Greening Photovoltaics

An Overview of the Silicon Valley Toxics Coalition's Solar Scorecard and Industry Trends

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I. Introduction.

The Silicon Valley Toxics Coalition (SVTC) began conducting surveys of photovoltaic (PV) module[1] manufacturers in 2009. The 2015 Solar Scorecard will be the sixth annual evaluation of sustainability, health, and safety principles and practices in the PV industry. The SVTC surveys consist of questions about key element of SVTC's Sustainable Solar Industry Initiative, which is based on the following elements.

- **Extended Producer Responsibility:** Manufacturers take responsibility for the environmental and health impacts of solar products throughout their lifecycles. SVTC has been active in electronic waste (e-waste) issues since the 1990s and aims to ensure that environmental and public health issues from e-waste do not arise in the PV industry.
- **Green Jobs:** Manufacturers implement and monitor equitable labor standards in their own facilities and throughout global supply chains.
- **Toxic Reduction:** Manufacturers pursue innovative approaches to reducing the toxic chemicals used in panels and manufacturing processes. SVTC's early campaigns were related to hazardous waste from semiconductor manufacturing issues in Silicon Valley, where there remains the highest concentration of Superfund sites in the US.
- **Transparency**: Manufacturers post environmental policies and programs on websites or in annual reports and provide data to support all claims for being green. The electronics industry has brought these practices already into the mainstream and many PV companies could do similarly.

The scoring methodology has evolved over the years from relying on only survey responses to using other forms of data including media coverage, public data, websites, annual reports, and/or sustainability reports. Companies are allotted two to three months or more to respond to the survey and extensions to deadlines are always granted. Companies can respond in hard copy or via email. Survey response rates have varied in the range of 35 to 50% of PV module manufacturing market share. The Solar

[1] PV modules are solar electric power generation devices that take photons in sunlight and convert it into electricity using the photovoltaic effect.

Scorecard reviews approximately 40 companies, representing about 80% of the market share of PV manufacturers.

II. Silicon Valley Toxics Coalition Solar Scorecard Results

The scorecard categories used since 2013 are represented in Figure 1. Each category awards points based on survey answers and publicly available information. The weighting of the points reflects SVTC top campaign goals and what SVTC believes companies can achieve with industry best practices. The total possible points are 100.

Figure 1. Solar Scorecard Scoring Categories

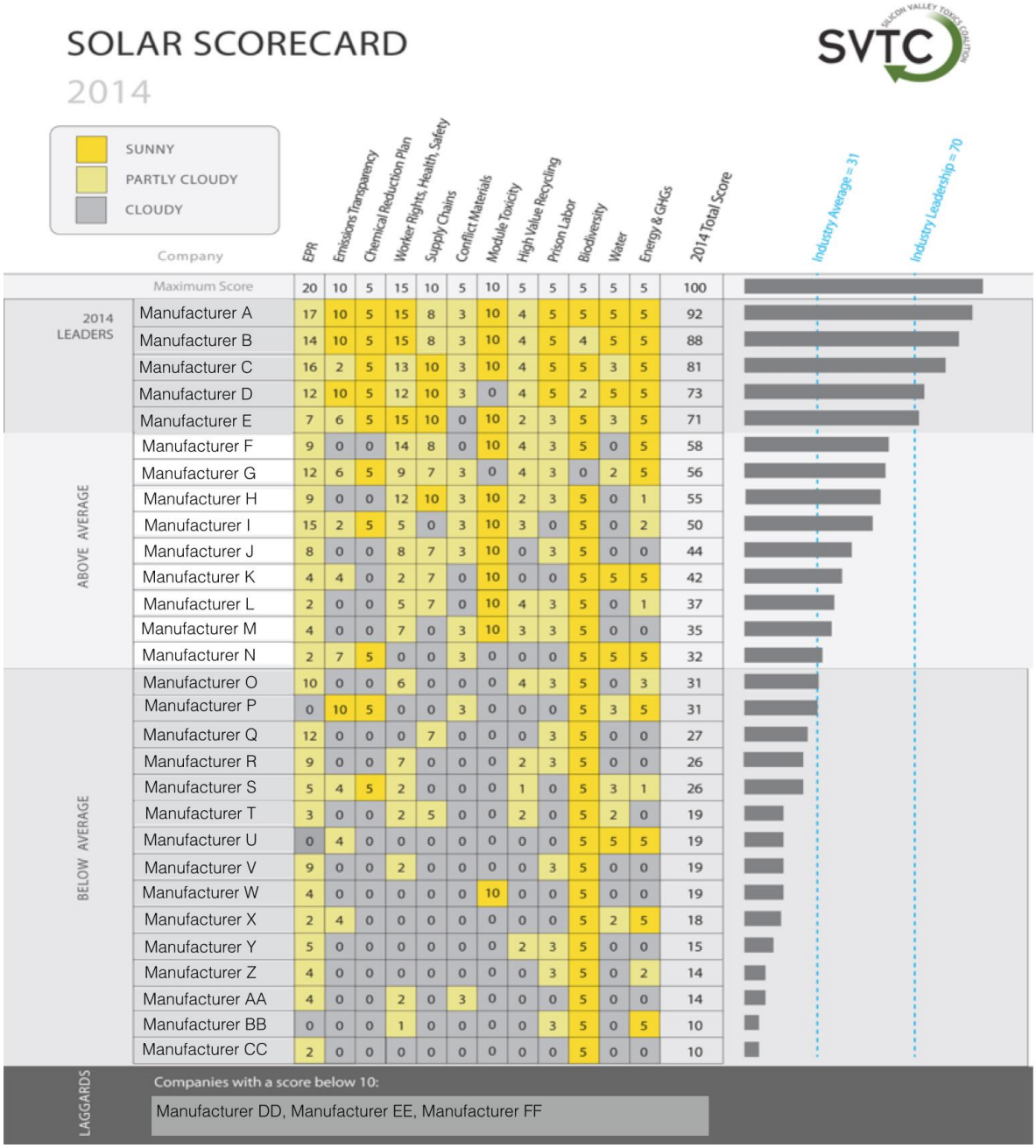
Sustainability Categories	points
Extended Producer Responsibility (EPR)	20
Emissions Transparency	10
Chemical Reduction Plan	5
Worker Rights, Health, and Safety	15
High Value Recycling	5
Supply Chain	10
Module Toxicity	10
Biodiversity	5
Energy Use and Greenhouse Gas (GHG) Emissions	5
Water	5
Prison Labor	5
Conflict Minerals	5

The "EPR" category is worth the most points (20), followed by "worker, health, and safety" (15), and two categories related to chemicals ("emissions transparency" (10) and "chemical reduction plan" (5)). The past several years have seen the top companies score in the range of the 80s to low 90s. Companies that respond to the survey tend to get scores ranging from 30 to 80 or low 90s scores. Companies that do not respond to the survey score anywhere from the 60s and below. It is difficult for companies that do not respond to the survey to score all of the points because some require a reply on the survey or they are unaware that their websites are being evaluated based on criteria specified in the scorecard.

Figure 2 below shows the result of the 2014 scorecard using generic names in place of the companies scored. The scorecard provides both a cumulative score of 100, but also scores corresponding with the categories and point allocations described in Figure 1.

The following section describes the key categories of the Solar Scorecard, the scoring metrics, and industry trends, and identifies some of the key challenges associated with sustainability leadership in this sector.

Figure 2. 2014 SVTC Solar Scorecard



1. Extended Producer Responsibility (EPR)

PV modules at the end-of-life could become a new e-waste stream and pose some of the problems associated with e-waste as they may contain rare/precious and toxic metals. There is a growing concern that PV modules will be found in future e-waste streams sent to developing countries, and mismanagement of these streams could lead to worker health and safety concerns and environmental damage. At the root of the problem with e-waste exports are people looking to inexpensively extract the rare/precious metals, while exposing themselves and the environment to the toxic ones.

EPR is a "strategy to place a shared responsibility for end-of-life product management on the producers, and all entities involved in the product chain, instead of the general public; while encouraging product design changes that minimize a negative impact on human health and the environment at every stage of the product's lifecycle."[2] The SVTC campaign has made EPR a primary objective to get companies to plan early for the wave of end-of-life (EoL) PV modules that will begin to enter waste streams in large volumes starting sometime in the next decade. Brookhaven National Labs estimates that PV modules are "expected to become a critical part of the waste stream in 10−15 years, when a large number of EoL modules become available for recycling."[3] This waste stream will have the highest volumes in Europe first (most notably Germany, Spain, Italy, an the Czech Republic), followed by the U.S. and China.

SVTC Goal: SVTC's campaign goal is to ensure that there is safe and responsible end-of-life management and recycling for PV modules. Their aim is that companies have a global take-back and responsible recycling program and support legislation that moves in the direction of making companies more accountable for their products.

Scoring: SVTC has developed several criteria for awarding points for EPR as shown in Figure 3.

[2] CalRecycle. 2015. Product Stewardship and Extended Producer Responsibility (EPR) http://www.calrecycle.ca.gov/EPR/

[3] Choi, Jun Ki, and Vasilis Fthenakis. 2010. "Economic feasibility of recycling photovoltaic modules." *Journal of Industrial Ecology* 14.6: 947–964.

Figure 3. EPR category criteria and points

Criteria	Description	Points Possible
EPR program participation	*Fully funded collection & recycling system for End of Life PV modules produced globally*	**+5** – *all PV modules produced globally, or,* **+2** – *PV Cycle*[4] *member only*
Direct support for EPR policy in USA	*Manufacturer letter to Solar Energy Industry Association (SEIA) urging them to support EPR laws and regulations*	**+5** – *SEIA letter*
Commitment to EPR in principle	*Reports to SVTC that they support public policies based on EPR in the regions they manufacture and sell PV modules.*	**+5** – *Direct communication to SVTC or evidence of policy support from website.*
Module Label & Website	*Clearly describes on website how all customers can responsibly return PV modules for recycling*	**+1** – *PV Cycle on web* **+1** – *PV Cycle link* **+1** – *Recycling info* **+2** – *Detailed info about how to recycle*

Industry Trends: Recycling and safe disposal of PV modules is recognized as an important issue by the solar industry as well as recycling and waste experts. Companies operating in Europe are leading the way in developing take-back and recycling programs due to the European Union's Waste Electrical and Electronic Equipment Directive (WEEE), which sets EPR requirements for electronic products, including PV modules. PV Cycle is an industry-wide consortium in Europe for the recovery and recycling of PV modules and is used by industry for compliance with the WEEE; more than half of all PV modules ever made are in Europe. An EPR policy for electronics does not exist in the US so no companies have scored the top possible points for this category.

Most companies participate as members of PV Cycle in Europe and more than 10 companies surveyed have supported public policies based on EPR (although there is ambiguity about whether this means voluntary or mandatory). Companies participating in PV Cycle must have information about recycling and disposal prohibitions on the PV modules (typically denoted by a crossed-out garbage bin). Companies selling PV modules made specifically for the U.S. do not show this marking. Website information about recycling and disposal is inconsistently incorporated in the industry, with companies in PV Cycle often listing their membership, but not linking their website to PV Cycle. Some companies do have live links. Only one company has

[4] PV Cycle is an organization that collects and manages end-of-life PV waste in Europe. Most large and mid sized PV manufacturers are members of PV Cycle.

comprehensive recycling information for customers wishing to safely dispose of or recycle PV modules.

Challenges: The development of PV Cycle in Europe is seen as driven by the EU's Waste Electrical and Electronic Equipment Directive (WEEE)[5], which regulates the handling and treatment of electrical and electronic waste at the product's end-of-life. After earlier exemptions, PV modules were added in 2012. Countries and regions without comprehensive end-of-life management legislation or policies for PV modules are not able to require PV manufacturers to have extended producer responsibility programs. PV manufacturers prefer that end-of-life management policies are voluntary in places where there are no mandatory policies.

One limitation of current take back programs is that not all high value materials are being recovered. PV modules are often not recycled. What constitutes "recycling" in some instances is using end-of-life PV modules as smelter flux or other lower value uses. High-value recycling can be costly with crystalline silicon PV modules because it requires separating parts, which is not possible without more advanced and automated recycling technology. Thin-film PV modules may be easier for high-value materials recovery as a hammermill can be used to break modules into small pieces and chemical treatments are effective at recovering heavy metals. Occupational hazards also exist in advanced developed recycling schemes, so automation is seen as an important goal for safe and responsible recycling.

2. Module Toxicity

PV modules can contain toxic substances, which can present problems in throughout the product's life cycle. Using toxic substances in PV module production poses a risk to the environment and workers during manufacturing, and increases the cost of disposing of end-of-life PV modules.[6] The category of module toxicity attempts to score companies based on whether or not the final product sold contains toxic substances. Many thin film PV modules intrinsically contain toxic substances such as cadmium, while crystalline silicon technologies use lead. Some thin films contain indium tin oxide (ITO), which does not have much information about toxicity except for Centers for Disease Control case documenting pulmonary illnesses at ITO recycling processes in

[5] European Commission. 2015. Waste Electrical and Electronic Equipment Directive (WEEE). http://ec.europa.eu/environment/waste/weee/index_en.htm

[6] Toxic substances are those that cause harm to humans or ecosystems based on their toxicity. Hazardous substances can be toxic, but also include substances that require special handling for reasons such as flammability.

Japan.[7] There are a number of applicable laws that limit the amount of toxic substances in consumer products, but these do not currently apply to PV modules, which receive an exemption from product design laws in Europe (Restriction on Hazardous Substances, RoHS).

SVTC Goal: Companies should manufacture PV modules that contain no toxic substances. Companies should innovate based on principles of green chemistry using non-toxic substances.

Scoring: As shown in figure 4, companies are awarded 10 points if they sell PV modules that contain no lead or cadmium, or do not contain these metals at appreciable levels (set as RoHS thresholds). Scoring for this category is challenging because some companies have phased out toxic substances, but only in some of the models they offer.

Figure 4. Module Toxicity

Criteria	Description	Points Possible
Eliminate Toxic Heavy Metals	*Companies manufacture PV modules that do not contain toxic heavy metals. The levels of Cd and Pb allowed in products under RoHS is the threshold used for claims to be cadmium or lead free.*	***+10*** *– for no more Pb or Cd than allowed under RoHS.*

Industry trends: Several companies have phased out lead altogether or for some PV module models. Thin films manufacturers are not able to easily phase out these metals if they are intrinsic to the semiconductor type. For example, manufacturers of CdTe PV modules cannot phase out cadmium. However, cadmium sulfide (CdS) semiconductor layers in CIGS and CdTe PV modules can be replaced with zinc sulfide (ZnS), which lowers the module toxicity overall.

Challenges: There are different PV technologies comprised of semiconductors with different degrees of toxicity. The reason companies manufacturing crystalline silicon modules use lead is because it is malleable. Using more brittle metals can result in PV modules failing earlier, which means more PV modules must be produced and, therefore, increased chemical use overall. Companies may be slow to phase out lead due to concerns about insuring warrantees. For thin film PV modules, it will not be possible to phase out some semiconductor types while others have alternatives. For

[7] Cummings, K. J., Donat, W. E., Ettensohn, D. B., Roggli, V. L., Ingram, P., & Kreiss, K. (2010). Pulmonary alveolar proteinosis in workers at an indium processing facility. *American journal of respiratory and critical care medicine*, *181*(5), 458-464.

example, as noted above, cadmium in CdTe cannot be phased out since cadmium is intrinsic to the semiconductor technology.

3. High Value Materials Recycling

PV modules contain rare and precious metals and other valuable materials, including tellurium, silver, and indium. Recycling of PV modules is not widespread and even where recycling occurs, not all high value materials are being recovered. Several materials used in PV modules are finite resources and making PV from recycled materials will reduce waste, improve recycling markets and lessen the overall impact on natural resources. Failing to recover these metals means that natural resources required to make PV modules are being depleted as there are only limited materials that exhibit the photoelectric effect. Ensuring adequate supplies and lowering price volatility are considered important motivations for recovering these metals.

SVTC Goal: Companies should recycle products to recover high value materials. One threshold is 95% or more of the materials recovered are destined for high value recycling and materials recovery.

Scoring: As shown in figure 5, scoring for this category includes three metrics. In addition to high value material recovery rate, recycling in facilities with ISO 14001 certification is rewarded as well as design for environment.

Figure 5. High Value Materials Recycling

Criteria	Description	Points Possible
High Value Material Recovery Rate	*95% of the PV module is recycled into similar value and quality products; or 95% of the PV module is down-cycled into lesser value and quality products*	**+2** *– cradle to cradle recycle, or* **+1** *– down-cycle*
ISO 14001 Facilities	*All recycling activities take place at a facility with a documented environmental management system and worker safeguards and protections consistent with ISO 14001*	**+1**
Design for the environment	*Cradle to cradle recycling is encouraged at the design stage through design for the environment (dfe) training programs offered by company.*	**+2**

Industry trends: High-value materials recycling is uncommon in the PV industry because these processes require handling PV modules in dedicated waste streams in high volumes to be economically viable. Currently, PV modules are typically sent in

bulk with other electronics waste and the volumes of end-of-life PV modules remains low. There is no industry-wide system for collecting manufacturer discards for example (PV Cycle only covers end-of-life products). Companies making thin films can find more value in recycling as it may be easier to recover valuable (otherwise costly) semiconductor inputs. One company recovers 95% of their semiconductor material from PV modules returned from customers and PV module discards at their manufacturing sites. No companies attained top score in this category because none have recycling in place that recovers all high value materials with no down-cycling.

Challenges: Today the value proposition for high-value materials recycling is likely most impacted by outside forces. For high-value materials recycling to become common practice would require the development of markets for many of these inputs (recycled indium, tellurium, silver silicon, etc.), advancement in recycling technology, and the development of a reverse logistics infrastructure that can improve the economics of collecting end-of-life PV modules.

4. Chemicals: Emissions Transparency & Reduction Plan

PV module manufacturing involves similar chemicals and manufacturing processes to semiconductor and electronics production. This section described two of the categories in the Solar Scorecard with overlapping goals related to chemical use.

SVTC Goal: SVTC's goal for emissions transparency is that PV companies disclose chemical emissions information on their website. The disclosure of chemical use and the reporting of volume could spur companies to reduce use. The goal for chemical reduction is that companies have a plan for reducing the volume of chemicals, particularly toxic and hazardous ones, used in manufacturing. Companies should be able to measure, track, and report on progress. Reducing chemical use per module has benefits to the environment, workers, and the cost of making PV.

Scoring: These two categories have related objectives of reducing the volume of chemicals used in PV manufacturing. Figure 6 shows the points awarded for reporting various kinds of environmental emissions. Figure 7 shows the points awarded to companies that have a chemical reduction plan to reduce chemical use per module made.

Figure 6. Chemical use and disposal reporting and disclosure

Criteria	Description	Points Possible
Chemical Emissions	*Information on chemical emissions, chemical waste, hazardous waste disposal &/or heavy metals.*	**+4** – *chemical waste (HCL, HF, Cl_2), hazardous waste disposal, heavy metals*
Air Pollutants	*Air pollutants are disclosed in annual report, &/or confirmed by 3rd party auditing or gov't agency.*	**+2** – *NOx, SOx, VOCs, Particulate matter (PM)* *Or* **+1** – *if fewer*
Ozone Depleting Substances	*Information regarding ozone depleting substances is disclosed in annual report, &/or confirmed by 3rd party auditing or gov't agency.*	**+2 –** *Ozone depleting substances*
Landfill Disposal	*Information regarding landfill disposal is disclosed in annual report, and/or confirmed by third party auditing or gov't agency.*	**+2**

Figure 7. Chemical reduction plan

Criteria	Description	Points Possible
Chemical Reduction Plan	*Companies have adopted a plan with goals to reduce chemical use per module and described it on their website or sustainability report.*	**+5**

Industry trends: Four companies extensively report all categories of waste and emissions: chemical emissions, air pollutants, ozone depleting substances, and landfill disposal. Of the individual categories, six companies are known to report chemical emissions. Air pollutants are only reported by four companies, although air pollutants are a smaller overall environmental burden than chemical emissions. Four companies report ozone-depleting chemicals. Six companies report landfill disposal. Ten companies included in the SVTC Scorecard report or post chemical reduction targets on their websites or in sustainability reports.

Challenges: It is difficult to compare performance across different companies in the annual survey. Companies report different values (mass reduction, percent reduction), and since their operations might cover different segments of the value chain it is not easily possible to compare different companies on chemical emissions and reductions because some companies outsource the early stages of production to other companies.

Chemical emissions are also reported in different ways (by specific chemical such as hydrofluoric acid or chemical classification such as hazardous waste).

5. Water use and wastewater effluent

There are significant amounts of water used and wastewater generated during the manufacturing of PV modules.

SVTC Goal: PV companies should not pollute water bodies during PV module production, and should minimize wastewater generation and reduce the amount of water used in production. SVTC believes that requiring manufacturers to disclose water use, wastewater emissions, and water quality indicators is the first step to reducing water consumption and wastewater generation.

Scoring: As shown in figure 8, out of the 5 points available, companies receive +2 for reporting water use and an additional +1 if they report wastewater volumes. They receive an additional +2 points if wastewater is reported based on water quality indicators (chemical oxygen demand, biological oxygen demand), for a total of 5 possible points.

Figure 8. Water use and wastewater

Criteria	Description	Points Possible
Report Water Use & Wastewater effluent	*Company recognizes the importance of reducing impacts to water.*	**+2** *They report volume of water use* **+1** *and wastewater generated* **+2** *according to several water quality indicators.*

Industry trends: Only six companies post all categories of water use and report wastewater effluent volumes according to water quality indicators. Some companies only report water use and wastewater generated. Water use is the most commonly reported metric, whereas wastewater generation and water quality indicators were rarely reported by manufacturers.

Challenges: A major challenge to reporting these measures of wastewater effluent is how the receiving entity classifies the material. In some countries or regions wastewater effluent might be considered hazardous waste, and in others hazardous waste might be allowed into municipal or industrial sewer systems. The very same effluent could have different waste classification depending on jurisdiction.

6. Workers' Rights, Health and Safety

A core theme in SVTC's green jobs platform is that PV manufacturing should be done in a way that protects worker rights, health and safety. The category aims to measures how well companies proactively protect workers' rights, health, and safety in facilities where their products are made.

SVTC Goal: SVTC's goal in their Green Jobs platform is that companies that are providing green jobs do what they can to protect workers' rights, health and safety.

Scoring: The scoring reflects PV manufacturer's efforts in proactively protecting workers' health, rights, and safety. One way that companies have engaged in these issues is to sign on to formal commitments to these issues. Companies are awarded the most points if they are able to demonstrate that they have such agreements in place to protect their workers. The Solar Energy Industry Association (SEIA) developed an industry code of conduct based on the Electronic Industry Code of Conduct (EICC) that they post on their website, which exemplifies the kinds of commitment that SVTC is looking for from PV companies. Additionally, companies get points for committing to pay a living wage, post signage about minimum wage, and utilize a workforce protected by collective bargaining. Companies are also awarded points for reporting on workday case rate and recordable incident rates. Starting in 2015, companies will receive 1 point for reporting and another if their rate shows an annual improvement.

Figure 9. Workers' Rights, Health and Safety

Criteria	Description	Points Possible
Formal Commitment	*Companies adopt a formal commitment that protects worker rights, health, and safety that goes beyond compliance with local laws and regulations*	**+4** *SEIA's commitment or equivalent company declaration, or* **+2** *policy for a company declaration that is missing important elements of a commitment to worker, right, health, and safety.*
Living Wage	*Commitment to improving wages of employees.*	**+2** All *employees paid more than min wage.*
Post Signs in workplace	*Post signage for minimum wage provisions for illiterate workers*	**+1**
Collective Bargaining	*Utilize a workforce protected by collective bargaining*	**+2** if 100% **+1** if > 50%
Work Day Case Rate	*Report and show improvements in workday case rates*	**+1** *for annual improvement* **+1** *for reporting*
Recordable Incident	*Based on reporting criteria used Bureau of*	**+1** *for annual improvement*

Rates	*Labor Statistics* *http://www.bls.gov/iif/osheval.htm*	**+1** *for reporting*
OHSAS	*OHSAS for 100% of their facilities*	**+2** if 100% of facilities, **+1** if >50%

Industry trends: Several companies have their own worker commitment or have signed onto the one developed by SEIA. However, very few companies overall have their own policy or have adopted the industry code of conduct developed and promoted by the SEIA, described above.

Challenges: This is one of the more difficult categories to assess because working conditions, environmental and worker safety regulations, and worker rights vary by geography and jurisdiction. Some companies manufacture in countries with strict regulation while others are more lax. There are challenges related to the quality of data obtained in this category for these reasons as well. There are also difficult issues in benchmarking. SVTC for example, hopes the PV industry can pay a living wage, but it is not clear if there is an agreed upon value for this, how it varies by region, and how this would be monitored. Labor laws and regulations vary by region as well. Some countries collective bargaining is a norm, others it is a privilege, and in some instance it is disallowed altogether. It is not clear how meaningful worker commitments or even labor certifications are.

7. Supply Chain

As global supply chains become increasingly complex, it is often not known what is happening regarding worker and environmental impacts in the supply chain.

SVTC Goal: Companies have their suppliers from across the lifecycle report chemical emissions; have companies adopting binding commitments to monitoring and improving the environmental, health, and safety of their operations.

Scoring: Companies can get 7 of the 10 points in this category for simply signing onto the SEIA code of conduct or if they have a similar internal policies or certifications such as SA8000. Companies are also awarded points if suppliers they purchase from report chemical emissions, with an additional point available for going deeper in supply chain tiers. Scoring as described in Figure 10 consists of awarding points for companies with worker commitments that cover the first tier of the supply chain, and an additional point if their commitment covers tier two.

Figure 10. Supply Chain Criteria and Points

Criteria	Description	Points Possible
Supply Chain Chemical Monitoring	*Purchase from suppliers that report all chemical emissions from module upstream to polysilicon production or semiconductor preparation*	**+2** *if all tiers report* **+1** *if only first tier suppliers report*
Commitment from Suppliers	*Enforceable commitment from suppliers to protect workers and the environment.*	**+7** *SEIA commitment, UNGC , or SA8000* **+3** *if a less comprehensive code of conduct*
Commitment from Tier 2 Suppliers	*Companies could also earn points if the agreement with suppliers extended to tier 2 of suppliers' supply chain.*	**+1** *code of conduct covers tier two.*

Industry trends: Many companies have worker commitments, but SVTC is aware of only four PV manufacturers that have officially signed the SEIA code of conduct. No companies purchase all their inputs from suppliers who report their emissions. Few companies that have a code of conduct report that their code of conduct goes as deep as tier 2 (SEIA code covers tier one; a tier one supplier in the PV industry is one that directly sells to a company, whereas tier two suppliers are companies that sell to tier one suppliers.

Challenges: The two key challenges in this category are verification and significance of the certification. It can be difficult to verify claims by companies. Some have questioned whether worker commitments are adequate and whether more information about supply chains is warranted. Where companies do have certifications, there are questions about whether the certifications actually result in better outcomes for workers and the environment.

8. Energy Use & Greenhouse Gas (GHG) Emissions

It has become commonplace in many industries to report energy use and greenhouse gas emissions. Reporting on energy use and GHGs will encourage manufacturers to use the cleanest energy possible to make PV.

SVTC Goal: Companies report energy use, sources of energy, and greenhouse gas emissions (GHGs). Eventually companies should make PV modules with renewable energy.

Scoring: Companies received one point each for energy, GHGs, and perfluorocarbon reporting. If these were to a third party, these data were considered high quality and +2 was awarded in these cases.

Figure 11. Energy and Greenhouse Gases

Criteria	Description	Points Possible
Energy & GHG Reporting	*Companies that report energy use, GHGs, perfluorocarbon and/or report information to a third party.*	**+1** report energy use annually **+1** report greenhouse gases **+1** Report perfluorocarbons **+2** report GHGs and/or energy to third party

Industry trends: More companies report on these metrics every day and several companies report these environmental performance metrics to third party organization such as the Global Reporting Initiative and/or the Carbon Disclosure Project.

Challenges: There are no foreseeable challenges in this regarding reporting these values as means for measuring emissions are readily available.

9. Conflict Minerals

Conflict minerals are minerals from central Africa where it is believed the trade in these metals is fueling armed conflict. Tin (cassiterite) is a conflict mineral and its use in PV is widespread in various inputs for all technologies.

SVTC Goal: Companies confirm through due diligence that there are no conflict minerals in their products.

Scoring: Companies that have started the due diligence process receive +3 points, while companies that can verify no conflict minerals receive +5 points. So far, no company has earned +5.

Figure 12. Conflict Minerals

Criteria	Description	Points Possible
OECD Guidelines	*PV manufacturing does not contain conflict minerals from the Democratic Republic of the Congo (DRC), Angola, Burundi, Central African Republic, Republic of the Congo, Rwanda, South Sudan, Tanzania, Uganda, Malawi and Zambia as per the due diligence guidance outlined by the OECD and can produce documentation*	**+5** *Document OECD Due Diligence* **+3** *Starting the due diligence process*

Industry trends: SVTC is not aware of any companies that can provide documentation to verify that their supply chains do not contain conflict minerals based on the due diligence guidelines set by the OECD. Twelve companies are engaged in or have started the process of due diligence to determine if conflict minerals are present in their supply chains.

Challenges: PV companies are only one of many companies that may have conflict minerals in their supply chains; they make up only a small portion of tin demand. Given the relatively small size of these companies, they have very little leverage to demand more information from suppliers.

10. Prison Labor

Prison labor does not have the same oversight as non-prison labor and prisoners may be exposed to higher levels of pollution in the workplace.

SVTC Goal: Companies have written policies forbidding the use of prison labor throughout the supply chain.

Scoring: Companies that have strict policies forbidding the use of prison labor receive +5 points, while those that assert they do not use prison labor are awarded +3.

Figure 13. Prison Labor

Criteria	Description	Points Possible
Prison Labor Free Production	*The company has an explicit policy forbidding prison labor*	**+5** – *for providing the policy to SVTC or posting on website.* **+3 –** *company declared they do not use prison labor on previous SVTC surveys.*

Industry trends: No company has ever reported using prison labor in the PV industry. 12 companies declare that they do not use prison labor and four companies have provided SVTC with a copy of an explicit policies prohibiting prison labor or have posted this information on their website.

Challenges: Verification is one challenge to accurately scoring this category.

11. Biodiversity

Many solar power plants have been built on lands of conservation significance—lands that contain intact ecological habitat or threatened or endangered species. This category is only partially relevant to a sustainability leadership standard for PVs because it mostly applies to PV power plant installations and not PV module design and production. While the category does ask companies to report on whether their facilities were built on lands of conservation significance, the magnitude of the impacts from utility-scale power plants is much more significant than any projects that see manufacturing facilities built on ecologically sensitive lands.

SVTC Goal: Companies build projects (PV installations, manufacturing fabs, factories) on previously disturbed or degraded lands or on rooftops and parking lots and have no direct impacts on threatened and endangered species or on wildlife and biodiversity.

Scoring: Scoring is based on questions derived from commonly used corporate social responsibility reporting frameworks.

Figure 14. Biodiversity

Criteria	Description	Points Possible
Zero Take permits	*Zero take permits for endangered, threatened, or special concern animals (U.S.)*	***+3***
No harm to wildlife or sensitive species	*No Species of Special Concern Present at Project Sites*	***+1***
No Biodiversity Impacts	*No significant impacts of activities on biodiversity in protected areas or on areas of high biodiversity value outside protected areas*	***+1***

Industry trends: Only a handful of the companies in the scorecard are vertically integrated to project integrators and/or developers. No company has ever reported biodiversity impacts associated with manufacturing facilities, only utility-scale power plants.

Challenges: Issues depend on the particular place and vary on a case-by-case basis. The challenge with including this in the standard is that the only biodiversity issues evaluated would be at the manufacturing facility, which SVTC has determined to have an insignificant biodiversity impact. This runs the risk of awarding a company that has built a power plant on ecologically sensitive land with a high biodiversity score, solely because their manufacturing facilities' impacts are minimal or non-existent.