

# Chapter 8 Lecture - Recyclable Resources: Minerals, Paper, Bottles, and E-waste

## Econ 2675 – Environmental Economics

### Chapter 8 Lecture - Recyclable Resources: Minerals, Paper, Bottles, and E-waste



## Minerals

- Important in production processes
- Effect of recycling will increase the size of the available resources.
- Consider a resource with a stock of  $A$ .
- With a recovery rate of  $a$  and an infinite time period, the amount made available by recycling will be  $A/(1-a)$ .  
**Can you prove?**
- If  $a = 0$ , the resource is nonrecyclable. The effect of recycling is to increase the availability of the resource.
- The larger the value of  $a$ , the larger the value of resource flows.

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## An Efficient Allocation of Recyclable Resources

### Extraction and Disposal Cost

- Disposal costs rise with rising wealth and with increasing population densities.
- As land has become more scarce and thus, valuable, the burial of wastes is becoming increasingly expensive.
- Concerns over contamination of groundwater from buried waste has also made landfill disposal less attractive
- The composition-of-demand effect—as long as quality is not adversely affected, consumers will shift to materials made of recycled products if products made with virgin materials are more expensive.
- Recycling and actual market factor – Will there be a demand for the recycled products and what are price effects.
- Purity of the recycled products

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## An Efficient Allocation of Recyclable Resources

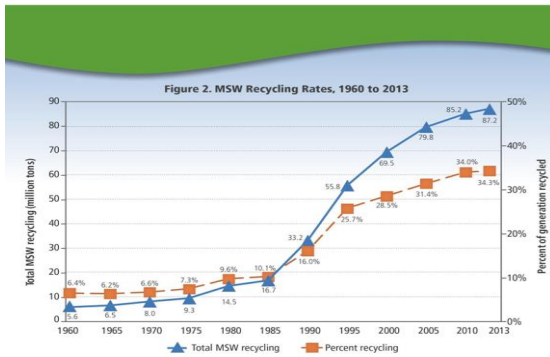
### Recycling: A Closer Look

- Recycling increase and recycling rates are on the rise.
- Transport, labor, processing costs, energy costs, and compliance cost with environmental regulation are usually significant and play a large role in overall recycling rates.
- As recycling becomes more cost competitive, manufacturers rely more heavily on recycled inputs as well as product design.

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## Municipal Solid-Waste Recycling Rates 1960–2013



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## Situation in Qatar

- The generation rate of household solid waste is estimated at 2.1-4.1 kilogram (kg) per capita per day in GCC countries, 1.2 in the US, and 4.1 in European Union countries, compared to 1.6 kg per person per day in Qatar.
- Domestic solid waste usually consists of different proportions of organic matter (food waste, etc), paper, plastics, glass, metals, fabrics, bones, leather, home dust, etc. Domestic solid waste in Qatar is the second largest source of waste after construction waste.

<https://thepeninsulaqatar.com/article/17/09/2018/Qatar-aims-to-recycle-15-of-solid-waste-by-2022>

<https://www.psa.gov.qa/en/nds1/pages/default.aspx#ManageEnvDev>

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## An Efficient Allocation of Recyclable Resources

### Recycling and Ore Depletion

- In terms of the switch point introduced earlier, if the resources can be recycled at a marginal cost lower than that of the substitute, the market will likely use the recyclable resource longer than it would the non-recyclable resource.
- An efficient economic system will try to find a balance between the consumption of newly mined and recycled materials, between disposing of used products and recycling, and between imports and domestic production.

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## Lead Recycling

The domestic demand for lead has changed significantly over the last 30 years. In 1972 dissipative, nonrecyclable uses of lead (primarily gasoline additives, pigments in paint, and ammunition) accounted for about 30 percent of reported consumption. And only about 30 percent of all produced lead came from recycled material.

Over the last three decades, however, congressional recognition of lead's negative health effects on children has led to a series of laws limiting the amount of allowable lead in gasoline and paints. This has resulted not only in a decline in the total amount of lead used, but also in the dramatic decline of the dissipative uses (which, by 1997, had fallen to only 13 percent of total demand). A declining role for dissipative uses implies that an increasing proportion of the production is available to be recycled. And, in fact, more is now recycled. By 2012, 80 percent of the domestic lead consumption came from recycled scrap. The lead-acid battery industry continues to be the largest user of lead.

Old (postconsumer) scrap accounts for nearly all the total lead scrap recovered. Used batteries supply about 90 percent of that old scrap. Battery manufacturers have begun entering buyback arrangements with retail outlets, both as a marketing tool for new batteries and as a means of ensuring a supply of inputs to their downstream manufacturing operations. Contrast this with aluminum, for example. In 2012, 53 percent of recycled aluminum came from new (manufacturing) scrap, while only 47 percent was from old scrap (beverage cans and other discarded aluminum products).

Source: U.S. Department of the Interior. *Minerals Yearbook*. Retrieved from <http://minerals.usgs.gov/minerals/pubs/mcs/>

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### Factors Mitigating Resource Scarcity

#### Exploration and Discovery

- A profit-maximizing firm will continue to explore until the marginal discovery cost of exploration equals the marginal scarcity rent from a unit of the resource sold.
- The marginal scarcity rent equals the difference between the price received and the marginal cost of extraction.
- Income growth and population growth both cause demand for the resource to rise over time.
- Changes in scarcity rents will lead to different stimulations in exploration activities.

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### Factors Mitigating Resource Scarcity

#### Technological Progress

- Technological progress reduces the cost of the ore.
- Rising extraction costs stimulate the development of new technologies.
- The rate and type of technological progress are influenced by the degree of resource scarcity.

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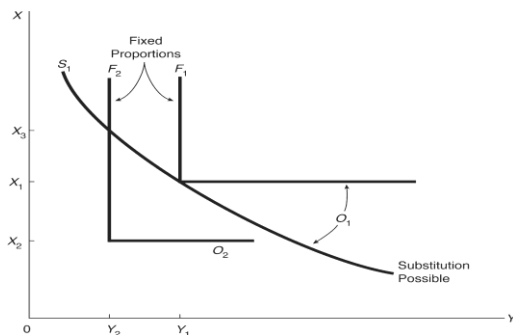
### Factors Mitigating Resource Scarcity

#### Substitution

- Looking at isoquants we can illustrate the effect of substituting abundant resources for scarce resources.
- The more substitution possibilities, the smaller the impact resource scarcity will have on output.
- Some factors increase the likelihood of resource scarcity, while others mitigate the seriousness of scarcity.

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### Output Levels and the Possibilities for Input Substitution.



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## Market Imperfections

### Disposal Cost and Efficiency

- If an economic agent does not bear the full cost of disposal, the agent will be biased toward the use of virgin materials and away from recycling.
- The avoided marginal cost of disposal is considered a marginal benefit from recycling. This amount must be included in recycling decisions
- Both marginal disposal costs and the prices of recycled materials will affect the efficient level of recycling.

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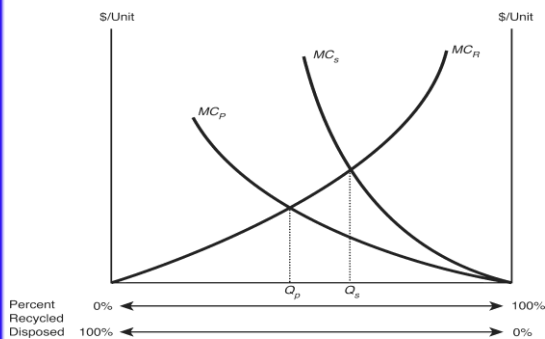
## Market Imperfections

### • The Disposal Decision

- Recyclable waste comes from either new scrap or old scrap. New scrap is residual material from a production process while old scrap is recovered from used products.
- When the private marginal cost of disposal is lower than the marginal social cost, the market level of recycling is inefficient.

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## The Efficient Level of Recycling



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## Market Imperfections

### • Disposal Costs and the Scrap Market

- If consumers bear the true marginal disposal cost, more materials could be integrated into production process; price falls, and total consumption of inputs would increase as well as the use of recycled materials.
- Correct inclusion of disposal cost would increase the amount of recycling and extend the economic life for depletable and recyclable resources.
- Corrective Public Policies include pay-as-you-throw (PAYT) trash disposal, curbside recycling, refundable deposits, Plastic Bag Bans and Fees, and taxes.
  - Volume or user-pay pricing are disposal charges that reflect the true social cost of disposal.
  - A pre-implementation concern about volume pricing was that it might impose a hardship on poorer residents.

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## Market Imperfections

- Curbside Recycling attempts to achieve an efficient balance between disposal and recycling, especially in combination with pay-as-you-throw trash disposal.
- A refundable deposit system is typically designed to be an initial charge that reflects the cost of disposal and to provide a refund that encourages recycling and helps conserve virgin materials.



## Market Imperfections

- Advocates of Plastic Bag Bans and Fees claim that bans significantly reduce plastic bag waste which frequently ends up in storm drains and in oceans creating hazards for marine mammals, seabirds, and fish.
- Opponents of Plastic Bag Bans and Fees argue that consumers will simply use more paper bags and those also have environmental impacts, as do cotton tote bags.
- Taxing virgin materials and subsidizing recycling activities can also promote recycling.

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## Markets for Recycled Materials

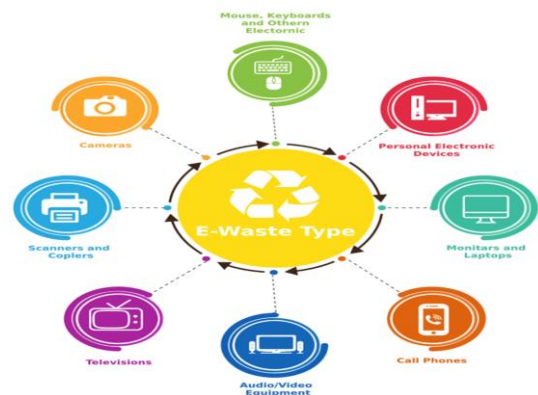
- Successful recycling programs depend to a large extent on the existence of markets (buyers) for recycled materials.

### E-Waste

E-Waste (disposed electronics equipment)

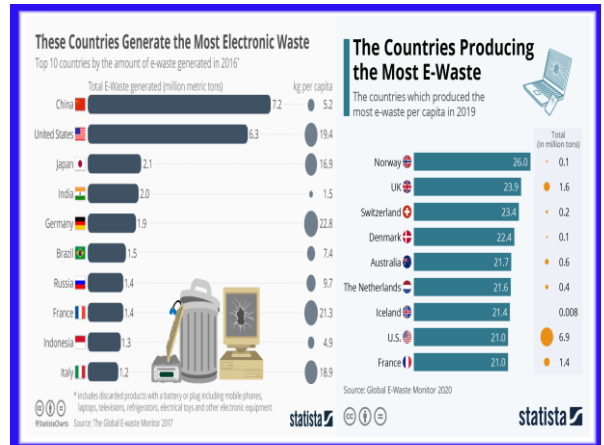
- Regulations on consumers and manufacturer
  - 25 states enacted e-waste legislation.
- The Basel Convention
  - Regulates the movement of electronic wastes across international boundaries.

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**Pollution Damage**

- **Non-internalized environmental damages** from the use of **virgin materials** will also bias the market away from recycled materials. These might be damages from extraction or from processing.
- **Host fees** are being used to address the issue siting of landfills. Host fees compensate the community that agrees to house the landfill.

Russia, Vladivostok. Source: Press Service of the Administration of Vladivostok.

USA, Las Vegas

The Netherlands

Singapore.

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