Southern Sydney Regional Organisation of Councils

SSROC

Product Stewardship Centre of Excellence

Product Stewardship Centre of Excellence

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Acknowledgement of Country

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Supporting Documents

- Stewardship Solutions: Product Stewardship Pathways for Large Household Appliances. (main report), June 2025
- Desktop Review of Product Stewardship and EPR Laws for Large Appliances. June 2025
- Improving Stewardship for Large Household Appliances – Economic Modelling. June 2025

1. Introduction

The Product Stewardship Centre of Excellence (the Centre), Southern Sydney Regional Organisation of Councils (SSROC) and the NSW Environment Protection Authority (NSW EPA) are collaborating on a research project to investigate stewardship pathways for large household appliances, including whitegoods such as refrigerators, freezers, washing machines, dryers, and dishwashers. To inform this project a desktop review of some of the different international policies and regulatory approaches relevant to large household appliances was undertaken and summarised in this Report.

This review has looked at policies and regulations for both Waste Electrical and Electronic Equipment (WEEE) and the manufacturing and consumption of ozone-depleting substances from the European Union (EU), Germany, France, Italy, the Republic of Ireland, Sweden, Canada, the USA, Japan, South Korea, Taiwan, China and Australia.

The responsible treatment of waste and ozone depleting substances from electronics and electrical equipment (EEE) including large household appliances presents unique operational and regulatory challenges for supply chain stakeholders and governments globally.

These challenges are being met by introducing product stewardship principles into government WEEE management policies and regulations. Product Stewardship principles require producers to take responsibility for the environmental impacts of their products across their entire product lifecycle including increasing collection/recycling rates, avoiding GHG emissions, and increasing material and ozone depleting substances recovery rates. The implementation of these policies and regulations varies across regions and countries, ranging from an effective and cohesive transposition of European Union Directives throughout member state domestic law, to voluntary state funded programs in Australia and the USA.

Of the countries that have implemented WEEE management legislation, a range of common themes arise. These regulations tend to identify similar priority product categories, including refrigerators, freezers, washing machines and clothes dryers, as well as outlining financial and operational penalties that can be imposed on non-complying producers. While these broad similarities strengthen the international response to WEEE management, there is continued deviation across borders regarding the scope of producer responsibility and the role of government programs in funding and enabling the safe collection, treatment and disposal of large household appliances.

In countries that have not enshrined WEEE management into law, a trend emerges where producers have no legal responsibilities for the end-of-life treatment of their products, and governments are left to ensure their goods are disposed of safely.

Given the widespread ratification of the Montreal Protocol in 1987, domestic ozone-depleting substance regulation presents a more globally uniform response to waste management, demonstrating the effectiveness of cohesive international policy guidance.

A summary of the key features of each country's policies and regulatory approaches relevant to large household appliances are provided in the table below. A more detailed description of each country's approach is provided in Attachment A.

2. Product Stewardship and EPR laws covering appliances

The following table summarises key elements of selected international policies and regulatory approaches for waste electrical and electronic products including large household appliances.

Table X: Product Stewardship and EPR laws covering appliances

Region & Country / Law or Government Program	Key Features
European Union Waste from Electrical and Electronic Equipment (WEEE) Directive (2003)	Provides a cohesive framework for European countries to align e-waste management strategies, to address environmental and economic challenges. Aims to prevent the creation of electronic waste, encourages efficient use of resources, retrieval of secondary raw materials through re-use, recycling, improving the environmental performance of everyone in the EEE life cycle and establishing regulatory guidance on how stakeholders can incorporate EPR principles into their supply chain strategies.[1]
Germany Electrical and Electronic Equipment Act (Elektrogesetz) (2005)	Aims to protect human and environmental health from the harmful substances used in WEEE, ensure the proper collection and return of waste materials, prevent waste and reduce the amount of waste through reuse, preparation for reuse or recycling and recovery,[2] placing the responsibility on organisations who profit from the distribution and sale of WEEE. Includes language that discourages producers from intentionally preventing products' re-use. Targets include a minimum of 80 per cent [rate of recovery] by average weight per appliance.
France Title IV, Environmental Code (2003)	Any person who professionally manufactures, imports or introduces onto the national market electric or electronic household appliances… is obliged to provide for or contribute to the collection, removal and treatment of electric or electronic household appliance waste, irrespective of the date on which they were put on the market.[3] Financial penalties to producers who do not comply.
Italy Legislative Decree 49/2014	WEEE made into domestic law, updated 2018 with open scope approach that any electrical equipment that meets definition needs to follow requirements including that large household appliances achieve 80% recovery rate based on product weights.
Rep. of Ireland Statutory Instrument No. 149 (2014)	Clear direction on responsibilities of manufacturers, importers & retailers in managing collection & financial guarantee for full cost of recovery when discarded by the final user.

[1] WEEE (2024) European Commission

[2] Meunier, C. (2013) Umweltbundesamt

[3] ibid

Region & Country / Law or Government Program	Key Features
Sweden Ordinance 2022:1276	WEEE plus Ordinance outlines requirements for producers including 85% recyclability & that they design for reuse & recycling.
Canada Canada-wide Action Plan for EPR (2009)	9 out of 10 Canadian provinces introduced EPR policies & programs, with exceptions made for remote northern territories due to logistical difficulties, no minimum recycling target. However, KPIs are identified for EPR programs, including kgs of waste/capita captured, dollars/kg recovered and avoided GHG emissions.
USA Responsible Appliance Disposal Program (2006)	No federal regulation, 25 states regulate e-waste management. Responsible Appliance Disposal (RAD) program for voluntarily participate in EPR practices but no enforcement
Japan Home Appliance Recycling Law (2001)	Regulated EPR with required recycling rate of 55-82% (depending on product category) & assigns clear responsibilities e.g. retailers required to facilitate the collection of goods from consumers, while manufacturers & importers are responsible for product recycling & financially accountable for costs associated with collection. Also regulates the recovery and treatment of products containing CFCs, HCFCs and HFCs.[4]
South Korea Product Recycling System (2003)	Retailers and suppliers are financially responsible for the collection and transport of goods, they have the choice of fulfilling their obligations by recycling the products themselves or engaging third party recyclers and Producer Responsibility Organisations.[5] Consumers also have a responsibility to pay a disposal fee. Includes recycling rate targets and penalties where producers fail to meet the mandatory recycling rates, a fee equivalent to the amount of the recycling shortage multiplied by 115 to 130% of the standard recycling cost will be payable by the infringing producer.[6]
Taiwan 4-in-1 Recycling Program under the Waste Disposal Act (1988)	Manufacturers and importers are required to pay a fixed fee per unit sold domestically, which is allocated to the collection and recycling of post-consumer products.[7] Guidelines are also provided on collection strategies, determining that collection points for Regulated Recyclable Waste (including large household appliances) are required at certain retail locations, including supermarkets and convenience stores.[8] Manufacturers can be penalised for non-compliance, No mandatory recycling rates. Exported appliances are exempt from the fixed-fee-per-unit pricing mechanism.[9]

[4] ibid

[5] ibid

[6] ibid, p.14

[7] ibid

[8] WEEE Management in Taiwan (2012) USEPA, p. 2

[9] ibid, p. 21

Region & Country / Law or Government Program	Key Features
China Management of Collection and Disposal of Waste Electrical and Electronic Products Regulation (2011)	Manufacturers and importers are held financially responsible for the end-of-life treatment of their products.[10]. China's approach to managing WEEE hinges on a state administered Disposal Fund, that collects fees from manufacturers and importers that are allocated to the collection and disposal of waste electrical and electronic products.[11] Collection and disposal service providers are licensed to ensure they are meeting regulatory expectations, with severe penalties administered to non-complying service providers.[12] Stakeholders suggest that the legislation has not materially influenced the product design processes.[13] due to insufficient awareness among stakeholders, the perception of insignificant impact and limited understanding of the practical changes the regulation incurs.[14]
Australia - Fridge Buyback Scheme (2006-2017) - ACT Fridge Buyback Product scope: Refrigerators and freezers.	No national, state or territory regulations exist. State and territory government funded programs. NSW Fridge Buyback Schemed offered residents across 51 Councils the opportunity to responsibly dispose of their fridges between from 2006 – 2017. The program created significant economic benefits, saving a total of ~$18 million/yr on residential bills.[15] ACT's Fridge Buyback scheme available to ACT residents who are also ActewAGL customers, offers in home collection of one and two door refrigerators with two door refrigerators receiving a $30 credit.

[10] China WEEE (2020) Enviliance Asia

[11] ibid

[12] ibid

[13] ibid, p. 12

[14] ibid

[15] ibid

3. Policies and regulatory approaches for ozone depleting substances

The following table summarises key features of selected international policies and regulatory approaches for ozone depleting gases for large household appliances

Table X: Policies and regulatory approaches for ozone depleting substances

Region & Country / Law or Government Program	Key Features
European Union Regulation (EU) 2024/590 on Substances that Deplete the Ozone Layer (2024)	Focuses on producers' management of the recovery, destruction, recycling and reclamation of ozone-depleting substances.
Canada Ozone-depleting Substances and Halocarbon Alternatives Regulation (2016)	Ensures responsible reclamation, recovery and recycling of hazardous chemicals found in heating, plumbing or refrigeration systems.[16] These regulations transpose guidelines from the Vienna and Montreal Protocol.[17] However, OSHAR has not yet been amended to restrict the incidental production of harmful substances,[18] limiting its regulatory oversight in comparison to European leaders in the space.
USA American Innovation and Manufacturing Act (2020)	American Innovation and Manufacturing Act (2020) regulates HFCs in refrigeration, air conditioning, heat pump & fire suppression equipment, ensuring that those who own, operate, service, repair, recycle, dispose, or install equipment containing HFCs are held responsible for the proper treatment of hazardous chemicals.
Japan Ozone Layer through the Control of Specified Substances and Other Measures (1988)	This law refers to the Vienna and Montreal Protocol, outlining strict controls on the production of 'specified substances', requiring comprehensive reporting, research and independent oversight of the substances' production.
South Korea Act on the Control of Manufacture of Specific Substances for the Protection of the Ozone Layer (2008)	Integrating the Montreal Protocol into domestic law, the regulation defines the responsibilities of producers, the entities eligible for exemption and penalties incurred because of non-compliance.[19]

[16] OSHAR (2016)

[17] ibid

[18] ibid

[19] Act No. 19002

Region & Country / Law or Government Program	Key Features
Taiwan Air Pollution Control Act	Regulation to phase out the use of ozone-depleting substances, guided by the Montreal Protocol.[20] Taiwan has phased out the majority of ozone-depleting substances since 2006, with a target of eliminating the consumption of HCFCs by 2030.[21] A suite of regulations under the Air Pollution Control Act provide guidelines for producers' responsibility in reducing their use of HCFCs, specifically targeting manufacturers of refrigeration and air conditioning equipment.[22]
China Regulations on Administration of Ozone Depleting Substances (2010)	Oversight of refrigeration and air conditioning equipment, while expanding state control of HFC reporting and elimination.[23]
Australia Ozone Protection and Synthetic Greenhouse Gas Management Legislation (1989)	Controls ozone-depleting substances throughout the product lifecycle from production to disposal.[24] The regulation specifically acknowledges refrigerators and air conditioners as priority product categories given their reliance on CFCs and HCFCs.[25]

[20] Ozone Layer Protection (2024) Ministry of Environment

[21] ibid

[22] ibid

[23] ibid

[24] The Ozone Acts (2021) DCCEEW

[25] ibid

4. Summary

Regulatory responses to product stewardship for large household appliances varies across borders. Regional agreements, like those in the EU, provide a cohesive framework for member states to transpose into domestic law, while a lack of unity across North America and the Asia Pacific region has resulted in a scattered range of approaches that respond to domestic needs.

Most notably, the USA and Australia's lack of governmental oversight leaves white goods producers unaccountable for the treatment and disposal of WEEE. While voluntary programs in these countries encourage the extension of producer responsibility, there is a need to assign and regulate increased accountability for producers throughout the supply chain.

In contrast, regulatory responses to the reduction of ozone-depleting substances are comparatively uniform throughout Europe, North America and the Asia-Pacific region. The influence of the Montreal Protocol is in part responsible for this international cohesion, with many of the legislative instruments that have been analysed referring to its contribution to the regulation's formulation.

Drawing on regulatory lessons from EU member states, influential Asian economies, and progressive North American action plans should encourage the rapid adoption of comprehensive EPR policy for the large appliance sector in Australia.

Regulatory responses should prioritise the assignment of responsibility throughout the supply chain, incentivising compliance with these policies, increasing local capabilities to process white goods and establishing succinct and clear methods of knowledge sharing and communications to ensure industry stakeholders are aware of their responsibilities.

ATTACHMENT A

1. EUROPE

1.1 European Union's WEEE Directive

The European Union's Waste from Electronics and Electrical Equipment (WEEE) directive, first entered into force in February 2003, aims to prevent the creation of electronic waste across the region. The directive further encourages efficient use of resources and the retrieval of secondary raw materials through re-use, recycling and other forms of recovery while improving the environmental performance of everyone involved in the life cycle of EEE, and establishing clear regulatory guidance on how stakeholders can incorporate EPR principles into their supply chain strategies.[26]

Large household appliances including fridges, washing machines, and dishwashers are captured under this directive, given their utilisation of a complex mixture of materials and chemicals, some of which are hazardous.[27] The WEEE Directive highlights the importance of product longevity and recyclability, "encouraging [the] design and production of EEE which take into full account and facilitate its repair, possible upgrading, re-use, disassembly and recycling".[28] To strengthen this, the directive also notes that relying on product replacement strategies can accelerate EEE waste streams, if materials in the returned products are not appropriately repurposed.[29]

Prioritising the repair and re-use of discarded products, rather than their replacement, provides a mechanism for producers to slow their resource loops and divert e-waste from landfill. As a leader in circular waste management policy, the EU has established clear and effective guidance for producers of large household appliances to adopt extended responsibility for the lifecycle of their products. The WEEE Directive uniquely provides a cohesive framework for European countries to align e-waste management strategies, leading to a regionally strong response to environmental and economic challenges.

The following review of domestic legislation in EU member states will consider the implementation of WEEE directives in Germany, Italy, France, Ireland and Sweden given these countries' economic influence and participation in the large household appliance market.

1.2 Ozone-Depleting Substances Regulation in the EU

[26] WEEE (2024) European Commission
[27] ibid
[28] Directive 2012/19/EU
[29] ibid

In February 2024, the EU strengthened regulations partly in response to the Union's 27% year-on-year increase in ozone-depleting substances in 2021 compared to 2020.[30] Maintaining the Union's enforcement of the Montreal and Vienna Protocol outlined in Regulation (EC) No 1005/2009, the renewed regulation aims to align the Union's guidance on ozone-depleting substances with the strategic objectives of the European Green Deal (2021).[31] The updated regulation states that

> Ozone-depleting substances which are contained in refrigeration and air-conditioning equipment and heat pumps…during the maintenance or servicing of equipment or before the dismantling or disposal of equipment, be recovered for destruction, recycling or reclamation, unless such recovery is regulated under other Union legal acts.[32]

The regulation's focus on producers' management of the recovery, destruction, recycling and reclamation of ozone-depleting substances is indicative of a product stewardship approach to producer responsibility, ensuring environmental, economic and social duties are adopted by those who profit from the harmful substances' production and distribution. These regulatory amendments will be uniformly rolled out across EU member states to ensure the collaborative reduction of ozone depleting substances with high global warming potential.[33]

1.3 Germany

Introduced in 2015, and last amended in 2021, the German Electrical and Electronic Equipment WEEE (Elektrogesetz) increases the responsibility of producers, importers and (in some instances) resellers for the products they bring to market.[34]

The Elektrogesetz aims to protect human and environmental health from the harmful substances used in WEEE, ensure the proper collection and return of waste materials, prevent waste and reduce the amount of waste through reuse, preparation for reuse or recycling and recovery,[35] placing the responsibility on organisations who profit from the distribution and sale of WEEE. Under the Elektrogesetz scope, large household appliances are subject to the WEEE's regulations.[36] The WEEE offers an extensive list of products that fall within this category under Annex I, including, but not limited to: refrigerators, freezers, washing machines, clothes dryers and air conditioning appliances.[37] Transposing the EU's WEEE directives, the Elektrogesetz states that WEEE products should, wherever possible, "be designed to provide for and facilitate

[30] Regulation (EU) 2024/590
[31] ibid
[32] ibid
[33] ibid
[34] Elektrogesetz (2005)
[35] Meunier, C. (2013) Umweltbundesamt
[36] Elektrogesetz (2005)
[37] ibid

its disassembly, recycling and recovery, and particularly the reuse and recycling of WEEE and its components and substances," notably including language that discourages producers from intentionally preventing products' re-use.[38]

Specific recovery targets are included to ensure producers have clear objectives, with large household appliances requiring "a minimum of 80 per cent [rate of recovery] by average weight per appliance".[39] This represents a 35% increase from the mandated rate of recovery under the Article 7 of the WEEE directive.[40] By extending the mandates required within the WEEE directive, ***the Elektrogesetz demonstrates leadership in e-waste management and should be recognised as a template for domestic adoption of large household appliance EPR policy.***

1.4 France

France's Environmental Code has incorporated articles to regulate EPR within the EEE industry, focusing on product design, durability, and recyclability for a range of electronic products including large household appliances. These articles have been introduced to increase the responsibility of producers who financially benefit from the sale and distribution of EEE ensuring that they incorporate waste stream considerations into their supply chain strategies.

The Code refers to Annex 1A and Annex 1B of Directive 2002/96/EC of the European Parliament to define the product categories that are subject to Title IV's EPR mandates.[41] Similar to Germany's Elektrogesetz, France's transposition of product categories under Annex 1B explicitly detail the subcategories of large household appliances, including, but not limited to refrigerators, freezers, washing machines, clothes dryers and air conditioning appliances.[42] Title IV outlines the specific responsibilities of producers, determining that manufacturers are required to prevent or reduce the production and noxiousness of waste, organise the transport of waste and to limit it in terms of distance and volume, and to recover waste by reuse, recycling or any other action aiming to obtain reusable materials or energy from waste.[43]

Additional clarity is offered under Article L541-10-2 of Title IV, which states "any person who professionally manufactures, imports or introduces onto the national market electric or electronic household appliances… is obliged to provide for or contribute to the collection, removal and treatment of electric or electronic household appliance waste, irrespective of the date on which they were put on the market".[44] The Code also authorises policing power to issue financial penalties to producers who do not comply with Title IV's

[38] ibid
[39] ibid
[40] Directive 2012/19/EU
[41] Title IV, Environmental Code (2003)
[42] Directive 2002/96/EC
[43] Title IV, Environmental Code (2003)
[44] ibid

stipulations, providing a thorough account of what is considered non-compliance.[45] Title IV of France's Environmental Code provides clear direction for producers to comply with modern e-waste management strategies, outlining reasonable and achievable producer responsibilities that align with domestic environmental targets.

1.5 Italy

The EU's WEEE Directive was transposed into domestic law under Italian Legislative Decree 49/2014, establishing EPR requirements for EEE.[46]

Previously covered under Legislative Decree 151/2005, Italy enacted 49/2014 to provide updated governance on waste management responsibilities, strengthening producer obligations for WEEE handling.[47] In transposing new, strengthened regulation, Italy's enactment of 49/2014 exemplifies the need for policy makers to continually revise and update legislation to respond to environmental and societal needs. Leveraging the scope and definitions provided by the EU's WEEE Directive, 49/2014 regulates the waste management of large household appliances that are listed in Annex IB.[48]

Notably, the Decree has moved to an 'open scope' approach as of 2018, determining that any electrical and electronic equipment, corresponding to the definition given in the Decree, is to be considered subject to the legislation, except for explicit exclusions.[49] The open scope approach has also redefined equipment classification, opting to focus on the size of products rather than their category type.[50] Aligned with the Elektrogesetz's recovery targets, 49/2014 states that large household appliances must achieve an 80% recovery rate based on the product's weight.[51] The Decree also offers flexibility for producers, noting that manufacturers can fulfil obligations either individually or through collective schemes.[52] Most importantly, aligning with regional policy directives, 49/2014 assigns financial responsibility for waste management, treatment and recovery to the producers who sell and distribute electrical and electronic equipment products.[53]

Italy's success in large household appliance EPR legislation can in part be attributed to policymakers' ability to respond to regional policy trends and a willingness to revise outdated legislation.

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[45] ibid
[46] Decree No. 49/2014
[47] ibid
[48] ibid
[49] ibid
[50] ibid
[51] Ibid
[52] ibid
[53] ibid

1.6 Republic of Ireland

Ireland's enactment of Statutory Instrument No. 149 of 2014 (S.I. 149/2014) transposes the EU's WEEE Directive into domestic legislation, increasing the responsibility of producers while protecting the rights of consumers.

Aligned with the Directive, S.I. 149/2014 declares that the legislation has been introduced to prioritise the prevention of WEEE in addition to improving the country's efficient use of resources and the retrieval of valuable secondary raw materials.[54] Adopting the product scope set out in Annex I and II of the EU's Directive, Ireland applies these regulations to several electronic goods including large household appliances.[55]

The regulation holds a number of supply chain stakeholders responsible for the collection and disposal of electrical products, including manufacturers, importers and retailers, accounting for the scope of participants who profit from the distribution and sale of WEEE.[56] Assigning the responsibilities of each stakeholder, S.I. 149/2014 provides clear direction on the steps manufacturers, importers and retailers must take to align with the regulatory standards under Part III, Section 14.[57] These responsibilities include providing appropriate collection timeframes for consumers, not placing undue financial burden on consumers for participating in collection programs, as well as a financial guarantee showing that the full cost of the environmentally sound management of WEEE will be financed when it is discarded by the final user.[58] These regulations are paired with a number of WEEE initiatives administered by WEEE Ireland, including the Binning is Sinning campaign and WE'll Take it Back campaign, designed to encourage consumer participation in EPR programs.[59]

Ireland's extensive assignment of responsibility throughout the supply chain provides stakeholders with clear EPR principles to adhere to, and when paired with consumer facing programs, provides a comprehensive regulatory response to minimising domestic WEEE generation.

1.7 Sweden

Sweden's enforcement of Ordinance 2022:1276 on producer responsibility for electrical equipment aims to reduce e-waste's impact on human and environmental health, increase producer responsibility for the waste generated by their products, improve consumer disposal methods and promote domestic resource efficiency.[60]

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[54] S.I. 149/2014
[55] ibid
[56] ibid
[57] ibid
[58] ibid
[59] WEEE Initiatives (2022) WEEE Ireland
[60] Ordinance (2022:1276)

Aligning with the EU's product categorisation, Ordinance 2022:1276 applies to a range of large household appliances including washing machines, dryers, dishwashers, cooking appliances and electric stoves.[61] Section 36 of the Ordinance clearly defines the responsibilities of producers, stating 'a producer must ensure that electrical equipment supplied on the Swedish market is manufactured and designed in such a way that reuse and material recycling are promoted', with exemptions provided to products that have 'decisive advantages with regard to human health and the environment, safety requirements or other considerations'.[62]

The EU-wide recycling targets have been integrated into the Ordinance, with large household appliances needing to meet an 85% threshold of recyclability.[63] Further defining these stipulations, the Ordinance notes that the verifiable 'recycling amount may only include waste that has been treated in accordance with regulations', with waste materials only being suitable for transport outside of the European Economic Area (EEA) once it has been treated under conditions that correspond to the requirements in Directive 2012/19/EU.[64]

Ordinance 2012:259 details the penalties that apply to manufacturers and producers who do not comply with Sweden's WEEE disposal and collection requirements, delineating penalties specific to both the mismanagement of harmful substances and improper material recycling processes.[65] Ordinance 2022:1276 explicitly defines the roles and responsibilities of stakeholders across the supply chain, prioritises human and environmental health, protects the economic rights of non-EEA nations and imposes strict penalties for non-compliance, demonstrating the rigidity of the legislation, which is strengthened by its alignment with the EU's regional directive.

2. NORTH AMERICA

2.1 Canada

The Canada-wide Action Plan for EPR (CAP) was established by the Canadian Council of Ministers of the Environment, made up of 14 environmental ministers from federal, provincial and territorial governments.[66]

Canada's introduction of EPR directives for provincial and territorial adoption was inspired by increasing rates of waste generation per capita and limited producer responsibility for their products' end of life.[67] Following the development of the CAP, 9 out of 10 Canadian provinces introduced EPR policies and programs, with exceptions made for remote northern territories given logistical difficulties in transporting and treating post-

[61] ibid
[62] ibid
[63] ibid
[64] ibid
[65] ibid
[66] Séguin, J. (2014)
[67] Canada-wide Action Plan (2009) p. 1

consumer goods in the region.[68] The CAP identified the need to address the recycling of appliances, including ozone-depleting substances as a priority area in the initiative's second phase.[69] Key performance indicators are identified for EPR programs, including kgs of waste/capita captured, dollars/kg recovered and avoided GHG emissions.[70] Differing from the EU's designation of assessable targets, Canada's strategy does not prescribe minimum rates of recycling or material recovery, limiting the KPIs' influence to a guideline on how stakeholders might comparatively assess their progress. In addition to increasing the responsibilities of producers, the CAP extends implicit responsibilities to consumers, noting consumers should participate in EPR programs if access to the program is convenient, while also shifting expenses associated with product end-of-life management on to producers and consumers.[71]

Canada has introduced a unique approach to regulating EPR within the large household appliance industry, providing a federal directive that is voluntarily transposed into provincial and territorial legislation, offering KPIs for EPR progress (without the inclusion of assessable metrics), and increased responsibility of both producers and consumers. Separate regulations are enforced to control the production, importation, exportation and distribution of ozone-depleting substances. Canada's Ozone-depleting Substances and Halocarbon Alternatives Regulation (OSHAR) (2016) under the Environmental Protection Act (1999) ensures the responsible reclamation, recovery and recycling of hazardous chemicals found in heating, plumbing or refrigeration systems.[72] These regulations transpose guidelines from the Vienna and Montreal Protocol, aligning Canada's management of ozone-depleting substances with globally recognised standards.[73] However, OSHAR has not yet been amended to restrict the incidental production of harmful substances,[74] limiting its regulatory oversight in comparison to European leaders in the space.

While these regulations have demonstrated interest in responsibly treating material and chemical waste generated from large household appliances, their lack of rigidity may result in an uneven application across the nation, ultimately softening the producers' responsibility for their products' end of life.

2.2 USA

The USA does not federally regulate WEEE disposal, collection and recycling, instead extending independent power to states and districts. Currently, 25 states regulate e-waste management, addressing regionally specific issues and challenges.[75] As a result of the decentralised approach to WEEE management, each state-based law varies in its product scope and effectiveness. However, federally sponsored initiatives including the

[68] Séguin, J. (2014)
[69] Canada-wide Action Plan (2009) p. 5
[70] ibid, p. iv
[71] ibid, p. 10
[72] OSHAR (2016)
[73] ibid
[74] ibid
[75] Regulations for Electronics Stewardship (2024) EPA

Responsible Appliance Disposal (RAD) program encourage manufacturers, retailers, and state and local government agencies to voluntarily participate in EPR practices.[76]

The initiative explicitly notes that stakeholders are invited to go 'beyond federal requirements' to preserve human and environmental health,[77] highlighting the lack of mandated EPR standards pertaining to large household appliances across the USA. The RAD program primarily focuses on limiting improper treatment of ozone-depletion substances, with secondary considerations for opportunities to increase resource efficiency and slow and close resource loops.[78] Considering the voluntary nature of this program, enforcement mechanisms are limited, with RAD partners being asked to commit to annual reporting to track the environmental impacts of their efforts.[79]

Notably, the EPA's example partnership agreement declares RAD partners are not entering into a binding agreement which does not create any right, obligation or benefit enforceable by law.[80] Although the RAD program recognises the environmental, economic and social externalities associated with improper collection and disposal of large household appliances,[81] its lack of enforcement through federal legislation absolves producers of any mandated responsibility to participate in the safe treatment of products they distribute, sell and import. Contrastingly, the USA has established comprehensive regulations surrounding the treatment and production of ozone-depleting substances under Title VI of the Clean Air Act (1961).

Specifically, the American Innovation and Manufacturing Act (2020) regulates HFCs in refrigeration, air conditioning, heat pump and fire suppression equipment, ensuring that those who own, operate, service, repair, recycle, dispose, or install equipment containing HFCs are held responsible for the phasedown and proper treatment of hazardous chemicals.[82] This regulations' extensive consideration of supply chain stakeholder responsibilities and pathways to HFC elimination demonstrates strong alignment with product stewardship principles.

1. ASIA -PACIFIC

3.1 Japan

In Japan, EPR compliance mechanisms pertaining to large household appliances are regulated by the Home Appliance Recycling Law (2001). Prior to the enforcement of this legislation, almost half of the post-consumer

[76] Responsible Appliance Disposal (2024) EPA
[77] ibid
[78] About the RAD Program (2024) EPA
[79] ibid
[80] Example Partnership Agreement (n.d) USEPA
[81] About the RAD Program (2024) EPA
[82] AIM Fact Sheet (2024) Office of Air and Radiation

home appliances discharged by households had previously been discarded at landfill sites without any treatment.[83]

The primary objective of the Home Appliance Recycling Law is to place an obligation on manufactures and retailers of home appliances.[84] In doing so, the legislation creates a framework to support the reduction of waste diverted to landfill, while also increasing domestic resource efficiency by realising the full utilisation of recyclate.[85] The scope of product categories subject to the recycling framework are detailed in the regulation, specifically identifying air conditioners, refrigerators, freezers, washing machines and clothes dryers as priority products.[86]

The Home Appliance Recycling Law explicitly assigns responsibility across the supply chain, strengthening the legislation's impact. Retailers are required to facilitate the collection of goods from consumers, while manufacturers and importers are responsible for product recycling as well as being held financially accountable for costs associated with collection.[87] Specific guidance is provided on post-consumer home appliance recycling rates, requiring manufacturers and importers to achieve a recycling rate of 55-82% of the product (depending on product category), while also regulating the recovery and treatment of products containing CFCs, HCFCs and HFCs.[88] In addition to these controls on harmful chemicals, Japan introduced the Law Concerning the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures in 1988. This law refers to the Vienna and Montreal Protocol, outlining strict controls on the production of 'specified substances', requiring comprehensive reporting, research and independent oversight of the substances' production.[89]

To ensure compliance with both the home appliance and specified substance regulation, the government reserves the right to financially penalise business entities that make improper claims or fail to act in accordance with their assigned responsibilities.[90] Japan's legislation covers a number of critical components of regulated EPR, including clear recycling and recovery targets for supply chain participants and the explicit assignment of responsibility throughout the supply chain, ultimately increasing the obligations of the retailers, manufacturers and importers under Japanese legislation.

3.2 South Korea

[83] Home Appliance Recycling Law (2001)
[84] ibid
[85] ibid
[86] ibid
[87] ibid
[88] ibid
[89] Law No. 53 of 1988
[90] Home Appliance Recycling Law (2001)

South Korea's regulation of EPR has evolved to respond to market trends and consumer needs in recent decades. The Producer Deposit Refund Scheme (1992-2002), South Korea's first iteration of domestic EPR legislation, required manufacturers to pay an advance deposit (i.e. upfront payment before recycling cost has been occurred) that would cover recycling costs, based on sales data from the previous year.[91] This evolved into the Product Recycling System (PRS) in 2003, covering electronic products including refrigerators, air conditioners and washing machines.[92]

Individual producers are advised of mandated recycling targets annually, based on the previous year's sales.[93] In addition to these targets, the South Korean Ministry of Environment set item specific recycling rates between 55-70%, depending on weight.[94] Manufacturers are able to fulfil their obligations by recycling the products themselves or engaging third party recyclers and Producer Responsibility Organisations.[95] In instances where producers fail to meet the mandatory recycling rates, a fee equivalent to the amount of the recycling shortage multiplied by 115 to 130% of the standard recycling cost will be payable by the infringing producer.[96]

The PRS is unique in its inclusion of consumer obligations when assigning responsibility throughout the supply chain. While retailers and suppliers are financially responsible for the collection and transport of goods if a consumer purchases a similar product, consumers are required to pay a fee when choosing to discard appliances.[97] Compared to other EPR regulations, this places increased responsibility on the consumer, as the conditional product recovery guidelines require user initiative. South Korea's PRS legislation is varied in its effective implementation of EPR principles. While the scheme has successfully increased the responsibility of producers in certain areas, its continued reliance on consumer participation dilutes the role of manufacturers, ultimately softening the impact of the legislation. South Korea separately regulates the production and disposal of ozone-depleting substances through the Act on the Control of Manufacture of Specific Substances for the Protection of the Ozone Layer (2008). Integrating the Montreal Protocol into domestic law, the regulation defines the responsibilities of producers, the entities eligible for exemption and penalties incurred because of non-compliance.[98]

These regulatory controls have been effectively designed and implemented to ensure producers adopt increased responsibility for the treatment and disposal of harmful chemicals, demonstrating a strong policy response to ozone-depleting substances.

[91] Institute for Sustainable Futures (2009), p.13
[92] ibid
[93] ibid
[94] ibid
[95] ibid
[96] ibid, p.14
[97] ibid, p.13
[98] Act No. 19002

3.3 Taiwan

Taiwan's Waste Disposal Act (1988) introduced the 4-in-1 Recycling Program in 1997 to increase producer responsibility for their products' recovery and recycling. The legislation was passed to address a range of environmental and economic externalities, including reduced landfill capacity, severe air pollution caused by high rates of WEEE incineration, limited infrastructure to appropriately treat harmful substances and inefficient resource recovery and re-use.[99]

Product types subject to the recycling program include televisions, washing machines, refrigerators, air conditioners, and fans, which are grouped under the 'waste electrical appliances' category.[100] Under this program, manufacturers and importers are required to pay a fixed fee per unit sold domestically, which is allocated to the collection and recycling of post-consumer products.[101]

Guidelines are also provided on collection strategies, determining that collection points for Regulated Recyclable Waste (including large household appliances) are required at certain retail locations, including supermarkets and convenience stores.[102] In instances where illegal dumping occurs or manufacturers make false declarations on sales and processing of specific products, the government is able to administer financial penalties and require auditing and verification organisations to evaluate the infringing party's processes.[103]

However, the domestic EPR legislation holds some comparative shortcomings. Differing from other regional and global directives, Taiwan's 4-in-1 Recycling Program does not specify mandatory rate of recycling targets, providing additional leniency for manufacturers, importers and retailers. Additionally, given Taiwan's status as a net exporter of goods, protections have been integrated into the program to ensure the exportation of large household appliances are not disincentivised. Namely, exported appliances are exempt from the fixed-fee-per-unit pricing mechanism,[104] meaning importing countries must adopt stronger legislation to ensure their domestic infrastructure is capable of recycling the products.

The Ministry of the Environment also administers regulation to phase out the use of ozone-depleting substances, guided by the Montreal Protocol.[105] Taiwan has phased out the majority of ozone-depleting substances since 2006, with a target of eliminating the consumption of HCFCs by 2030.[106] A suite of regulations under the Air Pollution Control Act provide guidelines for producers' responsibility in reducing their use of

[99] Institute for Sustainable Futures (2009), p.20
[100] ibid
[101] ibid
[102] WEEE Management in Taiwan (2012) USEPA, p. 2
[103] Institute for Sustainable Futures (2009), p.20
[104] ibid, p. 21
[105] Ozone Layer Protection (2024) Ministry of Environment
[106] ibid

HCFCs, specifically targeting manufacturers of refrigeration and air conditioning equipment.[107] The Taiwanese legislation surrounding large household appliance EPR provides an example of how programs are altered to suit the needs of certain national economies, but may compromise the rigidity of their enforcement.

3.4 China

Under China's Management of Collection and Disposal of Waste Electrical and Electronic Products Regulation (WEEE China), manufacturers and importers are held financially responsible for the end-of-life treatment of their products.[108] Similar to Taiwan's key drivers for EPR policy implementation, the Chinese government enacted the WEEE regulation to protect their competitive WEEE manufacturing and exporting industries.[109]

In 2015, the regulation expanded its product scope, featuring categories including refrigerators, air conditioners and washing machines, alongside other smaller consumer appliances.[110] China's approach to managing WEEE hinges on a state administered Disposal Fund, that collects fees from manufacturers and importers that are allocated to the collection and disposal of waste electrical and electronic products.[111]

Non-compliance with the Disposal Fund incurs a fine of up to 500,000[112] Chinese yuan ($109,600AUD). Additionally, a licensing system has been established, to ensure collection and disposal service providers are meeting regulatory expectations, with severe penalties administered to non-complying stakeholders.[113] These penalties range from operational injunctions including revocation of operational licenses as well as fines of up to 5,000,000[114] yuan ($1.09 million AUD). While these regulatory frameworks establish clear incentives for manufacturers and importers to develop internal EPR standards, stakeholders suggest that the legislation has not materially influenced their product design processes.[115] This lack of influence has been attributed to insufficient awareness among stakeholders, the perception of insignificant impact and limited understanding of the practical changes the regulation incurs.[116] As such, the WEEE China regulation exemplifies the need to engage supply chain stakeholders in the consultation and implementation phase of renewed legislation, to ensure all parties subject to the initiatives are well-informed and well represented in its development.

China has also demonstrated leadership in its regulation of ozone-depleting substances, amending the Regulations on the Management of Ozone-Depleting Substances (RMODS) (2010) in early 2024 to increase

[107] ibid
[108] China WEEE (2020) Enviliance Asia
[109] Institute for Sustainable Futures (2009), p. 11
[110] China WEEE (2020) Enviliance Asia
[111] ibid
[112] ibid
[113] ibid
[114] Institute for Sustainable Futures (2009), p. 11
[115] ibid, p. 12
[116] ibid

oversight of HFCs.[117] The amendments maintain oversight of refrigeration and air conditioning equipment, while expanding state control of HFC reporting and elimination.[118]

Chinese policymakers have demonstrated an ability to effectively respond to environmental issues through regulatory amendments to the RMODS, leading to increased producer responsibility throughout the supply chain.

3.5 Australia

Australia does not currently mandate EPR at the Commonwealth level, instead utilising consumer protection mechanisms and government funded programs to manage WEEE. EPR principles pertaining to large household appliances can be found in some regulatory instruments including the Australian Consumer Law which ensures consumers have access to repair services that are financed by producers in instances of product malfunction.[119]

However, these instruments do not prioritise resource efficient remedies, offering refunds or replacements as a reasonable alternative.[120] In place of federal EPR legislation, several fixed-term product collection and disposal programs have emerged. Between 2006-2017 the Fridge Buyback Scheme offered NSW residents across 51 Councils the opportunity to responsibly dispose of their fridges.[121] The program collected ~60,000 fridges, recovered ~4,700 kgs of CFCs and recycled 5,300 tonnes of metals.[122] The program also incurred significant economic benefits, saving a total of ~$18 million/yr on residential bills.[123] ACT's Fridge Buyback scheme is offered to residents in the ACT who are also ActewAGL customers, one and two door refrigerators are eligible for in home collection and two door refrigerators receive a $30 credit.

In contrast to Australia's limited oversight of WEEE, there is long-standing regulation that controls the production and consumption of ozone depleting substances. In accordance with the Montreal Protocol, Australia's Ozone Protection and Synthetic Greenhouse Gas Management Legislation controls ozone-depleting substances throughout the product lifecycle from production to disposal.[124] The regulation specifically acknowledges refrigerators and air conditioners as priority product categories given their reliance on CFCs and HCFCs.[125]

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[117] National Decree No. 770/2024
[118] ibid
[119] Electrical and whitegoods (2013) ACCC
[120] ibid
[121] Fridge Buyback Scheme (2020)
[122] ibid
[123] ibid
[124] The Ozone Acts (2021) DCCEEW
[125] ibid

While these regulatory instruments and programs demonstrate an interest in addressing the environmental and economic externalities associated with improper collection and disposal of large household appliances, there is a pressing need to regulate producer responsibility at the Commonwealth level to ensure taxpayers and consumers are not implicitly responsible for their white goods' end of life treatment.

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European WEEE Directive 2002/96/EC ANNEX IB

List of products which shall be taken into account for the purpose of this Directive and which fall under the categories of Annex IA:

1. Large household appliances

- Large cooling appliances
- Refrigerators
- Freezers
- Other large appliances used for refrigeration, conservation and storage of food
- Washing machines
- Clothes dryers
- Dish washing machines
- Cooking
- Electric stoves
- Electric hot plates
- Microwaves
- Other large appliances used for cooking and other processing of food
- Electric heating appliances
- Electric radiators
- Other large appliances for heating rooms, beds, seating furniture
- Electric fans
- Air conditioner appliances
- Other fanning, exhaust ventilation and conditioning equipment