EPEAT Disclosure Report 2024

October 2024

First Solar®

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The following EPEAT disclosure report was prepared for conformance to the ANSI/NSF 457 Sustainability Leadership Standard.

1. Substances of Very High Concern (Criterion 5.2.1)

First Solar Series 6, Series 6 *Plus* and Series 7 PV modules consist of four articles: glass module, junction box, cable, and frame/rail. These articles do not contain substances on the Candidate List of Substances of Very High Concern (SVHC) as defined by EU REACH regulation (revision date: Sep. 25, 2023) above 0.1% by weight per article.

2. Life Cycle Assessment (Criterion 7.1.2 and 7.2.1)

First Solar conducted a life cycle assessment (LCA) of its Series 6 PV modules, which was published in the IEEE Journal of Photovoltaics: https://ieeexplore.ieee.org/document/8305539 (doi: 10.1109/JPHOTOV.2018.2802786), in accordance with the requirements of the European Union Product Environmental Footprint Guide. A copy of the conference paper is available on First Solar's website and includes an overview of identified life cycle hotspots: http://www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/Sustainability-Studies/PVSC_44_Addressing-Hotspots-in-the-Product-Environmental-Footprint-of-CdTe-PV.ashx?dl=1.

The LCA quantifies the following mid-point indicators according to ILCD 2011 for First Solar Series 4 modules and First Solar Series 6 modules as follows:

3kWp installation, roof mounted (total all life stages, recycling benefits included)			
Impact category	Unit per kWh DC electricity	First Solar Series 4	First Solar Series 6
Climate change	kg CO2 eq	1.94E-02	1.66E-02
Ozone depletion	kg CFC-11 eq	8.78E-10	9.47E-10
Human toxicity, non-cancer effects	CTUh	4.95E-09	5.11E-09
Human toxicity, cancer effects	CTUh	5.97E-10	5.16E-10
Particulate matter	kg PM2.5 eq	9.95E-06	7.72E-06
Ionizing radiation HH	kBq U235 eq	9.06E-04	7.83E-04
Photochemical ozone formation	kg NMVOC eq	7.43E-05	5.62E-05
Acidification	molc H+ eq	1.46E-04	1.10E-04
Terrestrial eutrophication	molc N eq	2.76E-04	2.07E-04
Freshwater eutrophication	kg P eq	3.60E-06	3.51E-06
Marine eutrophication	kg N eq	2.54E-05	1.91E-05
Freshwater ecotoxicity	CTUe	7.63E-02	7.50E-02
Land use	kg C deficit	1.19E-02	8.61E-03
Water resource depletion	m3 water eq	7.83E-05	6.07E-05
Mineral, fossil & ren resource depletion	kg Sb eq	3.09E-06	2.58E-06
Cumulative energy demand non renewable	MJ	2.90E-01	2.47E-01
Cumulative energy demand renewable	MJ	3.63E+00	3.62E+00
Nuclear waste	m3 HAA eq	2.12E-11	1.84E-11

First Solar conducted a life cycle assessment (LCA) of its Series 7 PV modules, which was published in EPD Norge: https://www.epd-norge.no/epder/bygg/solcellepaneler-og-komponenter/first-solar-series-7-photovoltaic-module, in accordance with ISO 14025 and EN15804 +A2. The Series 7 EPD includes an overview of identified life cycle hotspots (p. 13).

The LCA quantifies the following mid-point indicators according to EN15804 +A2 for First Solar Series 7 modules as follows:

Core environmental impact indicators

Indicator	Unit	A1-A3[3]	A4[3]	A5	B2	B4	C1	C2[4]	C3[4]	D
GWP-total	kg CO2 eq.	2.35E-01	2.17E-02	1.69E-03	5.61E-05	2.40E-03	1.26E-04	4.36E-02	1.51E-02	-6.42E-02
GWP-fossil	kg CO2 eq.	2.33E-01	2.17E-02	1.29E-03	5.26E-05	2.38E-03	1.17E-04	4.34E-02	1.36E-02	-6.38E-02
GWP-biogenic	kg CO2 eq.	1.06E-03	1.86E-05	4.01E-04	3.43E-06	1.14E-05	8.57E-06	1.18E-04	1.46E-03	-2.99E-04
GWP-LULUC	kg CO2 eq.	2.35E-04	1.32E-05	1.38E-06	6.97E-08	2.20E-06	2.88E-07	2.19E-05	1.91E-05	-2.61E-05
ODP	kg CFC11 eq.	3.13E-09	3.30E-10	2.06E-11	1.16E-12	3.77E-11	2.20E-12	9.21E-10	5.83E-10	-1.04E-09
AP	mol H^+ eq.	1.59E-03	2.62E-04	8.34E-06	2.51E-07	1.57E-05	6.61E-07	9.20E-05	4.07E-05	-2.18E-04
EP-freshwater	kg P eq.	1.42E-05	1.60E-07	7.33E-08	2.88E-09	1.26E-07	1.14E-08	3.57E-07	2.17E-06	-1.61E-06
EP-marine	kg N eq.	3.01E-04	6.50E-05	1.67E-06	4.57E-08	3.21E-06	8.30E-08	2.23E-05	7.79E-06	-8.00E-05
EP-terrestial	mol N eq.	3.56E-03	7.15E-04	1.92E-05	5.17E-07	3.70E-05	9.68E-07	2.32E-04	7.73E-05	-4.68E-04
POCP	kg NMVOC eq.	1.02E-03	2.15E-04	5.84E-06	1.87E-07	1.12E-05	3.11E-07	1.42E-04	2.60E-05	-1.79E-04
ADP-M&M[2]	kg Sb eq.	2.94E-06	5.16E-08	1.30E-08	3.30E-10	2.38E-08	1.40E-09	1.48E-07	4.86E-08	-5.47E-07
ADP-fossil[2]	MJ	2.83E+00	2.85E-01	1.73E-02	8.07E-04	3.00E-02	2.62E-03	6.00E-01	2.04E-01	-5.70E-01
WDP[2]	m^3	4.63E-02	1.03E-03	2.41E-04	4.55E-03	4.31E-04	2.98E-05	2.42E-03	7.72E-03	-1.49E-02

GWP-total: Global Warming Potential; **GWP-fossil:** Global Warming Potential fossil fuels; **GWP-biogenic:** Global Warming Potential biogenic; **GWP-LULUC:** Global Warming Potential land use and land use change; **ODP:** Depletion potential of the stratospheric ozone layer; **AP:** Acidification potential, Accumulated Exceedance; **EP-freshwater:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; See "additional requirements" for indicator given as PO4 eq. **EP-marine:** Eutrophication potential, fraction of nutrients reaching freshwater end compartment; **EP-terrestial:** Eutrophication potential, Accumulated Exceedance; **POCP**: Formation potential of tropospheric ozone; **ADP-M&M**: Abiotic depletion potential for non-fossil resources (minerals and metals); **ADP-fossil:** Abiotic depletion potential for fossil resources; **WDP:** Water deprivation potential, deprivation weighted water counsumption

Additional environmental impact indicators

Indicator	Unit	A1-A3[3]	A4[3]	A5	B2	B4	C1	C2[4]	C3[4]	D
PM	Disease incidence	1.34E-08	1.02E-09	6.64E-11	2.76E-12	1.31E-10	2.00E-12	2.36E-09	2.26E-10	-2.43E-09
IRP[1]	kBq U235 eq.	6.70E-03	8.78E-05	5.29E-05	5.09E-06	5.89E-05	2.37E-05	3.29E-04	7.18E-04	-5.77E-04
ETP-fw[2]	CTUe	1.96E+00	1.62E-01	9.55E-03	2.05E-04	1.91E-02	2.62E-04	3.20E-01	7.23E-02	-4.42E-01
HTP-c[2]	CTUh	2.82E-10	9.48E-12	1.23E-12	1.92E-13	2.39E-12	5.42E-14	1.97E-11	4.92E-12	-1.00E-10
HTP-nc	CTUh	5.18E-09	2.26E-10	2.64E-11	2.54E-12	4.86E-11	2.32E-12	5.40E-10	4.92E-10	-9.66E-10
SQP[2]	Dimensionless	1.27E+00	1.23E-01	7.08E-03	2.53E-04	1.35E-02	5.11E-04	3.40E-01	3.19E-02	-1.94E-01

PM: Particulate matter emissions; **IRP:** Ionising radiation, human health; **ETP-fw:** Ecotoxicity (freshwater); **ETP-c:** Human toxicity, cancer effects; **HTP-nc:** Human toxicity, non-cancer effects; **SQP:** Land use related impacts / soil quality

3. Material Recovery Targets (Criterion 9.1.3)

First Solar's high-value PV recycling process recovers more than 90% of a First Solar module for reuse in new First Solar modules, glass products and rubber products. Approximately 90% of the glass and more than 90% of the semiconductor material and more than 90% of other metals are recovered at end-of-life.

First Solar PV Module Recycling Material Recovery Achievements	
Glass	= 90 mass-%
Metals (not including semiconductor materials)	≥ 90 mass-%
Semiconductor Materials	≥ 90 mass-%

4. Corporate Reporting (Criterion 11.2.1)

Key Performance Indicators	Reference Source of Key Performance Indicator			First Solar		
	GRI Standards [14]	SASB solar energy sustainability accounting standard[30]	SEIA Commitment[28]	2022	2023	Boundary
PV modules produced in MW DC in reporting period	2-6	RR-ST-000.A	Included	9,068	12,100	Manufacturing (Global)
Recycled input materials used (%)	301-2			7%	0% - 37%	Semiconductor material (Global)
Standards, methodologies, assumptions, and/or calculation tools used				Disclosed recycled input materials in 2022 and 2023 is limited to the semiconductor material and is based on actual data from suppliers.		
Energy consumption within the organization	302-1	RR-ST-130a.1	Included	1,072,663 MWh (3,861,587 GJ)	1,449,109 MWh (5,216,792 GJ)	Global (equity share)
Total fuel consumption from non-renewable sources	302-1	RR-ST-130a.1		32,827 MWh (118,177 GJ)	56,869 MWh (204,728 GJ)	Global (equity share)
Natural gas	302-1	RR-ST-130a.1		29,749 MWh (107,096 GJ)	56,078 MWh (201,880 GJ)	Global (equity share)
Diesel/Gas oil	302-1	RR-ST-130a.1		482 MWh (1,735 GJ)	636 MWh (2,289 GJ)	Global (equity share)
Motor Gasoline	302-1	RR-ST-130a.1		2,596 MWh (9,346 GJ)	155 MWh (558 GJ)	Global (equity share)
Consumption of self-generated non-fuel renewable energy- onsite solar	302-1	RR-ST-130a.1		7,172 MWh (25,819 GJ)	7,532 MWh (27,115 GJ)	Global (equity share)
Consumption of purchased electricity	302-1	RR-ST-130a.1		1,032,664 MWh (3,717,590 GJ)	1,384,708 MWh (4,984,948 GJ)	Global (equity share)
Standards, methodologies, assumptions, and/or calculation tools used				Energy data is based on electricity bills. Solar generation is estimated based on size of the PV installations at our production sites in Ohio, Malaysia, Vietnam, and at our recycling facility in Frankfurt Oder, Germany. Conversion factors from WRI GHG protocol. Heating, steam, and cooling from non-renewable and renewable sources are not applicable, and fuel from		

				renewable sources are not applicable. Electricity, heating, cooling, and steam was not sold.		
Energy consumption in manufacturing	302-1	RR-ST-130a.1		1,016,560 MWh (3,659,616 GJ)	1,376,981 MWh (4,957,131 GJ)	Manufacturing (Global)
Grid electricity consumed (%)		RR-ST-130a.1		96%	96%	Global (equity share)
Renewable energy consumed-onsite solar (%)		RR-ST-130a.1		1%	1%	Global (equity share)
Manufacturing Energy Intensity (kWh per Watt Produced)	302-3			0.11	0.11	Manufacturing (Global)
Standards, methodologies, assumptions, and/or calculation tools used				Data includes total energy (electricity and fuel) consumed global manufacturing operations on a per watt produced basis. The ratio uses energy consumption within the organization.		
Total water withdrawal from all sources (megaliter or thousand m^3)	303-3	RR-ST-140a.1	Included	3,149	3,859	Manufacturing, Recycling and R&D (Global)
Water withdrawn in water stressed areas (%)		RR-ST-140a.1		0.02%	8%	Manufacturing, Recycling and R&D (Global)
Total water consumption from all sources (megaliter or thousand m^3)	303-5	RR-ST-140a.1	Included	1,776	2,158	Manufacturing, Recycling and R&D (Global)
Water consumed in water stressed areas (%)		RR-ST-140a.1		0.04%	6.6%	Manufacturing, Recycling and R&D (Global)
Standards, methodologies, assumptions, and/or calculation tools used				All water withdrawals come from local municipal suppliers (third-party/freshwater). Data is based on water bills. In 2023, 8% of our water withdrawals came from water stressed areas, compared to 0.02% in 2022 because of our new manufacturing facility in India. In 2022, our Mesa, Arizona test site was the only one classed as water stressed. In India, we operate a net-zero PV manufacturing water withdrawal facility which relies entirely on tertiary treated reverse osmosis water from the city's sewage treatment plant for its process water with zero wastewater discharge. We used the WWF Risk Filter Tool and defined stressed areas as having baseline water stress that is equal to/greater than 'High': 40-80%. For information on our water management approach, please see our sustainability report and CDP water response.		

Direct GHG emissions-Scope 1 (MT CO_2eq)	305-1		Included	7,690	11,638	Global (equity share)
Standards, methodologies, assumptions, and/or calculation tools used				Data includes all greenhouse gases. Calculations are based on published criteria, such as emission factors and Global Warming Potential (GWP) rates from WRI GHG protocol and IPCC Fifth Assessment Report (AR5 – 100 year), respectively. Biogenic emissions are not applicable. For comparison purposes, the base year scope 1 emissions in 2008 were 1,020 MT CO2eq. The 2008 base year is the earliest year when First Solar international facilities started operating. Consolidation approach is based on equity share.		
Energy indirect GHG emissions-Scope 2 (MT CO2eq)	305-2		Included	563,652	776,502	Global (equity share)
Standards, methodologies, assumptions, and/or calculation tools used				Data includes all greenhouse gases for market-based scope 2 emissions. Calculations are based on published criteria, such as emission factors and Global Warming Potential (GWP) rates from WRI GHG protocol and IPCC Fifth Assessment Report (AR5 – 100 year), respectively. For comparison purposes, the base year scope 2 emissions in 2008 were 123,046 MT CO2eq. The 2008 base year is the earliest year when First Solar international facilities started operating. Biogenic emissions are not applicable. Consolidation approach is based on equity share.		
Waste by type and disposal method	306-3 306-4 306-5	RR-ST-150a.1	Included	Sustainability Report (pg.33,73 and 74)	Sustainability Report (pg. 81-82)	Manufacturing (Global)
Standards, methodologies, assumptions, and/or calculation tools used				Data includes total weight of waste disposed (landfill, incineration, or other disposal) and total weight of waste diverted from disposal (recycled, reused, or recovered by other operations) by type (hazardous or non-hazardous) in accordance with 2020 GRI standards. Waste disposal method is determined by information provided by the waste disposal contractor. 100% of waste directed to disposal and diverted from disposal occurs onsite.		
Type of injury and rates of injury, lost days, and absenteeism, and number of work-related fatalities	403-9		Included	Sustainability Report (pg. 55 and 74)	Sustainability Report (pg. 83)	Global (manufacturing and offices)

First Solar Work-Related Recordable Injury Rate (per 200,000 hours)	403-9			0.46	0.58	Global (manufacturing and offices)
Number of recordable work-related injuries	403-9		Included	27	42	Global (manufacturing and offices)
Rate of High-Consequence Work-Related Injuries (excluding fatalities)	403-9			0	0	Global (manufacturing and offices)
Number of High-Consequence Work-Related Injuries (excluding fatalities)	403-9			0	0	Global (manufacturing and offices)
Number and Rate of Work-Related Fatalities	403-9			0	0	Global (manufacturing and offices)
Occupational diseases	403-9		Included	0	0	Global (manufacturing and offices)
Standards, methodologies, assumptions, and/or calculation tools used				Safety data includes all full-time, part-time, and temporary employees as well as interns at all global manufacturing, R&D and office locations. There are no workers who are not employees but whose work and/or workplace is controlled by the organization. Rates of injury are calculated per 200,000 hours. First Solar's manufacturing data covers all processes (from the beginning of the manufacturing process to the finished module) and includes all of the company's manufacturing facilities in the U.S., Malaysia, Vietnam, and India. First Solar's advanced thin film modules are manufactured in a high-throughput, automated environment that integrates all manufacturing steps into a continuous flow operation under one roof. First Solar's safety management system hazard identification and risk assessment process identified the following hazards that have the potential for serious injury or fatality: confined space entry, electrical exposure and arc flash, line of fire, lock out/tag out, machine guards, vehicle collision, working with a suspended load, and working at heights. First Solar has developed EHS Design Requirements for new equipment that includes equipment and machine safety			

	requirements. Training and procedures are in place to identify and control potential hazards.

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5. Corporate Reporting (Criterion 11.2.2)

Key Performance Indicators	Reference Source of Key Performance Indicator			First Solar		
	GRI Standards[14]	SASB solar energy sustainability accounting standard[30]	SEIA Commitment[28]	2022	2023	Boundary
Reduction of energy consumption	302-4			3,405 MWh (12,258 GJ)	12,245 MWh (44,082 GJ)	Global Manufacturing (electricity)
Standards, methodologies, assumptions, and/or calculation tools used				Engineering measurements of lighting and HVAC electricity conservation projects using previous year as a baseline, in order to show annual progress. Scope 2 WRI/WBCSD GHG Protocol.		
Water withdrawn in water stressed areas (megaliter or thousand m^3)	303-3	RR-ST-140a.1 (or WBSCD Global Water Tool[40])		0.692 (0.02%)	325 (8%)	Manufacturing, Recycling and R&D (Global)
Standards, methodologies, assumptions, and/or calculation tools used				In 2023, 8% of our water withdrawals came from water stressed areas, compared to 0.02% in 2022 because of our new manufacturing facility in India. In 2022, our Mesa, Arizona test site was the only one classed as water stressed. In India, we operate a net-zero PV manufacturing water withdrawal facility which relies entirely on tertiary treated reverse osmosis water from the city's sewage treatment plant for its process water with zero wastewater discharge. We used the WWF Risk Filter Tool and defined stressed areas as having baseline water stress that is equal to/greater than 'High': 40-80%. For information on our water management approach, please see our sustainability report and CDP water response. 100% of our withdrawals come from local municipal suppliers (third-party/ freshwater or wastewater), including 100% third-party water from surface water for our Mesa, Arizona test site.		
Water recycled and reused (megaliter or thousand m^3)				169	318	Manufacturing, Recycling and R&D (Global)
Standards, methodologies, assumptions, and/or calculation tools used				We measure the amount of water recycled at our manufacturing and recycling facilities in Malaysia, Ohio, Vietnam, India, and Germany, which represented 99.9% of our water withdrawals in 2022 and 2023. We recycled approximately 318		

				megaliter or thousand m^3 in 2023 (or approximately 8% of our total water withdrawals) and 169 thousand megaliter or thousand m^3 in 2022 (or approximately 5% of our total water withdrawals) across our operations.		
GHG emissions intensity (metric tons of CO2-eq / MW produced)	305-4			63	65	Global (equity share)
Standards, methodologies, assumptions, and/or calculation tools used				In 2022 and 202, our GHG emissions intensity includes direct (scope 1) and indirect (scope 2) emissions of all manufacturing and recycling plants, R&D and testing facilities, company-owned operational solar projects, and company-owned vehicle fleet on a carbon intensity basis measured per megawatt (MW) of PV modules produced. All GHGs are included in the calculations.		
Reduction of GHG emissions (metric tons CO2-eq)	305-5			Scope 1: 0 Scope 2: 2,254	Scope 1: 0 Scope 2: 7,779	Global Manufacturing (electricity)
Standards, methodologies, assumptions, and/or calculation tools used				Scope 1 and 2 WRI/WBCSD GHG Protocol using previous year as baseline, in order to show annual progress. We implemented several projects in 2023 to reduce emissions, including reducing the consumption of compressed dry air (CDA), installing a heat exchanger for the CDA inlet of air dryers, replacing LED lighting in the canteen, increasing the temperature in the facility, and installing motion sensors for sanitary facilities, and improving panel wattage, which collectively resulted in a reduction of 7779 metric tons CO2e. Our scope 1 and 2 emissions in the previous year (2023) amounted to 776,502 metric tons CO2-eq. Our emissions reduction activities amounted to a 1% decrease in our gross global emissions in 2023. In 2022, we implemented a re-lighting and chiller optimization project at our manufacturing facility in Malaysia, and various lighting, HVAC, wastewater recycling and chiller optimization projects at its manufacturing facility in Vietnam. These measures resulted in savings of 2,254 metric tons CO2-eq in 2022 from avoided electricity consumption in 2022. Our scope 1 and 2 emissions in the previous year (2021) amounted to 560,210 metric tons CO2-eq. Our emissions reduction activities amounted to a 0.4% decrease in our gross global emissions in 2022. All GHGs are included in the calculations.		
Product Recycling Program in Place	301-2 301-3	RR-ST-410b.2 RR-ST-410b.4	Included	Yes	Yes	Global

First Solar's manufacturing data covers all processes (from the beginning of the manufacturing process to finished module) and includes all of the company's manufacturing facilities in the U.S., Malaysia, Vietnam, and India. First Solar's advanced thin film modules are manufactured in a high-throughput, automated environment that integrates all manufacturing steps into a continuous flow operation under one roof.

6. Reporting on screening of Tier 1 suppliers (11.2.3)

In 2023, First Solar assessed 100% of our tier 1 suppliers that provide materials and components for manufacturing and 100% of our new suppliers using social and environmental criteria. 100% of our major suppliers completed an RBA Self-Assessment Questionnaire (SAQ). We leverage third-party tools and indices on global slavery, forced labor and other environmental, social, governance (ESG) aspects to identify high-risk suppliers based on industry, geography and spend. We publicly report on the environmental and social performance of the suppliers we audit in our sustainability report on an annual basis. Please see pg. 49 of our 2024 Sustainability Report.

7. Public Disclosure of Use of Conflict Minerals in Products (Criterion 11.4.1)

First Solar is committed to responsible sourcing and operating a supply chain free of conflict minerals. First Solar's Specialized Disclosure and Conflict Minerals reports are available on our public website (see "Specialized Disclosure" tab in SEC Filings).