August 20, 2024

EPEAT Disclosure Report 2022

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: June 10, 2022) 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 also 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]	2021	2022	Boundary
PV modules produced in MW DC in reporting period	2-6	RR-ST-000.A	Included	7,903	9,068	Manufacturing (Global)
Recycled input materials used (%)	301-2	RR0102-10		4-10.5%	7%	Semiconductor material (Global)
Standards, methodologies, assumptions, and/or calculation tools used				Disclosed recycled input materials in 2021 and 2022 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	990,098 MWh (3,564,353 GJ)	1,072,663 MWh (3,861,587 GJ)	Global (equity share)
Total fuel consumption from non-renewable sources	302-1			30,426 MWh (109,534 GJ)	32,827MWh (118,177 GJ)	Global (equity share)
Natural gas	302-1			30,131 MWh (108,472 GJ)	29,749 MWh (107,096 GJ)	Global (equity share)
Diesel/Gas oil	302-1			255 MWh (918 GJ)	482 MWh (1,735 GJ)	Global (equity share)
Motor Gasoline	302-1			40 MWh (144 GJ)	2,596 MWh (9,346 GJ)	Global (equity share)
Consumption of self-generated non-fuel renewable energy- onsite solar	302-1			7,172 MWh (25,819 GJ)	7,172 MWh (25,819 GJ)	Global (equity share)
Consumption of purchased electricity	302-1			952,500 MWh (3,429,000 GJ)	1,032,664 MWh (3,717,590 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 and Malaysia 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		RR0102-01.01		940,514 MWh (3,385,850 GJ)	1,016,560 MWh (3,659,616 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			0.12	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 (m3)	303-1	RR-ST-140a.1	Included	3,391,974	3,149,315	Manufacturing, Recycling and R&D (Global)
Water withdrawn in water stressed areas (%)		RR-ST-140a.1		0.01	0.02	Manufacturing, Recycling and R&D (Global)
Total water consumption from all sources (m3)	303-1	RR-ST-140a.1	Included	1,763,074	1,776,287	Manufacturing, Recycling and R&D (Global)
Water consumed in water stressed areas (%)		RR-ST-140a.1		0.015	0.04	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 2022, 0.02% of our water withdrawals came from water stressed areas, compared to 0.01% in 2021. 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%. In 2022, our Mesa, Arizona test site was the only one classed as water stressed and water withdrawals there increased by more than 157% compared to 2021. 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	8,536	7,690	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	551,674	563,652	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	306-3 306-5		Included	Sustainability Report (pg. 26 and 65)	Sustainability Report (pg.33,73 and 74)	Manufacturing (Global)
Standards, methodologies, assumptions, and/or calculation tools used				Data includes waste disposed (landfill or incineration) and recycled by type (hazardous or non-hazardous) in accordance with 2020 GRI standards. Approximately 43% of waste disposed (~3,273 metric tons) in 2022 and 48% (~4,370 metric tons) in 2021 was incinerated and the rest was sent to landfill. 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.47 and 66)	Sustainability Report (pg. 55 and 74)	Global (manufacturing and offices)
First Solar Work-Related Recordable Injury Rate (per 200,000 hours)	403-9			0.52	0.46	Global (manufacturing and offices)
Number of recordable work-related injuries	403-9		Included	28	27	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 global manufacturing, R&D and office locations. 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 and Vietnam. 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.		

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]	**2021**	**2022**	**Boundary**
Reduction of energy consumption	302-4			1,602 MWh (5,767 GJ)	3,405 MWh (12,258 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	303-3	RR-ST-140a.1 (or WBSCD Global Water Tool[40])		0.269 megaliters (0.01%)	0.692 megaliters (0.02%)	Manufacturing, Recycling and R&D (Global)
Standards, methodologies, assumptions, and/or calculation tools used				In 2022, 0.02% of our water withdrawals came from water stressed areas, compared to 0.01% in 2021. 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%. In 2022, our Mesa, Arizona test site was the only one classed as water stressed and water withdrawals there increased by more than 157% compared to 2021, from 0.269 megaliters in 2021 to 0.692 megaliters in 2022. 100% of our withdrawals come from local municipal suppliers (third-party/ freshwater), including 100% third-party water from surface water for our Mesa, Arizona test site.		
Water recycled and reused (m3)	303-3			268.12 megaliters	169.32 megaliters	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 and Germany, which represented 99.9% of our water withdrawals in 2022. We recycled approximately 268 megaliters in 2021 (or approximately 8% of our total water withdrawals) and 169 megaliters 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			71	83	Global (equity share)
Standards, methodologies, assumptions, and/or calculation tools used				In 2021 and 2022, 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: 1,584	Scope 1: 0 Scope 2: 2,254	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. In 2021, we implemented a lighting and HVAC project at its manufacturing facility in Malaysia, and a lighting and HVAC projects at its manufacturing facility in Vietnam. These measures resulted in savings of 1,584 metric tons CO2-eq from avoided electricity consumption in 2021. Our scope 1 and 2 emissions in the previous year (2020) amounted to 502,271 metric tons CO2-eq. This amounted to a 0.31% decrease in our gross global emissions in 2021. All GHGs are included in the calculations. In 2022, we implemented a re-lighting and chiller optimization project at its 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. This 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			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 and Vietnam. 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)

GRI Indicator	Title	2022 Disclosure	Social impacts Used for Screening
414-1	New suppliers that were screened using social criteria	100%	Suppliers are screened on the following social criteria: • Clean and safe facilities • Minimum wages and compensation for overtime • Working hours (allowing at least one day off per week) • Health and safety practices • Non discrimination • Freedom of association and collective bargaining • Humane treatment and prevention of harassment or abuse • Prohibition of child labor • Prohibition of forced or compulsory labor • Collective bargaining • Business ethics (including corruption, extortion, embezzlement, conflict of interest, bribery, excessive gift giving, disclosure of information, intellectual property, fair business advertising and competition, privacy and non-retaliation.) • Conflict minerals
414-2	Negative impacts on social impacts in supply chain and actions taken	3	In 2022, First Solar conducted three onsite audits which included environmental and social criteria based on the RBA Code of Conduct and one supplier completed a third-party VAP closure audit. Out of the four audits, there were zero priority non-conformances and only one (or 25%) of the suppliers were identified

			as having significant actual or potential negative social impacts. Three major non-conformances were identified in the areas of health and safety relating to inadequate risk assessment and safety action plans. We are working with the supplier to put corrective action plans in place. The five major findings reported in last year's sustainability report were closed during our supplier's RBA VAP closure audit
308-1	New suppliers that were screened using environmental criteria	100%	Suppliers are screened on the following environmental criteria: • Environmental management systems • Pollution prevention and resource reduction • Solid waste management • Hazardous substances management • Environmental permits • Air emissions monitoring and management • Water management • Energy consumption and GHG emissions
308-2	Negative environmental impacts in the supply chain and actions taken	5	In 2022, First Solar conducted three onsite audits which included environmental and social criteria based on the RBA Code of Conduct and one supplier completed a third-party VAP closure audit. Out of the four audits, there were zero priority non-conformances and two (or 50%) of the suppliers were identified as having significant actual or potential negative environmental impacts. One supplier had one major non-

			conformance for not having a GHG emissions target. A corrective action has been put in place. Another supplier had four major environmental non-conformances relating to the lack of environmental targets and an inadequate permit management process. We are working with the supplier to put corrective action plans in place.

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).