



Flat-panel displays: overview and challenges

E-Cycle Wisconsin stakeholder meeting
June 1, 2016

Sarah Murray, Wisconsin DNR

Acknowledgements

- Bobby Elliot, E-Scrap News
- EPA Region 3 February webinar
 - Recording:
<https://epawebconferencing.acms.com/p3yi0uu9ppw/?launcher=false&fcsContent=true&pbMode=normal>

Flat-panel display types

- CCFL (cold cathode fluorescent lamp)—being phased out in favor of LEDs
- Plasma
- LED (light-emitting diode)
- OLED (organic light-emitting diode)



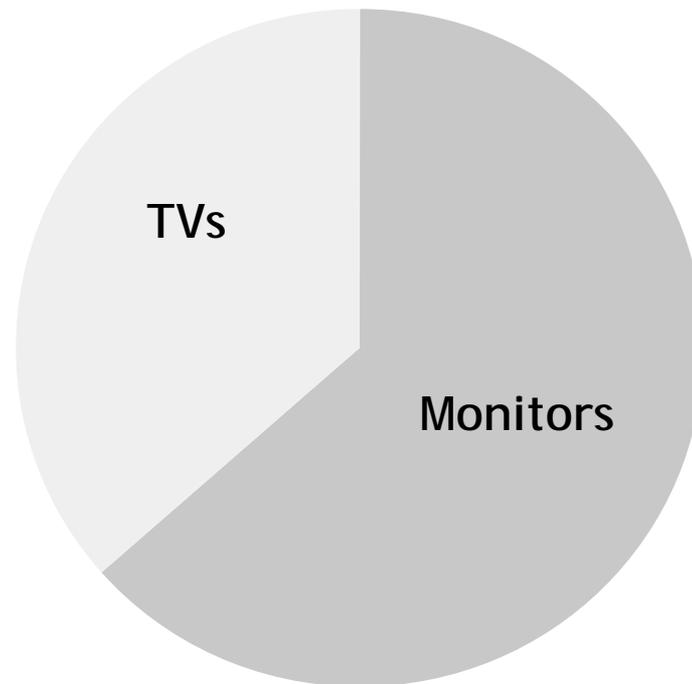
Sales of FPD TVs and monitors

TV sales: 2004-2014

- 174 million units (CEA)
- Note: All CCFLs

Monitor Sales: 2001-2014

- 302.5 million units (EPA, IDC)
- Note: Almost all CCFLs



**Rough
estimate: 470
million units**

Flat panels in recycling stream

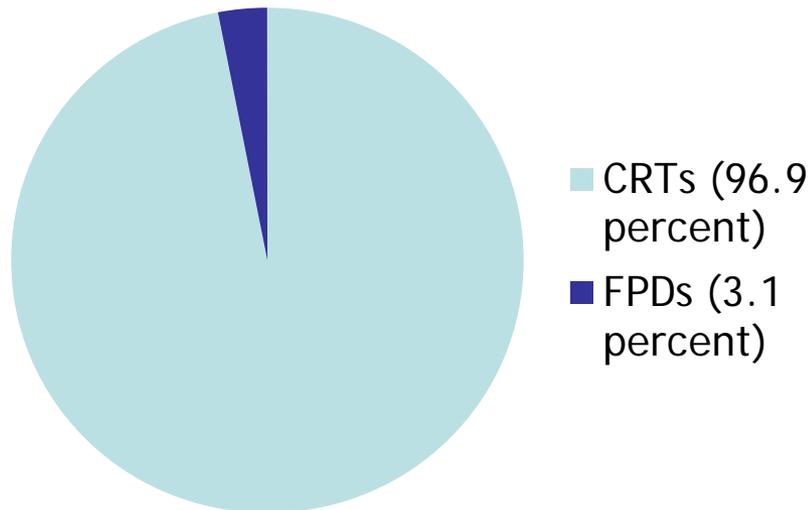
- Average life span: 3-10 years
- For monitors especially, refurbishment has been primary outlet
- Average weight: 15-30 lbs (roughly half of CRT weight)
- Estimated total weight: About 10 billion pounds over next 10-15 years
- Compares with estimated 50 billion total pounds of CRTs
- Recyclers charging for them, generally around 5-8 cents/lb
- Should be less attractive to scrappers (no copper yoke)



State data on flat panels

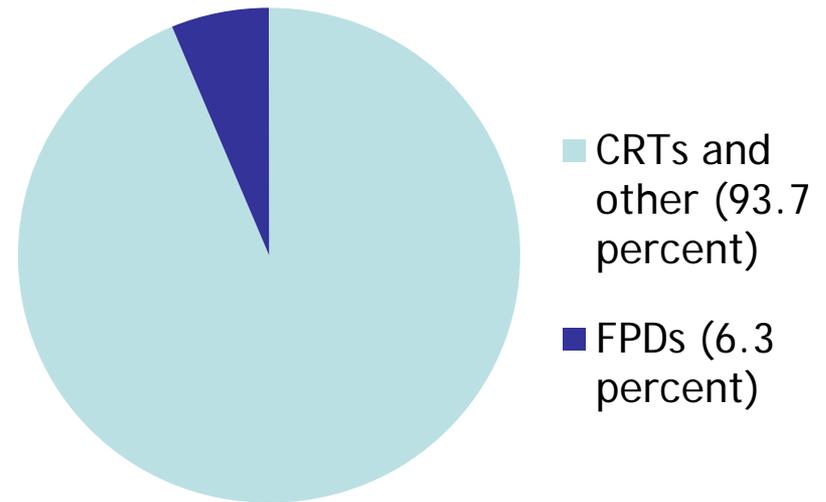
California

Display stream, 2014



Washington

E-scrap stream, 2014



Mercury in CCFL flat panels

- While lighter and not made with lead, CCFL flat panels contain mercury
- Each lamp contains anywhere from 1 to 10 mgs of mercury
- Number of lamps varies per device - smaller monitors have a couple, large TVs can have more than 20



Concerns & challenges handling CCFLs

- Mercury is hazardous, can cause various health issues
- Generally no easy way to tell from outside whether device contains CCFLs
- Little research in U.S. on safe handling
- Both manual and automated process can release mercury, endangering workers and environment
- Automated systems have had some problems getting mercury out, but as volumes rise, we'll need automated options
- Hard to make money off of them, especially with current commodity pricing

Manual disassembly

- Used by most U.S. recyclers, but requires appropriate worker safety precautions
- Takes 10-20 minutes per device (more time-consuming than CRTs)
- Flat panels contain steel, plastic, aluminum, glass, boards and, of course, mercury lamps



Handling mercury lamps

- Importance of locating and keeping fragile lamps intact
- WRAP (U.K.) study found 17 percent of lamps broke - and that was during highly careful process
- Lamps can be sent to mercury lamp recyclers for about \$1 per pound of tubes (5-10)



Automated processes

- Limited systems available (company in Illinois went out of business last year)
- Very fast, but challenge is safely handling mercury
- One Wisconsin recycler has DNR approval to use shredding technology

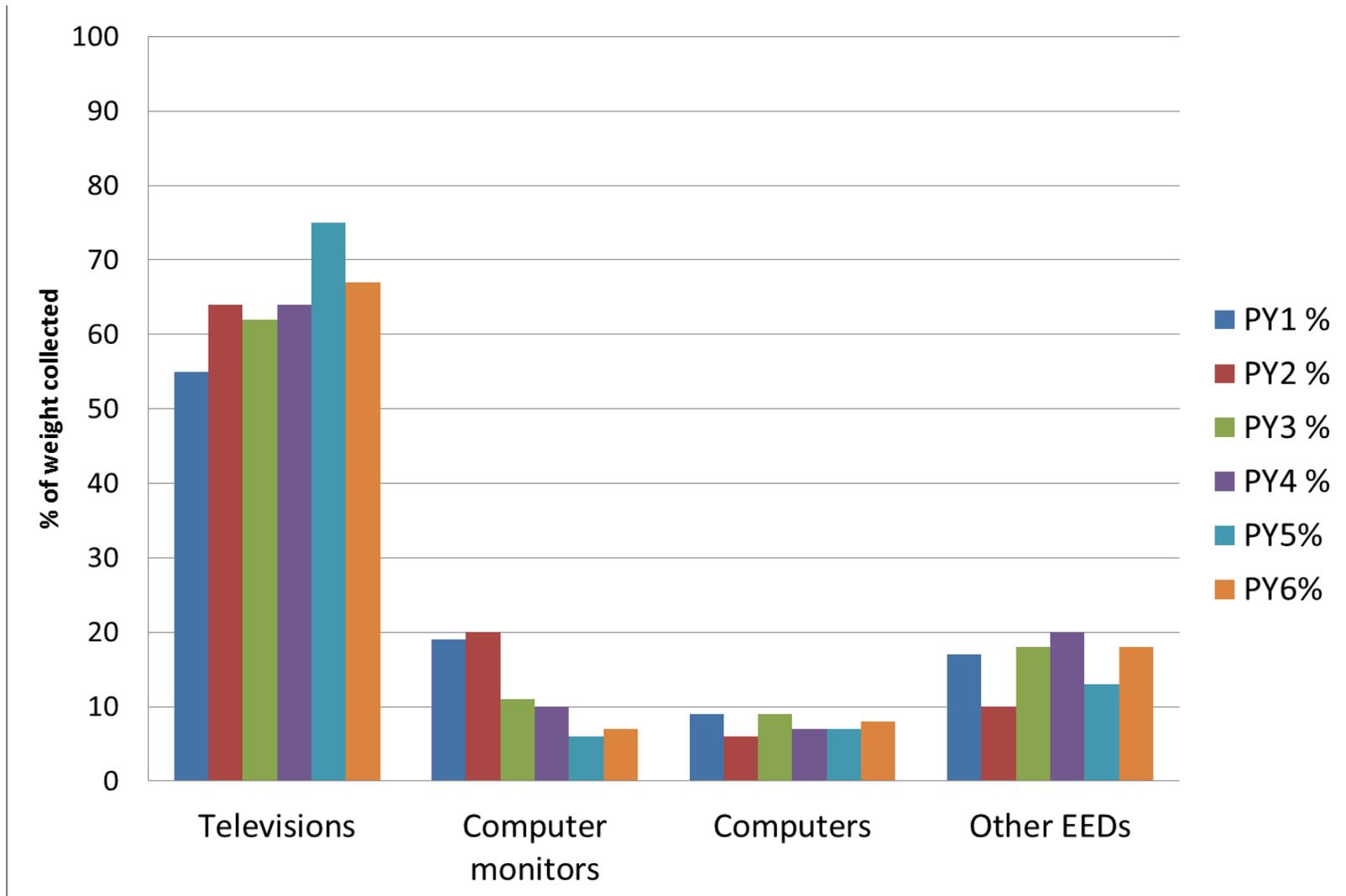
LEDs

- Not much information on them yet, especially bulbs within electronics (rather than those used for lighting)
- Concern with antimony, chromium, copper, lead, nickel, selenium, zinc
- Up to generator to make hazardous waste determination—contact manufacturers
- In general, appears that lighting LEDs could be managed as universal waste

Flat panels under E-Cycle WI

- In November 2015, 9 of 17 registered recyclers receiving flat panels under E-Cycle WI were doing manual disassembly
- Others sending intact to downstream vendors
- One registered recycler has approval for shredding
- In 2014, three large registered recyclers reported, on average, 97% of TVs and 81% of monitors, by weight, received under E-Cycle Wisconsin were CRTs
- Varies depending on mix of residential vs. school material

E-Cycle WI collection by device type



Contacts

- DNR website: <http://dnr.wi.gov/topic/ecycle>
- Sarah Murray, E-Cycle WI coordinator
sarah.murray@wisconsin.gov (608) 264-6001
- Marcy McGrath, E-Cycle WI compliance coordinator
marcy.mcgrath@wisconsin.gov (920) 662-5167
- Amalia Baldwin, E-Cycle WI outreach coordinator
amalia.baldwin@wisconsin.gov
- Amy Dubruiel, E-Cycle WI compliance specialist
amy.dubruiel@wisconsin.gov, (608) 267-7576

