

INDUSTRIAL ECOLOGY OF METALS:

BARRIERS AND INCENTIVES TO CLOSING LOOPS

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ABSTRACT

This thesis examines the end-of-life markets for NiCd batteries and Aluminum Intensive Vehicles (AIVs) through an industrial ecology framework. Case studies were chosen to examine the general characteristics of the industrial ecology of metals, barriers and incentives to closing material loops, and policy interventions associated with loop closing.

The NiCd case shows how industry policy and public policy converge towards creation of an environmentally beneficial end-of-life market. The industry coordinated take back program was motivated by public health concern for cadmium landfill contamination. The main barriers to taking back batteries are low consumer participation, insufficient economic incentive for cadmium recovery, and ambiguous industry motivations. Public policy makers should consider subsidizing recycled cadmium prices and adding serious accountability measures to the take back system (such as a tax per unit under a recycle rate goal).

The AIV case demonstrates the effectiveness of material value economic incentives for creating and maintaining a self-sufficient recycling system. However, the current recycling system built for steel automobiles will not most efficiently recycle AIVs. Barriers to efficient recycling include inadequate aluminum alloy sorting technology and lack of coordination between firms. Public policy options are limited because recycling efficiency regulation is outside the enabling legislation of agencies, but government should assist industry coordination as much as possible.

The case studies also speak generally to loop closing policies that affect either the supply or demand for recycled material. Demand increasing policies (procurement, minimum recycled content, etc.) are more appropriate for recycling systems where a functional system is in place and the last user has sufficient incentive to return the product. On the other hand, supply increasing policies (take back, landfill ban, etc.) may be necessary for products where the last user does not have sufficient incentive to deliver the used product to the recycling system. Industry policy is useful for developing mutually beneficial technology, setting product standards, and coordinating behavior through merger and acquisition.