SENATE COMMITTEE ON ENVIRONMENTAL QUALITY
Senator Allen, Chair
2023 - 2024 Regular

Bill No.	AB 2	**Hearing Date:**	7/12/2023
Author:	Ward		
Version:	06/28/2023		
Urgency:	No	**Fiscal:**	Yes
Consultant:	Brynn Cook		

SUBJECT: Recycling: solar photovoltaic modules

DIGEST: This bill adds consumer-owned solar panels as a covered product under the Electronic Waste Recycling Act of 2003 and establishes a fee on consumers to achieve the safe end-of-life of these panels. The bill also requires that solar panels that are not consumer-owned be part of a solar panel end-of-life plan.

ANALYSIS:

Existing law:

1) The California Integrated Waste Management Act (IWMA) of 1989, administered by the Department of Resources Recycling and Recovery (CalRecycle), generally regulates the disposal, management, and recycling of solid waste. (Public Resources Code (PRC) §§ 40000 et. seq.) Among other things, the act:

    a) Establishes state recycling goal that 75% of solid waste generated is to be diverted from landfill disposal through source reduction, recycling, and composting by 2020. (PRC § 41780.01)

    b) Establishes extended producer responsibility (EPR) programs for various products, including, among others, carpet, mattresses, and pharmaceutical and sharps waste. (PRC §§ 40000 et. seq.)

2) Pursuant to the Electronic Waste Recycling Act of 2003 (Act) (PRC §§ 42476 et seq.):

    a) Establishes processes for consumers to return, recycle, and ensure the safe and environmentally sound disposal of video display devices that are hazardous wastes when discarded.

    b) Requires fees collected on covered products to be deposited in the Electronic Waste Recovery and Recycling Account for covered electronic

waste recycling fee refunds and making electronic waste recovery and recycling payments.

c) Requires manufacturers of covered electronic devices to submit a report to CalRecycle that describes where and how to return, recycle, and dispose of the covered product.

3) Requires 60% of total retail sales of electricity in California to be generated from eligible renewable energy resources, including solar, by December 31, 2030, and creates the policy of planning to meet all of the state's retail electricity supply with a mix of renewable and zero-carbon resources, as specified, by December 31, 2045. (Public Utilities Code (PUC) § 399.11 et seq.)

4) Requires, by December 31, 2030, 50% of total retail sales of electricity in California to be generated from eligible renewable energy resources, including from solar energy. (PUC § 399.11-399.32)

This bill:

1) Adds customer-owned solar photovoltaic (PV) modules as a covered electronic device under the Electronic Waste Recycling Act.

2) Requires CalRecycle to establish a covered solar PV recycling fee by October 1, 2026, to cover the regulatory and administrative costs of covered electronic waste recycling. This fee will be put on consumers and CalRecycle will adjust the fee on or before October 1 of every year based on the Consumer Price Index.

3) Requires noncustomer-owned solar PV modules be included in a plan that describes how the module will be managed at the end of its useful life, who is responsible for managing it, and how it will be recycled, refurbished, or reused by January 1, 2028.

4) Requires CalRecycle to develop guidelines for the development of the plan, and adopt regulations to implement the bill by January 1, 2026.

5) Requires all records provided to CalRecycle under the provisions of this act be provided under penalty of perjury.

Background

1) *California's waste goals and EPR.* Under the IWMA, CalRecycle is tasked with reducing the amount of waste that gets landfilled in California. The IWMA establishes a goal that 75% of solid waste generated in the state be diverted from landfills through source reduction, recycling, and composting by 2020. However, in 2021, the state's recycling rate was just 41%, falling far short of the state's goal.

   To advance California's recycling goals, the Legislature has directed CalRecycle to establish several EPR programs. EPR is a strategy that places shared responsibility for end-of-life product management on producers and all entities involved in the product chain, instead of on the general public and local governments. EPR programs rely on industry, often via a product stewardship organization (PRO), to develop and implement approaches to create a circular economy with oversight and enforcement provided by the government. EPR programs have traditionally been used to improve the recapture and recycling rate for challenging-to-recycle materials that can pose a risk to the waste stream, like pharmaceuticals and sharps, paints, and batteries. The state also oversees EPR programs for high-volume products including mattresses, carpets, packaging, and single-use plastic food ware items.

2) *Solar by the Numbers.* California has set ambitious goals for deploying solar energy. By 2045, the state aims to generate 100% of its electricity from clean energy sources, including solar. In pursuit of this goal, California has introduced numerous policies, including grants and rebate programs, to advance the deployment of residential and commercial solar energy. In 1978, the state passed the Solar Energy Development Act, which established a goal of generating 20% of the state's electricity from solar by 2020. In 2006, California passed the Solar Initiative, which provided a number of incentives for the installation of solar panels. These incentives helped to make solar panels more affordable and accessible and led to a surge in solar panel installations. In 2018, California passed the Self-Generation Incentive Program (SGIP), which provides financial incentives for homeowners and businesses to generate their own electricity, including from solar panels. In 2017, California passed AB 1414 (Friedman, Chapter 849, Statutes of 2017), which requires all new homes be constructed with the proper infrastructure for solar installation.

   About 1.5 million homes and businesses have installed rooftop solar systems in California. California is the highest solar power generating state in the nation, with approximately 13% of the State's electric generation coming from solar

arrays in 2018 according to the California Energy Commission. The growing solar energy industry supports an increasing number of businesses and workers. According to the Solar Energy Industries Association (SEIA), there were 403 Manufacturers, 1103 Installers/Developers, 874 Other solar businesses in California in the first quarter of 2023.

3) *Solar Panels Incoming (to a Landfill Near You).* According to a 2020 report by SEIA, there are an estimated 100,000 metric tons of solar panels in landfills in the United States. The majority of these panels are located in California, which has the largest solar market in the country. These numbers will grow at an increasing rate to reflect the increase in solar panel deployment over the last decades. The SEIA report estimates that between 200,000 and 300,000 metric tons of solar panels will reach the end of their lifespan and be headed to landfills in the next ten years, and the International Renewable Energy Agency (IRENA) estimates that by 2030, the United States is expected to have a million tons of solar panel waste.

4) *Solar Panels Waste Classification.* On January 1, 2021, Department of Toxic Substances Control (DTSC) re-classified solar panels as universal waste instead of hazardous waste relaxing criteria on how solar panels can be handled in the waste stream. Universal wastes are hazardous wastes that are widely produced by households and many different types of businesses. Universal wastes include televisions, computers, other electronic devices, batteries, fluorescent lamps, mercury thermostats, and other mercury-containing equipment, among others. Under the new universal waste requirements, solar panel handlers may accumulate solar PV panels for up to one year, while under the previous general hazardous waste requirements, handlers could only accumulate solar panels for 90 days (for large quantity generators). The longer accumulation period now allowed under law will allow handlers to transport the solar panels to destination facilities in bulk rather than on a more frequent basis. DTSC estimated that streamlining the regulations for collecting, recycling, and treating solar panels would result in cost savings of nearly $18 million per year. In addition, DTSC estimated the total statewide benefits from this regulation at more than $91 million. This estimate is partially based on e-recyclers expressing interest in expanding their businesses in light of solar panels being regulated as universal waste.

5) *Repair, Reuse, and Recycle*. Solar panels can be repaired or reused to extend their life, or recycled, at the end of their life.
   a) Repair. Solar panels are typically sold under warranty, with a guarantee of 90% production at 10 years and 80% production at 25 years. During this

time, and barring accidents, solar panels require very little maintenance, needing only cleaning to remove dirt and debris that could obstruct incoming sunlight. Currently, if a solar panel is damaged, it is typically not repaired, and instead is recycled or disposed of.

b) *Reuse.* There is little data on the scale of the second-hand solar PV market. According to a report by Bloomberg, solar panels that are at the end or have surpassed their warranty in the US are sold to markets in other countries. While a number of businesses have emerged specifically in the reuse space, decommissioning solar installations and redirecting the used panels to other customers, the committee is not aware of any specific data on second-hand solar panel sales in California.

c) *Recycling.* Although 80% of a typical photovoltaic panel is made of recyclable materials, disassembling them and recovering the glass, silver and silicon is extremely difficult. During recycling, the panels undergo a series of steps such as mechanical shredding, thermal treatment, and chemical processing to separate the materials. Silicon-based PV cells, containing high-purity silicon, are the most valuable component of the solar panel. Glass, constituting a significant portion of the panel, is also relatively valuable and recyclable. Estimates on the value of recovered material for solar panels range based on industry estimates from $2- $7. Currently, solar panel recycling options are limited: according to the California Solar Storage Association (CSSA) as of July 2022, California had just one recycling plant accepting solar panels.

6) *Existing Solar Panel Management Policies.* In 2017, Washington State passed legislation that established an EPR program for solar PV modules. Under this law, manufacturers or other producers of solar panels are responsible for developing and implementing a stewardship plan that, among other things, sets a combined reuse and recycling rate of at least 85% by weight of solar PVs. The program will begin July 1, 2025. Washington is the first state in the nation to develop an EPR program for solar panels.

In the European Union, regulations have required an 85% collection and 80% recycling rate of the materials used in PVs under the Waste Electrical and Electronic Equipment (WEEE) Directive since 2012.

Comments

1) *Purpose of Bill.* According to the author, "In 2006, California launched the Million Solar Roofs Initiative to incentivize consumers and businesses to invest

in solar. As of 2022, California has the largest solar market in the United States, supplying over 20% of its electricity. Unfortunately, given a 20-30 year life span, many of these panels are beginning to reach the end of their lifecycle. Assembly Bill (AB) 2 will establish the foundation for a convenient, safe, and environmentally sustainable system for the end-of-life management of solar photovoltaic (PV) panels. With the right conditions in place, end-of-life industries for PV panels can thrive as an important pillar of a sustainable solar industry in California."

2) *What's the Plan?* AB 2 would require solar panels that are not owned by consumers to have a safe end-of-life plan. However, the measure does not describe what strategies or information must go into such a plan, or what entity will be responsible for developing the plan. It also does not specify that the plan must be implemented, or put the onus of implementing the plan on any entity. The process and timelines by which the plan will be developed (and who will be at the table during that process) and evaluated are not provided in the bill, posing a challenge to implementation.

   a) *What Goes into the Plan?* AB 2 does not specify what kind of strategies or parameters must be considered when developing a safe end-of-life management plan for solar panels. A good end-of-life management plan would consider criteria such as how to:
      i) Prioritize reuse and then recycling of solar panels;
      ii) Establish a high recapture rate of deployed solar panels;
      iii) Establish a high recycling efficiency rate for solar panels;
      iv) Minimize transportation and related emissions associated with the collection of solar panels;
      v) Identify a mechanism for successfully tracking solar panels through to the end of their life;
      vi) Ensure there is a responsible party for stranded solar panels;
      vii) Support business and labor in all aspects of recovery and recycling of solar panels;
      viii) Establish enforceable and quantifiable goals; and
      ix) Develop an education campaign to standardize procedures across stakeholders.

   AB 2 does not weigh in on these elements of the plan. Instead, it requires CalRecycle to develop guidelines on what should go into such a plan. While deferring to CalRecycle to develop guidelines based on their experience creates an opportunity to include data-informed nuance, it does not necessarily recognize or advance the policy goals of the Legislature.

b) *Who Develops the Plan?* It is unclear in the current language what entity is responsible for developing the end-of-life management plan for non-consumer-owned solar panels. Manufacturers, owners, or other entities along the product chain may be responsible in part or in whole for these plans.

In addition, it is not clear whether individual responsible entities would develop their own plans, or whether there would be one plan developed by many responsible entities. Some EPR programs in California allow individual producers to develop their own plans. However, EPR programs also create PROs, comprised of numerous entities, to develop product stewardship plans. Establishing a PRO ensures that all responsible producers are at the table when developing the end-of-life management plan for a covered product.

If individual responsible entities are large and covered products do not change hands many times, authorizing those responsible entities to develop their own individual plans may be more tailored and efficient than working through a larger PRO. In the case of the solar industry in California, however, with hundreds of manufacturers and thousands of installers and solar adjacent businesses, requiring one plan per responsible entities may result in a plethora of plans that would need to be reviewed to ensure they are effective. There would also need to be a clear protocol for identifying the responsibility entity to prevent "gaps" where no one steps forward to develop a plan, or overlap, with multiple entities preparing a plan for the same solar panels.

c) *What Will the Plan Accomplish?* Currently, there is no requirement that the plan developed pursuant to this measure would be implemented. Without this important specification, developing a plan is an important thought exercise, but is unlikely to accomplish policy goals that prioritize recycling or ensure the safe end of life of solar panels.

Given these uncertainties in the current language, the committee may wish to consider what entities should be responsible for developing a solar plan, what the primary policy objectives of such a plan could be, what requirements would fall on responsible entities to develop and implement these plans, and what enforcement mechanisms would be sufficient to ensure these goals are met.

3) *Enforcement Needed.* AB 2 does not have an enforcement mechanism to ensure that the end-of-life management plans for non-customer-owned solar panels are actually developed, that they align with the plans developed in CalRecycle's guidelines, or that they are implemented. While CalRecycle is authorized to develop guidelines for writing a plan, and this includes selective auditing by the department, it is unclear what entities CalRecycle would be auditing, what rubric CalRecycle would bring to inform the audit, or what the consequence would result if an audit found plans lacking. Without this enforcement mechanism, there is no way of ensuring that the provisions in the bill will be followed or that the policy goals of the measure will be achieved. As there is currently no requirement that the plans be implemented, the process for enforcing such a requirement is also not stipulated.

4) *Missing Guardrails.* AB 2 addresses a real concern that without proper end-of-life management plans, solar panels will end up in landfills, and the high cost of managing these universal waste products will be absorbed by local governments, and ultimately by ratepayers. To make the solar industry overall more sustainable, this status quo needs to shift to prioritize the longevity of solar panels, followed by reuse and recycling before landfilling. To make these policy outcomes achievable, manufacturers and other producers along the product chain, not just consumers, should be financially invested in those outcomes. The question remains how the end-of-life management plans outlined in AB 2 achieve these objectives.

   Numerous guardrails could be deployed to help ensure those objectives are met, including putting solar panels under warranty, requiring labeling for solar panels, setting explicit reuse and recycling goals, and requiring reporting and enforcement for all these measures.

   Warranty. While individual contracts may provide warranties on solar panels, there is no federal or state warranty requirement. For lithium-ion car batteries, the federal government requires manufacturers offer an eight-year/100,000-mile warranty on all electric vehicles (EV) batteries. California sets an even higher standard, mandating a warranty of 10 years or 150,000 miles. Warranties ensure that manufacturers are invested in making durable products with long lifespans, which keeps those same products out of landfills longer.

   Labeling. Different solar panels have slightly different compositions, depending on the manufacturer. Some solar panels contain materials that are hazardous at some concentrations, including, lead, cadmium, and arsenic. Labeling these solar panels with information that identifies the composition of the solar panel could help easily identify to consumers and waste managers

whether or not a solar panel has hazardous material and needs to be treated differently from other solar panels. It could also assist recyclers in recovering material from a solar panel at the end of its life.

Repair/Reuse/Recycling Hierarchy. Typically, stewardship plans consider how to prioritize reuse and recycling, before landfilling, for a covered product. This could look like establishing, or having the industry establish, specific performance goals for rates of reuse and recycling of collected (or deployed) solar panels. For instance, in Washington State's Solar Panel EPR program, at least 85% of PV modules, by weight, must be reused or recycled.

Enforcement. As described above, AB 2 currently does not have an explicit enforcement mechanism. Without an enforcement mechanism, there is no guarantee that the objectives, or any guardrails adopted to meet those objectives, will be met.

While these guardrails could apply to all solar panels, they may be especially important to the extent such end-of-life management cost are passed directly along to consumers. Because the cost of the program is put directly on Californians rather than being shared with industry, there is less economic incentive for producers to invest in solar panels with longer lifetimes or that they are more reusable or recyclable compared to other programs where there are explicit requirements on producers.

In moving forward with this legislation, the author and committee may wish to consider how to incorporate guardrails such as the ones described above to steer towards a circular economy for solar panels, prioritizing safe end-of-life, reuse, and recycling.

Related/Prior Legislation

AB 1215 (Newman Chapter 370, Statutes of 2022.) expands the Electronic Waste Recycling Act (EWRA) to include battery-embedded products.

AB 2440 (Creates the Responsible Battery Recycling Act (Act) of 2022 which requires producers of covered batteries, as defined, to establish a stewardship program for the collection and recycling of covered batteries.

SB 244 (Archuleta, 2021) would have required CalRecycle, in consultation with DTSC, to develop guidance for the proper handling and disposal of lithium-ion batteries and would have required the Department of Forestry and Fire Protection to develop protocols and training for the detection, safe-handling, and suppression

of fires started from discarded lithium-ion batteries in the waste-handling system to be adopted by solid waste enterprises. SB 244 was vetoed by the Governor.

SOURCE: Author

SUPPORT:
California Product Stewardship Council
California Solar & Storage Association
Californians Against Waste

OPPOSITION:
None received

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