Tailoring Product Stewardship and Extended Producer Responsibility To Prevent Marine Plastic Pollution

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I. INTRODUCTION: PLASTIC POLLUTION ORIGINATING ON LAND HAS SERIOUS CONSEQUENCES FOR MARINE AND AQUATIC ENVIRONMENTS AND SHOULD BE CONTROLLED AS CLOSE TO THE SOURCE AS POSSIBLE

Plastic waste now contaminates marine and fresh water ecosystems around the globe with serious consequences for marine life and possible grave consequences for the food chain and human health.[1] An estimated 60% to 80% of marine litter originates on land, and the majority of that waste is plastic.[2] Of all materials constituting marine debris, plastic is the material of greatest concern to the health of aquatic organisms that ingest or become entangled in the waste. According to one recent estimate, twenty million tons of plastic waste enters the marine environment every year.[3] A 2012 assessment by the Convention on Biological Diversity found that 663 species have been harmed or killed by marine litter.[4] New information is continually being revealed about the range of negative impacts that plastic pollution is having on the marine environment.[5]

The United Nations Environment Programme's (UNEP) 2011 *Year Book* highlighted plastic debris in the ocean as a priority emerging global environmental issue, noting that plastics of all kinds break down into fragments that can sorb and concentrate toxins from the seawater and chemicals in sediments, from polychlorinated biphenols (PCBs) to the

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1. *Plastic Debris in the California Marine Ecosystem: A Summary of Current Research, Solution Efforts and Data Gaps*, CAL. OCEAN SCI. TR., at viii-ix, 24 (Sept. 2011), http://calost.org/pdf/science-initiatives/marine%20debris/Plastic%20Report_10-4-11.pdf.

2. *Id.* at viii, 1.

3. Mark Gold et al., *Stemming the Tide of Plastic Marine Litter: A Global Action Agenda*, 27 TUL. ENVTL. L.J. 165, 166 (2014) (citing Raveender Vannela, *Are We "Digging Our Own Grave" Under the Oceans?: Biosphere-Level Effects and Global Policy Challenge from Plastic(s) in Oceans*, 46 ENVTL. SCI. & TECH. 7932, 7932 (2012)).

4. *CBD Technical Series No. 67, Impacts of Marine Debris on Biodiversity: Current Status and Political Solutions*, SECRETARIAT OF THE CONVENTION ON BIOLOGICAL DIVERSITY 9 (2012), http://www.cbd.int/doc/publications/cbd-ts-67-en.pdf.

5. *See, e.g.*, John Schwartz, *Scientists Turn Their Gaze Toward Tiny Threats to Great Lakes*, N.Y. TIMES, Dec. 15, 2013, at N24.

pesticide dichlorodiphenyltrichloroethane (DDT).[6] Many of these pollutants, including PCBs, cause chronic health effects such as endocrine disruption, mutagenicity, and carcinogenicity.[7] A recent study measured the bioaccumulation of chemicals and adverse health effects in fish receiving chronic dietary exposure to low-density polyethylene (LDPE) plastic, a polymer with a strong affinity for organic contaminants that is the largest component of plastic production globally (29%) and is one of the most common polymers recovered as aquatic debris.[8] This study found that persistent bioaccumulative and toxic substances (PBTs), which sorbed in plastics in the marine environment, transfer and bioaccumulate in fish tissue, causing hepatic stress.[9]

Single-use plastic packaging—including food wrappers, beverage bottles, and bags—is the category of waste most frequently collected on beaches during International Coastal Cleanup Days.[10] Global trends indicate that a wide range of products will increasingly be delivered to market in single-use plastic and composite (i.e., flexible, typically nonrecyclable) packaging.[11] To address the quantity and impacts of plastic pollution in the marine environment, urgent action is needed to slow or reverse this production (and consumption) trend, support increased reuse and recycling of products, and ensure downstream management of escaped or littered items (e.g., street sweeping, stormwater management, monitoring and assessment, and beach cleanup). The pathways by which plastic waste enters the aquatic environment are so numerous, it is necessary to employ a suite of policy tools, including fees or bans for products with significant environmental or human health implications, recycling initiatives, cleanup, education, and enhanced international agreements.[12]

Reduction of wasteful single-use plastic packaging is the most efficient approach to preventing impacts to the marine environment, as

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6. U.N. ENV'T PROGRAMME, UNEP YEAR BOOK: EMERGING ISSUES IN OUR GLOBAL ENVIRONMENT 26, 28 (2011) [hereinafter UNEP YEAR BOOK], *available at* http://www.unep.org/yearbook/2011/.

7. *Id.*

8. Chelsea M. Rochman et al., *Ingested Plastic Transfers Hazardous Chemicals to Fish and Induces Hepatic Stress*, 3 SCI. REP., art. no. 3263, 2013, at 2, *available at* http://www.nature.com/srep/2013/131121/srep03263/full/srep03263.html.

9. *Id.* at 3, 5.

10. *See* OCEAN CONSERVANCY, WORKING FOR CLEAN BEACHES AND CLEAN WATER: INTERNATIONAL COASTAL CLEANUP: 2013 REPORT, at 14 (2013), *available at* http://www.oceanconservancy.org/our-work/international-coastal-cleanup/2013-trash-free-seas-report.pdf.

11. *The Plastic Packaging Market Outlook in Food and Drinks*, MARKETRESEARCH.COM (Jan. 4, 2011), http://www.marketresearch.com/Business-Insights-v893/Plastic-Packaging-Outlook-Food-Drinks-6070299/.

12. *See* Gold et al., *supra* note 3, at 202-03.

well as minimizing costs of managing waste, including recycling and stormwater compliance activities. Producers and product brand owners (collectively referred to here as "producers") have the most control over decisions about what packaging is used; they dictate the market for packaging and are therefore "the least cost avoiders of the packaging waste problem."[13] Producers have generally benefitted from a "waste regulatory regime that externalizes disposal costs and environmental impacts from disposal to municipalities and taxpayers."[14] A comprehensive, long-term solution to the problem of marine plastic pollution in the marine environment must include producers and production trends.

II. TRENDS IN PACKAGING PRODUCTION RUN COUNTER TO REDUCTION OF MARINE PLASTIC POLLUTION

Plastic is attractive for many uses because it is durable, lightweight, and does not break down easily. Ironically, this highly durable, persistent material is increasingly used for single-use disposable products such as food and beverage packaging and grocery bags, the majority of which are derived from nonrenewable fossil fuels. Plastic pollution accumulates as a diffuse soup in the five gyres of the oceans and around the globe. Plastics (mostly extremely small particles) are found on the shore, floating on top of or suspended in the water column, and on the seafloor.[15]

The rise of plastic pollution in the marine environment corresponds with trends in waste management and recycling. The Environmental Protection Agency (EPA) reports that only 8% of 32 million tons of plastic in the municipal solid waste (MSW) generated in 2011 were recovered for recycling.[16] Therefore, 2.6 million tons were recycled and 29 million tons discarded—whether landfilled or incinerated. Of the 32 million tons of plastic waste generated, 14 million tons were plastic containers and packaging, about 11 million tons were durable goods, such as appliances, and almost 7 million tons were nondurable goods,

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13. Stephanie A. Goldfine, *Using Economic Incentives To Promote Environmentally Sound Business Practices: A Look at Germany's Experience with Its Regulation on the Avoidance of Package Waste*, 7 GEO. INT'L ENVTL. L. REV. 309, 318 (1994). The least or cheaper cost avoider principle approach is attributed to Ronald Coase who theorized that when two parties can both take actions to avoid harm, efficiency dictates that whoever can reduce the harm at the lowest cost should do so. *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

14. Noah Sachs, *Planning the Funeral at the Birth: Extended Producer Responsibility in the European Union and the United States*, 30 HARV. ENVTL. L. REV. 51, 56 (2006).

15. *Plastic Debris in the California Marine Ecosystem*, *supra* note 1, at 6.

16. *Plastics*, EPA, http://www.epa.gov/osw/conserve/materials/plastics.htm (last updated Feb. 28, 2014).

such as plates and cups.[17] It follows that if 21 million tons of the waste generated are containers, packages, and nondurable items from the to-go lifestyle, and if only 8% of that is being recycled, then 19.32 million tons of nondurable plastic is estimated to be landfilled or incinerated annually in the United States.[18]

It is critically important to note that these numbers do not include the unknown quantities of plastic that were littered or escaped into the environment, never making it to the MSW stream. There is a significant need for data that would permit the comparison of quantity of plastic produced to the quantity managed at MSW. This information would assist in quantifying the plastic escaping into the environment.

In 2009, the plastic packaging market was worth $142 billion, representing 37.4% of the food and drinks packaging market by value; this market is forecast to grow to reach $172 billion by 2014.[19] Given the low rates of recycling, this global market trend of increasing production of single-use packaging means more and more plastic is likely to end up not recycled, in landfills or incinerators, or improperly disposed in the environment. Together, these trends are likely to have negative implications for the problem of marine plastic pollution.

III. PRODUCT STEWARDSHIP AND EXTENDED PRODUCER RESPONSIBILITY CAN BE TAILORED TO ADDRESS MARINE PLASTIC POLLUTION

Product stewardship and extended producer responsibility (collectively referred to here as PS/EPR) are policy approaches applied around the world and in the United States with the purpose of requiring or encouraging producer companies to reduce the negative environmental and societal impacts of their products throughout the products' life cycle.[20] This overarching end is pursued for a wide array of products and through a range of operationalizing mechanisms. The Organization for Economic Cooperation and Development (OECD) lists two features of extended producer responsibility policy: "(1) the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities, and (2) to provide incentives

17. *Id.*

18. *Id.* This figure assumes that all plastic types are recycled at the same rate.

19. *The Plastic Packaging Market Outlook in Food and Drinks*, *supra* note 11.

20. *See generally* Jennifer Nash & Christopher Bosso, *Extended Producer Responsibility in the United States: Full Speed Ahead?* (Harvard Kennedy Sch. Mossavar-Rahmani Ctr. for Bus. & Gov't Associate Working Paper Series No. 10, 2013), *available at* http://www.hks.harvard.edu/var/ezp_site/storage/fckeditor/file/pdfs/centers-programs/centers/mrcbg/publications/awp/Nash_Bosso_2013-10.pdf.

to producers to incorporate environmental considerations in the design of their products."[21] The following definitions for PS/EPR have been developed and received support by a large number of businesses, trade associations, nongovernmental organizations, and other relevant stakeholders in North America:

> *Product Stewardship* is the act of minimizing health, safety, environmental and social impacts, and maximizing economic benefits of a product and its packaging throughout all lifecycle stages. The producer of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role. Stewardship can be either voluntary or required by law.
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> *Extended Producer Responsibility (EPR)* is a mandatory type of product stewardship that includes, at a minimum, the requirement that the producer's responsibility for their product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial and management responsibility, with government oversight, upstream to the producer and away from the public sector; and (2) providing incentives to producers to incorporate environmental considerations into the design of their products and packaging.[22]

Experts disagree over the precise categorization of particular programs as either product stewardship or EPR, so this Article focuses on recommendations that could be applied to both product stewardship and EPR. PS/EPR are applied to a wide range of products including batteries, carpet, thermostats, cell phones, paint, and fluorescent lighting.[23] The operational aspects of the programs largely focus on producer-controlled "take-back" or recycling programs, though upstream waste reduction and design change incentives are often included among the programs' overarching goals. Stakeholders in government, waste management, and the environmental community also disagree about

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21. *Extended Producer Responsibility: A Guidance Manual for Governments*, ORG. FOR ECON. & COOP. DEV. 9 (2001), http://www.oecd-ilibrary.org/environment/extended-producer-responsibility_9789264189867-en also (subscription required).

22. *Product Stewardship and Extended Producer Responsibility: Definitions and Principles*, PROD. STEWARDSHIP INST., http://productstewardship.us/displaycommon.cfm?an=1&subarticlenbr=231 (last visited Jan. 17, 2014). These definitions were developed by the Product Policy Institute, Product Stewardship Institute, and the California Product Stewardship Council and, as of March 27, 2013, endorsed by more than five dozen businesses, governments, government councils, nonprofit organizations, and academic institutions. *Endorsements: Product Stewardship and Extended Producer Responsibility: Definitions and Principles*, PROD. STEWARDSHIP INST. (Mar. 27, 2013), http://productstewardship.us/associations/6596/files/Endorsers.pdf.

23. *See Extended Producer Responsibility State Laws*, PROD. STEWARDSHIP INST. (Dec. 2013), http://productstewardship.us/displaycommon.cfm?an=1&subarticlenbr=280.

when and where comprehensive, mandatory EPR should apply.[24] This Article does not attempt to make the case for PS/EPR as applied to any specific jurisdictions, but instead offers recommendations for better addressing marine plastic pollution when, where, and in whatever configuration these policies are deemed appropriate.

As described above, because single-use plastic packaging is a priority category of marine litter to address, it follows that PS/EPR programs for packaging should be evaluated in order to identify opportunities for preventing a specific type of packaging—plastic—from reaching the marine environment. However, minimizing the impact of single-use plastic packaging does not necessarily require the same type of program that is best suited for achieving high overall recycling rates of packaging as a whole. For example, the European programs described in this report may achieve a high overall recycling rate, but they have not been tailored to have significant impacts on the recycling rate of single-use plastic packaging. Furthermore, any program (legislative or voluntary) intended to reduce marine plastic pollution should be evaluated carefully prior to implementation to ensure that it does not inadvertently create different types of environmental harm by substituting one product for another.

It is clear that PS/EPR policies have been and must continue to be tailored to the specific legal, economic, and societal background in which they operate. Yet, there are shared principles and a growing body of knowledge about the elements of programs that are appropriate in a given locale. The thesis of this Article is that, regardless of the jurisdiction and the specific form of PS/EPR applied, with innovation, these policies can achieve their nascent promise to prevent plastic pollution from reaching the marine environment. This Article suggests that the following policy innovations be considered to tailor PS/EPR programs to address plastic pollution in the marine environment: explicit statements of aquatic waste reduction among the program goals; stronger emphases on incentives to motivate product design improvements that reduce negative environmental impacts; incorporation of broader sets of downstream regulatory activities beyond just recycling or product take-back, which will generate producer support for those measures necessary

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24. To compare arguments for and against EPR for packaging in the United States, see Conrad MacKerron, *Unfinished Business: The Case for Extended Producer Responsibility for Post-Consumer Packaging*, AS YOU SOW (2012), http://www.asyousow.org/publications/2012/UnfinishedBusiness_TheCaseforEPR_20120710.pdf; *Evaluation of Extended Producer Responsibility for Consumer Packaging*, GROCERY MFRS. ASS'N (2012), http://www.gmaonline.org/file-manager/Sustainability/GMA_SAIC_EPR_Report_091112.pdf.

as the last points of intervention to prevent waste from polluting the marine environment; and monitoring and assessment of the extent to which programs and activities achieve a quantifiable reduction in marine plastic pollution.

A. Marine and Aquatic Waste Prevention Must Explicitly Be Included in the Underlying Analysis and Program Goals

The analysis underlying a policy and its stated program goals will determine the extent to which PS/EPR can effectively reduce marine plastic pollution.

1. Life Cycle Analyses Typically Do Not Contain Enough Information To Achieve a Clear Understanding of the Full Life Cycle Costs of Plastic Packaging

A life cycle analysis (LCA) for a given product is only as effective as its underlying data collected via a life cycle inventory. There is a noticeable lack of data or analysis in LCAs for any product, especially plastic packaging, to account for that portion of the product that is littered or improperly disposed of, ending up in the environment. LCAs typically assume that the last and only fate for products are that they are land-filled, recycled, or incinerated.[25] Individual product LCAs rarely, if ever, track the pathways and extent to which plastic packaging ends up in the marine and aquatic environment and the impact the products have as they travel to this end and once they become pollutants in the environment. The International Organization for Standardization (ISO) standards for conducting life cycle assessments to identify environmental problems and areas for improvement in the production and use of products do not instruct to consider the impacts of products' release into the environment.[26] Although it is difficult to generalize across all sectors,

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25. *See, e.g.*, Umberto Arena et al., *Life Cycle Assessment of a Plastic Packaging Recycling System*, 8 INT'L J. LIFE CYCLE ANALYSIS 92 (2003); Stuart Ross & David Evans, *The Environmental Effect of Reusing and Recycling a Plastic-Based Packaging System*, 11 J. CLEANER PROD. 561, 561 (2003) ("The resources and environmental effects assessed over the life of each of the packagings included fossil fuel consumption, greenhouse gas emissions and photochemical oxidant precursors.").

26. Application of ISO 14040:2006 (principles and framework for life cycle assessment) and ISO 14044:2006 (requirements and guidelines, for life cycle assessment designed for the preparation of, conduct of, and critical review of life cycle inventory analysis) typically stop at disposal as captured by municipal solid waste management, recycling, and incineration activities. *See e.g.*, Franklin Assocs., *Final Report: Life Cycle Inventory of 100% Postconsumer HDPE and PET Recycled Resin from Postconsumer Containers and Packaging*, NAT'L ASS'N PET CONTAINER RES. (Apr. 7, 2010), http://www.napcor.com/pdf/FinalReport_LCI_Postconsumer_PETandHDPE.pdf. The *Water Footprint Assessment Manual* appears to be the first systematic

one study observed, "Life cycle studies of products tend to focus on the use phase for several reasons including the assumed long life of components, the ease of implementation of strategies to reduce use phase impacts, and a general lack of expertise with other life cycle stages."[27] To craft a policy to prevent marine plastic pollution, it is necessary to track and analyze the pathways and fate of materials that are littered, dumped, or otherwise end up in the environment.[28]

To establish a foundation of information to solve the problem of marine plastic pollution, evaluation of products that are known to be well documented types of marine pollution should include LCAs and other underlying impact analyses that evaluate the impacts of the products once they reach the environment, as well as the full range of measures necessary to prevent them from becoming marine litter. These analyses could include assessments of cost and efficacy of management activities such as street sweeping, water quality protection activities,[29] litter abatement measures (such as booms, trash cleanups, monitoring, and assessment of litter), and scientific evaluations of the public and ecosystem health implications of plastic packaging in the marine environment. These downstream management activities, and their associated costs, are often overlooked by policy-makers and producers alike. A survey of ninety-five local governments in California collected their reported costs for a set of six downstream litter management activities and found that California local governments pay more than

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guidance for incorporating the value and impact of water usage and disposal in a variety of industrial processes, but it only considers the impacts of fresh water use and effluent discharges; it does not include evaluation of solid waste disposal into the marine or freshwater environment. *See* ARJEN Y. HOEKSTRA ET AL., THE WATER FOOTPRINT ASSESSMENT MANUAL: SETTING THE GLOBAL STANDARD (2011), *available at* http://www.waterfootprint.org/downloads/TheWaterFootprintAssessmentManual.pdf.

27. M. Helu et al., *Evaluating the Relationship Between Use Phase Environmental Impacts and Manufacturing Process Precision*, 60 CIRP ANNALS—MANUFACTURING TECH. 49, 49 (2011).

28. *See generally* Robert U. Ayres, *Life Cycle Analysis: A Critique*, 14 RES. CONSERVATION & RECYCLING 199 (1995).

29. The federal Clean Water Act (CWA) requires the establishment of water quality standards including water quality criteria established at levels sufficient to protect designated uses of the water body. *See* Cal. Reg'l Water Quality Control Bd., L.A. Region, *Trash Total Maximum Daily Loads for the Los Angeles River Watershed*, EPA 1 (July 27, 2007), http://www.epa.gov/waters/tmdldocs/34863-RevisedStaffReport2v2.pdf. The California Regional Water Quality Control Board for Los Angeles and other regional administrating authorities have identified waters as not meeting water quality standards and listed these waters in the state's CWA § 303(d) List of Impaired Waters, requiring the establishment of a total maximum daily load (TMDL) of each pollutant impairing the water quality standards in each waterbody. *See id.* TMDLs have been established for a number of waterbodies impaired by trash. *See, e.g.*, *id.*

$428 million per year.[30] West Coast-wide local governments pay more than $520 million per year to address litter.[31] Generalized LCAs on plastic products contribute to the lack of explicit marine and aquatic waste prevention goals. Standard protocols for developing LCAs should include an analysis of the predominant end-of-life fates of the materials being considered. In the case of plastic materials, evaluation of the product's tendency to become litter should be included.

2. Marine and Aquatic Impact Minimization Should Be Explicitly Included Among the PS/EPR Program Goals

A review of PS/EPR packaging programs currently in place reveals that no enacted programs explicitly address the propensity of single-use plastic packaging to be littered or escape from recycling or landfill recovery. For example, the European Union Packaging Directive focused on waste avoidance or reduction goals, but marine and aquatic impact reduction goals were not included.[32] The *Canada-Wide Action Plan for Extended Producer Responsibility* seeks the adoption by producers of full life-cycle cost accounting for their products so the costs of end-of-life management of products are considered during production, thereby shifting the expenses associated with product end-of-life management from taxpayers to producers and consumers and reducing the amount of waste generated and going to disposal.[33] But architects of the program note that it is not likely to have a significant impact on design improvements that consider the far-downstream marine impacts of plastic packaging.[34]

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30. Kier Assocs., *Waste in Our Water: The Annual Cost to California Communities of Reducing Litter That Pollutes Our Waterways*, NATURAL RES. DEF. COUNCIL 2 (Aug. 2013), http://docs.nrdc.org/oceans/files/oce_13082701a.pdf.

31. Kier Assocs., *The Cost to West Coast Communities of Dealing with Trash, Reducing Marine Debris*, EPA 1 (Sept. 2012), http://www.epa.gov/region9/marine-debris/pdf/WestCoast CommsCost-MngMarineDebris.pdf.

32. *See* Directive 2004/12/EC of the European Parliament and of the Council of 11 February 2004 Amending Directive 94/64/EC on Packaging and Packaging Waste, 2004 O.J. (L 47) 26.

33. *Canada-Wide Action Plan for Extended Producer Responsibility*, CANADIAN COUNCIL OF MINISTERS OF THE ENV'T 8-9 (Oct. 29, 2009), http://www.ccme.ca/assets/pdf/epr_cap.pdf.

34. The plan explicitly notes the deficiencies in the prospective programs' ability to impact design changes:

> In a complex and competitive national and global business market signals to producers from a relatively small market like Canada may not be strong enough alone to influence new environmentally conscious product design and supply chain management. The environmental objectives of EPR may therefore need to be supported and reinforced by other measures, such as: eco-labeling; restrictions on toxic substances; recycled content standards and regulations; green procurement

The lack of focus on reducing the marine and aquatic impacts of plastic packaging is also reflected in targets set for recycling and recovery. The European recycling targets for packaging waste are 60% by weight for glass, 60% by weight for paper and board, 50% by weight for metals, 22.5% by weight for plastics, and 15% by weight for wood.[35] This low target rate for plastics recycling is not likely to meaningfully reduce the amount of plastic packaging that ends up contaminating the marine environment. However, the British Columbia EPR program for printed paper and packaging has significantly improved its goals with a 75% target recovery rate for all covered products, including many types of plastic packaging.[36]

There is a growing recognition of the need for PS/EPR programs to be tailored to explicitly and effectively manage a broader set of possible end-of-life impacts of plastic packaging. For example, two U.S. state-level bills introduced in 2013, Assembly Bill 521 in California[37] and Rhode Island's House Bill 5264/Senate Bill S406,[38] are the first legislative measures to focus on marine impact reduction as a PS/EPR program goal. Additionally, advocates of comprehensive EPR for packaging in the United States have begun to include marine impact reduction in the rationale for these programs.[39] With appropriately scoped underlying analysis and program goals, the PS/EPR policies will cover and emphasize those plastic products with negative impacts on the marine and aquatic environment: lightweight single-use plastics and composites that blow away and are difficult or impossible to recycle and that have a propensity to release and/or accumulate toxins once in water. California Assembly Bill 521 listed the products covered by the program as those items found to be the "major sources of marine plastic pollution,"[40] based upon International Coastal Cleanup data and other monitoring data and analysis.

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policies; environmental performance/voluntary agreements and a variety of other potential standards, bans, guidelines and educational tools.

Id. at iv; *see also A Canada-Wide Strategy for Sustainable Packaging*, CANADIAN COUNCIL OF MINISTERS OF THE ENV'T 23 (Oct. 29, 2009), http://www.ccme.ca/assets/pdf/sp_strategy.pdf.

35. *Recycling and Reuse: Packaging Material: European Union Directive*, EPA (Apr. 2007), http://www.epa.gov/oswer/international/factsheets/200610-packaging-directives.htm.

36. *Packaging and Printed Paper Stewardship Plan*, MULTI-MATERIAL B.C. 19 (Apr. 8, 2013), http://www.env.gov.bc.ca/epd/recycling/pack/pdf/ppp_stewardship_plan2013.PDF.

37. Assemb. Bill 521, 2013-2014 Reg. Sess. (Cal. 2013).

38. H.R. 5264, 2013 Gen. Assemb., Jan. Sess. (R.I. 2013).

39. MacKerron, *supra* note 24, at 9-10, 25.

40. Assemb. Bill 521, 2013-2014 Reg. Sess. (Cal. 2013).

B. PS/EPR Programs Should Include a Stronger Emphasis on Incentives To Motivate Product Design Improvements

The most efficient way to reduce the negative impacts of a product is to reduce waste at the initial design stage, and current EPR programs often acknowledge that fact with inclusion of waste reduction goals.[41] The design phase of a product determines about 70% of the final cost of the product and is the stage that has the most impact on the product's functionality and environmental impact.[42] The architects of the first EPR program for packaging in Sweden placed emphasis on the waste prevention purpose of the programs:

> The main emphasis of EPR is to stimulate product and product system improvements. In order to reach this objective, various policy instruments must be used. It is by linking the economic responsibility to the individual manufacturers that the feedback loops for product improvement are constructed.[43]

Despite stated intentions to incentivize design improvements, the operationalization of program goals in major EPR programs for packaging has occurred largely through recycling enhancement and product take-back to achieve specific objectives tied to those activities. For example, although the EU Packaging Directive acknowledges that "the best means of preventing the creation of packaging waste is to reduce the overall volume of packaging,"[44] European EPR programs for packaging prioritize recycling and diversion rather than waste avoidance.[45] The EU Packaging Directive does not include "a clear hierarchy of objectives and disposal methods in which the prevention of packaging waste ranks higher than recycling, which in turn ranks higher than incineration."[46] It has even been argued that some aspects of the European models encourage the consumption of packaging by giving the

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41. *See* Kees Clement, *EPR and Goal Setting in Dutch Packaging Policy: A Personal Reflection*, *in* ORG. ECON. COOPERATION & DEV., OECD JOINT WORKSHOP ON EXTENDED PRODUCER RESPONSIBILITY AND WASTE MINIMISATION POLICY IN SUPPORT OF ENVIRONMENTAL SUSTAINABILITY 19 (1999) [hereinafter OECD JOINT WORKSHOP], *available at* http://search.oecd.org/officialdocuments/displaydocumentpdf/?doclanguage=en&cote=env/epoc/ppc(99)11/final/part1.

42. J. Jeswiet & M. Hauschild, *EcoDesign and Future Environmental Impacts*, 26 MATERIALS & DESIGN 629, 629-30 (2005).

43. THOMAS LINDHQVIST, EXTENDED PRODUCER RESPONSIBILITY IN CLEANER PRODUCTION: POLICY PRINCIPLE TO PROMOTE ENVIRONMENTAL IMPROVEMENTS OF PRODUCT SYSTEMS 153-54 (2000), *available at* http://lup.lub.lu.se/record/19692/file/1002025.pdf.

44. Eric Neumayer, *German Packaging Waste Management: A Successful Voluntary Agreement with Less Successful Environmental Effects*, 10 EUR. ENV'T 152, 159 (2000).

45. *Id.* at 153.

46. *Id.* at 160.

consumer the false sense that because packaging is being recycled or recovered, there is no need to move towards reusable alternatives.[47] European program outcomes to date illustrate that incentives to promote recycling do not necessarily also have the effect of promoting reduction or evolution in packaging and product delivery systems.[48] Producers have readily paid for the diversion or recycling of products rather than go through the process of intensive product redesign to move beyond single-use practices and pursue product-delivery innovations.[49]

The unfulfilled promise of PS/EPR programs to incentivize design improvements is also illustrated by current market trends. Today, producers' focus on single-use plastic packaging continues, and a large-scale movement toward innovations that dramatically decrease environmental impacts, especially impacts to the marine environment, for example, through deployment of modern, scaled refillable distribution systems, has not emerged.[50] The expected 24% global growth in the use of aseptic packaging[51]—which is very difficult to recycle—shows that the downstream impacts of products are still not given as much weight in product design decisions as elements such as the visual appeal of a package and its light weight in shipping.

The original call for design improvements based on full life-cycle assessment still holds strong appeal, but this end must be actualized through stronger incentives and binding pollution-reduction targets to reduce impacts to the marine and aquatic environment. In his dissertation on the subject, Thomas Lindhqvist, who first introduced the term "extended producer responsibility," reviewed a range of production strategies for product improvement,[52] and he noted that progress is often impeded most by "lack of awareness of the potential for preventive actions" and that "traditional reactive approaches are still today well

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47. *Id.* at 157-58 ("[A] mandatory deposit-refund system on cans suggests environmental friendliness to consumers who might no longer be able to distinguish between the different environmental effects of non-reusable and reusable systems and might prefer the lighter and more easily transportable cans to the heavier glass bottles. The mandatory deposit-refund system might thus very well defeat its own purpose of encouraging the use of reusable packages. This is a fundamental flaw symptomatic of a system that is hostile towards levying taxes on or banning non-reusable packages where alternatives exist.").

48. *See, e.g.*, Goldfine, *supra* note 13, at 309-10.

49. *See, e.g.*, *id.*

50. *See The Plastic Packaging Market Outlook in Food and Drinks*, *supra* note 11 ("Plastic was the leading packaging material used in new product launches in 2010, with a growth of 6.4 percentage points over 2007. Most of the innovations in plastic packaging took place in Europe, accounting for a share of 44.2% of new product launches globally in 2010[.]").

51. *Global Aseptic Packaging To Grow 24% in Next Five Years*, FOOD & BEVERAGE PACKAGING (Aug. 24, 2012), http://www.foodandbeveragepackaging.com/articles/85828.

52. *See* LINDHQVIST, *supra* note 43.

established in the minds of engineers and other decision-makers in industry."[53] It is doubtful that the hard work of minimizing a broad set of life-cycle impacts at the design stage will be undertaken without more assertive directives.

The British Columbia EPR program for printed paper and packaging requires that stewardship plans "adequately" provide for eliminating or reducing impacts of their product "through innovations that affect the stages of its life cycle *before* it reaches the consumer."[54] The stewardship plan does include mention of specific design improvements that should be considered, particularly with regard to plastic packaging.[55] Yet, the soft objective ("adequate") and lack of binding, numeric targets related to design improvements suggest that the British Columbia EPR program may suffer the same limited success in incentivizing design changes as the European programs before it. The work of voluntary product stewardship groups such as the Sustainable Packaging Coalition[56] are also noteworthy, but given the globally competitive marketplace, explicit and binding directives are best suited to even the playing field and ensure that innovation occurs at a pace and in a direction that is sufficient to address the rapidly growing problem of marine plastic pollution.

C. PS/EPR Programs Should Include Producer Responsibility for a Broader Set of Downstream Regulatory Activities, Beyond Product Take-Back or Recycling

In crafting or amending PS/EPR policies to address marine and aquatic pollution, it is critical to think broadly and holistically about the suite of activities necessary to achieve the policy goals. EPR need not be limited to product take-back or recycling enhancement, and there is a "rich set of policies which can stimulate the design of cleaner products from a life-cycle approach."[57]

Experience in Europe illustrates that if compliance targets are defined in terms of diversion alone, the producers will pursue the least expensive option, which in that case is incineration, rather than upstream

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53. *See id.* at 18.

54. *Packaging and Printed Paper Stewardship Plan*, *supra* note 36, at 25.

55. *See id.*

56. *See Definition of Sustainable Packaging*, SUSTAINABLE PACKAGING COAL. (Aug. 2011), http://sustainablepackaging.org/uploads/Documents/Definition%20of%20Sustainable%20Packaging.pdf.

57. Gary A. Davis, *Principles for Application of Extended Producer Responsibility*, *in* OECD JOINT WORKSHOP, *supra* note 41, at 101, 107.

waste reduction through design.[58] While the right system of incentives may ensure that plastic packaging products are recycled at high rates, with increasing population and industry trends, the net quantity of waste—even at the highest feasible recovery rates (e.g., 75% to 80%)—is likely to leave increasing quantities of plastic waste in landfills or escaping to the marine environment.

Recycling has significant environmental benefits over landfilling,[59] and container deposit programs have been shown to increase recycling and reduce the littering of the covered product. However, "[t]here is little evidence that deposit programs lead to significant reductions in other components of the litter stream."[60] Furthermore, even in states with high beverage container deposit rates, these items continue to appear among the most frequently collected litter from cleanup data.[61] This indicates that more information is needed about the relationship between recycling enhancement and marine litter reduction and the relationship between the percentage of waste not recycled and litter. It is reasonable to conclude that if a high percentage of products are being diverted, they are not going into the water, but the items we are concerned about as marine litter are not accounted for in landfill or diversion numbers. The city of San Francisco illustrates this conundrum. The city has an aggressive zero waste policy and has achieved an 80% diversion rate.[62] Yet, there is still a tremendous amount of waste that must be cleaned from city streets, removed from storm drains, and picked off beaches, requiring additional marine litter abatement measures.[63] This is the waste that is littered or escapes during the collection process.

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58. *See generally* Carolyn Abel, *Producer Responsibility: A Paper by the UK Department of Trade and Industry*, *in* OECD JOINT WORKSHOP, *supra* note 41, at 109, 109-10.

59. *See More Jobs, Less Pollution: Growing the Recycling Economy in the U.S.*, TELLUS INST. 1, http://www.tellus.org/publications/files/More_Jobs_Less_Pollution.pdf (last visited Feb. 16, 2014). The report finds that by diverting 75% of the nation's waste, including municipal and construction and demolition waste, the United States could reduce emissions by 276 million metric tons by 2030 and create 1.5 million jobs. *See id.* at 5, 47; *see also Too Good To Throw Away: Recycling's Proven Record*, NATURAL RES. DEF. COUNCIL (1997), http://www.nrdc.org/cities/recycling/recyc/recyinx.asp.

60. Univ. of Md. Envtl. Fin. Ctr., *2011 Impact Analysis of a Beverage Container Deposit Program in Maryland*, ABELL FOUND. 4 (Dec. 15, 2011), http://www.abell.org/pubsitems/CD-Deposit_Program_Analysis-312.pdf.

61. *See id.* at 18.

62. *Mayor Lee Announces San Francisco Reaches 80 Percent Landfill Waste Diversion, Leads All Cities in North America*, SF ENV'T (Oct. 5, 2012), http://www.sfenvironment.org/news/press-release/mayor-lee-announces-san-francisco-reaches-80-percent-landfill-waste-diversion-leads-all-cities-in-north-america.

63. *See generally* Jack Macy, *San Francisco Zero Waste Policies & Programs Preventing Marine Litter*, U.N. ENV'T PROGRAMME, http://rona.unep.org/about_unep_rona/marine_litter/Jack%20Macy.pdf (last visited Feb. 16, 2014).

Measures therefore must be tailored to address that percentage of products that ends up as marine litter. Expanding education and infrastructure to advance "away from home" recycling in public places is important.[64] Creating a bridge between conventional waste management activities and those laws and policies directed towards protecting water quality is a critically important innovation for PS/EPR programs. All of these activities must be carefully monitored and assessed, as described below.

D. Monitoring, Enforcement, and Adaptive Management

It is important to establish baseline data first, then to monitor and assess the extent to which PS/EPR measures actually reduce the quantity of waste reaching the marine environment.[65] In the context of plastic pollution in the environment, this requires setting targets, developing protocols, and ensuring robust oversight that is relevant and appropriate to that particular aspect of the program. For example, the *Canada-Wide Strategy for Sustainable Packaging* calls for a consistent set of indicator and data requirements and reporting to measure the performance of EPR programs for packaging in each province/territory.[66] This is intended to support harmonized requirements and enable Canada-wide assessment of packaging waste.[67] However, discussion with Canadian experts has revealed some concern about the level of monitoring and assessment that is occurring. This may be attributable to the desire to minimize government burdens, which caused the British Columbia Ministry of Environment to elect not to maintain a registry of those brandowners that should be included in the regulation, stating, "It is up to the stewardship agency or one of the competing brandowners to advise the ministry if a particular brandowner is not adhering to the regulation."[68]

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64. *See, e.g.*, *Packaging and Printed Paper Stewardship Plan*, *supra* note 36, at 8, 24. The British Columbia EPR for Packaging Producer Responsibility organization Multi-Material British Columbia will "[e]xperiment with streetscape programs to provide away-from-home service on municipal property such as sidewalks, plazas or parks" though there is not yet a clear schedule for implementation of these activities. *Helping Business Comply with BC's Recycling Regulation for Packaging & Printed Paper*, MULTI-MATERIAL B.C. 19 (Mar. 5, 2013), http://multimaterialbc.ca/mmbc/sites/default/files/documents/pdf/info-session/slides-march2013-1pp.pdf.

65. *See generally* ASHLEY L. ERICKSON ET AL., INCORPORATING ECOLOGICAL PRINCIPLES INTO CALIFORNIA OCEAN AND COASTAL MANAGEMENT: EXAMPLES FROM PRACTICE 137 (2012), *available at* http://www.centerforoceansolutions.org/sites/default/files/COS_Guide_web_ALL_0.pdf.

66. *A Canada-Wide Strategy for Sustainable Packaging*, *supra* note 34, at 5-6.

67. *Id.*

68. Ronald J. Driedger, *The British Columbia Experience in Monitoring and Reporting on EPR Programs*, *in* OECD JOINT WORKSHOP, *supra* note 41, at 61, 70.

A promising approach to developing and implementing a robust monitoring and enforcement program, which ideally feeds into ongoing adaptive management, is to create partnerships between the range of relevant agencies and stakeholders. For example, consideration of PS/EPR for plastic packaging in California would ideally include consultation and input from the terrestrial waste management authorities (CalRecycle,[69] local waste management districts, and private service providers, such as those from the recycling industry) with the water quality authorities (the State and Regional Water Quality Control Boards[70]) and entities tasked with maintaining the health of the coastal and marine environment (the California Coastal Commission,[71] the Ocean Protection Council,[72] and the California Ocean Science Trust[73]). These state-level entities should also continue to coordinate with national and regional monitoring and assessment activities conducted by the National Oceanic and Atmospheric Administration[74] and the West Coast Governors Alliance on Ocean Health[75] to understand the distribution and sources of waste.

IV. CONCLUSION

PS/EPR policies attempt to address market failures that occur due to lack of information, transparency, accountability, or feedback. The growing trend towards use of nonrecyclable composite packaging, such as flexible plastic pouches, is driven in part by lack of consideration of all relevant environmental costs, such as cleaning these products off beaches. These trends contribute to the global contamination of the marine and aquatic environment from significant levels of plastic pollution.

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69. *See California's 75 Percent Initiative: Defining the Future*, CALRECYCLE, http://www.calrecycle.ca.gov/75percent/ (last updated Jan. 14, 2014).

70. *See Statewide Water Quality Control Plans for Trash*, CAL. STATE WATER RES. CONTROL BD., http://www.waterboards.ca.gov/water_issues/programs/trash_control/ (last updated Aug. 9, 2013).

71. *See About the Cleanup*, CAL. COASTAL COMM'N, http://www.coastal.ca.gov/publiced/ccd/about.html (last visited Jan. 14, 2014).

72. *See Marine Debris*, STATE OF CAL. OCEAN PROT. COUNCIL, http://www.opc.ca.gov/category/projectsbytopic/marine-debris-projectsbytopic/ (last visited Jan. 14, 2014).

73. *See Science Initiatives*, CAL. OCEAN SCI. TRUST, http://calost.org/science-initiatives/?page=marine-debris (last visited Jan. 14, 2014).

74. *See Marine Debris Monitoring and Assessment Project*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., http://marinedebris.noaa.gov/research/marine-debris-monitoring-and-assessment-project (last visited Jan. 14, 2014).

75. *See Marine Debris Action Coordination Team*, W. COAST GOVERNORS ALLIANCE ON OCEAN HEALTH, http://www.westcoastoceans.org/index.cfm?content.display&pageID=81 (last visited Jan. 14, 2014).

Building on the experience and results from PS/EPR programs in place, it is possible to refine existing programs or create new ones that will help to prevent plastic pollution by motivating design changes and enhancing producer responsibility throughout the products' life cycles. Although PS/EPR programs must be tailored to fit the particular products or materials and the specific legal, economic, and societal background of the jurisdictions where they are enacted, application of the principles identified in this article can help prevent plastic pollution. In crafting PS/EPR programs, law makers, advocates, and producers are encouraged to consider explicit aquatic waste reduction program goals; incentives to motivate product design improvements that reduce negative environmental impacts; incorporation of the costs of the entire set of activities necessary to manage products, beyond just recycling or product take-back; and monitoring and assessment of the extent to which programs and activities achieve a quantifiable reduction in marine plastic pollution. Finally, producers of plastic commonly found as pollution in the environment should be reporting data about the quantity of plastic packaging produced, the quantity delivered to market, and the quantity recovered for recycling. Without enhanced information and a more holistic approach to producer responsibility, we will continue to struggle to prevent plastic pollution in the aquatic and marine environment.