stockpile. For that reason it is discussed here in some detail.

The government of Sweden maintains stockpiles of raw materials for strategic purposes and is currently examining the possibility of implementing an economic stockpile. It also provides tax incentives which encourage industry to maintain adequate inventories. The rules governing the taxation of corporate income in Sweden apply to three special areas: (1) inventory valuation; (z) depreciation and (3) reserves for future investment. The Swedish tax rules in these areas have increased the ability of Swedish industry to compete in world markets. By providing substantial incentives to industry and commerce, the Swedish Government has encouraged the use of private capital to deal with economic fluctuations and the business cycle. An essential feature of these devices is the degree of control they give business taxpayers over the amount of profit to be reported. The corporation has the option of taking larger or smaller deductions in any particular year. To that extent, corporate and other taxpayers are permitted a substantial degree of latitude in leveling out their annual results and in building up reserves.

a. Inventory Valuation.—Sweden's tax provision governing the valuation of inventories are designed to eliminate taxation of merely inflationary profits and permit the strengthening of corporate resources against the possibility of inventory price declines. Under this system the basic rule is that the valuation of the inventory entered by the taxpayer in his account books shall govern for tax purposes. However, the right to value inventories in the taxpayer's business discretion is subject to certain limitations established by the tax laws.

The main rule governing valuation is complemented by two supplementary rules. The first of these is the rule of "comparable value." If the value of the inventory at the end of a corporation's fiscal year-at cost or market, and after deducting obsolete or unsalable items—is less than the average of the value of the inventory at the close of the two prior years (average value termed the "comparable value"), the corporation may write its inventory down by 60 percent of that comparable value, rather than by 60 percent of the value at the end of the income year in question.

The second supplementary rule relates to the valuation of raw materials or staple commodities in the inventory. The corporation has an option to value these inventory assets at the lowest market price in effect during the income year or in any of the nine previous years, and then to reduce that figure by 30 percent to give an inventory valuation equal to 70 percent of the 10-year low. If the corporation chooses to value raw materials or staple commodities in this way, it may not also take advantage of the rule of "comparable value" outlined above, In any event, a corporation may always write its inventory down to its actual value, despite the foregoing rules, and take appropriate deductions from taxable income. So far as the company's books are concerned, it is immaterial whether the amount of an authorized writeoff is deducted directly from the cost or market value of the inventory price decline on the liability side, The latter method is customarily used, however, when the use of the "comparable value" rule results in a negative inventory value.

b. Depreciation.—The second area of incentives granted industry by the Swedish Government is depreciation. The main rule dealing with depreciation provides that a taxpayer, after first writing off all obsolete or unsalable items in full, may write down the balance of the inventory by 60 percent to a floor of 40 percent of cost or market value, whichever is lower. Cost is determined on a first-in, first-out basis. The amount of this inventory writeoff is deductible from taxable income.

c. Reserves for Future Investment.—The third area of incentive in the Swedish system is the establishment of reserves for future investment. A special provision enacted in 1964 permits a Swedish parent company selling in-

ventory assets to a foreign subsidiary for future resale on the foreign market to defer tax on profits attributable to goods which remain unsold in the hands of the subsidiary at the end of the parent's fixed year. The parent may take a deduction from taxable income by an amount not exceeding the difference between the price at which the parent sold these goods to the subsidiary (minus any amount of inventory writeoff deducted by the subsidiary), and the parent's cost of these goods. The allocation must be restored to taxable income during the following fiscal year; at the end of that year the question of a deduction for a renewed allocation is considered in view of the then existing circumstances.

While the tax system of Sweden was not designed to create a national stockpile, but rather to support a healthy industrial economy in good rapport with Government, it has tended to obviate the need for a national stockpile by encouraging industry to maintain inventories large enough to meet emergency situations. On the one hand, the inventories thus supported include items which are of a strategic and critical nature, as well as those which are not. On the other hand, the materials coverage becomes much greater than would be possible if the Government were to purchase and store only those items which it could afford and which were deemed vulnerable enough to warrant the Government effort. In brief, then, the Swedish tax rules, as they apply to inventories and other tax measures, are designed to increase the efficiency of Swedish industry as a competitor in world markets. The creation of a "Swedish stockpile" is more or less a byproduct of those rules,

2. Futures **Markets**

The extension of futures markets for materials in which they do not already exist could provide a means of greater market stability, despite the problems which would be raised by speculation in these materials. Among the metals, there are futures markets in the United States (such as the Commodity Exchange in New York) and abroad (such as the London Metal Exchange) in copper, gold, lead, mercury, platinum group, silver, tin, and zinc.

A commodity futures market is any exchange or association of persons engaged in buying or selling a commodity or receiving it for sale on consignment.[13] Contracts, called "futures," are made at a mutually agreed price between buyers and sellers or their agents for delivery of commodities at some future specified date. The commodity futures market provides a vehicle through which buyers and sellers hedge against losses which may be incurred because of price changes in the future. For example, the buyer in a long-term contract could hedge his purchase by selling forward; i.e., by taking a short position in the futures market. If the price were to fall in the interim before actual delivery is made to him, he would offset his short position on the futures market, making a profit on the closed-out position, thus compensating for the loss incurred under his long-term contract for accepting delivery on an overvalued commodity. Transactions could also be made to offset the effect of possible future price increases and apply to sellers as well as buyers. In short, gains in a rising market and losses in a falling market could be compensated for by opposite gains or losses resulting from physical delivery under a long-term contract.

Commodities which are traded on a futures market should meet certain criteria. Uniformity of specifications is a prime consideration. Since there must be certainty that the grade and quality named in the contract can be delivered with little variation from the standard, the commodity should therefore be interchangeable and homogeneous. Another requirement is that the freight cost should be small in comparison with the delivered value of the commodity. High freight-to-value ratios could require a number of storage warehouses at strategic locations and would make it

[13] See "A Study of Ferrous Scrap Futures," United States Department of Commerce, June 1974.

difficult to operate a central commodity exchange with a sufficient number of floor traders to keep the contracts liquid. In relation to the location of inventories, there should be enough stock available on the cash or spot market to allow a short position to be offset by delivery rather than by "buying in" the contract. A workable commodity exchange should either carry adequate inventories against actual delivery contracts or have ready access to inventories of others through adequate spot trading. The possibility of making or demanding delivery tends to keep the futures price levels of the nearest delivery month in close alignment with the spot price. Finally, a commodity with a large number of active buyers and sellers is necessary in order to supply the hedging contracts and the large volume of trading needed to keep the market liquid. The absence of a large number of traders on both sides of the market could reduce the competition required to avoid restrictive action by an individual or group on supplies or prices.

Although there has been consideration from time to time regarding the development of a futures market in commodities not now so handled, and although some of the materials which might be selected for consideration in an economic stockpiling program might qualify, there is no present indication of an extension of such markets in those directions. Nevertheless, this alternative should be kept in mind as a possible means of market stabilization if future developments warrant it.

3. Standby Capacity

Standby capacity to produce materials would require Government financing or tax incentives to encourage the construction of facilities for future use when needed. Standby capacity is a deferrable and/or mothballed mining and/or industrial capacity capable of producing in quantity critical and strategic materials in time of scarcity. Its major advantages are that it provides a quick reaction capability to scarcity problems and requires a relatively short leadtime to be put into use.

The major disadvantages of standby capacity, according to Buttner, are

> high capital tieup, rapid depreciation of capital through obsolescence, and deterioration of plants standing in idleness. The losses in mothballed plants are so great that the temptation has been overwhelming to run the plants instead, and that, like a night out on the town, results in a DPA-like, stockpile hangover. In addition, the deferral of "existing equipment and manpower from other less critical activity is disruptive to industry and usually requires special Government bodies set up to manage it equitably. To rely 100 percent on standby capacity to combat scarcity would incur exorbitant costs.[14]

The stockpiling of technology—in the form of standby capacity--can occur either as standby production plants or excess plant capacity, by subsidizing the operation of higher cost production plants or excess plant capacity, or by subsidizing the operation of higher cost production processes which permit the use of nonvulnerable resources, Compared with maintaining stocks of materials, the costs incurred in stockpiling technology are very large and it appears doubtful if the insurance provided would be worth it. A major relevant issue of science and technology policy is whether the Federal Government should underwrite research and development for alternative technologies, substitute materials, or raw material supplies. However, such an issue is really more concerned with long-term impacts than with short-term needs. Instituting standby capacity as an alternative to stockpiling, costly as it would be, is a doubtful development under peacetime conditions.

4. International Commodity Agreements

International commodity agreements with developing countries have been put forth as a potential means of achieving international market stability for two mutually beneficial purposes: materials supply/price stability for the United States and market/price stability for

[14] Henniker Report.

the materials-producing countries,[15] Under such agreements, floor and ceiling prices could be established to protect both producers and consumers. Without an economic stockpile as a repository for materials obtained through such international agreements, some types of allocations of supplies to consumers would probably be necessary. International commodity agreements would be expected to have limited effect on cartel or unilateral political actions which, because of their political nature, do not make the countries involved amenable to international agreements, However, the possibility y of such agreements should not be ignored,

The analysis of international commodity agreements in this chapter does not obviate the consideration of such an agreement as an economic stockpile. It is placed here as an alternative simply because it is clearly not a national stockpile and because it involves defined foreign-policy decisions,

One potential problem with international commodity agreements was cited by several of the persons interviewed, namely, that many countries might not consistently adhere to an international agreement during periods when it might not be to their best economic advantage,

Heavy investment costs of mineral development and processing plants have helped to promote the growth of large, vertically integrated firms and, more recently, of multinational corporations which have to a large extent organized and controlled markets and trade in minerals, The current picture is changing, however. The power and influence of the multinational mining corporations have been declining and will probably continue to diminish in the future, as their facilities, are nationalized, as foreign governments intervene in their operations and marketing, and as hostility toward foreign investment grows.

[15] "Prospects for International Cooperation in Critical Materials: The Case of International Commodity Agreements." A paper by John E. Tilton, Department of Mineral Economics, Pennsylvania State University, June 1975.

Since multinational corporations no longer appear to be serving the interests of producer (exporter) or consumer (importer) countries, other avenues are being considered. From the standpoint of importing countries, particularly the United States, there is a growing concern over future access to mineral supplies, and a fear of possible political confrontation over mineral policy issues, as well as of sharply higher prices. These countries are therefore looking more favorably on international commodity agreements and other alternative arrangements for organizing international mineral markets, In May 1975, Secretary of State Henry Kissinger indicated a willingness by the United States to consider international arrangements for individual commodities on a case-by-case basis, And, in fact, the U.S. has recently signed the International Tin Agreement and submitted it to the Senate for ratification,

a. Functions of International Commodity Agreement.—In certain respects, international commodity agreements might serve the interests of both importing and exporting countries in four ways. First, buffer stocks which stabilize the price and output of mineral commodities around their long-run trend might benefit both sets of nations, Second, buffer stocks might stabilize export earnings, Third, they might transfer earnings from developed countries to developing countries, if this were found to be desirable, Finally, they could provide gains in political good will and result in a type of materials detente,

N. E. Promisel lists the following services which an international organization could perform:

- Provide a forum for international discussion and debate of critical issues, followed by joint planning for action;
- Provide a recognized mechanism for cooperative programs in research and development and other sectors of materials and processes technology;
- Provide an adequate and rapid means for information and technology transfer, for mutual education, and for exchange of

materials scientists and engineers. Included would be international publications and jointly planned conferences and symposia;

. Stimulate the advancement of materials science and engineering on a global basis and promote professional growth in this field;

• Promote a better understanding and appreciation of materials science and engineering and its importance by key executives and administrators in many countries;

. Insure a mechanism for proper inputs and response to the many other international bodies in other fields and thus to insure adequate consideration (now mostly lacking) of materials science and engineering in many global, critical issues; and

. The organization would not deal with proprietary industrial technology or the market place per se although the impact of materials science and engineering on economics would be included.[16]

Whatever the agreement or disagreement regarding these possible benefits of an international stockpile, the international community should strive to achieve at least two additional objectives: (1) minimize the potential for political conflict arising from mineral trade, and (z) encourage production efficiency. Exploration, development, and production should not be encouraged in high-cost areas while lower cost areas are neglected, And material substitution should not be stimulated before relative production costs make such changes desirable, As Tilton points out

> International commodity agreements which attempt to set prices above the long run market clearing level are unlikely to achieve either of these objectives. Once importing states agree that exporting countries are entitled to monopoly profits, disagreements over just how high prices should be almost ensures continual confrontation. In addition, the incentives of producers and users are distorted in a manner that may promote serious production inefficiency. For these reasons, importing states should resist the strong pressures of exporting states for artificially high prices, Although a transfer of income and wealth from the importing countries, which tend to enjoy high standards of living, to the less developed, exporting countries may be highly desirable, it should be done in a manner which improves international relations and production efficiency, Moreover, a number of mineral exporting countries, such as Canada and Austria, already enjoy high standards of living, while some of the world's poorest countries have little mineral wealth to export. If a redistribution of income among nations is considered desirable for equity and humanitarian reasons, then a country's level of development, rather than its mineral endowment, seems a more appropriate criterion for receiving assistance.[17]

International buffer stocks have also been discussed by F. H. Buttner of Battelle Columbus Laboratories. Such a stockpile, he insists, would "replace national buffer stocks, for the main purpose of reducing the amplitude of world price fluctuations encountered in economic cycles. "18 Buttner would call this stockpile an International Trade Inventory (ITI) to avoid the "nationalistic and aggressive connotations" of the term "stockpile." He points out the following potential advantages of an international materials stockpile:

To Consumer Countries, An inventory would:

(1) Relieve the disruption of hand-to-mouth material procurement,

(2) Avoid economic damage of sudden scarcity, Bypasses a "decelerator effect, " (The decelerator effect occurs when a scarcity idles consumer's manufacturing capacity requiring him to carry higher costs,)

(3) Stabilize prices, preventing them from penetrating ceilings that add to costs; i.e., idle-equipment costs, which reduce profit margins and create an increment of inflationary pressure.

(4) Introduce de facto currency support by virtue of a nation's ownership of part of the inventory, thus strengthening its currency convertibility and valuation,

(5) Introduce de facto expansion of currency via extending credit against ITI stocks, thus relaxing need for IMC to be prepared to lend

16 Henniker Report,

170p, Cit.
laHenniker Report,

money to nations faced with sudden rises in demand for foreign currency,

To Producing Countries. An inventory would:

(1) Become an inventory-customer to stand in for disappearing consumer-customers in times of depressed demand and prices.

(2) A~oid economic damage of sudden high demand bypassing the "accelerator effect. " (Accelerator effects occur when an increased demand pushes producer beyond his capacity, requiring him to raise his investment. A five percent increase in output, above capacity, would as a rule, raise the investment/spending budget by perhaps 50 percent.) The Inventory would absorb the shock or a sharp discontinuity in demand, and relieve pressures on that investment/spending budget; also allow for an orderly expansion over time if demand proves to be continuous.

(3) Stabilize prices (of inelastic commodities) preventing them from penetrating floors that reduce revenues at a time when (1) idle capacity may be increasing unit costs due to lower productivity and (z) reduced revenues, and profits bear hardship on producer country.

(4) Introduce de facto currency support of producer-country currency in foreign exchange. Currency convertibility increases with knowledge that valuable raw material is available in its ITI account to holders of the producing country's currency,

(5) See (15) under "Consuming Countries, "

b. **International** Tin Agreements,—The ITA is currently the only formal international commodity agreement for a metal, For a complete discussion of the ITA, see appendix B; "Case-Study: The International Tin Council, "

D. ALTERNATIVE METHODS TO RESTRICT DEMAND

As an alternative to economic stockpiling, restricting demand is in part a negative approach, contrary to the other alternatives which are aimed for the most part at increasing supply. The distribution of materials could be achieved in at least three ways: (1) conservation, (2) substitution, and (3) export controls. Conservation and substitution are long-term solutions to the materials problems for which an economic stockpile is being considered, while export controls provide a short-term solution.

S, Victor Radcliffe lists the following methods for reducing demand for new supply:

- Better integration of materials selection with component design to develop manufacturing processes that reduce materials loss during manufacturing;
- New or improved materials to permit engineering designs that reduce the amounts of material required to perform a given function (e.g., miniaturization, as in solid-state devices, or improved reliability);
- Conservation in use through improved materials performance that provides increased service life (e.g., reduction in rates of deterioration by corrosion and wear); and
- Improved recovery or direct reuse of materials during processing, manufacturing, and after completion of the useful life of capital or consumer goods.[19]

1. Conservation

On the domestic side, conservation—whether voluntary, mandatory, or induced by higher prices—would be a means of reducing demand and therefore import dependence. Such conservation measures would have to be accompanied by allocation techniques in order to provide equitability among consumers, Conservation could also be achieved in a reduction of materials waste. A prime current example of conservation as an alternative has been the U.S. response to OPEC.

Ira Grant Hedrick identifies three certain mechanisms which can help promote more conservative designs in the use of materials:

[19]Henniker Report.

- A shift in customer appeal. Simply, this is getting the customer to choose products because they conserve materials. This could be quite a chore with the private and commercial customer.

. A reordering of the "Dollar Economy. " The introduction of a carefully considered system for assessing the true value of a material to our society such that the price of a product would better reflect its total materials impact,

- The application of artificial constraints and controls such that the traditional principles of maximum appeal at minimum cost are forcefully 'overridden' in favor of resource conservation. [20]

The National Commission on Materials Policy recommended that the public be alerted to materials savings by

- Publicity campaigns mounted by public and private consumer protection agencies or other appropriate means;
- Publicizing the results of public or private product testing laboratories; and
- Development of product performance specifications by trade organizations and technical and professional societies, with public participation and encouragement of compliance by their respective industries,

The Commission also recommended that "the Department of Commerce fund a comprehensive survey"

- To determine losses sustained in the United States from corrosion, friction and wear, fracture, and high temperatures, service failure in the various industries, and to calculate the amount of savings that can be affected by application of established measures;
- To assess adequacy of present research in these fields and to fund additional research, if necessary; and
- To recommend improved methods for dissemination of pertinent data.

The Office of Technology Assessment currently has a study underway on materials conservation.

2. Substitution

Also on the domestic side, substitution of other available materials—whether voluntary or under Government order—would tend to reduce demand for materials in short supply. The major advantages of substitution are, first, that it relieves critical-material demand by replacing them with noncritical materials offering equivalent effectiveness in given uses; and second, that once underway, it pays for itself as it goes, except where the replacement material is inferior and requires paying an incremental cost to make up for that margin of difference. The major disadvantage of substitution is that it cannot take the economy far enough to combat broad and deep scarcity situations. Substitution technology is not that well developed, and it will require long lead-times to develop it. That is not to say that substitution is not done in industry. It is, as Buttner points out, but on a relatively small "nutritional" scale, so to speak, not on a sufficient scale to provide the large-scale "therapy" we would need to combat real or sudden scarcity. "Even though further technical development appears worthwhile and should take further technical development appears worthwhile and should take us a long way, " he continues, "it would be visionary to expect a 100 percent substitution to solve all scarcity problems. One can foresee at its best exorbitantly high cost, and, for technical reasons, a significant short fall of the '100 percent' goal." [21]

The extent of substitution maybe limited by performance standards, relative costs, and the supply of substitutes, Substitution could be increased by the imposition of high tariffs, resulting in increased prices and reduced demand for the material involved, but such higher tariffs are not likely. Substitution of one scarce material for another would obviously change the problem but not solve it, Where alterations in processing methods and investment in new equipment are involved, substitu -

[20] Henniker Report

[21] Henniker Report.

tion is a more feasible solution for long-term supply problems than those of likely short duration. For example, the shortage of certain raw materials during World War II and the Korean war led to rather extensive substitution in the component elements of alloy steel and tool steel making. A major change occurred in the use of molybdenum in lieu of less plentiful materials, such as tungsten and vanadium,

The Office of Technology Assessment currently has underway a study on substitution.

3. Export Controls

On the foreign side, Government-imposed export controls or voluntary industry actions reducing exports would shift supplies to domestic consumers. These export limitations could apply directly to materials, or they could achieve much the same result by being applied to the products made from those materials. Except under wartime conditions or under extraordinary peacetime conditions, the imposition of Government export controls is unlikely. Over the past 10 years, such controls have been virtually limited to serious short-supply conditions in nickel, copper, ferrous scrap, and petroleum products. In 1974, for example, the United States discontinued the export controls it had imposed in July 1973 on ferrous scrap. This program was instituted as a result of the rising price of ferrous scrap associated with a surge in U.S. exports and a domestic short supply. As these conditions changed, the United States acted quickly, in consultation with its foreign trading partners and domestic suppliers and users of scrap, to terminate export controls.

E. SUMMARY OF ALTERNATIVES AND IMPACTED SECTOR GROUPS

1. Alternatives to Economic Stockpiling Policies

The following matrix (table VII-I) identifies alternatives which could principally apply to each of the five stockpiling policies studied in depth. The greatest number of alternatives—12 of the IA-offer possibilities in overcoming the problems of import disruption/price actions by cartels. Not all the alternatives shown for any single stockpiling policy would be required to achieve the purpose of that policy, nor are they all of equal value. A judicious choice of alternatives, based on a quantitative cost/benefit analysis of their advantages and disadvantages, is needed and could be performed by an agency responsible for economic stockpiling. Such an analysis of alternatives was beyond the scope of this assessment.

2. Sectors Impacted by Alternatives to Economic Stockpiling

Table VII–2 identifies the various sectors in the economy which are principally impacted by the three sets of alternatives discussed in this assessment. The identification of the sectors is derived in large part from the Relevance Trees.

Table VII–l—Alternatives to economic stockpiling policies

ALTERNATIVES	SP 1—Discourage or Counteract Cartel or Unilateral Political Actions Affecting Price or Supply	SP 2—Cushion the Impact of Non-political Import Disruptions	SP 3—Assist in International Materials Market Stabilization	SP 4—Conserve Scarce Domestic Materials by Reducing Current Consumption	SP 5—Provide a Market for Temporary Surplus and Ease Temporary Shortages
Direct Subsidy	X*	...	...	X	
Tax Incentives for Capital Investment & Production	X*	...	...	X	
Research & Development	X*	...	...	X	
Loans and Investment Guarantees	X*	...	X		
Tariff Concessions	X*				
Recycling	X*				
Production from Public Lands	X*				
Tax Incentives for Inventory Maintenance	X	X	X	...	X
Extended Futures Markets	X	X			
Standby Capacity	X	X	...	...	X
International Commodity Agreements	X	...	X	...	X
Conservation	X*				
Substitution	X*	X			
Export Controls	X	X			

● These are long-term alternatives which are not effective in the short run, but which may be effective in the long run.

Table VII–2.—Sectors impacted by alternatives to economic stockpiling

Sectors	Sets of alternatives		
	Increase supply	Stabilize supply and price	Redirect distribution
Government	X	X	X
Consumers	X	X	X
Producers—primary materials	X	X	X
Processors—primary materials	X	X	X
Processors—secondary materials	X	X	X
Scrap collectors	X	X	
University labs	X		X
Research labs	X		X
Private R&D groups	X	...	X
Resource investors	X	...	...
Traders	...	X	...
Importers	...	X	...
Exporters		X	