行政院所屬各機關因公出國人員出國報告書

出國報告（出國類別：開會）

赴美出席 2013 年「第 3 屆國際電子廢棄物回收管理夥伴會議」

2013 International E-Waste Management Network (IEMN) Meeting

服務機關：行政院環境保護署

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派赴國家：美國

出國期間：102 年 7 月 13 日至 7 月 23 日

報告日期：102 年 10 月 16 日

摘要

本次與美國環保署於 102 年 7 月 15 至 19 日於美國舊金山共同舉辦「第 3 屆國際電子廢棄物回收管理夥伴會議」，延續 101 年 10 月由我國與美國環保署於臺灣舉辦之「國際廢電子電器暨廢資訊物品回收管理研習會」，共有來自我國、美國、哥倫比亞、馬來西亞、日本、迦納、薩爾瓦多、泰國、印度、阿根廷、越南、奈及利亞、巴西及印尼等國家資源回收政府部門 20 餘位代表參與，並邀請部分州政府代表、NGO 團體代表、回收認證處理業者及認證團體代表一同參與，介紹美國聯邦管理政策、州政府電子廢棄物管理系統、回收處理業者認證系統、費率制度及再生料推廣使用政策等議題。

藉由本次會議分享電子廢棄物回收新政策，並說明目前正在推動的資訊物品類綠色差別費率，宣揚我國電子廢棄物品處理成效；於 101 年研習會上，提供許多回收管理之政策、制度及技術之經驗分享，於本次會議上，發現許多開發中國家，像是迦納、哥倫比亞、薩爾瓦多、奈及利亞等國，皆參考我國資源回收制度，建立該國回收制度，並研擬相關法規草案，表示我國完善的回收管理制度成功地被各國所推崇並學習。

建議未來持續藉由「臺美環境技術合作協定」之區域夥伴會議，分享我國電子廢棄物管理經驗，提供各國未來推動資源回收政策之參考，以強化電子廢棄物回收與處理技術，建立及優化我國管理制度，並提昇區域內環境管理能力。

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壹、目的

出席「第 3 屆國際電子廢棄物回收管理夥伴會議」，瞭解美國電子廢棄物回收處理體系，與各國交流電子廢棄物之管理策略與成果，包括電子電器產品綠色設計、電子廢棄物回收與處理技術，並將我國公告應回收廢電子電器暨廢資訊物品相關執行經驗分享予夥伴國家，促進夥伴國家間之經驗分享與技術合作，以減少電子廢棄物之產生，推動安全與有效之回收、處理與管理方法，提昇夥伴國家電子廢棄物回收制度，健全全球電子廢棄物之資源回收體系，並增加我國環保政策推動成效之國際能見度。

貳、會議過程

爲確保會議可順利進行，本次出國行程安排在抵達美國舊金山後隔日（102 年 7 月 14 日），與美國環保署國合處官員 Panah Bhalla 及第 3 分署官員 Daniel T. Gallo 等承辦人員會面，就爲期 5 天之「第 3 屆國際電子廢棄物回收管理夥伴會議」，討論每日議程、開場和致詞內容，瞭解各項活動細項時程及其主持角色。

本次正式會議期間爲 102 年 7 月 15 至 19 日，分別於加州州政府環保局（沙加緬度）及美國環保署第 9 分署（舊金山）舉行。會議模式主要以演講、共同討論及小組座談等方式運作（議程詳如附錄）。以下就該會議每日情形簡要說明：

一、第一天：102 年 07 月 15 日（於加州州政府環保局舉行）

會議一開始即由加州環保局 Jeff Hunts、本署回收基管會鄭副執行秘書祖壽及美國環保署 Panah Bhalla 致詞揭開序幕。當日議程包含對美國電子廢棄物的管理政策之簡介、加州電子廢棄物管理系統與有害廢棄物管理方式、美國與加拿大生產者延伸責任制(EPR)政策分析及加州電子廢棄物與飲料容器費率制度比較等。另亦前往參訪 California Electronic Asset Recovery (CEAR)公司，瞭解該公司回收處理電子廢棄物之方式。

圖 1、第 1 天會議情形及本署代表與加州環保局官員合影

二、第二天：102 年 07 月 16 日（於美國環保署第 9 分署舉行）

上午的議程，先由本署代表簡報「臺灣資源回收制度」，簡介我國資源回收系統，並說明公告應回收電子電器與資訊物品類相關回收處理政策，包含今年度實施之綠色差別費率。接續由美國明尼蘇達州及奧勒岡州官員分別說明其州內之電子廢棄物回收政策。

下午，由矽谷 NGO 團體代表 Barbara Kyle 介紹美國境內電子產品回收聯盟組織。之後由美國環保署第 3 分署代表 Daniel T. Gallo 主持座談，並邀請美國加州、明尼蘇達州及奧勒岡州等美方官員與矽谷 NGO 團體代表共同參加。討論議題主要著重於美國各州政策與利益團體的關係、對於電子廢棄物的定義及有害廢棄物之認定、回收目標訂定原則及再生料的推廣使用政策等。

圖 2、第 2 天會議情形

三、第三天：102 年 07 月 17 日（於美國環保署第 9 分署舉行）

由美國環保署助理署長 Michelle DePass（專責國際合作事務部門）致詞開場。之後由各區域夥伴分別介紹該國電子廢棄物回收政策，及從去年國際會議結束後，各國政策推動進度，包含哥倫比亞、馬來西亞、日本、迦納、薩爾瓦多、泰國、印度、阿根廷、越南、奈及利亞、巴西及印尼等 12 國。之後即分組針對「回收處理技術」、「認證制度」及「回收基金運作」等議題進行分組座談。本署出席人員分別參與「回收處理技術」及「回收基金運作」小組，除提供我國相關經驗，並協助訂定回收處理技術面之短、中、長程執行目標。最後由各小組主持人，依序將討論結果與所有成員說明討論。

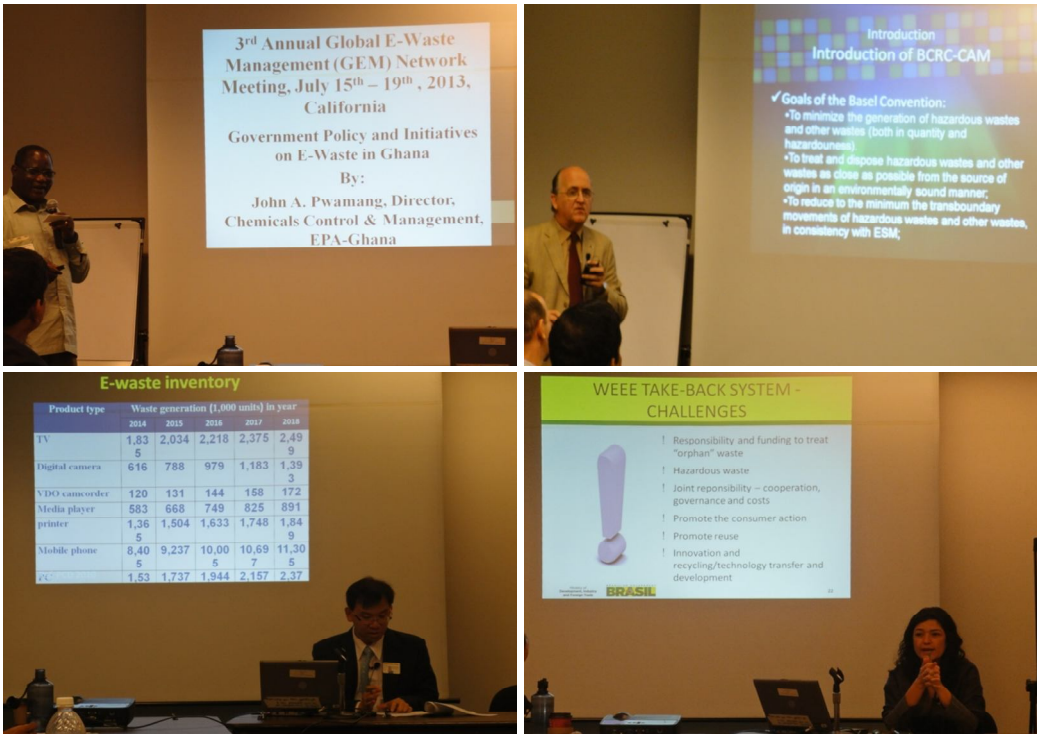

圖 3、夥伴國家分享國家電子廢棄物回收情形

四、第四天：102 年 07 月 18 日（於美國環保署第 9 分署舉行）

由美國環保署副助理署長 Lisa Feldt（專責廢棄物及緊急應變部門）致詞開場，並介紹目前美國國家電子產品監管策略方針(NSES)。接著請美國回收認證廠商和電子產品回收認證組織人員，介紹美國第三方認證機構和系統運作模式，分享回收認證之經驗。另說明美國回收處理業者認證標準 R2 及 e-Stewards Standard 程序之差別。之後請當地來自二手電腦捐贈組織 Computers for Classrooms、回收商 E-World Recyclers、E-Recycling of California 及 Sims Recycling Solutions 等業者，一起分享目前美國加州的回收狀況及面臨的挑戰。最後邀請兩大手機業者 Sony 及 Nokia 公司代表，說明該公司目前手機回收之策略及方法。

下午至 E-Recycling 公司及 Belmont Technology Remarketing 參訪，瞭解加州陰極射線管(CRT)螢幕回收情形，並瞭解不同型態的二手電腦回收商運作模式。

圖 4、第 4 天會議情形

五、第五天：102 年 07 月 19 日（於美國環保署第 9 分署舉行）

本署沈署長世宏蒞臨會場，與美國環保署第九分署副分署長 Alexis Strauss 於會前見面後，會議正式開始。由 Alexis Strauss 向大會介紹沈署長後，由沈署長致詞，向與會代表分享我國整體廢棄物零廢棄管理思維，即 5R 精神：包括減量(Reduction)、再使用(Reuse)、回收再利用(Recycling)、能源回收(Energy Recovery)及國土再造(Land Reclamation)等納入政策推動方向，以落實物質永續循環利用之最終目標。接著由日本的本多俊一博士、奈及利亞 Miranda Amachree 及薩爾瓦多 Miguel Araujo 發表對本次會議的心得感想。然後，由美方介紹美國「國家電子產品監管策略」，內容包括電子物品永續藍圖相關研究、電子廢棄物及衍生物質流向追蹤及電子產品環境評估工具(EPEAT)資訊更新。

下午，由 Daniel T. Gallo 簡報美國對於 CRT 螢幕廢棄物之相關管理規定，並由 Melissa Fiffer 負責報告電器處置計畫(Responsible Appliance Disposal)。最後由美國環保署 Panah Bhalla 與本署代表共同主持，與本次參與之各國夥伴討論未來資訊交流之方式與內容，並藉此蒐集各國對於下次會議的議題、活動及地區等想法，以利規劃未來計畫方向。


Federal Regulations for CRTs
EPA
Used CRTs and CRT glass generally contain hazardous levels of lead and are therefore regulated as RCRA hazardous waste when disposed.
Used CRTs and CRT glass being recycled are excluded from RCRA hazardous waste regulation, provided certain conditions are met ("CRT regulation," 40 CFR 261.4(a)(22))
Used CRTs discarded by households (considered "household hazardous waste") are exempt under 40 CFR 261.4(b)(1) and do not fall under the CRT regulation.
CRT exclusion only applies in RCRA-authorized states that have adopted the exclusion and states where EPA administers the RCRA program.

圖 5、第 5 天會議情形

參、會議內容

本次會議由本署與美國環保署共同舉辦，邀請哥倫比亞、馬來西亞、日本、迦納、薩爾瓦多、泰國、印度、阿根廷、越南、奈及利亞、巴西及印尼等12個夥伴國家代表參與，除瞭解美國環保署及其他州電子廢棄物回收制度與處理技術等情形，各夥伴國家亦分享自去年參與本署舉辦之研習會議後之制度推動現況。美方除邀請中央及部分州政府代表說明美國目前電子廢棄物回收管理政策外，亦請回收廠商與大家分享執行內容與狀況，並安排參訪行程，瞭解業者實際作業狀況。會議內容說明如下：

一、美國電子廢棄物管理政策

美國的國家體制爲聯邦制度，各州地方政府之廢電子電器產品管制方法各有差異，美國規範電子廢棄物相關責任主要傾向利用市場的力量，實施生產者責任延伸制度，當前美國聯邦政府、各州地方政府均依據「資源保育與回收法 (Resource Conservation and Recovery Act)」及「國家電腦回收法」禁止廢家電的掩埋及強制對有害物質進行回收，並推動電子廢棄物回收相關計畫；國家電腦回收法主要工作項目爲讓聯邦機構設定目標與實施綠色電子產品採購行爲，以對環境友善方式管理其電子產品 (包括採購、使用及廢棄處理)，接受協助改善其現有電子產品之使用實務，並且就其獲得成果進行全國表揚。美國目前已有25個州訂有電子廢棄物回收相關法令，主要回收項目包含電腦、監視器、電腦週邊設備、筆記型電腦、電視機、印表機、傳真機、影印機及行動電話等電子產品，不同地區州政府電子廢棄物管制上會有所差異。

(一) 加州

1. 法令摘要

加州於2003年公布實施「電子廢棄物回收法(The Electronic Waste Recycling Act)」，目的在於建立電子廢棄物回收機制，妥善處

置有害電子廢棄物，消費者於購買公告列管的電子產品時，需支付一筆費用給零售商，零售商再將該筆費用繳交給主管機關，主管機關會將這筆費用用於支付給合格的回收及處理業者，以促進電子產品的回收處理工作。有關電子廢棄物相關回收法令沿革如下：

(1) 2001 年-陰極射線管設備處理規範

(2) 2002 年-禁止電子廢棄物併入一般廢棄物中

(3) 2003 年-電子廢棄物回收法立法

(4) 2004 年-手機回收法

(5) 2005 年-電子廢棄物回收計畫啓動

2. 法令訂定目的

(1) 提供回收處理系統運作之財務支援

(2) 減少非法棄置情形

(3) 暢通廢電視機及顯示器去化管道

(4) 減少電子廢棄物有害物質對環境的污染

3. 法令內容要件

(1) 訂定費率

(2) 由資源循環部(Department of Resources Recycling and Recovery, CalRecycle)負責核撥回收系統相關費用

(3) 由毒性物質管理部(Department of Toxic Substances Control, DTSC)負責訂定電子廢棄物回收貯存清理相關規範

(4) 訂定電子產品有害金屬物質限制含量

(5) 建立生產者責任、提供消費者回收資訊、產品標示、年度報告、環境化設計、有害物質減量等機制

4. 回收項目

具有大於 4 英吋以上的顯示設備，即屬公告回收項目，包含：

(1) 含陰極射線管的電視機或顯示器

(2) 含液晶面板的電視機或顯示器

(3) 筆記型電腦

(4) 電漿電視

(5) 攜帶式影像播放產品

5. 徵收機制

有關加州回收處理費徵收機制內容及做法，說明如下：

(1) 消費者於購買電子產品時支付回收處理費給零售業者。

(2) 自 2013 年 1 月 1 日起，根據顯示設備螢幕大小不同，收取 3 美元（4~14 英吋）、 4 美元（15 英吋~34 英吋）、5 美元（大於 35 英吋）回收處理費。

(3) 零售業者將收取到的費用保留 3%做爲行政管理費，其餘轉交給加州公平委員會(Board of Equalization, BOE)，2012 年加州約有 10,700 個零售商登記參與此回收系統。

(4) 製造商需通知零售業者哪些項目需向消費者收費。

加州公平委員會之費用將存入電子廢棄物回收再利用專用帳戶(Electronic Waste Recovery and Recycling Account, EWRRA)，由加州政府進行管理， 2012 年總徵收費用爲 1 億 200 萬美元。CalRecycle 於 2012 年 7 月爲減少基金結餘，訂於 2013 年 1 月起調降徵收費率。歷年徵收費率如表 1。

表 1、加州歷年徵收費率

單位：美元/台

年 尺寸	2005	2006	2007	2008	2009	2010	2011	2012	2013
4~14 英吋	6	6	6	8	8	6	6	6	3
15 ~34 英吋	8	8	8	16	16	8	8	8	4
大於 35 英吋	10	10	10	25	25	10	10	10	5

6. 補貼機制

由 CalRecycle 審查回收處理業者資格，另由 DTSC 負責查核回

收處理業者是否符合環保規範，截至 2013 年，已登記之回收業者約有 550 家，已登記之處理業者約有 50 家，顯示透過「電子廢棄物回收法」及補貼制度已促進州內回收處理業者參與回收工作，回收處理業者型態包含非營利組織、地方政府、傳統電子廢棄物回收業者等，回收處理業者也帶來其它環境效益，回收處理業者不僅處理公告回收項目外，也另外回收處理其它非公告回收之電子廢棄物。

目前 CalRecycle 核定之回收處理補貼費爲 0.39 美元/磅（處理費：0.23 美元，回收費：0.16 美元）。統計自 2005 年起迄今，共已補貼 6 億 1.300 萬美元，相當於回收處理 14 億 6,000 萬磅的電子廢棄物。CalRecycle 並表示每年約有 1%~12%的申請補貼金額會被拒絕，主要原因爲不符合相關規定及文件資料不一致。歷年補貼費率如表 2。

表 2、加州歷年補貼費率

單位：美元/磅

年 補貼費	2005	2006	2007	2008	2009	2010	2011	2012	2013
回收補貼費	0.171	0.167	0.148	0.166	0.144	0.153	0.152	0.160	0.160
處理補貼費	0.252	0.215	0.21	0.228	0.187	0.181	0.192	0.230	0.230
合計	0.423	0.382	0.358	0.394	0.331	0.334	0.344	0.390	0.390

7. 年度淨成本報告

回收處理業者每年 3 月以前應提交前一度的年度淨成本報告，以供 CalRecycle 做爲費率調整之參考，並以所有業者平均淨成本做爲基礎，CalRecycle 預計將於 2014 年 7 月檢討調整補貼費率。

8. 防止詐領補貼費用機制

CalRecycle 和 DTSC 密切合作確保廢棄物處理符合相關規範，同時並與司法部門合作調查回收處理業者詐領補貼費行爲及其有權力拒絕補貼申請之案件，回收處理業者也需要提出電子廢棄物回收

記錄，證明該電子廢棄物是來自加州地區，防止詐領補貼費之情事。

9. 執行之挑戰

(1) CalRecycle 需確保補貼申請文件內有關廢物品來源、收集、運輸及處理等資料皆符合要求，並核撥補貼費，避免業者在數據中做假帳。

(2) 必須防止回收處理程序中非法處置電子廢棄物，卻領取補貼費情形。

(3) 回收系統應考量到回收後電子產品的再使用及再販售情形，此種情形應不予以補貼。

(4) CRT 玻璃的去化管道

統計 2010 年 CRT 玻璃約 20%送往墨西哥，26.7%送往亞歷桑納州，10%送往俄亥俄州，43.3%貯存中，然而 CRT 顯示器市場越趨縮減，將廢棄的 CRT 玻璃再利用做爲新的 CRT 玻璃原料，需求有限，目前已知印度尚有一家 CRT 玻璃製造廠，另北美有三個大型的冶煉廠可將 CRT 玻璃做爲冶煉的原料，但有需求量少及成本較高之問題，其它 CRT 玻璃再利用技術仍在持續開發中。因此 CRT 玻璃去化管道，將是近期需積極處理的。

(5) 針對非 CRT 電子設備處理上，也有須面臨的挑戰，包含廢液晶再利用市場、稀土金屬的回收、CCFL 燈管及 LED 的處置等問題。

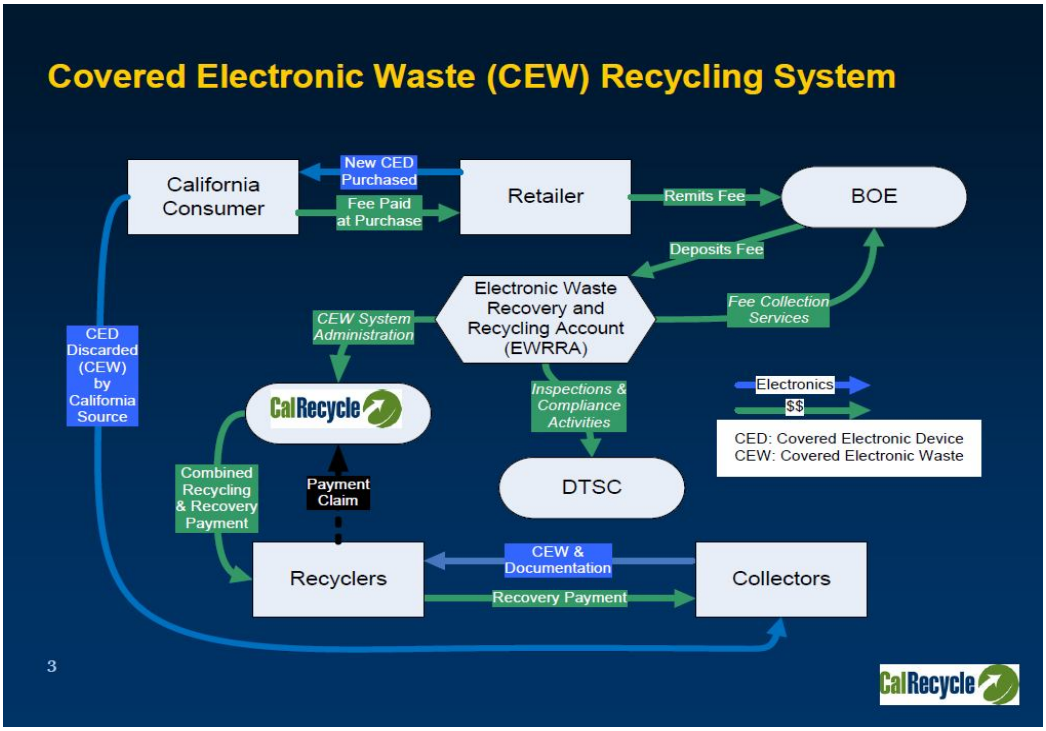

圖 6、加州電子廢棄物回收處理體系架構圖

(二) 明尼蘇達州

明尼蘇達州於 2007 年 5 月頒布「電子產品回收法」，監督單位主要爲稅務局及污染控制局。該法令係爲管理電子廢棄物處理成本及監控電子廢棄物數量，法令規範電子產品生產者需回收自行生產之產品，透過收集管理將電子廢棄物生命週期發揮最大效用，將可再利用之資源，利用回收技術分離並再利用，降低對環境危害。該法令所涵蓋的電子產品包含「影片播放裝置（電視、電腦螢幕及筆記型電腦）」、「電腦及其周邊設備」、「印表機」、「傳真機」、「DVD 播放器」及「錄放影機」等。

明尼蘇達州政府透過「電子產品回收法」建立對於電子產品回收之管理體系，除規範回收目標、訂定回收清除處理費制度、亦有回收業、處理業登記及申報制度。在回收目標部分，即特別要求影片播放裝置的製造業者需回收其銷售產品重量的 80%以上。此外，該法令另

發展「回收額度(recycling credit)」制度，當製造業者回收量多於其應負的義務時，即會產生回收額度(credit)。該法令要求製造業者在計畫推行的第 1 年購買 2 倍的額度，第 2 年後可抵換，惟 1 年可抵換的上限不得超過當年應回收量的 25%。

地方政府、零售商及品牌業者所提供的回收管道爲明尼蘇達州民眾回收電子廢棄物的主要途徑。除了地方政府提供的多種回收方式，經銷販賣業者（例如 Best Buy, Office Depot 及 Staples）亦提供消費者有關廢棄電子產品的回收服務。自 2011 年秋天開始，Best Buy 公司在州內的 28 家商店無償收受電子廢棄物。此外，電子產品品牌業者也提供了回收服務，許多製造商皆有逆向回收專案，依品牌可分爲無償運送及付費運送等方式。而對於大都市以外的區域，該法令另提供誘因，促進郊區回收工作。

目前明尼蘇達州合法登記之資源回收處理業者數量已趨穩定，其中有 3 家處理廠符合 e-Stewards 認證標準，另有 4 家處理廠已取得 R2 認證。

(三) 奧勒岡州

奧勒岡州於 2007 年 6 月實施「電子電器設備回收法」，以管理回收之電子電器設備之流向，規範生產電子電器設備之廠家應提供免費及便利之回收服務，製造商應於產品出售或是進口時，需註冊該產品，並參與國家回收計畫或製造商共同經營之回收計畫。

奧勒岡州政府於 2010 年修訂「電子電器設備回收法」，改用重量計算回收數量，所有電視機製造商將以重量進行回報回收統計成果，再根據市場占比領取補貼，另於 2011 年將印表機及主機外殼 (包含鍵盤、滑鼠及連接線)納入應回收項目中，將於 2015 年 1 月開始實施。

該法令規定電子電器設備回收計畫必須提供總回收數據給所有參與之業者，以激勵其他廠商提昇回收率，且須定期宣傳以促進奧勒岡

州整體回收情形。此外，應建立回收網站，供家庭及小型非營利組織進行回收。

每個回收計畫皆須確認參與該回收網絡的業者都同意也願意遵守同一個回收標準和規範，並確保每項回收設備都是從最原始的回收商手中經由單一管道進入後端處理的。

奧勒岡州於 2012 年設定全州電子廢棄物回收目標爲 2,750 萬磅，每人平均回收 7.1 磅，依據歷年數據顯示，每年可回收將近 2,600 萬磅電子電器設備。在奧勒岡州凡是經由環境品質部門(Department of Environmental Quality, DEQ)核可的回收業者，都應設置至少一個以上合法設置的回收據點，目前所有參與回收工作的製造商和回收業者皆已建立起穩定的基礎回收設施，總計該州的電子廢棄物回收點已超過 220 個，包含公共及私人回收轉運站、檢修中心、商店及零售販賣店面等，電子廢棄物回收廠商互有合作回收計畫者，則超過 160 家。DEQ 主要的任務包括下列各項：

1. 製造商註冊登記
2. 每月定期出版合法登記之製造商名冊
3. 決定製造商的競爭市場及登記費用
4. 回收設備的觀察和測試
5. 訂定每年回收目標
6. 收集各州徵收和補貼費資料
7. 持續修訂回收計畫和報告
8. 提供製造商、零售商和公眾回收資訊的諮詢
9. 提供協助或參與政府及其他回收相關工作計畫

二、與會各國制度現況

(一) 哥倫比亞

目前哥倫比亞境內共有 8 家公司正式獲得電子廢棄物拆解許可，

其中 3 家具有多年經驗並且與回收業者合資，並且持續有新的公司有興趣加入此市場。另有 10 家公司正式取得收集與貯存電子廢棄物之許可。目前正規回收管道之電腦回收量約 20%（相對於總產生量），非正規單位收集效率高，約可收集超過 50%的電腦。

現行哥倫比亞電子廢棄物管理的法規概要，包含以下內容：

1. 政策的整體目標與要求
2. 政策涵蓋之設備類型
3. 規範的活動類型（收集、拆解、整修等）、非正規的行爲
4. 生產廠商、回收業者、消費者的角色與責任
5. 各式機構及主管機關之責任
6. 與非電子廢棄物管理政策的關聯。

哥倫比亞回收系統之責任歸屬如圖 7。該國政府將會以電子產品生產廠商所呈交之年度報告進行回收目標追蹤作業，並依其執行管理作爲決定是否接受、核可或駁回，或是針對部分計畫加入特定應履行之義務項目。

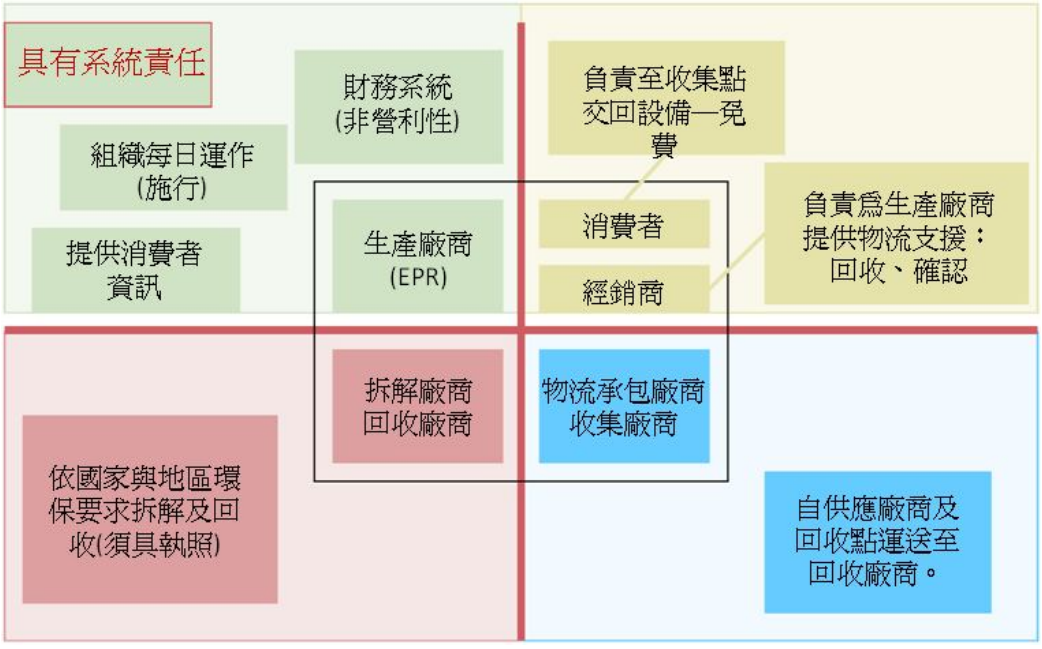

圖 7、哥倫比亞回收系統

哥倫比亞的回收計畫(ECOCOMPUTO)自 2012 年 1 月 1 日開始運作，目前有 47 家公司參與，包含製造廠商、進口廠商、批發廠商及地區組裝廠商，市場占有率約 51%。該國在電子廢棄物管理上，未來將面臨的挑戰及目標如下：

1. 法規施行
2. 機構一致性與跨領域主題
3. 回收基礎架構：評估、最終處置
4. WEEE 回收技術標準
5. WEEE 特定部分的回收解決方案：當地沒有 CRT 映像管玻璃與 BFR 塑膠的解決方案
6. 非正規體系的納入
7. 提升最終使用者的認知
8. 檢核程序（監督與控制）
9. 「區域化」與跨國際行動（WEEE 的進口及出口）

(二) 馬來西亞

馬來西亞 2005 年制定「環境品質條例 (Environmental Quality (Scheduled Wastes) Regulations)」，規範的廢棄物法令包含 SW (Scheduled Wastes) 103、109 及 110：

1. SW103：廢棄電池，含有鎘、鎳、汞、鋰
2. SW109：含汞及其化合物的廢棄物
3. SW110：規範電子廢棄物應處理部分

電子廢棄物如包含鉛、汞、印刷電路板、石棉及氟氯碳化物等危險物質，會對人體健康與環境造成威脅，因電子設備於全球廣泛被使用，電子廢棄物量快速成長，而電子廢棄物中含有價金屬 (valuable material)，可被開發作爲次級資源，以節省能源，減少溫室氣體的排放。目前馬來西亞電子廢棄物回收處理業者共有 146 家，每月的處理

量超過 2 萬 4,000 公噸，中、小型業者係以物理性或手工方式分離電子廢棄物以進行後續處理，具有完善回收處理設備有 18 家，提煉有價金屬或珍貴金屬，以進行販售或再利用。

馬來西亞回收處理的電子廢棄物包含映像管電視機、平面顯示機型電視機、電冰箱、洗衣機、冷氣機、桌上型個人電腦、筆記型電腦、印表機、行動電話、DVD 播放機、VCD 播放器、電池充電器、行動電話電池、滑鼠及鍵盤等。

馬來西亞在管理電子廢棄物上，面臨「在環境無害的狀況下建立回收處理家戶電子廢棄物的管理能力」、「家戶電子廢棄物的收集、分離以及運送作業」、「家戶電子廢棄物的丟棄或回收處理費用」、「立法與政策」及「電子廢棄物的跨國轉移」等多項考驗，希望以環境無害的方式回收處理家戶電子廢棄物、防範非法的電子廢棄物進出口等策略，以達到重量測量回收廢棄物的百分率，提昇全國資源回收再利用，建立永續管理系統。而與電子廢棄物回收處理相關者有主管機關、生產廠商/進口廠商、經銷商及回收處理業者，主要任務如下：

1. 生產廠商/進口廠商：建立法令及政策、於地方推動層級建立收集系統、監督回收處理目標
2. 經銷商：建立廢棄物回收系統與設立回收點、建立回收處理設備、符合回收處理目標
3. 回收業者：參與回收處理系統
4. 主管機關：回收處理家戶電子廢棄物

目前馬來西亞由 Japan International Cooperation Agency(JICA)在檳城島資助一項電子廢棄物回收計畫「家戶電子廢棄物的收集、分離以及運送以進行廢棄物回收處理」，希望發展一套合適且有效率的家戶電子廢棄物回收處理系統，期望此計畫能做爲馬來西亞全國回收處理電子廢棄物的典範，協助環境部找出合適之電子廢棄物回收處理政策。

(三) 日本

日本於 2012 年 8 月 10 日頒布「小型家電產品促進循環再利用法」，並於 2013 年 4 月 1 日生效，主要是將可再使用之小型家電產品回收，於二手市場中販售，且將可再利用之物料資源回收再利用，如金屬部分，以降低環境負荷量。大部分的小型家電產品皆被當作廢棄物回收，而「小型家電產品促進循環再利用法」規定製造商應負起責任，回收可再利用的資源，該法令規定應回收項目包含手機、數位相機、攝影機、微波爐、吸塵器及電子鍋等，地方政府依據事業固體廢棄物回收處理模式收集小型家電廢棄物。目前日本正試著推出更多可於二手市場中販售之電子產品，以促進廢棄物有效地再使用，達到產品生命終期階段，並進行妥善之後續處理。

(四) 迦納

1974 年迦納成立環境保護議會 (Environmental Protection Council)，針對環境議題對政府提出建議，之後於 1994 年依據環保署法 490 號法案(Environmental Protection Agency Act) (Act 490) 轉型成爲環境保護署 (Environmental Protection Agency, EPA)，並具有實質的公權力。

2009 年迦納產生 28 萬公噸老舊電子設備，其中維修占大多數，比例爲 57 %、非正式回收收集占 34 %、儲存占 8 %，只有 1 %較妥善回收收集，預估電子廢棄物回收收集業者及相關人員約 12 萬 1,800 人至 20 萬 1,600 人，占都會人口的 1.04 至 1.72 %、占迦納總人口數的 0.50 至 0.82 %。另估計非正規電子廢棄物回收處理單位對國家經濟的非直接貢獻約 1.05 至 2.68 億美元，然而非正規的電子廢棄物相關工作人員均非常貧窮，例如收集人員每月賺得 70 至 140 美元、翻修人員 190 至 250 美元，而回收人員則是每月 175 至 285 美元。

於 2012 年 12 月，電子廢棄物控制與管理法案草案 (Draft Bill on

Control and Management of E-waste) 重新獲得重視，此法案包含整體有害廢棄物的控制與管理，該法案禁止 CRT 及 CRT 玻璃的進口，且電子設備的製造廠或進口業者被要求向迦納 EPA 註冊，並依進口至本國或在本國製造的電子設備支付電子廢棄物處理費用。這些費用將會用於「電子廢棄物回收處理設備的建置與維護」、「贊助電子廢棄物控制及管理方法的研究」、「研究電子廢棄物回收處理政策與技術」、「出版電子廢棄物相關報告」、「教育大眾安全的電子廢棄物丟置方式及電子廢棄物的負面效應」、「提供回收處理電子廢棄物的獎勵」等工作，基金來源包含「徵收之費用」、「其他合法投入資金」、「國家議會所核可之資金」，並由環境保護署 (Environmental Protection Agency)、傳播部 (Ministry of Communications)、能源部 (Ministry of Energy)、環境部 (Ministry of Environment)、健康部 (Ministry of Health)、地方政府部 (Ministry of Local Government)、總稽核與會計部門 (The Controller and Accountant-General's Department) 等 7 個單位各派一位成員組成信託委員會 (Board of Trustees)，一同管理基金。另外，地方主管機關必須輔導進口廠商、製造業者、批發業者、代理廠商、經銷廠商或維修廠商進行回收分類，並設立回收點，監督所收集之電子廢棄物運送至指定地點，以符合電子廢棄物處理程序。

目前迦納推動電子廢棄物管理方向，包括推動雙邊合作計畫 (The Best of two Worlds (Bo2W) Project)，建立埃及與迦納兩國電子廢棄物無害化的收集、回收及再利用系統，以及永續回收再利用工業 (Sustainable Recycling Industries, SRI)。

(五) 薩爾瓦多

薩爾瓦多電子廢棄物管理概況，2009 年：二手電腦設備維修與翻修中心開始營運；2011 年：電腦行動夥伴 (Partnership for Action on Computing Equipment, PACE) 評估薩爾瓦多電腦設備二手及淘汰的狀

況；2012 年：發展國家回收處理電子廢棄物策略架構；2013 年：準備提出 PACE 先導型計畫，並正式啓動 3 項由私人公司贊助的 WEEE 回收宣傳活動，另有 3 個電子廢棄物處理設施正在建置中。

薩爾瓦多目前執行規劃及未來推動目標：

(1) 建立良好的電子廢棄物回收制度基礎

(2) 促進推動電子廢棄物回收策略架構

(3) 執行先導型計畫或活動，包含維修及翻新計算設備中心 (Center for used computing equipment)

(4) 推動持續性的回收行動，以收集資訊，並提昇回收電子廢棄物之認知

(5) 規劃整合性廢棄物管理法律及 WEEE 條例

(6) 學習臺灣、哥倫比亞及哥斯大黎加等先進國家電子廢棄物成功經驗

(六) 泰國

由污染控制部 (Pollution Control Department, PCD)、產業工作部 (Department of Industrial Works, DIW)及地方政府 (Local Governments, LG)共同合作執行電子廢棄物管理，電子廢棄物來源爲：

1. 工業（不符合規格之產品或製造產品所產生之碎料）

2. 家戶、商業、服務業（丟棄的/故障的電機與電子設備）

3. 進口（非法進口）

根據泰國 PCD 統計，至 2010 年爲止，二手商店約有 9,000 家，至 2011 年大約有 34 萬 2,000 公噸或超過 1,500 萬件的電子廢棄物，正規的電子廢棄物回收拆解工廠約有 41 家。目前根據 PCD 2012 年統計，泰國家用廢棄物回收處理途徑有 51.3%銷售至二手商店。

泰國雖無專責法令規範，但泰國政府單位頒布國家電子廢棄物整合管理策略 (National Integrated E-waste Management Strategy)，第二階

段實施期間爲 2012 至 2016 年，希望達到「建立電子廢棄物收集系統」、「推廣綠色設計」、「推廣環境無害拆解及回收工廠」、「提昇大眾電子廢棄物回收的知識」及「保護國家免於成爲垃圾場」等目的，規劃以下 6 項策略：

1. 策略一：加強進口及出口之管控
2. 策略二：推廣環境友善電子產品並首先聚焦於政府公共採購
3. 策略三：建立電子廢棄物回收處理資料庫
4. 策略四：推動地方政府執行電子廢棄物分類、收集、貯存及運輸等作業
5. 策略五：強化廢棄物拆解及回收設施
6. 策略六：提昇大眾對電子廢棄物回收制度之知識

另泰國未來將執行之工作內容，如以下 10 項：

1. 以國家作爲電子廢棄物回收單一窗口
2. 推動電子產品生產商及進口商之廠商登記作業
3. 越境轉移管控培訓
4. 拓展政府公共採購標準
5. 推廣綠色環保產品之減稅及獎勵措施，提高大眾綠色採購意識
6. 產品標準及認證
7. 制定法律規範產品回收費率及生產者延伸責任
8. 地方政府建立回收處理容量
9. 增加政府與民眾溝通管道
10. 推動公部門及民間機關之電子廢棄物收集、運輸、拆解、回收及處理等計畫

(七) 印度

印度中央污染控制委員會(Central Pollution Control Board, CPCB)

初步估計至 2012 年爲止，全國的電子廢棄物超過 80 萬公噸，其中有 10 個省所產生的電子廢棄物占全國總量 70 %，以孟買 (Mumbai) 爲最多，而根據印度總審計署 (Comptroller and Auditor-General, CAG)之報告，印度每年產生超過 720 萬噸的工業危險廢棄物、40 萬噸的電子廢棄物、150 萬噸的塑膠廢棄物、170 萬噸的醫療廢棄物及 4,800 萬噸的一般廢棄物，電子廢棄物主要來源爲政府機關、公眾部門與私人機關，占電子廢棄物總量的 70 %，個人或家戶的產生量占 15 %，其他 15 %則由其他電子產品廠商產出。電子廢棄物種類以電視機占大多數，約爲印度整體電子廢棄物種類的 68 %，接著爲桌上型電腦或伺服器，占 27 %，進口電子廢棄物及行動電話則各占 2%及 1 %。雖然已有 23 個廠商向政府註冊登記爲電子廢棄物回收處理或前置處理業者，但整體的回收流向仍無固定組織專責管理。

上述這些統計資料彰顯出印度等發展中國家對於處理電子廢棄物問題的急迫性，其電子廢棄物的收集、管理及回收處理等程序均需有適當規範，若持續讓非合法組織進行回收處理工作，將可能增加對於環境的傷害與人類健康問題。

印度電子產業市場成長快速，且能支付消費性產品的中產階級人口亦快速增加，因此每年產生大量的電子廢棄物，又印度爲全球最大的廢棄物進口國之一，每年進口約 5 萬公噸的電子廢棄物。印度超過 90 %國內產生的電子廢棄物，最終於非合法業者進行回收處理與處置。這些業者主要座落於大大小小都會區中的城市貧民窟，回收處理工作均由無專業技能的員工，在沒有手套或面罩等防護裝備下，用最基本的方式處理以降低成本，且常僱用童工以剪線鉗分離電路板上的元件，而電路板上的金與白金則利用硝酸來進行移除，據估計印度家電所使用的電路板約有一半在莫拉達巴德 (Moradabad)進行回收處理，這些員工均身處危險的作業環境，因此，透過政府部門制定嚴格處理

電子廢棄物的規範，是必須的管理手段。

印度電子廢棄物（管理與處理）規範 (E-waste (management and handling) rules) 自 2012 年 5 月 1 日起生效，將生產者延伸責任 (Extended Producer Responsibility, EPR) 概念納入此規範中，讓生產者對產品整個生命週期負責，尤其是在回收處理再利用方面，負責執行此規範的是污染控制委員會 (State Pollution Control Boards, SPCB)。此規範共有 6 個章節，分別說明法令適用範圍、生產廠商的責任、處理業者申請、註冊及許可程序、電子廢棄物貯存的程序、製造電機及電子設備時應減少對危險物質的使用等內容。此外，資訊科技製造業協會 (Manufacturers Association for information Technology, MAIT) 已開始執行一項為期 4 年（自 2010 年至 2014 年）的計畫，該計畫在非正式及正式回收處理業者間建立連結，並設計回收處理中心，讓電子廢棄物的處理通路化，目前含德里 (Delhi)、加爾各答 (Kolkata)、浦那 (Pune)和班加羅爾 (Bengaluru)等 4 座城市已經同意參與此計畫，且印度的電子廢棄物問題，因產業界投入培訓相關處理技術人員，並且使用合適的回收處理技術，期望得以早日解決該國電子廢棄物的問題。

(八) 阿根廷

阿根廷電子廢棄物的總量每年估計有 12 萬公噸，約每人每年 2 公斤。2006 年電腦產量約有 490 萬組，並有 360 萬組被丟棄；至 2010 年，電腦產量躍升至 1,160 萬組，被廢棄電腦的數量正逐年增加中。

行動電話與電池方面，阿根廷每人每年可消耗 10 組的電池，若以平均重量 10 公克計算，總電池量達到每年 4,000 公噸，行動電話總數量達 3,250 萬支，並有超過 5,000 萬組有效的行動電話門號，此數字已經超過阿根廷人口總數。因此，預估未來被丟棄的行動電話將會大幅的成長。

阿根廷電子廢棄物的管理架構尚在國會討論中，因在憲法第 41 條

的規定下，對於電子廢棄物回收處理管理的「國家環境保護最低標準法草案 (Draft National Law on Minimum Standards for Environmental Protection)」無法於國會上達成共識，目前正透過國家環境保護局及永續發展局專案計畫進行電子廢棄物回收處理相關作爲。

(九) 越南

越南電子廢棄物負責單位爲天然資源與環境部的環境管理署污染控制部門、工業與貿易部、財政部海關部門、警察部的環境警察、建設部及地方主管機關等公部門，而「環境保護法」於 2005 年通過並公告，此法目前正進行修改，預計於 2014 年頒布新的法令，而新法令將會有一條法令規定回收處理的做法。

越南目前正積極發展電子產業，現處於技術輸入、組裝電子元件的起步階段。依河內科技大學於 2009 年所進行的 1 項研究顯示，現有 50 家廠商生產及組裝電子元件，估計至 2020 年將會增加至 120 至 150 家。電子產業產值現在約占越南總體產業產值的 5%，年營收約爲 30 億元。然而，營收的 95%大部分歸外國投資公司所有。據估計，2012 年電子產品的營收超過 40 億元。電子設備需求的供需讓越南電子產業市場快速發展，然而電子廢棄物亦同步增加，依據當地天然資源與環境部的報告，電子廢棄物的數量每年約爲 55.4 公噸，其中有 8%屬於有害廢棄物 (Hazardous Waste)。

至 2012 年 10 月止，已有 53 家公司通過越南環境管理署審核而獲得處理有害廢棄物 (Hazardous Waste)之執照，其中 15 家公司已進行處理電子廢棄物，每日處理量從 0.3 到 2.5 公噸不等，處理技術包含：拆解、碎解、廢料回收（金屬、塑膠）以及焚化等。

目前越南環境管理署正在研發處理電子廢棄物技術的評估標準，未來除了持續修改環境保護法外，預計將制定電子廢棄物回收處理法令及造成環境污染賠償費用之法令。

(十) 奈及利亞

聯邦環境部 (Federal Ministry of Environment) 下的機關，國家環境標準與法令執行署 (National Environmental Standards and Regulations Enforcement Agency, NESREA)負責執行所有奈及利亞的環境法令，任務包含檢視現有及制定新的國家環境法令與規範，並執行所有奈及利亞簽署的多邊環境協議、協定、條約與公約，包含巴塞爾公約 (Basel Convention)，相對於其他機構，NESREA 有權力可以禁止使用破壞環境的設備或科技，希望給所有奈及利亞人民更爲乾淨與健康的環境，並啓發個人及群體建設一個有環境意識的社會，以達成奈及利亞永續發展的責任。

關於奈及利亞電子廢棄物控制的國家法律及規範，簡述如下：

1. 2004 年有害廢棄物（特別犯罪規定）法案 HI 條例 (Harmful Waste (Special Criminal Provisions) Act Cap HI)
2. 2009 年國家環境（衛生與廢棄物控制）規範 (The National Environmental (Sanitation and Waste Control) Regulation)
3. UEEE 進口業者指南 (Guide for Importers of UEEE)
4. 2011 年國家環境（電機電子部門）規範 SI 第 23 號 (The National Environmental (Electrical Electronic Sector) Regulations SI No. 23)

目前奈及利亞進口的電子廢棄物中，約 25 %爲二手電子產品，其他 75 %爲垃圾或不堪用之產品，最終皆被燒毀或隨意丟棄。根據 2005 年巴賽爾行動網路 (Basel Action Network) 與奈及利亞 BCC 合作研究奈及利亞每年透過 Lagos 港口進口約 50 萬套二手電腦，此數據在政府進行監督及執行奈及利亞二手 EEE 進口後，大幅下降。

奈及利亞目前沒有任何電子廢棄物收集中心，其大多時候係與其他廢棄物一起被丟棄，更有許多被堆積在辦公室及家中，極待回收設施的建立。奈及利亞回收處理作業，目前由非政府部門執行，但仍缺

乏電子廢棄物管理及環境無害化等相關知識。

在國家的執行層級，NESREA 與奈及利亞海關及國家有毒廢棄物丟棄監督委員會成員合作，處理管控非法電子廢棄物運送之事宜；在國際執行層級，奈及利亞正與國際組織合作，監控電子廢棄物流向及跨國移送之事宜。目前奈及利亞生產者延伸責任(EPR)施行細則草案已於近期被提出，包含有害廢棄物範圍的法律項目，該草案的生產者定義爲進口業者、製造廠商、生產廠商及組裝廠商，在特殊情況下，「生產者」包含「以自有品牌製造與銷售產品」、「進口或銷售由其他製造者所生產的產品」、「以自有品牌進口或銷售由其他供應商所生產的產品」、「進口電機電子設備之廠商」及「出口電機電子設備之廠商，或代理來自製造廠的電機電子設備」。此草案規範內容亦包含「電機及電子設備的辨識」、「生產者註冊與參與的條件」、「WEEE 回收的國家標準（以臺灣相關法令、E-stewards 及 R2 爲制訂認證程序之參考範本）」、「產品辨識與標示」等。

奈及利亞現行 WEEE 管理狀況所獲得的經驗，促使 NESREA 對非正式部門進行訓練，包含二手電子產品進口業者與處理業者技術能力以及認知，未來推行目標包含「改善目前二手電子產品的資料蒐集」、「建立示範性 WEEE 回收設施」、「透過第三方及公私機關之合作，建立並實行電子註冊系統」、「與 OEM 合作建立回收收集中心」。奈利亞政府與 NESREA 感謝臺灣與美國環保署協助提供電子廢棄物管理之知識，使他們不論在政策或是法律架構上均有明確的進展，未來將透過此會議持續獲取經驗，以增進改善國家相關策略。

(十一) 巴西

巴西身爲全球第 6 大經濟體、第 3 大電腦市場，每年生產 1,400 萬臺電腦、6,100 萬支行動電話，廢棄物量每年成長 7 至 10 %，電子廢棄物每年產生超過 90 萬公噸。因此，急需改善固體廢棄物收集、修

繕及回收處理等系統，並找尋合適的最終處置場地。

巴西的國家固體廢棄物政策有 2010 年第 12.305 號法律「國家固體廢棄物政策 (National Solid Waste Policy)」及 2010 年第 7.404 號法令，而電子廢棄物政策亦包含在其中，推動電子廢棄物回收處理政策需要製造廠商、進口業者、代理商與經銷商一同規劃並實施電子廢棄物回收系統，使消費者可將毀壞或欲棄置之電子產品，送至回收收集地點，進行後續回收處理作業。

巴西 WEEE 回收系統的運作係以逆向回收的方式，「消費者」需將廢棄的物品送回代理商或經銷商手上；「代理商或經銷商」需將從消費者收到之廢物品，送回生產者或進口業者手上；而「生產者或進口業者」則需提供一個合適且對環境無害之回收處理方式或處置地點。但需面對「孤兒」電子廢棄物回收處理之責任與資金、有害廢棄物、共同責任、消費者行爲、廢棄物再利用、回收技術的創新發展及轉移等問題之挑戰。因此，規劃後續 5 年內需完成「在人口超過 8 萬人的市區推動 100% 回收再利用系統」、「推動市區每 2 萬 5,000 人之區域，設置一個回收地點」、「可回收收集電子產品重量 17% 的廢棄物」及「修訂現行法規」等目標。

巴西目前推廣環境友善 (Eco-friendly) 的電子產品，相關策略及主要目標說明如下：

1. 整合政府、大學或研究中心及產業界之資訊與技術，以推廣電子領域(electronics sector) 的永續性。
2. 推廣電子產品以符合國家及國際環境法令、標準及其他相關要求進行設計及回收處理方式（環保設計、清潔生產及回收 (eco-design, cleaner production and recycling)）。
3. 創造必要的基礎建設以發展具環境意識的技術，以滿足國人對於永續科技的需求（創新、認證與管理）。

4. 支持與電子產品生命週期有關的社會企業發展、創造工作機會、收入與社會參與。

(十二) 印尼

目前正研擬電子廢棄物回收處理專責法令，希望 2014 年能夠完成制定新的電子廢棄物回收處理規範，並規劃讓環境部門 (Ministry of Environment)可利用錄影監視設備監控電子廢棄物從回收階段至處理階段之整體流程，以達妥善管理之效。

三、分組討論議題

運作模式係請各國代表提出自己希望深入討論的議題，利用投票表決選出關切度最高之主題進行分組討論，包括「回收認證制度」、「回收基金之建立」及「廢棄物處理技術」。

(一) 回收認證制度：

我國環保署參與「回收認證制度」小組討論，並提供我國相關經驗，協助各區域夥伴訂定未來執行目標和管理制度方面希望加強了解之項目。討論主題包含以下幾項：

1. 認證系統應爲自願性
2. 證照分爲強制性和自願性
3. 中、小型回收處理業者、非正規回收處理業者
4. R2 認證團體的角色
5. 希望補強自己國家內之不足之處
6. 官方介入的執行效果

(二) 回收基金之建立：

討論主題包含以下幾項：

1. 基金組織規模：國家組織／地方組織／私營部門
2. 基金管理責任歸屬

3. 組織成本－內需／外部

4. 回收市場的自給自足、自由市場的運作

5. 消費者、回收商及政府的角色

6. 進口商與製造商的角色

7. 台灣案例分享：責任業者制度與費率審議委員會

(三) 回收處理技術：

目前各區域夥伴國家之回收處理制度和技術仍有大幅差距，美方建議透過夥伴會議，訂定目標期程並交流技術資訊，以掌握各國發展狀況，提昇電子廢棄物處理技術。本小組討論重點如下：

1. 討論主題：

(1) 目前開發中國家最迫切需要的處理技術

(2) 目前各區域夥伴國能提供的技術和方向

(3) 其他尋求技術的管道及可行性評估

(4) 區域夥伴共同研發創新技術

2. 訂定長期策略和短期目標：

(1) 長期策略

a. 建立 IEMN 管理策略和工作方向

b. 提供開發中國家處理技術及法令架構之指導

c. 建立區域夥伴溝通平台

(2) 短期目標

a. 研發 LCD 液晶面板處理技術

b. 研發 CRT 玻璃處理技術及去化管道

c. 尋求具技術國之專家協助

圖 8、座談討論情形

四、第三方認證團體經驗分享

美國回收認證廠商和電子產品回收認證組織人員介紹 R2 及 E-Stewards 認證程序，並說明美國第三方認證機構運作模式、企業通過認證準則、認證程序、法律及職業安全與健康部門 (Occupational Safety and Health Administration, OSHA) 管理標準之關聯等議題。

(一) Responsible Recycling (R2)

美國環保署於 2008 年建立了 R2 回收規範認證系統，主要規範業者或廠商回收、再生及出口電子廢棄物至國外之作業，減少電子廢棄物中的有毒廢棄物，對接收中的發展中國家和地區，造成環境影響。

R2 主要規範回收業者或廠商在回收及出口電子廢棄物時對環境造成之影響，是一個自願性的認證規範，2009 年 7 月 27 日，美國宣布由第三方認證機構對符合 R2 標準之回收業者或廠商進行審核並進行監督。

R2 規範回收業者或企業具體做法如下：

1. 回收業者或廠商需要具備一套管理系統，管理電子廢棄物處理過程

中對環境、人員安全性、公共空間及產業鏈下游，甚至最末端處理之作業。

2. 擬定電子廢棄物再生或材料再利用策略。
3. 回收業者或廠商須遵守國內及國外相關法規。
4. 降低回收業者或廠商在回收過程中之廢棄物溢散情形。
5. 規範只能將電子廢棄物出口至願意接受之國家，且對方具有處理設備可處理該電子廢棄物。
6. 規範物質及材料，包含多氯聯苯 (Polychlorinated biphenyls, PCBs)、含汞材料、CRT 玻璃、電路板、電池。
7. 有毒（害）物質不得以焚化或掩埋方式處理。
8. 回收業者或廠商需瞭解並調查產業鏈下游回收再利用之程序及作業內容，以管控廢棄物回收及處理行爲之適當性。
9. 回收業者或廠商須負責管理廢棄物再生及再利用程序與後續作業內容。
10. 電子廢棄物中之私人資料，回收業者或廠商須保證已銷毀。
11. 回收業者或廠商須瞭解電子廢棄物流向，包含貯存及運輸，並對於回收處理設備之潛在風險購置保險，且制定公司金融風險管控機制及關廠程序作業計畫。

(二) E-Stewards

2010 年由美國環境活動團體「巴塞爾行動網絡 (Basel Action Network, BAN)」所建立，主要規範電子產品的循環利用企業，但也適用於生產、銷售電子產品企業的循環利用方法。

E-Stewards 標準係根據巴塞爾公約規定，因發展中國家尚不具處理電子廢棄物有毒物質之能力，故禁止出口電子廢棄物至該國，另將 ISO 14001 納入其中，要求電子廢棄物再利用廠商建立全面管理作業系統。

E-Stewards 包含以下內容：

1. 應符合 ISO 14001 規範。
2. 應符合 OHSAS 18001 規範，且電子廢棄物回收業者或廠商，需將環境管理規劃納入考量。
3. 應符合 Social Accountability 8000 (SA 8000) 規範。
4. 應符合電子產品再利用工業行爲規範，包含：
   (1) 以國際標準定義危險電子廢棄物。
   (2) 嚴格管制危險電子廢棄物之出口，且禁止將其出口至發展中國家，並符合巴塞爾公約及其修正條約。
   (3) 管制危險電子廢棄物及其他具危害性零件與材料處理之安全性。
   (4) 管控有毒廢棄物產業鏈。
   (5) 應符合美國國家標準與技術研究院的資料安全清除 800-88 標準 (NIST 800-88 Guidelines for Media Sanitization)。
   (6) 控管廢棄物再利用產品之安全性。
   (7) 管制有毒廢棄物處理方式，並禁止利用童工進行處理作業。
   (8) 回收業者或廠商需有風險及保險管理機制。
   (9) 回收業者或廠商需將職業安全管理、安全維護程序作業改進等製成報告，包括危險電子廢棄物粉碎及熱裂解時，散播至空氣中的有毒物質之管理措施。
   (10) 處理具危險性廢棄物之回收業者或廠商，需設置工廠安全維護及關廠計畫。
   (11) 必須提供客戶有毒廢棄物整體產業鏈之作業內容，包含電子廢棄物再利用之相關資料，使產業鏈透明化。

五、當地製造業者及回收業者經驗分享

本次會議分別邀請美國當地著名的品牌業者及回收業者分享其回收經

驗，其中，品牌業者 SONY 及 NOKIA 代表皆分享該公司目前在手機回收方面之策略與方法，該 2 家公司皆有參與美國環保署永續物料管理計畫 (Sustainable Materials Management Challenge)，希望透過正確的回收方式，將回收物料轉變爲可重複利用的原料，達到節約資源、減少浪費、減緩氣候變化及減少環境衝擊等目標。

在回收業者部分，本次邀請 4 位當地回收相關業者，分別是二手電腦回收捐贈組織 Computers for Classrooms、回收廠商 E-World Recyclers、加州電子回收商 E-Recycling of California 及 Sims Recycling Solutions (SIMS) 等代表，一同討論美國及加州回收相關議題。

(一) 業者簡介

1. Computers for Classrooms 爲非營利的二手電腦回收捐贈組織，主要的工作是回收民眾丟棄或是捐獻的老舊電腦，重新整理、清潔並修復成可供基本運作的狀態後，再捐給當地學校供師生使用。
2. E-World Recyclers 爲當地回收業者，其作法是與產品最源頭的製造商 Original Equipment Manufacturers（OEMs）簽訂契約，連結商品從製造到廢棄回收的過程，建立回收系統，並依據當地法律規定其回收義務，幫助其客戶製作相關文件和報告。
3. E-Recycling of California 原本爲廢棄物回收清運業者，現在則爲加州電子廢棄物再生處理計畫的一員，其中也包括了 CRT 顯示器的處理。
4. Sims Recycling Solutions 係依據歐盟 WEEE 制度而成立的研究單位，附屬於 SIMS 金屬管理公司，如今在美國多個州和世界各國都有分部。

(二) 座談結論

1. 業者一致同意，回收認證制度有助於提高工作效率，並有效管理下游廠商。

2. 認證制度雖然增加了成本的開銷，但是爲了因應客戶的要求，廠商應重視其必要性，而非著重在營利。
3. 美國境內目前以加州的回收工作成效最佳，但是在文書和行政工作方面也增加了業者許多負擔，若能減少一些繁瑣的程序，應該可以提升業者投入回收工作的比例。
4. 由於美國是由各州政府自行管理，故面對各州之間不同的法令要求，該如何變化和調適以有效地處理這些年年棄置的大量物品，是目前回收商面臨到的普遍挑戰。
5. CRT 玻璃的回收處理問題已經成爲美國目前極需處理的重要議題。
6. 目前仍有許多廢棄物沒有良好的回收處理方式，無論是回收制度或是技術方面都還有進步空間，業者認爲回收工作將是未來可積極發展的潛力事業。


圖 9、業者經驗分享情形

六、現場參訪

(一) California Electronic Asset Recovery (CEAR)

CEAR 公司自 2000 年創立開始即致力於電子廢棄物回收工作，觀察其回收處理過程，主要係將電子設備直接送入破碎機，再以人工分選方式，將各種物料予以篩選、分類，與我國處理廠著重以多段式人工拆解之處理過程明顯不同。

圖 10、參訪 CEAR 公司電子廢棄物回收情況

該公司已取得 ISO14001 認證，並強調注意個資安全問題是他們的首要目標，每項回收的資訊設備，都會經過機器銷毀程序，並可提供安全銷毀證明，其內容包括：

1. 確認銷毀後回收物的重量與進廠時之重量符合。
2. 廢料皆在監控下進行破碎處理。
3. 破碎過程的監控錄影紀錄可提供客戶即時連線觀看。
4. 可提供銷毀證書，其中包括銷毀廢料的總重量，銷毀時間和認證員的簽名。
5. 可提供客製化的回收報告。

圖 11、CEAR 公司處理後之電子廢棄物

(二) E-Recycling of California (ERC)

ERC 公司的核心業務在回收廢舊電子產品，採用人工和機械相結合的過程，仔細拆解電子廢棄物，轉化爲各種物料。目前每年回收超過 7 千萬磅的電子廢棄物，爲加州處理電子廢棄物之大廠，亦加入加州補貼體系，配合政府回收工作。

圖 12、E-Recycling 公司說明拆解 CRT 螢幕流程

該公司的處理流程，與我國相似，例如對於螢幕的處理流程，係以人工將電視機或是顯示器外殼與內部錐管玻璃分離，剪去電線後將各項元件分類裝箱分批賣出。

圖 13、 E-Recycling 公司 CRT 螢幕處理情形

(三) Belmont Technology Remarketing

貝爾蒙二手回收廠已通過 ISO14001 認證，該公司有兩大營運方向，一爲回收資訊物品，做最大限度的修復後再銷售；二爲評估產品市場，若不適合再販售，則將其拆解分類爲不同的電子廢料後賣出。貝爾蒙二手回收廠自行訂定一套回收資訊物品的標準程序，包含序號紀錄、資料清除、判定處理方式等流程。

此外，該公司特別重視內部處理和回收物品的流向問題，提供客戶詳細的貨物追蹤報告、寄件明細、銷毀證書等證明文件。並建立一套網絡系統，可供客戶追蹤回收物送進該公司後，直至最終處理完成，皆有流向記錄以供查詢。

七、IEMN 會議總結

透過本次會議，各國持續建立夥伴關係，並且共同討論出以下共識：

(一) 一致同意將此國際會議更名爲「International E-Waste Management Network Meeting」，縮寫爲 IEMN Meeting 。

(二) 關於明年的 IEMN 年度會議，初步決定在亞洲舉辦，確切的地點將透

過後續的電話會議繼續商議。

(三) 未來會議建議安排更多時段討論各類回收議題，讓各區域夥伴國家代表都有發言的機會。

(四) 經過五天的會議，成員整理出以下主題，作爲往後 IEMN 會議主要討論的方向：

1. 研議保護環境的電子廢棄物管理標準
2. 控管電子廢料的各種來源
3. 回收清除處理基金
4. 二手回收物無害化的管理制度
5. 持續瞭解不同類型之回收系統
6. 技術的創新和挑戰
7. 電子廢棄物流向追蹤
8. 綠色就業機會
9. 將非正規回收業者納入正式回收體系
10. 研擬關於電池和照明光源的回收計畫
11. 電子廢棄物管理的監管框架和商業模式

肆、會議成果與心得

一、我國綠色差別費率政策獲與會各國肯定

為鼓勵業者配合環境友善設計，發展有利於環境的產品，本署於101年起，對於公告列管之電子電器（電視機、電冰箱、冷暖氣機、洗衣機及電風扇），在徵收回收清除處理費用時，透過綠色差別費率，以經濟誘因促進業者朝向綠色生產，亦藉此提高綠色消費比例。本署藉由本次會議分享此項新政策資訊，並說明目前亦正推動資訊物品類之綠色差別費率，獲得各國之高度肯定，有助加強我國在相關領域環保發展先驅之地位。

二、我國資源回收基金及稽核認證制度獲得熱烈討論

本次會議雖著重於瞭解美國電子廢棄物回收及管理制度，惟因去年各區域夥伴瞭解我國經驗後，除了將臺美雙方對回收處理業者之認證制度相比較外，亦希望能更深入探討回收基金及稽核認證制度。於是在分組座談議題上，多主動提出希望參與「認證制度」及「回收基金」之組別，本署參與同仁亦透過分組討論時，主動分享我國相關實務經驗。

三、參考我國成功經驗，部分國家陸續建立法規制度

由於本署在101年研習會上，提供許多回收管理之政策、制度及技術之經驗分享，獲各國高度肯定，並將相關資訊帶回該國。因此，藉由本次會議，可發現許多國家皆參考我國資源回收制度，積極建立回收制度，並研擬相關法規草案，例如泰國、迦納、薩爾瓦多及哥倫比亞等。其他國家亦於會中表示將學習臺灣相關成功經驗，預計在該國推動更多電子廢棄物管理之環保事務。

四、加州回收處理業者廠務環境值得學習

本次會議除演講及討論形式之活動，亦安排相關參訪行程，其中位於沙加緬度之電子廢棄物回收廠 California Electronic Asset Recovery

(CEAR)公司爲美國地區前 20 大的回收處理業者，回收項目包含 CRT 螢幕、LCD 螢幕、筆記型電腦…等將近 40 項電子廢棄物。經現場瞭解其處理技術，雖自動化技術未如我國先進，惟破碎後人工分選較精細，後端再利用價值較高，另其廠內環境整潔，物料皆分類儲存於容器，不會與地面直接接觸，可提供給國內業者學習之參考。

伍、會議未來推動內容與建議事項

一、主動提供夥伴國家回收制度及技術之協助

美方建議將本會議以例行方式舉行，希望我國主動提供各區域夥伴國家在回收制度的建立以及相關回收處理技術精進上之協助，並親赴夥伴國家授課分享。本署建議可提供區域夥伴在建立各項回收制度之經驗或技術協助，惟執行方式可藉由視訊會議協助解答疑問或錄製相關影片送該國參考，另赴該國授課分享部分，建議在經費許可之前提下，1 年至多以 1 次爲限。

二、積極參與回收再利用技術調查研發

本次會議上，各國對於 CRT 螢幕回收處理問題非常關切，但目前各國之處理技術僅達將其中之平面玻璃與錐管玻璃分離階段，我國亦是如此。依目前實際運作情形，多數國家產出之錐管玻璃皆運送至印度作爲 CRT 螢幕製造之原料使用，惟現今電視及電腦螢幕產品發展趨勢改變，CRT 產品之需求量遽減，未來各國產生之錐管玻璃恐無合適再利用方式，且錐管玻璃屬含鉛玻璃，如未妥善處理，將造成環境衝擊。

因此，藉由本次會議之討論，各國希望可集結夥伴國家的力量，共同調查錐管玻璃回收再利用之可行技術，並規劃於未來尋找示範案例，推廣運用。建議我國亦可積極參與相關技術之調查計畫，蒐集可行技術，或鼓勵專家或業者研發回收技術，以避免未來我國面臨錐管玻璃無去化管道之情況。

三、擴大合作模式，邀請業者共同參與

觀察目前美國境內處理廠針對電子廢棄物的回收處理技術，主要是簡單的物理拆解，與我國類似，並未於回收處理廠內再生利用。其他的夥伴國家亦多屬資源回收起步階段，尚未建立完整的回收處理技術。而本次會議，美國也表示該國每年製造出的電子廢棄物遠高於其他國家，卻沒有得到最有效益的回收處理，造成大量的資源浪費。因此，未來在臺美合作或相關國際合作計畫，建議可邀請國內業者共同參與，除可分享實務運作經驗外，亦可能透過此機會拓展市場。

附錄一、「第 3 屆國際電子廢棄物回收管理夥伴會議」議程

3rd Annual Global E-Waste Management (GEM) Network Meeting

July 15th-19th, 2013

San Francisco and Sacramento, California

Monday, July 15th *Location: CalEPA, Sacramento*

7:00 AM: Meet in lobby and board bus

Parc 55 Wyndham Hotel, 55 Cyril Magnin St, San Francisco

****IMPORTANT: All must wear closed toe shoes for site visit! Flat heels are also suggested****

7:05 AM: Bus leaves for Sacramento

9:00 AM – 9:30 AM: Arrive at CalEPA

- Remarks from CalEPA
- Remarks from Environmental Protection Agency Taiwan (EPAT Deputy Executive Secretary Cheng)
- Remarks from USEPA (Panah Bhalla)
- Introductions

9:30 AM – 10:00 AM: Broad Overview of E-Waste Management Policies in the U.S. (Dan Gallo)

10:00 AM - 10:30 AM: Overview of history behind and results of California's e-waste management system (Jeff Hunts, CalRecycle)

- SB 20, SB 50 and their impacts
- Background on legislation- who introduced it, why
- Evolution from SB 20 to SB 50, and stakeholder positions for/against the bills
- Covered devices selected: which devices, why they were chosen
- Why consumers pay instead of producers
- Subsidy system: why was the government chosen to manage it? What are the administrative implications?
- How CalEPA works with stakeholders, what kind of flexibility is built into program

10:35 AM - 11:00 AM: Travel to site visit

11:00 AM - 11:30 AM: Tour of facility

11:30 AM - 12:00 PM: Q&A/Discussion

12:00 PM – 12:30 PM: Travel back to CalEPA

12:30 PM – 1:30 PM: Lunch

1:30 PM – 2:30 PM: E-waste management in the context of hazardous waste management in California
Rita Hypnarowski, California Department of Toxic Substances Control (DTSC)

- California definitions of universal waste and hazardous waste; differences from federal definitions
- How CRTs and other e-waste are regulated in California
- Recent emergency regulation on CRT panel glass

2:30 PM - 3:15 PM: The Subsidy System (Jeff Hunts, CalRecycle)

- How the fee was calculated
- How auditing is done
- Surpluses/deficits and how they are addressed
- The impact of the subsidy system on e-waste recycling and collection in California
- Recycling industry development since subsidy was established
- Recycling industry challenges- financial, CRT glass
- Q&A/Discussion

3:15 PM – 3:30 PM: Break

3:30 PM - 4:00 PM: E-Waste Fees and Bottle Bills- Similarities and Differences (CalRecycle)

- How have bottle bills and other fee systems for recycling worked in the U.S.?
- How do fee systems for e-waste compare to fee systems for recycling other goods?

4:00 PM - 5:00 PM: Q&A/Discussion *Moderator: Jeff Hunts, CalRecycle*

5:00 PM: Drive back to San Francisco

Tuesday, July 16th *Location: EPA Region 9, 75 Hawthorne Street, San Francisco*

8:00 AM: Arrive and go through security. EPA staff will greet you and direct you to meeting room

8:30 AM - 9:00 AM: Welcome and Overview of EPA Regional Offices' Role in E-Waste Management

9:00 AM – 9:05 AM: Introductions

9:05 AM - 9:30 AM: Update on Global E-Waste Management Network (EPA- Panah Bhalla, EPAT- Lillian Li)

9:30 AM - 10:00 AM: Update on E-Waste Management in Taiwan (EPAT- Lillian Li)

10:00 AM – 10:15 AM: Q&A

10:15 AM - 10:45 AM: Introduction to e-waste takeback policy from Minnesota (Garth Hickle)

10:45 AM - 11:00 AM: Q&A

11:00 AM – 11:15 AM: Break

11:15 AM – 11:30 AM: Introduction to e-waste takeback policy from Oregon (Loretta Pickerell)

11:45 AM - 12:00 PM: Q&A

12:00 PM – 1:30 PM Lunch

1:30 PM – 2:00 PM: NGO involvement in state laws and manufacturer takeback programs (Barbara Kyle- Electronics Takeback Coalition)

2:00 PM -4:00 PM: Policy Roundtable with State Officials and NGO Rep

Moderator: Dan Gallo

Officials discuss:

- Goals or stakeholder requests that resulted in varying policies from state to state
- Similarities/Differences in definitions of e-waste, covered devices and whether e-waste is considered hazardous
- Similarities/Differences in targets and performance measures for regulatory programs
- Similarities/Differences in results: collection rates, recycling rates, financial results, etc.
- Lessons to be learned from recycling programs for other commodities that could apply to e-waste, including bottle bills and fluorescent lights (if not included in e-waste)
- Policies that promote recycling and the use of secondary materials; promoting local processing

4:00-4:30 PM: Q&A/Discussion

Wednesday, July 17th *Location: EPA Region 9, 75 Hawthorne Street, San Francisco*

8:00 AM: Arrive and go through security. EPA staff will greet you and direct you to meeting room.

8:20 AM: Introduction of EPA Assistant Administrator for International and Tribal Affairs Michelle DePass

8:25 AM – 8:30 AM: Remarks from US EPA Assistant Administrator DePass

8:30 AM – 11:30 AM: Participant "Country Presentations"- Updates on Policy Development and Implementation, Issues and Challenges, New Case Studies *Moderator: AA Michelle DePass*

Countries Presenting: Colombia, Malaysia, Japan, Ghana, El Salvador, Thailand

11:30 AM – 1:00 PM: Lunch

1:00 PM – 4:00 PM: Participant "Country Presentations", Continued *Moderator: Panah Bhalla*

Countries Presenting: India, Argentina, Vietnam, Nigeria, Brazil, Indonesia

4:00 PM – 4:15 PM: Break

4:00 PM – 5:30 PM: Breakout Sessions on Specific Policy Challenges (Topics TBD)

5:30 PM – 6:00 PM: Breakout Sessions Share Results with Full Group and AA Michelle DePass

6:00 PM: Wrap-Up Remarks from EPA Assistant Administrator for International and Tribal Affairs Michelle DePass

Thursday, July 18th *Location: EPA Region 9, 75 Hawthorne Street, San Francisco*

*****IMPORTANT: All must wear closed toe shoes for site visit *****

8:00 AM: Arrive and go through security. EPA staff will greet you and direct you to meeting room.

8:30 AM – 9:00 AM: Introduction to National Strategy for Electronics Stewardship by EPA Deputy Assistant Administrator for Solid Waste and Emergency Response Lisa Feldt

- General overview of progress made under NSES
  - EPA Implementation Study
  - SMM Electronics Challenge

9:00 AM - 10:00 AM: Presentation by third-party Certifying Body and third-party Auditor on certified recycling in the U.S.

Speakers: Sharada Rao (Perry Johnson Registrars) and Kelley Keogh (Green-Eyed Partners)

- How third-party certification programs operate and why businesses pursue certification
- Standards for certification and how they relate to state laws and OSHA standards
- Auditing procedures
- Most common facility improvements needed for certification
- Financial, staffing and time investments associated with certification

10:00 AM - 11:30 AM: Roundtable with Certified and Compliant Recyclers from California

Moderator: DAA Lisa Feldt

Panelists: Pat Furr (Computers for Classrooms), Bob Erie (E-World Recyclers), Larry King (SIMS),

Dennis Kazarian (E-Recycling of California)

Topics :

- How/Why the companies established and grew their businesses in terms of processes, technology, investment; its long term outlook
- The companies' experiences being part of California's recycling program or other local regulatory programs (financial, business development, audits and compliance)
- What types of e-waste the companies handle and how
- Whether and how being certified has impacted the companies' businesses
- Any contrasting experiences operating in different states or countries
- The companies' experiences with the secondary markets for materials recovered from e-waste

11:30 AM – 12:30 PM: Presentations by Bay Area Original Equipment Manufacturers on takeback programs

Speakers: Doug Smith (Sony), Ed Butler (Nokia)

Manufacturers Discuss:

- Their companies' e-waste takeback programs in the U.S. and worldwide
- Which programs are mandatory (e.g. certain states/countries) and which are voluntary; how the programs vary
- How their collection systems or "reverse logistics" operate, including partnerships with retailers, municipalities, schools, state governments, other organizations
- Whether the company does recycling itself or through contracts with recyclers; any standards the company has for recyclers that receive its takeback material
- How the takeback programs do or don't support closed-loop manufacturing
- Manufacturers' experiences with secondary materials markets

12:30: Conclude

1:00 PM: Bus leaves for site visits in Hayward, CA

2:00 PM - 2:45 PM: Site visit to E-Recycling of California

3:00 PM – 3:30 PM: Site visit to Belmont Technology Remarketing

Friday, July 19th *Location: EPA Region 9, 75 Hawthorne Street, San Francisco*

8:30 AM Attendees through security at EPA and will proceed to conference room

8:50 AM: Introduction of EPAT Minister Shen by EPA Deputy Regional Administrator Alexis Strauss

8:55 AM – 9:00 AM: Remarks from EPAT Minister Shen

9:00 AM – 9:25 AM: Experiences from the GEM Network

Speakers: Shunichi Honda, Miranda Amachree, Miguel Araujo

9:30 AM - 12:00 PM: Update on U.S. Federal programs related to the National Strategy for Electronics Stewardship *Moderator: Panah Bhalla*

- ORD Sustainable Electronic Roadmap and Related Research *(Endalkachew Sahle-Demessie)*
- CEC Training Materials *(Rick Picardi)*
- Tracking Studies:
  - EPA/MIT/NCER *(MIT)*
  - USITC *(Laura Bloodgood or Andrea Boron)*
- EPEAT Standard Updates *(John Katz)*

12:00 PM- 1:00 PM: Lunch

1:00 PM - 1:30 PM: Updates to the Cathode Ray Tube Rule *(Dan Gallo)*

1:30 PM – 2:00 PM: Responsible Appliance Disposal (RAD) Program *Speaker: Melissa Fiffer*

2:00 PM -2:30 PM: Q&A/Discussion

2:30-3:00 PM: GEM Network Next Steps (EPA- Panah Bhalla, EPAT- Lillian Li)

附錄二、會議摘要報告

Draft 2013 International E-Waste Management Network (IEMN) Meeting Report

Summary:

USEPA and Environmental Protection Administration Taiwan (EPAT) convened the third annual meeting of the International E-Waste Management Network (IEMN), formerly known as the GEM Network, from July 15-19. The meeting was hosted by CalEPA in Sacramento, CA and by USEPA Region 9 in San Francisco, CA. Participants joined from Vietnam, Thailand, Malaysia, Indonesia, Japan, India, Ghana, Nigeria, Colombia, Argentina, El Salvador, and Brazil. This meeting coincided with the 20th anniversary of environmental collaboration between USEPA and EPAT.

This year's IEMN meeting focused on e-waste management in the United States. Participants learned about California's consumer-fee-based e-waste management system as well as the Extended Producer Responsibility-based e-waste management systems of Oregon and Minnesota, and interacted in depth with state officials. The group also heard from speakers representing U.S. NGOs, certifying bodies and auditors for third-party recycler certification programs, third-party certified recyclers, and manufacturers. As in previous years, meeting participants exchanged their latest updates related to e-waste management. OITA AA Michelle DePass moderated these updates and OSWER DAA Lisa Feldt presented an overview of the National Strategy for Electronics Stewardship. Staff from ORD, OSWER, MIT, USITC, and EPA Regions 3 and 9 presented the results of specific activities under the National Strategy. The participants also visited three certified recyclers in California: California Electronic Asset Recovery, E-Recycling of California, and Belmont Technology Remarketing. EPAT Minister Shen and DRA Alexis Strauss joined the last day of the meeting, which included a session in which participants from each region shared their experiences using the information from this network.

At the end of the meeting, IEMN participants identified topics for continued discussion and information sharing as well as economy-level activities that could be enhanced with the input or experiences of Network participants. The group also committed to continue sharing updates through quarterly teleconferences and to meeting again in 2014 in Asia.

Day 1: Spotlight on California

CalRecycle Chief Deputy Director Ken DaRosa welcomed IEMN participants to CalEPA and described the State of California's recycling achievements to date and its future goals. USEPA and EPAT thanked participants for traveling from all over the world and thanked CalEPA for hosting the opening day of this meeting.

To provide context for the state-level presentations, Dan Gallo of EPA Region 3 gave an overview presentation of e-waste management in the United States. The U.S. has a limited legal framework on managing used electronics. 25 states have laws on e-waste management that differ in scope and methodology. The Federal government does not specifically regulate the management of e-waste but does have rules on cathode ray tubes (CRTs) and spent lead acid batteries. Electronics

recyclers in the U.S. perform a variety of functions from resale to shredding. The Federal government's recommendations under the National Strategy for Electronics Stewardship have led to a significant increase in the number of third-party-certified recyclers in the U.S.

CalRecycle and the California Department of Toxic Substances Control (DTSC) gave an overview of e-waste management in California, which is unique compared to other states and the Federal government. Rita Hypnarowski of DTSC introduced how e-waste is regulated in California. Electronic devices were classified as universal waste in the state in 2002, which prohibited them from landfill disposal. There is no household exemption for e-waste in California. E-waste that is disposed of in California can be regulated as hazardous based on characteristics of toxicity, but e-waste is exempt from full hazardous waste regulations as long as it is recycled. Handlers of e-waste, such as collectors and recyclers, must notify and report their activities to DTSC (including exports), label and track e-waste, and meet other requirements.

Jeff Hunts of CalRecycle presented the history of California's payment system to subsidize e-waste recycling. Multiple state governmental bodies are involved in administering this system. California's Electronic Waste Recycling Act was passed in 2003 with multiple goals, including reducing the illegal dumping that had become a problem following the landfill disposal ban. It established a consumer recycling fee on retail sales of covered electronic devices (CEDs) which would in turn fund payments to qualified handlers of covered electronic wastes (CEWs). Recycling of CEDs and collection of CEDs which are in turn recycled are eligible for payment, but reuse is not. Although CEDs are just a subset of electronics and mostly consist of video displays, California consumers have expected recyclers to handle their full range of waste electronic devices. Consequently, California's electronic waste recycling industry has grown significantly since 2003.

E-waste recycling in California mainly consists of dismantling since heat treatment and wet treatment are only possible through a very expensive permit. As is the case around the world, downstream markets for CRT glass are limited for California recyclers. Recent emergency regulations were introduced in California to allow landfilling of panel glass from cathode ray tubes (CRTs), but so far no recyclers in the state have taken advantage of this disposal option. This is likely because of the cost associated with landfilling panel glass and because landfilled glass is not eligible for subsidy payments under California's e-waste program.

IEMN meeting participants made a site visit to California Electronic Asset Recovery (CEAR), an R2 and E-Stewards certified collector and recycler of e-waste. CEAR was founded as a refurbisher in 2000, prior to the establishment of the CEW payment system. After the payment system went into effect, CEAR began recycling, first processing CRTs and then all types of electronics. The company expanded over time, eventually investing in a "green machine" that uses centrifugal force to dismantle electronics into cleaner components than shredders can; the dismantled pieces are then separated by hand into commodity categories. This manual separation has resulted in increased employment, even as the company became more mechanized. The centrifugal technology is not used for CRTs and other CEWs, which must be "cancelled" through manual dismantling in order to be eligible for payments from the state.

Mike Miller of CalRecycle gave a presentation on the Californian Beverage Container and Litter Reduction Act, commonly known as California's bottle bill. This 26-year-old program has had highs and lows from its years of generating surplus revenue to its current deficit. The program has met its 80 % recycling rate goal for the past several years, but all structural payments will go to zero by 2015 unless action is taken by the state legislature to address the program deficit.

Day 2: State Policies and Stakeholder Involvement

Associate Director of USEPA Region 9's Waste Management Division Tom Huetteman opened the second day with an introduction to the role of the EPA Regional Office in managing e-waste.

Lillian Li of Environmental Protection Administration Taiwan's Recycling Fund Management Board (EPAT RFMB) summarized the 4-in-1 Recycling Program in Taiwan, which was presented in detail at the previous IEMN meeting in 2012. Through the 4-in-1 Program, the municipal solid waste stream in Taiwan has reduced dramatically, from 1.4 kg/day/person in 1998 to 0.4 kg/day/person in 2012. The 4-in-1 Program uses fees from manufacturers and importers to subsidize electronics recyclers who meet EPAT's standards and auditing requirements. IT equipment recycling and home appliances recycling have increased 24.4 times and 5.9 times, respectively, from 1998 to 2012.

Recently, Taiwan has implemented a "green differential fee rate" to encourage the development of environmentally friendly products by reducing the fees that manufacturers and importers pay for putting those products on the market. EPAT identifies products eligible for a 30% discount on the fees charged with a "Green Mark". The Green Mark and associated fee reductions were implemented for home appliances beginning in 2013 and will be implemented for IT equipment beginning in 2014. EPAT is also adding tablets and CCFL bulbs to the 4-in-1 Program's list of regulated recyclable waste beginning in 2014.

Garth Hickle of the Minnesota Pollution Control Agency presented an overview of the Minnesota Electronics Recycling Act, which uses the Extended Producer Responsibility model to manage certain discarded electronic products. Although Minnesota's e-waste program was enacted in 2007, e-waste has been collected since 1992 in Hennepin County, the state's most populous county, which includes Minneapolis. A state-wide e-waste disposal ban was proposed in 1995 but was not enacted until 2003 and became effective in 2006. However, the state's Product Stewardship Policy, which was adopted in 1999, included CRTs and led to the formation of a multi-stakeholder CRT task force. This increasing outreach to and engagement of stakeholders, especially that of manufacturers such as Best Buy (headquartered in Minnesota), IBM, and others, led to the widely-supported passage of the Minnesota Electronics Recycling Act in 2007. This law requires electronics manufacturers of video display devices to pay annual registration fees and meet e-waste takeback obligations.

Minnesota's takeback program uses the market-share approach, which the state asserts is easier and more equitable than other methods. Manufacturers have an 80% obligation level based on the weight of Visual Digital Displays (VDDs) sold in the state that year, but can meet this obligation with

a broader range of covered electrical devices. Additional credit towards the obligation is given for units collected in rural areas. Manufacturers can accumulate and trade credits, and can apply credits equivalent to up to 25% of their annual obligation to future years. Manufacturers in the state have consistently exceeded their collection obligations.

In the fifth year of the program, 6.6 lbs/capita of consumer-generated material were collected. 87% of material is being handled by certified processors. Six other states have built upon the Minnesota experience when fashioning their legislated e-waste programs. Although the amount of material collected and available for collection have far exceeded expectations, some of the challenges of this program include its narrow scope of covered devices, the lack of incentives for reuse, and the imbalance between the newer, lighter products that define manufacturers' obligations and the older, heavier products that are collected to meet them.

Loretta Pickerell of Oregon's Department of Environmental Quality (DEQ) presented the Oregon E-Cycles program, which also uses an Extended Producer Responsibility approach to manage e-waste. As in Minnesota, stakeholder involvement was essential to the successful development and implementation of Oregon's program. In particular, local governments were of great importance because they implement waste prevention, recycling, waste collection and disposal programs and conduct education and outreach. DEQ, in comparison, is responsible for developing the state's Solid Waste Management plan every 10 years and for establishing goals and measures as well as developing product stewardship and waste management programs.

DEQ convened stakeholder dialogues on producer responsibility models for e-waste in Oregon from 2001 to 2007. In 2007, the Electronics Recycling Law, the state's first producer responsibility law, was passed unanimously. The law requires manufacturers to provide free, convenient, state-wide recycling for computers, monitors and TVs. Amendments in 2011 added printers and computer peripherals beginning 2015. Under Oregon E-Cycles, manufacturers must register their brands and join either a state contractor-run recycling program or a manufacturer-run recycling program. Recycling program plans are approved by DEQ and have to be updated annually. Plans must meet standards for collection convenience, environmental practices, program promotion, and other requirements. Although manufacturers' registration fees are intended to cover DEQ's costs for program administration and compliance assurance (about $400,000/year), those fees alone are not sufficient. The state has also used solid waste disposal funds to make up the funding difference for Oregon E-Cycles. Oregon uses a contractor to manage its recycling program. The contractor can be a non-recycler who engages and hires recyclers.

Manufacturers' performance goals under Oregon E-Cycles are based on return share for IT manufacturers and market share for TVs. Return share goals are set based on manufacturers' share of returned devices from the previous year. For televisions, goals are based on manufacturers' share of TVs sold in Oregon. As in Minnesota, manufacturers in Oregon can earn credits for collection beyond their obligations; these credits can be sold to other manufacturers or can be applied for up to 15% of their annual obligation in any given year. Manufacturers can count only the covered devices to meet

their goals and penalties are levied for under-collection. Disposal of TVs, computers and monitors is banned in Oregon, and retailers are only permitted to sell products from registered brands.

Oregon E-Cycles' recycling goals increase each year. In 2012, 6.9 lbs per capita were collected; projections for 2013 and 2014 are 7.3 lbs/capita and 7.4 lbs/capita, respectively. More e-waste recyclers in the state are third-party certified than in previous years. In general, the program has increased e-waste processing capacity in Oregon and neighboring Washington State, creating new jobs in the process. Challenges associated with this program include a narrow scope of products, a lack of retailer oversight, and a lack of incentives to reuse and improve the design of new products.

Barbara Kyle of the Electronics Takeback Coalition (ETBC) presented the role of non-governmental stakeholders in e-waste management in the United States. ETBC is a coalition of environmental and consumer organizations in the United States that promotes sustainable design and responsible recycling in the electronics industry.

Based on ETBC's experience, there is no national e-waste legislation in the U.S. because of various opposing stakeholder interests. Now that states have moved ahead with legislation, a federal law would not be very useful from ETBC's perspective. ETBC's first step on e-waste was to get companies like Dell to do free takeback. It has been involved in state policy development by serving as a technical advisor to advocates and state groups working on passing takeback laws. ETBC has connected states and advocates working on similar programs and found that the local government is the key stakeholder whose engagement is needed in order to create a successful state program.

A variety of collection goals and requirements exist across the various state programs in the U.S. Similarly, requirements are not consistent across states on what must be done with collected e-waste, including whether it must be processed by third-party-certified recyclers. ETBC has identified the need to assign responsibility for making sure that electronics are recycled responsibly as the greatest challenge facing state laws. Other challenges that ETBC has identified include collection payments that may not be adequate to fund environmentally sound management of CRTs and other electronics, encouraging manufacturers to exceed collection goals, increasing rural collection, encouraging reuse, and enabling free recycling for a broad scope of products.

Following these presentations, USEPA Region 3's Dan Gallo moderated a Policy Roundtable Discussion featuring officials from California (Andrew Hurst), Minnesota (Garth Hickle), Oregon (Loretta Pickerell), and the Electronics Takeback Coalition (Barbara Kyle). Panelists were asked to describe the biggest influences on state programs, similarities and differences among state programs and among their results, goals and ideal outcomes for state programs, lessons learned from state programs, and policies that can promote local recycling and the use of secondary materials.

Panelists emphasized a number of key points. One recurring theme was that programs that set collection and recycling targets do not necessarily advance the goals of improving product design and recyclability or of achieving zero municipal solid waste. Another point was that the indicators used to compare state program results do not necessarily reflect the program's full impact. For example, measurements of pounds per capita of e-waste collected only reflect items covered under the state

program. In California, this indicator only counts CEW; other e-waste items that are recycled but which are not eligible for state payments are not accounted for in this measure. All of the state programs represented had driven the economic expansion of the recycling industry in their states even though each took a different approach to determining who should fund the program and how. A universal issue among states is how to ensure that obsolete equipment such as CRTs get properly recycled and how existing programs can support new recycling solutions rather than just encouraging collection, which has the potential to lead to stockpiling.

Day 3: Presentations from Around the World and Breakout Discussions

USEPA Assistant Administrator for International and Tribal Affairs Michelle DePass addressed the IEMN group on Day 3 of the meeting. AA DePass emphasized the unique opportunity afforded by the IEMN meetings for participants to directly exchange information and best practices, and, this year, to learn from the experiences of U.S. state officials. She reminded the group that e-waste management, a growing challenge around the world, is one of EPA's Global Top Six priorities. She also expressed the value that both she and EPAT Minister Shen place on being able to work multi-regionally on this and other issues through the EPA-EPAT collaboration.

As in previous IEMN meetings, participants shared the latest updates on e-waste management in their countries. Speakers from Asia, Central and South America, and Africa presented the results of recently completed projects, the status of new legislation, and discussed outstanding challenges and next steps. Many speakers also shared that they had been able to use information from the IEMN in their own work.

Speakers shared a variety of highlights from around the world. In Asia, Malaysia completed a project in March of this year that piloted a system intended to shift recycling away from the informal sector to licensed operators on Penang Island. Collection points were established at local hypermarkets and customers who turned in e-waste could receive vouchers for future purchases; however, the vouchers were not an effective incentive for all types of waste. Japan passed a new Small Appliances Recycling Act, which will expand the scope of regulated e-waste from the six appliances covered under the Home Appliances Recycling Act. Japan exports a significant amount of secondhand goods for reuse and is trying to learn more about how these goods are managed when they reach their end of life. Thailand's Draft Act on Fiscal Measures for Environmental Management would enable the government either to charge product fees in order to fund e-waste collection and recycling or to set up an Extended Producer Responsibility model which would require the private sector to fund and manage e-waste collection and recycling. The Vietnam Environment Administration is carrying out a study on developing a set of criteria for assessing technologies for handling e-waste. Indonesia is hoping to finalize its new e-waste regulations next year, which will enable the Ministry of Environment to monitor e-waste management from collection to disposal.

In Latin America, Argentina's federalist system has resulted in a similar situation to the United States; several states and municipalities have adopted e-waste management laws while the national

legislature has been unable to a national law due to stakeholder disagreement. Colombia just passed a new law establishing an Extended Producer Responsibility system to manage waste electric and electronic equipment (WEEE) and is working on a conformity assessment with the Swiss EMPA that will adapt regional recycling standards to apply to Colombia. In Central America, there is potential for Costa Rica to become a regional hub for both Spent Lead Acid Battery (SLAB) and e-waste recycling. In addition, a UNIDO project to develop national WEEE management policies in 13 Central and South American countries is working to become a GEF project in 2014. Brazil continues to progress in implementing its National Solid Waste Policy; proposals from the private sector have been submitted for the reverse logistics system for e-waste and the process is underway to get public comments and streamline the multiple proposals into a final sector strategy. In general, the Policy faces producer opposition and challenges relating to orphan waste and geographic distribution.

In Africa, Ghana's bill to control and manage hazardous waste, including e-waste, is being re-processed for consideration by Ghana's new Parliament following elections in December 2012. The bill will require manufacturers and importers of electronic equipment to register with EPA Ghana and pay fees based on the products placed on Ghana's market. Ghana is also working on a conformity assessment with the Swiss EMPA to develop recycling standards. Nigeria has been using Taiwan's recycling standards as well as the R2 and E-Stewards standards to develop Nigerian standards for recyclers and to inform its proposed Extended Producer Responsibility policy. Nigeria is now trying to develop a registry for producers and a fee system that would fund recycling.

Throughout the presentations, participants made note of topics that they wanted to suggest for the afternoon's breakout discussion sessions. Three topics were chosen: how to fund recycling, standards for recycling, and technologies for difficult-to-process wastes.

Day 4: Spotlight on the Private Sector

Lisa Feldt, EPA Deputy Administrator for Solid Waste and Emergency Response opened the day with an introductory presentation on the U.S. National Strategy for Electronics Stewardship (NSES). The four goals of the NSES address the entire life cycle of electronics. Under the National Strategy, EPA has the most commitments of any Federal agency. EPA activities include efforts to improve safe management of used electronics, developing new standards for the Electronics Procurement Environmental Assessment Tool (EPEAT), and launching the Federal Green Challenge (FGC) under which participants reported recycling 5,700 tons of electronics in 2012. These activities also involve other federal agencies, such as the General Services Administration.

Sharada Rao of Perry Johnson Registrars, which is a Certifying Body for the R2 Practices Certification and is soon to be a Certifying Body for the E-Stewards standards as well, presented on the role of third-party certification bodies. Organizations choose to become third-party certified for a number of reasons, including to be more competitive and to meet client demands for downstream due diligence. A recent

survey by R2 solutions found that 79.3% of recyclers saw an improvement in business after becoming certified. The certification process consists of two audit stages, where the first is more document-focused and the second is more hands-on. After organizations become certified, surveillance visits are conducted every 6-12 months depending on performance. Certified companies must be re-certified every three years. It takes an average of 8 to 12 months to get certified (8 months with a consultant and 1 year or more without a consultant) and can cost from $15,000 to $20,000 for a company to become certified, depending upon the size and experience of a company. Training of employees is also very important to support certification.

Kelley Keogh of Green-Eyed Partners presented the role of auditors in third-party certification. She also introduced the development and requirements of the two third-party certification programs for electronics in the U.S., the Responsible Recycling (R2) Practices and the E-Stewards certification program. R2 was developed through a multi-stakeholder group that met over a three to four year period. It is not an environmental, health and safety management (EH&SM) standard by itself, but must be incorporated into an EH&SM system such as ISO 14001 or OHSAS 18001. Implementing an EH&SM system is usually the largest change organizations make in becoming certified. The nonprofit Basel Action Network developed the E-Stewards certification after it left the R2 process. E-Stewards requires ISO 14001 integration. E-Stewards differs from R2 in certain aspects, such as by prohibiting prison labor and certifying at the company level versus the facility level, but downstream due diligence is a very important component of both R2 and E-Stewards.

DAA Lisa Feldt moderated a roundtable of certified recyclers who are also active and compliant under California's Covered Electronic Waste program. Four speakers were part of the panel: Pat Furr of Computers for Classrooms, Bob Erie of E-World Recyclers, Larry King of SIMS Recycling Solutions and Dennis Kazarian of E-Recycling of California. The panel represented a variety of perspectives and experiences. Computers for Classrooms is a nonprofit organization that focuses on refurbishing old computers for use in local schools but generates funds to operate through recycling. E-World Recycling works closely with Original Equipment Manufacturers (OEMs) through contracts and has developed an online recycling system that connects OEMs and recyclers and helps OEMs document and report on their recycling obligations under state laws. E-Recycling of California developed from a business that originally focused on waste hauling; it now processes covered devices under California's program, including CRTs. SIMS Recycling Solutions is a subsidiary of SIMS Metals Management that was started in 2002 in Europe as a result of the WEEE Directive; it operates in multiple U.S. states and in countries around the world.

Several key points were made during the discussion. Recyclers agreed that certification has helped them increase their business and has made it easier to manage certain aspects of their operations such as their downstream vendors. However, some mentioned that it is an expensive process that may be more of a necessity to meet client requirements rather than a tool to increase profits. Recyclers also emphasized the interdependence of their businesses, since few recyclers in California or the United States perform all stages of processing for end-of-life electronics. Some expressed the viewpoint that California's recycling system is the most fair and efficient of all the U.S. states, although it was also pointed out that California puts the burden of paperwork on recyclers. Several challenges facing

recyclers were identified, including complying with different requirements across states, the issue of how to effectively handle large quantities of outdated devices that are often recycled to meet state requirements, and the universal problem of CRT glass recycling. All recyclers agreed that, in general, a large quantity of recyclable material is currently available.

Doug Smith of Sony presented on the company's global electronics takeback programs. Sony has a "Road to Zero" program under which it has established a long term goal of zero net impact on the environment. Activities under this program target the full electronics life cycle as well as Sony facilities' operations. For end-of-life electronics, Sony has a product Trade-In and Take-Back program that has a long term goal of collecting one pound of e-waste for every pound sold; 270 million pounds of e-waste have been collected to date. Under this program, customers can return both Sony-brand and non-Sony-brand items for free, get credit for those items, and apply that credit towards the purchase of new Sony items. Mr. Smith also presented a chart ranking state programs by pounds of e-waste collected per dollar spent by the customer at point of sale (the cost of each state's internalized fee was used for this comparison). This chart ranked California's visible fee system as the highest-performing. From Sony's perspective, a national approach to recycling that rewards green design and that encourages the integration of recycling into business models would be preferable to the current patchwork of state regulations.

Ed Butler of Nokia presented on that company's takeback programs as well. One of the main challenges the company faces with takeback is that only 9% of customers want to give back their cellphones. Lack of awareness on where to recycle is the main obstacle to increasing this percentage. While many devices that are considered "e-waste" can be costly to recycle, mobile phones can be resold for $10-$250. Even nonfunctioning phones are worth at least $1 due to their precious metals content. Cell phones are not covered by most U.S. state e-waste laws, but this may change as cell phones increase in size and tend towards functioning as mini-computers. Nokia has country-level takeback programs in many countries, sometimes engaging government officials and celebrities to raise the profile of cell phone recycling. Nokia has also used media to promote cell phone recycling and environmental awareness, such as the movie *Wild Ocean 3D,* which is presented by Nokia and includes a message from the company. Both Nokia and Sony are part of EPA's Sustainable Materials Management Challenge, in which participating manufacturers and retailers work to increase the number of electronics being collected, send 100 % of their used electronics to a recognized third-party certified recycler by the third year of participation, and publicly report this information.

On Thursday afternoon, the IEMN made two site visits to third-party-certified electronics recyclers in Hayward, CA: E-Recycling of California and Belmont Technology Remarketing. E-Recycling of California participates in California's payment system. Its Hayward facility breaks down CEWs and sends component materials on for further processing. The bulk of E-Recycling customers at the Hayward facility are landfill transfer stations. Belmont Technology Remarketing performs the primary functions of auditing, testing, and data erasure of IT equipment. Tested, working equipment is resold and non-working equipment is manually disassembled before shipping downstream. Companies like these, which perform different stages of end-of-life management, often work together for downstream management.

Day 5: Federal Activities and IEMN Next Steps

EPAT Minister Shen and Deputy Regional Administrator Alexis Strauss opened the day. Three IEMN members shared their experiences being part of the network and using the information shared through it. Dr. Shunichi Honda of MOE Japan mentioned that the network provides the only opportunity to learn about the advanced e-waste management system in Taiwan. Miranda Amachree of NESREA described how Nigeria has used information from this network to inform its recycling standards. Miguel Araujo described how the multi-regional format of the network inspired him to advance regional cooperation in Central America to build capacity to manage e-waste.

Speakers from EPA, the U.S. International Trade Commission and the Massachusetts Institute of Technology presented the latest status of several activities under the National Strategy for Electronics Stewardship. Featured efforts included work to improve the life cycle sustainability of electronics, training materials on the environmentally sound management of e-waste, two studies to improve information on trade flows of used electronics, updates to the EPEAT standard, and updates to the Cathode Ray Tube Rule.

Melissa Fiffer of USEPA presented the Responsible Appliance Disposal (RAD) program. Although appliances are not commonly considered "e-waste" in the United States, some EPA regulations are relevant to ensuring safe appliance disposal. EPA implemented the RAD partnership program in 2006 to engage key players earlier in the disposal chain and achieve greater environmental benefits. Currently, the RAD partnership includes over 50 retailers, utilities and manufacturers. This partnership has multiple benefits. For example, in 2011, RAD utility partners collected appliances over 20 years old and in doing so saved 3.2 billion kWh in electric grid demand as well as $424 million in customers' energy costs.

The IEMN discussed next steps. The group agreed that future meetings should be more discussion-oriented as opposed to location-specific. Participants suggested potential discussion topics for future meetings, including standards for environmentally sound management of e-waste, managing multiple sources of e-waste material, fee systems to fund e-waste recycling, environmentally sound management of secondhand goods, collection systems, technological innovations and challenges, downstream tracking of e-waste, green jobs, and incorporating the informal sector into safe recycling. IEMN participants also identified topics on which it could be valuable for the group to compile information. Potential topics included different types of collection systems, programs for battery and lamp recycling as they relate to e-waste, standards for environmentally sound management of e-waste, and economy-level regulatory frameworks and business models for e-waste management. The group agreed to work on identifying potential locations for next year's meeting, to be held in Asia in 2014, and to continue sharing updates through quarterly teleconferences.

附錄三、與會夥伴成員名單

本次與會之各國區域夥伴成員名單

編號	姓名	性別	國籍	單位
1	Trong Manh Tuan	男	越南	自然資源及環境部
2	Taweechai Jiaranaikhajorn	男	泰國	環境資源部
3	Amelia Rachmatunisa	女	印尼	環境部門
4	Upik Kamil	女	印尼	環境部門
5	Miguel Araujo	男	薩爾瓦多	巴塞爾公約中美及墨西哥區域中心(BCRC-CAM)
6	Che Asmah Ibrahim	女	馬來西亞	環境部門
7	Carlos Hernandez	男	哥倫比亞	國家清潔生產中心
8	Miranda Amachree	女	奈及利亞	環境標準署
9	John Pwamang	男	迦納	環保部門
10	Beatriz Martins Carneiro	女	巴西	工業發展及國際貿易部門
11	Leila Devia	女	阿根廷	巴塞爾公約南美區域中心(BCRC-South America)
12	Asok Das	男	印度	Andhra Pradesh 州污染控制局
13	Honda Shunichi 本多俊一	男	日本	日本環境省
14	Panah Bhalla	女	美國	美國環保署
15	Daniel T. Gallo	男	美國	美國環保署

附錄四、會議資料

Broad Overview of E-Waste Management Policies in the U.S.

July 15, 2013
Global E-Waste Management (GEM) Network Workshop
Daniel T. Gallo, US EPA

Outline of US EPA Presentation

- **Presentation Topics**:
  - U. S. Legal Framework for e-Waste Management
  - State Laws for e-Waste Treatment and Recycling
  - Generation and Recycling/Reuse of e-Waste
  - Recent Findings on Status of e-Waste Processing in the United States
  - Efforts to Improve Electronics Recycling/Reuse in the United States and Beyond
  - Questions and Discussion

US Legal Framework for E-Waste Management

- Hazardous waste is regulated under the 1976 Resource Conservation and Recovery Act (RCRA)
  - Definition of hazardous waste is complex, based on testing and listing
  - Some electronics qualify as hazardous, some don't
  - Materials destined for reuse aren't considered "waste"
  - E-Waste is defined for each project or program, as appropriate
  - Authorized states can enforce federal RCRA regulations and manage electronics under their own state program
  - Federal Regulation: CRT glass and some batteries
  - Consensus-driven programs (e.g. recycling certification)
- Support ratification of the Basel Convention
- U.S. regulates used CRTs exported for recycling
- Federal export legislation: proposed, not passed

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State Laws

- **25 U.S. States have laws that require e-waste recycling**
  - Most use Extended Producer Responsibility model
  - Consumers and households usually eligible for free recycling
  - Fifteen include landfill disposal bans
  - Laws differ from state to state; challenge for manufacturers
- **No Federal take-back legislation; take back is mandated at the state level**

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Financing Mechanisms*

- Advanced recovery fee – 1 state (CA only)
- Producer Responsibility (PR): Annual fee or own programs -2 states
- PR: Return share – 1
- PR: Market share – 7 *(most like WEEE revisions)*
- PR: Return share & market share - 7
- PR: None specified, but manufacturers run their own programs – 6

*courtesy of Jason Linnell, Executive Director, National Center for Electronics Recycling (NCER)

State	Products Collected	Entities Collected From	2010 Lbs Per Capita
CA	Televisions, computer monitors , laptop	All	4.9
HI	Computer monitors, laptops, printers (no TVs until 2011)	All	2.4
IL	Computer, computer monitor, television, printer, mobile phones, telephone, others	Households only	2.4
IN	TVs, computer monitors, laptops, desktops, printers, computers, peripherals, fax machines, DVD players, VCRs	Households, public schools, small business	2.5
ME	TVs, computer monitors, laptops, printers, video game consoles, dig pic frames	Households (others added 2011)	4.0
MI	Computer, computer monitor, television, printer	Household and small business	0.8

*courtesy of Jason Linnell, Executive Director, National Center for Electronics Recycling (NCER)

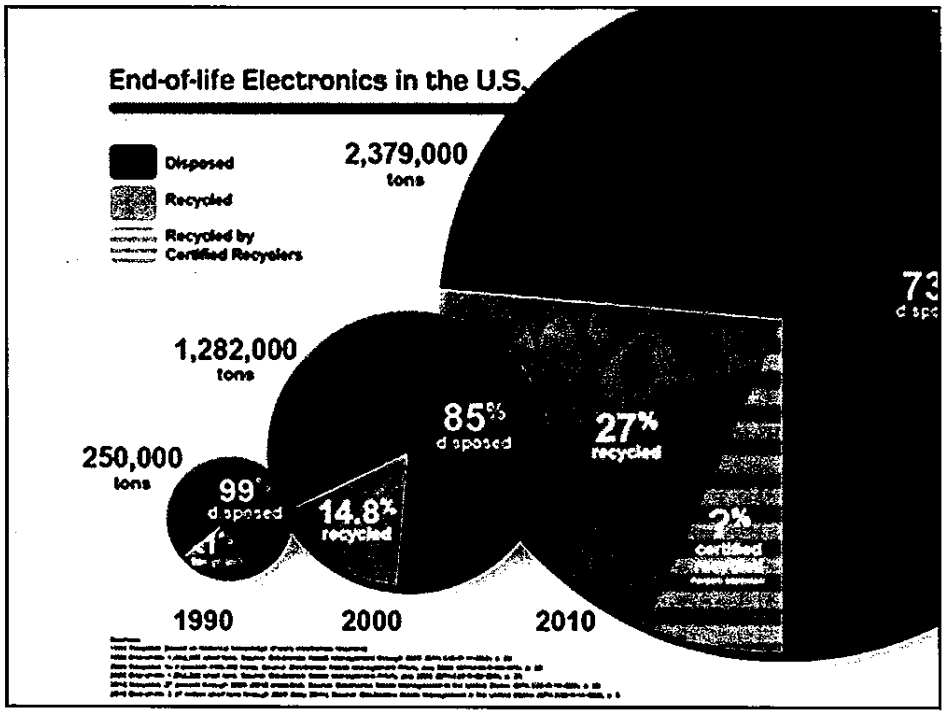
State	Products Collected	Entities Collected From	2010 Per Capita
MN	TVs, computer monitors, laptops, desktops, printers, computers, peripherals, fax machines, DVD players, VCRs	Households	6.7
OR	TVs, computer monitors, laptops, desktops	Households, small bus., non-profit, 7 or fewer	6.3
OK	computer monitors, laptops, desktops	Households	0.7
TX	computer monitors, laptops, desktops	Households	1.0
VA	computer monitors, laptops, desktops	Households	0.6
WA	TVs, computer monitors, laptops, desktops	Households, small gov'ts, small businesses, school district and charities	5.9
	televisions, computers (desktop, laptop, netbook and tablet computers), desktop printers, computer monitors; other computer accessories, e-readers, DVD players, VCRs and other video players (i.e., DVRs); and fax machines	Households, k-12 public schools	4.2

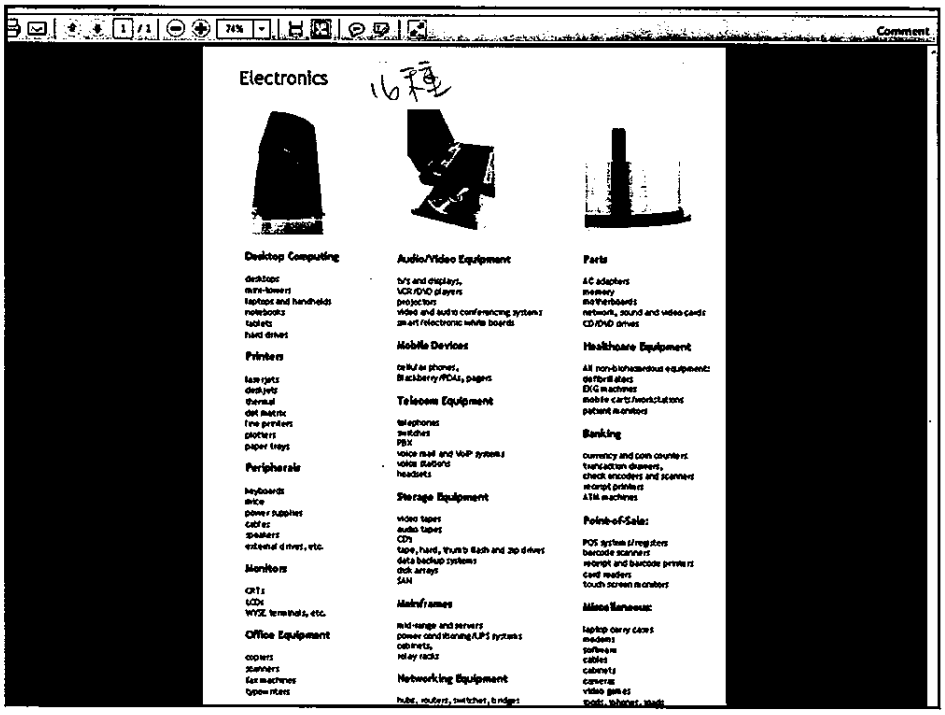
Generation and Recycling of Used Electronics in the U.S.

- E-Waste makes up 1-2% of total waste stream in U.S.
- 2011 EPA Waste Characterization Report
  - Used data from 1980-2010
  - Estimated number of products reaching end-of-life (EOL) annually and how many were recycled, landfilled or stored
  - PCs (desktop and laptop), monitors, keyboards, mice, hard-copy devices, TVs, mobile devices

Generation and Recycling of Used Electronics in the U.S.

- In 2009:
  - **438 million new** electronic products sold
  - **5 million short tons** electronic products in storage
  - **2.37 million short tons** ready for EOL management
  - **25% of 2.37 million short tons** sent for recycling
  - **1999 to 2009**: 122% increase in EOL electronics
  - **2006 to 2009**: increase in recycling of 179 thousand short tons
- Accurate, Reliable Data Are Limited


End-of-life Electronics in the U.S.
Disposed
Recycled
Recycled by Certified Recyclers
2,379,000 tons
1,282,000 tons
85% disposed
27% recycled
250,000 tons
99% disposed
14.8% recycled
2% certified
1990
2000
2010

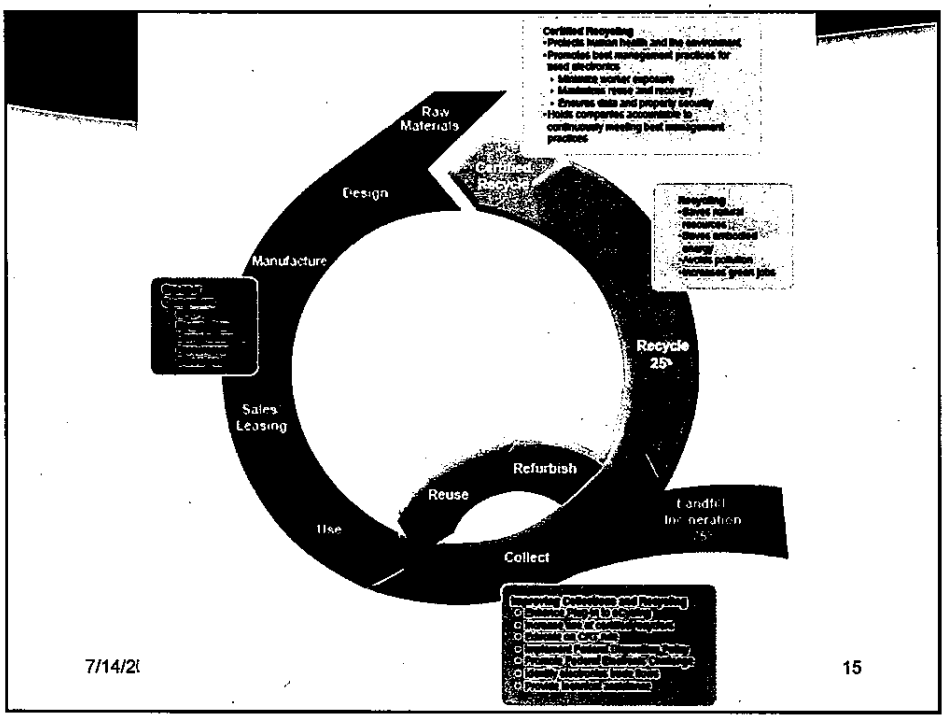

Electronics
Desktop Computing
desktops
mini-towers
laptops and handhelds
notebooks
tablets
hard drives
Printers
laserjets
deskjets
thermal
dot matrix
fax printers
plotters
paper trays
Peripherals
keyboards
mice
power supplies
cables
speakers
external drives, etc.
Monitors
CRTs
LCDs
WYSE terminals, etc.
Office Equipment
copiers
scanners
fax machines
typewriters
Audio/Video Equipment
TVs and displays
VCR/DVD players
projectors
video and audio conferencing systems
smart/electronic white boards
Mobile Devices
cellular phones
Blackberry/PDAs, pagers
Telecom Equipment
telephones
switches
PBX
voice mail and VoIP systems
voice Bluetooth
headsets
Storage Equipment
video tapes
audio tapes
CDs
tape, hard, thumb flash and zip drives
data backup systems
disk arrays
SAN
Mainframes
mid-range and servers
power conditioning/UPS systems
cabinets
relay racks
Networking Equipment
hubs, routers, switches, bridges
Parts
AC adapters
memory
motherboards
network, sound and video cards
CD/DVD drives
Healthcare Equipment
All non-biohazardous equipment:
defibrillators
EKG machines
mobile carts/workstations
patient monitors
Banking
currency and coin counters
transaction dispensers
check encoders and scanners
receipt printers
ATM machines
Point-of-Sale:
POS systems/registers
barcode scanners
receipt and barcode printers
card readers
touch screen monitors
Miscellaneous
laptop carry cases
modems
software
cables
cabinets
cameras
video games

Summary of U.S. E-Waste Scenario

- **Key Issues:**
  - E-Waste is a rapidly growing segment of MSW
  - Consumers own about 24 electronic products/ household
  - Limited legal framework on used electronics management:
    - A patchwork of 25 different state laws; 15 with landfill bans
    - CRT Regulation; Spent Lead Acid Battery Regulation
  - Strong consensus-driven programs
    - Recycling certification,
    - EPEAT
- **Resulting Approach:**
  - Focus on stewardship of Federal electronics throughout their life cycle approach
  - Foster electronics stewardship through a combination of legal requirements and consensus driven initiatives

National Strategy for Electronics Stewardship (NSES)

- Strategy Launched July 20, 2011 with issuance of Report
  - www.epa.gov/waste/conserve/materials/ecycling/taskforce/index.htm
- Report and Recommendations Developed by Interagency Task Force:
  - Council on Environmental Quality (CEQ)
  - U.S. Environmental Protection Agency (EPA)
  - U.S. General Services Administration (GSA)



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EPA's Role in Electronics Management

EPA is advocating the four goals of the National Strategy:

1. ***Build incentives for greener electronics design and innovation.***
2. ***Ensure that the Federal Government leads by example.***
3. ***Increase Safe and Effective Management and Handling of Used Electronics in the United States.***
4. ***Reduce Harm from US Exports of E-Waste and Improve Safe Handling of Used Electronics in Developing Countries.***

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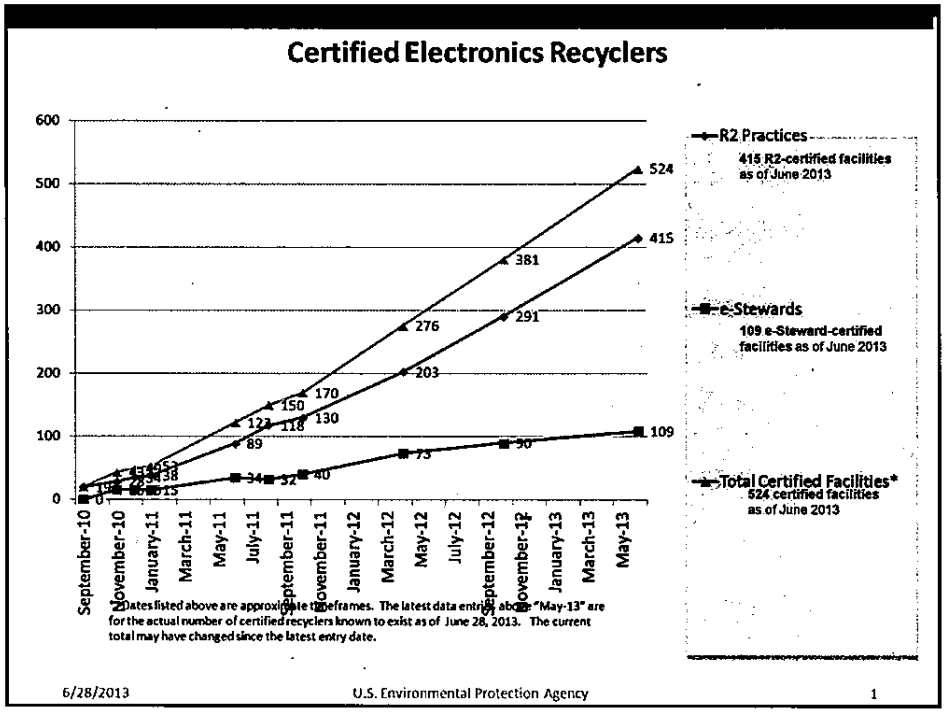
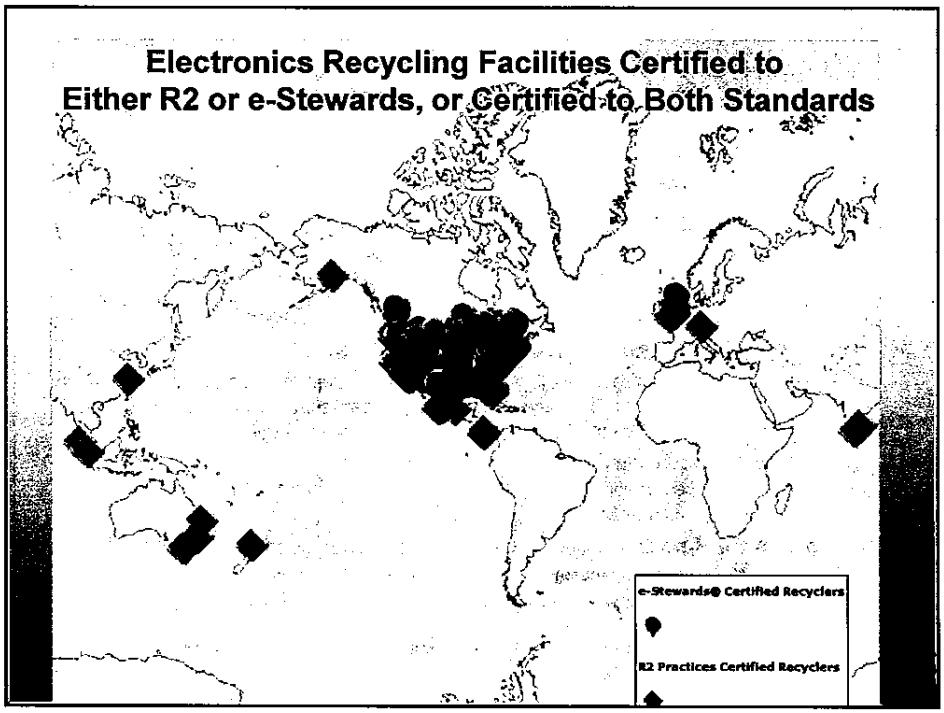
Goal 2: Ensure that the Federal Government leads by example.

- **Federal Electronics Challenge (FEC):**
  - **1) Acquisition and Procurement** (EPEAT)
  - **2) Operations and Maintenance**
    - Power Management, ENERGYSTAR
  - **3) End-of-life Management**
    - Use certified electronics recyclers
      - E-Stewards certified
      - R2 certified

- **Increase use of *certified recyclers* in the US:**
  - Have the Federal government **lead by example**:
    - Establish a comprehensive and transparent government-wide policy on used Federal electronics that:
      - ***maximizes reuse***,
      - ***clears data and information*** stored on used equipment, and
      - ensures that all Federal electronics are ***processed by certified recyclers.***
- **Certification Programs for Electronics Recyclers:**
  - EPA encourages all electronics recyclers to become certified by demonstrating to an accredited, independent third-party auditor that they meet specific standards to safely recycle and manage electronics
  - Two accredited certification standards exist:
    - Responsible Recycling Practices (R2) http://www.r2solutions.org/
    - E-Stewards® http://e-stewards.org/
- **Benefits of third-party certified responsible electronics recycling include:**
  - Reducing environmental and human health impacts from improper recycling;
  - Increasing access to quality reusable and refurbished equipment to those who need them; and
  - Reducing energy use and other environmental impacts associated with mining and processing of virgin materials – conserving our limited natural resources.


Certified Electronics Recyclers
600
500
400
300
200
100
0
September-10
November-10
January-11
March-11
May-11
July-11
September-11
November-11
January-12
March-12
May-12
July-12
September-12
November-12
January-13
March-13
May-13
524
415
381
291
276
203
170
150
130
123
118
109
89
73
90
40
34
32
R2 Practices
415 R2-certified facilities as of June 2013
e-Stewards
109 e-Steward-certified facilities as of June 2013
Total Certified Facilities*
524 certified facilities as of June 2013
*Dates listed above are approximate timeframes. The latest data entry above "May-13" are for the actual number of certified recyclers known to exist as of June 28, 2013. The current total may have changed since the latest entry date.
6/28/2013
U.S. Environmental Protection Agency
1


Electronics Recycling Facilities Certified to Either R2 or e-Stewards, or Certified to Both Standards
e-Stewards® Certified Recyclers
R2 Practices Certified Recyclers

U.S. International Trade Commission (ITC) Survey

- ***By value***, most exports were products that were ***refurbished and resold*** as:
  - working computers
  - cell phones and other used products.
- ***By weight***, most exports were ***scrap materials*** **that**:
  - come from UEPs that are ***disassembled or recycled in the United States***;
  - are commodity metals, plastics, and glass that ***are exported*** to be used ***in manufacturing processes overseas***;
- **Circuit boards** are exported to smelting facilities to recover gold and other precious metals;
- ***Only a small share of U.S. exports of UEPs*** was sent overseas for disposal.

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Emerging Issue: CRT Stockpiles

- Under RCRA, CRTs are hazardous waste when disposed of due to the presence of lead; Notice and consent is required for export for recycling or disposal.
- Few CRTs are made today. Therefore, recycling markets have become limited. This has caused an increase in the price of recycling the CRT glass.
- Concerns have been raised that this has led to CRT glass stockpiles.
- New technologies have become available; too soon to tell how they will help.
- Posted Frequently Asked Questions (FAQs) on the CRT regulations to ensure all parties understand their obligations for the CRT stockpiles under the Resource Conservation and Recovery Act (RCRA) and Superfund.
- Coordinating with state partners and other stakeholders to monitor the situation and determine what the appropriate federal role may be.

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Types of Electronics Recyclers/Electronics Recycling Facilities in the U.S.

- **There is no "one type" of Electronics Recycler or Electronics Recycling Facility in the U.S. "Recyclers" includes, but need not be limited to:**
  - Resellers
  - Asset recoverers
  - Refurbishers
  - Demanufacturers
  - Shredding facilities
  - CRT Glass Processors
  - Precious metals refining facilities
  - Plastic recyclers: mold plastic into new products
  - various combinations of the above types

Contact Information

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Electronics Recycling Coordinator
EPA-Region 3
Land & Chemicals Division/
Office of Materials Management (3LC40)
1650 Arch Street
Philadelphia, PA 19103
Phone: 215-814-2091
email: gallo.dan@epa.gov

California's Electronic Waste Recycling Act

GEM Network Meeting - Sacramento

CalRecycle

July 15, 2013

This Morning's Topics

- **Why Does California Care About E-waste?**
- **Legislative and Regulatory History**
- **The Electronic Waste Recycling Act**
- **The Covered Electronic Waste Program**

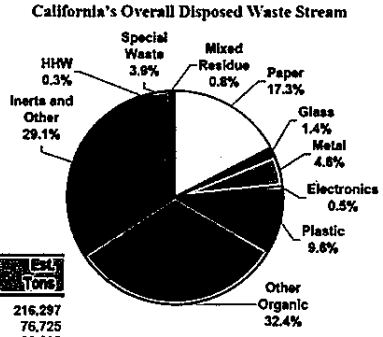
2

CalRecycle

Electronic Waste: What's the Problem?

Fastest growing part of the waste stream? Really?

CalRecycle's 2008 Data:



Material	Est. Percent	+/-	Est. Tons
Electronics	0.5%		216,297
Brown Goods	0.2%	0.1%	76,725
Computer-related Electronics	0.1%	0.1%	32,932
Other Small Consumer Electronics	0.1%	0.0%	34,588
Video Display Devices	0.2%	0.1%	72,053

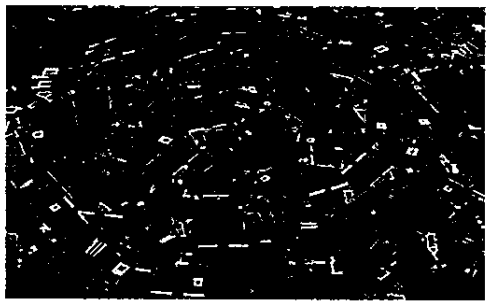
3

CalRecycle

Electronic Waste: What's the Problem?

Toxic Materials

- Lead
- Mercury
- Cadmium
- Arsenic
- Chromium
- Copper
- Halogenated Polymers
- Brominated Flame Retardants



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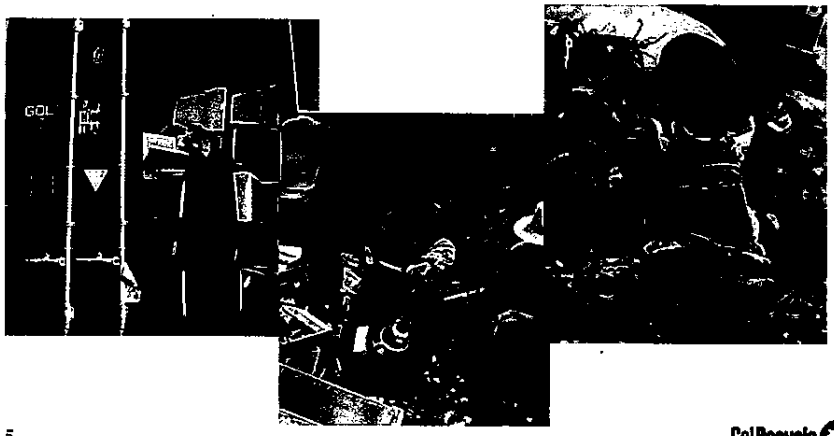
CalRecycle

Electronic Waste: What's the Problem?

Export Concerns

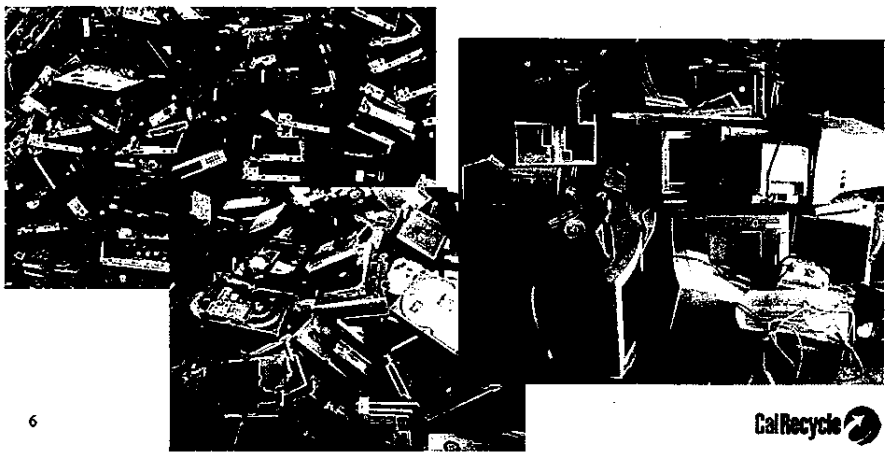


5

CalRecycle

Electronic Waste: What's the Problem?

Wasted Resources



6

CalRecycle

Legislative and Regulatory History

- 2001 – State clarifies that cathode ray tube (CRT) devices are in fact hazardous when disposed
- 2002 – California's universal waste rules prohibit disposal of electronics (household exception until 2006)
- 2003 – Electronic Waste Recycling Act (SB 20)
- 2004 – Cell Phone Recycling Act
- 2005 – Covered Electronic Waste (CEW) recycling program is initiated

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CalRecycle

Electronic Waste Recycling Act

Senate Bill (SB) 20

- Result of frustration with NEPSI (National Electronic Product Stewardship Initiative)
- Stakeholders included local governments, environmental interests, manufacturers, retailers, consumers, etc
- Several previous unsuccessful legislative efforts
- State had experience with "bottle bill" model
- Governor was on verge of recall...

8

CalRecycle

Electronic Waste Recycling Act

Intent

- Provide financial relief to Local Jurisdictions
- Foster convenient recycling opportunities for consumers throughout the state
- Reduce illegal dumping
- Eliminate the consumer stockpile of waste monitors/TVs
- Decrease amount of hazardous materials in covered devices

9

CalRecycle

Electronic Waste Recycling Act

Components

- Consumer recycling fee on retail sales of covered electronic devices (CEDs)
- Recovery / recycling payments to qualified handlers of covered electronic wastes (CEWs)
- Manufacturer requirements:
  - labeling, reporting
  - product design: ROHS
  - consumer information
- State purchasing guidelines: EPP
- Statewide public education campaign

10

CalRecycle

Electronic Waste Recycling Act

Government Administration:

- Department of Toxic Substances Control (DTSC)
  - Regulates all hazardous waste, including electronics
- Department of Resources Recycling and Recovery (CalRecycle)
  - Administers "covered electronic waste" system
- Board of Equalization (BOE) – handles revenue
- State Controllers Office (SCO) – issues payments
- Department of Justice (DOJ) – investigates

11 CalRecycle

Covered Electronic Devices

- ***Covered electronic devices*** **(CEDs) are just a subset of all electronics**
  - Bur remember: all electronics are presumed hazardous when disposed
- **DTSC determines what is a CED**
  - Video display device with a screen > 4"
  - Tested and added to DTSC regulations -- Title 22 CCR, Chapter 11, Appendix X

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Covered Electronic Devices

Currently include:

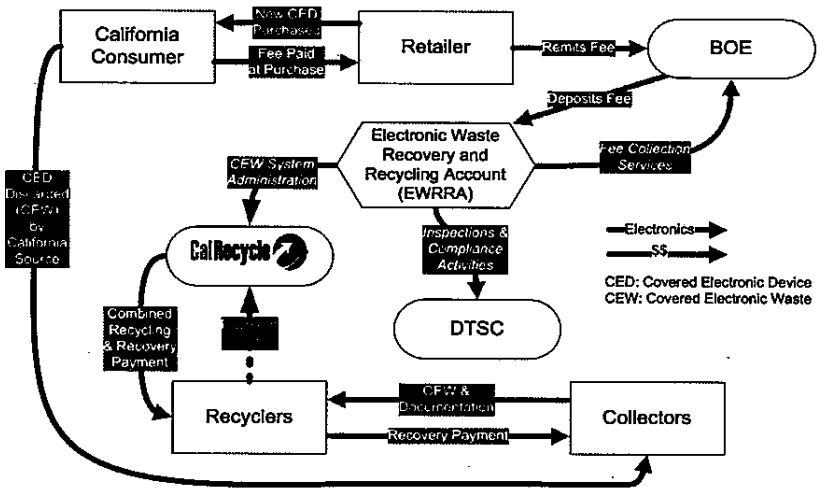
–Cathode ray tube (CRT) television or monitor
–Liquid crystal display (LCD) television or monitor
–Laptop computers with LCD display
–Plasma television
–Portable DVD players

–Tablet devices? Maybe yes, maybe no...
–Large-screen smart phones? Not yet...

13

CalRecycle

Covered Electronic Waste (CEW) Recycling System



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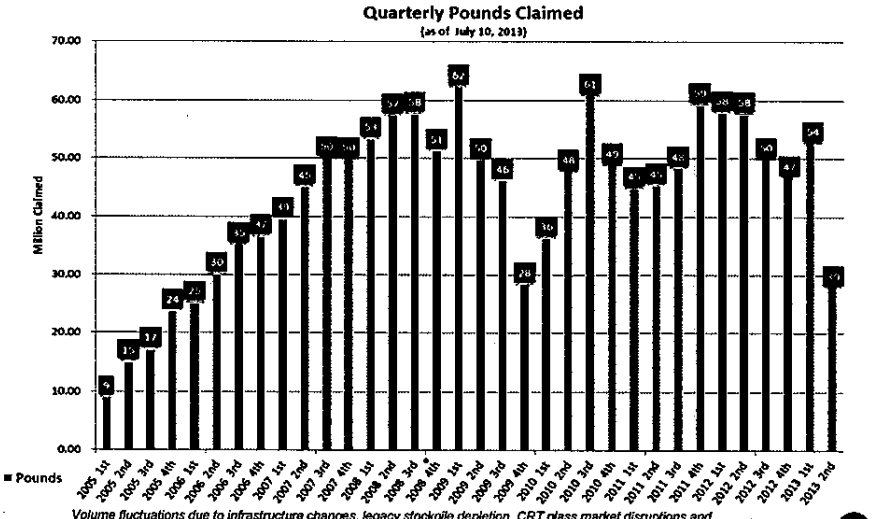
CalRecycle

CEW Recycling Payment System Claim Volumes

- ~1.4 billion pounds of CEW claimed since program inception (as of July 2013)



Volume fluctuations due to infrastructure changes, legacy stockpile depletion, CRT glass market disruptions and claim timing. Recyclers are supposed to submit claims within 45 days after the end of a reporting month.

15

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16

Introduction to E-Waste Management in California

Rita Hypnarowski
E-Waste Team Leader
Department of Toxic Substances Control (DTSC)

July 15, 2013

1

What We'll Cover Today

- CA definitions of universal waste & hazardous waste, and differences from federal definitions
- How CRTs and other e-waste are regulated in CA
- Recent emergency regulations for CRTs and CRT glass

2

Federal Definition of Universal Waste

According to 40CFR 261.9:

1. Batteries (not from vehicles)
2. Mercury-containing equipment
3. Lamps
4. Pesticides

3

CA Definition of Universal Waste

According to Title 22, California Code of Regulations, section 66261.9:

1. Batteries (not from vehicles)
2. Mercury-containing equipment
3. Lamps
4. Aerosol cans
5. CRTs
6. CRT glass
7. Electronic devices

4

What is an Electronic Device?

- Computers
- Telephones
- Answering machines
- Radios and stereos
- TVs
- Tape players
- CD players
- VCRs

5

CA Definition of E-Waste

There is no official definition.

E-waste is an electronic device that is *discarded*

→ The e-waste must be hazardous waste due to the characteristic of toxicity, *or* listed in Title 22

→ *It is exempt* from **full HW regulations** – as long as it is recycled!

6

Universal waste

Is E-Waste a UW under RCRA?

No; California regulates e-waste differently than U.S. EPA

E-waste is UW in California, so is banned from general landfill disposal

7

E-Waste as Hazardous Waste

- E-Waste is a subset of UW, *and* a subset of HW in California
- All e-waste is UW, but not all UW is e-waste
  - For example, batteries, lamps, and mercury switches are all UW, *but they are not e-waste*

8

What is E-Waste Hazardous for in CA/ Why is it Regulated?

- Lead
- Mercury
- Copper
- Cadmium
- Chromium
- Zinc
- Other heavy metals

9

E-Waste Regulations

Found in California Code of Regulations, Title 22, Chapter 23

Require handlers to:

- Notify and report to DTSC
- Label and track e-waste
- Not hold over one year
- Train personnel
- Manage and contain to prevent release
- Some other requirements apply

10

Typical E-Waste Recycling Activities

- E-waste is dismantled and separated into *distinct components* (e.g., printed circuit boards and CRTs)
- Distinct components are further processed
- No heat or chemicals allowed in treatment *except* with an expensive permit

11

Who's Handling All the E-Waste?

- Over 100 recyclers (dismantling or treating)
- Over 1,000 collectors
- Self-storage facilities and e-waste collection events
- Individuals conducting curbside pick-up, scavenging, etc.

12

What about Export?

- CA incorporates the CRT Rule requirements into its regulations, but cannot independently enforce them
- Millions of pounds of e-waste exported from California ports comes from other states

13

Emergency Regulations for CRTs and CRT Glass

- Necessary to address the disposition of an increasingly problematic wastestream
- Primary objective: identify what's happening to all of the CRT glass (i.e., how it is being recycled, or disposed of)
- These emergency regs do not affect other types of UW

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Industry Practice in CA

1. CRTs are often split by processors into funnel (RCRA) and panel (non-RCRA)
2. There is a demand for quality cullet (processed glass)
3. No CA recyclers have opted to dispose of CRT glass *(so far)*
4. Other uses for CRT panel glass are being pursued

New technologies for recovering lead are being developed *(out of state & out of country)*

15

Emergency Regs: Key Points

1. The e-waste facility must know where the CRTs or CRT glass is being sent

2. The e-waste facility must know what will happen to the CRTs or CRT glass

16

Emergency Regs Q&A #1

Q. Who is subject to the CRTs/CRT glass emergency regs?

A. Recyclers who dismantle or process CRT devices and CRTs

- Handlers that only accept/accumulate are *not* subject

17

Emergency Regs Q&A #2

Q. What expanded disposition options are allowed under the emergency regulations?

A. CRTs/CRT glass may be recycled by means *other than* CRT glass manufacturing or smelting

- If recycling options don't exist, then CRTs/CRT glass may be disposed of as HW

  → Conditions apply!

18

Emergency Regs Q&A #3

Q. How are e-waste recyclers regulated if they recycle CRTs or CRT glass by means other than lead smelting, or CRT glass manufacturing?

A. They're regulated as **generators** of hazardous waste (under Chapter 12 of Title 22)

- Potential exclusions for use or reuse exist!

19

Emergency Regs Q&A #4

Q. How are e-waste recyclers regulated if they choose to dispose of CRTs or CRT glass?

A. Like generators of hazardous waste...
with a potential exclusion for CRT panel glass

20

The Bottom Line

Can e-waste recyclers dispose of certain types of CRT glass in a class II or III landfill?

→ *Yes.* CRT panel glass may be disposed in a class II or III landfill if it meets specific waste criteria and management and treatment standards

- Whole CRTs do not qualify

21

What's Next for CRT Management in CA?

- Current emergency regulations expire in October 2014
- Recycling options will be reevaluated starting early next year
- DTSC (and CalRecycle) continue to listen to industry and other BDOs on what recycling technologies may become available

22

Questions?

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California's Covered Electronic Waste Recycling System – A Closer Look

GEM Network Meeting - Sacramento

CalRecycle

July 15, 2013

This Afternoon's Topics:

- **The Covered Electronic Waste (CEW) Program**
  - **Fees & Revenue**
  - **Costs & Payments**
  - **Participants**
  - **The Recycling Claim Process**
- **Program Challenges**
  - **What to do with 100 million pounds of CRT annually?**
  - **Will current model work for other technologies?**

2

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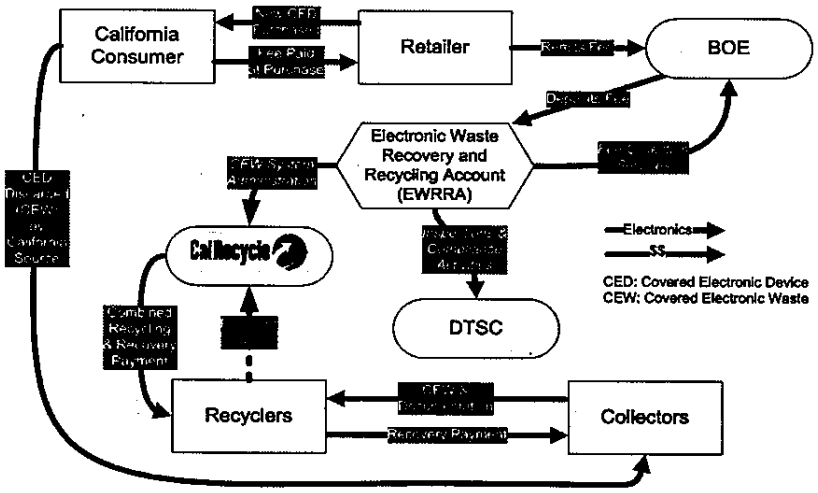
Covered Electronic Waste (CEW) Recycling System



3

CalRecycle

消費者付費
(線上購物示例)

3% of the fee for collect.

Electronic Waste Recycling Fee

Not an "ARF"

- No "trust fund" for future
- Today's revenue pays for yesterday's waste

Retailers collect fee from consumer

- Assessed on retail sales of new CEDs
- Retailers retain 3% for administrative costs
- Retailers remit funds to BOE
- Approximately 10,700 registered retailers (21,600 locations)

4

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Electronic Waste Recycling Fee

Consumer fee levels initially established in statute via Act:

- Six dollars ($6) for each covered electronic device with a screen size of less than 15 inches.
- Eight dollars ($8) for each covered electronic device with a screen size greater than or equal to 15 inches but less than 35 inches.
- Ten dollars ($10) for each covered electronic device with a screen size greater than or equal to 35 inches.

5

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Electronic Waste Recycling Fee

CalRecycle can adjust fee annually as necessary to maintain program solvency and prudent reserve

Due to solvency concerns, CIWMB acted in June 2008 to increase fee levels (effective January 2009):

- $8, $16 and $25

Due to excess reserves, CalRecycle acted in July 2010 to reduce fees to original levels (effective January 2011)

- $6, $8 and $10

Due to continuing surplus reserves, CalRecycle acted in July 2012 to further reduce fees (effective January 2013):

- $3, $4 and $5

6

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Net Costs and Payment Rates

CalRecycle must establish a recovery and recycling "payment schedule" on or before July 1 biennially

- Rates should cover the "average net cost" for a collector to collect, consolidate, and transport, and for a recycler to receive, process, and recycle, covered electronic wastes

Net Cost Reports inform CalRecycle

- Report content guided by regulation

Current payment rates: $0.23 / pound recycling; $0.16 / pound recovery

7

CalRecycle

Net Costs and Payment Rates

Comparison of Reported Costs in Cents per Pound

	2005	2006	2007	2008	2009	2010	2011
Recovery	17.1	16.7	14.8	16.6	14.4	15.3	15.2
Recycling	25.2	21.5	21.0	22.8	18.7	18.1	19.2
Total	42.3	38.2	35.8	39.4	33.1	33.4	34.4

Calculated weighted averages of operational costs reported Mar 1 of following year.

8

CalRecycle

Net Costs and Payment Rates

Reconciling "average net costs" with intent of Act may create policy questions

- –Are payment rates based on averages efficient? Fair?
  - •By definition: some paid too little, some too much
  - •Participants may charge fees if costs are not covered
- –Weighted averages reflect entire industry's cost
  - •Wide ranging business models
  - •Must be considered in context of scales and efficiencies
- –Data reflects historical costs
  - •Future markets / costs unknown

9

CalRecycle

CEW Recycling System Participation

Participation is voluntary

- – System relies on enterprise and initiative
- – Incentive? Responsibility and/or money

Who can be a participant?

- – Solid waste companies
- – Recycling companies
- – Asset management companies
- – Local governments
- – Non-Profits
- – Individuals

10

CalRecycle

CEW Recycling System Participation

Historically:

- > 1,400 total entities have participated
- < 90 local gov't have participated directly

Presently:

- ~ 550 approved collectors active
  - ~ 45 of which are local gov't
- ~ 50 approved recyclers active

11

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CEW Recycling System Participation

CalRecycle "approves" collectors and recyclers for two year terms.

- Application process
- Periodic assessment of basic compliance
- Not a permit or certification!

- Collectors
  - Notification and annual reporting
- Recyclers
  - Annual DTSC inspections

12

CalRecycle

State is Market Participant

Statutory declaration allows government to set program requirements and limitations

- Protect public funds
- Maximize in-state processing

- Participants must meet California standards
  - Jobs, environmental protection, etc
- Still must interface with global market
  - Post-processing residuals typically leave California

13

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Payment Claim Process

Review of Claim - Is it complete? Does it add up?

- Provided record of CEW recovery
  - CA source documentation
    - Collection Logs
    - Proof of Designation
  - Transfer documents

- Record of material recycling (cancelled)
- Demonstrate residuals (CRTs) shipped as required

14

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Payment Claim Process

Is it Truthful????

– Validation process

- Use of Lexis/Nexis -- Accurint
- Phone calls: *"Did you discard…?"*
- Work closely with DTSC / DOJ / CDFA

Finishing the Claim

- Courtesy opportunity to resolve deficiencies
- Claim review finalized: Approved, Adjusted, or Denied
- Accounting send to State Controllers Office for payment

– Appeals: Administrative relief

15

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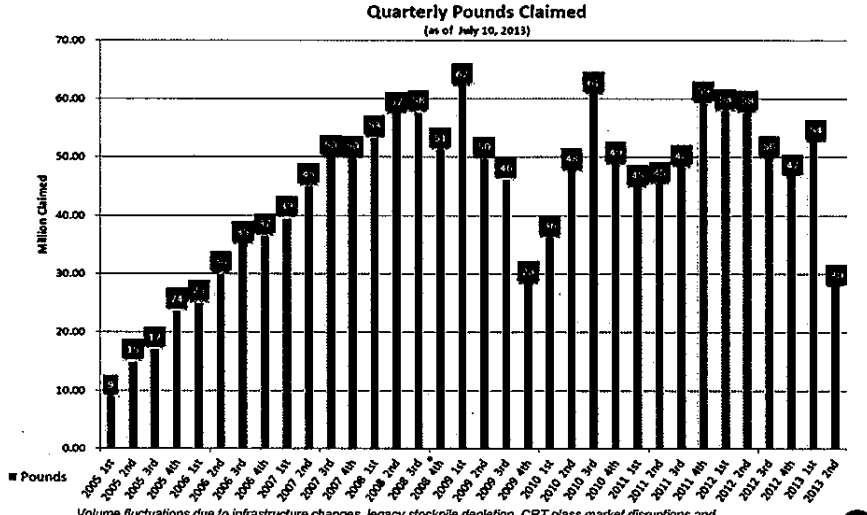
CEW Recycling Payment System Claim Volumes

- ~1.4 billion pounds of CEW claimed since program inception (as of July 2013)



Volume fluctuations due to infrastructure changes, legacy stockpile depletion, CRT glass market disruptions and claim timing. Recyclers are supposed to submit claims within 45 days after the end of a reporting month.

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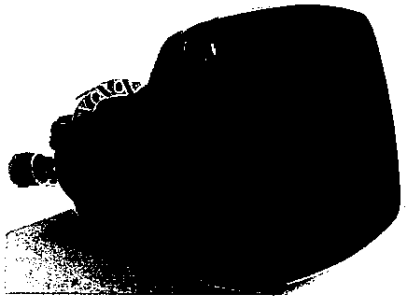
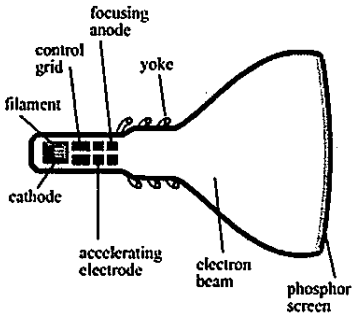
Cathode Ray Tubes (CRTs)

Composition and Components





In general:

- Funnel contains lead
- Panel contains barium

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CEW-CRT: Program Facts / Stats

98% of CEW claims are for CRT devices

– 3x increase in non-CRT in last two years

>300 million pounds of CRTs / glass "shipped" since January 2010:

– >60 million pounds to Mexico
– >80 million pounds to Arizona
– >30 million pounds to Ohio
– >120 million pounds initially to "in-state" intermediate destinations 当地的中間處理者

18

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CEW-CRT: Program Facts / Stats

Only one known CRT manufacturer available to Western glass generators

- Samtel / Videocon (India)

Only three large-scale smelters in North America consuming CRT glass

- Doe Run (Missouri)
- Teck Cominco (Canada)
- Xstrata (Canada)

New domestic lead extraction ventures reportedly in development; capacity uncertain

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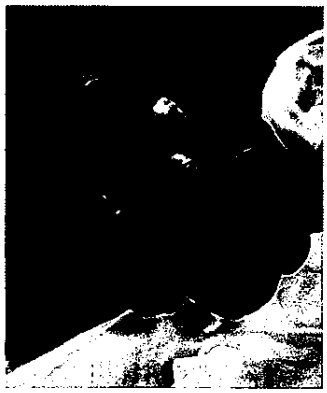
Program Challenges Today

- Viable uses for non-leaded CRT glass?
- Long-term supply of CRT glass is limited; impacts ROI
  - In-state processing capacities exist, but not final markets
  - New disposition options for residual glass are needed



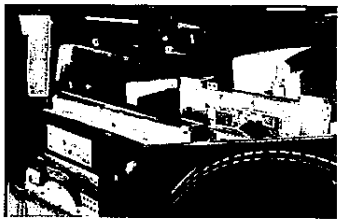
Will CEW recycling rules change to allow any CRT glass disposal?

CalRecycle

Future Program Challenges

Non-CRT CEW

- Plasma panel management advisory
- Markets for LCD residuals?
- Rare earth extraction?
- CCFL handling and treatment concerns?
- LED characteristics?



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Future Program Challenges

Can existing program model accommodate multiple technologies and market conditions?

Does artificial value (subsidy) create too much risk for a single state approach?

- Can fraud be effectively controlled?

And what about non-covered waste?

22

CalRecycle

In Summary...

California's CEW recycling program has been very successful... thus far

- Fostered robust collection infrastructure
- Provided public with opportunities

Program will need to adjust

- New laws and regulations to keep up with changing technologies and markets

Stakeholders will continue to shape policy future

- Materials covered and program model

23

CalRecycle

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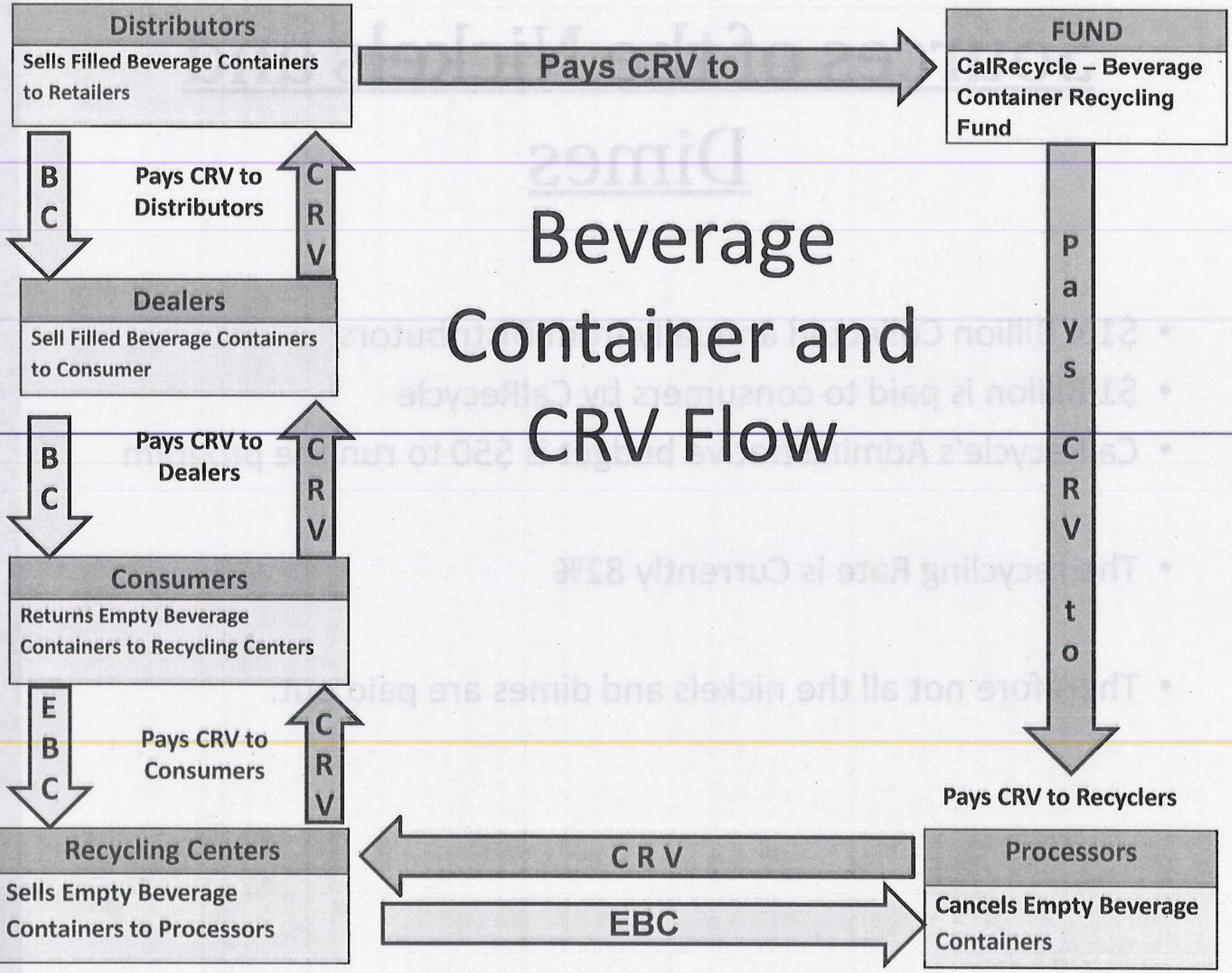
Californian Beverage Container and Litter Reduction Act

Overview of the Program
Follow all those Nickels and Dimes

Mike Miller, Chief of Operations, Division of Recycling, CalRecycle

It's about billions of Nickels and Dimes.

- $1.4 billion worth of nickels and dimes are paid to the Department annually by beverage distributors
- Consumers buy over 20 billion beverages from retail stores and pay the CRV (nickels and dimes)
- Consumer recycle the empty beverage containers and are paid by the recycling centers
- The empty beverage container material is recycled and processors invoice the state for the CRV paid to consumers
- It's a closed loop


Distributors
Sells Filled Beverage Containers to Retailers
Pays CRV to
FUND
CalRecycle – Beverage Container Recycling Fund
BC
Pays CRV to Distributors
CRV
Dealers
Sell Filled Beverage Containers to Consumer
Beverage Container and CRV Flow
BC
Pays CRV to Dealers
CRV
Consumers
Returns Empty Beverage Containers to Recycling Centers
EBC
Pays CRV to Consumers
CRV
Pays CRV to Recyclers
Recycling Centers
Sells Empty Beverage Containers to Processors
CRV
EBC
Processors
Cancels Empty Beverage Containers

Sources of the Nickels and Dimes

- $1.4 Billion Collected annually from Distributors
- $1 Billion is paid to consumers by CalRecycle
- CalRecycle's Administrative budget is $50 to run the program

- The recycling Rate is Currently 82%

- Therefore not all the nickels and dimes are paid out.

Where is the Rest of the Nickels and Dimes

California's law is unique in a serveral ways:

- Surplus Funding is used to promote public environment policy
  - Environmental and Resource Responsibility
  - ~~Producer Responsibility~~
    - Processing Fee to cover the cost of material that doesn't support its way.
  - Increased convenient redemption and recycling for consumers
    - 2700 Convenience Zones in California located near supermarkets
  - Increased recycling infrastructure and employment
    - Pet, HDPE and other plastic market development
  - Improved quality of material
    - Glass Cleaning and color sorting
  - Outreach, education and Public Relations

California spends millions for Policy Initiatives

- $35 million for convenient recycling for consumers (Convenience Zones)
- $20 million for California Conservation Corps
- $67 million for Processing Payments
- $10 million for Plastic Market Development
- $10 million for Quality Glass incentives
- $15 million for Curbside Programs
- $10 million for Cities and Counties
- Various Grants and Outreach

Program Accomplishments

- Program is very successful
- Sustaining High Recycling Rate about the goal of 80% for all material types combines
- Created thousands of jobs
- Created a sustainable Plastic Market for used beverage containers
- Assists with 85% of California Households with Curbside Recycling Centers

Loss and Fraud in the Program

- California as all other Bottle bill states has an issue with illegal redemption of beverages containers
  - As high a $40 million annually
- Other losses in the fund are systemic in the statute and regulations
  - Commingle Rates loses about $8 million annually
  - Shrink rate prescribed by law is being gamed upto $4 million annually
  - Fines and residual from Glass Cleaning
- Revenue Reporting
  - Self Reporting of Beverage Distributors and Manfactuers cause some revenue loss
  - 100 audits per year to determine proper reporting

Trends and Issues

- Issues
  - The program has run a structural Deficient $100 million annually since 2009/2010
  - Loan Repayment are keeping the program financially afloat
  - Proportional Reductions

	FY 2012-13 (Projected)	% of Revenue	FY 2012-13 (Projected) at Breakeven	% of Revenue
Redemption Fee Revenue	$1,152,628,000	100%	$1,152,628,000	100%
Program Administration *[Note 1]*	$50,588,000	4%	$50,588,000	4%
14581 Programs - Fixed *[Note 2]*	$69,562,000	6%	$69,562,000	6%
California Refund Value	**$1,070,673,000**	**93%**	**$938,193,000**	**81%**
Processing Fee Offsets *[Note 3]*	$67,430,000	6%	$59,087,000	5%
Handling Fees	$40,168,000	3%	$35,198,000	3%
Total Expenditure *[Note 4]*	$1,298,421,000	113%	$1,152,628,000	100%
Structural Deficit	($145,793,000)	-13%	$0	0%

[Note 1] - Includes Pro Rata, Fi$cal, and payments to the State Controller
[Note 2] - Curbside Supplemental Payments, Local Conservation Corps Grants, City/County Payments, Competitive Grants, Quality Incentive Payments, and Plastic Market Development
[Note 3] - Used for Processing Payments which are paid based on volume recycled
[Note 4] - Total Expenditure based on projected recycling rate of 85% and breakeven recycling rate of 75%

Trends and Issues

- Trends
  - Sales of beverages are flat overall, water and flavored water are a large growth trend in PET.
  - Consumers redemption is continuing to slowly increase, we do not forecast any decrease in the next 3 year window.
  - CalRecycle is under taking a ambitious reform of the program to address the structural deficit and improve the effectiveness

Conclusion

- California's recycling program is one of the most successful
- It is now over 26 years old, and showing signs of stress.
- Issues that need addressing
  - Structural deficit, solving the fix cost expenditures
  - Collecting all the revenue from Beverage Distributors and Manufactures
  - Creating a financial model that is sustainable into the future
  - Resources to combat fraud

Questions?

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Update on California's Covered Electronic Waste Recycling Program
Implementation of the Electronic Waste Recycling Act of 2003 (SB 20, Sher)

July 2013

All program responsibilities of the former California Integrated Waste Management Board (CIWMB) have been transitioned to the Department of Resources Recycling and Recovery (CalRecycle).

Overview

The Electronic Waste Recycling Act of 2003 (Act), as amended and as codified in the Public Resources Code (PRC) 42460, et seq, established a funding mechanism to improve and provide for the proper end-of-life management of certain hazardous electronic products. The program is funded through a fee paid by consumers of covered electronic devices (CED) at the time of retail purchase. Collected fees are remitted by retailers to the State and deposited in an account. Subsequently, payments are made to approved collectors and recyclers of covered electronic waste (CEW) to offset the average net cost of appropriate waste recovery, processing, and recycling activities.

Intent of the Act:

- Provide financial relief to responsible parties for managing covered electronic waste
- Foster cost-free recycling opportunities for consumers throughout the state
- Reduce illegal dumping
- Eliminate the stockpile of waste computer monitors/TVs
- Decrease amount of hazardous materials in covered products

Major Components of the Act:

- Assesses an electronic waste recycling fee on retail sales of covered electronic devices (CED).
- Tasks the Department of Resources Recycling and Recovery (CalRecycle) with administering a payment system for collectors/recyclers to cover the costs of recovering/recycling CEW.
- Authorizes the Department of Toxic Substances Control (DTSC) to develop regulations for the proper management (storage, collection and recycling) of discarded electronic devices.
- Requires DTSC to adopt regulations, consistent with the European Union's Restriction of Hazardous Substances (RoHS) directive, limiting the concentration of hazardous metals in covered electronic devices offered for sale in California.
- Establishes certain manufacturer responsibilities: consumer information, brand labeling, annual reporting, product design for recycling, and reduction of hazardous materials

Covered Electronic Devices (CED)

CEDs are video display devices that have been determined by the Department of Toxic Substances Control (DTSC) to be hazardous when disposed. Covered devices must have screens greater than four inches on the diagonal. Unless excluded by PRC 42463(f)(2), current covered devices include:

- Cathode Ray Tube devices
- Televisions and computer monitors containing cathode ray tubes (CRTs)
- Televisions and computer monitors containing liquid crystal displays (LCDs)
- Laptop computers w/ LCD screens
- Plasma televisions
- Personal portable DVD players w/ LCD screens

Revenue and Payment Status

CalRecycle is charged with statutory obligations to adjust the consumer fee in order to maintain fund solvency.

In July 2012, CalRecycle acted to lower the consumer recycling fee in an effort to reduce excess fund reserves. This change took effect January 1, 2013.

Annual Gross Revenue (from Governor's FY 12/13 Budget Projections):

FY 09/10 ~ $175M; FY 10/11 ~ $156M; FY 11/12 projected ~ $95M; FY 12/13 projected ~ $102M

- Consumers pay fee to retailers at time of new device purchase based on the screen size
- ***In July 2012, CalRecycle acted to adjust the fee to better manage fund reserves. Effective January 1, 2013, the fee is $3, $4, and $5, depending on screen size.***
- Retailers remit collected fees to the Board of Equalization and retain 3% for administrative costs.
- Manufacturers are required to notify retailers regarding which products are subject to the fee.

Covered Electronic Waste (CEW) Payment System (as of July 2013):

Approved Collectors: ~550 **Approved Recyclers: ~50**

- Growth in California's electronic waste collection and recycling infrastructure has been fostered by the Act and the CEW recycling payment system.
- Voluntary participants represent a diverse group: non-profits organizations, landfills, local governments and traditional e-waste collection and recycling businesses.
- DTSC inspections of recycling facilities and compliance with environmental standards are required for participant approval and eligibility to receive payments.
- The infrastructure to recover CEW also recovers substantial quantities of miscellaneous electronic waste, the handling of which is not directly funded by the CEW payment system.

CalRecycle pays approved recyclers; approved recyclers are required to pay collectors. The current combined recovery and recycling payment rate is $0.39 per pound.

Payment Statistics to Date:

- Approximately 2,590 claims submitted by recyclers for payment since January 2005
- Approximately $ 617 million (representing approximately **1.47 billion pounds** of recycled *covered electronic waste*) have been claimed through the CEW payment system since January 2005
- Mean claim size: ~$240,000; Median claim size: ~$125,000

Year to Year Comparison (based on claim reporting month):

- 2005 total 225 claims submitted: $ 31 M (~ 65 M pounds)
- 2006 total 298 claims submitted: $ 61 M (~128 M pounds)
- 2007 total 351 claims submitted: $ 89 M (~185 M pounds)
- 2008 total 412 claims submitted: $ 96 M (~218 M pounds)
- 2009 total 315 claims submitted: $ 73 M (~186 M pounds)
- 2010 total 254 claims submitted; $ 75 M (~194 M pounds)
- 2011 total 303 claims submitted; $ 77 M (~ 198 M pounds)
- 2012 total 317 claims submitted; $ 83 M (~ 212 M pounds)
- 2013 thus far ~114 claims; ~$32.5 M (~ 83 M pounds) – *Not a complete year*

CalRecycle has annually denied between 1% and 12% of moneys claimed in the CEW system due to non-compliant or significantly inconsistent documentation. Current total payment denial is about $25 million (~5% of claimed) over life of program.

Compliance Assurance and Fraud Prevention:

- CalRecycle works closely with DTSC to ensure material handling compliance. The departments had an MOU that delineated fraud investigation responsibilities. CalRecycle now works with the Department of Justice, Bureau of Investigation on fraud matters.
- CalRecycle retains broad authority to deny participation and/or payment.
- Through the FY 2012/13 Budget Act, CalRecycle secured statutory authority (SB 1018) to impose civil liabilities on persons who make false statements in documentation required by the program.

Current System Challenges

- CalRecycle must ensure that payment is made in a timely manner only for eligible and properly documented CEW; specifically through complete and verifiable payment claims, including appropriate source, collection, transfer, processing, and residual disposition documentation.
- The program must accommodate continued use (resale, reuse) as a possible destination for recovered CEW, but only pay for recycled CEW.
- The program must allow for certain instances of otherwise eligible (California-sourced) covered electronic wastes resulting from illegal abandonment and load check activities to enter the payment system while simultaneously not creating a portal for fraudulent activities.
- The use of "handlers" not directly approved in the CEW system by approved recyclers and collectors has exposed system participants to increased risk of falsified collection documentation.

Future Markets for Residual CRT Glass Uncertain:

- Residual CRT glass must be managed as a universal waste or as a hazardous waste depending on ultimate disposition of the glass; the burden of compliance is on the California glass handler.
- Recycling residual CRT glass into new CRTs has limited outlook since CRT technology is being replaced by flat screen technologies, such as LCDs.
- Smelter feedstock/flux continues to be option; but limited domestic destinations, higher cost.
- New recycling applications need to be explored, vetted; disposal may need to be considered.

Costs of Managing Non-CRT CEW:

- Approximately 99% of CEW claimed since 2005 has been CRT devices; however program now is seeing increasing amounts of non-CRT devices, which have different recycling economics.

Non-CEWs: How Best to Manage Rest of E-waste Stream?

- Mixed e-waste (non-CEW) volumes are substantial and in aggregate have nominal value.
- CEW collectors and recyclers are expected by consumers to handle mixed e-waste at no cost.
- No State-level restrictions exist on wholesale export of miscellaneous e-waste; however substantial domestic processing and "de-manufacturing" is occurring.
- All e-waste handlers/processors are required to report activities, including exports, to DTSC.

Other Program Implementation Activities

Regulations:

- The Office of Administrative Law (OAL) approved emergency regulations issued by CalRecycle relating to fee level changes in fall 2012, with new fee levels effective January 1, 2013.
- DTSC issued new emergency regulations for residual CRT glass management effective October 15, 2012, that potentially created pathways to non-traditional recycling applications and the possibility of proper disposal, as well as established more stringent disposition documentation.
- If necessary, CalRecycle will engage in emergency rulemaking pursuant to the Act to address changes in CRT market conditions and new management rules promulgated by DTSC.
- CalRecycle will soon begin working on emergency regulations to implement new administrative authorities to impose civil liabilities of persons who make false statements (PRC 42474(d)).

Recent Legislation:

- Four bills were introduced in the 2011/12 session relating to electronic waste management – AB 549, AB 583, AB 794, and AB 960. AB 549 passed. (http://www.leginfo.ca.gov/index.html).
- Two bills have been introduced in the 2013/14 session relating to electronic waste management – AB 1022 (Eggman) and AB 468 (Chesbro).

Annual Net Cost Reporting

- Program participants must report annually on costs to handle and process CEWs if so directed by CalRecycle. This information is used to inform CalRecycle in fulfilling its obligation to adjust payment rates.
- CalRecycle determined in June 2012 that Net Cost Reports covering 2011 operations indicated that no changes should be made to the existing payments rates.
- Net Cost Reports covering 2012 operations were required to be submitted by all CEW program participants on or before March 1, 2013.
- Under existing statute, the next opportunity for CalRecycle to make changes to the payment rates (schedules) will be July 1, 2014.

Other States and Federal Government:

California is monitoring activity on the national level. Approximately two dozen states have passed legislation, all taking more of a producer responsibility approach. A large CEW program challenge -- ensuring payment only for California material -- would be minimized or eliminated by a national-level program. However, any national system should provide cost relief to local governments and not contradict the hazardous waste/universal waste management standards adopted by DTSC. The Act specifies conditions under which a national program would preempt the Act (PRC 42485 (a)).

Outreach and Other Resources:

- CalRecycle maintains a public oriented web address (www.eRecycle.org) to inform the public on environmental matters associated with the management of electronic waste, including a directory of recycling opportunities throughout California.
- The Board of Equalization website contains Frequently Asked Questions, registration information and registration forms. (www.boe.ca.gov/sptaxprog/ewaste.htm)
- The Department of Toxics Substances Control website contains information on covered devices, hazardous waste management standards, and regulatory requirements. (http://www.dtsc.ca.gov/HazardousWaste/EWaste/)

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***Comments on Quarterly Claim Chart (Next Page)**

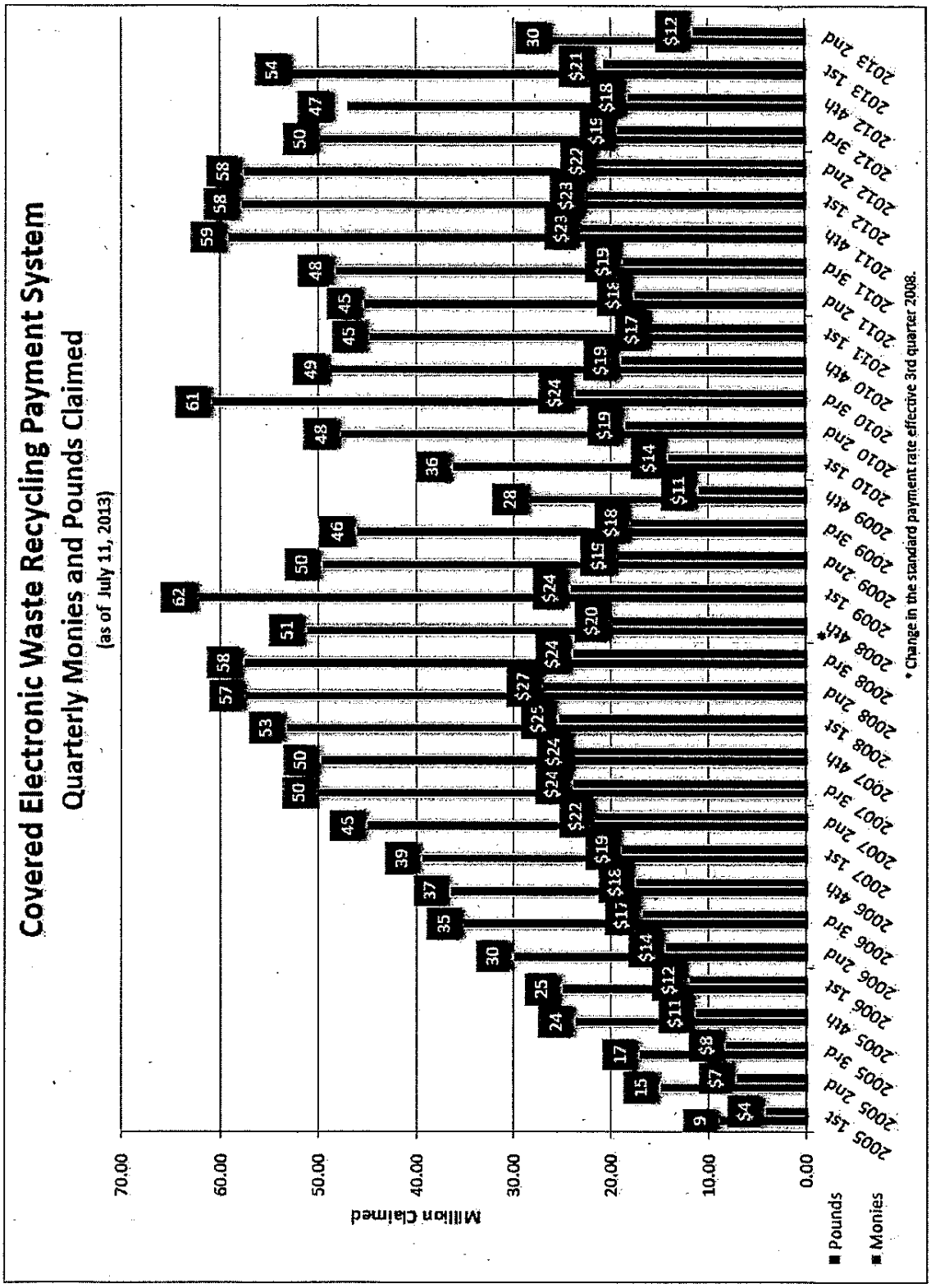
The depiction of claim volumes in the chart reflects the general growth of the program since its inception in January 2005. Factors affecting the fluctuating volumes in the program include infrastructure development, a lowered payment rate (effective July 2008), economic uncertainty, the digital television broadcast transition in the first half of 2009, and the fundamental availability of recycling opportunities over the past five years that has recovered much of the legacy stockpile.

Recyclers must ship CRT glass to qualifying destination prior to submitting a claim. CRT glass market disruptions in October 2009 involving Mexican destinations dramatically impacted claim submittals beginning 4th quarter 2009. The industry has recovered somewhat, but ongoing CRT glass market uncertainties may be impacting recyclers' ability to submit claims regularly.

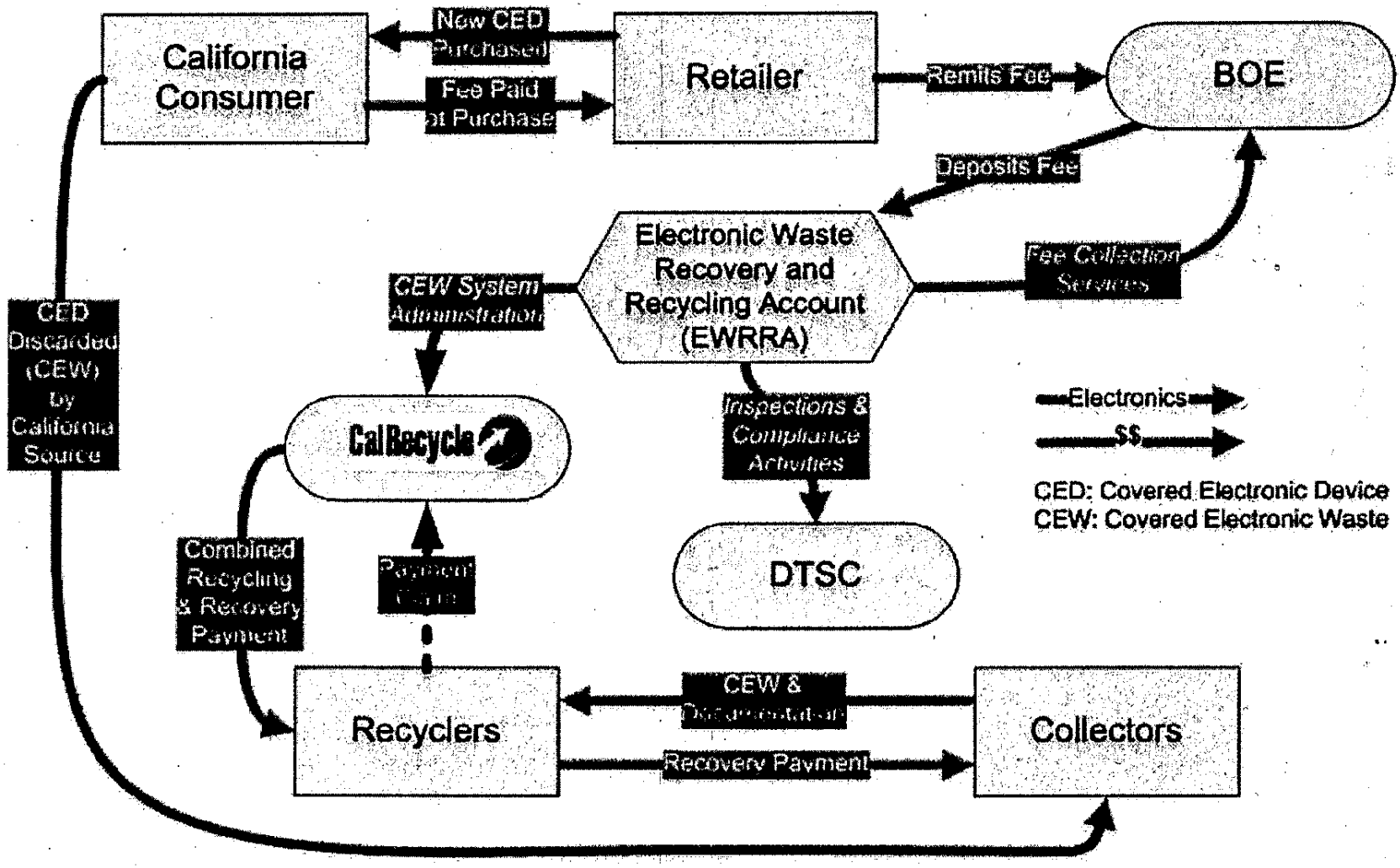
Recyclers are required to submit claims within 45 days of the end of a claim reporting month, which leads to a delay in the tracking of program volumes. For instance, May 2013 claims aren't technically due until approximately July 15, 2013. However, it is not uncommon for recyclers to incur market conditions that can delay a claim submittal and CalRecycle has yet to enforce on this requirement.

Question concerning this document may be directed to Jeff Hunts, Program Manager, at (916) 341-6603 or jeff.hunts@calrecycle.ca.gov

(* See Chart Comments on Previous Page)


Covered Electronic Waste Recycling Payment System
Quarterly Monies and Pounds Claimed
(as of July 11, 2013)
Million Claimed
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Pounds
Monies
* Change in the standard payment rate effective 3rd quarter 2008.

Covered Electronic Waste (CEW) Recovery & Recycling Payment System



2011 Evaluation Report on the Minnesota Electronics Recycling Act

Minnesota Pollution Control Agency

December 2011

Legislative charge

Minn. Stat. §§ 115A.1320 sub. 1(e) and (c)

On or before December 1, 2010, and each year thereafter, the agency shall provide a report to the governor and the Legislature on the implementation of sections 115A.1310 to 115A.1330. For each program year, the report must discuss the:

- total weight of covered electronic devices recycled and a summary of information in the reports submitted by manufacturers and recyclers under section 115A.1316
- various collection programs used by manufacturers to collect covered electronic devices; information regarding covered electronic devices that are being collected by persons other than registered manufacturers, collectors, and recyclers; and information about covered electronic devices, if any, being disposed of in landfills in this state.
- a description of enforcement actions under sections 115A.1310 to 115A.1330

The agency may include in its report other information received by the agency regarding the implementation of sections 115A.1312 to 115A.1330.

The agency is to annually review and if necessary, recommend changes to the value of the following variables that contribute to effective functioning of the act: the proportion of sales of video display devices sold to households that manufacturers are required to recycle; the estimated per-pound price of recycling covered electronic devices sold to households; the base registration fee; and the multiplier established for the weight of covered electronic devices collected.

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Minnesota Pollution Control Agency

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Summary

The Minnesota Electronics Recycling Act was enacted in May 2007 to address the increase in the amount of waste electronics generated in Minnesota and the rising costs associated with properly managing waste electronics. The Minnesota Pollution Control Agency (MPCA) evaluation of the act for program year four (July 1, 2010-June 30, 2011) indicates that the amount of e-waste recycled has remained steady. The number of registered collectors and recyclers did increase from the prior program year, but the majority of recycling is done by a few processors. Manufacturers again recycled beyond the obligation, and the number of recycling credits held by manufacturers continues to increase. Finally, MPCA's enforcement activity increased, however, this was primarily for those entities such as collectors and recyclers that did not report or register by the annual due date.

Overview of the act

The law is premised on a producer responsibility approach that engages the manufacturers of certain electronic products in the collection and recycling of waste electronics. By internalizing the costs of end-of-life management, this more economically efficient approach to providing collection and recycling takes steps towards incentivizing the manufacturers to implement design for environment practices such as design for recyclability and other techniques to reduce cost.

The act establishes an obligation for manufacturers of video display devices (household televisions, computer monitors, and laptops) to collect and recycle 80 percent by weight of their products sold in Minnesota.

To meet this recycling obligation, manufacturers are able to apply a broader range of products called covered electronic devices (CEDs) including computers and peripherals, printers, facsimile machines, DVD players, and video cassette recorders in addition to video display devices (VDDs) to meet their obligations. To encourage collection in Greater Minnesota, an additional 0.5 lb. credit is offered for CEDs collected outside the 11-county metropolitan area (Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright).

The law establishes responsibilities for the Minnesota Department of Revenue and the MPCA, the two state agencies charged with oversight duties. Manufacturers report to the Department of Revenue by September 1 of each year. The department compiles and reviews the data submitted: total weight of video display devices sold to households, how manufacturers met their recycling obligation, and calculations of recycling credits.

The MPCA administers the Minnesota Electronics Recycling Act. Collectors and recyclers report and register with the MPCA by July 15 of each year and manufacturers register with the MPCA by September 1 of each year. MPCA staff review the compiled data submitted by collectors and recyclers on the total weight of CEDs collected and recycled; calculate estimated sales of video display devices sold to households during the preceding program year, based on national sales data; and manage the electronic waste account that includes manufacturer base registration fees and recycling fees.

The law caps the amount of credits that can be applied to an annual obligation. A manufacturer may meet only 25 percent of their program year obligation through the use of recycling credits.

Program year comparison

A program year runs from July 1 through June 30 of the following year. The most recent data available are from program year 4, ending June 2011.

	PY1/FY08	PY2/FY09	PY3/FY10	PY4/FY11	
Recycled per capita, statewide (pounds)	6.5 lbs.	5.7 lbs.	6.5 lbs.	6.2 lbs.	Supply
CEDs recycled (pounds)	33.6 million	30.3 million	34.7 million	33.0 million	
Conversion: program pounds*	41.8 million	36.5 million	41.4 million	38.4 million	
VDD sales (pounds)	25.6 million	31.2 million	29.2 million	26.9 million	Demand
Manufacturer recycling obligation (program pounds)	15.3 million (60 percent)	25.0 million (80 percent)	23.4 million (80 percent)	21.5 million (80 percent)	
Purchased: program pounds (and actual pounds)	32.7 million (28.0 million)	29.1 million (24.3 million)	33 million (28.7 million)	31.5 million (27.7 million)	
New recycling credits: net change**	17.6 million	5.1 million	10.5 million	10.2 million	Credits
Recycling credits available at program-year-end	17.6 million	22.7 million	33.2 million	43.4 million	

*Program pounds reflect 1.5x multiplier applied to pounds collected outside of the 11-county metropolitan area

**Recycling credits have the same value as program pounds, but their use was restricted starting in PY3

Collection

Registered collectors are public or private entities that receive covered electronic devices from households and arrange for delivery of the devices to a registered recycler. Collectors report annually on the total pounds of covered electronic devices collected during the program year and where those pounds were sent.

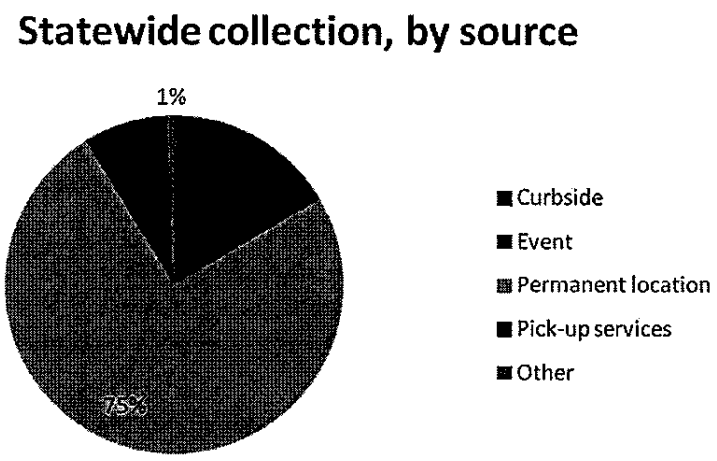
Registered collectors

The following table illustrates the number of registered collectors by program year and the counts of permanent collection locations in the 11-county metropolitan area and Greater Minnesota.

	Registered collectors	Permanent collection sites	
		11-county metropolitan area	Greater Minn.
PY5/FY12	214	118	157
PY4/FY11	229	113	158
PY3/FY10	207	90	148
PY2/FY09	181	N/A	127
PY1/FY08	177	N/A	136

While permanent collection sites account for 75 percent of the actual pounds collected, residents also have the opportunity to drop off devices through events, pick-up services and mail back services. One goal of the

program is to reduce the cost of recycling for Minnesota households. When searching for options, residents need to take fees, location and convenience into consideration. A variety of collection opportunities are offered by both local government programs which are subsidized with taxes or environmental fees as well as those offered by private businesses. Some local governments charge per item, while others may offer no fee recycling, but this is being subsidized by taxes or environmental fees. Retailers such as Best Buy, Office Depot and Staples offer collection as a service to customers. In fall 2011, Best Buy started accepting e-waste at no charge at their 28 stores in the state.



Another option is to access different programs based upon the brand of the device. Many registered manufacturers offer take-back programs, such as mail back options, for their brands and other brands as well. Some accept their brands for free and provide shipping, while others require payment for shipping. One notable manufacturer program is the Apple Recycling Program, which accepts all brands at no charge, including shipping.

Some collection sites also accept certain brands at no charge. For example, Waste Management of Minnesota collection sites will accept Sony and LG devices, while Electronic Manufacturers Recycling Management (MRM) listed sites will accept Mitsubishi, Panasonic, Sanyo, Sharp, Toshiba and VIZIO.

Collection in Greater Minnesota. To encourage collection activities in Greater Minnesota, the act provides a multiplier of an additional 0.5 pound to be applied to each pound collected outside of the 11-county metropolitan area (Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington and Wright). About fifty percent of the collection opportunities available in Greater Minnesota are offered by local governments.

Collection data

The following table illustrates the weight of waste electronics collected in Minnesota. The data indicates that the distribution of the weight collected between the Non-Metropolitan Area and the Metropolitan Area is consistent with the population distribution between the two regions.

Minnesota's PY3 per-capita collection rate of 6.7 lbs. compares favorably with other leading states, such as Oregon (6.3 lbs), Washington (5.9 lbs) and Wisconsin (4.2 lbs.).

	Metro	Non-metro	Statewide	Program pounds*
PY4/FY11	22.2 million lbs.	11.1 million lbs.	33.3 million lbs.	38.9 million lbs.
PY3/FY10	21.1 million lbs.	14.5 million lbs.	35.6 million lbs.	42.9 million lbs.

*Program pounds reflect 1.5x multiplier applied to pounds collected outside of the 11-county metropolitan area

Role of local government

Some local governments in Minnesota have elected to collect household e-waste as a service to their residents and then contract with registered recyclers for the actual processing of the devices. Some local governments provide this service due to a lack of collection options provided by other entities, to divert heavy metals from waste to energy facilities, or because a facility was already available and collecting household hazardous waste.

Local governments have the opportunity to enter into contracts with recyclers to recover a portion of costs involved with collection. Statewide, local governments collected nearly half (49 percent) of covered electronic devices in program year 4, offering a mix of permanent collection sites, special events for residents, and curbside recycling.

Local government collection efforts demonstrate that Minnesota residents want to recycle their waste electronic devices. The permanent sites and event collections offer convenient locations for residents where they can usually also bring other non-waste electronics to recycle. The MPCA recognizes the value of local government collection, but will continue to communicate with local government leaders to encourage evaluation of other collection options.

The following examples illustrate the costs borne by local governments for collection and the financial arrangements with recyclers that offset, to varying the degrees, those costs.

Metropolitan Area

Among metropolitan counties registered to collect covered electronic devices, most recover some of their costs from recyclers who work with manufacturers. With reported costs of $1.6 million, counties covered nearly half using revenue from contracts with recyclers that sold the recycled pounds. Public collection is subsidized through various fees, such as solid waste tip fees or disposal fees charged to residents using the service.

County	Pounds CED collected (CY2010)	Recycling and transportation cost*	Share of costs recovered, by source		
			Recyclers/ manufacturers	Consumer recycling fees	Not recovered
Carver	513,193	$73,115	40%	39%	21%
Dakota	1,384,407	$301,000	12%	0%	88%
Hennepin	5,867,854	$978,266	68%	0%	32%
Scott	110,425	$21,283	0%	100%	0%
Washington	1,504,255	$230,091	33%	0%	67%

*Does not include labor and facilities cost

Hennepin County collects an average of 5.8 million pounds of covered electronic devices (CED) annually from two year-round drop-off facilities (Bloomington and Brooklyn Park), Minneapolis curbside collection, Household Hazardous Waste events and city cleanup/recycling days. The consumer electronics program is one component of the Hennepin County Solid Waste System financed through solid waste tip fees and hauler fees. Residents do not pay additional fees when dropping off consumer electronics at county sites. In 2009 and 2010 it cost the county an average of $1 million per year to process CEDs, not including hauling, labor and facility costs.

Since 2009, Hennepin's recycling provider has increased the proportion of pounds sold to manufacturers from 51% to 87% of the total, which corresponds to an increase in the proportion of processing costs recovered from manufacturers from 36% to 68%. In 2010 the amount of CED processing costs not recovered through the program was 32%, or $311,355. In addition, Hennepin County collects an average of 725,000 pounds per year of consumer electronics which are not CED as defined by the law, for which the county assumes the full cost of processing, an average of $145,000 annually.

Washington County has an Environmental Center for year-round drop-off in Woodbury where county residents can recycle electronics at no charge, with the cost partially subsidized by county taxpayers. Washington County collected over 1.5 million pounds last year. In 2010 it cost the county $230,091 to manage the recycling and transportation of these pounds, not including additional costs for labor and the facility. The county was able to recover 33 percent of these recycling costs from the eventual sale of recycled pounds by their recycler, leaving the county to pay the balance ($154,986).

Dakota County has The Recycling Zone for year-round drop-off in Eagan where county residents can recycle electronics at no charge, with the cost subsidized by environmental fees. In 2009 the electronics collection was operated by Gopher Resources, so the county does not have cost data prior to 2010. In 2010 Dakota County collected 1.4 million pounds and it costs the county $301,000 to manage the recycling and transportation of these pounds, not including the additional costs for labor and the facility. The county was able to recover 12% of those costs from the manufacturers with 88% not recovered, or $263,649.

Carver County operates an Environmental Center for year-round drop-off in Chaska where county residents can recycle electronics. Residents bringing in televisions and monitors are charged $5, but the rest of the e-waste is collected with no end-of-life fee, and thus partially subsidized by the tax payers. Carver County has collected around 500,000 pounds per year. In 2010 it cost the county $73,115 to manage the recycling and transportation of these pounds, not including the additional costs for labor and the facility. From 2009 to 2010 the recycler decreased the amount sold to manufacturers from 100% to 78%. With this drop and additional $5 for TVs and monitors in 2010, 40% was recovered from manufacturers, 39% was recovered from the fee and 21% was not recovered, or $15,760.

Scott County has a Household Hazardous Waste facility for year-round drop-off in Spring Lake Township (east of Jordan) where county residents can recycle electronics for a fee, ranging from $3-$40 per item, depending upon the size and type of device. Scott County has collected around 100,000 pounds per year. In 2010 it cost the county $21,283 to manage the recycling, transportation and labor of these pounds, not including the additional cost for the facility. The fee charged to residents at drop-off has covered the costs of the program. Scott County did not recover any costs from manufacturers.

Non-metropolitan Area

While most of the metropolitan counties recover some of their costs from recyclers who work with manufacturers, Crow Wing and St. Louis County receive a set amount of pounds that will be recycled for free that is known at the start of the program year. Their recyclers also work with manufacturers in order to offer this to the counties. The data below show that costs are not recovered from recyclers and manufacturers like it is with some metropolitan counties; rather, savings occur from a set amount of pounds recycled for free or through consumer recycling fees.

County	Pounds CED collected (CY2010)	Recycling and transportation cost	Total CEDs cost*	Share of cost recovered, by source		
				Recyclers/ manufacturers	Consumer recycling fees	Not recovered
Becker	178,000	$26,289	$26,289	0%	55%	45%
Crow Wing	295,980	$15,830	$31,252	0%	94%	6%
St. Louis	565,875	$0	$31,805	0%	26%	**74%

*Includes labor and facility costs

**St. Louis County receives free recycling and transportation through their recycler, so this only represents costs not recovered for labor and facilities.

Becker County has a transfer station just north of Detroit Lakes with a covered container for recycling electronics, therefore reducing the facility costs that many counties have. This site accepts all electronics, but charges $5 for TVs and monitors. In 2010 Becker County collected 178,000 pounds. With an increase in pounds collected in 2010, the recycling and transportation costs increased from $4,087 to $26,289, not including labor costs. In 2009 the recycling fee covered the costs of recycling and transportation, while in 2010 it covered 55%. This left 45% not recovered, or $11,949.

Crow Wing County has a year-round storage facility in Brainerd that charges a flat $5 fee per e-waste item. Crow Wing County has collected around 285,000 pounds per year. In both 2009 and 2010, the county has received a set amount of pounds for free from the recycler. In 2010 it cost the county $31,252 to manage the recycling, transportation, labor and facility costs. 94% of this was recovered through the $5 fee and 6% was not recovered, or $1,892.

St. Louis County has ten collection sites for waste electronics and charges $1 for small CRTs (screens up to 20") and $2 for larger. St. Louis County collects almost 600,000 pounds per year. In 2010 it cost the county $31,805 to manage the labor and facility costs, with 26% of that covered with the disposal fees. With St. Louis County contracting with a vendor at the start of the e-waste program, there is no recycling or transportation cost.

In conclusion, local governments offer collection opportunities that are convenient for their residents, but the data show this service is a cost borne by the taxpayers. The cost varies depending upon the agreement with the recycler, with the metro counties not able to recover 47 percent of their costs in calendar year 2010. While local governments hope to completely cover their costs with a recycler who works with a manufacturer or through consumer recycling fees, MPCA will communicate with local government leaders to encourage evaluation of other collection options.

Recycling

Registered recyclers are public or private entities who accept household covered electronic devices from registered collectors for the purpose of recycling. The recyclers report annually on the total pounds received and recycled during the program year.

Registered recyclers

The number of recyclers registered in Minnesota has remained steady for each of the program years, but reporting continues to indicate that the majority of the recycling is done by a few processors. An analysis of program year four recycler reports indicates that the top ten recyclers accounted for 95 percent of the pounds recycled with the top three processing 72 percent of the total weight processed.

	Registered recyclers
PY5/FY12	71
PY4/FY11	77
PY3/FY10	59
PY2/FY09	52
PY1/FY08	55

This past program year also saw a movement toward recyclers obtaining certifications for environmentally-sound management practices, including e-Stewards and R2 (Responsible Recycling). This is driven by concerns regarding the final disposition of waste electronics, including the media attention devoted to processing practices overseas, as well as desire for greater oversight on domestic recycling operations. There are currently three recycler facilities located in Minnesota certified with e-Stewards and four with R2. (Registrations as of November 30, 2011.)

Recycling data

The weight of covered electronic devices collected for recycling during each of the four program years of the Minnesota Electronics Recycling Act continues to show that there is a significant amount of material still available from households. The switch to digital television in June 2009 was anticipated to result in a temporary increase in recycling of televisions; however, the overall weight of e-waste collected has not decreased.

The table presents the actual weight of recycled covered electronic devices collected from households in Minnesota for each program year.

	Pounds recycled	Pounds per capita	Pounds per household
PY4/FY11	33 million	6.2	15.8
PY3/FY10	34.7 million	6.5	16.4
PY2/FY09	31 million	5.9	14.8
PY1/FY08	33.6 million	6.4	16.1

It is important to note that the law does not require recyclers to report the weight of recycled waste electronics by product type. Thus, the MPCA is not able to determine, for instance, how much of the recycled e-waste weight was composed of televisions.

Manufacturer registration and reporting

Manufacturers report annually to the Minnesota Department of Revenue on their program year sales of video display devices (VDD) to households in Minnesota and how they met their recycling obligation (80 percent, by weight, of these Minnesota sales). An analysis of the annual reports for program years 1 through 4 demonstrates prominent trends:

- By weight, the manufacturers' recycling obligation is lower than the available pounds that are recycled; total recycling obligation is 54 percent of the total program pounds recycled.
- Manufacturer purchases of recycled pounds have far exceeded their recycling obligation for each program year (an average of 50 percent above obligation for program years 1 through 4). This has generated a large amount of recycling credits.

Addressing this imbalance of supply of recycled pounds and manufacturer demand for them is a significant challenge articulated by many program stakeholders.

Registration fees

Manufacturers remit a registration fee each program year based on their sales of video display devices in the previous program year:

- $2,500 for companies with sales of 100 or more units to Minnesota households
- $1,250 for companies with sales of fewer than 100 to Minnesota households.

These base registration fees, paid to the Minnesota Department of Revenue, are dedicated to funding the state agency responsibilities under the act. The Minnesota Electronics Recycling Act is managed by one FTE for implementation and oversight activities under the act, along with a 0.75 FTE for compliance and enforcement. Additional annual costs include $16,500 to the Department of Revenue for managing manufacturer reporting and registration and an estimated $15,000 for market share data and analysis as required under the act.

	Registered manufacturers	Base registration fees
PY5/FY12	*68	*$ 152,500
PY4/FY11	78	$ 161,250
PY3/FY10	71	$ 151,250
PY2/FY09	72	$ 151,250
PY1/FY08	80	**$ 310,000

*As of Nov. 30, 2011

**Registration fees for the first program year were higher to cover start up costs: $5,000 (est. sales of 100+ VDD) and $1,250 (less than 100 VDD).

The data show that the base registration fees have remained consistent.

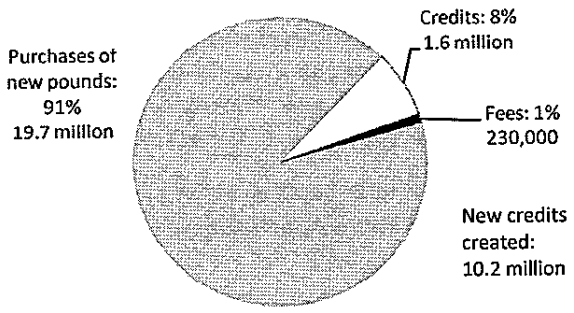
Sales and recycling obligation

In program year 4 (PY4), the overall weight of VDD sales dropped for the second consecutive year, with recycling obligation of 21.5 million pounds. At the same time, manufacturer reports to the Department of Revenue show the number of devices increased; this reflects changes in technology toward devices which are generally lighter, with a notable increase in the sales of mobile devices.

As allowed under Minnesota's law, manufacturers can meet their recycling obligation through a combination of three options:

- purchases of eligible pounds of recycled CED
- recycling credits (manufacturer's use limited to 25 percent of their PY recycling obligation)
- recycling fees; per-pound fee charged to the manufacturer

Meeting PY4 obligation



Purchases of recycled pounds

Manufacturer purchases of recycled pounds represent the largest share of recycling obligation; in program years 3 and 4, purchases of recycled pounds were at least 90 percent.

Combined with the use of recycling fees and recycling credits, manufacturer purchases of new pounds far exceed the recycling obligation each program year. In turn, this generates new recycling credits.

Recycling fees

In keeping with the underlying premise of flexibility for stakeholders, the program permits manufacturers to remit a fee to fulfill their obligation. The recycling fee is also assessed to manufacturers that did not meet their full obligation:

- Met 90 percent or more of their obligation: $0.30 per pound of shortfall.
- Met 50 to 89 percent of their obligation: $0.40 per pound of shortfall.
- Met less than 50 percent of their obligation: $0.50 per pound of shortfall.

	Total recycling fees paid by manufacturers	Manufacturers paying fees
PY4/FY11	$83,720	21
PY3/FY10	$233,142	27
PY2/FY09	$120,320	26
PY1/FY08	$219,855	24

Manufacturers have used recycling fees to meet recycling obligation each program year, from 1 to 3 percent. MPCA would prefer to see manufacturers purchase eligible recycled pounds from registered stakeholders, rather than paying fees. To this end, the program has worked to foster greater communication between stakeholders with pounds to sell and manufacturers that need them to meet their recycling obligation.

Recycling credits

Recycling credits are generated when manufacturers exceed their program year recycling obligation; for each extra program pound purchased, manufacturers receive a credit that they can apply to meet a future obligation.

In the first program year, manufacturer purchases of recycled program pounds were more than double the recycling obligation, creating 17.6 million recycling credits. Concerns about reduced manufacturer purchases of pounds in the following program year (PY2) led to a change in the statute that limits a manufacturer's use of recycling credits to 25 percent of their program year obligation. This means for

every "pound" of credit used, a manufacturer needs three pounds obtained through new purchases or recycling fees, ensuring demand for pounds recycled each program year.

Since this amendment went into effect, recycling credits have been used to meet just 8 percent of the obligation in program years 3 and 4; new purchases have exceeded obligation, generating still more credits each program year. The total available for program year 5 is 43.4 million. The Department of Revenue reports that 68 percent of the credits are held by two manufacturers.

While manufacturer purchases have consistently exceeded recycling obligation, they are still, on average, just 80 percent of the program pounds available each program year.

	Manufacturers holding credits	Credits available	Credits used	Net change
PY5/FY12	43	43.4 million	N/A	N/A
PY4/FY11	39	33.2 million	1.6 million	10.2 million
PY3/FY10	35	22.7 million	1.8 million	10.5 million
PY2/FY09	42	17.6 million	16.9 million	5.1 million

Other program activities

The MPCA manages many activities that contribute to the efficient function of efforts under the act.

Grant program

In an effort to ensure collection occurs in Greater Minnesota, the act authorizes the MPCA to offer a competitive grant program, funded from manufacturer fees, for counties outside of the eleven-county metropolitan area. The MPCA issued a request for proposals during 2011 and awarded a total of $129,890 to fund three grant proposals: Polk County, Cass County, and the East Central Solid Waste Commission. Results are expected in 2013.

The MPCA also issued a request for proposals during 2011 for market development for plastic and/or other components from e-waste. This request for proposals was for projects to develop markets in Minnesota for components of e-waste, including plastic. The agency did not receive any submissions.

Compliance and enforcement activity

The act established annual deadlines for registration and reporting by collectors, recyclers, and manufacturers. There were six forgivable administrative penalty orders (APO) sent out after August 1, 2011, to collectors and recyclers for noncompliance with the deadlines to register and/or report.

Additionally, the compliance and enforcement staff conduct inspections and investigate citizen complaints, as well as initiate enforcement cases related to any violations. This is not a requirement under the household e-waste program. There were ten new enforcement cases for mismanagement and abandonment and three additional inspections conducted that were in full compliance. The citizen complaints were addressed quickly.

Outreach to affected parties was also conducted to clarify the operating requirements for collectors and recyclers.

MPCA activity to promote consistency

The MPCA recognizes the importance of identifying opportunities to promote consistency with other states' programs, particularly with those in the Midwest. To that end, the MPCA is an active member in the Electronics Recycling Coordination Clearinghouse (ERCC), an organization created as a forum for the states with electronics recycling programs to exchange information and learn from each other's experience with implementation. A key function of the ERCC is to identify opportunities for program consistency as well as serve as a venue for discussion with manufacturers, retailers, haulers and others along the product chain.

There are now 25 states with e-waste laws. Among states with provisions similar to what is in place in Minnesota, these recent statutory changes are especially relevant to the Minnesota program.

- Illinois expanded the scope of obligated products to include televisions, monitors, printers, computers (including tablet computers), electronic keyboards, facsimile machines, videocassette recorders, portable digital music players, digital video disc players, video game consoles, small scale servers, scanners, electronic mice, digital converter boxes, cable receivers, satellite receivers and digital video disc recorders.
- Oregon added printers and peripherals as covered products in 2015 and allows credits for pounds collected over the minimum goal for programs.

Recommendations for legislative consideration

As required by the law, the MPCA issued recommendations in the 2010 Evaluation Report to address specific shortcomings of the functioning of the Act. None of these recommendations were enacted by the Legislature in 2011. The following recommendations seek to improve the efficient functioning of the act.

Recommendation 1: Include desktop computers, desktop printers, digital video recorders (DVRs), set-top TV boxes, video game consoles and DVD players in the obligation

Rationale: Expanding the scope of products that determine manufacturers' obligation serves several important objectives for the program. First, this would more closely align the list of obligated products with the purchasing habits, and ultimately recycling needs, of Minnesota residents. Second, it enhances convenient collection opportunities for Minnesota residents for products that are used in a typical household. Finally, the expansion of the number of obligated products will serve to address the imbalance between the weight-based obligation of manufacturers and the weight of products that is entering the collection and recycling infrastructure. Of particular importance is the trend toward smaller and lighter weight products that are being purchased by Minnesota residents. This is illustrated by program year 4 data that indicate the total weight is going down while the number of units sold is increasing. There was an increase in VDDs sold to Minnesota residents from 1,329,820 in program year three to 1,453,588 in program year 4.

The products identified, with the exception of DVRs, set-top TV boxes and video game consoles, are currently included in the program as covered electronic devices (CEDs) but do not count towards establishing the manufacturers' obligation. In effect, adding these products to the list of obligated products will create a level playing field in terms of what constitutes the obligation and what is collected.

Impact: Based upon Wisconsin's experience, the MPCA estimates that adding desktop computers and desktop printers would increase manufacturer obligation by 28% (by weight). Other impacts:

- Add a number of new large manufacturers, notably in printers. Comparing Wisconsin's E-cycle program, this would add printer manufacturers that currently aren't registered with our program. Comparing New York's e-waste program that includes all of the recommended products and a minimum screen size of four inches discussed in recommendation 2, there are around 100 registered manufacturers, which could add another thirty to our program.
- Add obligated device types to the reporting of several of the major manufacturers already registered.
- Would not add to the eligible devices collected for recycling (old CED).

Recommendation 2: Reduce the minimum screen size requirement for video display devices to four inches.

Rationale: Reducing the screen-size requirement will accomplish two objectives of the program. The first is to ensure a level playing field for manufacturers. Several products, most notably laptops, are now sold with a screen size smaller than nine inches. Secondly, the screen-size reduction will also be consistent with the video display device screen-size requirement in most states. Out of the 25 states with e-waste programs, 15 have screen sizes of 4 inches or larger and 5 don't have a minimum screen size.

Recommendation 3: Change the concurrent program year obligation to be based on the previous program year sales of obligated products.

Rationale: The proposed change will provide more certainty to all parties involved in the program regarding the annual collection target for a particular year since it is based on actual data. This is similar to Wisconsin's e-cycle program where manufacturer obligation is based upon sales from two years ago.

Recommendation 4: Remove registration fee requirement for manufacturers who sell fewer than 100 video display devices.

Rationale: Even though Minnesota has a comparatively low registration fee of $1,250 for manufacturers who sell fewer than 100 video display devices, the fee may be onerous for those who only sell a few devices in the state. The Wisconsin E-cycle program does not charge a registration fee for manufacturers who sell less than 25 devices, while New York does not require registration for manufacturers who sell fewer than 1,000 units of covered electronic equipment.

Impact: The Minnesota Department of Revenue estimates a $25,000 loss in registration fees based upon manufacturers that reported fewer than 100 units sold in program year 4, which would be offset with additional manufacturers added with recommendations one and two.

A benefit would be a decrease in staff time used for compliance and enforcement.

Recommendation 5: Eliminate six-month grace period for retailers selling brands where the registration has expired.

Rationale: The intent was to have the six month grace period for retailers when the program started in 2007 to help them with brands they had purchased, but didn't register. Now that the program has matured and retailers have been educated to only sell registered brands to Minnesota households, this grace period can be removed. It also removes confusion when communicating with retailers when the manufacturer registration due date passes.

Recommendation 6: Restrict the generation and use of recycling credits by manufacturers.

Rationale: Given that new recycling credits continue to be generated and held by manufacturers which, in turn depresses demand for current pounds, the MPCA recommends statutory change to address this issue. Potential policy approaches include phasing out banked credits by a date certain, placing restrictions on the generation of new credits and reducing the pound equivalent for credits (e.g., credits are worth 0.5 pounds rather than one pound). This recommendation would be most effective if coupled with recommendation three.

Comparative Analysis of Extended Producer Responsibility Policy in the United States and Canada

Garth T. Hickle

Keywords:

e-scrap
extended producer responsibility (EPR)
governance
industrial ecology
recycling
waste electrical and electronic equipment (WEEE)

Summary

This article analyzes the policy choices and programmatic elements of extended producer responsibility (EPR) as implemented in the United States and Canada. The article traces the historical development of EPR in each country and defines common features of EPR in each nation. The U.S. states and the Canadian provinces have assumed the primary role, rather than the federal governments, for enacting producer responsibility requirements in their respective countries. However, the paths taken demonstrate several fundamental differences, including the prevalence of individual versus collective responsibility and the financing mechanisms implemented for EPR. Given the deepening experience with EPR and the breadth of its application to a widening array of products in the United States, the Canadian model for EPR is starting to receive more examination from policy makers in the United States, indicating that the policy and programmatic differences between the two nations may eventually be narrowing.

The comparative policy analysis is illustrated through the lens of EPR regulatory efforts for waste electronics, with particular profiles of the programs in the State of Minnesota and Province of Ontario. Both approaches broadly reflect many of the policy considerations and governance and programmatic themes that dominate EPR programs in each country. Finally, the article offers recommendations for collaborative work between the United States and Canada to explore consistency between programs and other complementary strategies to support producer responsibility activities.

Overview

While the United States and Canada share a common border, a significant trade relationship with Canada as the largest trading partner for the United States, and an interconnected economy with many of the same manufacturers, retailers, and others along the product chain, the political cultures and governing structures demonstrate significant contrasts. These differences are illustrated by the prevailing policy approaches to implementing the principle of extended producer responsibility (EPR) that are currently in place in the U.S. states and Canadian provinces.[1] Despite similar motivations and policy drivers for implementing EPR, such as shifting the waste management costs from local governments to brand owners and the internalizing of costs to promote the design of more sustainable products that are shared by both U.S. states and the Canadian provinces, important differences exist in terms of how programs are implemented to achieve these outcomes.

For example, the policy path in the United States has been premised, until recently, on detailed statutory requirements, while the Canadian provincial approach has emphasized a more flexible outcome-based regulatory model. In another notable difference, the Canadian regulatory approach to EPR has generally resulted in collective producer responsibility organizations funded by brand owners through the use of eco-fees. In the United States, however, the trend has been to emphasize the collection and recycling obligations placed on individual brand

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owners with few regulatory incentives or requirements for the brand owners to work in a collective fashion.

The article identifies the primary policy approaches and implementation scenarios for EPR in Canada and the United States and illustrates the thematic differences in policy structures through the use of two case studies for waste electronics, one in the Province of Ontario and the other in the State of Minnesota. Both case studies demonstrate several of the prevailing policy features of EPR in their respective countries.

Finally, the analysis identifies opportunities for potential collaboration between programs as well as promoting policy consistency in North America, albeit with the recognition that such an effort may be well into the future. The analysis is intended to inform the policy development process, including identification of opportunities to support the evolving cross-fertilization between the two countries on EPR.

The analysis is particularly timely with the application of EPR policy to a wider breadth of products in Canada and the ascendant influence of the Canadian policy structure for EPR that is influencing the legislative footprint in the United States (e.g., the EPR framework law adopted in Maine and the carpet and paint statutes enacted in California in 2010).

Review of Comparative Environmental Policy Analysis Between the United States and Canada

Despite the fertile ground for comparative environmental policy and program analysis between the United States and Canada relatively little research has been devoted to the topic (Rabe 1999a). Harrison (2007) analyzes the differing approaches to climate change with a particular emphasis on the Kyoto Treaty. Harrison (2007) also offers a comparison of the regulation of the pulp and paper industry and Casey (2011) identifies opportunities for collaboration in the area of public resource management. Product-oriented policy more broadly and producer responsibility in particular has yet to receive comparable attention. However, the research presented here identifies specific characteristics of governing, policy making, and implementation that are clearly at play for EPR in each nation.

Fundamental to any comparative policy analysis is a recognition of the differences between a parliamentary system, as exists in Canada, and the presidential system with a distinct separation of powers that exists in the United States (Harrison 2007). These differing governing structures translate into an ease of policy making in Canada that is not replicated in the United States due to the clear division between the administrative and legislative branches.

While both the United States and Canada can be characterized as exhibiting environmental regulatory regimes that invoke both national and subnational governments, Canada is generally considered to do much more without federal government preemption of provincial statutory actions or transfer grants to provinces to implement national environmental laws, a hallmark component of state implementation of federal statutes in the United States (Rabe 1999b). The United States has a much more expanded national government footprint, an intertwined federal and state implementation approach, and thus an often confrontational relationship between the national and state regulatory authorities (Rabe 1999b). However, despite the differing intergovernmental allocation of authority, both the states and provinces are perceived as the environmental policy innovators and more adept at replicating and enhancing environmental policy adopted in other jurisdictions.

The literature emphasizes that the United States has had a historical tendency toward a more legalistic approach to environmental regulation and enforcement activity than in Canada (Howlett 2000). On the other hand, Canada exemplifies a more cooperative model of policy making, with the environmental administrative agencies allowed more flexibility for implementation of provincial laws (Rabe 1999b). This dynamic is reinforced by a broader deference to the regulatory agencies and generally less direct oversight and intervention from legislative bodies than is often present in the United States (Rabe 1999a).

In keeping with the overall tone of policy making, the judicial system in Canada plays a much smaller role in regulatory or policy implementation than in the United States, which is not only more litigious generally, but offers broader access to courts for citizens and advocacy organizations (Howlett 2000). In Canada, however, compliance and enforcement activity often illustrate a more cooperative than prosecutorial emphasis (Harrison 1995).

As Howlett (2000) observes, little evidence of historical policy convergence between the United States and Canada exists, but during the 1990s, both nations embraced voluntary, collaborative, market-based strategies that include more stakeholders. This dynamic is clearly demonstrated with the embrace of producer responsibility and the endorsement of market-based, outcomes-oriented policy instruments.

As is evident in the EPR policy dialogue in the United States, many elements of environmental policy making in Canada are not only worthy of consideration for application in the United States but present opportunities for joint policy consideration and action (Casey 2011). As the following analysis demonstrates, the broader differences in environmental policy making between the United States and Canada are manifested in the policy choices and implementation strategies for EPR. For example, the primacy of the provincial regulatory, rather than statutory, mechanism in Canada to mandate EPR for individual products or categories of products combined with brand-owner-driven plans and significant flexibility allocated to provincial authorities is reflective of broader themes of environmental policy making in Canada and is influencing EPR policy development in the United States.

Profile of Extended Producer Responsibility in Canada

The evolution of EPR in Canada borrows significantly from the experience in the European Union and reflects an industry-managed and financed approach that generally offers significant

flexibility to brand owners (often referred to as "stewards" in the provincial programs).

Recognizing that voluntary measures were insufficient to achieve substantive results or ensure a level playing field for brand owners, particularly for packaging, the Canadian provinces have been engaged in developing and implementing producer responsibility measures for a wide range of products initiated with the Post-Consumer Paint Stewardship Program Regulation in British Columbia in 1994 (Driedger 2001). As of 2011, there were approximately 65 mandated producer responsibility programs in Canada, all regulated and implemented at the provincial level, making Canada a global leader in terms of applying EPR to the broadest palate of products. Given the reach of EPR, it is serving as a transformative tool for transitioning waste management from a local government responsibility to brand owners and consumers.

As in the case of the United States, there is no existing federal authority to implement a federal approach for producer responsibility except, under the Canadian Environmental Protection Act of 1999, to address products that contain toxic substances (McKerlie et al. 2006). Unlike the United States, however, the Canadian Constitution specifically reserves the significant authority for environmental protection matters for the provinces, a key dynamic that has arguably propelled provincial regulatory activity because the question of at which level of government regulations should be executed is largely resolved. Therefore the provincial environment agencies are responsible for drafting regulations, providing oversight of programs, and ensuring compliance.

As illustrated by table 1, broad environmental protection statutes such as the Environmental Management Act in British Columbia and the Waste Reduction and Recycling Act in Manitoba provide the statutory underpinning for issuing regulatory requirements for specific products or materials. However, a number of provinces, including British Columbia and New Brunswick, offer a more comprehensive regulation that provides authorization for the Minister of the Environment to designate individual products or product categories for inclusion in EPR programs through an amendment to the comprehensive regulation without issuing a separate regulation.

The recycling regulation in British Columbia, issued in 2004, consolidated all of the existing producer responsibility programs in the province and created a pathway for adding additional products for producer responsibility. The British Columbia recycling regulation, in particular, emphasizes an industry-managed, outcomes-based approach (British Columbia Ministry of the Environment 2006).

Four provinces, New Brunswick, Newfoundland and Labrador, Ontario, and Quebec, have created nongovernmental organizations to oversee the development and implementation of producer responsibility programs. The organization in Ontario, Waste Diversion Ontario (WDO), was created by the Waste Diversion Act and serves as a permanent nongovernmental corporation with 16-member multistakeholder governance. These entities have not functioned without some criticism, and Recyc-Quebec, a sister organization to WDO, was briefly considered for dissolution (Solid Waste and Recycling 2010). Similarly, the elimination of WDO was suggested by one of the political parties in Ontario in 2012 as part of a restructuring of stewardship programs in the province The Canadian Press 2012).

One notable aspect of the EPR approach in the provinces is the emphasis on brand owner development and submittal of stewardship plans that outline the financing and operational aspects of the proposed program. The regulations generally require a consultation process that engages other entities such as local governments or recyclers in the development of the plan and ultimately requires review and approval by the regulatory authority.

While the majority of provincial programs assign financial or physical responsibility to brand owners, the packaging and printed paper regulations enacted to date specify a defined financial obligation for local government. This ranges from 50% of the net costs of operating the program in the case of the Ontario "Blue Box" program to a 20% municipal share in the Manitoba regulation (Green and Treiblock 2010). In 2010, Quebec announced a regulation that transitions from the cost-sharing arrangement for packaging and printed paper akin to Ontario to 100% brand owner funding of municipal recycling programs by 2013 (Government of Quebec 2011a). Furthering the transition to 100% producer funding, the British Columbia Ministry of the Environment issued a provincial regulation in May 2011 for packaging and printed paper that places the full financial responsibility on the brand owners (Solid Waste and Recycling 2011).

Canadian EPR regulatory requirements emphasize, and in some cases require, collective responsibility through producer responsibility organizations (also referred to as industry funding organizations [IFOs] in a few provinces) that are managed and funded by brand owners. Most of the producer responsibility obligations are fulfilled by formal producer responsibility organizations representing the majority, if not the entirety, of brand owners selling in a particular province. While this approach provides an efficient portal for brand owners to comply with the producer responsibility requirements and, it is argued, results in greater economies of scale and improved compliance, it is criticized as not promoting competition to attain higher performance or drive down program costs (Quinn and Sinclair 2006).

A developing aspect of the EPR landscape in Canada is the presence of organizations that provide services to fulfill the brand owner EPR obligations in multiple provinces. For example, Product Care, after an initial programmatic focus on British Columbia for several different product categories of household hazardous waste, including paint, expanded to and began operating paint producer responsibility programs in British Columbia, Alberta, Saskatchewan, New Brunswick, and Nova Scotia.

Another key feature of the provincial producer responsibility programs is the use of eco-fees as the financing mechanism to fulfill the brand owner obligations. Eco-fees, as distinct from fees collected on a product at its end of life, are generally determined

by the estimated cost to fulfill the EPR program requirements and are paid by producers to the producer responsibility organization on a per weight or unit basis of products placed on the market in a particular jurisdiction. The characteristics of eco-fees are not uniform and may or not be visible to the consumer at the point of sale and managed through the sales chain by different methods. The prevalence of eco-fees as the primary financing vehicle chosen by producer responsibility organizations, whether visible to consumers or not, are an illustrative outcome of the policy intent to support collective responsibility approaches as well as the brand owners recognition of the benefits of a collective approach.

The reliance on eco-fees, rather than cost-internalized individual producer responsibility approaches, is often supported due to the presumed benefits of promoting transparency regarding the costs of the program and as a communication tool for consumers. It is argued that visible eco-fees support more consistent pricing across the nation (Bury 2010). The retail sector has consistently supported the use of visible eco-fees, as illustrated by the positions taken by the Retail Council of Canada, the primary trade association for retailers in Canada (Bury 2010).

However, the use of eco-fees, and particularly those that are visible, is receiving more scrutiny due to the controversy generated by the implementation of the municipal hazardous or special waste (MSHW) program in 2010 in Ontario with eco-fees being assessed on an expanded range of products (Green and Trebilcock 2010). In a departure from the other provinces, both New Brunswick and Quebec have taken regulatory action to curtail the use of visible fees (Bury 2010).

One notable feature of the provincial programs is the inclusion of "first importers," as is included in the Saskatchewan waste electronics regulation. The obligation for "first importers" applies when a brand owner does not exist or an entity, such as a retailer, takes title to the product or material as an option for fulfilling stewardship obligations (Deathe et al. 2008). The first importer obligation varies from province to province; for example, Ontario has fewer first importers registered as stewards relative to a province such as Manitoba.

Another prominent attribute of producer responsibility in Canada is the Canadian Council of Ministers of the Environment (CCME) work program. The CCME has led a discussion to promote harmonization among provinces for particular products, but there is also a broad, yet common, framework that has been applied across the product spectrum. This degree of consistency not only substantiates the emphasis placed on consistency by the CCME but also reflects the priority placed on engagement in the EPR policy dialogue by representative industry associations. In October 2009 the Council of Ministers approved the Canada-wide Action Plan for Extended Producer Responsibility that specified products to be designated by all of the provinces for inclusion in EPR programs in two phases (CCME 2009a). Recognizing the importance of promoting consistency in the provincial packaging programs, the CCME issued the Canada-wide Strategy for Sustainable Packaging (CCME 2009b).

Profile of Extended Producer Responsibility in the United States

Individual states in the United States have enacted producer responsibility measures that emphasize a specific policy and programmatic focus for each product. All mandated EPR activities have occurred with statutory direction rather than regulation under a broader environmental law. As with many other aspects of solid waste management, and recycling in particular, the federal government does not play a significant role in solid waste policy, leaving the states to assert leadership regarding producer responsibility (Vogel et al. 2010). However, individual states in the United States are considering a statutory producer responsibility framework underpinning that would guide the designation of products, articulate the expectations for brand owners, and direct the development and submittal of stewardship plans as the key programmatic vehicle for implementing programs.

Producer responsibility measures were first enacted in the United States in the mid-1990s with state statutes requiring producer responsibility for rechargeable batteries that spurred the development of the Rechargeable Battery Recycling Corporation (RBRC), the first producer responsibility organization in the United States (Sachs 2006).[2]

Given the preeminence of the product-specific statute-driven mechanism in the United States, the statutes enacting producer responsibility programs are thus necessarily often quite detailed and stipulate specific performance requirements such as recycling goals, standards for collection convenience, or requirements for certain practices by recyclers. For example, under the New York State Electronic Equipment Recycling and Reuse Act, manufacturers must provide at least one reasonably convenient method of collection within each county and within each municipality with a population of 10,000 or greater (Buseman 2012). The statutory approach, while ensuring a degree of accountability, contributes to a lack of flexibility for the programs to accommodate new products placed on the market or respond to changes in the collection and processing infrastructure without returning to the legislative body for amendments to the statute.

State environmental agencies are charged with oversight, compliance, and enforcement and in some cases an active role in implementation. In the United States, several producer responsibility programs for certain products offer a "government administered" compliance option; examples include electronics in Maryland and mercury-containing lamps in Washington (Gregory and Kirchain 2008).

A key component of the compliance and enforcement mechanism to reduce the number of "free riders," those companies whose products are being collected and managed in the EPR program but who are not fulfilling their financial obligations, is the inclusion of a "do not sell" provision that prohibits both brand owners and retailers from distributing products within the state. This mechanism is featured in many of the state waste electronics laws and is emerging in statutes for other products such as that enacted for unwanted paint in Oregon (Oregon Department of Environmental Quality 2011).

The prevailing method for achieving the program outcomes in the United States, particularly for electronic waste (e-waste) laws, is to assign responsibility to individual brand owners of a particular product to make collection and processing arrangements to meet their legal obligation. This variant of individual responsibility, more akin to an individual compliance approach, places legal responsibility on brand owners to achieve a specific obligation that is, in the case of several state statutes for waste electronics, determined by the share of their products being returned or by the total weight of products placed on the market. While this approach for determining a brand owner's responsibility departs from the conventional emphasis of individual responsibility whereby brand owners are specifically responsible for their own products placed on the market, it differs markedly from the collective responsibility approach that offers few opportunities for differentiation by product or brand (Atasu et al. 2008).

The emphasis on a specific obligation for each brand owner rather than obligations assigned to a producer responsibility organization illustrates several important threads conspicuous in the U.S. marketplace. The broader political context regarding imposition or authorization of additional fees, frequently construed as taxes, is apparent in the dialogue in the United States and contributed to a preference for models that do not result in programs funded by defined fees. This application of an individual obligation model also suggests policy makers' interest in spurring design for environmental activities on behalf of individual brand owners, a fundamental precept of EPR and a theme of the policy dialogue in the United States (Lindhqvist and Lifset 2003).

The competitive landscape in the United States spurs the creation of distinct business models that often inhibit brand owner collaboration, thus contributing to a desire for mandated producer responsibility to accommodate this diversity and support individual company efforts to, for example, implement product take-back programs. However, a significant driver for the hesitancy to embrace collective responsibility models is the concern regarding violating antitrust or anticompetitive conduct requirements, as could occur with collective fee-setting activities. As Salzman (1997) and others have noted, recognizing restrictions on activity that may violate antitrust or anticompetitive conduct statutes should give rise to provisions addressing this issue. Several state statutes, such as the Minnesota Electronics Recycling Act, contain provisions that essentially immunize brand owners for the purposes of fulfilling the intent of the producer responsibility program.

However, the EPR landscape in the United States is undergoing a transition, as the paint and carpet producer responsibility laws, at the behest of the brand owner trade associations, stipulate establishment of collective organizations. These organizations, Paint Care in Oregon and California and the formerly purely voluntary organization the Carpet America Recovery Effort (CARE) in California, are funded by statutorily authorized eco-fees, a financing mechanism similar in practice to that in Canada (Palmer and Walls 2002).

With a few notable exceptions, such as the waste electronics program in the State of Maine whereby municipalities are required to provide collection services, local governments often play a crucial role in providing collection infrastructure in EPR programs, but it is generally of a voluntary rather than mandatory nature (Wagner 2009).

Products addressed have emphasized household hazardous waste broadly and waste electronics more specifically. By early 2011, 24 states had enacted producer responsibility requirements for waste electronics. Oregon and California adopted laws for paint and California also added carpet to the list of regulated programs in 2010. Following the first producer responsibility statute for mercury-containing lamps in Maine in 2009, Washington followed suit in 2010 and Vermont in 2011 (Wagner 2012). Maine and Washington have also considered proposals for unwanted pharmaceuticals. In contrast to other jurisdictions globally that have prioritized packaging as a waste stream well positioned for producer responsibility, only Vermont has considered, but not yet enacted, an EPR approach modeled after the programs in Canada for packaging and printed paper (Hickle 2010).

Key Differences Between the State and Provincial Extended Producer Responsibility Policy Approaches

As illustrated above, substantive policy and programmatic differences exist between the United States and Canadian approaches to EPR. These differences reflect not only contrasts in constitutional and legal authorities, and parliamentary versus presidential governance structures, but they also illustrate cultural differences between the two nations.

The history and context for producer responsibility in Canada reflects the higher degree of influence of the European Union and other international policy activity and, in particular, the Organization of Economic Co-operation and Development (OECD). In contrast, the European experience has had a much less direct influence on producer responsibility in the United States, as evidenced by hesitancy to embrace the term, the products prioritized for producer responsibility, and elements of policy design (Jackson 2007).

The maturity of EPR in the Canadian provinces has also provided both provincial regulatory agencies and brand owners with a common understanding of how the policy approach will be applied and has resulted in a transition of the dialogue from whether EPR is appropriate to how to optimize its application in Canada.

A fundamental distinction between the U.S. and Canadian policy structure is the process by which products are designated for an EPR program. By instituting a regulation-driven designation, the provinces arguably create a streamlined approach that favors greater industry engagement and thus a more direct role, through the program planning process, in determining many aspects of program design and implementation. With the requirement for legislative action, the U.S. landscape for EPR may be

subject to legislative politics and ensures that each product is addressed individually, a factor that inhibits consistency.

Legal statutes in the United States are more prescriptive than is generally encountered in the regulations adopted in the Canadian provinces. U.S. practice is partly driven by the desire to avoid the financial resources and time required to engage in state agency promulgation of administrative rules (MPCA 2009). However, as the stewardship planning component becomes more commonplace in the United States, it is expected that many of the requirements and program expectations currently contained in the statutes will migrate to content requirements for inclusion in stewardship plans.

A prominent feature of the provincial EPR programs that contrasts with those in the United States is the centrality of collective producer responsibility organizations. While this aspect of EPR in Canada reflects the experience of the brand owner response to EPR in the European Union, it also indicates the leadership demonstrated by several of the industry trade associations in assuming a proactive role in shaping EPR policy development in Canada. This is illustrated, for example, by the engagement of Electronics Product Stewardship Canada (EPSC), an electronics industry association formed in 2003. The EPSC forged a consensus among brand owners of electronic products, advanced an industry-developed approach for provincial consideration, and engaged in the policy development process in each province in order to promote consistency (Deathe et al. 2008). However, the Ministry of the Environment in Ontario in 2009 signaled their intent to move toward individual responsibility and full financial responsibility (Ontario Ministry of the Environment 2009).

Another striking feature of the Canadian approach is the primacy of the stewardship plans submitted on behalf of brand owners as the tool to define brand owner obligations and illustrate the functioning of the program. While the United States is beginning to implement a plan-driven approach, particularly in regards to paint and carpet, many of the strictures and expectations for brand owners and others along the product chain are specified in statutes and regulations. The Canadian approach to consultation during stewardship plan development and review and approval by the provincial authority shift much of the decision making outside of the legislative process.

The significant difference in the use of eco-fees, and particularly those that are visible, reflects a difference between the U.S. and Canadian financing approaches and illustrates a greater degree of comfort with collective organizations in Canada, but also demonstrates the political challenges in the United States facing the imposition of any fees that may be construed as a tax. As opposed to the political dynamic in the United States, retailers have been much less reticent to accept visible eco-fees that are, for example, reflected on the receipt for products purchased or to serve as the fee remitter on behalf of brand owners. However, both the provincial and state regulatory approaches have shied away from imposing mandatory collection requirements for discarded products as exemplified in the European Union's Waste Electrical and Electronic (WEEE) Directive.

While the United States has targeted EPR regulatory activity for a single product or narrow suite of products within a particular category, the provinces have typically addressed a broad scope of products within a particular regulation. This more comprehensive approach is exemplified by the household hazardous waste regulations adopted in several provinces that address products ranging from paint and solvents to mercury-containing lamps. However, even within the more narrowly tailored regulations for products such as waste electronics, the scope of products is broad.

Case Studies of the Extended Producer Responsibility Programs for Waste Electronics in Minnesota and Ontario

This article offers two case studies of producer responsibility programs to illustrate the similarities and differences between a state product-specific producer responsibility program for waste electronics and its counterpart in Ontario. Both programs are representative of many of the policy principles for EPR in the respective countries and demonstrate the common programmatic emphasis in implementation. The programs in Minnesota and Ontario for waste electronics were chosen due to their representative nature as well as the availability of data for evaluation and analysis.

Overview of Extended Producer Responsibility for Electronics in the United States

As of May 2011, 25 states had enacted state waste electronics recycling laws. All of them, with the exception of an advance recycling fee (ARF) program in California that was enacted in 2003, place requirements on brand owners to undertake activities to increase the collection and recycling of waste electronics. However, these requirements often vary significantly from state to state with varying degrees of statutory prescription and responsibilities placed on brand owners (Ezroj 2010). These differentiations range from, for example, what products are included in the regulated program to whether brand owners are required to meet certain performance criteria annually.

Most statutes address televisions, computer monitors, and laptops, with several states obligating printers and desktop computers. The statute adopted in New York in 2010 included a much broader range of products, including gaming consoles and equipment such as digital video disc (DVD) players, and this may inspire other states to broaden the scope of obligated products (Buseman 2012).

As opposed to other financing mechanisms that rely on eco-fees established and managed by producer responsibility organizations, the producer responsibility programs are often premised on each manufacturer registering with the state regulatory agency and, in most programs, being obligated to reach a certain level of recycling determined by their return share or current market share. Unlike the context for the EPR program in Canada and the European Union, there are no traditional representative industry producer responsibility organizations

Table 1 Overview of provincial legal authority and stewardship organizations for extended producer responsibility (EPR) in Canada as of 2012

Province	*Enabling statute*	*Broad EPR regulation*	*Stewardship oversight board*
Alberta	*Environmental Protection and Enhancement Act, RSA 2000, c E-12*		
British Columbia	*Environmental Management Act, SBC 2003, c 53*	Recycling Regulation, BC Reg 449/2004	
Manitoba	*The Waste Reduction and Prevention Act, CCSM c W40*		
New Brunswick	*Clean Environment Act, RSNB 1973, c C-6*	Designated Materials Regulation, NB Reg 2008-54	Recycle NB
Newfoundland and Labrador	*Environmental Protection Act, SNL 2002, c E-14.2*	Waste Management Regulations, 2003, NLR 59/03	Multi-Materials Stewardship Board (MMSB)
Nova Scotia	*Environment Act, SNS 1994–1995, c 1*		
Ontario	*Waste Diversion Act, 2002, SO 2002, c 6*		Waste Diversion Ontario
Prince Edward Island	*Environmental Protection Act, RSPEI 1988, c E-9*		
Quebec	*Environment Quality Act, RSQ, c Q-2*	Regulation respecting the recovery and reclamation of products by enterprises, RRQ, c Q-2, r 40.1	Recyc-Quebec
Saskatchewan	*Environmental Management and Protection Act, 2002, SS 2002, c E-10.21*		

that are engaged in proactive EPR program design and development activities such as authoring stewardship plans, developing and arranging collection infrastructure, and joint reporting activities. In the United States, however, compliance entities such as the Electronic Manufacturers Recycling Management Company (MRM) have emerged to serve as vehicles for brand owners in several states (Ongondo et al. 2011). For example, the MRM contracts with one or more vendors to collect sufficient weight to fulfill the individual obligations of its member companies in states, such as Minnesota, with a market-share-based obligation. These compliance entities, while easing the burden of fulfilling a weight-based recycling obligation, are not representing the majority of the brand owners and are characterized as providing a service rather than proactively developing and managing an EPR program.

In the United States, the state waste electronics programs can be broadly characterized by four approaches, as illustrated in table 2: return share, a hybrid of market and return share, market share, and registration and planning requirements. The programs are often categorized by the methodology utilized for establishing a brand owners obligation. This mechanism for establishing obligation has often ignited significant debate during legislative deliberations and is often determinative of several other aspects of the program.

The return share approach, such as in Maine, determines a manufacturer's financial obligation based on the actual weight or percentage of a manufacturer's branded products that are collected for recycling (Atasu and Van Wassenhove 2011). On the other hand, the market share model establishes a producer's obligation based on the weight of their products placed on the market during a year. A hybrid approach embraces both the return and market share approaches, typically implementing the return share approach for information technology products such as computers and peripherals and market share for consumer electronics such as televisions.

Following the precedent established with the waste electronics law enacted in California that requires compliance with the European Union's Directive on the Restriction of Hazardous Substances (RoHS), seven states as of 2011 have followed suit with either a requirement for compliance with the RoHS or disclosure regarding compliance with the directive (Sachs 2006).

Finally, the registration and plan model generally requires producers to register with the state regulatory authority and submit a plan that outlines their strategy for the collection of discarded products. The states that have implemented this approach have generally not imposed collection and recycling goals and have lower recycling rates than other models.

Case Study: Minnesota Electronics Recycling Act

The Minnesota Electronics Recycling Act was enacted by the legislature in 2007 following 5 years of intensive evaluation and consideration of various policy approaches. The policy options, such as an advance recycling fee enacted in California in

Table 2 Models of U.S. extended producer responsibility programs for waste electronics as of 2011

Market share obligation	MN, WI, IN, NY, PA, VT
Return share obligation	WA
Hybrid approach obligation	ME, CT, RI, SC, OR, NJ, IL
Registration and plan	MI, HI, MD, MO, NC, OK, TX, UT, VA, WV

Table 3 Provincial extended producer responsibility (EPR) regulations for waste electronics*

Province	*Program implemented*	*Stewardship organization (industry funding organization)*
British Columbia	2007	Electronics Stewardship Association of British Columbia
Manitoba	Regulation approved in 2010	Electronic Products Recycling Association (EPRA) Manitoba
Nova Scotia	2008	Atlantic Canada Electronics Stewardship (ACES)
Ontario	2009	Ontario Electronic Stewardship
Prince Edward Island	2010	Atlantic Canada Electronics Stewardship (ACES)
Saskatchewan	2007	Saskatchewan Waste Electronic Equipment Program
Quebec	Regulation issued in 2010	Electronic Products Recycling Association (EPRA) Quebec

Notes: *The waste electronics program in Alberta is operated by the Alberta Recycling Management Authority (ARMA), a provincial crown agency governed by a broad range of stakeholders, including government representatives, that provides services for several other stewardship programs in Alberta. While it shares several characteristics with the EPR programs for waste electronics across Canada, the brand owners have few responsibilities under the regulation.

2003 as well as the return share obligation enacted in Maine in 2004, received significant scrutiny (Atasu and Van Wassenhove 2010). The statute enacted in Minnesota is representative of many of the producer responsibility measures enacted in the United States, including those in Indiana, Wisconsin, New York, Vermont, and Pennsylvania.

Driven by concerns regarding heavy metals in electronic products, increasing management costs borne by local governments due to their presence in municipal solid waste, and a disposal ban on cathode ray tube–containing products enacted in 2003, the legislature ultimately endorsed a producer responsibility model as the preferred policy option. The Minnesota Pollution Control Agency (MPCA), the state environmental regulatory authority, is charged with oversight, compliance, and enforcement activities to ensure implementation of the statute.

Summary of the Act

The statute implements an individual responsibility approach that offers significant flexibility for brand owners to achieve their obligation. The act implements a market share obligation that applies to manufacturers of video display devices such as computer monitors, televisions, and laptop computers. The brand owner's obligation for collection and recycling is equivalent to 80% by weight of obligated products during the program year (Eifert 2010). The determination of a brand owner's market share is accomplished through knowledge of direct sales to consumers rather than through traditional retail locations, such as the sales model employed by Dell, or through the use of national sales data adjusted for Minnesota's population.

The statute does not prescribe requirements as to the type of collection infrastructure that must be provided or contain a convenience requirement as found in several other state's legal requirements, such as Washington, New York, and Oregon, that require at least one site per county (Wagner 2012). However, the act does attempt to ensure collection opportunities through an additional 0.5 pound credit for pounds collected outside of the Twin Cities Metropolitan Area as an incentive for collection in less densely populated areas of the state (Buseman 2012). The act also does not prohibit end-of-life fees from being charged by collectors; a provision restricting such fees is present in several others states' EPR statutes for waste electronics.

Recognizing that precisely gauging collection volume is challenging, the statute contains a provision for recycling credits that are created and held by manufacturers if they collect more than their annual obligation. Following an amendment to the statute enacted in 2009, manufacturers may only meet 25% of their annual obligation through the use of credits (MPCA 2010).

In order to facilitate accurate accounting, annual registration and reporting is required for collectors, recyclers, and manufacturers. However, individual manufacturers report their sales and collection weight to the Minnesota Department of Revenue, rather than the MPCA, as a measure to ensure proprietary sales data are not available to the public.

The statute also requires the disclosure by brand owners of whether their obligated products are compliant with the European Union's RoHS directive.

Products Addressed

Although the obligation is determined by the individual brand owner's sale of video display devices, a broader category of electronic products labeled covered electronic devices, such as printers, desktop computers, and video cassette recorders (VCRs), among others, can be collected and applied toward the individual brand owner's obligation.

Financing

The financing mechanism can be defined as "cost internalization," given the lack of set fees, visible or otherwise, that are common with many EPR programs for waste electronics globally. However, if a manufacturer does not fulfill their individual obligation or chooses not to, the law stipulates a per pound penalty of 0.30, 0.40, or 0.50 (U.S. dollars) per pound determined by how close they are to meeting their obligation (Ezroj 2010). The fee amounts were deliberately set by the legislature at above market rates to encourage manufacturers to establish their own programs.

Implementation

Since the program is premised on individual brand owner responsibility, the law did not stipulate the creation of a formal compliance organization. However, the act does permit one or more collective organizations to represent obligated brand owners, and in recognition of this option, it specifically authorizes collaborative activity through statutory protections from state anticompetitive conduct regulations. Manufacturers have generally worked directly with recyclers who in turn develop arrangements with collectors to provide sufficient pounds for manufacturers to meet their program-year obligation.

While the law does not prescribe a particular responsibly for collection and encourages a wide array of entities to serve in that role, local governments in Minnesota are central to the existing infrastructure, collecting approximately 50% of the weight collected annually (MPCA 2011). The program also supports a mix of collection strategies including permanent collection sites, collection events, and mail-back efforts. Retailers such as Best Buy, for example, are becoming essential to the collection infrastructure in the state and collect approximately 30% of total weight of household-generated waste electronics in the state. The Minnesota-based retailer began collecting a defined set of discarded electronics through in-store offerings in the summer of 2008 and has become the single largest collection entity in the state.

Program Outcomes

Approximately 75 brand owners of video display devices have registered with the MPCA each year of the program and thus have a defined collection and recycling obligation determined by the weight of their products sold during the program year.

Achieving one of the desired outcomes of the statute, there has been a significant increase in the number of collectors as well as the number of recyclers providing service in the state since the law was implemented. The number of permanent collection sites across the state has increased with nearly 80% of Minnesota's 87 counties having at least one permanent collection site.

The program has resulted in approximately 30 million pounds of consumer electronics recycled in Minnesota each year of the program. The program has resulted in per capita collection rates of 5.7 pounds, 6.7 pounds, and 6.3 pounds for the three completed program years (MPCA 2010).

One consequence of the absence of a central producer responsibility organization that publishes and collects fees as well as reports on overall program costs is the difficulty in conducting an economic analysis. However, the cost per pound to recycle waste electronics from households has declined significantly from the prevailing per pound costs prior to implementation of the law, based on reported and anecdotal evidence from local government collection programs (MPCA 2010).

While the program has resulted in a significant increase in the collection of waste electronics from households in Minnesota, it is not clear whether other desired outcomes of EPR are being achieved. For example, no evaluation has been conducted into what impact, if any, the program has had on influencing product designs.

Summary of Extended Producer Responsibility for Waste Electronics in Canada

As referenced in table 3, as of May 2011, eight provinces had promulgated regulations for waste electronics in Canada, all of which, with the exception of Alberta, are premised on EPR. The regulations and implementation demonstrate a remarkable degree of consistency, not only with each other, but also with the overall framework for EPR in Canada as demonstrated by significant flexibility in program design, stewardship plans, collective compliance, and financing mechanisms. The producer responsibility obligations are generally fulfilled by collective compliance organizations and funded by eco-fees, referred to as "environmental handling fees" in some provinces, that are often visible to consumers at the point of sale.

With the exception of the regulation for EPR for waste electronics adopted in Quebec in 2011, the provincial regulations do not specify quantitative performance goals for brand owners, although the stewardship plans generally outline targets such as, for example, collection volume (Government of Quebec 2011b).

Case Study: Extended Producer Responsibility for Waste Electronics in Ontario

Ontario is one of six provincial e-waste programs that are operational and is illustrative of the general policy approach adopted in Canada for implementation of EPR. Other provinces that have embraced EPR for waste electronics include Prince Edward Island (PEI), Saskatchewan, British Columbia, and Nova Scotia.

All of the mandatory EPR programs in the province are regulated under the authority of the Waste Diversion Act (WDA) of 2002. The WDA authorizes the Minister of the Environment to designate a material for a producer responsibility program. The WDA also created Waste Diversion Ontario (WDO) to develop, implement, and operate waste diversion programs for a broad range of materials.

In December 2004 the Minister of the Environment submitted the regulation for WEEE with a program request letter submitted to WDO for creation of a diversion program for WEEE

in June 2007. The initial regulation outlined seven categories of electrical products as designated waste under the WDA. The Waste Electrical and Electronic Equipment Regulation did not specify particular performance goals to be attained.

In September 2007 Ontario Electronic Stewardship (OES) was created as the industry funding organization (terminology used in Ontario for producer responsibility organization) for WEEE in the province and led the effort to develop the stewardship plan (OES 2009). While the first program plan was approved by the minister in July 2008, a revised program plan for phases 1 and 2 was submitted in July 2009 and approved by the minister in August 2009.

Despite the central role of OES, the WDA creates a pathway for individual manufacturers or a group of brand owners to submit plans to WDO as long as it will fulfill the objectives of the diversion program as an alternative to full participation in OES. However, no brand owners, as of 2011, have availed themselves of the individual plan option. The stewardship plan stipulates performance goals for the program including 5-year collection, reuse, and refurbishment and recycling targets. However, failure to achieve the goals does not lead to potential enforcement activity against a specific company.

Ontario Electronics Stewardship

OES is the producer responsibility organization responsible for implementing the program for WEEE in Ontario. OES manages the program on behalf of the obligated brand owners and is governed by a board of directors composed of representatives from the obligated brand owners.

OES activities to fulfill the brand owner obligations are funded through fees that OES establishes. Unlike the cost-sharing arrangement in place for the packaging and printed paper program in Ontario, brand owners are obligated to assume full financial responsibility for the costs of managing e-waste. The fees are based on several factors, including the overall program costs and the number of units placed on the market in Ontario. In addition, several other considerations influence the fee structure, including the desire to avoid the cross-subsidization of products using an approach that defines the management costs for each product category. However, management costs that are common for all brand owners are shared. The fees remitted by brand owners are not specifically designed to promote or reflect design for environment activities and are not differentiated by brand owner or other features within the product category

While OES establishes the fees, the regulation and program plan do not prescribe how the fees are managed through the product chain. In practice, many of the brand owners pass along the fees to retailers, who then voluntarily implement visible fees for consumers. OES also permits entities such as large retailers, rather than brand owners, to remit fees to OES.

OES requires contracted recyclers to abide by the recycler qualification requirements established by EPSC that were created to ensure environmentally sound management practices and adherence to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Lepawsky 2012).

Products Addressed

The producer responsibility program for managing waste electronics currently addresses 44 product types comprising the phase 1 and phase 2 product categories articulated in the regulation. Phase 1 of the program began on April 1, 2009, with six initial products, including televisions, monitors, desktop computers, laptop computers, computers peripherals, and fax machines. Phase 2, which began on April 1, 2010, added new products including phones, cameras, and audiovisual equipment.

Financing

OES collected 45 million Canadian dollars (C$) in eco-fees during first program year, April 2009 to March 2010, with current fees ranging from C$26.25 for displays with a larger than 29-inch screen to C$0.10 for cell phones and pagers (OES 2010).

Program Outcomes

As of early 2011, there were approximately 780 stewards, 566 permanent collection sites, and 12 approved processors. The goal of the first year of the program, April 2009 to March 2010, was to collect 42,000 metric tons of electronic waste; the program actually collected 17,303 tons, or 1.31 kilograms (kg) per capita (2.9 pounds). The cost for the year 1 WEEE program was C$1604 per ton. It is estimated that OES is managing 60% to 70% of all waste electronics managed in the province. It is important to note that no disposal ban is yet in place in the province.

Influence of the Canadian Approach to Extended Producer Responsibility in the United States

Policy makers in the United States are examining EPR, not only for specific products with a successful track record in Canada, such as paint and pharmaceuticals, but they are also conducting an intensive examination of the policy structure guiding the provincial programs and the resulting outcomes. This focus is directly manifested in the development of producer responsibility "framework" legislative proposals considered in several states. These initiatives are directly influenced by the provincial approach, particularly that in British Columbia, to producer responsibility. Maine enacted a modified "framework" in 2010, with similar bill introductions in New York and Rhode Island in 2011 (Product Stewardship Institute 2010). Regardless of the fate of these individual state proposals, the themes of consistency between programs, brand owner leadership in program design and implementation, and an emphasis on outcomes are coming to the fore in the EPR dialogue in the United States.

With the enactment of several producer responsibility measures in several states starting in the 2009 legislative session that borrow significantly from the approach to EPR in Canada, the provincial policy influence continues to expand and deepen in the United States. The producer responsibility statutes enacted in Oregon for paint in 2009, in California for paint and carpet in 2010, and in Maine for mercury-containing lamps

in 2009 all demonstrate thematic similarities to the general policy approach prevalent in the provinces featuring broad programmatic outlines in the statutes, significant flexibility in how the outcomes are achieved, and a stewardship plan requirement.

It is expected that policy makers in the United States will continue to seek guidance from the experience in the provinces both in terms of policy construction and in terms of emphasis on particular products or product categories.

Opportunities for Collaboration

Given the historical cooperation between the United and Canada on a number of environmental measures, an identification of potential avenues and topics for collaboration with a focus on steps toward consistency in EPR programs is worthwhile. Several institutions devoted to supporting cooperation on environmental matters, such as the International Joint Commission between the United States and Canada that addresses the Great Lakes region and the Commission for Environmental Cooperation (CEC) serving the North American Free Trade Agreement (NAFTA) region, create institutional bodies that establish common environmental priorities and could serve as vehicles for collaborative action.

There are several specific options for promoting program consistency between the United States and Canada, including joint identification and designation of products and materials for producer responsibility measures. While challenging, the United States and Canada could initiate an effort to identify the common objectives and policy objectives of producer responsibility and seek to realize their recognition in policy measures. Of particular interest for both the United States and Canada may be an emphasis on policy measures to support "design for environment" in the context of EPR or developed as supporting measures as demonstrated by the RoHS directive in the European Union.

Another potential initiative worthy of attention is to enable and support producer responsibility organizations that function on a cross-border basis furthering the objective of program consistency. An emerging binational initiative under way is the Western Product Stewardship Collaborative (WPSC), which is identifying opportunities for joint action, including policy consistency and program assessment on EPR for California, Oregon, Washington, and British Columbia (Bury 2012).

The development of a materials processing roadmap for ensuring adequate end-market processing availability in North America would be valuable for identifying currently available processing locations and gaps in commodity end markets to channel investment.

Finally, both the United States and Canada would benefit from a coordinated effort at evaluation to further identify the economic efficiency and environmental outcomes, such as the nexus of EPR and product design, of the respective policy choices and program implementation strategies.

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The views expressed in this article are solely the author's and do not necessarily reflect the views of his agency or any other organization with which he is affiliated.

Notes

1. For the purposes of this article, EPR is characterized by the Organization for Economic Co-operation and Development (OECD) definition: EPR is an environmental policy approach in which a producer's responsibility for a product is extended to the postconsumer stage of a product's life cycle. An EPR policy is characterized by (1) the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities, and (2) the provision of incentives to producers to take into account environmental considerations when designing their products (OECD 2001).
2. Lindhqvist and Lifset (2003) and Walls (2006) among others cite deposit refund policies, most prominently for beverage containers, as a policy tool that reflects the principles of EPR. However, given the often significant level of prescriptive requirements and a financing mechanism that does not incentivize design for environment practices, deposit programs are best characterized as "proto" EPR or placed within a broader category of product-specific policy instruments.

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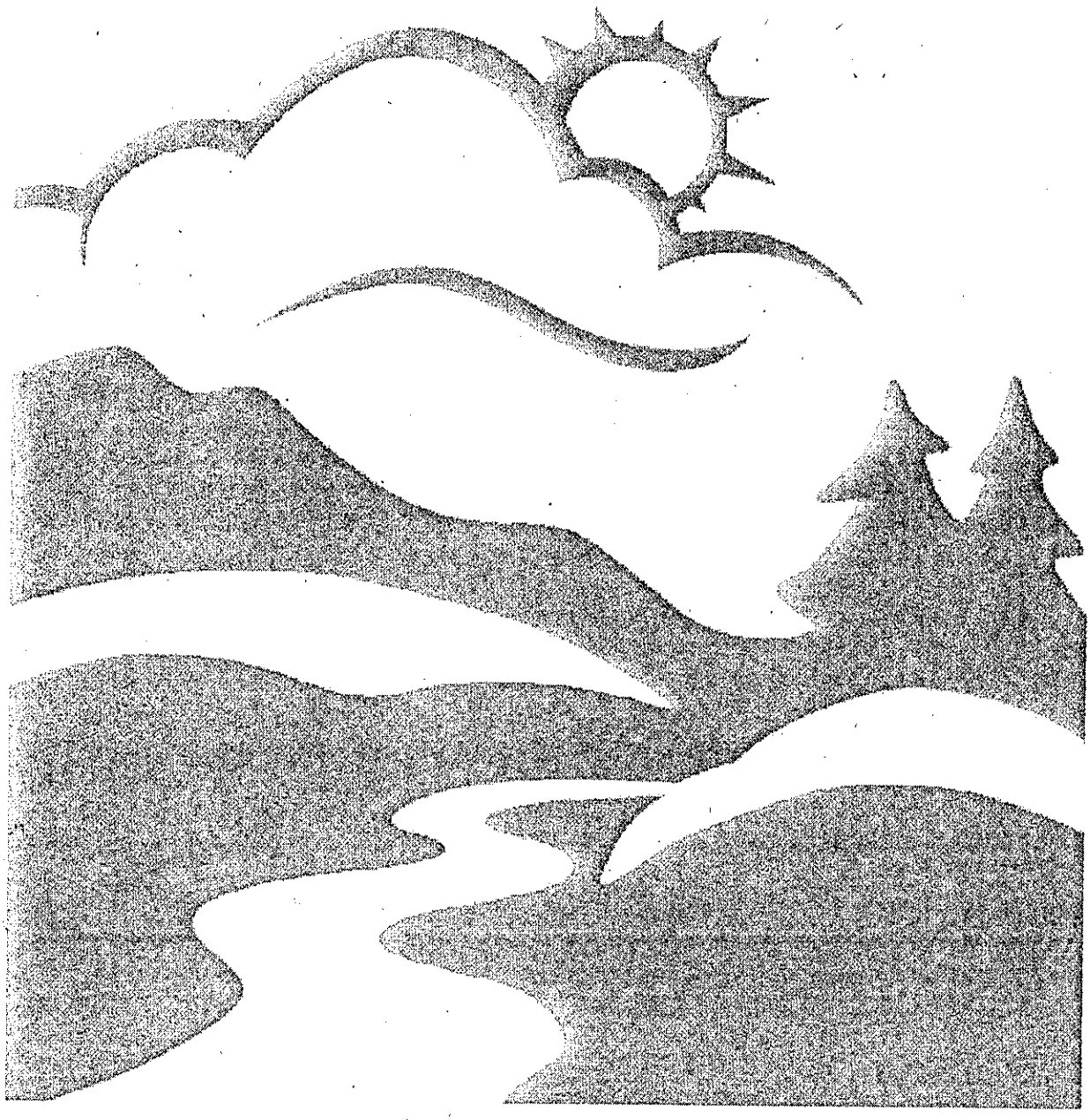
Legislative Report

Oregon E-Cycles Biennial Report

March 2012

State of Oregon
Department of
Environmental
Quality



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Executive Summary

This report fulfills DEQ's requirement to submit a biennial report to the Legislature on the operations of Oregon E-Cycles under Oregon's Electronics Recycling Law, ORS 459A.340(8). The full 2012 Oregon E-Cycles Biennial Report is available at: www.deq.state.or.us/pubs/legislativepubs/

Oregon's Electronics Recycling Law, adopted in 2007, established a product stewardship program[1] for electronics, Oregon E-Cycles. The law requires electronics manufacturers to provide free, convenient, statewide recycling for computers, monitors and TVs. Amendments in 2011 added printers and computer peripherals beginning 2015. Manufacturers selling devices into Oregon must register their brands with DEQ and join either the state contractor or a manufacturer-run recycling program. Each program operates under a plan approved by DEQ and is funded by its participating manufacturers.[2]

Retailers may sell into Oregon only registered brands of manufacturers in compliance with the law. They must also inform consumers about recycling opportunities under Oregon E-Cycles.

The law also bans computers, monitors and TVs from disposal at solid waste disposal facilities.

Oregon E-Cycles has produced significant environmental benefits since operations began in 2009. Each year the weight of devices recycled and the number reused has increased, exceeding statewide recycling goals. Preliminary figures show nearly 26 million pounds of devices were recycled and another 36,700 units were reused through Oregon E-Cycles during 2011 alone. Since 2009, Oregon E-Cycles recycling has saved approximately 1,050 billion BTUs of energy, which equates to approximately 8 million gallons of gasoline. Net greenhouse gas reductions are estimated at 80,000 metric tons of carbon dioxide equivalent, comparable to the benefit of eliminating tailpipe emissions from approximately 16,300 average passenger cars per year.

Four recycling programs have comprised Oregon E-Cycles operations since its inception: a state contractor program operated by a private entity under a contract with DEQ, and three manufacturer-run recycling programs. Combined, these four programs include more than 160 manufacturers and use about eight recyclers..

Each recycling program must ensure the collectors and recyclers in its network comply with approved standards and practices. The programs must also verify that devices are

[1] Product stewardship is an environmental management strategy in which all parties involved in the design, production, sale and use of a product take responsibility for minimizing the product's environmental impacts throughout all stages of the product's life.

[2] Manufacturers in the state contractor program pay recycling fees to DEQ to cover that program's costs. Manufacturers in manufacturer-run programs pay according to their program agreements.

managed appropriately from the initial recycler through the point at which materials are processed into single-stream commodities. In its oversight role, DEQ reviews program reports and addresses any issues with the recycling programs. In 2011, DEQ also conducted oversight visits at 20 percent of Oregon E-Cycles collectors across the state and at all in-state recycling facilities. DEQ identified some concerns regarding facility operations and is following up with the recycling programs to ensure improvement. Based on these results, DEQ will conduct fewer but more targeted visits in 2012.

Although Oregon E-Cycles recycling programs change slightly every year, the four programs have established a stable recycling infrastructure with more than 220 collection sites and additional events statewide.

Oregon E-Cycles is a successful product stewardship program where stakeholders have worked cooperatively to provide convenient, responsible recycling for the growing electronics waste stream. The program has significantly expanded opportunities for Oregonians to recycle electronic wastes and has shifted responsibility and costs for managing this waste from rate payers and local governments to product manufacturers, sellers and users. DEQ will continue to work with recycling programs, the E-Cycles advisory workgroup and other interested parties to evaluate and improve the Oregon E-Cycles program.

Overview

Purpose

This is DEQ's biennial report to the Legislature on the operations of Oregon's electronics recycling program – Oregon E-Cycles – as required under Oregon's Electronics Recycling Law, ORS 459A.340(8).

Oregon's Electronics Recycling Law

Oregon's Electronics Recycling Law, adopted in 2007, established a product stewardship program for electronics recycling, Oregon E-Cycles. The law requires electronics manufacturers to provide free, convenient, statewide recycling for computers, monitors and TVs. Manufacturers whose covered devices are sold in or into Oregon must register their brands with DEQ and join either the state contractor recycling program or a manufacturer-run recycling program. These programs are funded by their participating manufacturers.

Each recycling program establishes a statewide network of sites and services to collect and recycle covered devices under a plan approved annually by DEQ. The plan must provide at least one collection site in every city with a population of 10,000 or more and convenient service (e.g., sites, events, mail back) in every county. The plan must also ensure its collectors, transporters and recyclers follow environmentally sound management practices, and provide inspections and audits to verify compliance from collection through final processing. DEQ oversees compliance with the plans.

Each year DEQ determines the total weight of computers, monitors and TVs expected to be recycled in the state the following year and assigns each manufacturer a portion of that total weight as its minimum recycling obligation (called return share by weight) for the coming year.[3] Manufacturer recycling programs must recycle at least the total return share weight of their participating manufacturers to avoid penalties, but must collect and recycle year-round under their plans, even if they exceed that amount. Recycling programs must also regularly advertise and promote collection opportunities statewide.

Any person may drop off up to seven computers, monitors and TVs at a time at a collection site free of charge. Households and small non-profit organizations and businesses may recycle any amount without charge.

Retailers and manufacturers may sell a covered electronic device in or into Oregon only if it has a currently registered brand affixed to the device, and the brand manufacturer is

[3] Return shares and return shares by weight are based on the percentage of each manufacturer's computers, monitors and TVs **returned for recycling** through the E-Cycles program the previous year, as determined through sampling those returns. For TV manufacturers only, that total return share weight for all TV manufacturers is then reallocated among individual TV manufacturers based on their respective market share of TVs **sold in or into** Oregon the previous calendar year to determine their final return share by weight. TV manufacturers are those making more TVs than computers and monitors in any given year.

on DEQ's list of manufacturers currently in compliance with the Electronics Recycling Law. Retailers must also inform consumers purchasing covered electronic devices about recycling opportunities under Oregon E-Cycles.

The law also banned computers, monitors and TVs from disposal at solid waste disposal sites after January 1, 2010.

In 2010 the Legislature amended the Electronics Recycling Law (House Bill 3606) to change the method for calculating the return shares by weight (minimum recycling obligations) for TV manufacturers. The collective weight of all TV manufacturers' devices returned for recycling is redistributed among TV manufacturers based on their respective market share of TVs sold in Oregon the previous year.

Amendments in 2011 (Senate Bill 82) added printers and computer peripherals (keyboards, mice and associated cords) to Oregon E-Cycles beginning January 2015. These devices were not included in the disposal ban for other covered electronic devices. SB 82 also established a recycling credit system that allows recycling programs to claim the pounds they collect over their minimum recycling obligation in any year as recycling credits that can be sold or used in future years to meet up to 15 percent of a program's minimum recycling obligation.

Oregon E-Cycles Implementation

Program Performance

Oregon E-Cycles began collecting and recycling computers, monitors and TVs in January 2009, and completed its third year of operations in December 2011. Table 1 summarizes program performance since 2009.

Table 1
Oregon E-Cycles Program Performance

	2009	2010	2011	Totals
Recycling and Reuse				
Statewide recycling goal (pounds)	12.2 million	21.5 million	23 million	66.7 million
Total recycled (pounds)	19.0 million	24.2 million	25.9 million [a]	69.1 million
Per capita recycled (pounds)	4.96 lbs	6.3 lbs	6.75 lbs[a]	
Units reused	25,900	38,000	36,007 [a]	100,600
Recycling Programs				
Plans	3 mfr + 1 state	3 mfr + 1 state	3 mfr + 1 state	
Participating manufacturers	176	162	169	
Services				
Collection sites	~ 220	~240	~230	
Collection events	22	17	13	
Recyclers	6	6	8	
Energy Savings/ Greenhouse Gas Reductions				
Energy savings (BTUs)	290 billion	370 billion	390 billion	1,050 billion
(equivalent gallons of gas)	(2 million)	(3 million)	(3 million)	(8 million)
GHG emission reductions (metric tons CO_2E)	22 ,000	28 ,000	30,000	80,000
(equivalent tailpipe emissions, cars/year)	(4,500 cars)	(5,700 cars)	(6,100 cars)	(16,300 cars)

[a]Preliminary 2011 figures; final 2011 figures available March 2012.

Recycling and Reuse

DEQ has increased the goal for statewide recycling each year based on past years' recycling, per capita recycling trends in states with comparable programs, and other factors. For example, DEQ has considered the 2009 switch to digital TVs, 2010 disposal ban, promotional efforts, sales of covered electronics and light-weighting of covered electronics when setting recycling goals. The statewide recycling goal for 2012 is 27.05 million pounds of computers, monitors and TVs, which is 7.1 pounds per capita.

The weight of electronic devices recycled and number reused has increased each year since the Oregon E-Cycles program began. This reflects an increasing demand for these services. Preliminary figures show nearly 26 million pounds of electronic devices were recycled and another 36,727 units were reused in Oregon during 2011. The weight of electronics recycled per capita has also increased each year.

Even if demand for electronics recycling continues to increase, DEQ will evaluate relevant trends and information and consult with stakeholders each year to determine whether the total *weight* of recycling – and thus the statewide recycling goal for E-Cycles – should also increase. As the mix and weight of devices returned for recycling changes (e.g., fewer old, heavy TVs and computers and more, lighter-weight flat screens, laptops and net books), the total weight of electronics recycled each year may stabilize or even decline.

Recycling Programs

Four recycling programs have comprised Oregon E-Cycles operations since its inception:

- A state contractor program operated by the National Center for Electronics Recycling under a contract with DEQ
- Three manufacturer-run recycling programs:
  - Electronic Manufacturers Recycling Management Company
  - Manufacturers' Group Program
  - Individual Producer Responsibility group plan

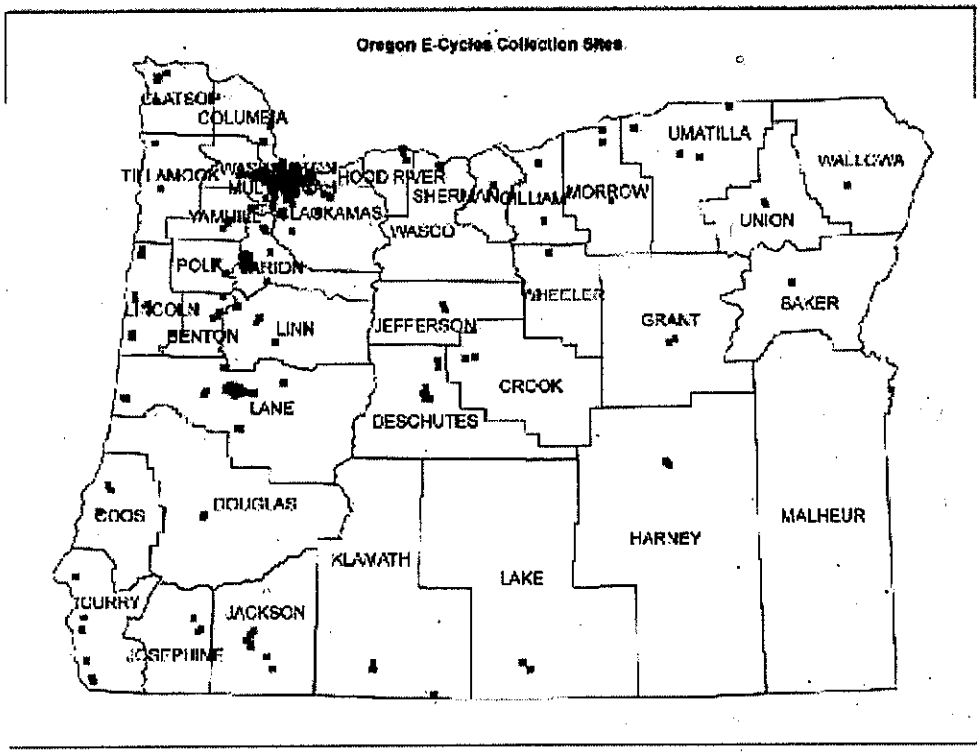
Combined, these four programs include more than 160 manufacturers.

Services

Although Oregon E-Cycles recycling programs undergo some change every year (e.g., participating manufacturers, minimum recycling obligations and collection and recycling networks), collectively the four programs have established a fairly stable recycling infrastructure for Oregon E-Cycles with more than 220 collection sites. The recycling programs must each provide at least the minimum collection service required by the law (service in each county and at least one site for every city with a population of 10,000 or more), but can and do share collection sites. For example, multiple recycling programs may share sites that collect high volumes or are in areas where few are available. Collection sites include public and private transfer stations, landfills, recycling and refurbishment centers, thrift stores and retail locations. Figure 1 provides a map of the

collection sites in Oregon in October 2011. DEQ's E-Cycles web pages provide a search page and hotline number for locating collection sites and services.

Figure 1: Map of Oregon E-Cycles Collection Sites, October 2011



The four recycling programs collectively used the following eight recyclers during 2011. Each recycling program contracted directly with at least two recyclers and used others through site sharing agreements with the other programs.

- Universal Recycling Technologies, Clackamas, OR
- Waste Management Recycle America, LLC, Tigard, OR
- Total Reclaim Inc, Portland, OR (sends some material to Seattle, WA)
- Free Geek, Portland, OR
- Technology Conservation Group, Portland, OR
- Electronic Collection Services Refining, Santa Clara, CA (consolidation point in Medford, OR)
- IMS Electronics Recycling, Vancouver, WA
- Electronic Recyclers International, Seattle, WA

Environmental Benefits

Recycling waste electronics achieves significant environmental benefits when the recycled materials are used to replace virgin feedstock in manufacturing. Responsible recycling also keeps toxic materials from being released to the environment. To help quantify those benefits, DEQ has used U.S. Environmental Protection Agency models

and emissions factors to estimate both the energy savings and the reductions in greenhouse gases associated with recycling computers, monitors and TVs through the Oregon E-Cycles program since it began in 2009. Those savings are significant.

DEQ estimates E-Cycles recycling has led to energy savings of approximately 1,050 billion British thermal units (BTUs), which is equivalent to approximately 8 million gallons of gasoline. Net greenhouse reductions are estimated at 80,000 metric tons of carbon dioxide equivalents. Using data from EPA, Oregon Department of Transportation and Oregon Department of Energy, DEQ estimates those reductions are comparable to the greenhouse gas benefit of eliminating tailpipe emissions from approximately 16,300 average passenger cars per year.

While the energy and greenhouse gas benefits of recycling are significant, reusing computers, monitors and TVs may produce even greater benefits. Reuse that replaces new products avoids the resource consumption and environmental impacts that occur over the life of a product, from resource extraction, materials processing, manufacture and distribution to end-of-life management.

Economic Impacts

Although electronics recycling has increased dramatically under the Oregon E-Cycles program, information on the program's economic impacts and job creation is limited. A March 2010 report by the Northwest Product Stewardship Council, "Preliminary Analysis of E-Cycle Programs in Washington and Oregon," highlighted the following impacts on processors and recyclers based on interviews with Northwest processors/recyclers during 2009, the first year of Oregon E-Cycles operations.

- Processors/recyclers estimated 61 net new jobs were created in Oregon for program start-up (79 jobs in Washington). An estimated ongoing 360 jobs at these facilities were attributable to Oregon and Washington E-Cycles programs.
- Processing capacity had increased in the Northwest. Three processors/recyclers established new facilities largely because of the E-Cycles programs, 1 in Oregon and 2 in Washington. Another acquired a facility because of these laws.
- The long-term ability of processors/recyclers to thrive under a producer responsibility system is untested.
- Short-term impacts on processors/recyclers were mixed. Some saw negative financial impacts (e.g. those not participating in E-Cycles), while others with newly established facilities were satisfied with the system.

Since the March 2010 NWPSC report, collection and recycling under the Oregon E-Cycles program has increased by 36.3 percent, likely creating additional new jobs.

Compliance Oversight

Each recycling program is responsible for ensuring the collectors, transporters and recyclers in its network comply with the operational standards and environmental management practices described in its approved plan. As described in those plans, the programs inspect all collection sites before they begin collection for Oregon E-Cycles

and inspect a number of existing collection sites annually. The programs also perform or require annual audits of their recyclers, or use recyclers that are certified by approved third-party certification programs. Audits must track whole CEDs, components and materials from the direct recycling facility though the point at which the material becomes a single material commodity suitable for final processing. Audits must also verify that downstream vendors appropriately managed the materials they received.

Each program reports the CEDs collected and recycled or reused each quarter to DEQ and submits an annual report that describes how its plan was implemented during the previous year. The annual report includes the outcomes of the inspections and audits conducted that year, including any issues identified and how they were resolved.

DEQ reviews the quarterly and annual reports and addresses any issues with the recycling programs. In 2011, DEQ also conducted oversight visits at 20 percent of Oregon E-Cycles collectors across the state and at all in-state recycling facilities. DEQ identified some concerns regarding facility operations or environmental management practices and is following up with the recycling programs to ensure improvement. For example, a few facilities were storing wastes where they could be exposed to stormwater, some lacked adequate plans for managing broken cathode ray tubes and some did not have adequate liability insurance. Based on these results, DEQ will conduct fewer but more targeted visits in 2012.

DEQ Administration

DEQ's duties include:

- registering manufacturers;
- publishing monthly lists of registered manufacturers and brands and manufacturers in compliance with the law;
- determining manufacturers' market share and registration fees;
- overseeing sampling of devices returned for recycling;
- determining the total weight of devices to be collected each year;
- calculating return shares and return shares by weight (minimum recycling obligations) for manufacturers;
- collecting registration fees and recycling fees for manufacturers in the state contractor program;
- reviewing recycling program plans and reports;
- administering the contract for the state contractor program;
- providing information to retailers, manufacturers and the public;
- conducting compliance oversight and enforcement activities; and
- working with stakeholders on program and policy planning and development.

DEQ's E-Cycles program costs are funded by the annual registration fees manufacturers pay.[4] The Legislature established a registration fee schedule in 2007 based on estimated costs and revenue for administering Oregon E-Cycles. The Legislature also authorized

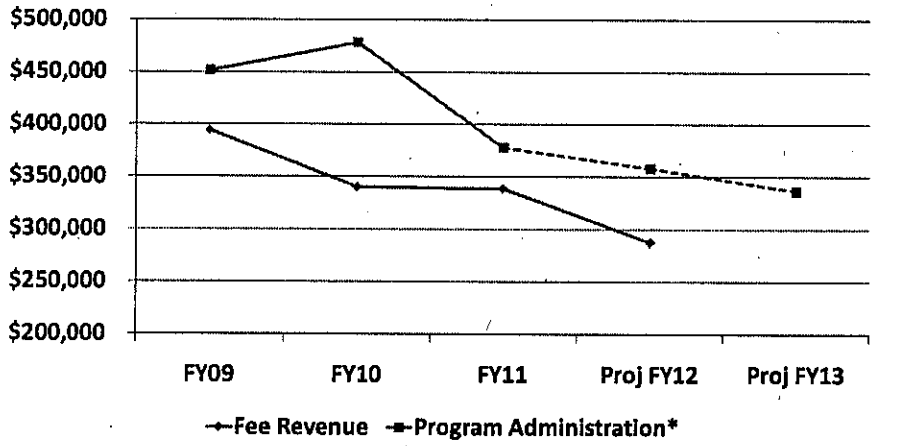
[4] Registration fees cover DEQ's costs for administering the E-Cycles program except for the state contractor program. Manufacturers in the SCP pay recycling fees that cover the full costs of that program, including DEQ's administrative costs.

the Environmental Quality Commission to modify those fees for 2012 and beyond so that registration fees approximately match DEQ's costs for implementing the program.

The existing registration fee structure has not generated sufficient revenue to cover DEQ's start-up and ongoing operating costs, even though current operating costs are lower than estimated in 2007, and additional streamlining may further reduce costs. DEQ has used solid waste disposal fee revenue to make up the registration fee revenue shortfalls each year. The graph in Figure 2 illustrates the revenue shortfalls.

Figure 2

Oregon E-Cycles Registration Fee Revenue and Program Costs



* Program costs paid by registration fee, excluding database development

In late 2011, DEQ convened an advisory committee with representatives from all major stakeholders (e.g., manufacturers, solid waste industry, local government and environmental groups) to help develop a revised registration fee structure that will cover DEQ's costs. The advisory committee will meet through the spring of 2012. DEQ plans to recommend a revised fee structure to the Environmental Quality Commission for adoption in the summer of 2012.

Looking Forward

Oregon E-Cycles is a successful product stewardship program. Electronics manufacturers, service providers, government, retailers, consumers and other stakeholders have worked cooperatively to provide convenient, responsible recycling for the growing electronics waste stream. The program has significantly expanded opportunities for Oregonians to recycle electronic wastes and has shifted responsibility and costs for managing these waste products from rate payers and local governments to product manufacturers, sellers and users. DEQ will continue to work with recycling programs, the E-Cycles advisory workgroup and other interested parties to evaluate and improve Oregon E-Cycles as they collectively gain experience and take advantage of new opportunities to more effectively achieve priority environmental outcomes.

Electronics Stewardship in the United States of America

Lisa Feldt

Environmental Protection Agency

GEM Network

July 18, 2013

Objectives

- Importance of Recycling Electronics
- Overview of National Strategy of Electronics Stewardship (NSES)
- Status of EPA activities under NSES
- Highlights of other Federal activities

Importance of Reuse and Recycling

Complex Devices: Electronics are constantly changing in design & makeup

- Contain steel, plastic, glass, ceramics, copper, aluminum, lead, nickel, lithium, cadmium, mercury, beryllium, gold, silver, & flame retardants, to name a few
- Different components have different potential for reuse, recycling and recovery

Prevents Harm: Some electronic waste contains components that could present an environmental risk if not managed safely

- Cathode Ray Tubes contain 2-5 lbs lead
- Back lighting contains mercury in lamps
- Circuit boards may contain leaded solder

Conserves Resources: Reusing or recycling electronics conserves natural resources such as gold, silver, palladium by avoiding the need to mine virgin materials

- Contain valuable materials; 1 metric ton of obsolete cell phones contain on average:
  - 140 kilograms copper
  - 3.14 kilograms silver
  - 300 grams gold
  - 130 grams palladium
  - 3 grams platinum

Avoids Pollution: Reducing the need to mine new elements avoids air and water pollution, and greenhouse gas emissions that can be caused by mining and refining virgin materials

USGS "Recycled Cell Phones – A Treasure Trove of Valuable Metals (July 2006)"

National Attention: *Electronics Stewardship*

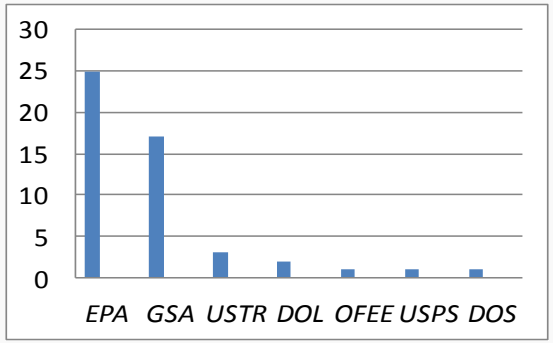
- **11/15/10**: Presidential Proclamation established the U.S. Government Interagency Task Force to lead a coordinated federal effort to improve safe handling and disposal of used electronics throughout the product lifecycle
  - Co-Leads: CEQ, EPA and GSA
  - 15 Agencies

- **7/20/11**: ***National Strategy for Electronics Stewardship (NSES)*** announced; 4 overarching goals:
  - Promote the development of more efficient and sustainable electronics products
  - Direct federal agencies to buy, use, reuse and recycle their electronics responsibly
  - Support recycling options and systems for American consumers
  - Strengthen America's role in international electronics stewardship

- Will create opportunity to better protect human health and the environment, conserve valuable resources, save money and create jobs

Background: *NSES Commitments*

- National Strategy for Electronics Stewardship (NSES) contains 19 actions that include 47 discrete tasks
- Seven Federal Agencies have commitments under the NSES
- Tasks per agency:



- EPA offices actively engaged:
  - Office of Solid Waste and Emergency Response (OSWER)
  - Office of Chemical Safety and Pollution Prevention (OCSPP)
  - Office of International and Tribal Affairs (OITA)
  - Office of Enforcement and Compliance Assistance (OECA)
  - Office of Research and Development (ORD)
  - Office of Air and Radiation (OAR)

Goal 1: *Build incentives for design of greener electronics; enhance science, research and technology*

- Convene multi-stakeholder groups to design greener electronics products that have reduced environmental impacts across the lifecycle and are easier to recycle.

- Launch a series of prize competitions to spur innovations in technology and design across the lifecycle of electronics.

- Develop new standards for Electronics Procurement Environmental Assessment Tool (EPEAT) and expand the ENERGY STAR program beyond the energy consumed by electronics while in use.

- Support research into the toxicology, exposure pathways, and recovery methodologies of the rare earth elements (and their compounds) used in electronics and during their recycling, remanufacturing and disposal.

Status of Design & Research Greener Electronics Commitments

- **Building on the Electronics Procurement Environmental Assessment Tool (EPEAT),** a tool that shows electronics products designed with the environment in mind. EPEAT products have fewer toxic materials, use less energy, last longer, have more recycled content and are easier to recycle than standard equipment. EPA committed to:
  - Made preparations to establish multi-stakeholder groups to address key research questions and design challenges, and accelerate development of and investment in green electronics design standards;
  - Launched the Greener Products website to promote consumer purchasing of green electronics that are certified as meeting stringent environmental performance criteria that address environmental impacts across the products' entire lifecycle http://www.epa.gov/greenerproducts/
  - Adding the new, EPEAT-registered imaging equipment and televisions to the products that Federal Agencies purchase from to ensure expansion of green electronics certification programs.

- **Promote scientific research into the recovery of material from used electronics**
  - Life Cycle Assessment (LCA) of electronic products : Identify potential environmental trade-offs for reuse and recycle of materials in electronics (rare earth elements and plastics).
  - Health Impacts (ORD /NIOSH): Study on exposure during electronic recycling processes.
  - Create Innovation Challenges: Challenged industry to develop a system to track electronic devices and a list their chemical contents to advance recycling and recovery of valuable products.
  - Sustainable Electronic Workshop – Convened key stakeholders to assess current and future needs.

Goal 2: *Federal Government Leads by Example*

- Revise the Federal Electronics Stewardship Policy to require Federal agencies to use recyclers that are certified to the certification programs and ban landfill of federally used electronics.

- Improve tracking of used Federal equipment throughout the lifecycle.

- Encourage electronics manufacturers to expand their product take-back programs in Federal electronics purchase, rental and service contracts.

- Require and enable recipients of former Federal equipment that has been sold, transferred, or donated for reuse to use certified recyclers and follow other environmentally sound practices.

- More effectively direct Federal Government spending on electronics toward green products through procurement.

Status of Federal Government Leads by Example

- General Services Administration (GSA) is developing a government-wide regulation that will require Federal Agencies to maximize reuse, clear data and to ensure used Federal equipment is managed by certified recyclers.

- EPA is working with GSA to conduct an Implementation Study of the R2 and e-Stewards certification programs to determine if the programs are implemented transparently, consistently and are achieving desired results.
  - Will inform GSA requirements for managing federal used electronics.
  - Hope to understand better the strengths and weaknesses of the programs.

- GSA will improve tracking of used Federal equipment throughout the recycling chain.

- EPA launched the Federal Green Challenge (FGC)
  - Program goal is for federal facilities located throughout the U.S. to reduce their environmental impacts in six areas, including electronics.
  - In 2012, FGC participants reported recycling 5,700 tons of electronics.

Goal 3: *Improve Handling of Used Electronics in the U.S.*

- Launch voluntary partnerships with the electronics industry and stakeholders to increase collection of used electronics that are safely managed by certified recyclers.

- Provide guidance to electronics recycling employers on providing facilities that offer safe and healthful working environments.

- Establish approaches to gather, track, and provide public access to information on quantities and movement of used electronics within the U.S.

Status of Improve Handling of Used Electronics in the U.S.

- Launch voluntary partnerships that center around certified recyclers.
  - EPA successfully launched the Sustainable Materials Management (SMM) Electronics Challenge
    - A voluntary partnership with electronics manufacturers and retailers (e.g., Best Buy, Dell, LG, Nokia, Panasonic, Samsung, Sharp, Sony, Sprint, Staples).
    - Partners commit to:
      - Send 100% used electronics collected to certified recyclers/refurbishers.
      - Increase total amount used electronics collected.
      - Promote transparency by publically sharing results.
- Increase the use of 3rd party certified recyclers by states, business and the general public to ensure proper handling and disposal of used electronics.
  - There has been an increased of awareness and demand in the use of certified recyclers.
  - Since release of the NSES in July 2011 to April 2013, there has been a 240% increase in certified recyclers.
  - EPA Developed and launched a map of recyclers and refurbishers that are certified to the electronics recycling certification programs. http://www.epa.gov/epawaste/conserve/materials/ecycling/certmap.htm

Goal 4: *Reduce Harm from US Exports; Improve Handling in Developing Countries*

- **Improve information on trade flows and handling of used electronics,** and share data with Federal and international agencies, within the limits of Federal authorities.

- **Provide technical assistance and establish partnerships with developing countries** to better manage used electronics.

- **Work with exporters to explore how to incentivize and promote the safe handling** of remanufactured, recycled, and used electronics at home and abroad.

- **Propose regulatory changes** to improve compliance with the existing regulation that governs the export of cathode ray tubes from used computer monitors and televisions that are destined for reuse and recycling.

- **Support ratification of the Basel Convention** on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Status of Reduce Harm from US Exports; Improve Handling in Developing Countries

- **Improve trade flow information on used electronics.**
  - UNU-StEP/MIT/NCER study to characterize transboundary flows of e-waste from US.
  - USITC report using trade data to estimate flows released February 2013.
- **Propose regulatory changes to better track exports and support compliance monitoring of CRTs exported for reuse and recycling.**
- **Provide technical assistance and establish partnerships with developing countries to better manage used electronics.**
  - Collaborating in Asia, Africa, Latin America and the Caribbean and North America.
  - Cooperate through bilateral and regional agreements/initiatives and with UNU-StEP.
- **Support ratification of the Basel Convention.**
  - Participation in Basel working groups (e.g. PACE, ESM) that develop guidance on recycling of used electronics and their transboundary movement.

E-Waste Enforcement

- RCRA compliance monitoring and enforcement program includes the Cathode Ray Tube (CRT) regulations.

- Regions and states continue to inspect electronics recycling facilities and bring appropriate enforcement actions.

- EPA has concluded two recent criminal enforcement actions:
  - **Executive Recycling Inc**., its owner, and its vice president, were convicted on multiple counts of mail and wire fraud, obstruction and environmental crimes related to illegally disposing electronic waste and smuggling. The company claimed to safely recycle e-waste in the U.S., but regularly exported obsolete and discarded electronic equipment with toxic materials to other countries.

  - **Discount Computers Inc. (DCI**) and its owner and a second company executive pled guilty to trafficking in counterfeit goods and services and violating environmental laws relating to the illegal export of CRTs. DCI was sentenced to pay a $2 million fine and $10,839 in restitution. The owner received 30 months incarceration, two years of supervised release, and must pay a $10,000 fine.

- EPA with INTERPOL's Environmental Crime Program, launched Operation Enigma in late 2012.
  - Program identifies and disrupts the illegal collection, recycling, export, import and shipping of discarded electronic products.
  - The first phase targeted Europe and Africa and led to the seizure of 240 tons of electronic equipment and electrical goods and the launch of criminal investigations against some 40 companies involved in all aspects of the illicit trade.

Other Federal Agencies NSES Commitments https://www.fedcenter.gov

- **General Services Administration (GSA):**
  - Revising policy and regulations for managing the Federal Government's electronics.
  - Proposed regulation to include requirement for Federal Government to use certified electronics recyclers to manage unwanted used electronics.

- **Occupational Safety and Health Administration (OSHA):**
  - Developing "Safety and Health Management Guidelines for E-Waste."

- **National Institute for Occupational, Safety and Health (NIOSH):**
  - Conducting studies (with EPA) on exposures during electronic recycling processes.

- **United States Trade Representative:**
  - Commissioned a US International Trade Commission report "Used Electronic Products: An Examination of U.S. Exports."

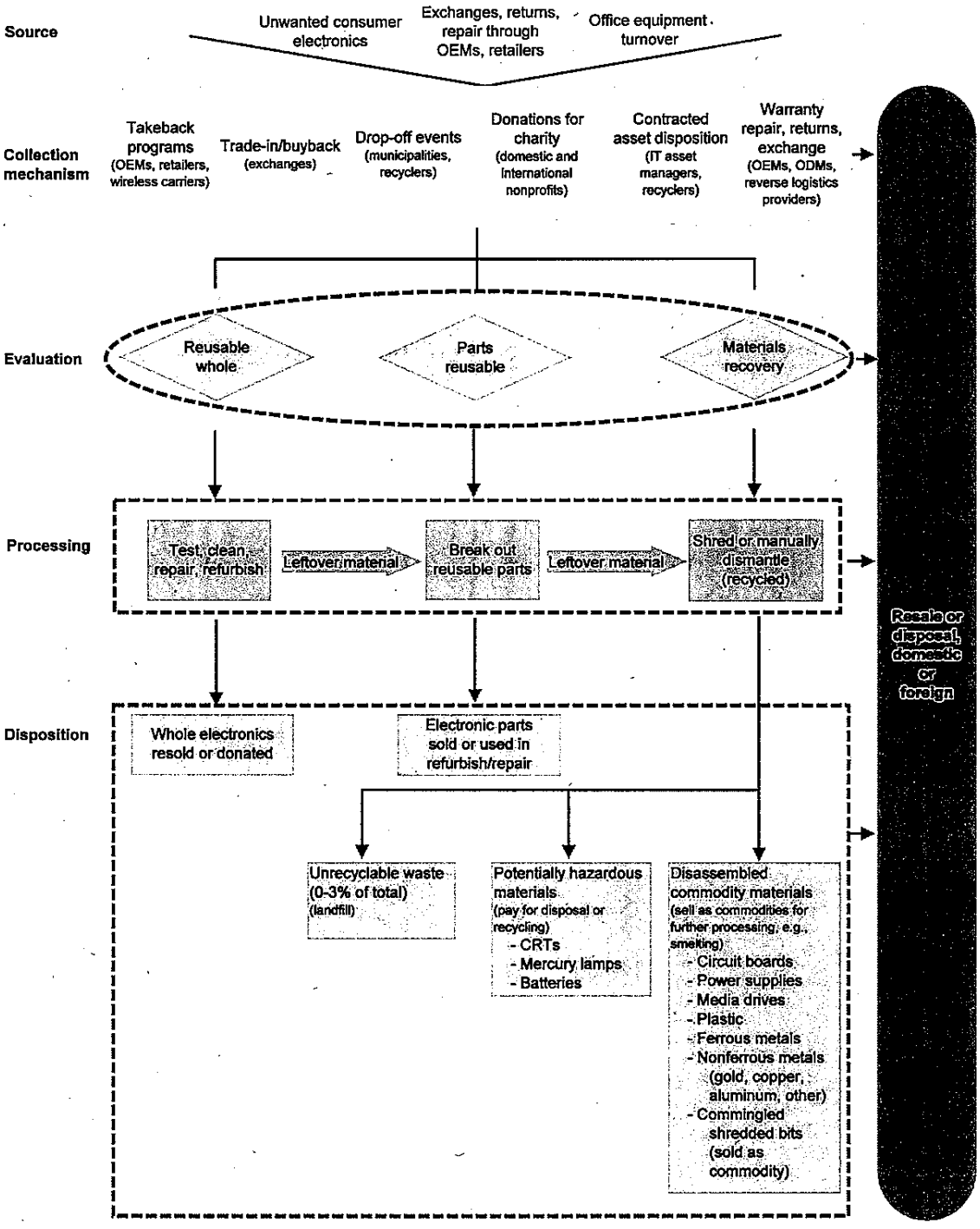
- **United States Postal Service:**
  - Launched USPS Blue Earth, a electronics recycling program that allows Federal Agencies and their employees to recycle electronics free of charge; program uses certified recyclers.
  - Especially valuable to facilities located in rural areas by providing easy transportation for recycling.

Benefits: National Strategy for Electronics Stewardship

- Using an Interagency approach to develop the National Strategy for Electronics Stewardship:
  - Elevated importance and priority of proper electronics management.
  - Allowed fast and easy communication about electronics management throughout Federal Government.
  - Encouraged other Federal Agencies (e.g., USTR, OSHA, USPS) to develop needed information, guidance or programs.

- Developing the National Strategy for Electronics Stewardship:
  - Provided a coordinated and public blueprint of actions the Federal Government will accomplish.
  - Electronics stakeholders better understand the importance the Federal Government places on electronics stewardship.
  - Electronics recyclers realize the importance of becoming certified to an electronics recycling standard.

FIGURE ES.1 Used electronic products end-of-life cycle: Sales, including exports, may occur at any point along this complex chain



Source: Compiled by the Commission.